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REPORT

Ministry of Environment and Parks

Hatzic Emergency Works Program
Post Construction Report for
Lagace Creek - Sites S-CR-14/17



MAY 2026

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1 INTRODUCTION

1.1 Purpose of Report

This report documents the post-construction activities for flood recovery works on Lagace Creek (S-CR-14 and S-CR-17), located in the Hatzic Valley, British Columbia. The works involved sediment removal and addressing bank instability as part of the ongoing recovery from the November 2021 Atmospheric River Event (ARE).

Associated Engineering (Associated) was retained by the Ministry of Environment and Parks (ENV) to lead the technical aspects of this project.

Note that the works of this project are located on Crown land and private property.

1.2 Background

The November 2021 ARE caused extensive sediment deposition, debris accumulation, and bank failures along Lagace Creek, reducing channel capacity and increasing flood and bank-instability risks in Lagace Creek between Allan Lake and Hatzic Lake. The project was initiated to restore hydraulic capacity, stabilize banks, and reduce future flood hazards in this reach of Lagace Creek.

Key observations included:

- S-CR-14: Sediment and debris deposition reduced flow capacity through Lagace Creek and under the Dale Road bridge, with bank failure observed at various locations.
- S-CR-17: Extensive sediment and debris deposition and restricted culvert capacity adjacent to Sylvester Road were significant concerns.

ENV/PwC (Price Waterhouse Coopers) commissioned Qualified Professional assessments and tech memos (see Appendix A – Conceptual Design Report and Drawings, Appendix A) that outlined the need for emergency sediment removal and flood restoration work. This work was subsequently approved and completed under the technical direction of Associated, with oversight from PwC. This work is intended to restore conditions to “pre-flood conditions.”

1.3 Location

The project sites are located in the Hatzic Valley, in the southern lowland portion of the Fraser Valley Regional District (FVRD), east of Mission, British Columbia. Two site locations were included for this contract, S-CR 14 and S-CR 17.

Site ID: S-CR-14
Location: 49.198500, -122.251100
Site Description: Lagace Creek from the confluence with Herford Creek to the Farms Road Bridge
Local Government Agency: FVRD
Waterbody: Lagace Creek

Site ID: S-CR-17
Locations:

- Site 1 – Restricted Culvert: 49.235435, -122.218722
- Site 2 – Lagace Creek Tributary: 49.237556, -122.217835

Site Description: Lagace Creek between Allan Lake and the Pattison Creek confluence
Local Government Agency: FVRD
Waterbody: Lagace Creek

1.4 Scope

The scope of work for this project is generally described as follows:

- Sediment and debris removal;
- Sand Recovery Station construction and restoration;
- Bank repairs at select locations within the watercourse;
- Installation of measures addressing bank instability concerns; and
- Excavation and off-site removal of invasive species

Figure 1-1 illustrates the project locations.

Figure 1-1 Project Locations



1.5 Project Team

The Associated project team included:

- Program Manager – Paul Hague, RPF
- Senior Technical Advisor – Andrew Wiens, P.Eng.
- Engineer of Record – Ryan Karsgaard, P.Eng.
- Project Coordinators – Dianna Christopoulos and Lana Kravets
- Environmental Lead – Naomi Sands, R.P. Bio.
- Contract Administrator – Alyson Meyers, P.Eng.
- Site Inspectors – Jordon Rozon. Jordan Fiske, Vinizza Pingos, Joon Kwak, Duncan McCormick, and Braeden Sykes

Subconsultant support was provided by Leq'á:mel First Nation (Leq'á:mel), from Deroche, B.C., for Archaeological/Cultural Resource Management with the following staff:

- Rick McKamey
- Tina Pederson

The general contractor for the work was Quantum Murray (QM) Environmental, with the following key staff:

- Nicholas Doucette, Vice President
- Mert Gezgin, Project Manager

On behalf of the client, project direction was provided by the following:

- Thyren Garde-Jacobs, Flood Debris Management Secretariat, ENV
- Amy Vallarino, Flood and Debris Management Secretariat, ENV

2 DESIGN

2.1 Site Condition

An initial site assessment was completed by Associated in April 2022. As part of the conceptual design development, a follow-up site review was undertaken on September 14, 2023, for S-CR-14, and between August 7 and 9, 2023, for S-CR-17. Site conditions documented in the 2022 Initial Site Assessments were generally confirmed during the 2023 site visits.

Within the project limits of S-CR-14, Lagace Creek is located within the Lower Hatzic Valley and extends from the Herford Creek confluence (just north of the Dale Road Bridge) to the Farms Road Bridge (just south of Riverside Road). Fine sediment accumulation is prevalent throughout this reach, particularly near the Dale Road Bridge, where reduced channel capacity was observed. Conditions at the Youngston Road Bridge were generally stable, with gradual sediment accumulation noted but no significant impacts to adjacent infrastructure. Channel meandering, localized bank failure, and woody debris were observed along the reach, consistent with typical fluvial processes.

Within the project limits of S-CR-17, Lagace Creek transitions from relatively flat grades near the Allan Lake outlet to steeper grades downstream of Sylvester Road. Conveyance capacity in the upper reach is limited, with flooding and overtopping of Sylvester Road reported by local landowners. These conditions are influenced by roadway alignment, channel geometry, and multiple crossings that promote sediment accumulation. Downstream of Sylvester Road, the channel generally provides adequate conveyance, with only localized sediment deposition and bank failure observed.

2.2 Conceptual Design

The conceptual design for the S-CR-14 and S-CR-17 was developed to restore hydraulic system conveyance and stabilize eroded banks. The design process incorporated site-specific hydrological assessments to restore the creek system to near pre-event conditions and to reduce flood and bank instability risks. A Conceptual Design Report (CDR) outlining the approach, methodology, and findings is provided in Appendix A. Attached to the CDR as Appendix M are the conceptual design drawings.

2.2.1 Key Design Considerations

- Hydraulic System Conveyance and Bank Restoration: The design aimed to re-establish channel capacity by removing accumulated sediment and debris and by restoring eroded banks to improve flow capacity and reduce flood risk.
- 10-Year Site-Specific Design Flows: Hydrologic modelling was used to estimate peak flow conditions and confirm that the restored channel can safely convey design events. A sediment-bulking factor was applied to account for additional sediment load when calculating design flows for sizing the works.
- Hydraulic Modelling: Two-dimensional hydraulic analysis was completed for S-CR-14, while one-dimensional hydraulic analysis was completed for S-CR-17 to evaluate the performance of the existing channel and to identify potential remediation solutions.
- Sediment Removal Depth: Sediment removal depths were determined from survey and hydraulic information, with removal limits selected to restore the channel to pre-ARE conditions while maintaining channel stability.

2.2.2 Site Constraints

Several site-specific constraints were factored into the conceptual design, including:

- Site Access: Access to portions of Lagace Creek is constrained by private properties, the need to work safely from Sylvester Road, steep banks, and existing infrastructure, requiring careful planning of temporary access routes, staging areas, and equipment mobilization.
- Existing Environmental Conditions: Consideration was given to protecting aquatic habitats, riparian vegetation, and water quality during construction activities.
- Archaeological Investigations: The presence of culturally significant areas necessitated careful planning and compliance with regulatory guidelines to avoid disturbances.
- Geohazards: Potential geotechnical hazards, such as flooding and slope instability, were assessed to inform bank restoration strategies and support long-term stability.
- Invasive Species: Japanese knotweed is prevalent in the Lagace Creek area. Environmental measures were required during construction to prevent the spread of its seeds and contaminated soil.

2.3 Design Objective

The design objective was to restore the site to pre-event conditions as practically possible. The key design objectives were:

- Restoring pre-event channel capacity through targeted sediment and debris removal;
- Restoration of existing Sand Recovery Stations (SRS) for sediment and debris removal;
- Construction of a new SRS for sediment and debris removal;
- Remediating damaged channel banks to reduce ongoing bank failures;
- Addressing bank instability at critical locations using bioengineering; and
- Confirming the proposed design complied with applicable environmental and regulatory requirements.

3 PERMITTING AND APPROVALS

3.1 First Nations Consultation

The project is located within the traditional territory of the Leq'á:mel First Nation. Various First Nation Cultural Monitors alternated on site.

Monitors were on site to observe and report on the reconstruction of the creek as per Associated's conceptual design drawings and field directions as per the engineering team.

The First Nations Cultural monitors did not identify any archaeological finds during the construction activities.

3.2 Environmental

The *Fisheries Act* is the main federal legislation for Canadian fisheries management through the conservation and protection of fish and fish habitat (RSC 1985, c.F-14) and is administered by Fisheries and Oceans Canada (DFO). In accordance with Sections 34.4(2)(c) and 35(2)(c) of the *Fisheries Act*, an authorization is required for any activity that may result in the death of fish and harmful alteration, disruption, or destruction of fish habitat. Sediment removal and bank stabilization works were anticipated to result in a temporary HADD (Habitat Alteration, Destruction or Disruption) of habitat for fish in Lagace Creek, and an emergency *Fisheries Act* Authorization was issued by DFO on October 27, 2022, for all impacted sites under the Hatzic Emergency Works Program (22-HPAC-01308). The authorization was further amended on November 23, 2023, and September 17, 2024, to extend the project completion date and allow dredging in the wet under certain conditions, respectively.

The provincial *Water Sustainability Act* protects the quality of water, fish and wildlife habitat, and the rights of licensed water users (SBC 2014, c15) and is administered by the Ministry of Water, Lands and Resource Stewardship (WLRS). Under Section 11 of the *Water Sustainability Act*, any activities that result in "changes in or about a stream" require notification or approval. A Change Approval for Changes in and About a Stream on Lower Lagace Creek (S-CR-14) was granted by WLRS on August 23, 2024 (WSA 2011310), and a Change Approval for Upper Lagace Creek (S-CR-17) was granted on September 6, 2024 (WSA 2011242). Environmental approvals and authorizations are included in Appendix B.

All instream works were to be conducted under the oversight of a Qualified Professional (QP) and in accordance with regulatory authorizations and approvals, the Lower Lagace Creek (S-CR-14) and Upper Lagace Creek (S-CR-17) Sediment Removal and Bank Protection Environmental Management Plans (Associated Environmental, 2024), respectively, applicable DFO Codes of Practice, and provincial guidance in the "Requirements and Best Management Practices for Making Changes In and About A Stream in British Columbia" (2022).

Keystone Environmental (Keystone) was the QP engaged by the Contractor, QM Environmental, to conduct environmental monitoring during construction. Keystone prepared a Construction Environmental Management Plan (CEMP) for S-CR-14 in August 2024 and a draft plan for S-CR-17 in September 2024. Fieldwork was completed under best management practices and applicable environmental regulations.

3.3 Archeological

Leq'á:mel First Nation provided cultural, archeological, and environmental monitors to review the work daily, keeping records and submitting daily reports. The archeological permit is included in Appendix C.

3.4 Other Approvals

The Contractor was responsible for obtaining other permits, including road use permits.

4 CONSTRUCTION

4.1 Contract Award

The Request for Proposals (RFP) package with project drawings and specifications was prepared by Associated and presented to ENV. ENV's procurement group submitted the RFP documents for bids. Bids were collected and evaluated based on pre-determined selection criteria and ranking methodology. Associated is aware that two bidders provided the required bid responses and pricing for evaluation.

The province set the requirements for contractor evaluation. The results of the bid evaluation were reviewed with ENV, and a contractor was selected for award. The contractor was informed of the award, and requirements for the agreement were then submitted before executing the agreement and issuing a Notice to Proceed. The final bid evaluation documentation was shared by ENV with Associated and has been included in this report as Appendix D. QM was selected with the highest ranking from the evaluation process.

The contract with QM was awarded under MWK25EPFLOOD0001 (see Appendix E). Following the execution of the original agreement, several modification agreements were also executed. Each modification agreement has also been included in Appendix E.

4.2 Approach to Construction

Activities along Lagace Creek at Sites S-CR-14 and S-CR-17 were conducted primarily on private properties and within the Lagace Creek right-of-way. Land access agreements were obtained (see Appendix F) from affected property owners before construction commenced in 2024. QM secured a temporary laydown area on Parcel 008-042-217, accessed from Dale Road, for staging equipment and materials. Temporary stockpiling of sediment and debris removed from Lagace Creek was completed in the vicinity of SRSs before off-site disposal. No laydown area was defined or access agreements obtained for Site S-CR-17.

Construction activities were undertaken within an active watercourse and required adaptive methods to address site-specific conditions. Sediment removal was completed using excavators and support equipment working from the banks of the creek along temporary access routes. Excavation areas were isolated using sandbags and dewatering pumps where feasible, with downstream turbidity control measures implemented to limit sediment transport. Where dry excavation was not achievable, work proceeded under wet conditions in accordance with amended authorization requirements (see Appendix B for the amended permit).

Environmental Monitors were present throughout construction to oversee isolation measures, turbidity management, fish removal, and invasive species management, ensuring compliance with applicable regulatory requirements.

The main goals of construction were to restore channel capacity, stabilize eroded banks, and protect adjacent properties. Construction activities along Lagace Creek were undertaken to:

1. Remove accumulated sediment from the channel at the existing SRS;
2. Construct new SRSs to support future maintenance activities;
3. Install measures addressing bank instability at critical locations; and
4. Restore disturbed areas through the installation of coconut matting and live stake planting.

The timing and sequencing of excavation activities are summarized in the following schedule.

4.2.1 Schedule

QM mobilized to the site on August 27, 2024, and began work by locating the existing SRSs and removing necessary trees and vegetation to facilitate access/construction. Three new SRSs were constructed. Table 4-1 summarizes the construction milestones for each station.

Table 4-1 SRS Excavation Dates

SRS Location	Excavation Completion Date
E	August 31, 2024
C	September 1, 2024
L	September 2, 2024
B	September 13, 2024
C2	September 17, 2024
B3	September 19, 2024
J	September 26, 2024
K	September 26, 2024
B2	September 27, 2024
F	September 28, 2024
I	September 29, 2024
G	September 29, 2024

After completing the creek excavations and SRS installations, coconut matting was installed along the creek bank from SRS C2 to SRS B. The gate and fence installation was completed on October 8, 2024. Live stake installations were completed at Sites 1 and 2 on November 29, 2024. QM demobilized from the site on December 4, 2024.

4.3 Quality Control

Associated Engineering

- Provided daily inspection and review of the engineering components of the work.
- Tracked construction activities to support progress payment development.
- Provided engineering input through field memos and site communications to clarify design intent and respond to contractor inquiries.
- Kept daily reports of construction activities and contractor forces (see Appendix G).

Quantum Murray Environmental

- General Contractor responsible for site management, safety, coordination, overall delivery of the construction and subcontracted environmental monitoring to Keystone Environmental.
- General Contractor responsible for construction means, methods, sequencing, procedures, and compliance with regulatory requirements and contract documents.

Keystone Environmental

- Developed the Construction Environmental Management Plan, including a spill response plan.
- Designed environmental measures for protecting aquatic life, including bank stabilization and sediment control, and managing spills.
- Guided the management of invasive species as required.
- Conducted routine environmental monitoring to verify the success of environmental measures.
- Kept periodic records of work completed and pertinent information, summarized in a daily monitoring report (see Appendix G).

Leq'á:mel First Nation

- Provided cultural and environmental monitors to review the work periodically. No reporting was provided.

4.4 Changes During Construction

During construction of the Hatzic Emergency Works Program at Lagace Creek (Sites S-CR-14 and S-CR-17), several refinements, clarifications, and scope adjustments were implemented in response to field conditions, regulatory requirements, and coordination with landowners. These changes were addressed through Requests for Information (RFIs) and Field Memos (FMs), as documented in Appendix H.

Regulatory and Environmental Constraints

Early construction activities identified challenges with meeting *Fisheries Act* Authorization requirements to conduct instream works "in the dry." These challenges were first documented in RFI-0005 (submitted August 20, 2024), which requested confirmation on whether there were any areas where wet excavation was acceptable. RFI-0005 was responded to on August 22, 2024, indicating that the existing DFO Emergency Authorization required that all works be conducted in the dry. Subsequent clarification was requested via an email sent on September 3, 2024, which outlined limitations in dewatering isolated excavation areas despite the use of sandbag berms, poly sheeting, turbidity curtains, and pumping systems. FM-01 was sent on September 3, 2024, as a response to that email reiterating that QM must follow the existing DFO Emergency Authorization and associated guidelines, adhere to the CEMP and EMP, and before applying for amendments to the DFO Emergency Authorization, they need to demonstrate that working in the dry is not reasonably achievable.

As isolation and dewatering efforts continued to prove ineffective due to permeable streambed conditions and persistent seepage, the issue was formally escalated through FM-03 (September 6, 2024). This Field Memo documented engagement with Fisheries and Oceans Canada (DFO) and recommended submission of an amendment to the Fisheries Act Authorization to permit excavation under controlled wet conditions. Permit amendments were subsequently pursued and approved (via email on September 24, 2024, and forwarded to QM on September 25, 2024), allowing excavation to proceed under wet conditions with enhanced isolation, fish salvage, and turbidity control measures in place.

Environmental compliance audits conducted during construction also identified deficiencies related to invasive species management. FM-05 (September 11, 2024) documented non-compliance with knotweed handling requirements, including insufficient containment of cut material and lack of stem injection treatment. The memo required immediate corrective actions and updates to the Contractor's CEMP, reinforcing compliance with Addendum 1 to the Contract Documents and applicable best management practices.

Design Clarifications and Field-Fit Adjustments

Several design elements required clarification or adjustment to address discrepancies between conceptual design assumptions and site conditions encountered during construction. Excavation extents and Sand Recovery Station (SRS) layouts were clarified through RFI-0012 (submitted September 6, 2024; responded to on September 10, 2024), which provided direction on excavation limits, top-of-bank alignment, and station positioning relative to property boundaries.

Material specifications were clarified through FM-04 (September 10, 2024), which confirmed the required granular base material for lock block installation. Working platform requirements were further clarified through FM-07 (September 16, 2024), which confirmed that Combigrid and 75 mm minus crushed gravel were to extend 5 m from the back of lock block structures to provide adequate stability for construction equipment.

In some instances, construction sequencing was adjusted based on field discussions. FM-06 (September 12, 2024) documented Contractor proposals to excavate certain locations before SRS construction, with Associated identifying the risks and confirming that such work would proceed at the Contractor's discretion.

Bioengineering and Restoration Revisions

Bioengineering and restoration work required several refinements during construction due to constructability considerations and environmental performance requirements. Initial clarification on the use of excavated sediment as topsoil was addressed through RFI-0011 (submitted September 5, 2024; responded September 10, 2024), which confirmed that excavated sediment was not suitable as a growing medium for bioengineering applications.

Subsequent field discussions resulted in FM-09 Rev. 1 (October 9, 2024), which approved limited reuse of stockpiled material from Sand Recovery Station C-2 as topsoil beneath coconut matting, subject to environmental measures recommended by the Environmental Monitor to control sedimentation and prevent knotweed spread.

Installation methods for live staking and stake clusters were further refined through FM-11 (November 8, 2024). This Field Memo removed riprap-related specifications from the bioengineering design, revised installation details for live stake clusters, and required submission of an Implementation Plan to confirm handling, preparation, and installation methods for living materials.

Live staking quantities were later reconciled following clarification of treatment extents through an email from QM sent on November 26, 2024, and responded to on November 28, 2024, which confirmed reductions in dense live staking areas, including the complete removal of one dense staking zone.

Tree Planting Modifications

Tree planting specifications were revised during construction due to material availability constraints and landowner preferences. RFI-0010 (submitted September 5, 2024; responded to September 10, 2024) confirmed that the tree species proposed by the Contractor was not acceptable as it was non-native. Further clarification was provided through RFI-0018 (submitted October 2, 2024; responded to October 8, 2024, and rev 1 response submitted on October 28, 2024), which resulted in approval of a revised planting plan consisting of a reduced number of Big Leaf Maple trees supplemented by Paper Birch trees.

Landowner-specific requests regarding planting elevations and re-planting responsibilities were documented through FM-13 (December 6, 2024).

Measurements, Quantities, and Payment Adjustments

Significant changes during construction related to the measurement and reconciliation of excavation quantities. RFI-0003 (submitted August 20, 2024; responded August 22, 2024) confirmed that the works were predominantly field-fit and that CAD files would not be provided, limiting the feasibility of relying solely on pre- and post-construction survey methods to determine excavation volumes, particularly under submerged conditions.

Subsequent review of design quantities identified errors in the estimated sediment volumes. RFI-0015 (submitted September 11, 2024; responded September 17, 2024) confirmed that the total clean sediment volume shown on Drawing 2632-03-C-3103 was incorrect and that the correct total quantity was 6,300 m^3. Concurrently, field observations and environmental monitoring identified higher-than-anticipated volumes of knotweed-contaminated sediment at several locations.

The increased presence of contaminated material affected construction sequencing and scope. In particular, Sand Recovery Stations SRS D and SRS H were confirmed to be impacted by knotweed contamination. Due to contamination risks, disposal requirements, and schedule constraints within the instream work window, excavation at these stations was not completed, and the stations were removed from the construction scope. Remaining excavation activities were prioritized at locations with confirmed clean or manageable contaminated sediment conditions, and quantities were reconciled accordingly.

Access, Scheduling, and Work Sequencing

Extended work hours were requested through RFI-0016 (submitted September 25, 2024; responded September 30, 2024) to complete instream works within the permitted window. Following coordination with the Fraser Valley Regional District, landowners, and environmental monitors, extended hours were approved for September 27–30, 2024.

Construction sequencing and access were adjusted to address site constraints, regulatory windows, and landowner coordination. Requests to reuse clean sediment on adjacent properties were documented through RFI-0017 (submitted October 2, 2024; responded October 4, 2024), with clarification provided regarding Agricultural Land Reserve requirements and landowner approvals.

Scope constraints and unresolved permitting and contamination issues resulted in the removal of Site S-CR-17 from the construction scope. These included late receipt of regulatory approvals, unresolved Construction Environmental Management Plan (CEMP) requirements, unclear excavation limits, identification of knotweed-contaminated soils requiring specialized handling and disposal, and insufficient available time within the approved instream work window to complete excavation activities at the site.

4.5 Construction Monitoring

Construction monitoring was conducted by Associated, with site inspectors present daily to oversee project activities and confirm compliance with design specifications. Inspectors tracked construction progress, verified quantities for progress payments, and provided field-fit recommendations to address site-specific challenges.

Key responsibilities of the construction monitoring team included:

- Daily site inspections to confirm work was progressing in accordance with design plans and project requirements.
- Tracking construction progress to confirm alignment with the approved schedule and scope.
- Monitoring material quantities for accurate progress payments and contract administration.

- Providing field-fit recommendations and assisting to address unforeseen conditions.
- Documenting construction activities through daily reports, which were submitted to project managers and engineers for review.
- Capturing photographic records, including drone footage, to document site conditions and construction milestones.
- Monitoring construction methods to confirm the Contractor was complying with permitting and regulatory requirements.

Site photographs (before and after construction) are included in Appendix I.

4.5.1 Environmental

Full-time environmental monitoring was conducted by Keystone Environmental during instream works for S-CR-14 and audited by Associated Environmental. As the Environmental Monitor (EM), Keystone was responsible for collaborating with the Contractor to develop measures to protect the environment and to respond to environmental incidents as they occurred. The responsibility of the auditor was to protect the interests of the owner by confirming that the EM and the Contractor adhered to the requirements of the CEMP (prepared by Keystone and reviewed by Associated), environmental permit conditions (see Appendix B), and any applicable regulations.

Key environmental activities included:

- Isolation of Dredge Zones and Fish Salvage: isolation of instream work areas by the Contractor and the subsequent capture and relocation of fish from isolated work zones by Keystone before dredging.
- Dewatering of Dredge Zones: pumping down of instream work areas by the Contractor under the oversight of Keystone.
- Bank stabilization and Sediment Control: implementation of temporary measures to intercept and manage surface water runoff (e.g. installation of silt fence, covering stockpiles), and instream turbidity (e.g., silt curtain), as directed by Keystone.
- Water Quality Monitoring: routine sampling by Keystone during site inspections to confirm compliance with turbidity levels and water quality standards for offsite discharge.
- Invasive Species Removal: excavation of Japanese Knotweed by the Contractor under the direction of Keystone.

Permits obtained by the EM during the course of their work are included in Appendix J. Keystone also prepared daily Environmental Monitoring Reports, which were submitted to Associated. These reports are provided in Appendix G. Following the completion of construction in 2024, Keystone prepared a final Environmental Monitoring Summary Report, which is included in Appendix J.

4.5.2 Archaeological

Archaeological monitoring was conducted by Leq'á:mel First Nation, with monitors present on-site periodically throughout excavation activities. Leq'á:mel was responsible for identifying and assessing any archaeological discoveries during excavation, confirming that work proceeded in accordance with permit conditions and cultural heritage protection requirements. Throughout the project, no archaeological finds were encountered, and construction proceeded without disruption related to cultural resources.

4.6 Project Completion

On November 1, 2024, FM-10 was issued to QM, outlining a list of deficiencies to be addressed before project completion. A final walkthrough was completed by representatives of Associated on November 15, 2024. Following the completion of outstanding work, construction was deemed complete on December 4, 2024, and QM demobilized from the site. A final inspection was conducted on the day of demobilization by Associated site inspectors to confirm that all work had been completed in accordance with project specifications.

Substantial performance of the contract occurred on August 12, 2025. A certificate of completion was issued on March 5, 2026. These documents are included in Appendix K.

Record Drawings were developed based on field inspector measurements and removal quantities verified through final survey data and truck hauling weight tickets. These drawings are available in Appendix L.

4.7 Summary of Key Dates

Construction Activities for S-CR-14 experienced multiple adjustments to scheduling and construction sequencing due to site conditions, environmental constraints, and permitting requirements. Despite these challenges, the project progressed accordingly with the following key milestones summarized in the table below:

Table 4-2 Construction Key Dates

Milestone	Date
Contractor Mobilization	August 27, 2024
Permit Amendment for Wet Excavation Approved	September 17, 2024
Final Day for Working in Creek per Environmental Regulations	October 1, 2024
Environmental and Bioengineering Installation	October 8 through November 29, 2024
Project Completion / Contractor Demobilization	December 4, 2024

6 FUTURE CONSIDERATIONS

6.1 Operations and Maintenance

The involvement of the Ministry of Environment and Parks in this project was limited to addressing impacts resulting from the 2021 Atmospheric River Event. Effectiveness monitoring is required as part of the regulatory authorization of the works, but these works will largely be focused on the riparian plantings carried out as part of the works.

Legace Creek is a dynamic watercourse and, even during the implementation of the works, continued to undergo natural changes due to subsequent flood events. With the 2021 ARE-related response complete, the FVRD will resume its role as the primary jurisdictional authority over the project area. The FVRD should incorporate the record drawings and this completion report into its project records. Additional operation and maintenance considerations relating to the works are as follows:

- Remediate damaged channel banks and stabilize bank areas; install additional stabilization where bank instability is observed or anticipated by a Qualified Professional.
- Regularly assess the success of riparian plantings and remove invasive species (e.g., Japanese Knotweed) to prevent their spread.
- Sediment deposition will continue in the watercourse. Inspect each SRS structure and remove sediment from the watercourse periodically to maintain their functionality. A long-term solution needs to be developed to address the impacts of the ongoing bedload accumulation in Legace Creek.

6.2 Monitoring

The following monitoring procedures should be adopted:

- Perform a survey to monitor sediment deposition and the resulting channel bed aggradation annually, as well as following severe storms, high water events, and debris flow events. This can be achieved by carrying out channel cross-section surveys.
- Perform visual inspections for channel bank instability, degradation, and potential avulsion locations annually, as well as following severe storms, high water events, and debris flow events.

CERTIFICATION PAGE

This report presents our findings regarding the Ministry of Environment and Parks Hatzic Emergency Works Program Post Construction Report for Lagace Creek - Sites S-CR-14/17.

Respectfully submitted,

Associated Engineering (B.C.) Ltd.
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APPENDIX A – CONCEPTUAL DESIGN REPORT AND DRAWINGS

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

REPORT

Ministry of Environment and Parks

Hatzic Emergency Works Program
Conceptual Design Report
Lagace Creek - Sites S-CR-14/17



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REVISIONS PAGE

Hatzic Emergency Works Program Conceptual Design Report Lagace Creek - Sites S-CR-14/17	
Client:	Engineer:
Ministry of Environment and Parks	Associated Engineering (B.C.) Ltd.

Revision/ Issue	Date	Description	Prepared by/ Reviewed by	Client Review
Final	2026-05-20	Final Report	Ryan Karsgaard/Paul Hague	

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EXECUTIVE SUMMARY

Lagace Creek experienced significant flooding and bank failure during the November 2021 Atmospheric River Event, posing risks to adjacent landowners and infrastructure. Excessive sediment deposition and debris accumulation have severely limited the creek's flow capacity and caused localized bank instability. Immediate action is required to restore Sites S-CR-14 and S-CR-17 to their pre-event condition and mitigate future flooding risks.

To address these challenges, Associated Engineering has developed a comprehensive restoration plan focused on restoring hydraulic system conveyance and stabilizing channel banks. This approach adheres to current codes and standards while utilizing hydraulic modelling to calculate 1 in 10-year and 1 in 200-year design flows. The design incorporates a 30% sediment bulking factor to account for modest sediment and debris. A primary focus of the restoration is ecological integrity, with designs including specific recommendations for fish habitat protection (supporting species such as salmon and trout) and the use of bio-engineered solutions for sustainable bank stabilization.

The proposed restoration plan for Site S-CR-14 involves restoring existing Sand Recovery Stations (SRS), constructing three new SRS near the Dale Road bridge, and removing approximately 8,250 m^3 of sediment. For Site S-CR-17, the plan recommends a targeted approach to remove 300 m^3 of sediment and debris at specific locations to minimize impacts on natural habitats. The estimated opinion of probable cost to complete the recommended works is approximately $2,060,000 for S-CR-14 and $76,000 for S-CR-17.

If these flooding and bank instability issues are not addressed, nearby landowners will face continued risks of property damage and loss. Furthermore, ongoing sediment accumulation will likely lead to increased future costs for governing bodies in terms of emergency repairs and long-term improvements, while also contributing to potential environmental degradation. The success of these works is dependent on securing land access agreements and required environmental permits.

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1 PURPOSE OF PROJECT

The BC Ministry of Environment and Parks (ENV) have retained Associated Engineering (B.C.) Ltd. (Associated) to alleviate bank instability and flooding risks at sites in the Hatzic Valley area east of Mission, B.C., that were damaged or disturbed during the November 2021 Atmospheric River Event (ARE). The project objective is to restore the sites to their pre-event condition by removing sediment and restoring channel banks based on current codes and standards.

This site-specific conceptual design report summarizes the following:

- Existing site conditions
- Site assessments
- Site-specific design criteria and
- Site-specific constraints

The report also provides:

- A summary of rightsholder and stakeholder consultations;
- Restoration concept options;
- An opinion of probable cost and
- Conceptual design drawings.

2 SITE SUMMARY

2.1 Site Locations

Site ID: S-CR-14
Location: 49.198500, -122.251100
Site Description: Lagace Creek from the confluence with Herford Creek to the Farms Road Bridge
Local Government Agency: Fraser Valley Regional District (FVRD)
Waterbody: Lagace Creek

Site ID: S-CR-17
Location:

- Site 1 – Restricted Culvert: 49.235435, -122.218722
- Site 2 – Lagace Creek Tributary: 49.237556, -122.217835

Site Description: Lagace Creek between Allan Lake and the Pattison Creek confluence
Local Government Agency: FVRD
Waterbody: Lagace Creek

Site locations are shown in Figure 2-1.

Figure 2-1 Site Locations



2.2 Site Condition and Site Assessment Summary

Initial site assessments were completed by Associated in June 2022. The site inspection reports are attached in Appendix A. As part of the concept design development, Associated conducted another site review in August 2023. A photo log from the 2023 site inspection is included in Appendix B.

Current Site Conditions

Site conditions summarized in the 2022 initial site assessment were verified during the 2023 site visit. Significant debris deposition along Lagace Creek in the project area has limited the flow capacity of the creek. Tree blockages are also common along Lagace Creek, which allows for further debris accumulation in the flow path. High flow velocity in portions of the creek has contributed to localized bank instability and failure. Based on the initial site assessment and recent site visit, the project extent (the blue line) for this concept design has been defined as illustrated in Figure 2-2 for Site 14 and Figure 2-3 for Site 17.

Figure 2-2 S-CR-14 Concept Design Project Extent

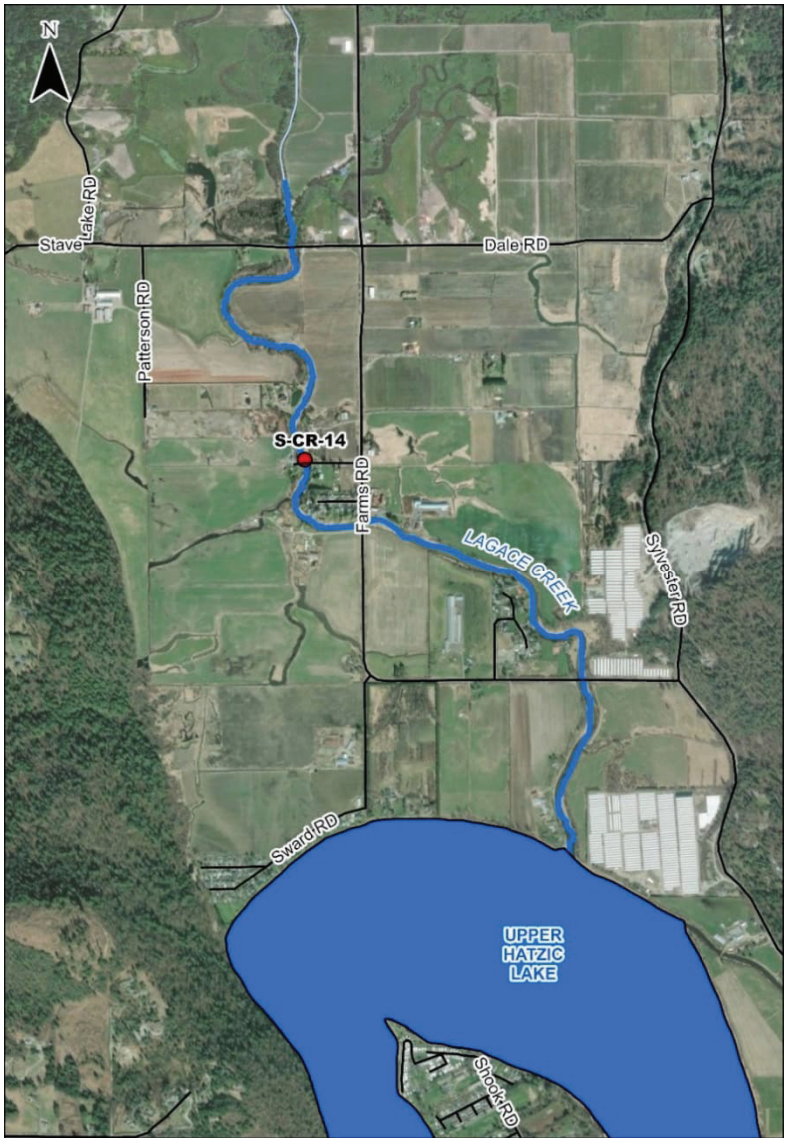


Figure 2-3 S-CR-17 Concept Design Project Extent



2.3 Relevant Site History

The following sections define the relevant site history for both S-CR-14 and 17; however, previous reports (NHC, 2005a, b) also comment on bank instability along the creek banks. Rock and gravel accumulation has been excavated from the creek and placed on the banks as protection in the past, though reports suggest that some of the armouring was being undermined. Widespread armouring of the banks has not been recommended by others in the past, instead focusing on localized bank protection.

2.3.1 Site S-CR-14

Sediment deposition has been an extensively documented issue in Legace Creek. Reports dating back to 1985 (NHC, 1985) discuss sediment being washed downstream from Pattison Creek and deposited along the more gradual slope. Larger diameter sediment is deposited upstream, while small diameter sediment, such as sand, is carried further downstream to this project location. Sediment (gravel) traps and widespread sediment excavation were some of the proposed solutions to restore the creek flow capacity. In that vein, in 2015, eleven permanent sand recovery stations (SRS) were constructed. These stations are comprised of lock block platform structures set into the bank and stabilized with soil treatments. These platforms allow for a long-reach excavator to remove material from the creek, maintaining channel depth and flow capacity.

2.3.2 Site S-CR-17

In the 1985 NHC report, sediment being washed downstream from upstream sources such as Eng and McNab Creeks was also discussed. The Preliminary Steep Creek Hazard Assessment completed for the Project by BGC Engineering Inc. (BGC) (attached as Appendix C and further defined in Section 4-4 – Geohazards) refers to Saporano Creek, also contributing at S-CR-17. Road building and logging have likely influenced the increased magnitude and elevated frequency of debris flow, according to past reports (BGC, 2023). The project location is along Sylvester Road, which was built in a natural, low-lying area. The creek is forced to meander through multiple road crossings and provide opportunities for flow restriction. The crossings, combined with a low-grade slope in the creek, are allowing for heavy sediment deposition throughout the project area.

Photos of the confluence with Saporano Creek show the distal edge of the alluvial fan washing sediment into Lagace Creek (BGC, 2023).

3 SITE DESIGN CRITERIA

3.1 Proposed Site Restoration Measures

The proposed site restoration measures are based on the project design criteria that are described in the Hatzic Project Design Basis Memo (DBM) (version dated June 9, 2023), which can be found in Appendix D (Associated, 2023).

The works involved include:

- Restoration of Hydraulic System Conveyance
  - Channel modification to restore hydraulic capacity (widening, realignment)
  - Sediment and Debris removal with consideration for habitat sustainability
  - Retention/placement of Large Woody Debris (LWD)
- Bank Restoration to Current Codes and Standards
  - Riprap
  - Engineered products
  - Bio-engineered solutions

3.2 Site-specific Design Criteria

Habitat protection and restoration shall be considered within the scope of this work. Sites S-CR-14 and S-CR-17 show evidence of both fish spawning and passage, as further detailed in Section 4 – Site Constraints. Attached as Appendix E is a technical memorandum that provides fish habitat design recommendations, while Appendix F is a technical memorandum that provides bioengineering design recommendations.

Site S-CR-14 has four bridge crossings within the project area, one at Dale Road, another at Youngston Road, and two crossings of Farms Road. Each of these bridges is owned, operated, and maintained by the Ministry of Transportation and Infrastructure (MoTI). The scope of work permitted within the scope of this project limits our involvement to repairing these structures to merely armouring the abutments and confirming that sufficient flow capacity exists under each bridge. As the bridges are existing structures and are not considered critical infrastructure (there are multiple roads accessing the area), there is no minimum design freeboard for the structures; however, every effort will be made to maintain the standard of 1.5 m for the 1 in 200-year event for the post-sediment removal condition.

Site S-CR-17 is located adjacent to Sylvester Road, through which the creek meanders several times, as well as crossing several private driveways. The driveway crossings are comprised of both small bridges and multi-culvert infrastructure. Excessive sediment removal could adversely impact the structural integrity of the bridge crossings. As the driveway crossings are existing privately-owned structures, they are not included in the project scope, as upgrades are the responsibility of the owner. Future sediment deposition will reduce the channel capacity without regular maintenance.

3.3 Site-specific Design Flows

The creeks within the Hatzic Valley were assumed to convey a 1 in 10-year peak instantaneous flow before the ARE. A site-specific review was conducted to determine practical/reasonable conveyance capacities along Lagace Creek (S-CR-14) and along Lagace Creek and Saporano Creek (S-CR-17). Saporano was included in the design flows and model for S-CR-17 due to its proximity upstream and contributions to the flows. This included a review of the following:

- Site-specific constraints

- Hydraulic gradients
- Engineering experience

For the design of watercourse capacity in areas with high sediment and debris accumulation, the use of a sediment bulking factor can help more accurately calculate design flows for sizing infrastructure, such as bridge openings. A bulking factor is used to account for high concentrations of sediment, which increases the volume of flow transported. The bulking factor for this site location is discussed in more detail in Section 3.4 – Hydraulic Assessment.

Flow profiles show a significant change in slope as the creek moves downstream at S-CR-17. As such, the project location was split into three separate reaches for the purpose of calculating design flows, which will allow for more accurate calculations. Refer to Figure 3-1 for the various reach locations.

Figure 3-1 S-CR-17 Reaches

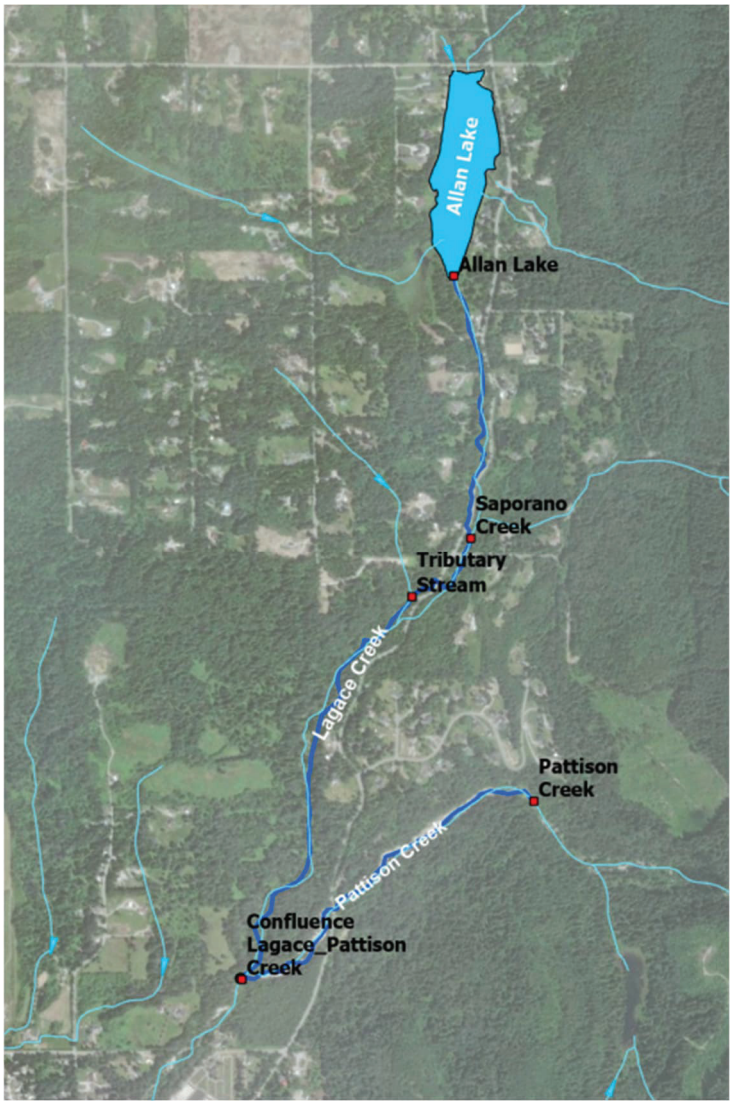


Table 3-1 summarizes the project flows for each site.

Table 3-1 Site-Specific Design Flows and Bulking Factor

Site	10-Year Flow (m^3/s)	10-Year +30% Flow (m^3/s)	200-Year Flow (m^3/s)	200-Year +30% Flow (m^3/s)
S-CR-14	25.5	n/a	33.6	n/a
S-CR-17 (Allan Lake to Saporano Creek)	22.1	28.73	33.3	43.29
S-CR-17 (Saporano Creek to Tributary Stream)	26.5	34.45	39.4	51.22
S-CR-17 (Tributary Stream to Confluence)	28.4	36.92	42.1	54.73

te y ically l s increase in a cree as y u r cee nstrea ue t increase in l an an increase catch ent area he l s n te in Table 3-1 n t e licitly re lect this e ect he re uce l s nstrea can be attribute t a c u le act rs such as st ra e in the l lain re ucin the nstrea l an ut ban l in

3.4 Hydraulic Assessment

As part of the Hatzic Emergency Works Program Phase 1, various models were completed for the selected sites (S-CR-14, S-CR-17). These models were developed to assess the capacities of the hydraulic structures and support the detailed design. The modelling report found in Appendix G details the two-dimensional (2D) modelling assessment completed for the entire valley (site S-CR-14). The modelling memo found in Appendix H details the one-dimensional modelling (1D) assessment completed for site S-CR-17. Both deliverables include all the variables and inflow results from the hydrological HEC-HMS model.

High flows have resulted in significant flooding and widespread sediment deposition throughout the downstream reaches of the Lagace Creek. The goal of this assessment was to determine if the channel can convey the 10-year flow within the banks and to determine if the existing infrastructure has adequate freeboard during the 200-year event. This hydraulic assessment was completed based on clear water flows plus an allowance for an increase of the flows by 30% for modest sediment and debris. It is important to note that debris flow events are possible within this area and that they are considered beyond the project scope. A debris flow event results in significantly larger flow rates due to sediment bulking as well as a reduction in channel capacity due to sediment deposition. This is discussed further in Section 3.5 – Sediment Removal Depth.

3.4.1 Site S-CR-14

As noted, to assess the key hydraulic processes at Site S-CR-14, a 2D model was developed. The modelled reach for this project location was approximately 7 km long, with cross sections spaced approximately every 200 m extracted from the 0.5 m resolution LiDAR (Light Detection and Ranging) data collected in November 2022.

Model results show a downstream reduction in confined flow as water spills into adjacent low-lying areas. While the channel bed is characterized by minimal to locally adverse gradients, hydraulic conditions are dominated by backwater effects from Hatzic Lake, extending to just beyond the Dale Road bridge, with associated low velocities and sediment deposition. Predicted overtopping during the 1:10-year event occurs where bank elevations are lower than the modelled hydraulic grade line. Where sufficient freeboard exists, the channel cross-sections generally provide adequate hydraulic conveyance capacity.

Refer to Appendix G for the complete modelling results.

3.4.2 Site S-CR-17

As noted, to assess the key hydraulic processes at Site S-CR-17, a 1D model was developed. The modelled reach for this project location was approximately 2.2 km long, with cross-sections spaced approximately every 40 m extracted from the 0.5 m resolution LiDAR data collected in November 2022.

This model showed that several private driveways crossing the creek have inadequate capacity for [insert event]. This results in a higher upstream flood profile, which causes lower flow velocity and increased sediment deposition on the upstream side of each crossing. The sediment deposition over time further reduces channel capacity. Narrowing of the channel at crossings also makes the area susceptible to scour and bank failure. Sediment removal and crossing upgrades would improve the hydraulics in the targeted areas, potentially reducing these occurrences. Although many of the crossings for Lagace Creek in the project area are under-capacity, upgrading private structures is outside of the project scope at this time.

Refer to Appendix H for the complete modelling results.

3.5 Sediment Removal Depth

Associated reviewed estimated sediment input volumes detailed in the Preliminary Steep Creek Hazard Assessment (Appendix C) resulting from debris flow events for various Hatzic Valley watercourses. As pre-ARE channel conditions are unknown, the sediment deposition that occurred as a result of the event can only be estimated. For context, Table 3-3 shows the estimated sediment volumes for Saporano Creek, which discharges into Lagace Creek above S-CR-17, while the North and South Herford Creeks, along with Upper, North, and South Dale Creeks, all discharge into Lagace Creek above S-CR-14.

Table 3-2 200-year BGC Estimated Sediment Volumes

Creek	Estimated Volume (m^3)
Saporano Creek	6,400 to 19,400
North and South Herford Creeks	12,100 to 34,500
Upper, North, and South Dale Creeks	20,600 to 23,600

Sediment sources along the east side of the Hatzic Valley generally appear to consist of glacial till. While the distribution is unknown, we anticipate that it consists of a range of particle sizes from clays and silts to boulders.

Based on anecdotal discussions with property owners and our site observations, we understand that sediment particles are being deposited over a large area from the mountains to Hatzic Lake. The deposition particle sizes and depths will vary throughout the Hatzic Valley. Deposited sediment may be remobilized and carried further downstream during subsequent rainfall events.

Based on our review of the available information, Associated estimated that the ARE deposited between 0.5 m and 1.0 m of sediment within the project extent. Although the hydraulic capacity of Lagace Creek has been reduced within S-CR-14, the creek can still pass the 1:10-year winter flow. Further, in 2015, Sand Recovery Stations (SRS) were installed to facilitate periodic sediment removal within the creek. On this basis, we have prepared a concept design to restore the creek to pre-ARE conditions at each project site. A concept has been developed (see Section 6 – Restoration Concepts). We note that sediment removal volumes are subject to the scale and condition of each SRS and the direction by Associated staff during construction.

4 SITE CONSTRAINTS

4.1 Site Access

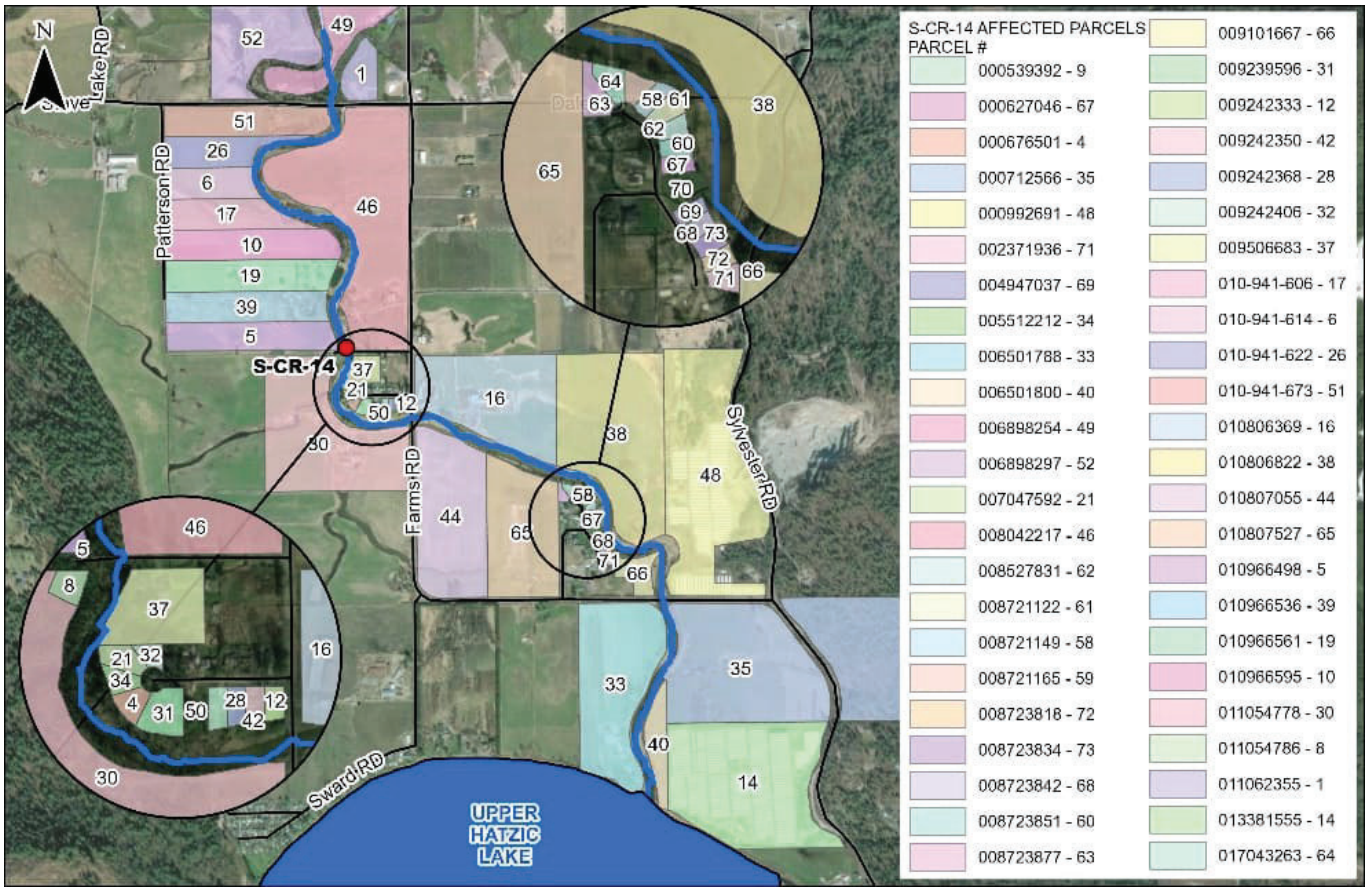
Associated engaged Zenith Appraisal & Land Consulting Ltd. (Zenith) to support us in securing land access related to project tasks and advancing the overall project as it proceeds to construction.

Consultation with landowners is ongoing as we work to secure approval of the proposed concept and signed access agreements. Some parcels will require one-time access during immediate construction, and others will require regular access in the future to allow for more regular maintenance of the constructed works. The following sections outline the parcels potentially impacted or required for access during the construction of both sites. For additional detail on potential access points, see the Design Drawings in Appendix M.

4.1.1 Site S-CR-14

Forty-seven parcels along Lagace Creek will potentially be impacted or required for access during the construction of Site S-CR-14. Figure 4-1 depicts the potentially impacted parcels.

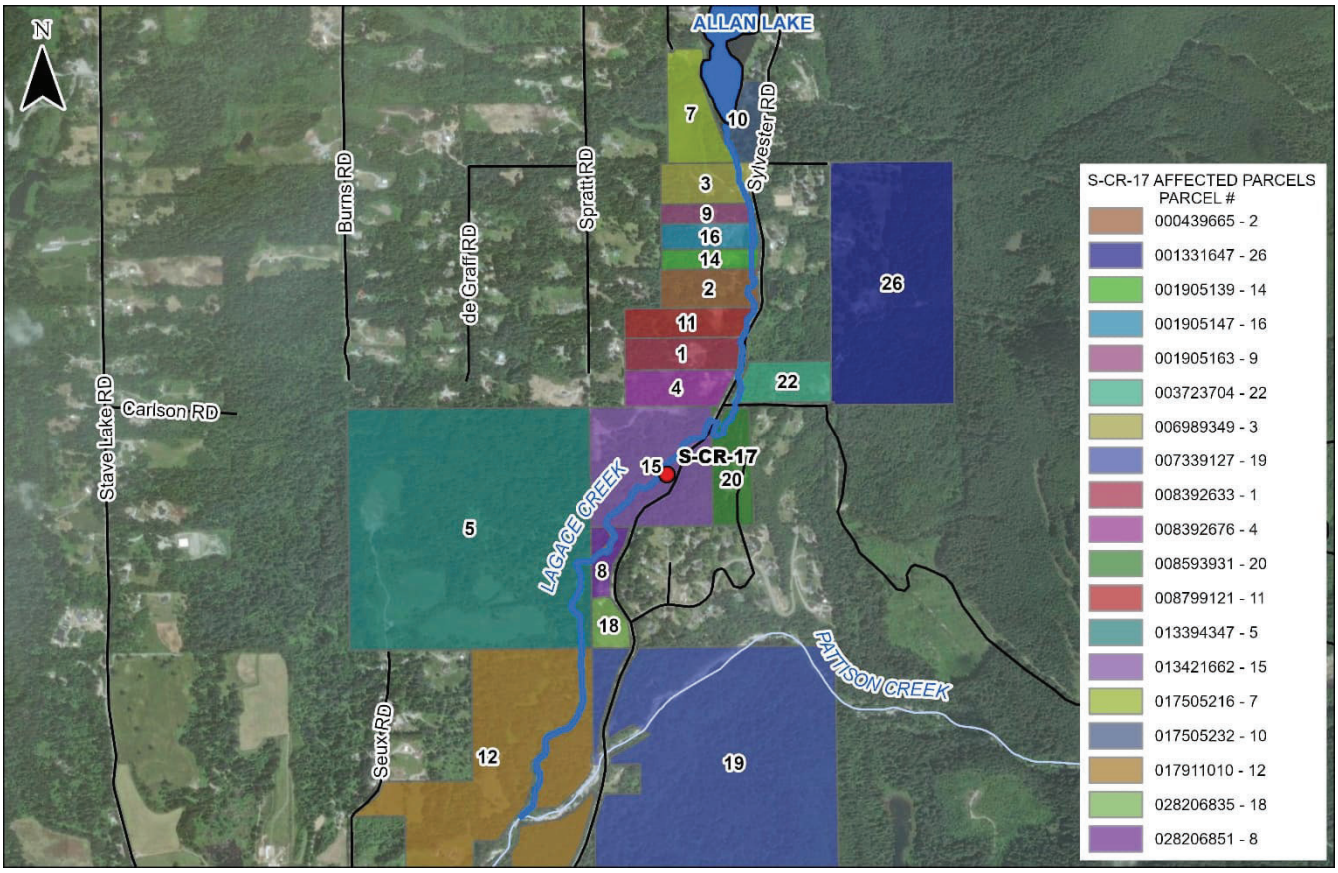
Figure 4-1 Potential Parcels for Access at S-CR-14



4.1.2 Site S-CR-17

Nineteen parcels along Lagace Creek and Saporano Creek will potentially be impacted or required for access during the construction of Site S-CR-17. Figure 4-2 depicts the potentially impacted parcels.

Figure 4-2 Potential Parcels for Access at S-CR-17



4.2 Existing Environmental Conditions

Associated has prepared a site Environmental Constraints Assessment to characterize existing conditions in Lagace Creek for each project location, including significant environmental features, to identify potential interactions between the environment and the proposed scope of work to inform design. Field investigations were conducted for S-CR-14 in October 2023 and for S-CR-17 in August 2023, comprising both instream and terrestrial assessments. The assessment is attached in Appendix I.

Lagace Creek is a 3rd order stream (ENV, 2023a) that is a tributary of Hatzic Slough to the south. The channel within the Study Areas is partially confined by farms, access roads, and residential lands. It is a fish-bearing stream with recorded sightings of species such as rainbow trout, cutthroat trout, chum salmon, coho salmon, and sockeye (ENV, 2023a, b). Evidence of fish was observed throughout the wetted portions of the creek and in isolated pools at S-CR-17. Fish were observed where the substrate became more gravel and cobble upstream in S-CR-14, as opposed to the sandy material downstream, which does not support pool habitat. S-CR-17 provides very good rearing and overwintering habitat, while S-CR-14 provides only low to moderate rearing and overwintering habitat.

The riparian area along Lagace Creek comprises a narrow corridor of young deciduous forest dominated by red alder, with some western red-cedar and western hemlock. Understory vegetation includes pacific ninebark, vine maple, salmonberry, and other understory vegetation typical to the area. There are no documented rare plants or known ecosystems at risk within 2 km of Lagace Creek (CDC, 2023a). A total of twelve invasive plant species were observed throughout the S-CR-14 Study Area, and nine invasive species throughout S-CR-17, including numerous patches of the highly invasive Japanese knotweed and Policeman's helmet, as well as the pervasive Himalayan blackberry.

Habitat along Lagace Creek comprises a complex of forest, wetland and agricultural land and has the potential to support a diversity of wildlife. The young deciduous forest provides extensive foraging and nesting opportunities. Nesting activity was observed during the site visit, including a possible raptor nest in the S-CR-14 Study Area. Bird nesting activity was not detected in the S-CR-17 Study Area. Narrow areas of riparian vegetation on the banks of the creek are likely used by deer and other mammals as travel corridors. Off-channel habitats and wetlands along the creek provide highly suitable breeding habitats for amphibians. Species that were observed during the site visit include the at-risk Northern red-legged frog and invasive green frogs in S-CR-17, as well as Pacific chorus frogs in the S-CR-14 Study Area.

The key constraints that should be addressed during Project design and construction planning are:

- Protection of sensitive fish and wildlife habitats associated with wetlands and off-channel habitats;
- Reducing adverse impacts to potential species at risk; and,
- Management of invasive plants.

Instream works should be restricted to the least risk window for fish (August 1 – September 15) where possible. If instream work is required outside of this window, the upstream fish passage must be maintained, either via a diversion channel or ongoing fish salvage. Standard Best Management Practices (BMPs) and restoration measures must be implemented to prevent the migration of sediment downstream and the death of fish (e.g., from stranding). Wetlands have the potential to support species at risk and should be avoided to the extent possible. If impacts to wetlands are anticipated and/or depending on the timing and scope of vegetation clearing required, wildlife salvages may be necessary (e.g., Northern red-legged frog, Pacific water shrew). The houses/dens/dams of both beaver and muskrats are protected under Section 9 of the Wildlife Act, and the Project will need to consider their presence in the project area and manage accordingly.

Vegetation clearing will need to consider the presence of nesting birds and should be timed to avoid the peak bird nesting season (March 12 to August 17). The nesting cavities of pileated woodpeckers are also protected under the Migratory Bird Regulations and, if found, require a 36-month observation period to determine if they are still in use. If clearing during the bird breeding season is unavoidable, nest/cavity surveys by a Qualified Environmental Professional in advance of construction will be required. Invasive plants are priority species requiring special management to prevent their spread. The Project should be sited to avoid these invasive plant locations, where possible. Site-specific measures will be required during construction to prevent encroachment and mitigate the potential spread of these and other invasive species.

The environmental constraints identified are expected to be manageable through appropriate care and consideration during design to avoid negative effects on environmental features and habitats. Standard approaches and best management practices during construction will be implemented along with the following legislation: the Fisheries Act, Migratory Birds Convention Act, Species at Risk Act, Water Sustainability Act, and the Wildlife Act. The Project will also need to abide by any permit conditions.

Based on the anticipated scope of instream works (e.g., sediment removal), a *Water Sustainability Act* Section 11 Change Approval will be required. An emergency *Fisheries Act* Authorization has already been obtained from DFO (Fisheries and Oceans Canada) for flood restoration works in Lagace Creek; works under this authorization must be completed by December 31, 2023. An amendment to the emergency authorization to extend the window to December 31, 2024, has been submitted and is under review. Fish salvages are anticipated, and a Scientific Fish Collection Permit from the B.C. Ministry of Forests (MOF) and a Scientific License from DFO will be required.

Depending on the scope of clearing, if a wildlife salvage is deemed necessary, a General Wildlife Permit is required under the *Wil li e Act* to be submitted to MOF. These specialized permits require negotiation with MOF to determine appropriate compensation and /or the location for a replacement nest.

4.3 Archaeological Investigations

Associated engaged Ursus Heritage Consultants Ltd. (Ursus) to lead the archaeological work for this project. Ursus' report is attached in Appendix J.

This initial archaeological investigation is an Archaeological Overview Assessment (AOA). The AOA was conducted following the British Columbia Archaeological Impact Assessment Guidelines and addresses the following key objectives:

- Identify any known archaeological sites within the study area, based on existing records.
- Evaluate the potential for encountering additional archaeological sites within the study area.

Based on the findings from the AOA, the chance find procedure will be used during construction activities.

4.4 Geohazards

The Preliminary Steep Creek Hazard Assessment completed for the Project by BGC is attached in Appendix C, as previously noted. The executive summary of the report notes the following:

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The steep creek geohazard likelihood, volume, discharge, and annual sediment yield noted in the BGCs report that impact this project are limited to Saporano Creek for S-CR-17 and North and South Herford Creeks, along with Upper, North, and South Dale Creeks for S-CR-14. As Lagace Creek is a 3rd order stream flowing from Allan Lake. As shown in their report, BGC has characterized the geohazard likelihood at Saporano Creek as low. Their estimate of sediment supply volume during the 1 in 200-year steep creek event ranges from 6,400 m^3 to 19,400 m^3. BGC has characterized the geohazard likelihood at North Herford Creek as low and South Herford Creek as moderate. Their estimate of sediment supply volume during the 1 in 200-year steep creek event ranges from 12,100 m^3 to 34,500 m^3. BGC has characterized the geohazard likelihood at Upper, North, and South Dale Creeks as low. Their estimate of sediment supply volume during the 1 in 200-year steep creek event ranges from 20,600 m^3 to 23,600 m^3.

5 RIGHTSHOLDER AND STAKEHOLDER ENGAGEMENT

Discussion with stakeholders occurred throughout the conceptual design process, including property owners, the MoTI, and local First Nations groups. Work for both sites was heavily dependent on land control and access to complete the proposed work. A summary of discussions with each group is below.

5.1 Ministry of Transportation and Infrastructure

Discussions with MoTI were largely focused on Site S-CR-17 as Lagace Creek winds along Sylvester Road within the project area. Without private property consent, riprap could not be placed along Sylvester Road for bank stability control, as this work requires channel widening outside of the MoTI right-of-way. As a result, only sediment removal contained within the MoTI right-of-way could be completed in this area.

A draft technical memorandum dated March 25, 2024, was sent to MoTI providing a high-level, qualitative culvernability assessment of the sites along Sylvester Road, which are subject to proposed Disaster Financial Assistance (DFA) funded flood recovery efforts in the Hatzic Valley. Refer to Appendix K for a copy of the memo. Unfortunately, no formal response was received to our communication; however, MoTI has verbally indicated that they prefer to defer repairs to damage along Sylvester Road so that more comprehensive corridor improvements to current codes and standards can be completed at a later date. Further, MoTI noted that any future work required will be undertaken by MoTI. This was discussed with ENV, and the associated scope of work was removed from the project.

All permits required from MoTI to proceed with the restoration works were obtained through an application completed by Zenith.

5.2 First Nations

The project team has engaged First Nations via the Task Force meetings. In addition to this, Associated has been working directly with Leq'a:mel First Nation, which is also engaging separately with other interested First Nations. Additional engagement will occur throughout the project's life cycle on an as-needed basis.

5.3 Property Owners

A License of Occupation (LOO) is required for access to the creek through private property to complete work. While most property owners were supportive of restorative work on Lagace Creek, others were unwilling to allow access. Access to S-CR-14 was restricted in some areas due to a lack of creek access, which limited sediment removal work. Bank instability control shown on Parcel 011-054-778 in S-CR-14 was removed from the scope due to land access denial as well.

In S-CR-17, sediment removal upstream of Sylvester Road was removed from the scope due to the property owner indicating that they were not willing to participate in the flood recovery program. Furthermore, the replacement of private crossings was also removed from the scope, as ENV indicated they were out of scope.

6 RESTORATION CONCEPTS

Restoration concepts were developed to recover hydraulic system conveyance. Specifically, these concepts address:

- Channel modification to improve hydraulic capacity (widening, realignment, re-grading)
- Sediment and debris removal
- Crossing structure upgrades

Restoration concepts were developed for bank instability protection measures. Specifically, these concepts address:

- Riprap
- Engineered products
- Bio-engineered solutions

6.1 Restoration Options

6.1.1 Channel Modification

Channel modification includes earthworks to move or remove material to improve hydraulic capacity. This is most effective in an area of flow unimpeded by crossings or channel constriction. For this reason, channel modifications were not considered for the majority of S-CR-17, as most of the issues there were due to frequently undersized crossings.

While S-CR14 does generally have cross-sectional capacity, re-grading a large portion of the creek would improve flow efficiency. The creek would require re-grading from the Dale Road bridge to Hatzic Slough to eliminate portions of backgrading. The overall elevation difference at this project site is so small that even re-grading the entire section would likely not stop the backwater effect at Dale Road bridge, and the outcome would not be worth the effort. Re-establishing the channel in select spots, such as the existing SRS, was considered as part of the proposed work.

6.1.2 Sediment and Debris Removal

The stream bed material within the proposed sediment removal areas for S-CR-14 is assumed to be very sandy from the visual, on-site assessment. There is heavy sediment deposition around the Dale Road bridge due to frequent times of zero velocity as a result of elevated Hatzic Slough / Hatzic Lake levels. Further, several existing sand recovery stations within S-CR-14 have filled in due to sediment deposition and a lack of maintenance.

Sediment at S-CR-17 varies from large cobbles and gravel at the upstream boundary to more sandy material downstream. Heavy sediment deposition was noted around crossings, causing flow restriction, as well as at the Saporano Creek confluence. Sediment removal in Saporano Creek would provide channel capacity improvement downstream to Lagace Creek.

6.1.3 Crossing Upgrades

S-CR-14 includes one major crossing at Dale Road. This bridge was shown to have adequate flow capacity during hydraulic analysis, and upgrades were not considered a requirement; however, extensive sedimentation has occurred at the structure.

S-CR-17 features frequent crossings, with the majority being privately owned and therefore out of our scope. While crossing upgrades would limit flow restriction, there could also be negative flooding impacts downstream from an increase in flow.

6.1.4 Riprap

Riprap is a bank protection measure that is relatively easy to source and inexpensive. Installation is relatively easy, and the material comes in a range of sizes for each specific application. Unfortunately, riprap can be dislodged and washed downstream during events that exceed the target design flow event, further contributing to debris blocking the creek flow.

6.1.5 Engineered Products

Engineered products are often installed in addition to riprap or other slope stabilization applications, for example, underneath riprap. Some options for engineered products for erosion control include Turf Reinforcement Matting (TRM) and coconut matting.

6.1.6 Bio-Engineered Solutions

Bioengineering is used to prevent bank failures while preserving ecological principles. This approach combines living plants, such as live staking, with natural or biodegradable materials to stabilize soil and protect waterways from instability. For both site locations, a hybrid approach with riprap would be required to provide immediate strength while the bioengineering applications root naturally. The root structure of live staking would encourage slope cohesion in very sandy locations, such as near the Dale Road bridge. Bioengineering is a preferred approach to erosion control while minimizing habitat impacts and may be suitable in areas away from vulnerable infrastructure.

6.2 Restoration Plans

6.2.1 Site S-CR-14

The proposed approach aims to combine several restoration options to achieve the project goal of repairing and protecting bank failure locations, protecting hydraulic structures, and removing notable sediment deposits while restoring the hydraulic capacity of the creek. These include:

- Restoring the existing SRS and excavating sediment from the creek.
- Construction of three new SRS around the Dale Road bridge to support sediment excavation and maintain hydraulic capacity under the bridge.
- Bioengineering applications at three sites to address bank failures.

6.2.2 Site S-CR-17

The proposed approach is limited in what can be achieved due to stakeholders' willingness to participate and program objectives. The intent is to remove sediment and debris accumulation from two locations along Lagace Creek.

7 OPINION OF PROBABLE COST

A detailed breakdown of the opinion of probable cost is located in Appendix L.

Our Opinion of Probable Cost is dependent on the following assumptions:

- Unit rates are based on recent bid prices for similar projects.
- Assuming we can get approval to access all necessary property, land acquisition is not required.
- A 50% contingency is included due to the simplistic nature of the concept design for the sediment removal within the creek channel and is intended to account for unknown items and uncertainties in the design scope of work and construction methods.
- Sediment removal quantities are based on available LIDAR surface and localized survey data. Quantities may require adjustment based on site conditions at the time of construction.
- Conditions at the site remain similar to when the site assessments occurred (e.g. no additional bank scour/failure, sediment deposition, etc.).
- Contaminated material handling is not included.
- Environmental habitat compensation is not included.

7.1 S-CR-14 Proposed Works

Our Conceptual Opinion of Probable Cost for S-CR-14 restoration, sediment excavation and bank repair, including bioengineered bank stability controls, is approximately $2,060,000. This value includes a 30% contingency markup. Appendix L contains a detailed breakdown with quantity estimates.

7.2 S-CR-17 Proposed Works

Our Conceptual Opinion of Probable Cost for S-CR-17 restoration and sediment excavation is approximately $76,000. This value includes a 30% contingency markup. Appendix L contains a detailed breakdown with quantity estimates.

8 CONCLUSIONS AND RECOMMENDATION

Based on the assessment completed herein, Associated Engineering makes the following conclusions and recommendations, considering the current and future requirements within the project area:

- Site S-CR-14 scope includes construction of three new SRS and approximately 8,250 m^3 of sediment removal from the new and existing SRS, along with bank stabilization.
- Site S-CR-17 scope includes approximately 300 m^3 of sediment and debris removal at targeted locations while minimizing impact on natural habitats.
- Additionally, permitting requirements note that environmental habitat compensation (e.g. offsetting) may be required for adversely impacting the creek. Sediment removal for Site S-CR-14 was targeted at existing sand recovery stations to limit the extent of the earthworks.
- A long-term strategy for managing sediment deposition and removal is required, and this likely includes sand recovery stations that require permanent access to facilitate regular maintenance.

8.1 Proposed Restoration Plan

Conceptual design drawings have been developed for the recommended work and are attached in Appendix M.

REFERENCES

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CLOSURE

This report was prepared for the Ministry of Environment and Parks to assess bank instability and flooding risks at sites in the Hatzic Valley area that were damaged or disturbed during the November 2021 Atmospheric River Event and to outline restoration concepts to return the sites to their pre-event condition.

The services provided by Associated Engineering (B.C.) Ltd., in the preparation of this report, was conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions. No other warranty, expressed or implied, is made.

Respectfully submitted,
Associated Engineering (B.C.) Ltd.

Engineers & Geoscientists BC Permit Number 1000163

Prepared By:

Ryan Karsgaard, P.Eng.
Engineer-of-Record



Reviewed By:

Paul Hague, RPF
Project Manager

APPENDIX A – SITE ASSESSMENT REPORT

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June 24, 2022
File: 2022-2462-00

Fred Bjork, P.Eng.
Price Waterhouse Coopers
Submitted via email: fred.bjork@pwc.com

Re: PRELIMINARY SITE ASSESSMENT OF POTENTIAL AREAS OF IMMEDIATE CONCERN
PWC SITE ID: S-CR-14 - 10491 FARMS RD, HATZIC, BC

Dear Mr. Bjork:

The purpose of this high level and preliminary assessment of identified potential Areas of Immediate Concern is to allow the Province of BC to review and consider risks, potential consequences, and to prioritize urgent mitigation measures, including removal of sediments introduced by the 2021 Atmospheric River event (and other potential mitigation measures). The objective is to avoid hydraulic restrictions in the waterways and associated flooding due to the upcoming 2022 spring freshet, which may cause additional damage to riverbeds, banks, and infrastructure, and pose a significant threat to the safety of people, properties, infrastructure, and the environment.

1 SITE INFORMATION

Site ID: S-CR-14
Site Location: 49.191343, -122.250592
Site Description: 10491 Farms Rd, Hatzic, BC
Local Government Agency: Fraser Valley River District (FVRD)
Waterbody: Lagace Creek

The site location is shown in **Figure 1** and **Figure 2** located at the end of the letter.

2 SITE HAZARD

2.1 HAZARD ASSESSMENT METHODOLOGY

The assessment, as summarised in this letter for the noted Area of Immediate Concern, follows the following general methodology and approach:

1. High level senior engineering level experience and judgement, review of available relevant reference information, site visits and visual inspections, and communication with relevant stakeholders;
2. Risk assessment; and
3. Identification and advice on prioritized and appropriate mitigation measures (if any), their required timing, and further work required to validate such advice.

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Associated Engineering (AE) completed the assessment of the above-noted site, based on a site visit completed on April 5, 2022 and a review of the background data noted in **Section 3**.

2.2 HAZARD ASSESSMENT SUMMARY

The November 2021 Atmospheric River resulted in significant flooding and widespread sediment deposition throughout Lagace Creek. Sediment from the steeper upstream portions of the Hatzic Lake watershed were transported to and deposited throughout downstream reaches of Lagace Creek.

According to Northwest Hydraulic Consultants (NHC) *Flood Damage Recovery Plan. Lagace Creek, Hatzic Valley* (2005, June) report, it appears that the Lagace Creek Reach 1 (upstream of Hatzic Lake to the Dale Road Crossing) has been heavily aggraded in the past few years. Frequent flooding of the area has been reported by landowners not only during high-flow events but also during successively lower flows. Sediment deposition appears to be a regular occurrence during high-flow events as noted in the NHC report. This aggradation has an impact to the channel capacity and water levels of the creek.

Based on a review of previous assessments of Lagace Creek and available historical imagery, it appears that there is a history of deposition and bank erosion along this creek. High flows are generated during fall and winter storms, such as an atmospheric river, rather than a freshet (snowmelt) event.

During our site assessment of 10491 Farms Road, we noted the following:

1. Some sediment deposition was observed at the bottom of the Lagace Creek; however, due to the high water levels of Lagace Creek, the extent of the deposition was not discernable during our site visit;
2. Localized stream bank erosion was observed upstream and downstream of the Youngston Road bridge. Bank erosion is likely due to higher flow volume, velocities and sediment deposition from the November 2021 event;
3. At the time of this assessment, water levels in Lagace Creek were observed to be backing up into the Youngston Road ditches limiting the conveyance capacity of the ditch. This creates an increased risk of flooding of adjacent areas; and
4. Roadway ditches along Youngston Road are currently filled with debris and sediment also impacting the overall conveyance capacity of the ditch.

In our opinion, the available hydraulic capacity of the creek is not adequate for typical spring and summer flows. Due to the heavily aggraded Creek bottom and increased water levels in the creek, the risk of damage to the Youngston Road bridge and existing properties is considered high. Site improvement should be completed immediately to reduce the risk to nearby properties.

3 PRELIMINARY RISK EVALUATION

The Preliminary Risk Evaluation for the site is shown in Table 3-1. The risk key is included in Enclosure A for ease of reference.

Table 3-1:
Preliminary Risk Evaluation

Category	Preliminary Risk Evaluation	Anticipated Consequence
Public Health and Safety	High	Road and land conditions that make travelling and accessing property dangerous. Flooding of houses.
River Capacity	High	River capacity has been significantly reduced due to sediment deposition.
Environmental	High	Increased frequency and duration of flooding of agricultural areas is expected to result in financial losses to farmers.
Infrastructure	High	Residential and agricultural structures at increased risk of flooding.

Based on the preliminary risk evaluation noted above, we assess the risk to be **High**. On this basis, we confirm that the site remains an Area of Immediate Concern.

The Preliminary Risk Evaluation is based on the following currently available information:

1. Background Reports:
    a. Northwest Hydraulic Consultants (NHC). (2005, June). *Flood Damage Recovery Plan. Lagace Creek, Hatzic Valley.*
    b. Associated Engineering. (1992, August). *Hatzic Prairie Drainage Study Volume 1.*
    c. Stirling Geoscience Ltd. (2021, December 16). *Hatzic Prairie Creek Assessment and Preliminary High-Level Mitigation Cost Estimate, Hatzic Prairie, BC. - DRAFT*
2. Site Assessment completed on April 5, 2022;
3. Phone Conversation with Jamie Stirling, P.Eng. on April 6, 2022;
4. Google Satellite Imagery;
5. Discussions with FVRD staff; and
6. Debris assessment mapping and GIS base data (hydrology, provided by Emergency Management BC)

4 SITE OPINION AND ADVICE

Based on the hazard and risk assessment, it is our opinion that Site S-CR-14 is an Area of Immediate Concern (AIC), requiring further assessment, emergency work, and potential mitigation measures to be implemented as soon as possible:

Emergency Works (ASAP):

1. Remove sediment deposition on Lagace Creek upstream and downstream of the Youngston Road Bridge to increase channel capacity. Extend of sediment removal to be confirmed through additional field investigation.
2. Remove debris from ditches.

Long-Term Holistic Solutions (to current Codes and Standards):

1. Complete a hydraulic capacity assessment of the creek channel.
2. Restore the channel's hydraulic capacity by:
   a. Coordinating with FVRD and environmental regulators;
   b. Sediment removal, as required, based on the results of hydraulic capacity assessment;
   c. Bank restoration; and
   d. Installation of riprap on channel banks. Locations and extents to be determined as part of the hydraulic capacity assessment.

5 CLOSURE

Please contact Andrew Wiens at 403-863-4009 if there are additional questions or concerns.

Yours truly,

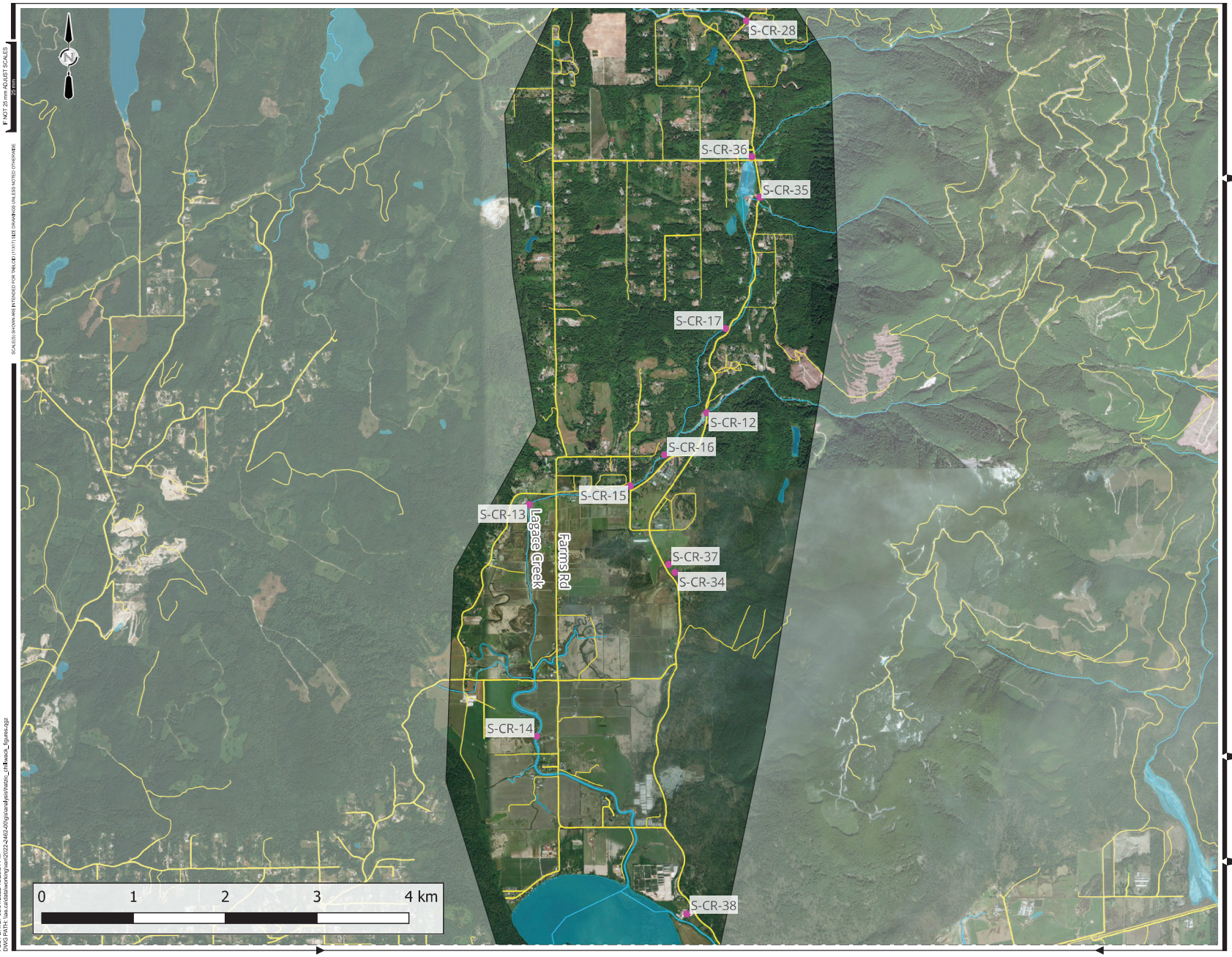
Prepared by:

Lisbeth Medina, P.Eng. (Alberta)
Water Resources Engineer
LM/AW/fd/kc

Reviewed by:

Jun. 24 2022

Andrew Wiens, P.Eng. (BC)
Senior Water Resources Engineer



Associated Engineering

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Platinum member

Legend

- Roads
- Watercourse
- Waterbodies
- Problem Location (Site)

NOTE: AERIAL IMAGERY PROVIDED BY BING AERIAL MAY NOT REFLECT CURRENT CONDITIONS DUE TO FLOOD EVENTS SINCE THE DATE OF COLLECTION

PROJECT LOCATION



pwc

FIGURE 1

PRICEWATERHOUSE COOPERS
BC MINISTRY OF ENVIRONMENT

WATERWAY SEDIMENT ASSESSMENT
PWC HATZIC PRARIE SITE OVERVIEW

AE PROJECT No.	20222462-00
SCALE	AS SHOWN
APPROVED	A. WIENS
DATE	20220531
REV	A
DESCRIPTION	ISSUED FOR FINAL

IF NOT 25 mm ADJUST SCALES
25 mm

SCALES SHOWN ARE INTENDED FOR 11"x17" SIZE DRAWINGS UNLESS NOTED OTHERWISE

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Associated Engineering

BEST MANAGED COMPANIES
Platinum member

Legend

- Roads
- Watercourses
- Waterbodies
- Problem Location (Site)

NOTE: AERIAL IMAGERY PROVIDED BY BING AERIAL MAY NOT REFLECT CURRENT CONDITIONS DUE TO FLOOD EVENTS SINCE THE DATE OF COLLECTION

PROJECT LOCATION



pwc

FIGURE 2

PRICEWATERHOUSE COOPERS
BC MINISTRY OF ENVIRONMENT

WATERWAY SEDIMENT ASSESSMENT
PWC SITE: S-CR-14
FARMS RD NEAR YOUNGSTON RD

AE PROJECT No.	20222462-00
SCALE	AS SHOWN
APPROVED	A. WIENS
DATE	20220427
REV	A
DESCRIPTION	ISSUED FOR FINAL

IF NOT 25 mm ADJUST SCALES
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Enclosure A – Risk Matrix

Risk Evaluation and Response						
	Consequence Rating	**Very Low**	**Low**	**Medium**	**High**	**Very High**
Indices	**Public Health and Safety**	Minor disruption to few.	Minor, short term disruption to local community or moderate disruption to few.	Moderate disruption to local community, or substantial disruption to few.	Moderate, long term disruption to local community.	Substantial, long term disruption to region.
	River Capacity	Flow contained within the channel	Flow temporarily floods adjacent land	Flow floods adjacent lands resulting in prolonged flooding	Partial avulsion of flow resulting in flooding, erosion and scour damage to adjacent land and infrastructure	Full avulsion of flow resulting in flooding, erosion and scour damage to adjacent land and infrastructure
	Environmental	No noticeable loss or deterioration of habitat, species, unique landscapes, or culturally valued sites.	Small, short term loss or deterioration of important, unique, rare, or endangered habitat, species, landscapes, or culturally valued sites. Moderate, recoverable loss or damage of less valued habitat, species, landscapes, or sites.	Moderate temporary or small permanent loss or deterioration of important, unique, rare, or endangered habitat, species, landscapes, or culturally valued sites. Moderate loss or damage of less valued habitat, species, landscapes, or sites.	Moderate permanent loss or deterioration of important, unique, rare, or endangered habitat, species, landscapes, or culturally valued sites.	Major permanent loss or deterioration of important, unique, rare, or endangered habitat, species, landscapes, or culturally valued sites.
	Infrastructure	No infrastructure impacted	Impacts to infrastructure (minor erosion or scour, some debris accumulation, partial infilling, etc.) are not expected to have an impact of the operation of the infrastructure.	Impacts to infrastructure (erosion or scour, debris accumulation, infilling, etc.) leave infrastructure vulnerable	Impacts to infrastructure (erosion or scour, debris accumulation, infilling, etc.) should be repaired post-freshet	Impacts to infrastructure (erosion or scour, debris accumulation, infilling, etc.) will likely result in failure or irreparable damage to the infrastructure - repairs should commence pre-freshet
Likelihood	**Annual Exceedance Probability**	**Very Low**	**Low**	**Medium**	**High**	**Very High**
Very Likely	>0.2	**M**	**H**	**H**	**VH**	**VH**
Likely	0.2-0.1	**L**	**M**	**H**	**H**	**VH**
Moderate	0.1-0.02	**L**	**L**	**M**	**H**	**H**
Unlikely	0.02-0.005	**VL**	**L**	**L**	**M**	**H**
Very unlikely	<0.005	**VL**	**VL**	**L**	**L**	**M**

Risk Key			
	VH	Very High	Risk is unacceptable short-term (before next flood season); Risk reduction required
	H	High	Risk is unacceptable medium-term; Risk reduction plan must be developed and implemented in a reasonable time frame
	M	Medium	Risk may be tolerable; more detailed review required
	L	Low	Risk is tolerable; monitor
	VL	Very Low	Risk is broadly acceptable; no further review needed

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June 24, 2022
AE File: 2022-2462-00

Fred Bjork, P.Eng.
Price Waterhouse Coopers
Submitted via email: fred.bjork@pwc.com

Re: PRELIMINARY SITE ASSESSMENT OF POTENTIAL AREAS OF IMMEDIATE CONCERN PWC SITE ID: S-CR-17 - LAGACE CREEK BETWEEN PATTISON CREEK AND ALLAN LAKE, HATZIC, BC

Dear Mr. Bjork:

The purpose of this high level and preliminary assessment of identified potential Areas of Immediate Concern is to allow the Province of BC to review and consider risks, potential consequences, and to prioritize urgent mitigation measures, including removal of sediments introduced by the 2021 Atmospheric River event (and other potential mitigation measures). The objective is to avoid hydraulic restrictions in the waterways and associated flooding due to the upcoming 2022 spring freshet, which may cause additional damage to riverbeds, banks, and infrastructure, and pose a significant threat to the safety of people, properties, infrastructure, and the environment.

1 SITE INFORMATION

Site ID: S-CR-17
Site Description: Lagace Creek between Pattison Creek and Allan Lake, Hatzic, BC
Site Locations:
Site 1 – Failed Driveway: 49.235909, -122.218453
Site 2 – Lagace Creek Tributary: 49.240045, -122.217729
Local Government Agency: Fraser Valley River District (FVRD)
Waterbody: Lagace Creek

The site location is shown in **Figure 1** and **Figure 2** located at the end of the letter.

2 SITE HAZARD

2.1 HAZARD ASSESSMENT METHODOLOGY

The assessment of this potential Area of Immediate Concern follows the following general methodology and approach:

1. High level senior engineering level experience and judgement, review of available relevant reference information, site visits and visual inspections, and communication with relevant stakeholders;
2. Risk assessment; and
3. Identification and advice on prioritized and appropriate mitigation measures (if any), their required timing, and further work required to validate such advice.

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Associated Engineering (AE) completed a high-level, qualitative assessment of the above noted site by visiting the site on April 5, 2022 and reviewing background data as noted in **Section 3**.

2.2 HAZARD ASSESSMENT SUMMARY

The November 2021 Atmospheric River resulted in significant flooding and widespread sediment deposition throughout Lagace Creek. Sediment from the steeper upstream portions of the Hatzic Lake watershed were transported to and deposited throughout downstream reaches of Lagace Creek Sediment deposition is a regular occurrence during high-flow events as noted in the Northwest Hydraulic Consultants (NHC) *Flood Damage Recovery Plan. Lagace Creek, Hatzic Valley* (2005, June) report.

Based on a review of previous assessments of Lagace Creek, it appears that there is a history of deposition and bank erosion along this creek. High flows are generated during fall and winter storms, such as an atmospheric river, rather than a freshet (snowmelt) event.

During our site assessment of the Lagace Creek reach between Allan Lake and the Patterson Creek confluence, we noted the following:

1. There are several residences with private driveways across Lagace Creek, west of Sylvester Road. Most of these driveways consisted of wooden bridges with large hydraulic openings. These crossings are generally considered acceptable form a hydraulic capacity perspective;
2. **Site 1 – Failed Driveway:** At one (1) of the private driveways, the creek crossing consisted of three (3) culverts, estimated at 1.2 m diameter each. Relative to other private crossings, the hydraulic capacity is considered inadequate. Based on discussions with nearby residents, we understand that this location caused a significant increase in upstream water levels which placed several structures at risk of flooding. The driveway embankment failed during the event and eroded sediment which was deposited downstream. We expect that another high-flow event will erode additional sediment which is expected to negatively impact downstream areas if mobilized during a high flow event;
3. **Site 2 – Lagace Creek Tributary**: The Lagace Creek tributary has deposited sediment on the east and west sides of Sylvester Road. Additional sediment from this location appears to have been carried downstream into Lagace Creek. We anticipate that this has reduced the channel capacity in this area. Deposited sediment is located upstream and downstream of Sylvester Road. This sediment restricts local channel and culvert capacity; and
4. Sediment deposition is visible at several various locations along Lagace Creek, particularly in the lower parts of this reach.

3 PRELIMINARY RISK EVALUATION

The Preliminary Risk Evaluation for the site is shown in **Table 3-1**. The risk key is included in **Enclosure A** for ease of reference.

Table 3-1:
Preliminary Risk Evaluation

Category	Preliminary Risk Evaluation	Anticipated Consequence
Public Health and Safety	Low	Inundation of roadways and private property is expected during a high-flow event, however, this is not expected to create a significant public safety concern. Overtopping of Sylvester Road may also occur during lower rainfall events.
River Capacity	Medium	Channel capacity has been reduced which creates an increased risk of flooding adjacent areas.
Environmental	Low	Potential for trees and vegetation along the creek edge to die if inundated for a long time. Additional bank erosion may result in addition to vegetation dying. This vegetation is expected to regrow. The value of the habitat is not known but is not expected to be rare.
Infrastructure	Medium	Potential impacts to nearby private buildings and Sylvester Road.

Based on the preliminary risk evaluation noted above, we assess the risk to be **Medium**. On this basis, our opinion is that the site rating should be revised to an Area of Concern.

The Preliminary Risk Evaluation is based on the following currently available information:

1. Background Reports:
    a. Northwest Hydraulic Consultants (NHC). (2005, June). *Flood Damage Recovery Plan. Lagace Creek, Hatzic Valley.*
    b. Associated Engineering. (1992, August). *Hatzic Prairie Drainage Study Volume 1.*
    c. Stirling Geoscience Ltd. (2021, December 16). *Hatzic Prairie Creek Assessment and Preliminary High-Level Mitigation Cost Estimate, Hatzic Prairie, BC.*
2. Site Assessment completed on April 5, 2022;
3. Google Satellite Imagery;
4. Hydrology mapping provided by Emergency Management BC;
5. Phone Conversation with Jamie Sterling on April 6, 2022; and
6. Communications with FVRD Staff.

4 SITE OPINION AND ADVICE

Based on the hazard and risk assessment, it is our opinion that Site S-CR-17 (Sites 1 and 2) is an Area of Concern (AC), by definition one not requiring sediment removal prior to the 2022 spring freshet but requiring further assessment, emergency work and potential mitigation measures prior to the 2022 fall / winter storm season as follows:

Emergency Works (ASAP):

1. Not applicable.

Long-Term Holistic Solutions (to current Codes and Standards):

1. **Site 1 – Failed Driveway**: Remove sediment from Lagace Creek. Consider reinstating / upgrading the driveway crossing, if required, and associated hydraulic capacity to accommodate larger fall / winter storm events;
2. **Site 2 – Lagace Creek Tributary**: Remove sediment from the Lagace Creek tributary near Sylvester Road. Limits of sediment removal to be confirmed through an additional site review; and
3. Complete a hydraulic capacity assessment of the channel between Allen Lake and Pattison Creek to determine if additional activities are required.

5 CLOSURE

Please contact Andrew Wiens at 403-863-4009 if there are additional questions or concerns.

Yours truly,

Prepared by:



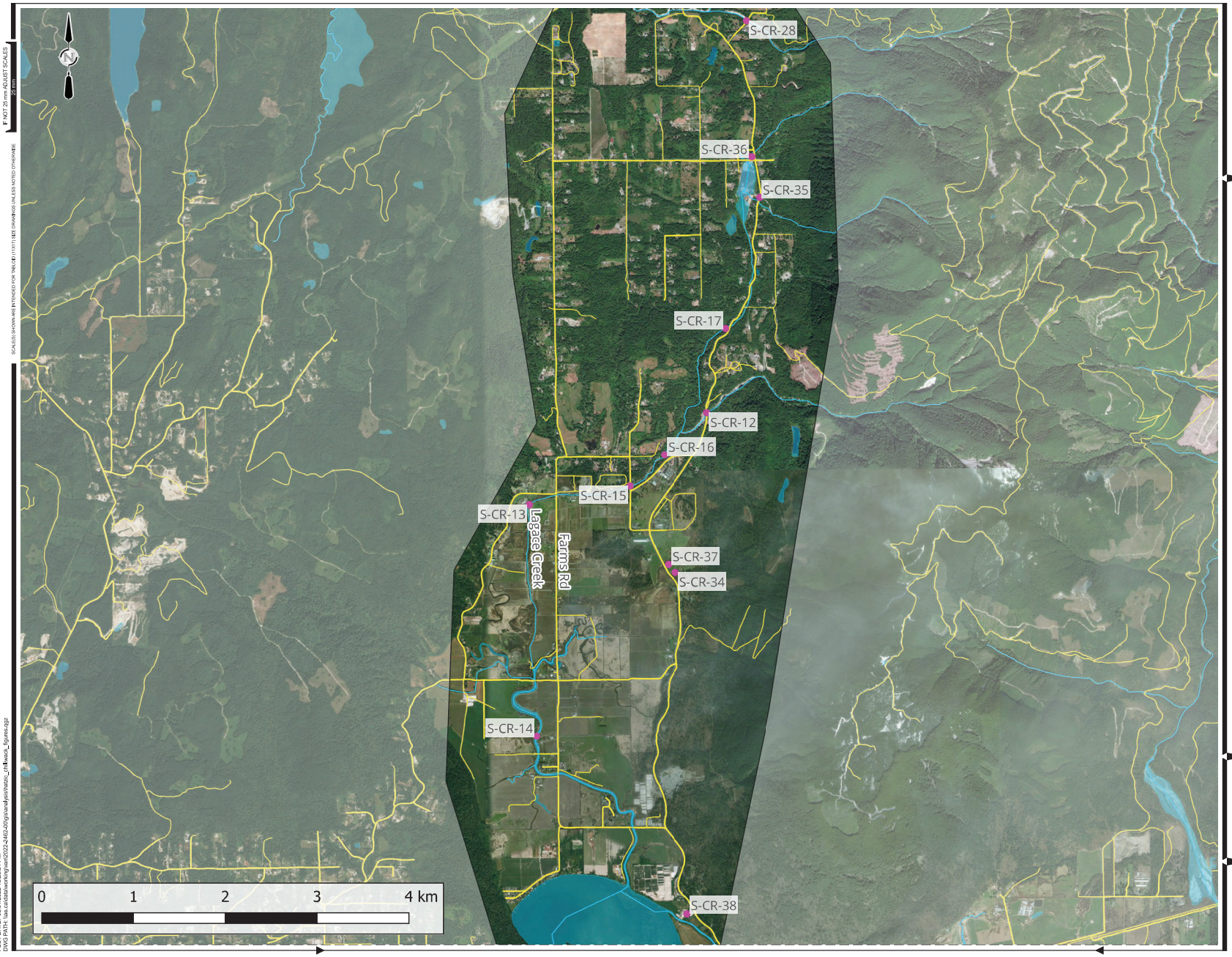
For Danielle Nyarko, E.I.T. (Alberta)
Water Resources Engineer
DN/AW/fd/kc

Reviewed by:



Jun. 24 2022

Andrew Wiens, P.Eng. (BC)
Senior Water Resources Engineer



Associated Engineering

BEST MANAGED COMPANIES
Platinum member

Legend

- Roads
- Watercourse
- Waterbodies
- Problem Location (Site)

NOTE: AERIAL IMAGERY PROVIDED BY BING AERIAL MAY NOT REFLECT CURRENT CONDITIONS DUE TO FLOOD EVENTS SINCE THE DATE OF COLLECTION

PROJECT LOCATION



pwc

FIGURE 1

PRICEWATERHOUSE COOPERS
BC MINISTRY OF ENVIRONMENT

WATERWAY SEDIMENT ASSESSMENT
PWC HATZIC PRARIE SITE OVERVIEW

AE PROJECT No.	20222462-00
SCALE	AS SHOWN
APPROVED	A. WIENS
DATE	20220531
REV	A
DESCRIPTION	ISSUED FOR FINAL

IF NOT 25 mm ADJUST SCALES
25 mm

SCALES SHOWN ARE INTENDED FOR 11"x17" SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 05/31/2022 12:25:34 PM
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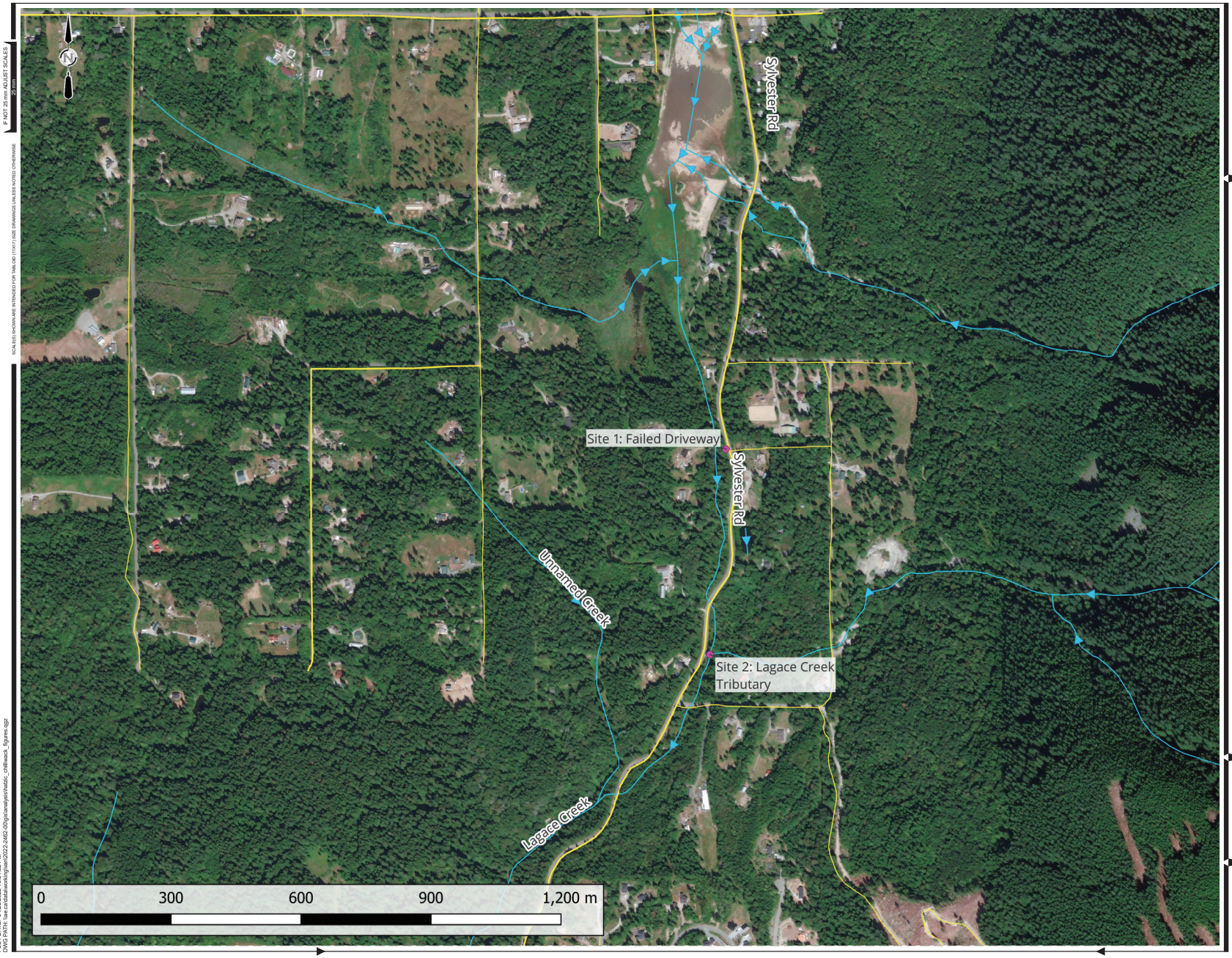


Associated Engineering

BEST MANAGED COMPANIES
Platinum member

Legend

- Roads
- Watercourses
- Waterbodies
- Problem Location (Site)

NOTE: AERIAL IMAGERY PROVIDED BY BING AERIAL MAY NOT REFLECT CURRENT CONDITIONS DUE TO FLOOD EVENTS SINCE THE DATE OF COLLECTION

PROJECT LOCATION



pwc

FIGURE 2

PRICEWATERHOUSE COOPERS
BC MINISTRY OF ENVIRONMENT

WATERWAY SEDIMENT ASSESSMENT
PWC SITE: S-CR-17
LAGACE CREEK NEAR LUNDGREN RD

AE PROJECT No.	20222462-00
SCALE	AS SHOWN
APPROVED	A. WIENS
DATE	20220427
REV	A
DESCRIPTION	ISSUED FOR FINAL

IF NOT 25 mm ADJUST SCALES
25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 04/28/2022 13:54:52 PM
DWG PATH: \\ae.ca\data\working\van\2022-2462-00\gis\analysis\hatzic_chilliwack_figures.qgz

Enclosure A – Risk Matrix

Risk Evaluation and Response						
	Consequence Rating	**Very Low**	**Low**	**Medium**	**High**	**Very High**
Indices	**Public Health and Safety**	Minor disruption to few.	Minor, short term disruption to local community or moderate disruption to few.	Moderate disruption to local community, or substantial disruption to few.	Moderate, long term disruption to local community.	Substantial, long term disruption to region.
	River Capacity	Flow contained within the channel	Flow temporarily floods adjacent land	Flow floods adjacent lands resulting in prolonged flooding	Partial avulsion of flow resulting in flooding, erosion and scour damage to adjacent land and infrastructure	Full avulsion of flow resulting in flooding, erosion and scour damage to adjacent land and infrastructure
	Environmental	No noticeable loss or deterioration of habitat, species, unique landscapes, or culturally valued sites.	Small, short term loss or deterioration of important, unique, rare, or endangered habitat, species, landscapes, or culturally valued sites. Moderate, recoverable loss or damage of less valued habitat, species, landscapes, or sites.	Moderate temporary or small permanent loss or deterioration of important, unique, rare, or endangered habitat, species, landscapes, or culturally valued sites. Moderate loss or damage of less valued habitat, species, landscapes, or sites.	Moderate permanent loss or deterioration of important, unique, rare, or endangered habitat, species, landscapes, or culturally valued sites.	Major permanent loss or deterioration of important, unique, rare, or endangered habitat, species, landscapes, or culturally valued sites.
	Infrastructure	No infrastructure impacted	Impacts to infrastructure (minor erosion or scour, some debris accumulation, partial infilling, etc.) are not expected to have an impact of the operation of the infrastructure.	Impacts to infrastructure (erosion or scour, debris accumulation, infilling, etc.) leave infrastructure vulnerable	Impacts to infrastructure (erosion or scour, debris accumulation, infilling, etc.) should be repaired post-freshet	Impacts to infrastructure (erosion or scour, debris accumulation, infilling, etc.) will likely result in failure or irreparable damage to the infrastructure - repairs should commence pre-freshet
Likelihood	**Annual Exceedance Probability**	**Very Low**	**Low**	**Medium**	**High**	**Very High**
Very Likely	>0.2	**M**	**H**	**H**	**VH**	**VH**
Likely	0.2-0.1	**L**	**M**	**H**	**H**	**VH**
Moderate	0.1-0.02	**L**	**L**	**M**	**H**	**H**
Unlikely	0.02-0.005	**VL**	**L**	**L**	**M**	**H**
Very unlikely	<0.005	**VL**	**VL**	**L**	**L**	**M**

Risk Key			
	VH	Very High	Risk is unacceptable short-term (before next flood season); Risk reduction required
	H	High	Risk is unacceptable medium-term; Risk reduction plan must be developed and implemented in a reasonable time frame
	M	Medium	Risk may be tolerable; more detailed review required
	L	Low	Risk is tolerable; monitor
	VL	Very Low	Risk is broadly acceptable; no further review needed

Enclosure B – Site Photos



Lagace Creek:
Private Bridge



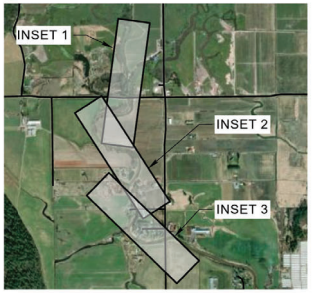
Legace Creek:
Site 1 – Failed Driveway

APPENDIX B – PHOTO LOG



LEGEND:
- S-CR-14 PHOTO LOCATION

PROJECT LOCATION



Associated Engineering

CANADA'S BEST MANAGED COMPANIES
Platinum member

BRITISH COLUMBIA | Ministry of Environment

FIGURE B-1

BC MINISTRY OF ENVIRONMENT
AND CLIMATE CHANGE STRATEGY

S-CR-14
SITE CONDITION AND SITE ASSESSMENT
PHOTO LOCATIONS

AE PROJECT No.	20222632-00
SCALE	1:1,700
APPROVED	R.KARSGAARD
DATE	2025MAR06
REV	0
DESCRIPTION	ISSUED FOR REPORT

IF NOT 35 mm AS LIST SCALES SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE
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SAVE DATE: 2025-03-06 2:24 PM SAVED BY: JORDON ROZON
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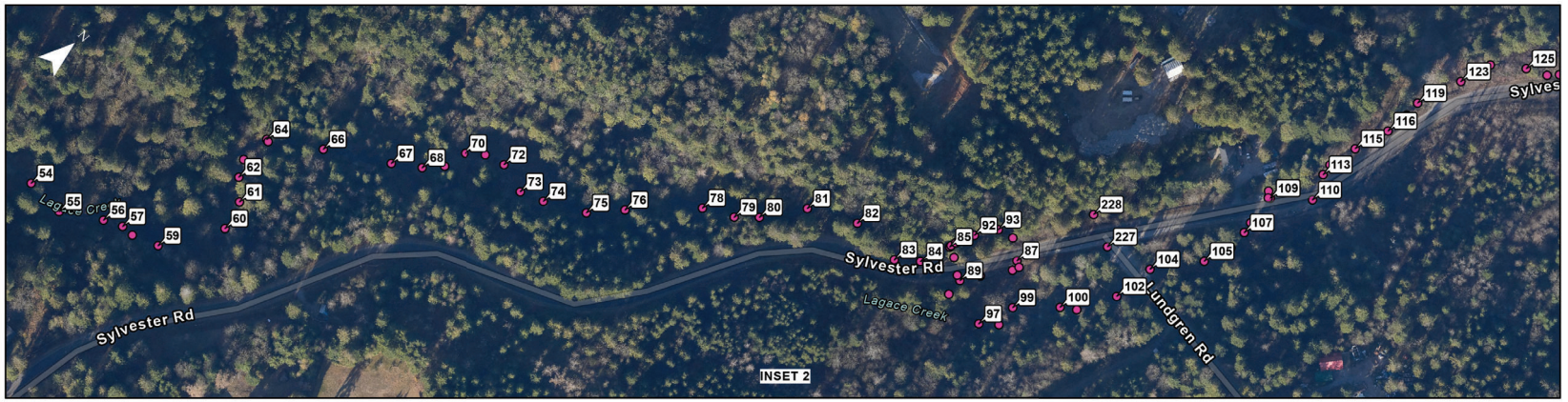


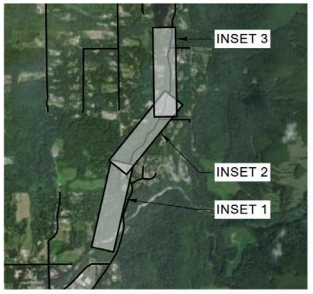


Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:
- S-CR-17 PHOTO LOCATION

PROJECT LOCATION



BRITISH COLUMBIA | Ministry of Environment

FIGURE B-1

BC MINISTRY OF ENVIRONMENT
AND CLIMATE CHANGE STRATEGY

S-CR-17
SITE CONDITION AND SITE ASSESSMENT
PHOTO LOCATIONS

AE PROJECT No.	20222632-00
SCALE	1:1,700
APPROVED	R.KARSGAARD
DATE	2025MAR06
REV	0
DESCRIPTION	ISSUED FOR REPORT

IF NOT 35 mm AD JUST SCALES BARS

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

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SAVE DATE: 2025-03-06 2:24 PM SAVED BY: JORDON ROZON
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SITE: S-CR-14
PHOTO ID: 58
COORDINATES: 49.2009490,-122.2514791

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering









SITE: S-CR-14
PHOTO ID: 59
COORDINATES: 49.2004019,-122.2515013

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering









SITE: S-CR-14
PHOTO ID: 60
COORDINATES: 49.2003350,-122.2514483

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering



SITE: S-CR-14
PHOTO ID: 61
COORDINATES: 49.1999578,-122.2513117

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering









SITE: S-CR-14
PHOTO ID: 62
COORDINATES: 49.1995771,-122.2512940

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering









SITE: S-CR-14
PHOTO ID: 63
COORDINATES: 49.1990396,-122.2510774

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17









SITE: S-CR-14
PHOTO ID: 64
COORDINATES: 49.1986184,-122.2509363

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17









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PHOTO ID: 65
COORDINATES: 49.1984629,-122.2511823

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17









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HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17









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COORDINATES: 49.1981759,-122.2510204

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17









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COORDINATES: 49.1976914,-122.2508714

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17









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COORDINATES: 49.1973815,-122.2513715

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FIELD VISIT OF SITES S-CR-14 & S-CR-17









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COORDINATES: 49.1973729,-122.2522508

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17









SITE: S-CR-14
PHOTO ID: 71
COORDINATES: 49.1972765,-122.2529162

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering









SITE: S-CR-14
PHOTO ID: 72
COORDINATES: 49.1973267,-122.2536445

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17









SITE: S-CR-14
PHOTO ID: 73
COORDINATES: 49.1970793,-122.2543210

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17









SITE: S-CR-14
PHOTO ID: 74
COORDINATES: 49.1965746,-122.2545660

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17









SITE: S-CR-14
PHOTO ID: 75
COORDINATES: 49.1961901,-122.2544705

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17









SITE: S-CR-14
PHOTO ID: 76
COORDINATES: 49.1959545,-122.2543450

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17









SITE: S-CR-14
PHOTO ID: 77
COORDINATES: 49.1956608,-122.2538613

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17









SITE: S-CR-14
PHOTO ID: 78
COORDINATES: 49.1953687,-122.2533025

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17









SITE: S-CR-14
PHOTO ID: 79
COORDINATES: 49.1952888,-122.2525369

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17









SITE: S-CR-14
PHOTO ID: 80
COORDINATES: 49.1951242,-122.2519024

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17









SITE: S-CR-14
PHOTO ID: 81
COORDINATES: 49.1950387,-122.2510812

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17









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PHOTO ID: 82
COORDINATES: 49.1947434,-122.2504009

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17









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COORDINATES: 49.1943958,-122.2501403

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17









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PHOTO ID: 84
COORDINATES: 49.1938206,-122.2501796

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17









SITE: S-CR-14
PHOTO ID: 85
COORDINATES: 49.1935366,-122.2504536

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17









SITE: S-CR-14
PHOTO ID: 86
COORDINATES: 49.1927906,-122.2511306

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17









SITE: S-CR-14
PHOTO ID: 87
COORDINATES: 49.1923706,-122.2511923

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17









SITE: S-CR-14
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HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17









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PHOTO ID: 89
COORDINATES: 49.1916905,-122.2509003

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17









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COORDINATES: 49.1913577,-122.2506185

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17









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HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17









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FIELD VISIT OF SITES S-CR-14 & S-CR-17







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FIELD VISIT OF SITES S-CR-14 & S-CR-17









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FIELD VISIT OF SITES S-CR-14 & S-CR-17









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HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17









SITE: S-CR-14
PHOTO ID: 96
COORDINATES: 49.1892999,-122.2505042

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17









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FIELD VISIT OF SITES S-CR-14 & S-CR-17









SITE: S-CR-14
PHOTO ID: 98
COORDINATES: 49.1890174,-122.2494604

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17









SITE: S-CR-14
PHOTO ID: 99
COORDINATES: 49.1891278,-122.2487109

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17









SITE: S-CR-14
PHOTO ID: 100
COORDINATES: 49.1891960,-122.2478738

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering









SITE: S-CR-14
PHOTO ID: 101
COORDINATES: 49.1892809,-122.2475996

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering









SITE: S-CR-14
PHOTO ID: 102
COORDINATES: 49.1893393,-122.2470919

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17









SITE: S-CR-17
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HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17






SITE: S-CR-17
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COORDINATES: 49.2224914,-122.2289263

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering






SITE: S-CR-17
PHOTO ID: 4
COORDINATES: 49.2227391,-122.2287311

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 7
COORDINATES: 49.2227687,-122.2284144

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering



SITE: S-CR-17
PHOTO ID: 8
COORDINATES: 49.2228026,-122.2283988

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 9
COORDINATES: 49.2230915,-122.2281942

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



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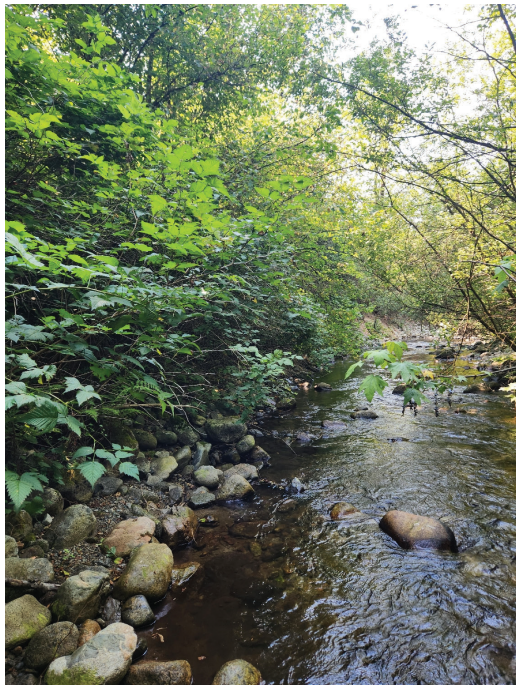
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering





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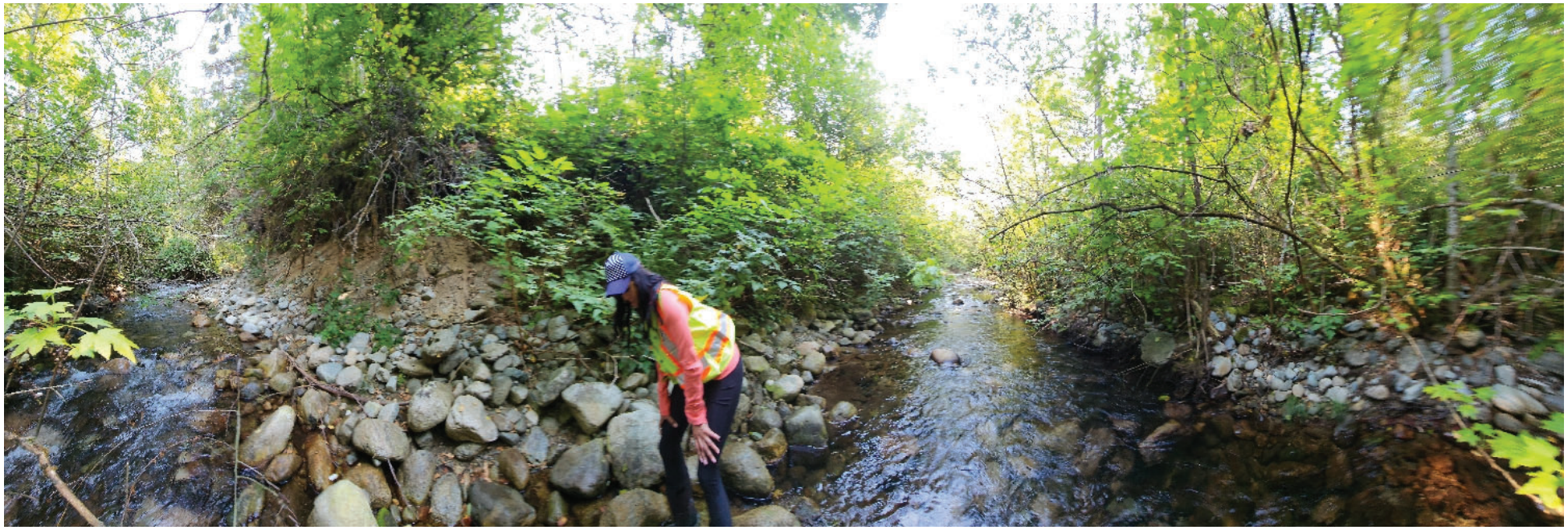
HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



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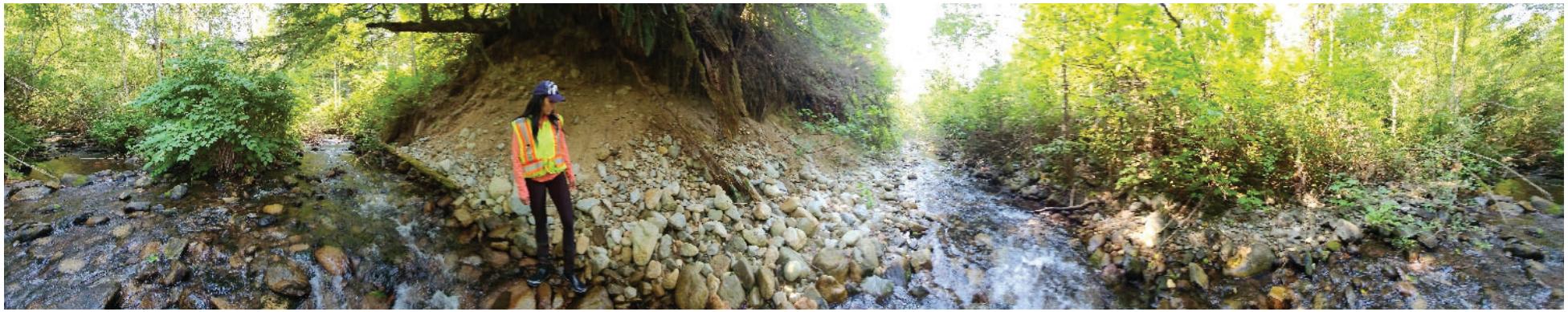
HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



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COORDINATES: 49.2234854,-122.2282617

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering



SITE: S-CR-17
PHOTO ID: 17
COORDINATES: 49.2236599,-122.2283255

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 18
COORDINATES: 49.2238307,-122.2283848

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 19
COORDINATES: 49.2238825,-122.2284921

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 20
COORDINATES: 49.2238639,-122.2285514

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17









SITE: S-CR-17
PHOTO ID: 21
COORDINATES: 49.2240683,-122.2282466

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

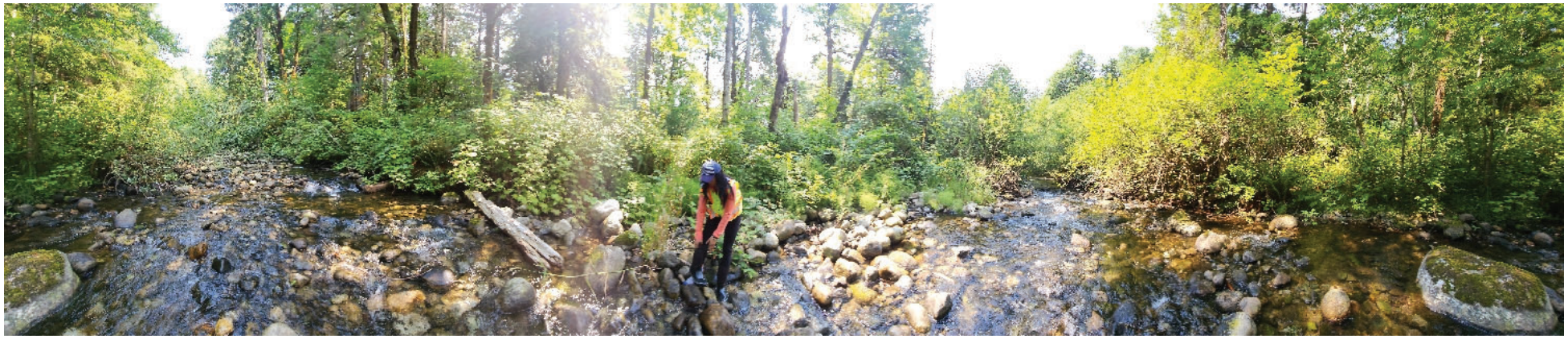
Associated Engineering



SITE: S-CR-17
PHOTO ID: 22
COORDINATES: 49.2242717,-122.2277989

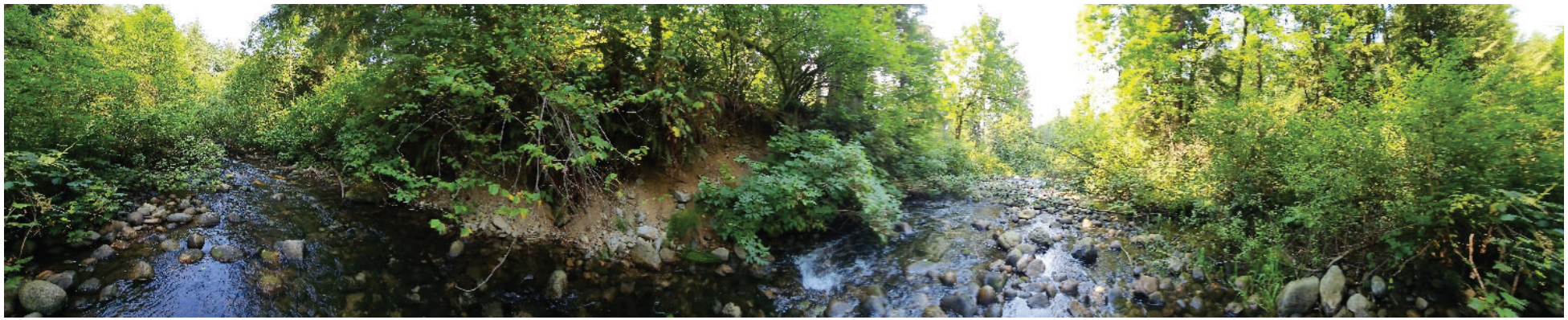
HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering



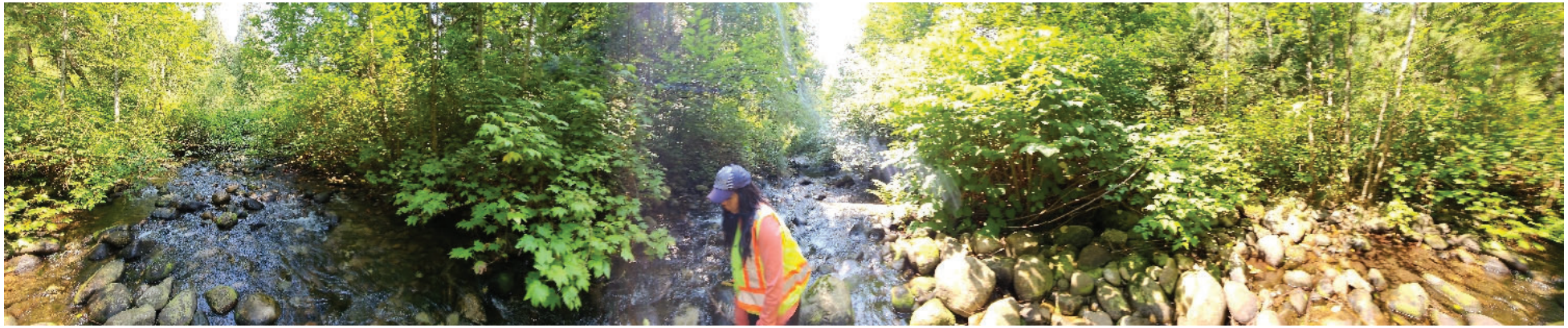
SITE: S-CR-17
PHOTO ID: 23/24
COORDINATES: 49.2244626,-122.2276356

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 25
COORDINATES: 49.2247570,-122.2276591

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 26
COORDINATES: 49.2248987,-122.2275551

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 27
COORDINATES: 49.2250632,-122.2270351

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering



SITE: S-CR-17
PHOTO ID: 28
COORDINATES: 49.2251421,-122.2267416

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 30
COORDINATES: 49.2256105,-122.2260829

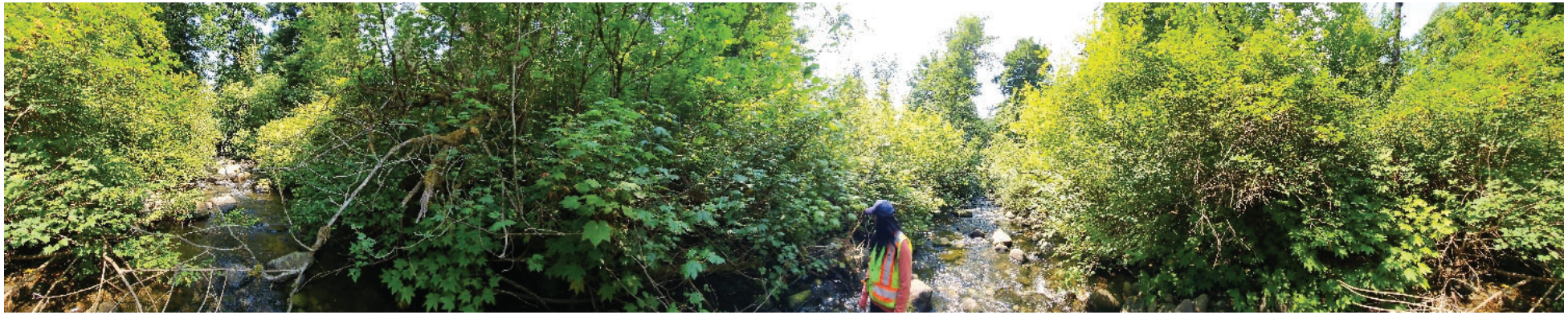
HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 31
COORDINATES: 49.2258546,-122.2259887

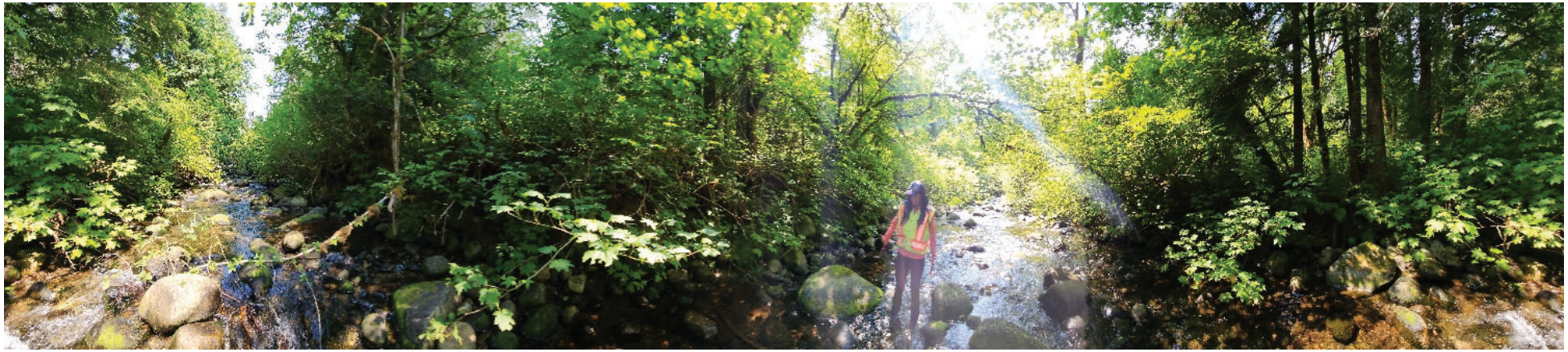
HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering



SITE: S-CR-17
PHOTO ID: 32
COORDINATES: 49.2260589,-122.2259122

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 33
COORDINATES: 49.2263888,-122.2259657

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering





SITE: S-CR-17
PHOTO ID: 34
COORDINATES: 49.2266637,-122.2259296

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 35
COORDINATES: 49.2268974,-122.2259455

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 36/37
COORDINATES: 49.2271615,-122.2259780

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 38
COORDINATES: 49.2275119,-122.2259823

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 39
COORDINATES: 49.2278496,-122.2260015

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 40
COORDINATES: 49.2280931,-122.2260563

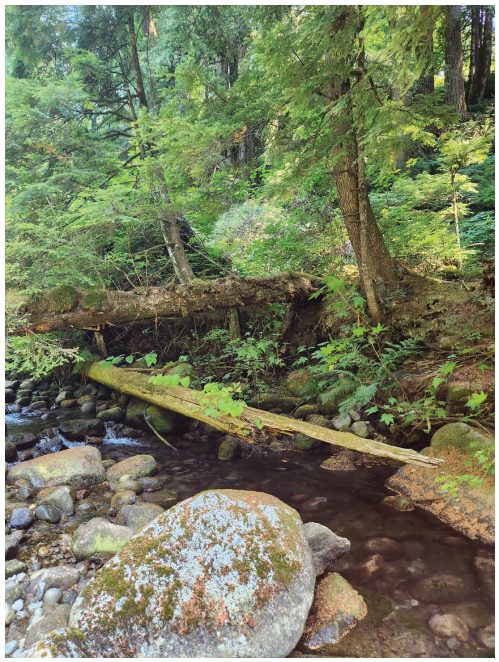
HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 41
COORDINATES: 49.2282065,-122.2260277

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17






SITE: S-CR-17
PHOTO ID: 42
COORDINATES: 49.2284524,-122.2260436

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 43/44
COORDINATES: 49.2286531,-122.2262726

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 45
COORDINATES: 49.2288008,-122.2264064

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 46
COORDINATES: 49.2288720,-122.2263723

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17






SITE: S-CR-17
PHOTO ID: 47
COORDINATES: 49.2289347,-122.2262442

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 48
COORDINATES: 49.2290704,-122.2261560

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering



SITE: S-CR-17
PHOTO ID: 49
COORDINATES: 49.2292871,-122.2260256

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 50
COORDINATES: 49.2294861,-122.2259965

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17





SITE: S-CR-17
PHOTO ID: 51
COORDINATES: 49.2297593,-122.2259932

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 52
COORDINATES: 49.2299068,-122.2260940

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 53
COORDINATES: 49.2299654,-122.2261481

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 54
COORDINATES: 49.2300235,-122.2261061

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering





SITE: S-CR-17
PHOTO ID: 55
COORDINATES: 49.2301019,-122.2257837

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 56
COORDINATES: 49.2301232,-122.2254362

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 57
COORDINATES: 49.2302895,-122.2251274

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 58
COORDINATES: 49.2303514,-122.2249784

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering



SITE: S-CR-17
PHOTO ID: 59
COORDINATES: 49.2303638,-122.2248651

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering











SITE: S-CR-17
PHOTO ID: 60
COORDINATES: 49.2304396,-122.2246458

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 61
COORDINATES: 49.2307996,-122.2243920

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering



SITE: S-CR-17
PHOTO ID: 62
COORDINATES: 49.2309628,-122.2244935

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 63
COORDINATES: 49.2310491,-122.2246653

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering



SITE: S-CR-17
PHOTO ID: 64
COORDINATES: 49.2311369,-122.2247600

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering



SITE: S-CR-17
PHOTO ID: 65/66
COORDINATES: 49.2313131,-122.2247560

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 67
COORDINATES: 49.2315286,-122.2243831

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 68
COORDINATES: 49.2317804,-122.2239072

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 69
COORDINATES: 49.2319020,-122.2237068

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 70
COORDINATES: 49.2320085,-122.2235919

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 71
COORDINATES: 49.2321496,-122.2235600

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 73
COORDINATES: 49.2322868,-122.2232577

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 74
COORDINATES: 49.2322604,-122.2229861

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 75
COORDINATES: 49.2323246,-122.2227896

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering



SITE: S-CR-17
PHOTO ID: 76
COORDINATES: 49.2324771,-122.2224714

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering



SITE: S-CR-17
PHOTO ID: 77
COORDINATES: 49.2326600,-122.2222762

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 78
COORDINATES: 49.2327630,-122.2222105

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 79
COORDINATES: 49.2330125,-122.2218532

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 80
COORDINATES: 49.2331204,-122.2216123

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering



SITE: S-CR-17
PHOTO ID: 81
COORDINATES: 49.2332311,-122.2214730

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 82
COORDINATES: 49.2334764,-122.2212643

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 83
COORDINATES: 49.2336469,-122.2208833

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 84
COORDINATES: 49.2336776,-122.2204325

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering





SITE: S-CR-17
PHOTO ID: 85
COORDINATES: 49.2337861,-122.2202744

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 86/91
COORDINATES: 49.2339711,-122.2202078

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering





SITE: S-CR-17
PHOTO ID: 87
COORDINATES: 49.2339524,-122.2201127

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17






SITE: S-CR-17
PHOTO ID: 92
COORDINATES: 49.2340130,-122.2202020

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 93
COORDINATES: 49.2341228,-122.2201493

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17





SITE: S-CR-17
PHOTO ID: 94
COORDINATES: 49.2342525,-122.2200542

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering





SITE: S-CR-17
PHOTO ID: 225
COORDINATES: 49.2342857,-122.2199165

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 88
COORDINATES: 49.2342209,-122.2197374

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 89
COORDINATES: 49.2341649,-122.2196983

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 95
COORDINATES: 49.2342048,-122.2196837

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 96
COORDINATES: 49.2340008,-122.2198370

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 90
COORDINATES: 49.2338925,-122.2199197

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17





SITE: S-CR-17
PHOTO ID: 97
COORDINATES: 49.2337934,-122.2198913

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 98
COORDINATES: 49.2338191,-122.2195206

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 99
COORDINATES: 49.2339047,-122.2193992

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 100
COORDINATES: 49.2340289,-122.2194413

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 101
COORDINATES: 49.2342459,-122.2191737

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering



SITE: S-CR-17
PHOTO ID: 102
COORDINATES: 49.2343120,-122.2190636

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 103
COORDINATES: 49.2345378,-122.2189299

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 104
COORDINATES: 49.2346538,-122.2189191

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17









SITE: S-CR-17
PHOTO ID: 105
COORDINATES: 49.2347868,-122.2189290

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



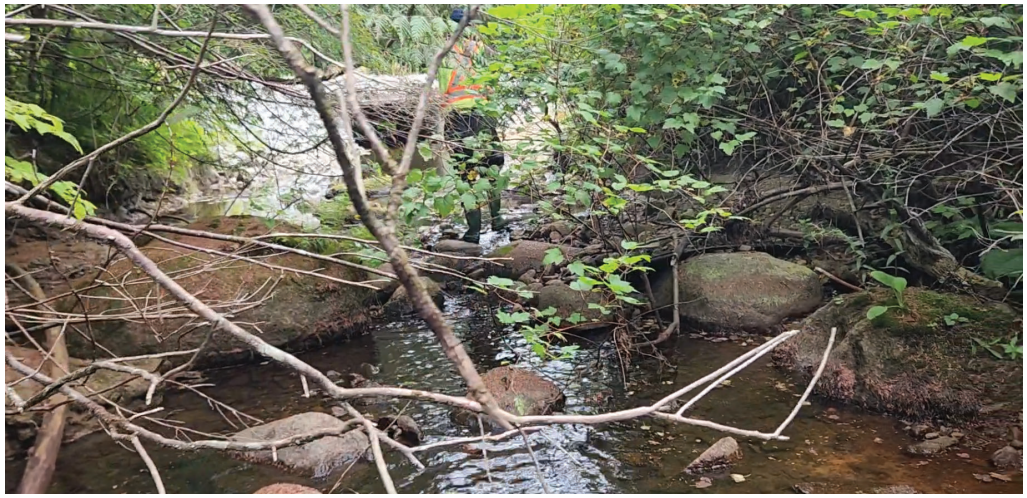
SITE: S-CR-17
PHOTO ID: 106
COORDINATES: 49.2350564,-122.2186796

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 107
COORDINATES: 49.2352277,-122.2186218

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17





SITE: S-CR-17
PHOTO ID: 108
COORDINATES: 49.2353426,-122.2186521

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 109
COORDINATES: 49.2354070,-122.2186851

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering







SITE: S-CR-17
PHOTO ID: 112
COORDINATES: 49.2356030,-122.2188013

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17







SITE: S-CR-17
PHOTO ID: 199
COORDINATES: 49.2357655,-122.2184952

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering



SITE: S-CR-17
PHOTO ID: 113
COORDINATES: 49.2357403,-122.2186973

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 114
COORDINATES: 49.2359076,-122.2186071

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 115
COORDINATES: 49.2359733,-122.2186342

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 116
COORDINATES: 49.2361440,-122.2186034

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering



SITE: S-CR-17
PHOTO ID: 117
COORDINATES: 49.2363545,-122.2185422

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 118
COORDINATES: 49.2364282,-122.2185348

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering



SITE: S-CR-17
PHOTO ID: 119
COORDINATES: 49.2364979,-122.2185431

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 120
COORDINATES: 49.2365912,-122.2185682

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering



SITE: S-CR-17
PHOTO ID: 121
COORDINATES: 49.2366526,-122.2185578

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17







SITE: S-CR-17
PHOTO ID: 122
COORDINATES: 49.2367216,-122.2185180

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 123
COORDINATES: 49.2367366,-122.2185023

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering



SITE: S-CR-17
PHOTO ID: 124
COORDINATES: 49.2368635,-122.2184734

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 125
COORDINATES: 49.2370561,-122.2184217

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 126
COORDINATES: 49.2372031,-122.2181944

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 127
COORDINATES: 49.2372715,-122.2180312

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering



SITE: S-CR-17
PHOTO ID: 128
COORDINATES: 49.2373287,-122.2179683

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 129
COORDINATES: 49.2373887,-122.2180183

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17





SITE: S-CR-17
PHOTO ID: 130
COORDINATES: 49.2374971,-122.2180717

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17





SITE: S-CR-17
PHOTO ID: 131
COORDINATES: 49.2376157,-122.2179607

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering



SITE: S-CR-17
PHOTO ID: 132
COORDINATES: 49.2376314,-122.2178674

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering









SITE: S-CR-17
PHOTO ID: 133
COORDINATES: 49.2377698,-122.2179893

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 134
COORDINATES: 49.2379387,-122.2181518

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering





SITE: S-CR-17
PHOTO ID: 135
COORDINATES: 49.2380249,-122.2182024

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering



SITE: S-CR-17
PHOTO ID: 136
COORDINATES: 49.2382168,-122.2181984

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17





SITE: S-CR-17
PHOTO ID: 137
COORDINATES: 49.2382608,-122.2180166

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering



SITE: S-CR-17
PHOTO ID: 138/139
COORDINATES: 49.2384684,-122.2179537

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 140
COORDINATES: 49.2385350,-122.2179682

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering



SITE: S-CR-17
PHOTO ID: 141
COORDINATES: 49.2385616,-122.2180083

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17







SITE: S-CR-17
PHOTO ID: 142
COORDINATES: 49.2387310,-122.2180732

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering



SITE: S-CR-17
PHOTO ID: 143
COORDINATES: 49.2388762,-122.2180259

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17









SITE: S-CR-17
PHOTO ID: 144
COORDINATES: 49.2391146,-122.2181032

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering









SITE: S-CR-17
PHOTO ID: 145
COORDINATES: 49.2392241,-122.2181135

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering



SITE: S-CR-17
PHOTO ID: 146
COORDINATES: 49.2394047,-122.2180922

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering



SITE: S-CR-17
PHOTO ID: 147
COORDINATES: 49.2402615,-122.2180469

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17









SITE: S-CR-17
PHOTO ID: 148
COORDINATES: 49.2404166,-122.2180673

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering



SITE: S-CR-17
PHOTO ID: 149/150
COORDINATES: 49.2405430,-122.2180868

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 151
COORDINATES: 49.2406403,-122.2181525

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17





SITE: S-CR-17
PHOTO ID: 152
COORDINATES: 49.2407477,-122.2182225

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17







SITE: S-CR-17
PHOTO ID: 153
COORDINATES: 49.2409739,-122.2183442

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17







SITE: S-CR-17
PHOTO ID: 154
COORDINATES: 49.2412113,-122.2184797

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17

Associated Engineering



SITE: S-CR-17
PHOTO ID: 157
COORDINATES: 49.2414119,-122.2186157

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 158
COORDINATES: 49.2415051,-122.2186158

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 159
COORDINATES: 49.2417284,-122.2186310

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17





SITE: S-CR-17
PHOTO ID: 160
COORDINATES: 49.2419161,-122.2186828

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17





SITE: S-CR-17
PHOTO ID: 161
COORDINATES: 49.2421308,-122.2187888

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17





SITE: S-CR-17
PHOTO ID: 162
COORDINATES: 49.2422078,-122.2188236

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17



SITE: S-CR-17
PHOTO ID: 163
COORDINATES: 49.2422780,-122.2188469

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17





SITE: S-CR-17
PHOTO ID: 164
COORDINATES: 49.2424148,-122.2190099

HATZIC EMERGENCY WORKS - AUG AND OCT, 2023
FIELD VISIT OF SITES S-CR-14 & S-CR-17





APPENDIX C – PRELIMINARY STEEP CREEK HAZARD ASSESSMENT

Hatzic Valley

Preliminary Steep Creek Hazard Assessment

Prepared by BGC Engineering Inc. for:

Associated Engineering (BC) Ltd.

February 26, 2025

Project 2348003

Pioneering responsible solutions to complex earth science challenges

February 26, 2025 Project 2348003

Associated Engineering (BC) Ltd.
500 – 2889 East 12th Avenue
Vancouver, BC V5M 4T5

Attention: Jamie Fitzgerald, A.Sc.T., P.Eng.

Preliminary Steep Creek Hazard Assessment

Please find a draft report attached. We appreciate the opportunity to collaborate with you on this challenging and interesting project.

Should you have any questions, please do not hesitate to contact the undersigned.

Yours sincerely,

BGC Engineering Inc.
per:



Marc-André Brideau, Ph.D., P.Geo. (BC, AB, QC)
Senior Engineering Geologist

EXECUTIVE SUMMARY

Between November 14 and 16, 2021, Southern British Columbia (BC), including the Hatzic Valley, was subject to widespread flooding and landslides due to a particularly intensive (Category 4) atmospheric river. In response to the November 2021 storms, BGC was retained by Associated Engineering (BC) Ltd. to provide a preliminary steep creek hazard characterization with a focus on sediment source and delivery downstream, for nine watercourses in the Hatzic Valley. This report updates BGC's (March 1, 2004) hazard assessment of Field, Carratt, Eng, McNab and also characterizes steep creek hazards at Pattison, Herford, Dale, and Davies creeks.

As part of the work, BGC mapped alluvial fans subject to steep creek hazards along the streams listed in Table E-1. Based on aerial imagery, BGC interprets that there are houses on alluvial fans that could be affected by these hazards. Per Engineers and Geoscientists of BC professional practice standards, BGC recommends that Associated Engineering share the alluvial fan extents with Fraser Valley Regional District (FVRD). Hazards may exist beyond the alluvial fan extents mapped by BGC, and any land use or planning decisions should also align with alluvial fan areas and Hazard Development Permit Areas that are available through the FVRD.

Table E-1 below provides a summary of the main steep creek hazard and sediment supply characterization results from this work. Geohazard likelihood and representative return periods estimates are based on watershed and fan activity, and provide an estimate of how frequently steep creek geohazard events (e.g. debris floods or debris flows) are expected to occur for each of the creeks. As well, the lower and upper bound estimates for sediment volume and peak discharge for the 200-year return period event are outlined.

The information provided in this report will support the characterization and management of sediment deposits from the November 2021 atmospheric river and from future steep creek events by the BC Ministry of Environment and Climate Change Strategy. The scope of this report was limited to hazard characterization and assessment. This information would be a useful starting point for a detailed geohazard risk assessment, which would support updated land use guidance in the Hatzic Valley and inform potential mitigation decisions.

Table E-1 Summary of steep creek geohazard likelihood, relative return period, volume, and discharge for each watershed considered in this study.

Fan	Geohazard Likelihood	Relative Return Period[1] (years)	200-year Return Period Steep Creek Event			
			Volume (m^3)		Peak Discharge (m^3/s)	
			Lower	Upper	Lower	Upper
Field Creek	Low	> 50	2,600	3,200	30	40
Carratt Creek	High	< 20	15,500	68,500	120	370
Eng Creek	High	< 20	8,100	70,100	70	380
McNab Creek	High	< 20	9,300	34,200	80	220
Saporano Creek	Low	> 50	6,400	19,400	60	140
Pattison Creek	High	< 20	22,100	35,400	160	220
North Herford Creek	Low	> 50	6,500	13,200	60	110
South Herford Creek	Moderate	20 to 50	5,600	21,300	60	150
Upper Dale Creek	Low	> 50	4,800	5,800	50	60
North Dale Creek[1]	Low	> 50	7,900	8,900	70	80
South Dale Creek[1]	Low	> 50	7,900	8,900	70	80
Davies Creek	Low	> 50	2,800	3,000	30	40

Note:

1. Relative Return Period estimates correlate with Geohazard Likelihood, where low Geohazard Likelihoods are estimated to have a return period > 50 years, moderate Geohazard Likelihoods 20 to 50 years, and high Geohazard Likelihoods < 20 years.
2. For volume estimation, North and South Dale Creek fans are treated as one combined fan due to undifferentiated watershed areas

TABLE OF REVISIONS

Date	Revision	Remarks
April 28, 2023	DRAFT	
February 26, 2025	FINAL	BGC addressed comments from AE, received on April 3, 2024.

CREDITS AND ACKNOWLEDGEMENTS

BGC would like to acknowledge the following contributors to this report:

- Andrew Funk, B.A.Sc., EIT (BC), Geological Engineer-in-Training
- Gemma Ferland, B.A.Sc., EIT (BC), Geological Engineer-in-Training
- Gemma Bullard, B.A.Sc., EIT (NS), Civil Engineer-in-Training
- Joel Knickle, B.Sc., GIT (BC), Geoscientist-In-Training

BGC is grateful for the discussions about past-events and stratigraphy in the Hatzic Valley with Drew Brayshaw, Ph.D., P.Geo., Senior Hydrologist and Geoscientist, Statlu Environmental Consulting Ltd.

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[1] References in these Limitations to the "document" include the document to which these Limitations are attached, any content contained in this document, and any content referenced in this document but located in one of BGC's proprietary software applications (e.g., Cambio).

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1.0 INTRODUCTION

Between November 14 and 16, 2021, Southern British Columbia (BC), including the Hatzic Valley, was subject to widespread flooding and landslides (Sepulveda et al. 2022) due to a particularly intensive (Category 4) atmospheric river (Gillet et al. 2022). In response to the November 2021 storms, the BC Ministry of Environment and Climate Change Strategy (the Ministry) retained Price Waterhouse Coopers (PWC) to oversee the evaluation and prioritization of sediment and debris hazards at sites across southern BC. PWC retained Associated Engineering (BC) Ltd. (AE) to evaluate sediment hazards at prioritized sites. These include twelve sites in the Hatzic Valley. This project will provide information to support the characterization and management of sediment deposits from the November 2021 atmospheric river and from future steep creek events by the Ministry.

AE retained BGC Engineering Inc. (BGC) to provide a preliminary steep creek hazard characterization with a focus on sediment source and delivery downstream. BGC understands that the proposed scope is Phase 1 of an anticipated two-phase project. Phase 2 consists of a more detailed characterization of select steep creek hazards as needed. The details of the second phase workplan are informed by the findings of the first phase. The current scope of work was outline in BGC's P22277 proposal dated September 30, 2022 and approved by AE on November 14, 2022. The work is covered under an agreement for professional services between BGC and AE dated January 19, 2023.

1.1 Scope

This project uses desktop characterization and field observations in the study area (Figure 1-1) to update BGC's (March 1, 2004) hazard assessment based on landslide activity associated with the November 2021 atmospheric event and 2022 lidar dataset. The current scope includes:

- Review of publicly available aerial photographs, published maps, and FVRD held geohazard reports published since 2004
- Use of lidar data to update and supplement the BGC (March 1, 2004) watershed morphometrics and mapping of potentially unstable slopes
- Review dominant steep creek processes based on watershed morphometrics, recorded activity and expert judgment
- Review and update magnitude-frequency curve for each creek based on empirical relationships between fan area and debris volumes
- Outline a workplan for addition analysis to support the project
- Report on methodology and results of the above tasks.

The scope focused on hazard assessment and did not include exposure characterization or risk assessment.

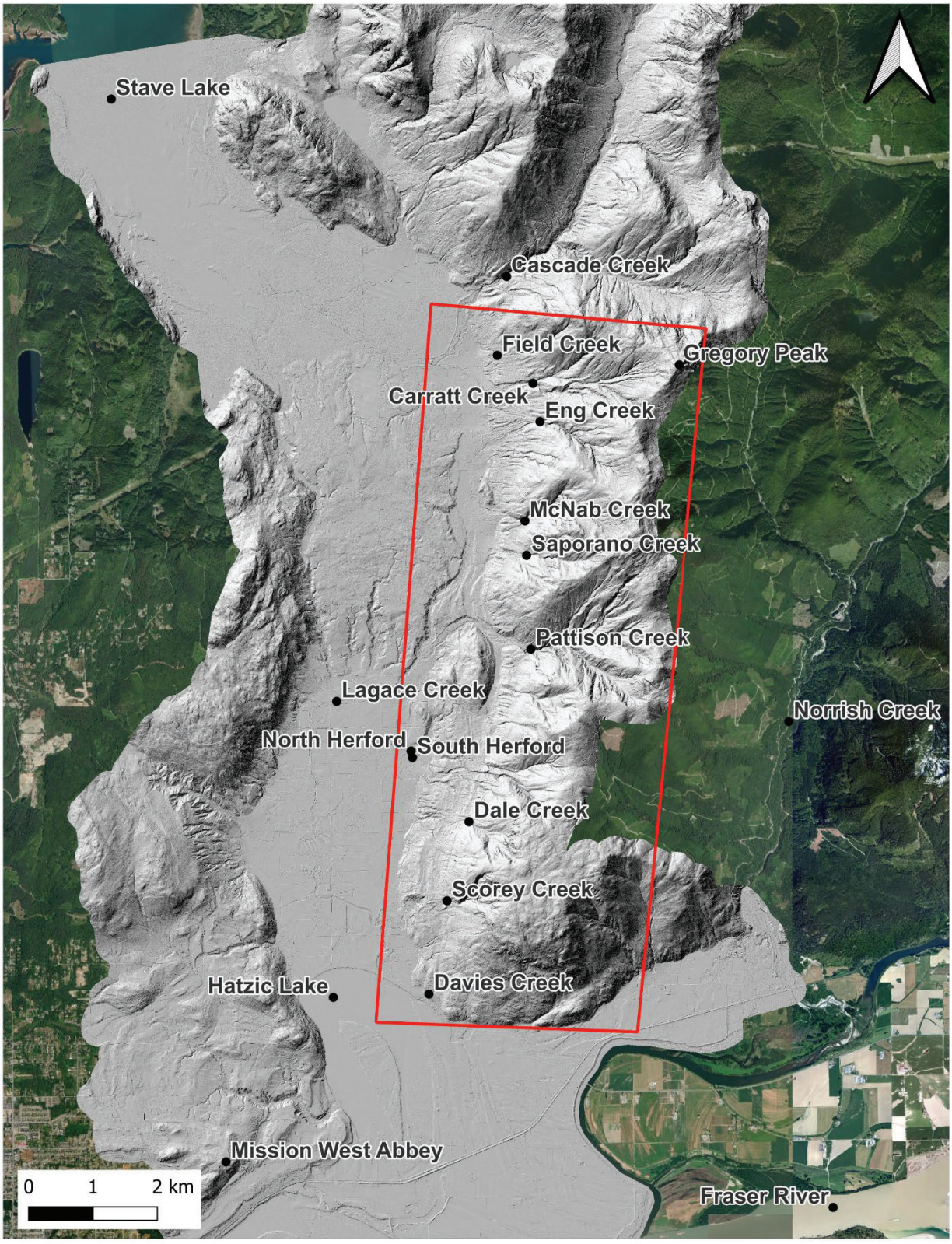

Figure 1-1 Map of study area with locations mentioned in the report. Background imagery contains 2022 lidar and ESRI imagery.

2.0 DESKTOP REVIEW

2.1 Site Characterization

The Hatzic Valley represents the transition between the Fraser Lowland and the Pacific range of the Coast Mountains (Holland, 1976). The Fraser Lowland is a low-lying area characterized by the deposition of sediment from the Fraser River. The Fraser Lowland is bounded to the north by the Pacific Range which is a dominantly granitic mountain range where bedrock structures control drainage. Gregory Peak is at the northernmost point of the study area, and at 1,355 m elevation is the highest point in the study area. Gregory Peak represents the headwater of Carratt Creek. Durieu Ridge, approximately 10 km long, connects Gregory Peak to Dewdney Peak (elevation 930 m), which is near the southern extent of the study area. Several creeks descend the steep slopes of the ridge, each of which has potential of producing geohazard events that contribute sediment to the Hatzic Valley. The majority[1] of the Hatzic Valley is part of Electoral Area F of the Fraser Valley Regional District (FVRD). Land use in the valley consists of rural-residential, agricultural, and forested landscape. The official community plan (OCP) identifies most of the fans in the project area as limited use (FVRD, 2010).

2.2 Bedrock and Surficial Geology

The Hatzic Valley and surrounding slopes are composed of middle to late Jurassic granodiorite and quartz diorite from the Jasper Pluton (Roddick, 1965; Cui et al. 2017). The regional surficial geology map by Armstrong (1980) shows that the valley material south of Lagace Creek consists of post-glacial Fraser River sediments whereas the valley floor north of Lagace Creek consists of thick sequence (~100 m) of till (sandy texture) overlying glaciomarine (stony silt to loamy clay) sediments. Terrain mapping was performed on select sections of the eastern valley slopes by Howes et al (1985). The surficial cover of upper slopes of the eastern valley slopes are mapped as mixture of till and colluvium material. The lower slopes are mapped as a complex distribution of glaciofluvial, glaciomarine, colluvium, and active fluvial deposits. A range of mass movement types were also identified as part of the terrain mapping (Howes et al. 1985). Additional details on the geohazard processes are presented in Section 2.4.

2.3 Climate Normals and Observed Conditions in 2021

Climate normals are available from the Mission West Abbey (elevation 197 m) at the south end of the study area (Figure 1-1). On average over the period from 1981 to 2010, the weather station recorded an average yearly total precipitation of 1883 mm (rain – 1809 mm and snow – 75 cm). Figure 2-1 shows the distribution of the monthly average daily temperature and precipitation compared to the 2021 values. The average daily temperature in May to July were above normal, which include the heat dome of June 2021 (White et al., 2023). The precipitation in September and November 2021 were over twice the normal values for those months. Figure 2-2 shows that most of the precipitation amounts occurred during two storms. A

[1] The Hatzic Lake area is part of FVRD's Electoral Area G.

category 4 atmospheric river on November 14 and 15 was responsible for widespread flooding and landslide damage over southwestern British Columbia (Gillett et al., 2022).

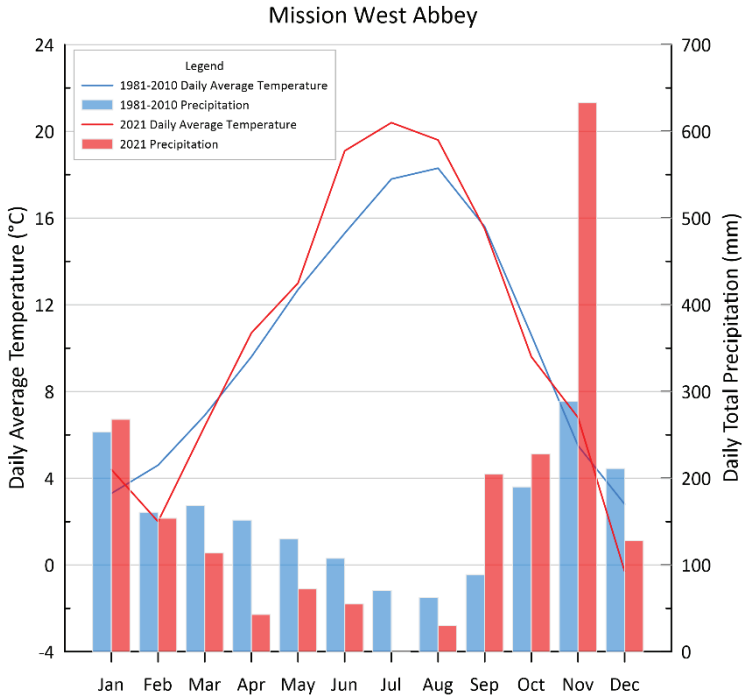

Figure 2-1 Climate normals and 2021 monthly meteorological conditions recorded at the Environment Canada Mission West Abbey Station.

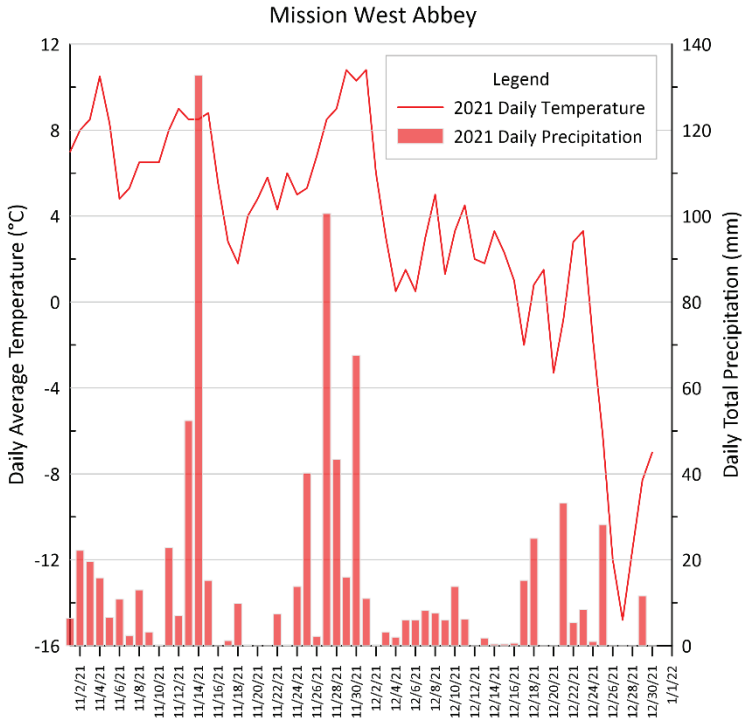

Figure 2-2 Daily meteorological conditions recorded November and December 2021 recorded at the Environment Canada Mission West Abbey Station.

2.4 Geohazard Overview

Geohazard events, including landslides, debris flows, debris floods, and flooding events, are common in the Hatzic Valley. Many of these geohazard events in the study area over the past 75 years have been documented by Septer (2007). A majority have been flooding events in the Hatzic Valley bottom due to the proximity of major water bodies such as Stave Lake, Hatzic Lake, and the Fraser River (Septer, 2007). Flooding events are not explicitly studied in this assessment with the focus instead being on debris flows, debris floods, and landslides within watersheds as source of sediments being delivered to the valley bottom. A summary of known steep creek and landslide events impacting the study area between 1951 and 2006 based on Septer (2007) is provided in Table 2-1.

Table 2-1 Review of Septer (2007) for steep creek and slope hazard event history in Hatzic Valley.

Date	Description
January 20-25, 1951	Rain-on-snow and tidal flooding. Flooding creeks in Hatzic Prairie carried away three bridges.
February 21, 1961	Intense rain caused Cascade Creek (outside of assessment) to flood the prairie. Landslide occurred on Dewdney Mountain 11.2 km NE of Hatzic Lake (22.4 km NE of Mission). Landslide killed a farmer. Distances reported in Septer (2007) indicate the landslide occurred outside of study area, but specific mention of houses in the runout area indicate distance values may be erroneous. BGC (2004) identified a landslide that killed a farmer, which occurred at Eng Creek between 1960 and 1964. It is likely that these two accounts refer to the same event.
December 23-27, 1980	Rain-on-snow event. Extensive flooding of Hatzic/Stave Lake, mudslide (estimated 10,000 m^3) on Stave Lake Road destroyed a home, and a debris torrent on Kenworthy Creek (west side of study area) destroyed a house. The Ministry of Environment (1980) identified an event on Eng Creek in which the creek avulsed high in the fan and eroded a water line, and a flooding event on Pattison Creek.
January 1-4, 1984	Extensive flooding damage, argument over impact of logging on flood damage. Lagace and Pattison Creek experienced reduction of channel capacity due to deposition of bedload materials from Sylvester Road bridge crossing downstream to Hatzic Lake. Eng Creek experienced bedload deposition and bank erosion resulted in estimated 30-40% of flow avulsing out of channel on the north side. Cascade (McConnell) Creek experienced severe deposition of gravel and boulders debris at the top of the fan, resulting in complete channel relocation down Ridgeview Road affecting multiple properties. Davis Creek experienced deposition causing overland flow to impact a house and trailer.
November 8-10, 1989	Rain on snow, estimated $10,000 damages on Carratt Creek. Septer (2007) did not specify hazard/damage type.
November 9-10 1990	Septer (2007) reported that McMullen (1990) provided detailed damage reports for a Carratt, Dale, Herford, Lagace, McNab, and Pattison Creeks. Original McMullen (1990) report was not consulted for this study.
November 15, 1990	Two landslides occurred in Pattison Creek above an existing slide, infilling the creek and threatened two homes.

Date	Description
October 16-22, 2003	Rain-on-snow: debris flows on Field, Carratt, and Eng Creeks. High sediment floods (debris floods?) on McNab, Saporano, Pattison, and Dale Creeks. No existing houses damaged, but minor boulder impacts reported and liquid debris after-flow and floodwaters caused flooding and debris/sediment deposition.
January 29-30, 2004	Rainfall and tidal flooding: flooding and evacuations affecting several homes near Field, Carratt, Eng, McNab, Saporano, and Dale creeks. Property near Eng creek sustained flood damage 5 times in the 2003-2004 winter. Carratt/Field Creek experienced at least two debris flows during the last week of January 2004. Another debris flow occurred on March 11 2004 at Field Creek.

The penultimate major storm which caused extensive damage in the Hatzic Valley occurred in October 2003. Emergency hazard assessments were carried out at the time by Thurber (October 31, 2003) for FVRD and by BGC (December 12, 2003) for the BC Provincial Government. BGC (March 1, 2004) subsequently prepared a risk assessment for Field, Carratt, Eng, McNab, and Dale creeks.

Qcd Geotechnics (October 22, 2008) prepared an overview geotechnical hazard assessment for the Hatzic Valley which informed the OCP for Electoral Area F (FVRD, 2010). Geological and flooding hazards are among the reasons that most fans in the study area are designated as “limited use” in the OCP. The distal portion of the Eng Creek Fan is designated as “conservation area”, which may have implications for any geohazard mitigation efforts in the area.

The BC Ministry of Forests, Land, and Natural Resource Operations (FLNRO) inventoried 55 landslides greater than 0.1 ha occurring in the Hatzic Lake watershed between 1952 and 2004 (FLNRO, 2013). The Hatzic Lake watershed does not include Carratt and Field Creeks, so the actual number of landslides that has occurred in the current study area is actually higher. Of these landslides, FLNRO (2013) estimates that approximately two thirds are associated with forest-management related practices (i.e., harvest-related and logging-road related activities).

A preliminary geohazard and sediment deposition assessment following the November 2021 atmospheric event was prepared by Stirling Geoscience Ltd. (December 22, 2021) for the FVRD.

2.4.1 Sediment Availability

Due to the strength of the granitic bedrock in the study area, the dominant sediment source from Durieu Ridge into the Hatzic Valley is the erodible soil deposits that overlay the bedrock slopes. These soils include thick colluvial deposits from debris flows and rock slides of Holocene age, as well as complex sequences of glacial and glaciomarine materials from the Fraser glaciation (BGC, March 1, 2004). These Quaternary-age deposits are of varying thickness, with some till deposits thick enough to develop chronic landslides (Denny Maynard & Associates Ltd (Maynard), 1995) that provide a consistent supply of sediment. Failures in the granitic bedrock may cause large rock slides or rock avalanches, which are also significant potential sources of sediment to the Hatzic Valley.

3.0 METHODS

3.1 Desktop Characterization

The objective of the desktop characterization was to characterise the morphology and steep-creek activity in the watersheds and fans of the study area. Lidar data (2016 from BC Government, 2019 from Natural Resources Canada, 2022 from Terra Remote) was used to measure the watershed dimensions and map the fan extents. The fan extents are shown in figures D-1 to D-9 in Appendix D, and a shapefile of these features was provided to AE with the submission of this report. Historical aerial photographs were reviewed to document landslide activity, resource road construction, and land use change over time (Appendix A).

3.1.1 Fan Mapping and Attribution

Fan mapping involved the following steps:

- Identification of creeks that have the potential to effect sediment load reaching each damage site identified by MoE.
- Mapping extents of each of these fans.
- Identification the dominant geohazard process for each fan based on morphometric parameters. In the study area seven creeks were estimated to have debris flow as their dominant process while two had mix debris flow and debris flood processes.
- Characterization of the relative fan activity and basin activity for each creek, based on known geohazard event history, airphoto review, and lidar terrain interpretation.

Appendix B outlines the criteria used to map the alluvial fans in the study area.

3.1.2 Frequency-Magnitude Estimate

BGC used a regional frequency-magnitude (F-M) approach to estimate possible sediment volumes that could be mobilized at each of the study creeks in a 200-year return period event. The regional F-M approach involves a few key assumptions:

- That watersheds with similar watershed areas or fan areas will produce similar sediment volumes at similar return periods.
- That the behaviour of smaller watersheds can be predicted from the behaviour of large watersheds (or vice versa) by scaling based on watershed or fan area.

The approach is further outlined in Jakob et al. (2020), which compiled a series of detailed investigations in southern British Columbia and Alberta. For each of these projects, an F-M curve had been established using a variety of methods. Jakob et al. (2020) normalized the individual F-M curves by fan area and watershed area and plotted them on the same graph. A best-fit line was plotted, and a predictive equation extracted.

For this project, BGC developed an F-M equation for the study area using debris-flood and debris-flow prone creeks from the Jakob et al. (2020) study with similar characteristics to the study creeks. The resulting relationships for the study area are summarized in Equations 3-1 and 3-2 and shown in Figure 3-1.

$$V_{Normalized\ by\ fan\ area} = 57567\ln(T) - 195580 \quad R^2 = 0.17 \qquad \text{[Eq. 3-1]}$$

$$V_{Normalized\ by\ watershed\ area} = 2932\ln(T) - 8825; \quad R^2 = 0.55 \qquad \text{[Eq. 3-2]}$$

where $V_{Normalized\ by\ fan\ area}$ is the normalized sediment volumes associated with fan areas, watershed areas $V_{Normalized\ by\ watershed\ area}$, and T is the return period. The equations above allow the user to choose any return period (T) and calculate the corresponding debris-flood or debris-flow volume, as appropriate.

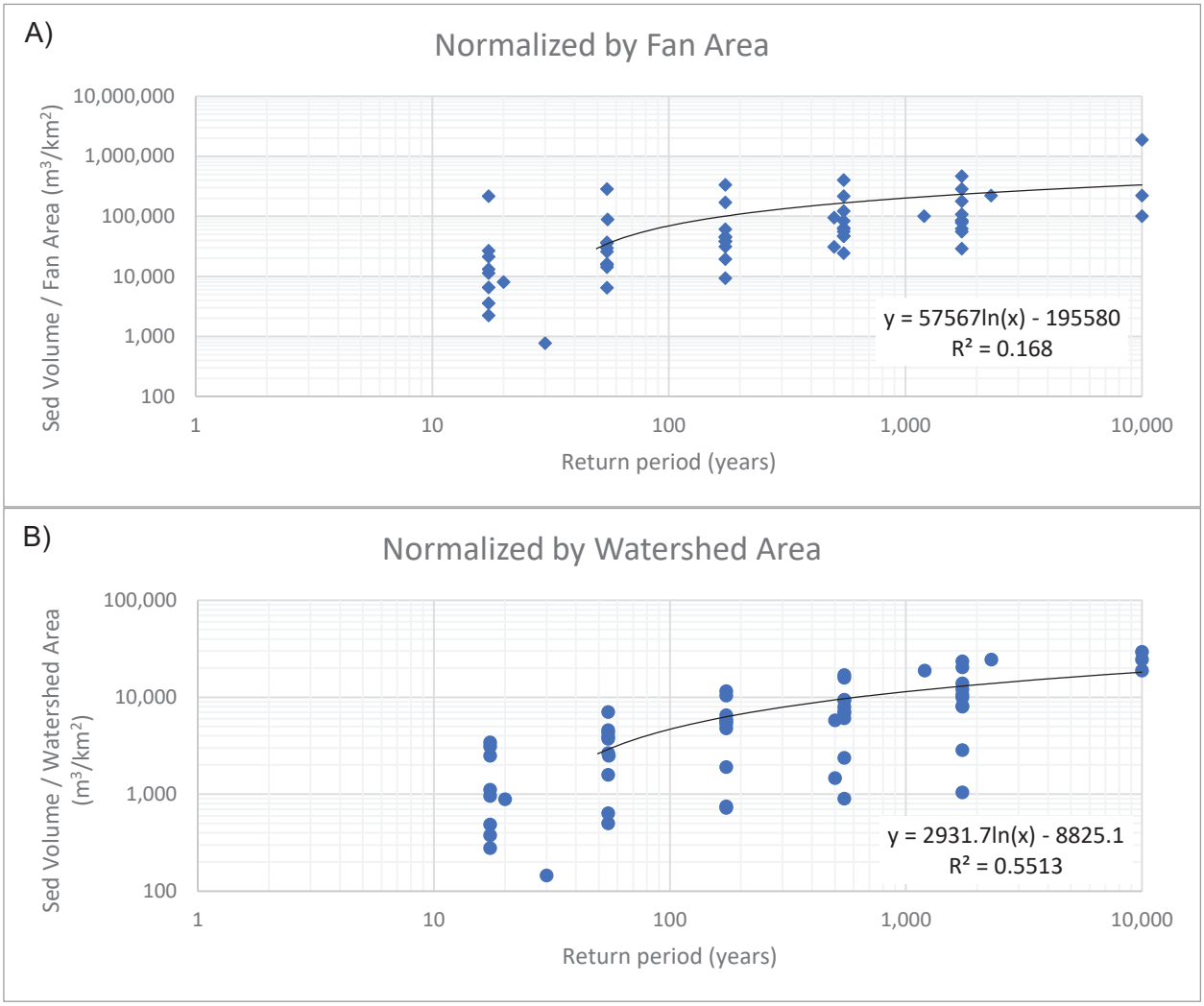

Figure 3-1 Regional debris flood and debris flow frequency-magnitude data normalized by A) fan B) watershed area for thirteen detailed studies in southern Alberta and British Columbia. (Data from Jakob et al. 2020 and BGC unpublished data)

Using these equations, BGC estimates the potential sediment volumes (V_s) at each Hatzic Valley fan considered in this project using the fan area (A_f) or watershed area (A_w) and an average return period (T) of 200 years. This equation was used for comparing the sediment production and estimating the average annual sediment yield at each site.

3.1.3 Peak Discharge Estimate

Given sediment volume, peak discharges for all drainages were estimated through an unpublished British Columbia (BC) relationship provided in Equation 3-3 and shown in Figure 3-2.

$$Q_p = 0.0853V^{0.7536} \quad \text{[Eq. 3-3]}$$

where V is the debris-flow volume in m^3 and Q is peak discharge in m^3/s. The above equation is solved for Q using the sediment volumes (V) derived in the previous section.

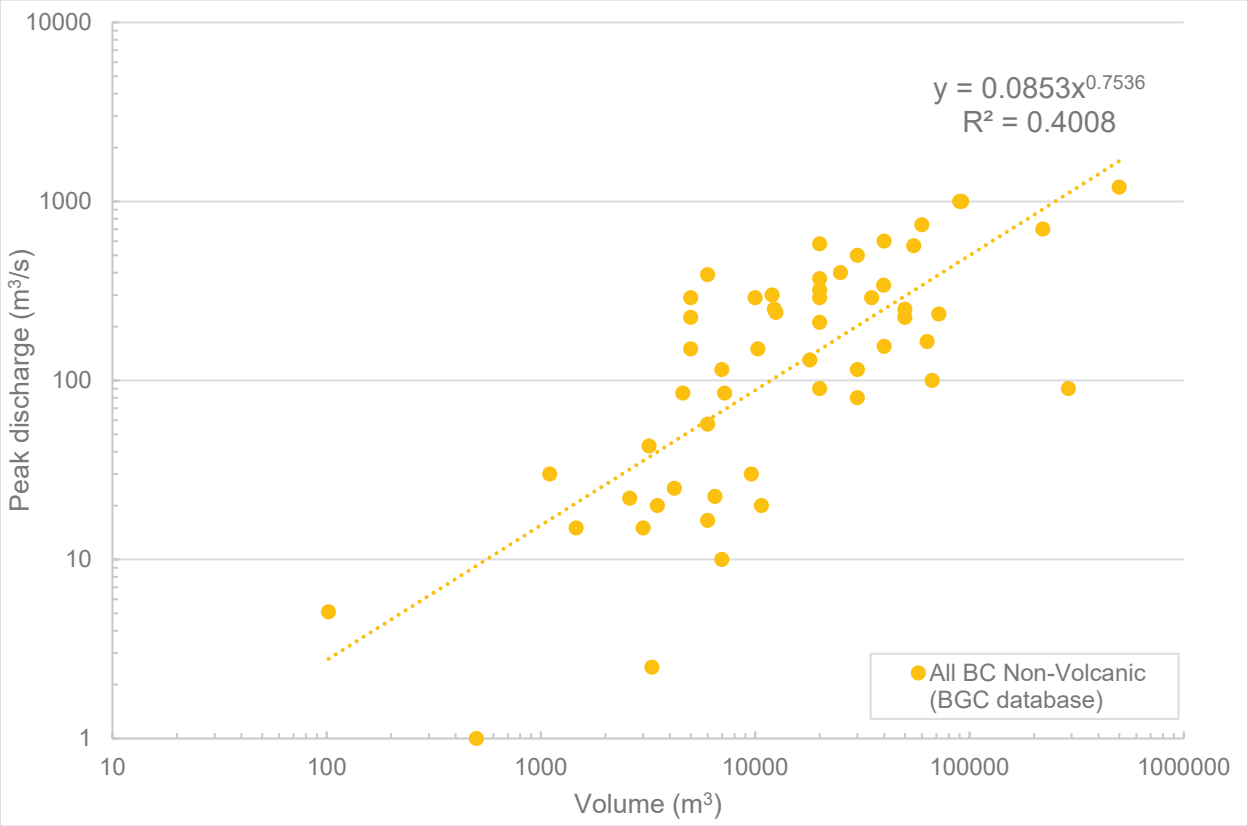

Figure 3-2 Empirical correlation between volume and peak discharge, developed using a dataset for non-volcanic debris flows in BC.

It should be noted that debris-flow peak discharge estimates using this method may result in overestimation. To address this issue, BGC assumed that debris-flow peak discharge could not exceed the 200-year peak discharge of a clear-water flood in the same creek by more than 50 times (Hungr et al., 1984).

Clearwater discharge estimate for a flow with 200-year return period (i.e., a Q_{200} clearwater flood) was provided by AE for each creek investigated in this study. The Q_{200} estimates are derived from HEC-HMS using rainfall data with considerations for climate change. Additional details of the methodology used to estimate the Q_{200} values are provided in AE (2023).

3.2 Field Site Visit

The objectives of the field site visit were to calibrate the desktop characterization and make observations of the current (March 2023) channel configurations. A field site visit was conducted by Marc-Andre Brideau and Andrew Funk of BGC on March 22, 2023. The weather was sunny with a high 17°C. No snow was present on the fan during the field work but snow was visible in the upper watersheds. A combination of georeferenced map, workspace in ESRIs field mapping application Collector, paper fieldnotes were used to navigate and record observations. The hillshade view of the lidar, mapped fan extent, and desktop hazard attribution were available during the field work.

Field work observation focussed on:

- Channel material type (bedrock or surficial), geometry, and high-level granulometry
- Debris depositional or impact features to estimate recent maximum flow depth (assumed to have occurred in November 2021)
- Anthropogenic modification/mitigation
- Presence/dimensions of culvert
- Bridge clearing
- General longitudinal fan evolution (distal to proximal)
- Evidence of past debris flow and debris flood.

4.0 RESULTS

The key results based on the desktop and field assessments are summarized in Table 4-1. The aerial photograph review for each creek is presented in Appendix A, the methodology for estimating Geohazard Likelihood is presented in Appendix B, the results of the steep creek attribution (including Geohazard Likelihood, Fan Activity, and Geohazard Process) are summarised Appendix C, and the detailed results of desktop characterization (including alluvial fan extents) and field observations are outlined in Appendix D.

Table 4-1 Summary of steep creek geohazard likelihood, volume, and discharge, for each watershed considered in this study

Fan (Debris flow, mix debris flow and debris flood)	Geohazard Likelihood[1])	200-year Return Period Steep Creek Event				200-year Return Period Clearwater Flood Estimate[2] (m^3/s)	Maximum Credible Debris Flow Peak Discharge[3] (m^3/s)
		Volume (m^3)		Peak Discharge (m^3/s)			
		Lower	Upper	Lower	Upper		
Field Creek	Low	2,600	3,200	30	40	-	-
Carratt Creek	High	15,500	68,500	120	370	17.9	900
Eng Creek	High	8,100	70,100	70	380	9.6	480
McNab Creek	High	9,300	34,200	80	220	10.8	540
Saporano Creek	Low	6,400	19,400	60	140	7.6	380
Pattison Creek	High	22,100	35,400	160	220	23.5	1180
North Herford Creek	Low	6,500	13,200	60	110	6.8	340
South Herford Creek	Moderate	5,600	21,300	60	150	6.4	320
Upper Dale Creek	Low	4,800	5,800	50	60	5.8	290
North Dale Creek[4]	Low	7,900	8,900	70	80	7.5	380
South Dale Creek[4]	Low	7,900	8,900	70	80	7.5	380
Davies Creek	Low	2,800	3,000	30	40	3.8	190

Notes:

1. Relative Return Period estimates correlate with Geohazard Likelihood, where low Geohazard Likelihoods are estimated to have a return period > 50 years, moderate Geohazard Likelihoods 20 to 50 years, and high Geohazard Likelihoods < 20 years.
2. 200-year clear water flood discharge estimate provided by AE.
3. Estimated to be 50 times greater than the 200-year clearwater flood discharge (Hungr et al., 1984). These discharges would be associated with much higher return periods (less frequent) than the 200-year events described in the other columns. These estimates are larger than the estimates from regional inventory for all creeks, supporting that the estimates are representative of 200-year return period events .
4. North and South Dale Creek fans are treated as one combined fan due to undifferentiated watershed areas.

5.0 DISCUSSION

5.1 Sediment Volumes

The preliminary steep creek hazard assessment and sediment supply estimates presented in this report are based on preliminary field observations and regional empirical relationships. The range of volume estimates (i.e., the upper and lower bounds in Table 4-1) comes from whether fan area (Equation 3-1) or watershed area (Equation 3-2) is used. The formula that returns the larger value varies between the different creeks. For Carratt, Eng, and McNab Creeks, the lower and upper bound values vary by 370% (McNab) to 870% (Eng); the upper bound values come from the fan area equation. This suggests that the fan area is large relative to its watershed area. Three factors might contribute to the size of the fans in these watersheds are the:

- Contribution of debris and sediment to the fan from slope processes other than steep creek (e.g., debris avalanches or rock slides)
- Presence of thick erodible surficial material over large parts of the watersheds
- Ground disturbance by historical logging operations resulting in elevated landsliding rates due to loss of root strength and disturbance of surface water drainage paths (e.g., Millard, 1999; Jakob, 2000; Guthrie 2002).

Based on the observations above and magnitude of recorded events on these creeks (e.g., BGC, March 1, 2004 and March 9, 2023) the upper range estimates (based on fan area) for Carratt, Eng, and McNab creeks are considered most representative. BGC (March 1, 2004) estimated the frequency of potentially damaging steep creek events for Carratt, Eng, and McNab creeks to be between 5 and 15 years. This is consistent with the high geohazard likelihood estimated as part of the current work (Section 4.0 and Appendix C). The typical return periods for various levels of fan activity are summarized in table B-8, and Table C-1 includes geohazard likelihoods and estimated return periods for all sites included in this assessment.

5.2 Peak Discharges

The 200-year return period steep creek event peak discharge estimate based on the regional inventory relationship (Equation 3-3) were compared to the highest credible peak discharge estimate by Hungr et al (1984). The highest peak yield discharge estimates were larger than the estimates from regional inventory for all creeks, supporting that the estimates are representative of 200-year return period events.

5.3 Annualized Sediment Volumes

The results of this assessment could be used to inform estimation of annualized sediment volumes, but additional study and analysis would be required.

The techniques used in this report focused on estimating expected sediment and debris volumes from debris flows and debris floods occurring on steep creeks within the Hatzic Valley. The regional F-M curve used in this project only provides a representative volume estimate for return periods greater than about 50 years, focused on sediment that deposits within the boundaries of the alluvial fans. Debris flood and debris flow events with short (less than 50

years) return periods are under-represented in the record as they have smaller magnitude, and routine bedload transport involving particle sizes that would be transported off of the fan (silt, clay, some sand) is also not fully accounted for. If calculation of annualized sediment volumes is required during future phases of work, other assessment methods could be used to estimate sediment contribution from routine events and bedload transport at different creeks, and at different points along Lagace Creek. Note that annualized sediment yield values can be misleading as most of the sediment delivery occurs in pulses over short period of time (such as during freshet, or in the 2021 event) separated by long periods of lower activity.

5.4 Additional Considerations

The current assessment focusses on preliminary steep creek geohazard and sediment supply characterization and does not evaluate or update the risk assessment presented in BGC (March 1, 2004). The steep creek geohazard likelihood estimates in Table 4-1 do not take into account the presence and location of elements at risk. The current work does update the potential geohazard spatial extent by using the 2016 and 2022 lidar digital elevation model (DEM) to improve the fan extent mapping presented in (BGC, March 1, 2004).

Slope processes are dynamic in space and time; therefore, the proposed desktop and fieldwork assessment will only provide a snapshot of the ground conditions during lidar/imagery acquisition and at the time of fieldwork. In case of future natural or anthropogenic changes to the slope conditions (e.g., heavy rainstorms, logging operations, progressive degradation of existing resource roads, wildfires, large-scale tree mortality due to beetle infestations or observations of slope instability) the proposed assessment may need to be updated. The current work does not characterize the risk from steep creek hazard to infrastructure and people.

6.0 CONCLUSION

This study presents a preliminary steep creek hazard assessment for twelve fans on nine creeks on the east side of the Hatzic Valley. These creeks are associated with sediment damage sites identified by the BC Ministry of Environment following the November 2021 atmospheric rivers. In addition to the geohazard likelihood, this work estimated the potential sediment volume and discharge from a 200-year return period event.

The four creeks with a High steep creek geohazard likelihood are:

- Carratt Creek
- Eng Creek
- McNab Creek
- Pattison Creek.

For these creeks, the estimated 200-year debris-flow volumes may exceed 30,000 m^3, and the discharges may exceed 200 m^3/s. These results are consistent with previous hazard and risk assessments of the Hatzic Valley. It is important to note that the current work did not estimate the risk to existing infrastructure on the fans associated with each watercourse.

7.0 RECOMMENDATIONS

7.1 Geohazards and Risk in the Hatzic Valley

This report characterized steep creek hazards in the Hatzic Valley, including possible debris volumes and peak discharges associated with a 200-year return period debris flow. This information would be a useful starting point for a detailed geohazard risk assessment, which would support updated land use guidance in the Hatzic Valley and inform potential mitigation decisions.

A first step for a detailed geohazard risk assessment would be to update the Overview Geotechnical Hazard Assessment Report (QCD, October 22, 2008) based on new information available. This includes lidar DEMs (2016, 2019, 2022), new practice guidelines for professionals (EGBC, 2017, 2018, 2023), latest seismic hazard model (Kolaj et al. 2023), and climate change models (Coupled Model Intercomparison Project 6 - **https://climatedata.ca/**).

Additional investigation of potential rock slope instabilities in Field, Eng, McNab, and Pattison creeks watersheds would contribute to our understanding of the hazard and risk from these infrequent but high consequence events in the Hatzic Valley. At least one fatality was previously recorded due to rock slide along Eng Creek and geomorphic features were noted in the hillshade representation of the lidar of both Field, Eng, McNab, and Pattison creeks (Appendix D).

7.2 Phase 2 Workplan

The proposed Phase 2 work plan identifies additional tasks that would provide additional information to support the characterization and management of sediment deposits from the November 2021 atmospheric river and from future steep creek events.

Lidar change detection between 2016 and 2022 along with 2019 and 2022 data set would provide additional information on location of sediment sources/deposits and quantify the volume of sediment mobilized in November 2021 atmospheric events and anthropogenic activity in the valley during those time periods.

Additional field work to investigate the source of sediment in headwaters of creeks considered in this report could provide information on sediment currently stored in the channel above the fans. This could inform the expected sediment delivery over the next few years. Field work in the watershed headwaters could also assess potential slope instabilities associated with legacy resource roads.

BGC recommends that a decommissioning or long-term management plan be developed for the emergency response Hesco barrier that was constructed on Carratt Creek in winter 2022. BGC understands that the structure was intended to be clear-water flood mitigation strategy and that its performance and potential risk transfer in the case of a debris flow has not been assessed. BGC (March 9, 2023) also provide long-term risk management recommendations for Carratt Creek.

More detailed hazard assessment methods would be needed to estimate the annual sediment yield on select fans. As discussed in Section 5.0, short return period events can contribute over 50% of the estimated annual sediment yield value. Hydrograph and grain size distribution information along the channel would be needed to support a bedload transport assessment for creek dominated by debris flood processes. To provide an estimate of the annualized sediment yield, future work should estimate sediment delivery to the channel in the 10-to-40-year return period range, as relatively short return-period events can represent up to 50% of the annualized sediment yield value. Additionally, it should be highlighted that the annualized sediment yield value can be misleading as most of the sediment delivery occurs in pulses over short period of time separated by long period of lower activity. For creeks dominated by debris-flow processes, detailed mapping of potential point sources could be compared with a model of Charles Creek (Sea-to-Sky Corridor) where detailed volume estimates are available for short return period debris flows (Jakob and Nolde, 2023).

8.0 CLOSURE

We trust the above satisfies your requirements. Should you have any questions or comments, please do not hesitate to contact us.

Yours sincerely,

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per:



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PHOTOS



Photo 1 Carratt Creek, facing downstream towards the avulsion point from 2021 event (in center of photo).



Photo 2 Carratt Creek. Barrier structure on left (downstream) side of image. Photo taken pointing upstream of avulsion path from 2021 event.



Photo 3 **Eng Creek. Facing downstream from the upper extent of the site visit, near the middle of the fan.**



Photo 4 **Eng Creek, facing upstream. Measuring the height of a mossy bench as a peak flow indicator of the past few years.**



Photo 5 McNab Creek, facing upstream from Sylvester Road at the distal edge of the fan.



Photo 6 McNab Creek, facing upstream towards the base of the boulder deposit (not visible).

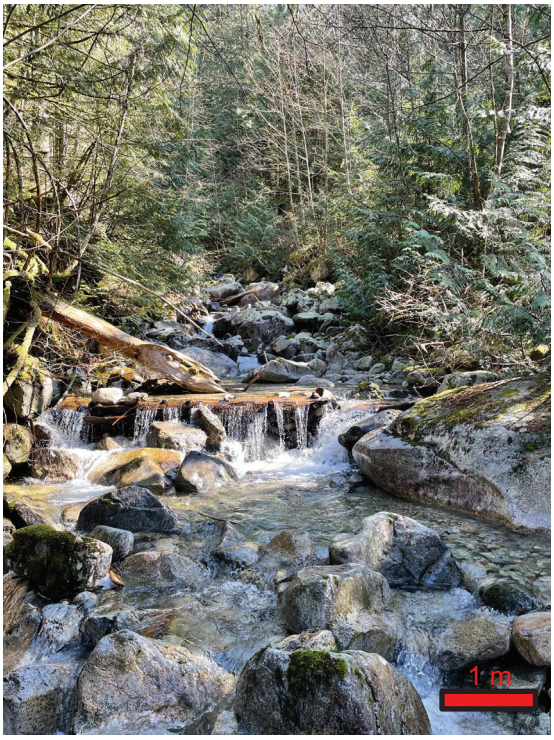

Photo 7 McNab Creek, facing upstream from the upper inspection extent.



Photo 8 Saporano Creek, facing upstream from where it flows into Lagace Creek (foreground) at the distal edge of the fan.



Photo 9 **Pattison Creek, facing downstream. Measurement of high-water indicator (moss bed) approximately 300 m upstream from the Sylvester Road bridge.**



Photo 10 **Pattison Creek, facing upstream. Abandoned avulsion channel visible on the left, with main channel on the right.**



Photo 11 Pattison Creek, facing upstream. Bedrock visible on right side of image.



Photo 12 North Herford Creek, facing downstream (west) from the main channel.



Photo 13 South Herford Creek, facing upstream along the main channel.



Photo 14 North Dale Creek, facing upstream.



Photo 15 South Dale Creek, facing downstream to Sylvester Road. BGCer standing on possible debris flow levee.



Photo 16 Davies Creek, facing upstream approximately 20 m upstream from Sylvester Road.

APPENDIX A
SUMMARY OF IMAGERY REVIEW

A-1 AIRPHOTO REVIEW

Table A-1 Carratt Creek (High Basin Activity) + Tributary (Field Creek, Very Low Basin Activity)

Year	Airphoto ID	Observation	Source
1958	BC 2322 41/104	No signs of debris flow activity in the fan. Sediment visible along main channel throughout entire watershed, sediment deposit visible south of the main channel in the lower watershed. No logging roads visible in watershed.	BGC 2023
1963	BC 5407 32/33	No signs of debris flow activity.	BGC 2004
1968	BC7058 99/100/101	Logging road in watershed, some logging in watershed, densely vegetated channel. Logging or landslide activity on hillslope in lower watershed adjacent to logging road. Channel path comparable to present	BGC 2023
1979	BC79039 087	Only shows fan and lower watershed. Comparable condition to previous, vegetated main channel through fan	BGC 2023
1982	BC82063 282/281/280	Channel on fan significantly less vegetated and much straighter, may indicate event or just construction. Photo limited to fan and lower watershed, no evidence of landslide activity in watershed. Potential historical landslide visible in photo 280 (headscarp visible in watershed)	BGC 2023
1984	BC84001 16	Comparable to previous	BGC 2023
1990	BC90124 145	Comparable to previous, more development/vegetation clearing on middle to distal fan	BGC 2023
1991	BC91079 059	Large scale perspective. At least one landslide evident in upper watershed. Incised drainage features visible in upper watershed	BGC 2023
1993	BC93035 183	Fan and watershed appear comparable to earlier years. Evidence of retrogression of one of the debris flows in the upper watershed	BGC 2023
1995	BC95045 151	Large scale perspective. Conditions appear comparable to recent years	BGC 2023
1996	BC96083 41	Channel on fan appears sparsely vegetated. Channel in lower watershed appears densely vegetated. Conditions appear comparable to recent years	BGC 2023
1999	SRS6064 343/344	No change (compared to 1963)	BGC 2004
2002	BC02028 061	Conditions appear comparable to recent years, with one new landslide visible in upper watershed (southern portion)	BGC 2023
2003	BC03048 023	Conditions appear comparable to recent years	BGC 2023
2016	BC16414 403 to 407	Images only extend from fan to lower watershed. Multiple small landslides on either side of main channel in the upper fan/lower watershed, moderately vegetated. These features are visible in 2004 Google Earth imagery. Features may be visible in previous years but are difficult to identify.	BGC 2023

Table A-2 Eng Creek (moderate basin activity based on airphotos)

Year	Airphoto ID	Observation	Source
1958	BC 2322 41/104	No signs of debris flow activity. No logging roads visible in the watershed. Landslide scar in lower watershed has limited vegetation.	BGC 2023
1963	BC 5407 32/33	Very large fan with many potential debris flow routes on the far southeast side if the fan. No recent debris flow activity, five buildings on fan, fan on far south side of channel, signs of a very large landslide in the upper watershed (Likely the one mapped by Howes in 1984)	BGC 2004
1968	BC7058 100 /033	Landslide scar in lower watershed, moderately connected to channel. Small vegetation only (no large trees), landslide toe appears to partially obstruct channel. Multiple small sediment sources on either side of main channel. No logging activity	BGC 2023
1979	BC79139 028	Increased large vegetation on landslide in lower watershed, majority of upper watershed recently logged with 1-2 logging roads across slope. 3-4 debris slides/flows in logged area of upper watershed, no deposits in fan observed	BGC 2023
1982	BC82063 281/280	Photo does not cover upper watershed. Overall increased vegetation of landslide path, channel, and fan	BGC 2023
1984	BC84001 15	Photo coverage of fan only. Narrow channel throughout fan, no sediment deposits observed	BGC 2023
1990	BC90124 146	Photo coverage of fan only. Comparable to 1984 conditions	BGC 2023
1991	BC91079 059	Large scale perspective. One potential landslide adjacent to channel in mid-watershed. Debris flow paths in upper watershed appear in similar locations/with similar extents to 1979, but are unvegetated. Large area of exposed sediment above logging road in upper watershed below trees, no clear landslide morphology or connection to watershed below logging road	BGC 2023
1993	BC93029 211/212	Sediment in channel through mid to lower fan is more distinct than 1979. Watershed appears to be in similar conditions to previous.	BGC 2023
1995	BC95045 151	Comparable coverage, scale, and features to 1991 image.	BGC 2023
1996	BC96083 41	Comparable conditions to previous	BGC 2023
1999	SRS6064 343/344	Landslide scar completely healed, no debris flows in upper watershed, channel located on far south side of fan	BGC 2004
2002	BC02028 061/060	Debris flow channels in upper watershed and main channel in fan appear more vegetated than in 1990's	BGC 2023
2003	BC03048 023	Large-scale view, conditions appear comparable to 2002. Clear view of partially revegetated landslide scar in middle of watershed identified in 1991	BGC 2023
2005	Google Earth	Several locations along watershed and fan with visible sediment adjacent to main channel (bank erosion or sediment deposition) not captured in airphotos.	BGC, 2023
2016	BC16414 403 to 407	Photo coverage only extends to upper fan. Channel appears wider and with more sediment than in previous imagery.	BGC 2023
2016	Google Earth	New development (or log harvest) underway on north side of upper-mid fan	BGC 2023
2019	NRCan lidar	Retrogression of a debris flow channel in the upper watershed evident in 2019 lidar, but not in airphoto.	BGC 2023
2022	Google Earth	New development noted in 2016 is cleared of trees, no buildings visible.	BGC 2023

Table A-3 McNab Creek (moderate basin activity based on airphotos)

Year	Airphoto ID	Observation	Source
1958	BC 2322 42	No signs of debris flow activity in the fan. No logging roads visible in watershed.	BGC 2023
1963	BC 5062 118/119	No signs of recent debris flow or debris flood activity (only lower watershed visible), freshly constructed road in upper watershed of Saporano Creek and fresh logging, several natural landslide features in mid-McNab Basin, large fresh failures in upper Saporano Watershed	BGC 2004
1968	BC7058 032/033/034	Extensive logging in upper to middle watershed, limited vegetation in landslide scars around watershed, but limited evidence of fresh activity. Moderate connectivity between landslide sources and main channel	BGC 2023
1971	BC 5407	Creek bed not visible, large fan with many possible debris flow trajectories	BGC 2004
1974	BC 5580 88/89	No debris flow activity, deciduous trees on fan	BGC 2004/23
1979	BC 79036	No change	BCG 2004
1979	BC79027 204/203/202, BC79193 028	No significant changes observed	BGC 2023
1982	BC82063 279	Large-scale view. No significant changes observed.	BGC 2023
1984	BC84001 13	Sediment visible at fan apex. Different resolution/angle from previous photos, unclear if this represents a change in conditions. Only the fan is covered by the photo	BGC 2023
1990	BC90124 149	No significant changes observed	BGC 2023
1991	BC91079 059	Large scale view. Potential moderate debris flow/avalanche in upper watershed, crossing logging road	BGC 2023
1993	BCB 93030	Creek on the north side of the fan, easily visible with debris flow runout zone at fan apex	BGC 2004
1993	BC93029 211	Several new debris flow/avalanche features visible in logged area of upper watershed, sediment visible along entire channel through to apex of fan. Mid-watershed landslides do not appear recently active.	BGC 2023
1995	BC95045 151	No significant changes observed	BGC 2023
1996	BC96083 41	Minor revegetation of some smaller landslide features in upper watershed identified in 1993, no other significant changes observed.	BGC 2023
1999	SRS 6064 343/344	Two debris avalanches/debris flows in upper watershed. May be the features identified in 1993 photo.	BGC 2004
2002	BC02028 062	Channel in upper fan and lower watershed are more vegetated than previous.	BGC 2023
2003	BC03048 014	Large scale view. No significant changes observed.	BGC 2023
2004	Google Earth	Construction to divert creek around a property in the middle of the fan. Evidence of avulsion to the south towards Kussman Road near apex of the fan	
2016	BC16407 178 to 174	Fairly vegetated but clearly identifiable main channel connecting from upper fan to lower fan (into Allan Lake). Sharp bend in creek at middle of fan to flow around a property, low channel confinement in this area indicates significant avulsion potential	BGC 2023

Table A-4 Saporano Creek/Lungden Road (low basin activity from airphotos)

Year	Airphoto ID	Observation	Source
1958	BC 2322 42	No signs of debris flow activity in the fan. No large vegetation adjacent to main channel in upper watershed. No logging roads visible in watershed.	BGC 2023
1963	BC 5062 118/119	No signs of recent debris flow or debris flood activity (only lower watershed visible), freshly constructed road in upper watershed of Saporano Creek and fresh logging, several natural landslide features in mid-McNab Basin, large fresh failures in upper Saporano Watershed	BGC 2004
1968	BC7058 032/033/034	No logging but a logging road across upper watershed, several areas throughout watershed of sparsely vegetated ground – potentially indicative of widespread landslide activity. Variable amounts of connectivity between landslide source and water channels	BGC 2023
1974	BC 5580 88/89	No debris flow activity, deciduous trees on fan	BGC 2004/23
1979	BC79027 204/203/202 BC79193 028	No significant changes observed	BGC 2023
1982	BC82063 279	Large-scale view. No significant changes observed.	BGC 2023
1984	BC84001 13/12	No significant changes observed. Challenging to discern main channel in fan.	BGC 2023
1990	BC90124 149/150	No significant changes observed	BGC 2023
1991	BC91079 059	Large scale view. No significant changes observed.	BGC 2023
1993	BCB 93030	No changes	BGC 2004
1993	BC93030 066	No significant changes observed	BGC 2023
1995	BC95045 151	No significant changes observed	BGC 2023
1996	BC96083 096	No significant changes observed	BGC 2023
2002	BC02028 062	No significant changes observed	BGC 2023
2003	BC03048 014	Large scale view. No significant changes observed.	BGC 2023
2004	Google Earth	Sediment deposited near apex of the fan, flow appears to travel along the northern boundary of the fan	BGC, 2023
2009	BCC09019 222	No significant changes observed.	BGC 2023
2016	BC16407 206 to 210	No significant changes observed.	BGC 2023

Table A-5 Pattison Creek (high to very high activity based on airphotos)

Year	Airphoto ID	Observation	Source
1958	BC2323 6	Significant sediment visible along channel downstream of fan extending a few hundred meters downstream of Farms Rd. Channel appears to be in the same position as present day. Logging roads and clearing visible in north side of watershed. Significant sediment exposed in south area of watershed. Sediment and landslide scarring visible in center of watershed.	BGC 2023
1968	BC7056 136/137/138	Logging road along N side of watershed, entire northern upper watershed logged. One large sediment source/landslide area unvegetated in upper watershed, two partially revegetated moderate size landslide scars on S side of watershed. Moderate to high connectivity between landslides and drainage channels. Overall, a large watershed, many topographic features (i.e., ridges), several sediment sources visible. Main channel is visible along entire watershed and creek (extends beyond fan), relatively consistent width. Unstable mass in upper watershed partially vegetated with large trees, significant volumes of angular sediment visible.	BGC 2023
1974	BC 5580 92/43/44/45	Landslide scar in upper watershed (north side) connecting two logging road segments. Extensive logging in upper watershed. Sediment in channel, visible along the entire length.	BGC 2023
1979	BC79193 004	No significant changes observed	BGC 2023
1982	BC82012 101	No significant changes observed	BGC 2023
1984	BC84001 13/12	Image only covers fan. No significant changes observed	BGC 2023
1989	BCC971 101	Logged areas are becoming revegetated, some small trees visible. Mid-slope landslide appears larger.	BGC 2023
1990	BC90124 203	Higher sediment load apparent visible in channel through lower watershed and entire fan. Southern/upper watershed not visible.	BGC 2023
1993	BC93030 066/065	Two moderate-sized debris flows/landslide scars in upper watershed. Channel width appears larger than 1990 airphotos. Debris flow event likely to have occurred between 1990 and 1993	BGC 2023
1996	BC96083 096	Landslide scars and main channel slightly revegetated	BGC 2023
2002	BC02027 154	No significant changes observed	BGC 2023
2003	BC03048 014	No significant changes observed	BGC 2023
2009	BCC09019 230/229/222	No significant changes observed	BGC 2023
2016	BC16407 574 to 577	Photos limited to lower south watershed. Significant forest clearing recently occurred in photo areas	BGC 2023
2019	NRCan lidar	Large ~800,000 m^3 source of deforming soil (or rock) mass visible in upper watershed.	BGC, 2023

Table A-6 North and South Herford Creek (shared watershed) – (low to moderate basin activity)

Year	Airphoto ID	Observation	Source
1958	BC 2322 49, 108	No signs of debris flow activity in the fan. Sections of main channel for North Herford Creek have sediment visible. No logging roads visible in watershed.	BGC 2023
1968	BC7056 136	Covers a small portion of both fans. Channel not visible through vegetation.	BGC 2023
1974	BC 5574 267/268/269	Cut block recently cleared from mid-slope adjacent to watershed basin (south side), not connected to main channel	BGC 2023
1979	BC79027 195	Photos only cover lower watershed and fans. Cut block(s) south of and adjacent to main channel in lower watershed. No landslide activity observed. Channel (s) not visible through vegetation. BGC 2004 also notes channels not visible from BC79036 225/226	BGC 2023
1982	BC82063 279	South side of upper watershed not visible. Extensive logging in upper north side watershed, multiple logging roads crossing watershed. Main channels not visible through vegetation.	BGC 2023
1984	BC84001 9	Lower watershed and upper-mid fans visible. No changes observed.	BGC 2023
1988	BC823 184	N side of watershed not visible. Logging in upper S watershed. Sediment visible in cut block in lower watershed, channel appears to flow into apex of south Herford Creek fan. Some sediment visible in channel through mid-watershed, no sediment visible in fan.	BGC 2023
1989	BCC971 99	No significant changes observed.	BGC 2023
1990	BC90108 94	Image only covers mid/lower fan. Sediment visible along both N and S Herford creek. Event likely to have occurred between 1989 and 1990.	BGC 2023
1993	BC93030 026	No significant changes observed (“no sign of activity” from BCG 2004)	BGC 2023
1996	BC96083 096	Large scale view. Debris flow deposits in mid-fan becoming revegetated.	BGC 2023
2002	BC02027 132	No significant changes noted	BGC 2023
2003	BC03048 014	Logging activity in upper watershed	BGC 2023
2004	Google Earth	Interpreted 2003/2004 event in mid-fan. Debris from neither event appears to cross Sylvester Rd., but sediment visible in channel immediately upstream of Sylvester Road. Limited evidence of debris flow event noted in upper fan or watershed.	BGC 2023
2009	BCC09019 259/258	Logging activity in upper watershed, channels through fans visible	BGC 2023
2016	BC16408 107 to 100	No significant changes noted	BGC 2023
2022	Google Earth	Evidence of debris flow/landslide deposit in logged/cleared area noted in lower watershed/upper fan, approximately 200 m south of South Herford Creek fan channel.	BGC 2023

Table A-7 Upper, North, and South Dale Creek (shared watershed) – (low basin activity)

Year	Airphoto ID	Observation	Source
1958	BC 2322 49	No logging roads or activity observed in watershed. Evidence of landslide activity and poorly vegetated areas in watershed evident, well connected to main channel. No sediment visible in main channel through middle or lower watershed, main channel difficult to observe in lower watershed.	BGC 2023
1963	BC5063 73/74	Road access in lower watershed 100 m north of the road intersection with Sylvester Road, extensive talus old landslides in upper watershed	BGC 2004
1968	BC7056 204	No significant changes observed from 1958.	BGC 2023
1969	BC5063 12/13	No change (from 1963)	BGC 2004
1971	BC 5406 161	No change (from 1971)	BGC 2004
1974	BC 5574 268/269	No change (from 1971), house west of Sylvester Road constructed between 1971 and 1974	BGC 2004
1974	BC 5574 267/268/269	No significant changes observed from 1968.	BGC 2023
1979	BC79027 192	Extensive logging west of watershed, the logged area does not appear to extend into Dale Creek watershed. Sediment may be visible along upper Dale Fan, interpreted to be a logging road. No other significant changes observed from 1968.	BGC 2023
1982	BC82063 278	A logging road may be visible extending along the north side of the watershed. No other changes observed.	BGC 2023
1984	BC84001 008/009	No significant changes observed.	BGC 2023
1988	BC823 184	Fresh, unvegetated cut block present in north side of lower watershed, near main channel. No other significant changes observed.	BGC 2023
1989	BCC971 98	Main channel is challenging to observe through lower watershed or Upper Dale Creek fan. No significant changes observed.	BGC 2023
1990	BC90108 96	Only covers North and South Dale Creek fans (no watershed visible). No evidence of debris flow activity, location of creeks challenging to identify.	BGC 2023
1993	BC93030 026	No significant changes observed.	BGC 2023
1996	BC96083 178	Fresh cut block on north side of lower watershed, adjacent to Upper Dale Creek fan. No other changes observed.	BGC 2023
1999	SRS 6064	No change (from 1993)	BGC 2004
2002	BC02027 132	Larger logging road present crossing the lower portion of the watershed. No other significant changes observed.	BGC 2023
2003	BC03048 014	No significant changes observed.	BGC 2023
2004	Google Earth	No evidence of debris flow or debris flood events occurring in the previous year.	BGC 2023
2009	BCC09019 141	Fresh cut block in middle of watershed on the north side adjacent to historical landslide area/talus slope. Fresh cut block in/near Upper Dale Creek fan.	BGC 2023
2016	BC16414 552-555, 637-640	Large logging road across lower watershed, with cut blocks partially revegetated. Unvegetated sediment visible in upper watershed landslide scars. No other significant changes observed.	BGC 2023
2019	Google Earth	Significant logging along lower watershed	BGC 2023
2021	Google Earth	Logging in upper watershed, partially behind slope crest.	BGC 2023

Year	Airphoto ID	Observation	Source
2022	Google Earth	No evidence of debris flows or debris floods observed. Evidence of debris flow/landslide deposit in logged/cleared area noted in lower watershed/upper fan, approximately 500 m north of Upper Dale Creek fan (also identified in Table A-6).	BGC 2023

Table A-8 Davies Creek – far south of study area (very low activity)

Year	Airphoto ID	Observation	Source
1958	BC 2322 49	No signs of debris flow activity in the fan or watershed. No logging roads visible in watershed.	BGC 2023
1968	BC7057 029	Channel, fan, or watershed drainage challenging to locate. Channel in north edge of airphoto visible with sediment in channel and potential small fan deposit on the downstream side of Sylvester Road	BGC 2023
1974	BC 5575 23/24	No significant changes observed	BGC 2023
1979	BCC200 39	Lower portion of hillslope visible, no significant changes observed	BGC 2023
1982	BC82063 277	No significant changes observed	BGC 2023
1984	BC84001 6	No significant changes observed	BGC 2023
1988	BC823 096	Logging road visible in lower watershed near inferred creek location. Creek in North section of airphoto has sediment visible throughout entire channel	BGC 2023
1993	BC93032 197	Large scale photo. Light tone upslope from Sylvester Road. May be debris flow deposit or result of clearing/construction activity.	BGC 2023
2002	BC02027 10	No significant changes observed.	BGC 2023
2009	BCC09019 114	Sediment visible between Sylvester Road and river through floodplain, potentially from 2004 event	BGC 2023

APPENDIX B
STEEP CREEK HAZARD ASSESSMENT METHODS

B-1 INTRODUCTION

This appendix describes methods used by BGC to identify and characterize steep creek geohazards within the study area. This appendix is organized as follows:

- Section B.1 provides background information and key terminology on steep creek geohazards, a high level introduction to climate change effects on steep creek geohazards, and describes the work used to prioritize steep creek geohazard areas.
- Section B.2 describes methods and criteria used to identify steep creek geohazard areas.
- Sections B.3 and B.4 describe methods and criteria used to assign geohazard and consequence ratings, respectively.

The results of the assessment are presented in Appendix D.

B-1.1 What Are Steep Creek Geohazards?

Steep creek hazards are natural hazards that involve a mixture of water and debris or sediment (Figure B-1). These hazards typically occur on creeks and steep rivers with small watersheds (usually less than 100 km^2) in mountainous terrain, usually after intense or long rainfall events, sometimes aided by snowmelt and worsened by forest fires.

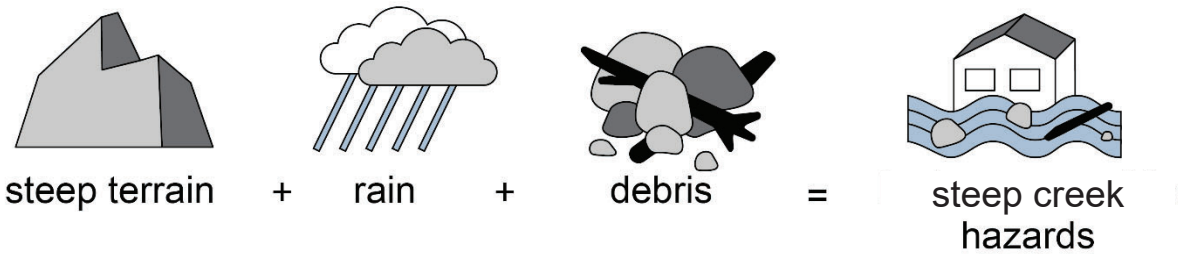

Figure B-1 Illustration of steep creek hazards.

Steep creek hazards span a continuum of processes from clearwater floods (flood) to debris flows (Figure B-2). Debris floods and debris flows are described further in the following sections.

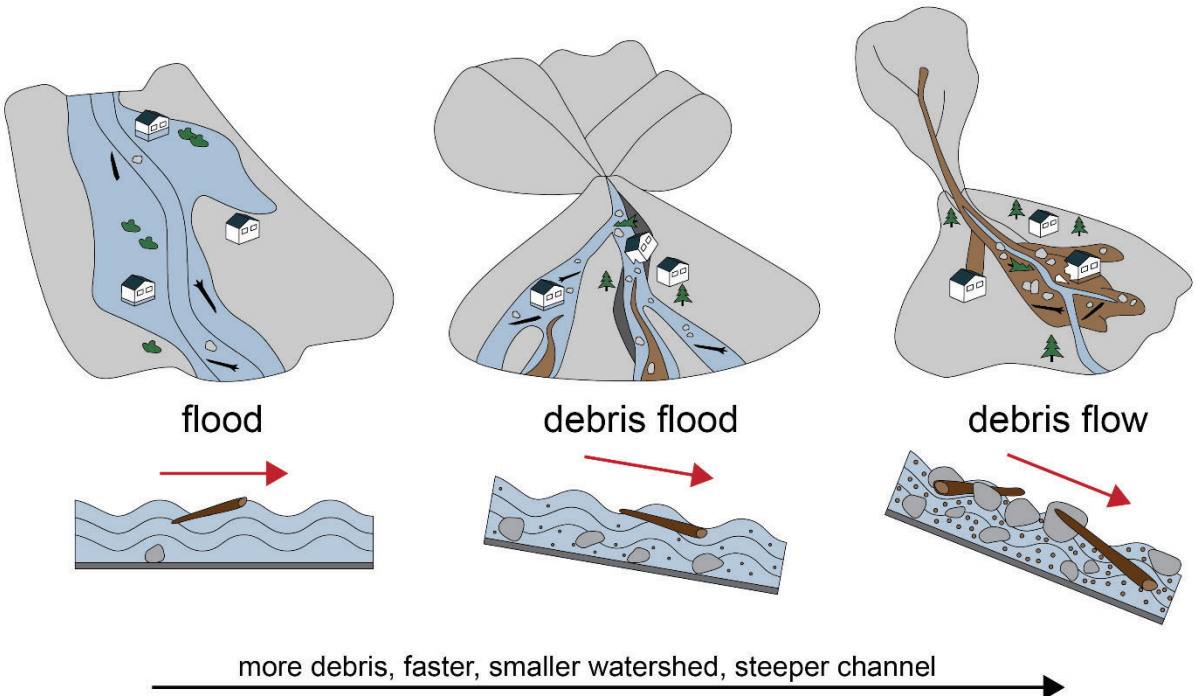

Figure B-2 Continuum of steep creek hazards.

B-1.1.1 Steep Creek Watersheds and Fans

A steep creek watershed consists of hillslopes, small feeder channels, a principal channel, and an alluvial fan composed of deposited sediments at the lower end of the watershed. Figure B-3 provides a typical example of steep creeks in the Hatzic Valley. Every watershed and fan are unique in the type and intensity of mass movement and fluvial processes, and the hazard and risk profile associated with such processes. Figure B-4 schematically illustrates two fans side by side. The steeper one on the left is dominated by debris flows and perhaps rock fall near the fan apex, whereas the one on the right with the lower gradient is likely dominated by debris floods.

In steep creek basins (or watersheds), most mass movements on hillslopes directly or indirectly feed into steep mountain channels from which they begin their journey downstream. Viewed at the scale of the catchment and over geologic time, distinct zones of sediment production, transfer, erosion, deposition, and avulsions may be identified within a drainage basin (Figure B-4 and Figure B-5).

Steep mountain slopes deliver sediment and debris to the upper channels by rock fall, rock slides, debris avalanches, debris flows, slumps and raveling. Debris flows and debris floods characteristically gain momentum and sediments as they move downstream and spread across an alluvial fan where the channel enters the main valley floor. Landslides may also create temporary dams that pond water, which can fail catastrophically. In these scenarios, a debris flood may be initiated in the channel that travels further than the original landslide.

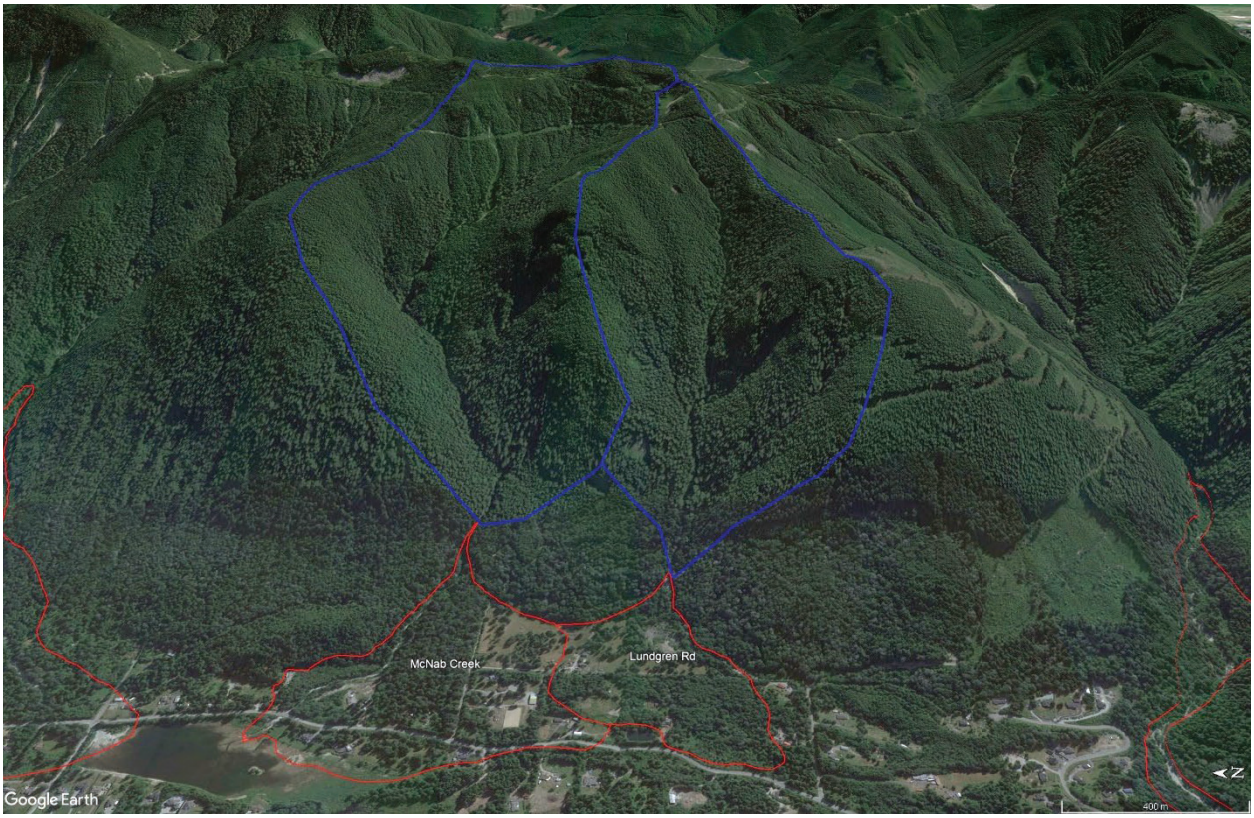

Figure B-3 Typical steep creek watersheds and fans in the Hatzic Valley. The approximate watershed and fan boundary are outlined in blue and red, respectively. Google Earth July 2022 imagery.



Figure B-4 Typical steep and low-gradient fans feeding into a broader floodplain. On the left a small watershed prone to debris flows has created a steep fan that may also be subject to rock fall processes. On the right a larger watershed prone to debris floods has created a lower gradient fan. Development and infrastructure are shown to illustrate their interaction with steep creek geohazard events. Artwork: Derrill Shuttleworth.

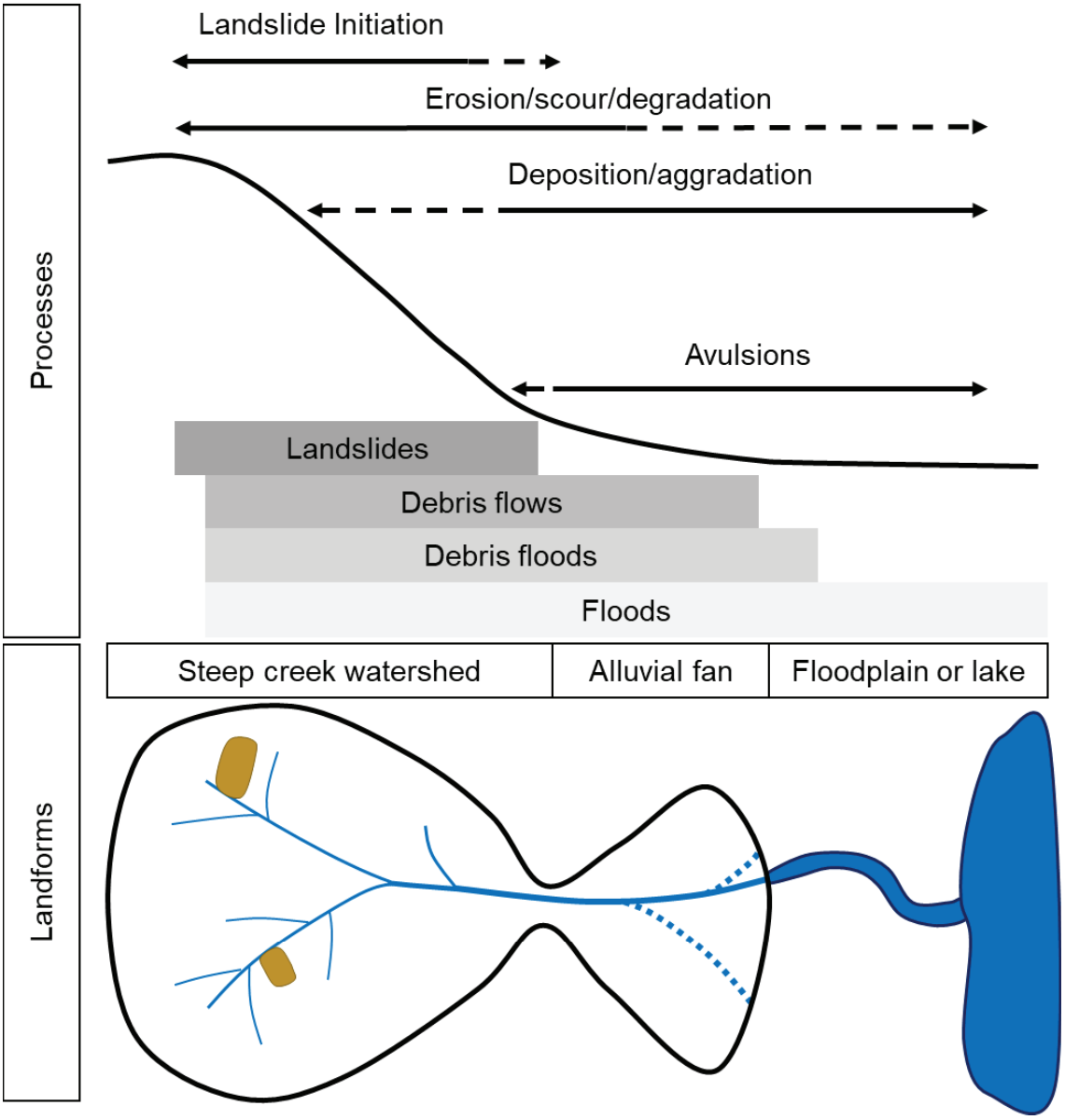

Figure B-5 Schematic diagram of a steep creek watershed system that shows the principal zones of distinctive processes and sediment behaviour. Landslides are shown in brown. The alluvial fan is thought of as the long-term storage landform with a time scale of thousands to tens of thousands of years. Sketch developed by BGC from concepts produced by Schumm (1977), Montgomery & Buffington (1997), and Church (2022).

The alluvial fan is a mostly depositional landform at the outlet of a steep creek watershed. Alluvial fans are dynamic and potentially very dangerous (hazardous) landforms that represent the approximate extent of past and future hydrogeomorphic processes. This landform is more correctly called a colluvial fan when formed by debris flows because debris flows are classified as a landslide process, and an alluvial fan when formed by clear-water floods (those which do not carry substantial bedload or suspended load) or debris floods. For simplicity the term alluvial fan is used herein irrespective of geohazard type. “Classic” alluvial fans are roughly triangular in planform, but most fans have irregular shapes influenced by the surrounding topography.

Redistribution of sediments from the upper steeper fan to the lower flatter fan, primarily through bank erosion and channel scour, is common (Lau, 2017).

Stream channels on the fan are prone to avulsions, which are rapid changes in channel location, due to natural cycles in alluvial fan development and from the loss of channel confinement during hydrogeomorphic events (e.g., Kellerhals & Church, 1990; van Dijk et al., 2009; 2012; de Haas et al., 2017; 2019; Zubrycky et al., 2021). If the alluvial fan is formed on the margin of a still water body (lake, reservoir, ocean), the alluvial fan is termed a fan-delta. These landforms differ from alluvial fans in that sediment deposition at the margin of the landform occurs in still water, which invites in-channel sediment aggradation due to a pronounced morphodynamic backwater effect. This can increase the frequency and possibly severity of avulsions (van Dijk et al., 2009; 2012).

The term “paleofan” is used to describe portions of fans interpreted as no longer active (under present climate and geomorphic/geological setting) and entirely removed from the channel processes described previously (i.e., with negligible potential for channel avulsion and flow propagation) due to deep channel incision (Kellerhals & Church, 1990). Although paleofans do exist in the FVRD, none were identified as part of this study.

B-1.1.2 Debris Flow

‘Debris flow’, as defined by Hungr et al. (2014), is a very rapid, channelized flow of saturated debris containing fine grained sediment (i.e., sand and finer fractions) with a plasticity index of less than 5%. Debris flows originate from a single or distributed source area(s) from sediment mobilized by the influx of ground or surface water. Post-fire debris flows are a special case where the lack of vegetation can lead to abundant rilling and gullying that delivers sediment to the main channel and the formation of debris flows. In those cases, no single source is required to initiate or maintain debris-flow mechanics.

Debris flows travel in confined channels bordered by steep slopes. In confined channels, the flow volume, peak discharge, and flow depth increase, and the debris becomes sorted along the flow path. Flow velocities typically range from 1 to 10 m/s, although very large debris flows from volcanic edifices, often containing substantial fines, can travel at more than 20 m/s along much of their path (Major et al., 2005). The front of the rapidly advancing flow is steep and commonly followed by several secondary surges that form due to particle segregation and upwards or outwards migration of boulders. Hence, one of the distinguishing characteristics of coarse granular debris flows is vertical inverse grading, in which larger particles are concentrated at the top of the deposit. This characteristic behaviour leads to the formation of lateral levees along the channel that become part of the debris-flow depositional legacy. Similarly, depositional lobes are formed where frictional resistance from unsaturated coarse-grained or large organic debris-rich fronts is high enough to slow and eventually stop the motion of the trailing liquefied debris.

Due to their high flow velocities, peak discharges during debris flows are at least an order of magnitude larger than those of comparable return period floods and can be 50 times larger or more (Jakob & Jordan, 2001; Jakob et al., 2016). Channel banks can be severely eroded during

debris flows, although lateral erosion is often associated with the trailing flow characterized by lower volumetric sediment concentrations. The most severe damage results from direct impact of large clasts or coarse woody debris against structures that are not designed for the impact forces (Jakob et al., 2012). Similarly, linear infrastructure such as roads, and railways are subject to damage from debris flows either from direct impact or erosion. Buried infrastructure can be damaged by debris flows if it is exposed by erosion and then impacted by boulders or woody debris.

Avulsions are likely in poorly confined channel sections and on the outside of channel bends where debris flows tend to superelevate. A sudden loss of confinement and decrease in channel slope cause debris flows to decelerate and slow the advancing bouldery front, which blocks the channel. Further flows are often deflected by the slowing front, leading to secondary avulsions and the creation of distributary channels on the fan. Because debris flows often display surging behaviour, in which bouldery fronts alternate with hyperconcentrated afterflows, the cycle of coarse bouldery lobe and levee formation and afterflow deflection can be repeated several times during a single event (Iverson, 2014).

B-1.1.3 Debris flood

Church and Jakob (2020) define debris floods as “floods during which the entire bed, barring the very largest clasts, becomes mobile for at least a few minutes and over a length of at least 10 times the channel width”. Accordingly, debris floods represent flood flows with high transport of gravel to boulder size material. Debris floods typically occur on creeks with channel gradients between 5 and 30% (3 and 17º) but can also occur on lower gradient gravel bed rivers.

Due to their initially relatively low sediment concentration, debris floods can be more erosive along low-gradient alluvial channel banks than debris flows. Bank erosion and excessive amounts of bedload introduce large amounts of sediment to the fan where they accumulate (aggrade) in channel sections with decreased slope. Debris floods can also be initiated on the fan itself through rapid bed erosion and entrainment of bank materials, as long as the stream power is high enough to transport clasts larger than the D50. Because typical long-duration storm hydrographs fluctuate several times over the course of the storm, several cycles of aggradation and remobilization of deposited sediments on channel and fan reaches can be expected during the same event (Jakob et al., 2016). Similarly, debris floods triggered by outbreak floods may lead to single or multiple surges irrespective of hydrograph fluctuations that can lead to cycles of bank erosion, scour and infill. This is important for interpretations of field observations as only the final deposition or scour can be measured.

Church and Jakob (2020) developed a three-fold typology for debris floods (Table B 1). Identifying the correct debris-flood type is key in preparing for numerical modeling and hazard assessments. Type 2 is the typical debris-flood type referred to in this prioritization study. Type 1 is associated with in clear-water flood on fan process. Type 3 is considered in the landslide dam outbreak flood (LDOF) parameter presented in Section B.3.2.5.

Table B-1 Debris-flood classification based on Church and Jakob (2020).

Term	Definition	Typical sediment concentration by volume (%)	Typical Qmax factor compared to calc. clear-water	Physical characteristics of the deposits	Typical impacts	Typical return period range (years)
Type 1	Rainfall/snowmelt generated through exceedance of critical shear stress threshold when most of the surface bed grains are being mobilized	< 5	1.05 (or higher should there be multiple side slope landslides expected or large organic debris)	Steep fans (1% to 10%), shallow but wide active floodplain, widespread boulder carpets, clast to matrix-supported sediment facies, poorly sorted, subrounded to rounded stones, imbrication of elongate clasts, occasional crossbedding, disturbed riparian vegetation, frequent avulsions on fan	Widespread bank instability, avulsions, alternating reaches of bed aggradation and degradation, blocked culverts, scoured bridge abutments, damaged buried infrastructure particularly in channel reaches u/s of fans	>2
Type 2	Transitional as a consequence of debris flows. Substantially higher sediment concentration compared to a Type 1 debris flood and accordingly greater facility to transport larger volumes of sediment. All grain calibers mobilized, except from lag deposits(big glacial or rock fall boulders)	< 50	2–5 (but possibly larger at the transition zone)	As for Type 1 but rarely clast-supported and with higher matrix sediment concentration, unsorted, inverse grading near debris flow tributary. Stones subangular to angular, boulder carpets on fans often display abrupt sediment deposit edges	Widespread bank instability, avulsions, substantial bed aggradation particularly on fans, blocked culverts, scoured bridge abutments, damaged and buried infrastructure on fans	>50
Type 3	Type 3 (outbreak floods) (artificial-, landslide-, glacial-, moraine-, beaver, o-log jam outbreaks)	<10 (except immediately downstream of the outbreak where it can reach greater than30%)	2 to 100 depending on size of dam and distance to dam failure	High matrix fines content especially in volcanic sources or fine-grained soil (e.g., loess), sometimes inverse grading near outbreak flood source, unsorted near source. Increasing sorting and stratification with downstream distance, erosion and fill structures	Extreme bank erosion, avulsions, substantial bed degradation along channels and aggradation on fans, destroyed culverts, outflanked or overwhelmed bridges, damaged and buried infrastructure on channels and fans	>100 (can be singular event in the case of a moraine dam or glacial breach)

B-1.2 Climate Change

B-1.2.1 Background

This section outlines some of the climate change affects specifically related to steep creek hazards. Climate change is expected to impact steep creek geohazards both directly and indirectly through complex feedback mechanisms. Given that hydrological and mass movement processes are higher order effects of air temperature increases, their prediction is highly complex and often site-specific.

Jakob (2022) provides a general overview of how climate change will affect steep creek hazards based on sediment availability:

- Supply-limited: meaning that debris available for transport is a limiting factor on the magnitude and frequency of steep creek events. In other words, once debris in the source zone and transport zone has been depleted by a debris flow or debris flood, another event even with the same hydro-climatic trigger will be of lesser magnitude.
- Supply-unlimited: meaning that debris available for transport is not a limiting factor on the magnitude and frequency of steep creek events, and another factor (such as precipitation frequency/magnitude) is the limiting factor. In other words, there is always an abundance of debris along a channel and in source areas so that whenever a critical hydro-climatic threshold is exceeded, an event will occur. The more severe the hydro-climatic event, the higher the resulting magnitude of the debris flow or debris flood.

Further subdivisions into channel supply-limited and unlimited and basin supply-limited and unlimited are possible but not considered herein.

The sensitivity of the two basic types of basins to increases in rainfall (intensity and frequency increases) differ (Figure B-6):

- Supply-limited basins would likely see a decrease in individual geohazard event magnitude, but an increase in their frequency as smaller amounts of debris that remains in the channel are easily mobilized (i.e., more, but smaller events).
- Supply-unlimited basins would likely see an increase in hazard magnitude and a greater increase in frequency (i.e., significantly more, and larger events).

Supply-limited basins can transition into supply-unlimited due to landscape changes. For example, sediment supply could be increased by wildfires, landslide occurrence, or human activity (e.g., related to road building or resource extraction).

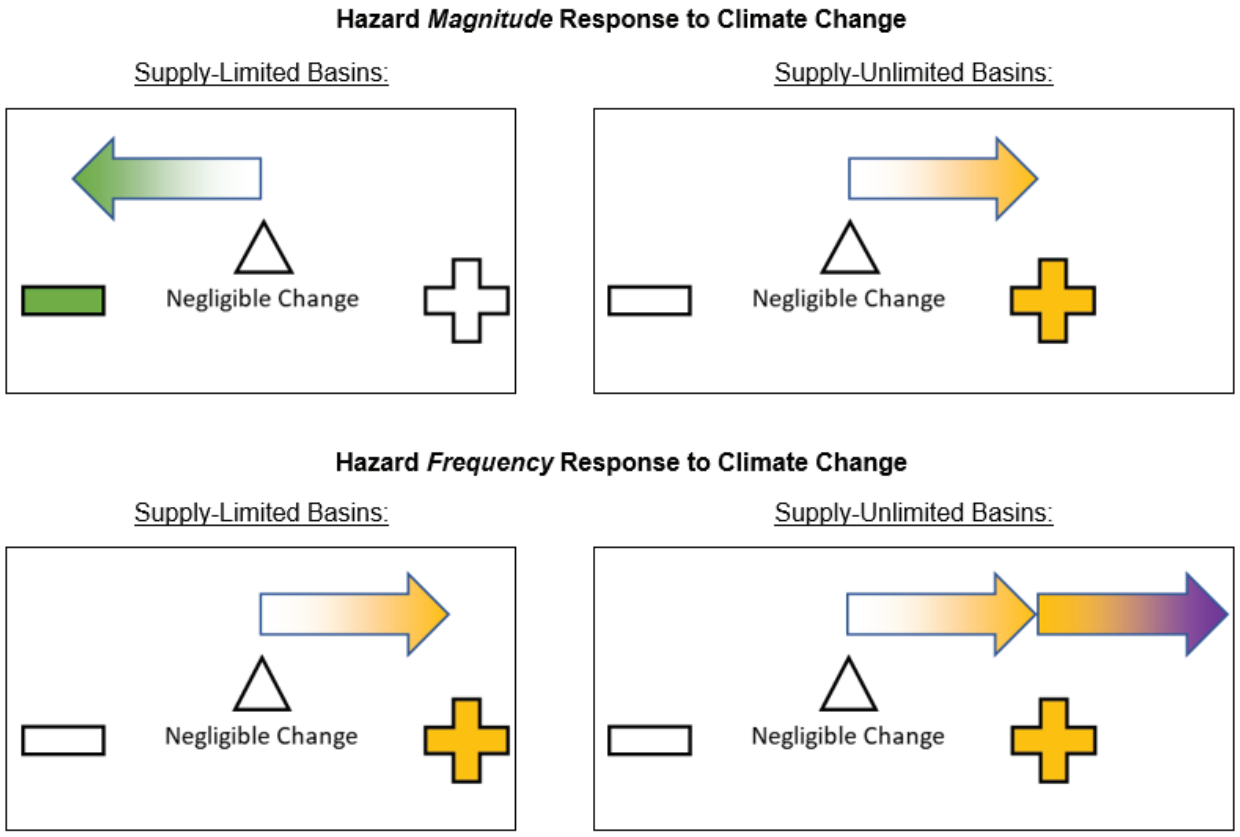

Figure B-6 Steep creek hazard sensitivity to climate change - supply-limited and supply unlimited basins.

Climate change is projected to increase the conditions for extreme fire weather (high temperature, low humidity, and high winds) and lengthen the fire season resulting in increased fire sizes (Utzig et al., 2011.; Haider et al., 2019). In addition to larger fires, changes to short duration (one hour and less) rainfall intensities are particularly relevant for post-fire situations. Debris-flows can be triggered within the year to a few years after a wildfire from short duration and high intensity rainfall that previously would not trigger debris flows or debris floods in the same watershed. Wildfires are known to both increase the sediment supply and lower the precipitation threshold for steep creek events to occur. Climate change is expected to increase the short-duration rainfall intensity in the Fraser Valley Regional District (Prein et al., 2017; Crévolin et al., 2023).

B.1.2.2. Climate Change Adjustment in Steep Creek Geohazard Assessment

Climate change was considered in steep creek hazard characterization by applying climate change adjusted estimates of peak discharge as inputs for hazard intensity ratings (Section B.4.1). Adjustment of the geohazard likelihood ratings that consider the 'sensitivity' of geomorphic activity in a watershed to climate change is not applied in the current prioritization study, because the adjustment would be applied to all geohazard areas, and therefore would not have any effect on the relative prioritization.

B-2 STEEP CREEK GEOHAZARD IDENTIFICATION

Steep creek geohazard identification for the Hatzic Valley focused on the delineation of alluvial fans, as these are the landforms commonly occupied by elements at risk. The boundaries of alluvial fans define the steep creek geohazard areas prioritized in this study, with an example of fan boundaries shown in Figure B-7 and a complete outline of fan boundaries in Appendix D. Watersheds upstream of each mapped fan were assessed to identify geohazard processes and determine geohazard ratings but were not mapped.

B-2.1 Fan Inventory

Fan extents were manually delineated in an ESRI ArcGIS Online web map based on hillshade images built from the coverage of lidar Digital Elevation Models (DEM). A total of 12 developed fans were mapped within the study area.

The accuracy of each fan's boundary and hazard rating depends, in part, on the resolution of the available terrain data. For this project, lidar was available for the entire study area but mapped fan boundaries should still be considered approximate as multiple natural and anthropogenic processes in the Hatzic Valley can obscure fan boundaries. The fan boundary approximates the extent of sediment deposition since the beginning of fan formation[2]. Geohazards can potentially extend beyond the fan boundary due to: localized flooding, where the fan is truncated by a lake or river; in young landscapes where fans are actively forming (e.g., recently deglaciated areas); or where large landslides (e.g., rock avalanches) trigger steep creek events larger than any previously occurring.

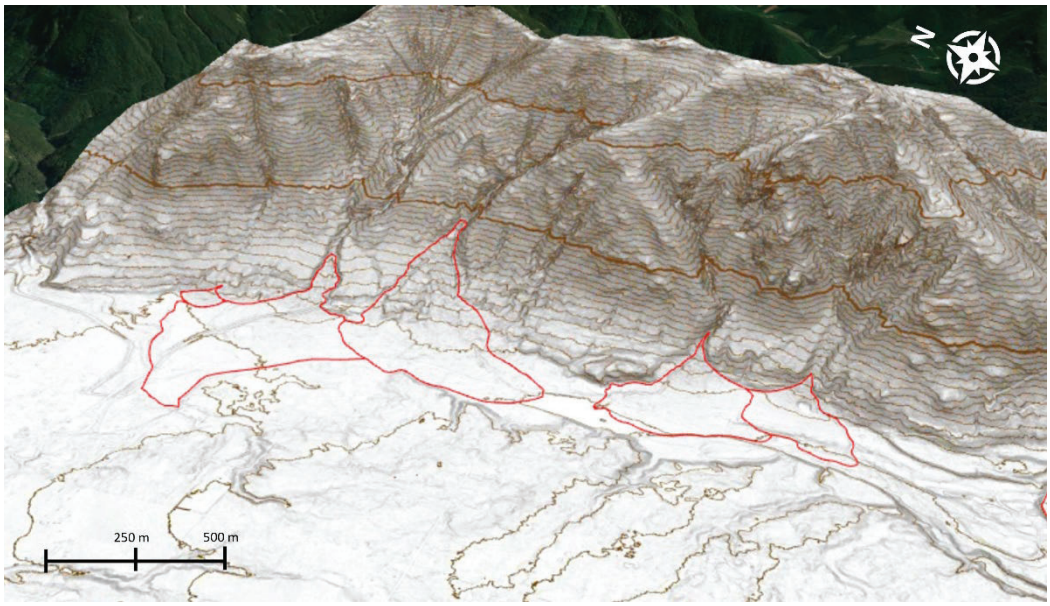

Figure B-7 Example of oblique lidar hillshade and 20 m contours showing alluvial fans in the Hatzic Valley. Lidar DEM provided by Government of BC (2019).

[2] Most of the alluvial fans mapped in this study represent the accumulation of sediment over the Holocene period (since about 11,000 years BP).

B-2.2 Stream Network

The streams of the Hatzic Valley were extracted from BGC's River Network Tools™ (RNT). RNT is a web-based application developed by BGC for analysis of hydrotechnical geohazards associated with rivers and streams. The basis for RNT is a digital stream network that is used to evaluate catchment hydrology, including delineating catchment areas and analyzing flood frequencies over large geographical areas. RNT incorporates hydrographic data with national coverage from Natural Resources Canada's (NRCan's) National Hydro Network (NHN) at a resolution of 1:50,000 (NRCan, January 25, 2016). The publicly available stream network is enhanced by algorithms within the RNT database to ensure the proper connectivity of the stream segments even through complex braided sections. Modifications to the stream network within RNT are made as necessary based on review of satellite imagery (e.g., Google Earth™) at approximately 1:10,000 scale. BGC reviewed the RNT stream segments used for the analysis in this report alongside the Lower Fraser Streams Update (CMN, 2021) and found that the names and locations of watercourses included in this report align with the desktop and field mapping performed by the Community Mapping Network in 2020 and 2021.

In the RNT, the stream network is represented as a series of individual segments that includes hydraulic information such as:

- A water flow direction
- The upstream and downstream stream segment connections
- A local upstream catchment area for each stream segment (used to calculate total catchment area)
- A Strahler stream order classification (Strahler, 1952)
- A local channel gradient, which is determined using a topographic dataset to assess the elevation differential between the upstream and downstream limit of the segment.

Strahler stream order is used to classify stream segments by its branching complexity within a drainage system and is an indication of the significance in size and water conveying capacity at points along a river (Strahler, 1952). Strahler order 4 and higher streams are typically larger streams and rivers (e.g., Cascade Creek), while Strahler order 3 and lower streams are typically smaller, headwater streams (e.g., McNab Creek). An illustration of Strahler stream order classification is shown in Figure B8 and described conceptually for the Hatzic in Table B-2.

BGC supplements these data with 1:50,000-scale CanVec digital watercourse linework to represent lakes and reservoirs and 1:20,000 scale GeoBase digital elevation models (DEMs; NRCan, January 25, 2016) to generate catchment areas and a local stream gradient for each segment in RNT.

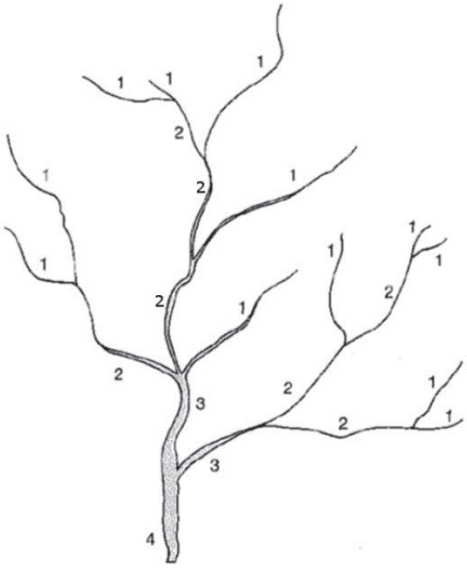

Figure B-8 Illustration showing Strahler stream order (Montgomery, 1990).

Table B-2 Strahler order summary for the SLRD stream network.

Strahler Order	Description	Hatzic Valley Examples
1 – 3	Small, headwater streams generally on steeper slopes and typically subject to steep-creek processes (debris floods/ flows). Channel may be dry for a portion of the year. They are tributaries to larger streams and are typically unnamed.	Pattison Creek, McNab Creek
4 – 6	Medium stream or river. Generally, less steep and lower flow velocity than headwater streams.	Cascade Creek, Lagace Creek
7+	Large river. Larger volumes of runoff and potentially debris conveyed then from smaller waterways.	Fraser River

B-2.3 Geohazard Process Type Identification

BGC used terrain interpretations and morphometric statistics to assign each creek as "dominantly" subject to debris flows, debris floods or clear-water floods. The term "dominant" refers to the process type that primarily controlled hazard assessment methodology and ratings. Recognizing that there is a continuum between clear-water floods and debris flows, BGC notes the following assumptions:

- Fans classified as subject to debris flows may also be subject to floods and debris floods at lower return periods (debris flows may transition to watery afterflows in the lower runout zone and after the main debris surge).
- Fans classified as subject to debris floods may be subject to clear-water floods, but generally not to debris flows.
- Fans classified as subject to clear-water flood are dominated by clear-water floods.

The morphometric statistical approach was applied to every stream segment in the entire study area, including both developed and undeveloped areas. For the alluvial fans, the morphometric

statistical approach was considered alongside terrain interpretations. Sections below outline these approaches.

B-2.3.1 Morphometric Statistics

BGC applied the following morphometric statistical approach to predict steep creek process type for all segments of every mapped creek within the study area:

1. Collect statistics on Melton Ratio[3] and watershed length[4] for each segment of each creek. These terrain factors are a good screening level indicator of the propensity of a creek to dominantly produce floods, debris floods or debris flow (Holm et al., 2016).
2. Apply class boundaries to predict process types for all stream segments in the study area, regardless of whether they intersect fans.

Figure B-11 plots the study area creeks with respect to Melton Ratio and watershed length[5] against additional fans in BC and Alberta. Although there is overlap, creeks with the highest Melton ratio and shortest watershed stream length are mostly prone to debris flows, and those with the lowest Melton ratio and longest watershed stream lengths are mostly prone to clear-water floods. Debris floods fall between these types. Table B-3 lists class boundaries used to define process types on each segment of each creek within the Hatzic Valley, based on recommendations from previous studies in BC (Holm et al., 2016).

Table B-3 Class boundaries using Melton ratio and total stream network length.

Process	Melton Ratio	Stream Length (km)
Floods	< 0.2	all
Debris floods	0.2 to 0.5	all
	> 0.5	> 3
Debris flows	> 0.5	≤ 3

[3] Melton ratio is watershed relief divided by the square root of watershed area (Melton, 1957).
[4] Stream network length is the total channel length upstream of a given stream segment to the stream segment farthest from the fan apex.
[5] The process type shown in the figure represents the process at the location of the fan apex. Many creeks subject to debris-floods are also subject to debris-flows on steeper creeks higher in the basin.

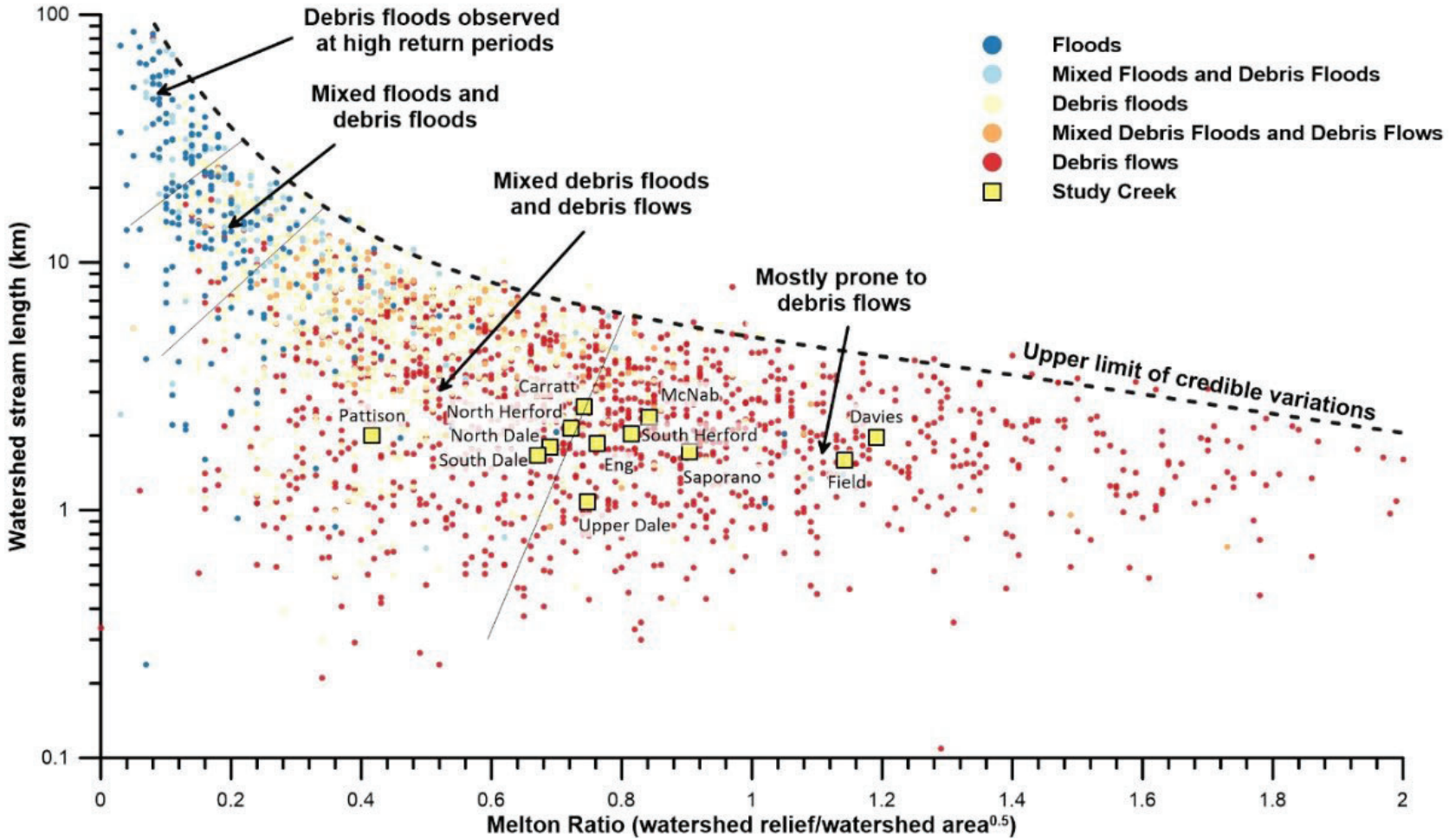

Figure B-9 Steep creek processes in the Hatzic as a function of Melton Ratio and stream length. Process boundaries are derived from this study and additional fans in Alberta and BC (Holm et al., 2016; Lau, 2017).

Steep creek process types predicted from watershed morphometry are subject to limitations:

- Creeks at the transition between debris flows and debris floods may generate either type of process and do not fall clearly into one category or another. The classification describes the potential dominant process type but does not consider the geomorphic or hydroclimatic conditions needed to trigger events. In rare occasions, channels may be classified as “debris flow” or “debris flood” without evidence for previous such events. Some streams subject to debris floods are subject to clear-water floods at lower return periods.
- Watershed conditions that affect hydrogeomorphic process types cannot be considered using a purely statistical approach. For example, a fan could be located at the outlet of a gentle valley, but a debris flow tributary enters near the fan apex. In this situation, debris flows could run out onto a fan that is otherwise subject to floods or debris floods from the main tributary.
- The morphometric statistical approach may be appropriate for hanging valleys, where the lower channel sharply steepens below a gentle upper basin.
- Finally, as explained in Section B-1.1, there is a continuum between each of the geohazard processes and consequently, a steep creek could have an event that has characteristics that fall between a debris flood and debris flow. Similarly, not every debris flood shows the same characteristics (see Section B-1.1.3)
- The major advantage of statistically based methods is that they can be applied to much larger regions than would be feasible to manually assess. However, interpretation of steep creek process types from multiple lines of evidence (statistical, remote-sensed, field observation) would result in higher confidence. Therefore, BGC manually interpreted the dominant fan-forming process types for the prioritized geohazard areas (Section B-2.3.2).

B-2.3.2 Terrain Interpretations

BGC interpreted the dominant fan-forming process types from the following information sources:

- The geomorphology of fans and their associated watersheds observed in the available imagery
- Field observations
- Records of previous events
- Review of statistically predicted process type for channel(s) intersecting the fan.

Table B-4 summarizes the characteristics used to differentiate hydrogeomorphic processes on fans from imagery and field evidence.

In some cases, remotely sensed (lidar and air photo) or field observations indicated that the stream may be subject to mixed processes. Where possible, BGC noted these “mixed-type” alluvial fans during terrain interpretation.

Table B-4 Characteristics used to classify hydrogeomorphic process types on fans (after Lau, 2017). Grey shading indicates key characteristic used to classify the process.

	Debris flow	Debris flood	Flood
Air photo	• Steep (>15°) average watershed channel gradient and typically small (< 3 km^2) watersheds with high relief • Frequent sediment sources in upper watershed (rockfalls, debris avalanches, etc.) • Inconsistent breaks in tree canopy on fan along stream channel.	• Moderately steep (3-15°) average watershed channel gradient, medium to large watersheds with moderate to high relief • Sediment sources in upper watershed (rockfalls, debris avalanches, etc.) • Consistent break in tree canopy on fan along stream channel.	• Low (<3°) average watershed channel gradient, medium to large watersheds with moderate to low relief. • Wide channels • Large gap in tree canopy along stream channel. • Overbank deposits
Lidar	• Fan gradient > 5° • Levees along channel margin • U-shaped channels • (Boulder) lobes on fan surface • Tongue-shaped boulder carpets • Sharp deposit boundaries	• Fan gradient 2-10° • No levees along channel • Potential lobes on fan surface • Paired terraces	• Fan gradient < 5° • Wide channels • Lack of lobes and levees along channel margin
Field	• Matrix-supported deposits common, clast-supported rarely • Inversely graded deposits • No imbrication in deposits • Levees along channel margins • U-shaped channels • Boulder lobes on surface • Impact scars on trees • Adventitious roots • Buried tree trunks	• Clast-supported deposits • Normally graded deposits • Imbricated channel deposits (moderate frequency) • Potential lobes on surface • Paired terraces • Impact scars on trees • Adventitious[6] roots • Buried tree trunks • Boulder carpets • Deposition of bedload up to water surface elevation	• Clast-supported deposits • Normally graded deposits • Imbricated channel deposits (common frequency) • Wide, shallow deposits • Wide and shallow channels • Evidence of multiple tree stand ages along stream channel.

[6] Adventitious roots are roots arising in abnormal places

B-3 GEOHAZARD RATING

The geohazard ratings are a function of:

1. Geohazard likelihood: What is the likelihood of steep creek geohazard events large enough to potentially impact elements at risk[7] (Section B-3.1)?
2. Geohazard impact likelihood: Given a geohazard event occurs, how susceptible is the hazard area to flows that could impact elements at risk (not evaluated for this project)?

These two factors were combined in the qualitative geohazard rating matrix shown in Table B-5 to prioritize each geohazard area. Sections B-3.1 describes methods and criteria used to estimate geohazard likelihood. In these methods, terrain interpretation was based on a combination of lidar, air photos, satellite imagery, recorded events (Section 2.7 of the main report) and past assessments (Appendix D).

Table B-5 Geohazard rating.

Geohazard Likelihood	Geohazard Rating				
Very High	M	H	H	VH	VH
High	L	M	H	H	VH
Moderate	L	L	M	H	H
Low	VL	L	L	M	H
Very Low	VL	VL	L	L	M
Impact Likelihood	Very Low	Low	Moderate	High	Very High

B-3.1 Geohazard Likelihood Rating

BGC assigned a geohazard likelihood rating to each fan based on terrain analysis. The geohazard likelihood rating represents a single, “typical” event frequency assigned to each fan and watershed based on surface evidence for previous events, recorded events, and reference to previous work. The typical event corresponds to an event of sufficient magnitude to have credible potential for consequences[8].

B-3.1.1 Geohazard Likelihood Rating

Geohazard likelihood ratings were estimated based on surface evidence for geomorphic activity within the basin and fan. The relative ***basin activity*** and relative ***fan activity*** ratings were

[7] Elements at risk are defined as assets exposed to potential consequences of geohazard events.

[8] While a single geohazard likelihood rating was assigned for prioritization (i.e., to compare areas in relative terms), BGC notes that events of different frequencies and magnitudes (volume of sediment deposited on a fan, peak discharge) can occur on any given steep creek.

combined to generate a geohazard likelihood rating (Table B-6) for each prioritized geohazard area, as discussed in the section below.

Table B-6. Geohazard likelihood hazard rating matrix.

		Typical Basin Activity Characteristics				
		Very Low	**Low**	**Moderate**	**High**	**Very High**
Fan Activity Characteristics	**Very High**	Moderate	Moderate	High	Very High	Very High
	High	Low	Moderate	High	High	Very High
	Moderate	Low	Low	Moderate	High	High
	Low	Very Low	Low	Low	Moderate	Moderate
	Very Low	Very Low	Very Low	Low	Low	Moderate

Table B-7 and Table B-8 summarize the criteria used to rate basin activity and fan activity, respectively. Figure B-10 and Figure B-11 show examples of events large enough to produce visible surface evidence of activity. It should be noted that dense tree cover could obscure small events that would not be detected at the scale of this study. Accordingly, the ratings are relative measures and can be subject to the limitations of available records and datasets. Specifically, terrain interpretation on less vegetated fans can be biased in favour of relatively smaller, more frequent events that would not have been visible under tree cover. All ratings are potentially subject to revision following future more detailed study.

Table B-7. Relative basin activity for steep creeks organized by dominant process type.

Basin Activity	Description	Characteristic Observations	
		Debris-flood dominated steep creeks	Debris-flow dominated steep creeks
Very Low	• Minimal sediment sources. • Supply limited watershed.	• Negligible sediment sources in or along channel or in tributaries.	• Absence of landslide scars or erodible terrain. • Basin is treed. • Several rounded slopes.
Low	• Identifiable sediment sources, but most show limited evidence of activity or connectivity. • Supply limited watershed	• Minimal sediment sources in or along channel and any existing channel material is not easily mobilized (e.g., dense till, partially bedrock controlled).	• Some exposed soil or rock occurs. • Absence of fresh landslide scars or debris below exposed terrain. • Absence of channel deposits. • Basin and channel are mostly treed
Moderate	• Active sediment sources, but the material is not easily mobilized AND is not connected to the main channel or fan. • Supply limited or unlimited watershed.	• Sediment sources are present in or along channel. • Channel material is not easily mobilized (e.g., dense till, partially bedrock controlled) • Tributaries with identifiable sediment sources (e.g., debris-flow tributaries) typically stall before reaching main channel. • Main channel often has variable width.	• Sediment sources are present on slopes (e.g., presence of landslide scars in soil or rock). • Source material or in channel deposits are not easily mobilized (e.g., coarse, angular colluvium, dense till, or partially bedrock controlled). • Landslide deposits typically stall before the main channel.
High	• Active sediment sources, but the material is either not easily mobilized, or not clearly connected to the main channel or fan. • Supply unlimited watershed	• Numerous, actively producing source areas along main channel and tributaries (i.e., debris slides, debris avalanches, raveling in lacustrine, glaciofluvial, or morainal sediments); • Evidence of temporary sediment storage along main channel.	• Numerous, actively producing source areas on slopes or in channel. • Channel is choked with debris, but the material is not easily entrained (e.g., coarse angular colluvium) • Source material could be easily entrained (e.g., talus, loose glacial deposits, volcanic), but there is no clear connection between the sources and main channel (e.g., hanging valley).
Very High	• Active sediment sources that could be easily mobilized and are well connected to the main channel or fan. • Supply unlimited watershed	• Numerous, actively producing source areas along main channel and tributaries (i.e., debris slides, debris avalanches, raveling in lacustrine, glaciofluvial, or morainal sediments); • Source material could be easily entrained. • Tributaries with identifiable sediment sources (e.g., debris-flow tributaries) deposit straight into main channel.	• Numerous, actively producing source areas on slopes or in channel. • Channel choked with debris. • Easily entrained source materials along channels (e.g., talus, glacial deposits, volcanics)

Table B-8. Relative fan activity for steep creeks organized by dominant process type. Fan activity refers to the frequency of steep creek events reaching the fan.

Fan Activity[1,2]	Return Period	Number of Recorded Events[3]	Fan Observations	
			Debris-flood dominated creeks	Debris-flow dominated creeks
Very Low	500 year	None	• Vegetated mainstem. • No distinguishable debris-flood related landforms. • Uniform tree canopy of mature forest.	• No observable mainstem. • No distinguishable debris-flow related landforms. • Uniform tree canopy of mature forest.
Low[3]	200 year	None	• Partially vegetated mainstem. • Muted channels or over bank deposits (most likely only visible in lidar). • Uniform tree canopy of mature forest.	• Vegetated mainstem. • Muted channels, lobes or levees (most likely only visible in lidar). • Uniform tree canopy of mature forest.
Moderate	50 year	0 to 1	• Unvegetated mainstem. • Channels and over bank deposits are visible in lidar, but potentially not in imagery. • Persistently includes swaths of mixed deciduous or conifer trees in riparian zone.	• Partially vegetated mainstem; • Channels, lobes or levees are visible in lidar, but potentially not in imagery. • Persistently includes swaths of mixed deciduous or coniferous trees associated with debris-flow landforms.
High	20 year	1 to 2	• Unvegetated mainstem; • Channels and over bank deposits are visible in imagery and lidar. • Persistently includes variable tree stand ages in riparian zone. • Regenerative vegetation and exposed sediment along channel. • Undersized channel in comparison with active floodplain width. • Partially vegetated bank erosion scars.	• Partially vegetated mainstem. • Channels, lobes or levees are visible in imagery and lidar. • Persistently includes swaths of regenerative (<10 year) or immature (<50 year) forest, potential areas of bare sediment.
Very High	5 year	8 (or at least two in the past 10 years where records are not available over a longer period)	• Unvegetated mainstem; • Channels and over bank deposits are visible in imagery and lidar. • Persistently includes areas of pioneer vegetation in riparian zone. • Fresh deposits are visible. • Undersized channel in comparison with active floodplain width. • Fresh bank erosion scars along mainstem.	• Fresh deposits are visible. • Channels, lobes or levees are visible in imagery and lidar. • Persistently includes swaths of bare sediment or low (<2 year) pioneer vegetation.
Cannot determine[3]	n/a	n/a	• Anthropogenic modifications across most of fan, and no evidence of past events in air photo record.	

Notes:

1. In cases where fan activity cannot be determined from available data, the basin activity rating was applied as the likelihood rating.
2. Very low vs. low classification cannot reliably be determined without lidar. A classification of low is conservatively applied in such cases.
3. For the purposes of this assessment, BGC defined the record event span to be 1980 to present, for which there are readily and freely available air photo and recorded event records in the study area. The true number of recorded events at each geohazard area depends on the length and quality of air photo, imagery, and media records.

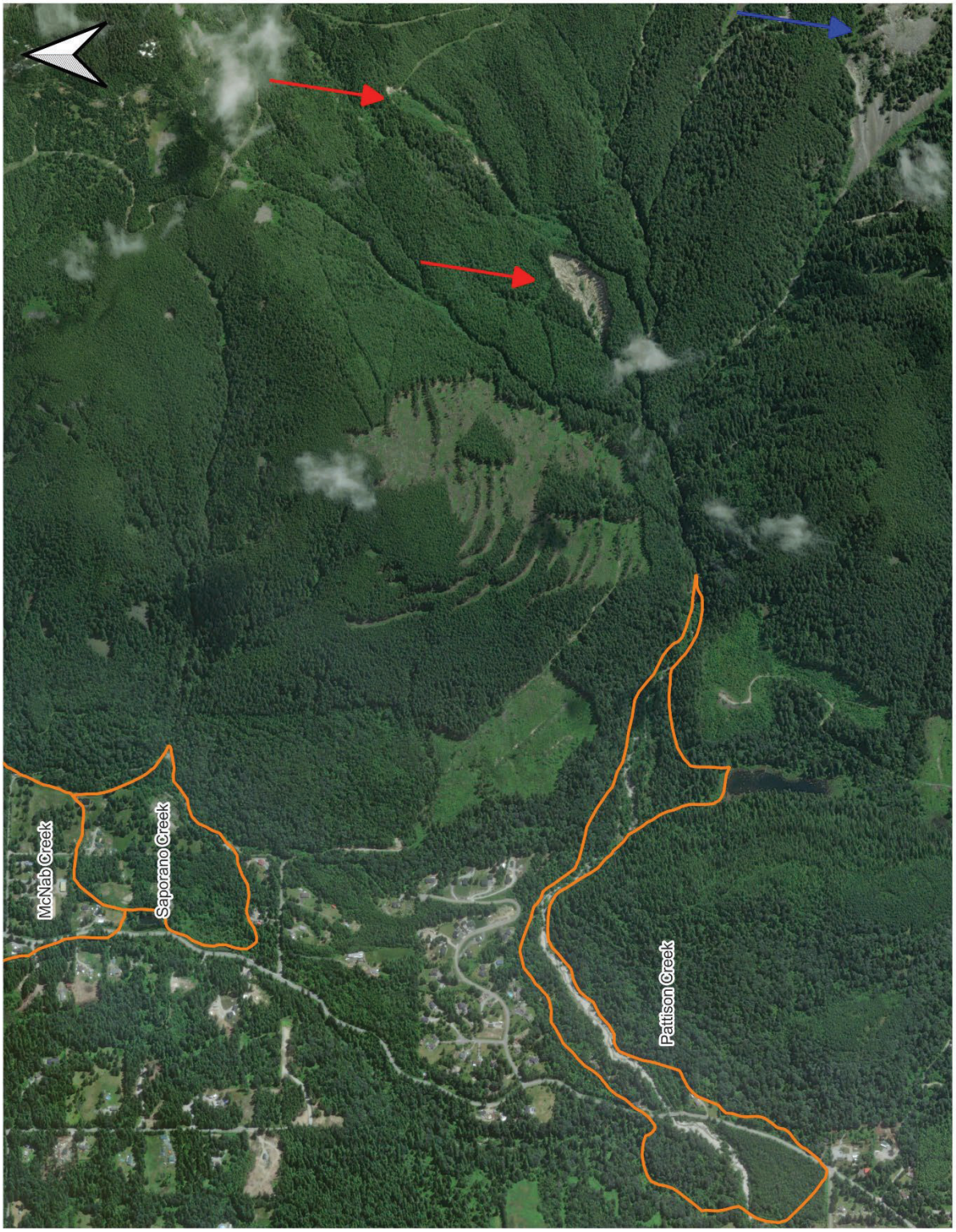

Figure B-10 **Example of evidence for recent landslide (red arrows) and large rock slope instability (blue arrow) within the basin of Pattison Creek. Fan extent outlined in orange (Imagery: ESRI, 2022).**

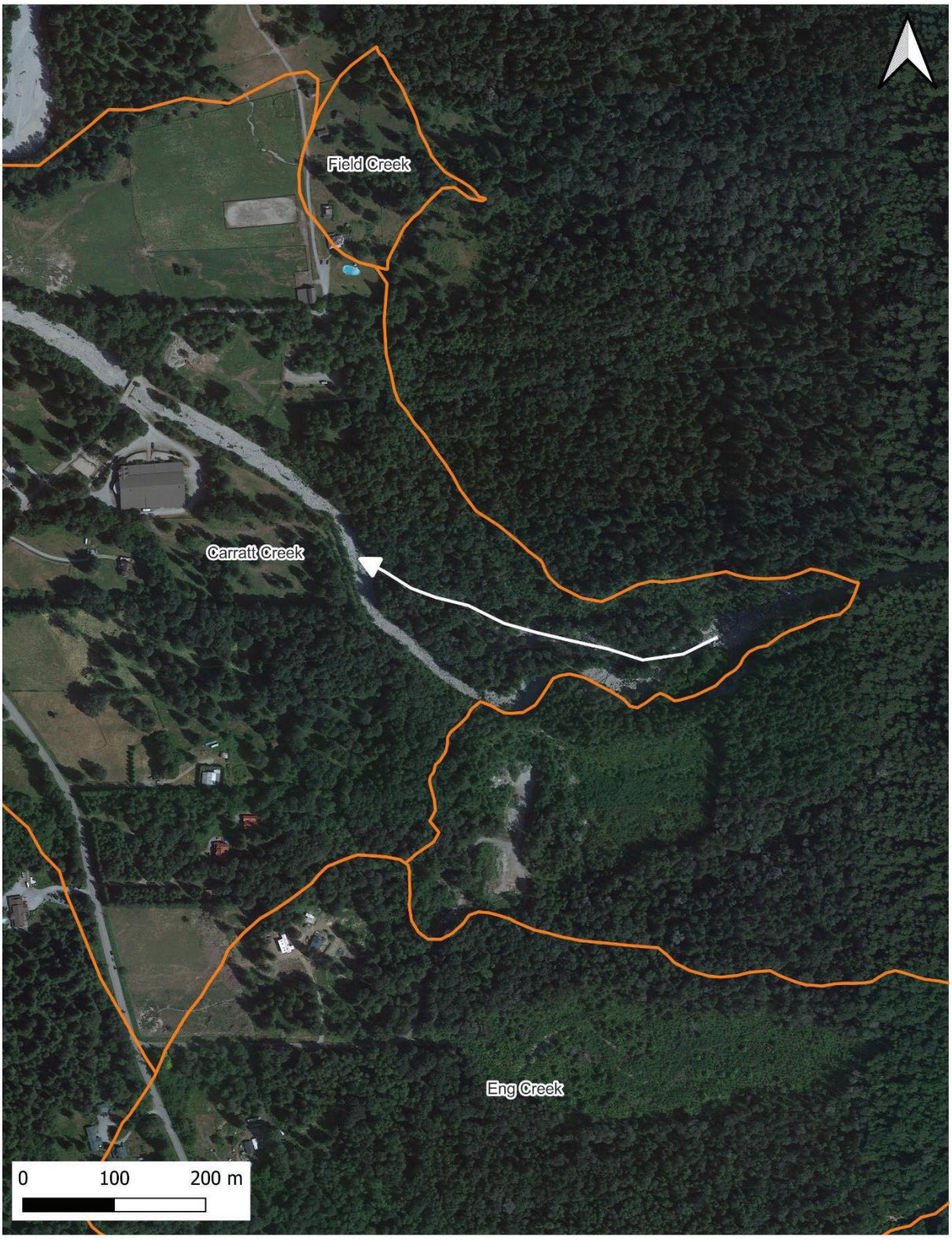

Figure B-11 Example of recent (2021) debris-flow avulsion (white arrow) on Carratt Creek. The approximate alluvial fan boundary is shown in orange (Imagery: Google, 2022).

B-3.1.2 Avulsion Activity

BGC used terrain interpretations of evidence of previous avulsions and description of potential avulsion mechanisms to assess the potential for avulsion to impact elements at risk at each fan. Surface evidence for previous avulsions includes pioneer vegetation on gravel deposits and the presence of relict channels, lobes, and deposits on the fan surface or along the channel (Table B9). These features are usually detectable on lidar hillshades and high-resolution satellite images; interpretations are less certain for areas without lidar or satellite image coverage. The rating is subject to greater uncertainty where development has obscured previous evidence for flow avulsions (e.g., channel modification or highly developed fans) or where avulsions deposits are removed by emergency works.

Fan-deltas (fans that form in standing water bodies, such as lakes, oceans and reservoirs) typically have a higher potential for avulsion than terrestrial (land-based) alluvial fans due to channel back-filling effects from the stream-lake/reservoir interface. As such, these fans typically exhibit characteristics of a “Very High” or “High” avulsion evidence rating, if the channel is not entrenched (highly incised) into the fan and the water level at any time of the year is well below the fan surface. Fan deltas with steeper gradients are less influenced by lake level and their avulsion rating remains unchanged.

The potential for avulsion can be variable along a channel due to relative confinement of the channel within the fan landform. For example, flows can more easily fill and overtop a channel that has low channel banks, rather than a deeply incised channel. In addition, structures such as bridges and culverts can become blocked during hydrogeomorphic events and encourage avulsion upstream.

Table B-9. Evidence of previous avulsions criteria. These criteria refer to the frequency of events avulsing on the fan, as opposed to Table B 7, which refers to the frequency of events reaching the fan regardless of avulsing or not.

Surface Evidence of Previous Avulsions[1]	Representative Return Period (years)	Number of Recorded Events[2]	Description	Characteristic Observations[3]
Very Low	500	None	Active or historical channels cannot be identified in lidar or imagery.	Vegetated fan with consistent, mature tree stand age. No avulsion channels visible in lidar if available.
Low[1]	200	None	Historical channels visible with lidar or air photographs, but they are muted and vegetated and not discernable on satellite imagery.	Vegetated fan with consistent, mature stand age. Muted historical channels visible in lidar if available.
Moderate	50	0 to 1	Historical channels on fan surface are visible in lidar, air photo and satellite imagery.	Swaths of young (<50 year) deciduous or coniferous vegetation exist in previous avulsion paths. Relict channels clear in lidar. Channels have similar characteristic geomorphic observations (e.g., debris-flow levees) as described in the fan activity rating.
High	20	1 to 2	An avulsion path is visible.	Swaths of bare sediment or low (<20 year) pioneer vegetation exist on previous avulsion path. Channels have similar characteristic geomorphic observations (e.g., boulder levees) as described in the fan activity rating.
Very High	5	8 (or at least two in the past 10 years where records are not available over a longer period)	At least one fresh avulsion path exists.	Swaths of bare sediment or low (<2 year) pioneer vegetation exist on previous avulsion paths. Channels have similar characteristic geomorphic observations (e.g., debris-flow levees) as described in the fan activity rating.

Notes:

1. Very low vs. low classification cannot reliably be determined without lidar. A classification of low is conservatively applied in such cases.
2. For the purposes of this assessment, BGC defined the record event span to be 1980 to present, for which there are readily and freely available air photo and recorded event records in the study area. The true number of recorded events at each geohazard area depends on the length and quality of air photo, imagery, and media records.
3. Fans classified as being a flood geohazard type are assessed according to these characteristics, but smaller flood events can be difficult to discern in air photos or satellite imagery. lidar, historical records and judgement is used where applicable. A low classification is conservatively applied as the lowest option for flood type fans.

B-3.1.3 Landslide Dam Outbreak Flood (LDOF) Potential

Some steep creek watersheds are prone to LDOFs, which could trigger flooding, debris floods, or debris flows with larger magnitudes than "typical" hazards. An example of this hazard is landslides in the Mount Meager volcanic complex, which have generated several landslide dams along Meager Creek and Lillooet River in British Columbia (Bovis & Jakob, 2000; Guthrie et al., 2012). In this assessment, LDOF potential is expected to be a factor potentially increasing the potential for avulsion. However, LDOFs are a distinct population of events from the "typical" debris flows and debris floods defined in Section B-1.1. Therefore, this rating serves as a flag for consideration of more specific analyses to address this type of geohazard.

Table B-10 lists terrain criteria used to estimate LDOF potential. Ratings are assigned based on evidence of past landslide dams, presence of large landslides with the potential to travel to the valley floor, and presence of channel sections potentially susceptible to blockage (e.g., channel constrictions).

Table B-10. Landslide dam outbreak flood potential criteria.

Relative Frequency	LDOF Potential
Very High	Presence of active landslides that are potentially large enough to reach the valley floor and block the typically confined stream channel. Historical evidence of several landslide dams in the main channel. Main stem channel is entrenched and confined within a steep sided and narrow valley, resulting in multiple constriction points (e.g., bedrock canyon).
High	Evidence of historical landslides that are potentially large enough to reach the valley floor and block the river channel. Historical evidence of at least one landslide dam in the main channel. Main stem channel is entrenched and confined within a narrow valley and may have constrictions (e.g., bedrock canyon).
Moderate	Evidence of historical landslides that are potentially large enough to reach the valley floor and block the river channel. Landslide damming is considered possible. No evidence of historical landslide dams in the main channel. Main stem channel has moderately steep valley walls and is partially confined (e.g., U-shaped valleys, glacial deposits, river terraces).
Low	No evidence of historical landslides potentially large enough to reach the valley floor and block the river channel. Landslide damming is improbable. No evidence of historical landslide dams in the main channel. Main stem channel is broad, with low angle to flat valley floor (e.g., floodplain).
Very Low	No evidence of historical landslides in the watershed. Main stem channel is broad and flat (e.g., floodplain). Landslide damming is impossible.

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APPENDIX C
FAN ATTRIBUTES

C-1 HATZIC VALLEY FAN ATTRIBUTES

Table C-1 Summary of Hatzic Valley fan attribution from this project.

Steep Creek	Basin Activity	Fan Activity	Geohazard Likelihood	Relative Return Period[1] (years)	Avulsion Evidence	LDOF[2]	Basin Type	Geohazard Process	Fan Delineation	Channel Confinement	Other Factor
Field Creek	Very Low	Moderate	Low	> 50	Low	Low	Supply Limited	Debris Flow	Lidar	Low	
Carratt Creek	High	High	High	< 20	Very High	Moderate	Supply Unlimited	Debris Flow	Lidar	Moderate	Logging
Eng Creek	Moderate	High	High	< 20	Low	High	Supply Unlimited	Debris Flow	Lidar	Moderate	Logging
McNab Creek	Moderate	High	High	< 20	Low	Low	Supply Limited	Debris Flow	Lidar	Moderate	Fire, Logging
Saporano Creek	Low	Moderate	Low	> 50	Low	Low	Supply Limited	Debris Flow	Lidar	Low	Logging
Pattison Creek	High	Moderate	High	< 20	Low	Moderate	Supply Unlimited	Debris Flow/Debris Flood	Lidar	Low	Fire, Logging
North Herford Creek	Low	Moderate	Low	> 50	Moderate	Low	Supply Limited	Debris Flow	Lidar	Low	Logging
South Herford Creek	Low	High	Moderate	20 to 50	Moderate	Low	Supply Limited	Debris Flow	Lidar	Low	Logging
Upper Dale Creek	Low	Moderate	Low	> 50	Moderate	Low	Supply Limited	Debris Flow	Lidar	Low	Logging
North Dale Creek	Low	Low	Low	> 50	Low	Low	Supply Limited	Debris Flow/Debris Flood	Lidar	Low	Logging
South Dale Creek	Low	Moderate	Low	> 50	Low	Low	Supply Limited	Debris Flow/Debris Flood	Lidar	Low	Logging
Davies Creek	Low	Low	Low	> 50	Low	Low	Supply Limited	Debris Flow	Lidar	Moderate	Logging

Note:
1. Relative Return Period estimates correlate with Geohazard Likelihood, where low Geohazard Likelihoods are estimated to have a return period > 50 years, moderate Geohazard Likelihoods 20 to 50 years, and high Geohazard Likelihoods < 20 years.
2. LDOF is a Landslide Dam Outburst Flood

APPENDIX D
DETAILED RESULTS FOR EACH CREEK ASSESSED

D-1 FIELD CREEK (SEDIMENT HAZARD SITE S-CR-28)

D-1.1 Desktop Characterization

Field Creek has a 0.47 km^2 basin area and 0.02 km^2 fan area. The dominant steep creek process is debris flow, which can mobilize a wide range of sediment sizes (clay through to cobble and boulder size particles), as well as large woody debris. Field Creek is supply limited, meaning it takes time for sediment to recharge in the watershed in between debris flow events (see Appendix B for more details). Few (1-2) geohazard events have been recorded at Field Creek. Even with low recorded activity on Field Creek, BGC (March 1, 2004) noted a residence at the edge of the fan could be at a High risk due to debris flow hazard. Potential slope deformation features were noted in the hillshade view of the lidar (Figure D-1). The estimated sediment volume resulting from a 200-year debris flow, as estimated using the methodology from Jakob et al. 2020 is 2,600 to 3,200 m^3. The 200-year clearwater flood discharge was not estimated for Field Creek by AE.

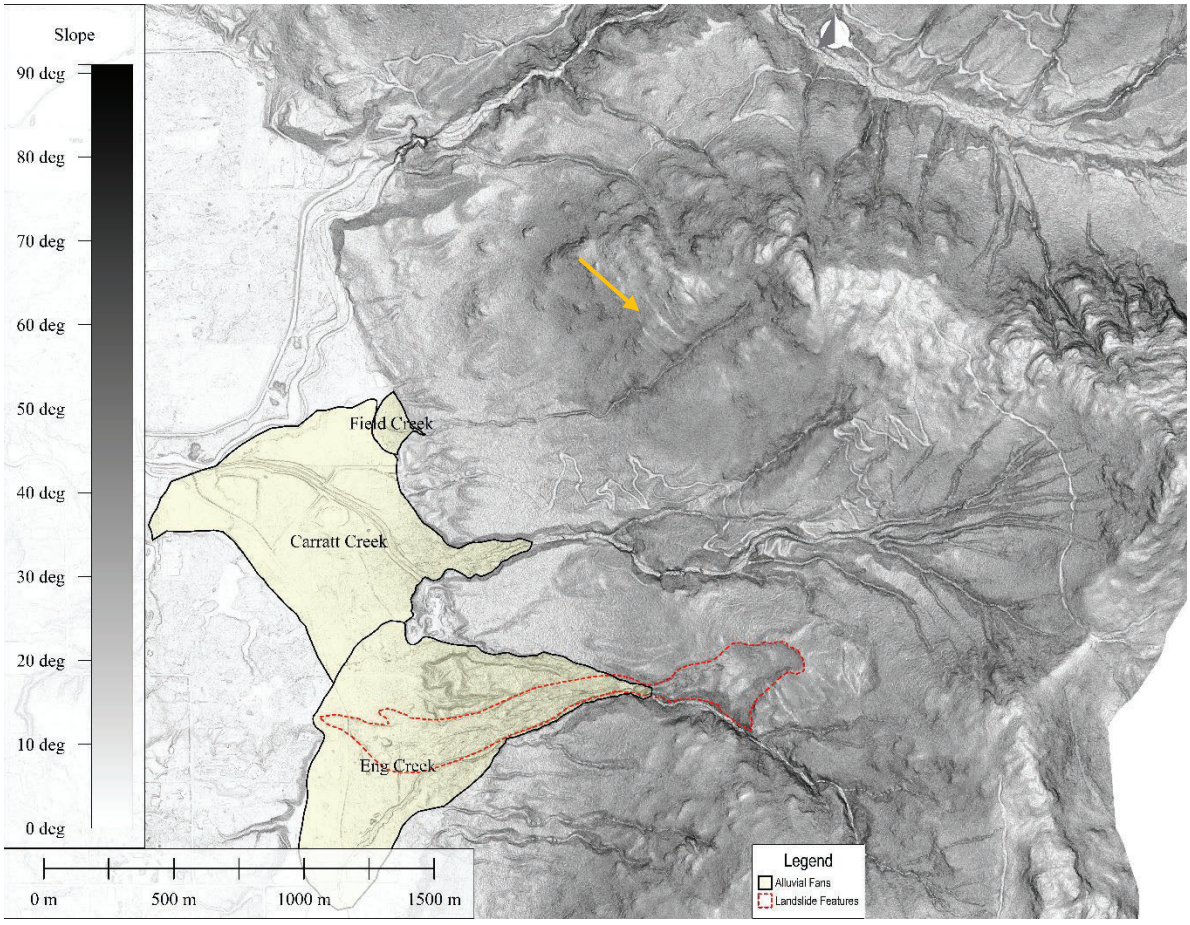

Figure D-1 Overview of the Field and Carratt creek watersheds and fans. Note potential slope deformation feature (orange arrow) and legacy resource roads in Carratt watershed.

D-1.2 Field Observations

Not observed in the field.

D-2 CARRATT CREEK (SEDIMENT HAZARD SITE S-CR-28)

D-2.1 Desktop Characterization

Carratt Creek has a 2.31 km^2 basin area and 0.63 km^2 fan area. The dominant steep creek process is debris flow, which can mobilize a wide range of sediment sizes (clay through to cobble and boulder size particles), as well as large woody debris. Carratt Creek is supply unlimited, meaning multiple events can occur in close succession due to the abundance of erodible sediment in the watershed (See Appendix B for more details). Several (5+) geohazard events have been recorded at Carratt Creek. Numerous reports (BC MoE 1983; Thurber, October 31, 2003; BGC December 12, 2003; BGC, March 1 2004; Kerr Wood Leidal, November 3, 2008; Thurber, July 31, 2012; BC FLNRO, 2013; Golder, March 28, 2022; BGC March 9, 2023) have described geohazard assessments, geohazard events or mitigation efforts along Carratt Creek. An extensive logging road network and substantial harvesting activities in the watershed have contributed to high landslide activity in the watershed (Figure D-1). The estimated sediment volume resulting from a 200-year debris flow, as estimated using the methodology from Jakob et al. 2020 is 15,500 to 68,500 m^3. See Section 5.0 for discussion on the wide range of volume estimate. The estimated 200-year clearwater flood discharge as estimated by AE is 17.9 m^3/s.

D-2.2 Field Observations

BGC inspected Carratt Creek from the bridge on Carratt Road to approximately 150 m below the fan apex. Bed material throughout the fan was observed to be predominantly gravel and cobbles, with many boulders present in channel and along banks of channel. In-channel mitigation work reshaping the main channel through Carratt creek was performed after a debris flow event in November 2021. Distinct boulder levees were visible near fan apex, upstream of where the channel has been reshaped. Boulders up to about 3.5 m diameter were observed on the upper fan (BGC, March 9, 2023). A debris flood travelled over the north bank of the main channel near the fan apex during the event in November 2021. The dimensions of the reshaped channel at the avulsion location were observed to be smaller than the dimensions of the channel further downstream (i.e., the pre-November 2021 channel capacity has not been fully restored). Impact marks on the upstream sides of trees at avulsion location are higher than the re-established channel bank (Photo 1). A Hesco-barrier (gabion-type) deflection barrier (Photo 2) has been constructed as a temporary mitigation along the north side of the creek across the avulsion path observed during the November 2021 event. Debris impact mark on trees were observed 3.8 m above the channel base near the fan apex.

D-3 ENG CREEK (SEDIMENT HAZARD SITE S-CR-36)

D-3.1 Desktop Characterization

Eng Creek has a 1.2 km^2 basin area and 0.64 km^2 fan area. The dominant steep creek process is debris flow, which can mobilize a wide range of sediment sizes (clay through to cobble and boulder size particles), as well as large woody debris. Eng Creek is supply unlimited, meaning multiple events can occur in close succession due to the abundance of erodible sediment in the watershed. Several (5+) geohazard events have been recorded at Eng Creek. A logging road in the upper watershed and historical harvest activities have contributed to moderate landslide activity in the watershed. The estimated sediment volume resulting from a 200-year debris flow, as estimated using the methodology from Jakob et al. 2020 is 8,000 to 70,100 m^3. See Section 5.0 for discussion on the wide range of volume estimate. The 200-year estimated clearwater flood discharge as estimated by AE is 9.6 m^3/s.

A landslide originating from the north side of the watershed, estimated to have occurred in 1961, that is thought to have killed a farmer (Septer 2007). The toe of this landslide material is visible in lidar to intersect Sylvester Road (Figure D-2). Features captured by lidar indicate the potential for another landslide event to occur, initiating as a retrogressive event from the same source area. This event could be comparable in size to the initial event. Numerous reports (BC MoE, 1981; Thurber, October 31, 2003; BGC December 12, 2003; BGC, March 1 2004; Cordilleran Geoscience, September 10, 2007; BC FLNRO, 2013) have described geohazard assessments, geohazard events or mitigation efforts along Eng Creek.

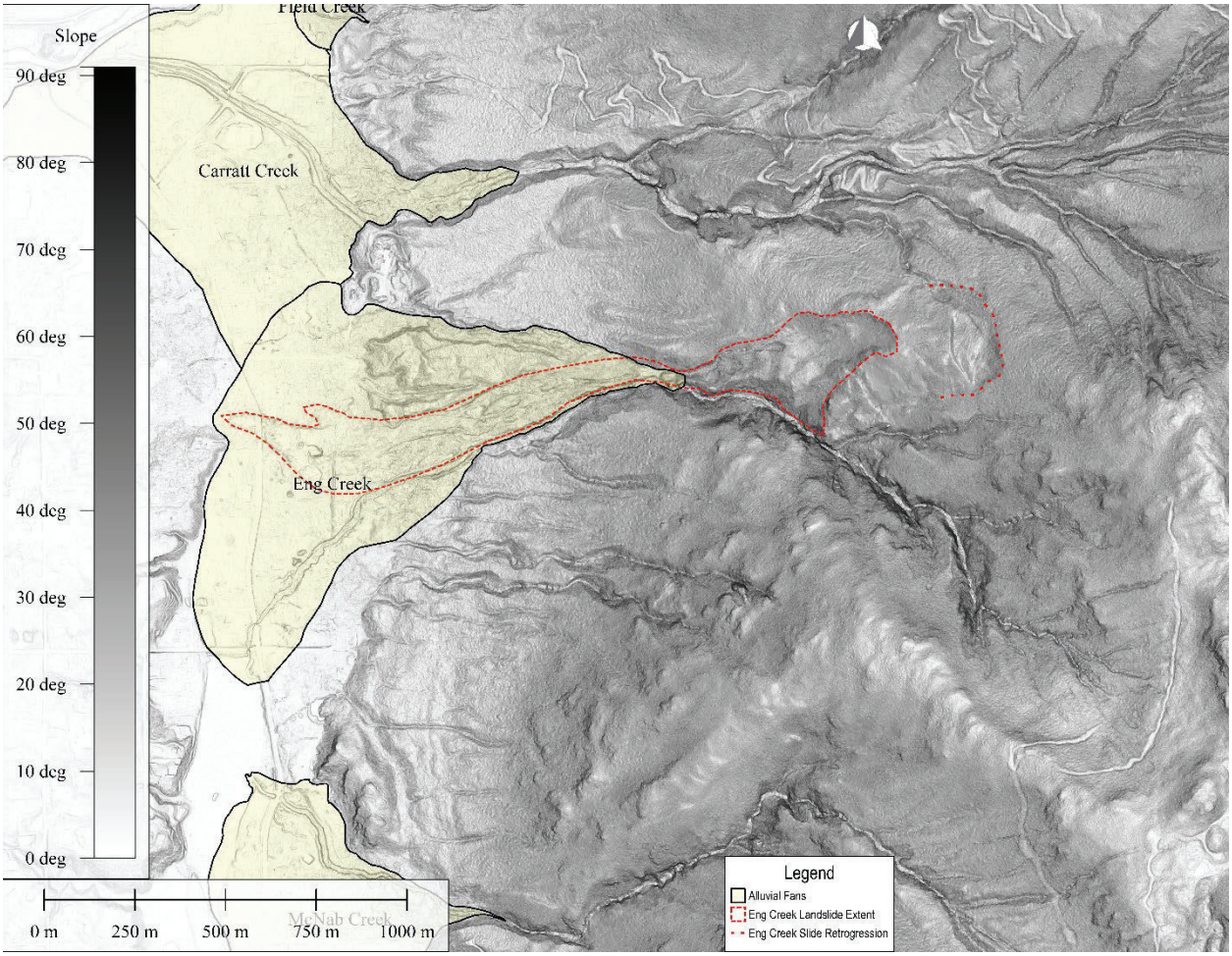

Figure D-2 Outline (short red dash) of large bedrock landslide source and deposit in Eng Creek. Extent (long red dash) potentially unstable rock slope.

D-3.2 Field Observations

BGC inspected Eng Creek from the bridge crossing at Sylvester Road in the distal southwest portion of the fan, to the middle of the fan approximately 600 m upstream from the bridge crossing. The bridge had approximately 0.7 m of clearance above the channel bottom. Bed material consisted of subrounded to subangular sand, gravel, and cobbles. Few boulders were present at the distal edge of the fan, and the creek was dry. While travelling upstream, the frequency and size of boulders on the sides of and within the channel increased, the channel gradient and flow within the stream increased, and the cross-sectional shape of the channel transitioned from a flat bottom with limited lateral confinement to a U-shaped channel with vegetated levees on either side (Photo 3). Abandoned flow paths on the sides of the main channel were vegetated with moss (Photo 4), providing a high-water constraint from the past few years. This feature was measured to be approximately 0.6 m above the current channel bottom. While no clear anthropogenic modification of the channel or its flow path were observed, an approximately 1.5 m tall berm was observed extending 230 m north from the creek approximately one third of the way from the distal edge to the fan apex.

D-4 MCNAB CREEK (SEDIMENT HAZARD SITE S-CR-35)

D-4.1 Desktop Characterization

McNab Creek has a 1.39 km^2 basin area and 0.31 km^2 fan area. The dominant steep creek process is debris flow, which can mobilize a wide range of sediment sizes (clay through to cobble and boulder size particles), as well as large woody debris. McNab Creek is supply limited, meaning takes time for sediment to recharge in the watershed in between debris flow events (see Appendix B for more details). Some (3-5) geohazard events have been recorded at McNab Creek. Part of the headwaters of the McNab Watershed burned in 1972. Forest fires can increase the frequency of debris flows and debris floods for a period of up to 10 years after the burn. A logging road in the upper watershed and historical harvest activities have contributed to moderate landslide activity in the watershed (Figure D-3). Potential slope deformation features were noted in the hillshade view of the lidar. The estimated sediment volume resulting from a 200-year debris flow, as estimated using the methodology from Jakob et al. 2020 is 9,300 to 34,200 m^3. See Section 5.0 for discussion on the wide range of volume estimate. The 200-year estimated clearwater flood discharge as estimated by AE is 10.8 m^3/s.

Geotechnical reports (Thurber, October 31, 2003; BGC December 12, 2003; BGC, March 1, 2004; Cordilleran Geoscience, September 10, 2007; BC FLNRO, 2013) have described previous geohazard assessments, geohazard events or mitigation efforts along McNab Creek.

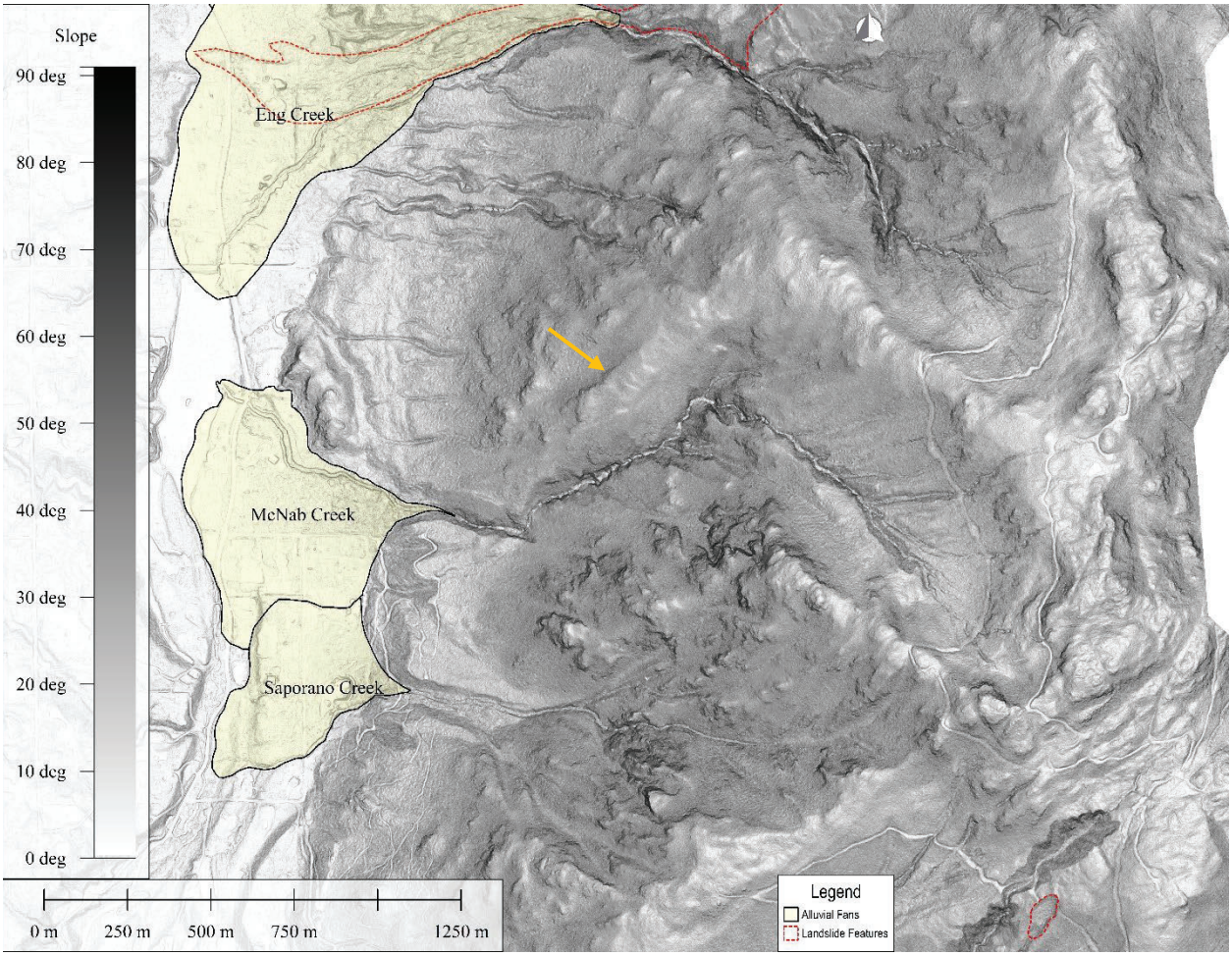

Figure D-3 Overview of the McNab and Saporano creek watersheds and fans. Note potential slope deformation feature (orange arrow) and legacy resource roads in McNab watershed.

D-4.2 Field Observations

BGC inspected the location where McNab Creek intersects Sylvester Road, and along the main channel for the upper third of the fan, stopping approximately 150 m downstream of the fan apex. Twin culverts approximately 800 – 1000 mm in diameter span under Sylvester Road into Allan Lake. Bed material at the distal edge of the fan is predominantly subangular to subrounded gravel and cobbles (Photo 5).

BGC accessed the upper third of the fan by parking at the northeast corner of Kussman Road and hiking north across the fan to reach the main channel. Numerous abandoned avulsion channels were observed along the south side of the main channel, including several boulder levees vegetated with young trees, stems ranging from 5 to 30 cm. The channel is U-shaped along the upper third of the channel, predominantly gravel and cobble bed material with many boulders present within the channel. Large woody debris within the channel were approximately equal to channel width. A large boulder deposit was observed on the south edge of the stream near the upstream extent of inspection. It is unclear whether this is a natural feature, as a

historical access road was observed extending to the southwest from this location towards Kussman Road. Downstream from this point, the channel was distinctly U-shaped, with channel gradient measured approximately 12° (Photo 6). Upstream from this boulder deposit the channel was observed to be less laterally confined with step-pool morphology, and a channel gradient further upstream of 10°-15° (Photo 7).

D-5 SAPORANO CREEK (SEDIMENT HAZARD SITE S-CR-17)

D-5.1 Desktop Characterization

Saporano Creek has a 0.95 km^2 basin area and 0.18 km^2 fan area. The dominant steep creek process is debris flow, which can mobilize a wide range of sediment sizes (clay through to cobble and boulder size particles), as well as large woody debris. Saporano Creek is supply limited, meaning takes time for sediment to recharge in the watershed in between debris flow events (see Appendix B for more details). Few (1-2) geohazard events have been recorded at Saporano Creek. A logging road extends across the upper watershed (Figure D-3). The estimated sediment volume resulting from a 200-year debris flow, as estimated using the methodology from Jakob et al. 2020 is 6,400 to 19,400 m^3. The estimated 200-year clearwater flood discharge as estimated by AE is 7.6 m^3/s.

D-5.2 Field Observations

BGC inspected the location where Saporano Creek intersects Sylvester Road at the southwest distal point of the fan, and were unable to inspect areas further upstream due to limited access from Kussman Road. Main (1800 mm) and overflow (900 mm) culverts were observed underneath Kussman Road, along Lagace Creek. Saporano Creek flows into Lagace Creek on the north side of Sylvester Road (Photo 8). Recently placed granular material extends along approximately 3 m of the embankment directly across from the outlet of Saporano Creek. Woody debris was observed rafted 40 cm high on the upstream side of trees in the channel. Bed material is predominantly coarse sand, gravel, and cobbles.

D-6 PATTISON CREEK (SEDIMENT HAZARD SITE S-CR-12, S-CR-16, S-CR-15)

D-6.1 Desktop Characterization

Pattison Creek has a 3.30 km^2 basin area and 0.32 km^2 fan area. The dominant steep creek processes are debris flow and debris flood, which can mobilize a wide range of sediment sizes (clay through to cobble and boulder size particles), as well as large woody debris. The geohazard process varies based on initiation mechanism, source location, and location on the fan. Pattison Creek is supply unlimited, meaning multiple events can occur in close succession due to the abundance of erodible sediment in the watershed (see Appendix B for more details). Several (5+) geohazard events have been recorded at Pattison Creek. This includes observations by AE (February 8, 2023) of creek bank failures and sediment pulses during in-channel work in January 2023. Part of the headwaters of the Pattison Watershed burned in 1972. Forest fires can increase the frequency of debris flows and debris floods for a period of up

to 10 years after the burn. An extensive logging road network and substantial harvesting activities in the watershed have contributed to high landslide activity in the watershed (Figure D-4). The estimated sediment volume resulting from a 200-year debris flow, as estimated using the methodology from Jakob et al. 2020 is 22,100 to 35,400 m^3. The estimated 200-year clearwater flood discharge as estimated by AE is 23.5 m^3/s.

A large mass of material is observed to be deforming in the upper watershed of Pattison Creek, covering an area of approximately 10 ha. A rapid failure of this material would likely pose a significant hazard to individuals and infrastructure located in the Pattison Creek fan, and potentially beyond.

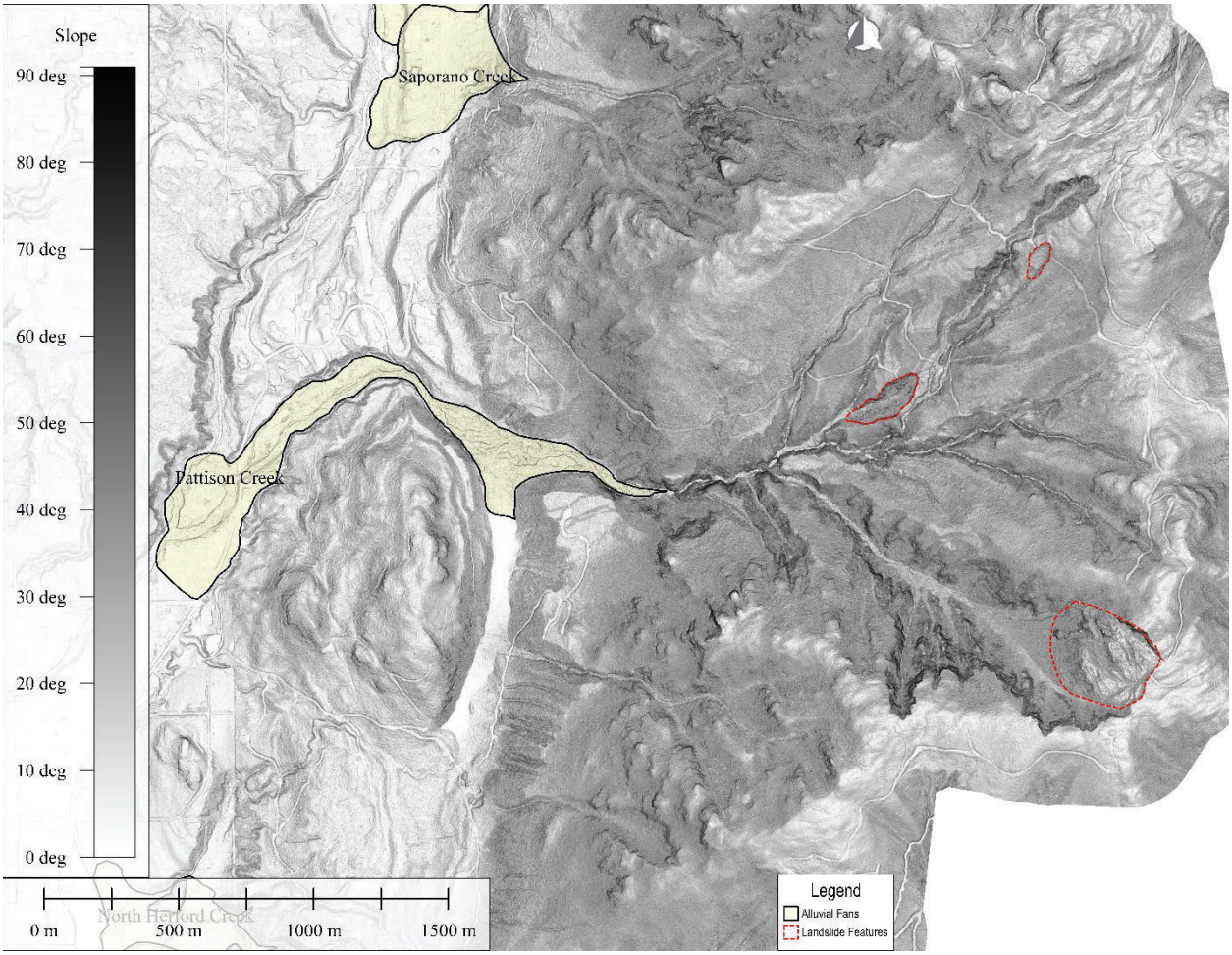

Figure D-4 Outline (short red dash) of large landslide areas in Pattison Creek. Landslide at far east side of image is the potentially unstable rock slope.

D-6.2 Field Observations

BGC inspected Pattison Creek from the bridge crossing at Sylvester Road 350 m from the distal edge of the fan, to the upper third of the fan stopping approximately 700 m below the apex of the fan and 350 m below the small unnamed lake on the south side of the watershed. In-

channel mitigation work reshaping the main channel at and downstream from the bridge was observed. In the lower half of the fan:

- Bed material observed to be a combination of silt, sand, gravel, and cobbles
- Channel has a flat channel bottom
- Few to no trees were observed growing within the channel
- Large woody debris smaller than the channel width.

From approximately 700 m to 800 m upstream of the bridge, the fan and channel are topographically constricted. From the bottom of this constriction to the upstream extent of area inspected:

- Bed material observed to be predominantly gravel and cobbles, with many boulders within channel
- U-shaped channel with multiple boulder levees and multiple flow paths
- Young (5-10 cm diameter trunk) deciduous trees observed growing within main channel
- Large woody debris greater than the channel width.

Additional features were observed along the channel, including abandoned flow paths forming small terraces beside the main channel vegetated with moss (Photo 9) and debris rafted on the upstream side of trees. These features provide a high-water constraint from the past few years (assumed to constrain peak flow during November 2021) and are summarized in Table D-1. At the upstream extend of the area inspected, a dry U-shaped avulsion channel was observed on the north side of the fan, converging with the main channel on the south side of the fan (Photo 10). Part of the main channel bed material at this location is highly fractured bedrock (Photo 11).

Table D-1 Estimated recent maximum flow depth measurements along Pattison Creek

Distance upstream from bridge (m)	Type	Maximum flow depth measurement (m)
300	Vegetated flow path	1.5
800	Woody debris rafted on upstream side of obstacle	1.6
850	Vegetated flow path	1.6

D-7 HERFORD CREEK (SEDIMENT HAZARD SITE S-CR-37 AND S-CR-34)

D-7.1 Desktop Characterization

Herford Creek has two fans; North Herford Creek has a 0.97 km^2 basin area and 0.12 km^2 fan area, South Herford Creek has a 0.83 km^2 basin area and 0.19 km^2 fan area. The dominant steep creek process is debris flows, which can mobilize a wide range of sediment sizes (clay through to cobble and boulder size particles), as well as large woody debris. Herford Creek is supply limited, meaning takes time for sediment to recharge in the watershed in between debris flow events (see Appendix B for more details). Few (1-2) geohazard events have been recorded at Herford Creek. A logging road in the upper watershed and harvest activities have been observed (Figure D-5). The estimated sediment volume resulting from a 200-year debris flow,

as estimated by Jakob et al. 2020 is 6,500 to 13,200 m^3 for North Herford and 5,600 to 21,300 m^3 for South Herford. The estimated 200-year clearwater flood discharge as estimated by AE is 6.8 and 6.4 m^3/s for North and South Herford Creek respectively.

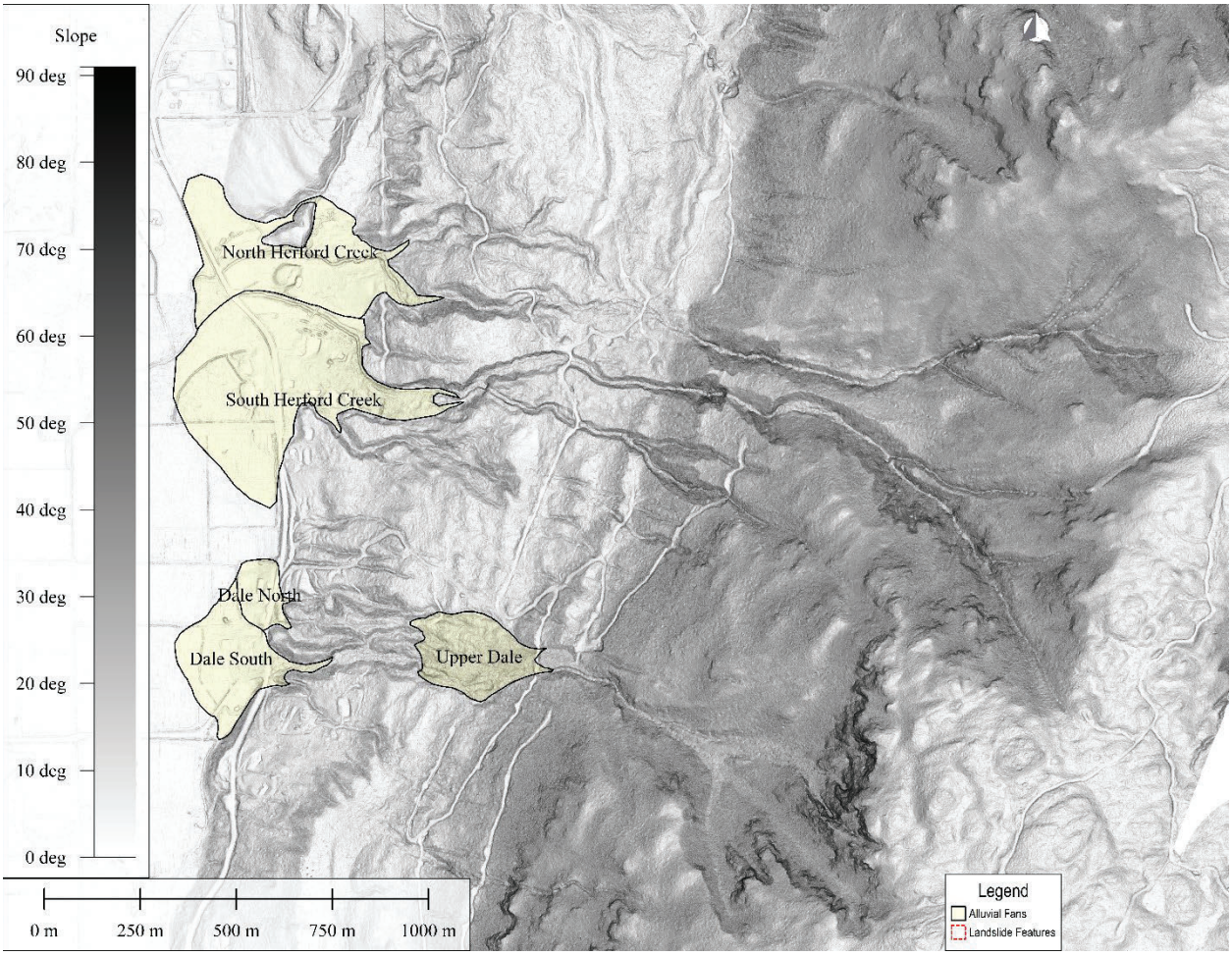

Figure D-5 Overview of the Herford and Dale creek watersheds and fans.

D-7.2 Field Observations

The distal portion of the North Herford Creek fan and the central portion of the South Herford Creek fan were inspected by BGC along Sylvester Road. Access to areas away from Sylvester Road were not possible due to private property. Two creeks were observed crossing Sylvester Road along North Herford fan, and three crossings observed along South Herford fan. Observations at each location, ordered from north to south, are outlined in Table D-2.

Table D-2. Observations along Herford Creek fans and Sylvester Road

Location ID	Fan	Culvert Notes	Bed Material	Comments
1	North Herford	-	-	Interpreted to be an agricultural channel. Highly vegetated/overgrown, unable to observe closely.
2	North Herford	Bowed culvert, approx. 1200 mm, 1/2 full of sediment	Sand, gravel, subangular to subrounded cobbles.	Interpreted to be the main channel.
3	South Herford	800 mm, 2/3 full of sediment	Sand, gravel, subangular to subrounded cobbles.	Interpreted to be the main channel. Ponded water observed on downstream side of culvert.
4	South Herford	600 mm	Sand, gravel, some cobbles.	-
5	South Herford	600 mm, hanging culvert outlet	Sand and gravel.	Property owner installed culvert 2 m upstream of Sylvester Road culvert

At location 2 (main channel of North Herford), evidence of channel capacity restoration work was observed downstream of Sylvester Road (Photo 12). Creeks from locations 1 and 3 converge at this location. At location 3 (main channel of South Herford, Photo 13), a homeowner from an adjacent property stated that the main channel of South Herford had been rerouted further north to flow around a property at some time in the past.

D-8 DALE CREEK (SEDIMENT HAZARD SITE S-CR-14)

D-8.1 Desktop Characterization

Due to a topographic bench in the lower watershed at Dale Creek, Dale Creek has three fans. Upper Dale Creek has a 0.71 km^2 basin area and 0.05 km^2 fan area. North and South Dale Creeks, which are approximately 300 m downstream of the distal edge of the upper fan, have a 1.17 km^2 basin area and 0.02 km^2 and 0.06 km^2 fan area, respectively. The dominant steep creek process for Upper Dale Creek is debris flows, which can mobilize a wide range of sediment sizes (clay through to cobble and boulder size particles), as well as large woody debris. The dominant steep creek processes for North and South Dale Creeks are debris flow and debris flood, which can mobilize a wide range of sediment sizes (clay through to cobble and boulder size particles). The geohazard process varies based on initiation mechanism, source location, and location on the fan. Dale Creek is supply limited, meaning takes time for sediment to recharge in the watershed in between debris flow events (see Appendix B for more details).

Some (2-5) geohazard events have been recorded at Dale Creek. A logging road and harvest activities in the lower watershed have been observed (Figure D-5). The estimated sediment volume resulting from a 200-year debris flow, as estimated by Jakob et al. 2020 is 4,800 to 5,800 m^3 for Upper Dale Creek Fan and 7,900 to 8,900 m^3 for the North and South Dale Creek Fan. The estimated 200-year clearwater flood discharge as estimated by AE is 7.3 m^3/s for the combined North and South Dale Creek.

D-8.2 Field Observations

Upper Dale fan was not visited in the field. The upper portions of North and South Dale Creek fans were inspected along Sylvester Road. A 400 mm diameter culvert under Sylvester Road at North Dale Creek had limited flow observed and was overgrown with vegetation (Photo 14). No sediment or bed material was observed. South Dale Creek fan had two active channels upstream of Sylvester Road, separated by a potential debris flow levee (Photo 15). Bed material was subangular gravel and cobbles. Flow from both active channels, and from the road ditch to the south, converge and flow under Sylvester Road through a 1400 mm smooth culvert. The first approximately 10 m of the channel downstream from Sylvester Road is lined with concrete, before diverting to the south.

D-9 DAVIES CREEK (SEDIMENT HAZARD SITE S-CR-18)

D-9.1 Desktop Characterization

Davies Creek has a 0.45 km^2 basin area and 0.03 km^2 fan area. The dominant steep creek process is debris flow, which can mobilize a wide range of sediment sizes (clay through to cobble and boulder size particles), as well as large woody debris. Davies Creek is supply limited, meaning takes time for sediment to recharge in the watershed in between debris flow events (see Appendix B for more details). Few (1-2) geohazard events have been recorded at Davies Creek. A logging road network and harvesting activities in the watershed have been observed (Figure D-6). The estimated sediment volume resulting from a 200-year debris flow, as estimated by Jakob et al. 2020 is 2,800 to 3,200 m^3. The estimated 200-year clearwater flood discharge as estimated by AE is 3.8 m^3/s.

Following the November 2021 atmospheric rivers, Sterling Geoscience Ltd. (2021) noted the presence of a long and debris jam approximately 100 m upstream of from the road.

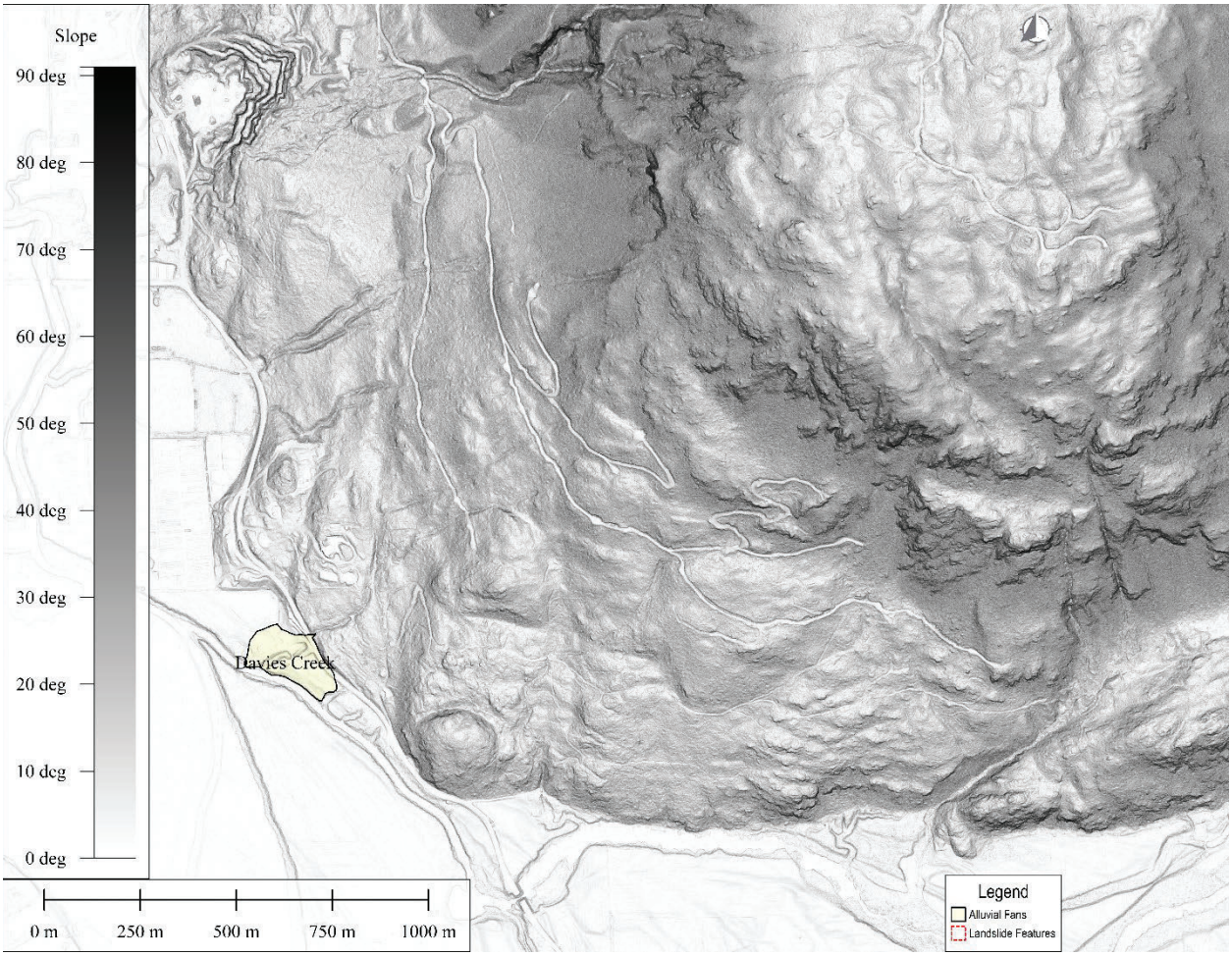

Figure D-6 Overview of the Davies watershed and fan.

D-9.2 Field Observations

BGC inspected Davies Creek from near the fan apex where it intersects Sylvester Road to approximately 100 m upstream. A 1000 mm diameter culvert extends underneath Sylvester Road. The road embankment approximately 30 m south of the fan apex appears to have been recently repaired, and may be a damage location resulting from overland flow following culver blockage. Bed material is observed to be predominantly bedrock (Photo 16). Sediment in the channel is predominantly coarse sand and gravel with angular cobbles, and boulders along the sides of the channel banks. Woody debris was rafted on the upstream side of trees in the channel near the fan apex, indicating a high water mark 1.3 m above the current channel bottom. The channel gradient between the fan apex and the upstream extent (80 m from road) of the inspection is 7.6°.

APPENDIX D – DESIGN BASIS MEMO

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DESIGN BASIS MEMO (REVISED)

Issue Date:	June 9, 2023	Reference/Project No.:	2022-2632-00
To:	Thyren Garde-Jacobs, Flood Debris Management Secretariat, Environmental Protection Division	Previous Issue Date:	April 14, 2023
From:	Andromeda MacIsaac, EIT and Andrew Wiens, P.Eng.		
Client:	BC Ministry of Environment and Climate Change Strategy (ENV)		
Project Name:	Hatzic Emergency Works Program		
Subject:	Design Basis Memo (Revised)		

1 INTRODUCTION

The BC Ministry of Environment and Climate Change Strategy (ENV) has retained Associated Engineering (B.C.) Ltd. (Associated) to mitigate erosion and flooding risks at sites in the Hatzic Valley area east of Mission, BC, that were damaged or disturbed during the November 2021 Atmospheric River Event (ARE). The project objective is to protect the sites from further erosion and bank retreat, which may cause additional damage to riverbeds, banks, and infrastructure and pose a significant threat to the safety of people, properties, infrastructure, and the environment.

This design basis memo summarizes the design standards which will govern the anticipated works under the Hatzic program. All design is governed by the following project directives:

- Work is focused specifically on repairing the damages and disturbances caused by the ARE, not implementing a redesign of the existing hydraulic system.
- Pre-existing infrastructure identified as undersized will be flagged and documented. Replacement of these structures is beyond the project scope.
- This project will not fund the replacement of private hydraulic infrastructure such as driveway culverts.

2 DESIGN WORKS CRITERIA, STANDARDS, GUIDELINES AND ASSUMPTIONS

This section summarizes the primary design criteria, standards, guidelines and assumptions for all anticipated works.

Works are grouped as follows:

- Recovery of Hydraulic System Conveyance
  - Channel modification to improve hydraulic capacity (widening, realignment)
  - Sediment removal
  - Debris removal
  - Retention/placement of Large Woody Debris (LWD) as provision of habitat
- Erosion Protection Measures
  - Riprap
  - Engineered products
  - Bio-engineered solutions
- Flood Protection Infrastructure
  - Dike repair (requires Ministry of Environment (ENV) input)

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- Sediment and/or Debris Collection Measures
  - Sediment and/or debris traps
  - Sediment basins

2.1 Recovery of Hydraulic System Conveyance

Recovery of hydraulic system conveyance includes channel modification to improve hydraulic capacity (widening, realignment), sediment removal, debris removal and retention/placement of LWD. Limited information exists on the actual creek channel dimensions and channel capacities prior to the ARE. As a result, professional judgment will be used to estimate the pre-event condition.

We have assumed that the creeks had the conveyance capacity necessary to convey 1 in 10-year peak instantaneous flows prior to the ARE. However, each site will require a site-specific review to determine what is practical/reasonable for that specific creek reach. Final conveyance capacity will be determined by site-specific constraints, hydraulic gradient and practical engineering experience.

Some provision of habitat will be included in the hydraulic system design. Our internal environmental staff will complete high-level habitat assessment and provide input for the incorporation of LWD within the channel reaches. As with the other aspects of design, LWD design will have to consider what is practical/reasonable for the specific creek reach. The final design will be determined by site-specific constraints and practical environmental and engineering experience.

2.2 Hydraulic Analysis

Hydraulic analysis for each site will be completed in the United States Army Corps of Engineers (USACE) HEC-RAS software (version 6.2). The 1 in 10-year peak instantaneous flow with climate change will be used as the design flow and act as an upstream model boundary condition. Downstream boundary conditions for all Stage 1 sites are assumed to be unrestricted normal flow and should be set to the channel frictional slope.

Downstream boundary conditions for Stage 2 sites are to be determined using the Hatzic Valley Hydraulic Model and will be included in a future update to this document.

2.3 Design Standards and Guidelines

Specific design standards are summarized in Table 2-1.

Table 2-1 Design Standards for Recovery of Hydraulic System Conveyance Works

Works	Design Standard	Key Criteria
Channel Modifications	Best practice /Design assumption (based on site-specific information and practical constraints)	Channel hydraulics and conveyance designed for 1 in 10-year event, with climate change, with site adaptation acceptable. No freeboard to be included.
Sediment Removal	To be completed to same standards as channel modifications.	To be completed to same standards as channel modifications.
Debris Removal	To be completed to same standards as channel modifications.	To be completed to same standards as channel modifications. Note: LWD removal and treatment to be considered separately.
LWD Placement	Best practice / Reconnaissance Level 1:20,000 Fish and Fish Habitat Inventory Version 2 (Resource Information Standards Committee, 2001)	Percent LWD cover in the stream reach of interest, with site adaptation acceptable.

Further general guidance is provided in the following documents:

- Investigations in Support of Flood Strategy Development in BC (Fraser Basin Council, 2021).
- *BC Supplement to TAC Geometric Design Guide* (Ministry of Transportation and Infrastructure, 2019).

2.4 Permitting / Approvals

All stream works will require Section 11 approval under the British Columbia *Water Sustainability Act* and approval by Fisheries and Oceans Canada (DFO). Further permitting requirements are to be determined.

2.5 Erosion Protection Measures

Erosion protection works include the installation of riprap, engineered products and bio-engineered solutions. All erosion protection works will be designed for a 1 in 200-year event, including a climate change factor.

Hydraulic Analysis: Design velocities and other hydraulic design characteristics for each site will be completed in the USACE HEC-RAS software (version 6.2). The 1 in 200-year peak instantaneous flow with climate change will be used to determine design velocities and will act as an upstream boundary condition. Downstream boundary conditions for all Stage 1 sites are assumed to be unrestricted normal flow and should be set to the channel frictional slope.

Downstream boundary conditions for Stage 2 sites are to be determined and will be in a future update to this document.

2.6 Design Standards and Guidelines

Specific design standards are summarized in Table 2-2.

Table 2-2 Design Standards for Erosion Protection Works

Works	Design Standard	Key Criteria
Riprap	Riprap Design and Construction Guide (Ministry of Environment, Lands and Parks, March 2000)	• Design to 1 in 200-year event • Riprap thickness normal to the slope should meet the following criteria: Not less than 350 mm Not less than 1.5 x D50; and Not less than a D100 • Bank slope and vertical extent of protection: Design slope should not be steeper than 1V:2H Further limits on the side slope steepness may be imposed by slope stability, groundwater flows, or rapid water level recession and piping failure.
	Guide to Bridge Hydraulics, 2nd Edition (Transportation Association of Canada, 2004) / (USACE 1991, Plate B-33)	• Use this source for riprap sizing. • Follow procedure in Section 5.4.1 Rock Sizing. Use the Corps of Engineers relationship (USACE 1991, Plate B-33). • Riprap should be designed for the combination of velocity and depth that gives the largest rock size.
	Riprap Installation Guide (Ministry of Transportation and Infrastructure, September 2013)	• Follow specifications within the sheet.

Works	Design Standard	Key Criteria
Engineered Products	Manufacturer's recommendations and engineering best management practices.	• Design to 1 in 200-year event
Bio-engineered Solutions	To be determined. Information to be provided by in-house environmental staff.	To be determined.

Further general guidance is provided in the following documents:

- *BC Supplement to TAC Geometric Design Guide* (Ministry of Transportation and Infrastructure, 2019)

2.7 Permitting / Approvals

All stream works will require Section 11 approval under the British Columbia *Water Sustainability Act* and approval by Fisheries and Oceans Canada (DFO). Further permitting requirements are to be determined.

2.8 Flood Protection Infrastructure

Flood protection infrastructure works are limited to the repair of existing flood protection dikes damaged during the ARE. Existing flood protection dikes are identified on the British Columbia Lower Mainland Dike Inventory Maps, specifically:

- Lower Mainland Dike Inventory Map No. 24 - Dewdney Area Improvement District / Norrish Creek
- Lower Mainland Dike Inventory Map No. 25 – Fraser Valley Regional District Cascade-Carratt Creek Specified Area

Any repair work will be completed to provincial dike standards using the 1 in 200-year return period design event with climate change. Any dike elements requiring repair should be identified as early as possible during the concept design phase, as construction strategy and site-specific design limitations will require input from three separate regulatory bodies (see Permitting / Approvals below). Also, ENV will need to provide direction with respect to funding considerations as well as confirm the dike ownership for long-term operation and maintenance activities.

Hydraulic Analysis: Hydraulic analysis for each site will be completed in the USACE HEC-RAS software (version 6.2). The 1 in 200-year peak instantaneous design flow with climate change will also act as an upstream boundary condition. Downstream boundary conditions for all Stage 1 sites are assumed to be unrestricted normal flow and should be set to the channel frictional slope. Downstream boundary conditions for Stage 2 sites are to be determined and will be in a future update to this document.

Design Standards and Guidelines

Specific design standards are summarized in Table 2-3.

Table 2-3 Design Standards for Flood Protection Infrastructure

Works	Design Standard	Key Criteria
Dike	Dike Design and Construction Guide – Best Management Practices for British Columbia (Ministry of Water, Land and Air Protection, July 2003) Environmental Guidelines for Vegetation Management on Flood Protection Works to Protect Safety and the Environment (Ministry of Environment, Lands and Parks, March 1999)	• Grassed dike slopes no steeper than 2.5H:1V to facilitate mowing. • Top of the berm of dyke to be designed to 200-year level plus minimum 0.6 m for freeboard , with top width of 4.0 m. • Radius of curvature should not be less than 15 m. • Dike crossing under an overhead power line minimum clearance of 5.5 m to be provided for lowest cable. • Access roads to the dikes are required. • Refer to document on details regarding turnouts and turnarounds Review this value in areas with high sediment inputs. • Dike crests shall be kept clear of vegetation other than trimmed grass, and accessible with due regard for inspection sight lines. • Dike side slopes: • The landside side slope of dike fills shall be kept clear of vegetation other than trimmed grass, including a minimum 3 m strip beyond the landside toe. (Increases in the landside strip may be considered where necessary, consistent with the minimum needs for efficient operation of mowing equipment. • The waterside side slope of riverside and setback dike fills shall be kept clear of vegetation other than trimmed grass to the toe of the dike fill as determined by the dike height. Large vegetation (greater than 300 mm diameter trunk/stem) shall be removed from an additional 2 m strip measured horizontally. Consideration may be given to increasing the riverside strip consistent with minimum needs for efficient operation of mowing equipment.)

Works	Design Standard	Key Criteria
	Hydrologic and Hydraulic Design Report Submitted in Support of Dike Maintenance Act Approvals (2008)	• A freeboard allowance is applied to the flood profile to determine the construction of the crest elevation of the flood protection works. Freeboard may be different for local conditions, however, the province historically has applied the following minimum freeboard allowance for open water conditions: The higher of: • Freeboard: 600 mm vertical allowance above the calculated 1 in 200-year peak mean daily profile, which normally applies to large river systems or 300 mm vertical allowance above the calculated 1 in 200-year peak instantaneous flow profile. Where the channel is potentially subject to sediment aggradation and/or debris jamming, additional freeboard may be required.

Further general guidance is provided in the following document(s):

- Investigations in Support of Flood Strategy Development in BC (Fraser Basin Council, 2021)

2. Permitting / Approvals

Any dike elements requiring repair should be identified as early as possible during the concept design phase, as construction strategy and site-specific design limitations will require input from three separate regulatory bodies. Also, ENV will need to provide direction with respect to funding considerations as well as confirm the dike ownership for long-term operation and maintenance activities. Construction of, or maintenance of, dike structures requires a Dike Maintenance Act Authorization. All stream works will require Section 11 approval under the British Columbia *Water Sustainability Act* and approval by Fisheries and Oceans Canada (DFO).

2.10 Sediment and/or Debris Collection Measures (Site-Dependent)

Sediment and/or debris collection works include sediment and/or debris traps, sediment basins and debris fencing/netting. Project scope does not include mitigation measures for debris flows, debris floods and other geohazard events which impact much of the Hatzic area. Hatzic area geohazard challenges and available sediment material transport information are summarized in the Preliminary Steep Creek Hazard Assessment prepared by our sub-consultant geohazard specialists at BGC Engineering Inc (BGC). There is limited information on the volume and frequency of sediment yield throughout the Hatzic Creek systems.

Sediment management provisions are limited to addressing sediment transportation processes associated with hydrologic flood events, not geohazard mechanisms. Each site will require a site-specific review to determine what is practical/reasonable for that creek reach. Final sediment collection capacity will be determined by site-specific constraints, hydraulic gradient and practical engineering experience. Site-specific sediment collection works design parameters, and approaches must be overseen by Andrew Wiens. The design will be developed in coordination with BGC and requires ENV input and final approval. Following the initial concept design, local rights holders and stakeholders will be engaged; this is expected to be an iterative process.

Further details will be included in a future update of this document.

3 DESIGN FLOW SUMMARY

All design flows for Hatzic works, and hydraulic analyses will be provided by our hydrology team and the unified Hatzic Emergency Works hydrologic model.

3.1 Hydrologic Modelling Analysis

The unified Hatzic Emergency Works hydrologic model was developed using USACE HEC-HMS software (version 4.10). Watershed characteristics were determined using 2022 LiDAR, 2022 aerial photography and provincial surficial soil mapping and reports accessed through iMapBC provincial. All parameters were set using this information and the standard parameter ranges specified by the USACE Hydrologic Engineering Center. As part of calibration, parameters were adjusted within these standard ranges to match available hydrometric flow gauging data collected by Fraser Valley Regional District (FVRD) during the ARE.

Upstream boundary conditions for the hydrologic model are set to the applicable design storm events to determine flows for each return period. Flow at the downstream boundary condition is unrestricted.

Stage 2 sites, which include the Hatzic Valley lowlands and extensive agricultural lands, may also include the Agricultural and Rural Development Subsidiary Agreement (ARDSA) regional drainage criteria and corresponding 1 in 10-year, 5-day duration winter design storm and 1 in 10-year, 2-day duration summer design storm. The final inclusion of these design storms is to be determined. Stage 2 design flow criteria will be included in a future update to this document.

3.2 Storm Design Events

The Hatzic Emergency Works hydrologic model was run for a suite of different design storm scenarios, which address the different hydrologic regimes present at different times during the year. The scenario with the highest instantaneous peak flow for a given return period was used as the design flow for that return period.

All design storms were developed using hourly precipitation or existing intensity-duration-frequency (IDF) curves from the Environment Canada and Climate Change (ECCC) climate station Mission West Abbey (Station No. 1105192), located 1.75 km from the Hatzic watershed. Average monthly snowpack values were taken from the ECCC manual snow survey station Dickson Lake (Station No. 1D16), located 9.78 km from the high-elevation mountain range on the eastern boundary of the watershed.

Specific hydrologic scenarios are summarised below.

3.3 Winter Design Scenario

This event captures the winter hydrologic regime extending from October through February. We modelled the most conservative scenario for a winter rain-on-snow event, a rain event on the highest winter snowpack (February). Two 24-hour duration storm events were modelled:

- 1 in 10-year 24-hour duration event
- 1 in 200-year 24-hour duration event

3.4 Spring Design Scenario

This event captures the spring freshet hydrologic regime within the Hatzic watershed extending from March through the end of May. We modelled the most conservative scenario for this freshet, a rain event on the highest spring snowpack (May).

Two 24-hour duration storm events were modelled:

- 1 in 10-year 24-hour duration event
- 1 in 200-year 24-hour duration event

3.5 Incorporation of Climate Change

All project design and analysis uses a climate change time horizon of 2100. Our analysis incorporated climate change impacts on average ambient temperature, precipitation and maximum snowmelt rates.

An increase of 51% from historic/IDF precipitation values has been included in all design storm events to compensate for precipitation changes due to climate change. We have chosen the average values, from a range of 31% to 81%, for our site-specific analysis based on the CSA Group protocols recommended by Environment and Climate Change Canada and the Pacific Climate Impacts Consortium.

This climate change increase value exceeds the minimum design requirement recommended for BC flood assessments by Engineers and Geoscientists BC (EGBC). We note that industry-standard engineering design and the design used for this project now exceed the recommendations of the EGBC document as a result of improved climate change projection information and processes. Our analysis is in alignment with the more recent climate change design guidance by EGBC, included in *Developing Climate Change-Resilient Designs for Highway Infrastructure in British Columbia v.2.*

3.6 Design Standards and Guidelines

The preceding design criteria are based on the following three documents:

- Legislated Flood Assessments in a Changing Climate in BC (Engineers and Geoscientists BC, 2018).
- Developing Climate Change-Resilient Designs for Highway Infrastructure in British Columbia Version 2.0 (EGBC, 2020).
- Plan2Adapt Tool (Pacific Climate Impacts Consortium).
- Technical Guide: Development, interpretation, and use of rainfall intensity-duration-frequency (IDF) information: Guideline for Canadian water resources practitioners CSA PLUS 4013:19 (CSA Group, 2019).

4 CLOSURE

This design basis memo is a draft of a living document. It is anticipated that the standards and guidelines within this document will be infilled and updated as the project progresses. At this time, the design basis memo addresses only Stage 1 site works; further information will be required to address the more complex design criteria for Stage 2.

APPENDIX E – FISH HABITAT DESIGN RECOMMENDATIONS

TECHNICAL MEMORANDUM

Issue Date:	June 15, 2023	**File:**	
To:	**Ryan Karsgaard, Design Lead (Sites 15 and 16)**	**Previous Issue Date:**	
From:	Mark Tiley, R.P.Bio.		
Client:	Ministry of Environment and Climate Change Strategy		
Project Name:	Hatzic Emergency Works Program	**Project No.:**	2022-2632-04
Subject:	Lagace Creek Fish Habitat Design Recommendations		

1 INTRODUCTION

The following technical memorandum provides a brief summary of fish habitat design recommendations for Legace Creek Site 15 (Farms Road Bridge to the Seux Road Bridge) and Site 16 (Seux Road Bridge to the Legace Creek/Pattison Creek Confluence) as a component of the Hatzic Emergency Works Program. These recommendations emphasize the installation of fish habitat structures intended to create channel bed scour that will result in the formation of pool and riffle habitats, capture spawning gravels, dissipate stream energy during high flow events which should reduce bank erosion, capture naturally mobilized pieces of woody debris, and provide cover for fish. In the interest of public safety, single-log structures are generally recommended for fish habitat designs intended for pool creation and spawning gravel retention over complex multi-log structures. Several locations where single-log structures should be sufficient for creating pool and riffle habitat and still withstand at least 1-in-50-year flood events, if installed properly, were observed. Two-log habitat structures may be required in some locations to withstand flood events, particularly in higher channel gradient sections observed in Site 16.

2 RECOMMENDED FISH HABITAT TYPES FOR CONCEPTUAL DESIGN

Priority given to creating pool ("pond") habitat with deflector logs and boulder clusters (see section 3 below) is recommended. Pool habitat provides the following:

- Staging habitat for migrating adult salmon;
- Rearing and overwintering habitat for native species such as juvenile Coho, and all stages of Steelhead (holding adults and juveniles), and all life stages of resident Rainbow and Cutthroat; and
- Pool tail-outs (the downstream portion of pools that transition into riffles) providing excellent, sometimes preferred, spawning habitat for the salmonid species that occur in Legace Creek (Coho, Sockeye, Steelhead trout, Rainbow trout, Cutthroat trout).

The retainment of side channel habitat wherever possible is recommended as juvenile salmonids extensively utilize these habitats. Achieving this would require leaving one or more mid-channel islands intact. Additional potential benefit of leaving the vegetated mid-channel islands intact are:

- The capture of cobbles and boulders. No cobbles or boulders were observed in Site 15 downstream of the mid-channel islands and within visual distance downstream of the Farms Rd bridge, whereas a large amount of cobbles were captured by the mid-channel island vegetation and side channels from upstream of the Farms Rd stream crossing to the upstream-most mid-channel island located within Site 15.
- The retention of riparian vegetation which imparts shade, terrestrial insect drop (food sources for fish), leaf litter and small woody debris which provides food, nutrients and cover.

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- The option of providing Large Woody Debris (LWD) structures spanning from the main channel bank to an opposite side channel bank.
    - Structures that can be incorporated into two opposite banks should have a greater probability of withstanding future floods and high-water events.
- The size of boulders and LWD pieces required to create pool/riffle habitat should be less than for structures that are installed within a single bank of a larger main channel, which may provide a cost savings, especially if sufficiently sized boulders and LWD pieces can be found on site.
- Leaving some mid-channel islands, or removing sections of mid-channel islands, may provide sufficient conveyance to minimize local flood risk while maintaining side channel habitat and opportunities for the installation of partially buried channel-spanning LWD pieces that create habitat value and boulder clusters that span channel widths.
- Retaining some or all of the mid-channel island habitat should also reduce costs associated with Alder and Willow tree/shrub removal and sediment removal.

It is recommended to determine (1) whether the removal of the mid-channel islands would significantly reduce the risk of flooding to property and infrastructure located upstream , adjacent to and immediately downstream of the mid-channel Islands before deciding to remove them, and (2) the rate at which the mid-channel islands would be expected to re-form, given Site 15 is a low-gradient depositional area.

3 DESIGN DETAIL

Typical examples of LWD structure designs are provided in Figure 1 from White *et al*., (1997) and Figure 2 (from Gadbury, 2003) below. Pools would be expected to form immediately downstream of the LWD structures, with riffles potentially forming at the downstream end of the pools. A hydrologist will need to determine the correct size of boulder anchors to withstand high-flow flood events.

Figure 1. A single log deflector design for pool and spawning habitat creation. From Whyte et al., 1997. Note the log is embedded in the substrate to capture spawning gravels.

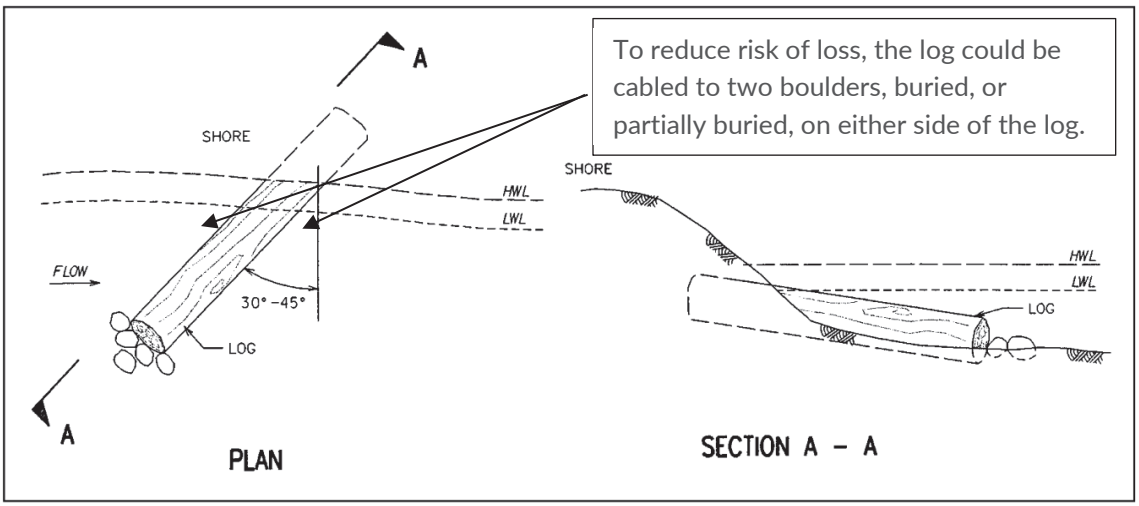
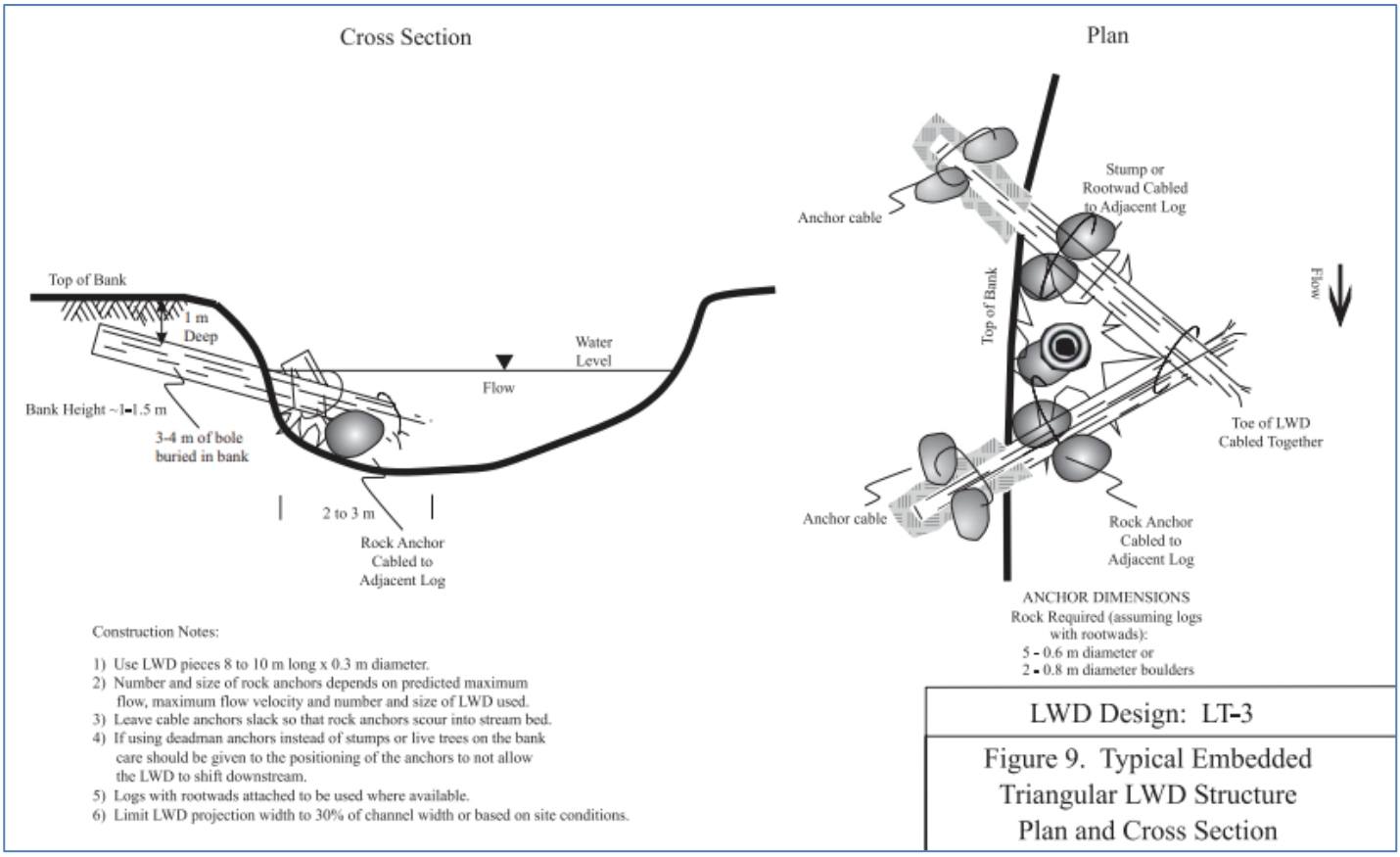


Figure 2. LWD structure example 2, which utilizes two pieces of LWD crossed and cabled together at the toes, would be expected to have a greater probability of withstanding high-flow flood events as compared to single-log LWD structures. From Gadbury (2003).



Logs and root wads used for fish habitat structures should be from rot-resistant tree species, ideally cedar or fir, to maximize the longevity of the structures. The diameters of logs and root wads should be ≥ 300 mm. Very few suitable pieces of LWD suitable for use as fish habitat structures were observed during the April 06, 2023, Site 15 stream survey. LWD structures should be designed, at minimum, to withstand at minimum a 50-year flood event (Cederholm *et al*., 1997).

3.1 Pools

In general, more smaller pools provide more habitat overall that fewer, larger pools. Out of nine observed pools in Site 15, five were measured during the April 06 habitat assessment. The observed pools, formed from scour created by clumps of small alder located within bankfull, were generally very small, averaging 10.7m in length, 4.15m in width, and 41.0 m^2 in area. If naturally occurring pieces of LWD from mature conifers were present, scour pools would be substantially larger. If it is decided to create larger pools, large LWD pieces may have to be delivered from an off-site source and cabled to large boulders to withstand flood events. Sufficiently large boulders may also have to brought to

site. To maintain pool habitat, scour caused by upstream LWD or boulders must occur, otherwise excavated pools will in-fill.

Placing instream cover (e.g., woody debris removed during sediment removal and access routes, cobbles and boulders) along pool margins, and in the deepest parts of the pool, largely avoiding pool tail-out spawning areas, is recommended to reduce predation and provide high water velocity refugia. The construction of "spawning platforms" between pools as depicted in NHC (2001) does not indicate either LWD or large boulders partially embedded at the downstream end of the platform to retain placed gravels and capture and retain naturally deposited new gravels.

3.2 Side Channels

Options to create / restore side channel habitat include installing full-span log structures to create scour pools downstream and capture/retain spawning gravels upstream. An upstream "log curtain" could be constructed with locally available logs to prevent excessive buildup of debris at the upstream end and within side channels (Figure 3). It is recommended that cover in the form of cobbles and/or small boulder clusters, LWD and/or small woody debris (SWD), be added to existing side channels that currently lack cover, or that will lack cover after sediment removal.

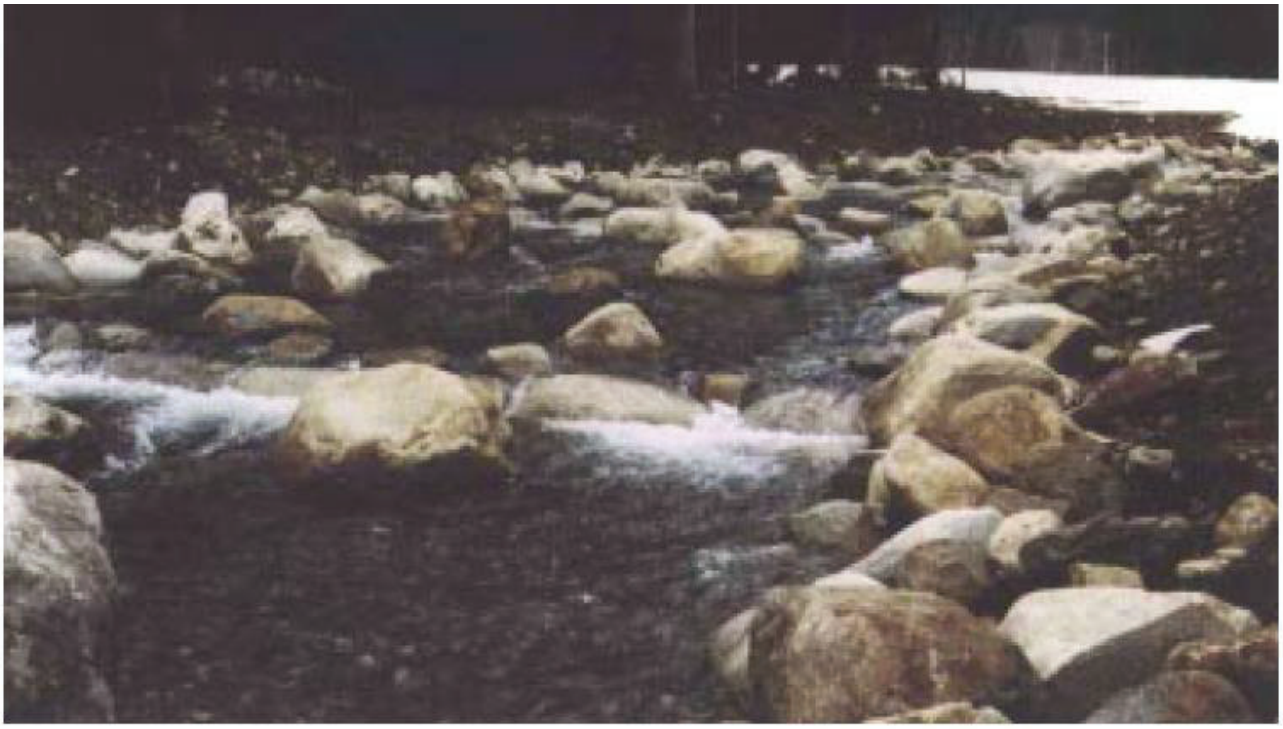
Figure 3. Log curtain installed to prevent build-up of debris at the upstream and within side channels. From Lister and Finnigan, 1997.



3.3 General Habitat Complexing and Pool Formation

Some of the extensive number of boulders and cobbles deposited by the atmospheric river flood event could be clustered or placed to create cover and high current velocity refugia as illustrated in Figure 4.

Figure 4. Boulders installed in a riffle area as habitat complexing, providing velocity refugia and retain spawning gravels. From Lister and Finnigan, 1997.



Additional design details for creating pool and spawning habitat are illustrated in Figures 5 and 6.

Figure 5. Surface water side channel design for spawning and rearing. From Lister and Finnigan (1997). Boulders spanning channel creates scour which forms and maintains pools.

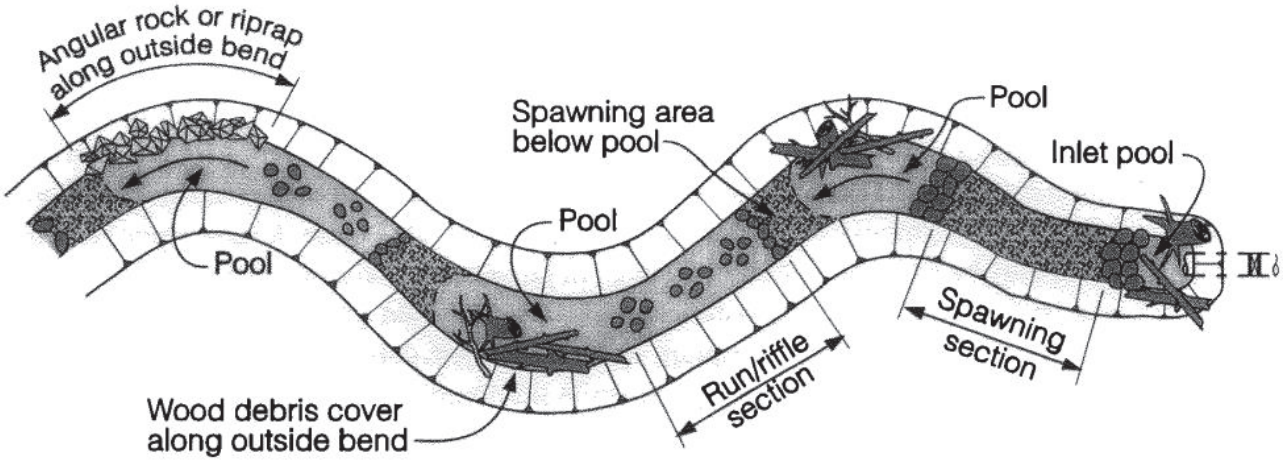


Figure 6. Log weirs spanning the channel width in series. Such a low-cost technique could be deployed within selected Site 15 side channels and narrow sections of mainstem. From Roni et al., 2005.



If LWD structures are utilized, their intended purpose and anticipated benefit to fish habitat, and protection against bank erosion and therefore loss of land, should be communicated to local landowners to help prevent any habitat works from being removed or altered by members of the local community.

Due to a relatively high public presence in the Hatzic area, public safety in terms of drowning risk for the Hatzic Emergency Works Program should be considered in the types and placement of structures. Simple structures such as partially buried single log weirs and single log defectors or debris catchers should pose lesser risk to the public than elevated complex log structures.

4 CLOSURE

We trust that the information in this memo is sufficient for your present needs. Should you have questions, please do not hesitate to contact the undersigned.

Prepared by:

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Reviewed by:

Naomi Sands, R.P.Bio.
Environmental Scientist

5 LITERATURE CITED

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APPENDIX F – BIOENGINEERING DESIGN RECOMMENDATIONS

Associated Environmental

TECHNICAL MEMORANDUM

Issue Date:	May 4, 2025	**Reference/Project No.:**	2022-2632-030
To:	Design Team	**Previous Issue Date:**	
From:	Carrie Nadeau, R.P.Bio., CERP, Ryan Karsgaard, P.Eng.		
Client:	Government of British Columbia		
Project Name:	Hatzic Emergency Works Program		
Subject:	Site S-CR-14 Bioengineering Design Considerations		

1 INTRODUCTION

The BC Ministry of Environment and Climate Change Strategy (ENV) has retained Associated Engineering (B.C.) Ltd. (Associated) to mitigate erosion and flooding risks at sites in the Hatzic Valley area east of Mission, B.C., that were damaged or disturbed during the November 2021 Atmospheric River Event (ARE). The project objective is to restore the sites to their pre-event condition by removing sediment and restoring channel banks based on current codes and standards in Section 4.

This site-specific soil bioengineering design considerations memo summarizes the following:

- Site location and conditions;
- Design methods;
- Design considerations and constraints; and
- Design prescription.

2 SITE LOCATION AND CONDITIONS

Site ID: S-CR-14
Location: 49.198500, -122.251100
Site Description: Lagace Creek from the confluence with Herford Creek to the Farms Road Bridge
Local Government Agency: Fraser Valley Regional District (FVRD)
Waterbody: Lagace Creek

Site conditions summarized in the 2022 Initial Site Assessment were verified during a site visit in 2023, completed by Associated. Significant debris deposition along Lagace Creek in the project area limited the flow capacity of the creek. Tree blockages were also observed along Lagace Creek, which allowed for further debris accumulation in the flow path. High flow velocity in portions of the creek contributed to localized bank instability and erosion.

3 SOIL BIOENGINEERING DESIGN METHODS

After the 2023 site visit, Associated identified that soil bioengineering could be used as one of the viable solutions to treat bank instability and erosion in four potential locations within S-CR-14. To evaluate if soil bioengineering could be an effective treatment, the following was completed:

- A baseline and background review, which included:
  - Review of previous reports, including risk assessments;
  - iMapBC background records search;

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- Biogeoclimatic zone, terrestrial ecosystems, and climatic conditions review;
- Review and analysis of observed flooding impacts in the watershed, including upstream and downstream of S-CR-14

- Field visit
  - The field visit was completed on March 5, 2024, by Sam Grenier, B.I.T. and Ryan Karsgaard, P.Eng. S-CR-14 was evaluated and traversed on foot.
  - Data collected and observations included:
    - Photo documentation;
    - Channel bank erosion and stability assessment;
    - Channel bank height, length and slope;
    - Channel bank substrates;
    - Vegetation cover;
    - Vegetation species (including non-native and invasive); and
    - Drilling test holes in the banks to assess planting feasibility.

4 DESIGN CONSIDERATIONS AND CONSTRAINTS

Design considerations and constraints were discussed between Ryan Karsgaard, P.Eng. and Carrie Nadeau, R.P.Bio., CERP, and they are summarized in **Table 4-1**. Four sites were identified requiring remediation, with areas, channel widths, and velocities summarized in **Table 4-2**.

Bioengineering design standards, recommendations and guidelines were applied from the following sources:

- Living on the Edge: A Manual for the Restoration of Drastically Disturbed Sites (Polster Environmental 2021)
- Design Guidelines for Erosion and Flood Control Projects for Streambank and Riparian Stability Restoration for the City of Calgary (AMEC 2012)
- Part 650 Hydrology National Engineering Handbook: Soil Bioengineering for Streambank and Shoreline Protection (USDA 2021)
- Bioengineering Techniques – Constructed Ditch Factsheet Drainage Management Guide No. 13. (BC Government Ministry of Agriculture, Food and Fisheries 2004)

Table 4-1 S-CR-14 Bioengineering Design Considerations and Constraints

Considerations	Constraints
Ease of planting depth and substrate type	Gravel substrates could limit hand installation options in some locations.
Site access and safety considerations	Height, stability and degree of slope could limit machine applications. Private property permissions could limit site access options.

Considerations	Constraints
Vegetation cover percent	Cover percent of existing vegetation can reduce the feasibility of live stake installation at the densities needed for bank erosion protection.
Vegetation cover type	Cover type (grasses/shrubs/trees) informs density and design prescription.
Vegetation species cover	Types of invasive species can influence installation methods (i.e. dense Himalayan blackberry bushes prohibit hand installation due to density of cover, reed canary grass can obscure the ground and wrap around installation tools, both require some removal before treatment).
Erosive force	Streamflow velocities were considered on a site-specific basis; this informs design density and prescription, or if the treatment was appropriate (acceptable range is from 0.91-3.05 m/s, AMEC 2012).
Erosion type	Erosion processes occurring onsite inform design prescription selection, or if the treatment was appropriate (i.e. bank failure caused by toe erosion requires treatment along the toe of the slope, acceptable range in shear stress are from 100.5-148.4 $N/m^{2,}$ AMEC 2012).
Water elevation at low streamflow and high streamflow throughout the year	Elevation of stake installation in design considers water elevations at low streamflows (dry times of year), as well as depth and duration of inundation during high streamflows, as they influence plant growth and survival. Access to water during low flow periods was a constraint to the planting elevation of the stakes.

Table 4-2 Site Characteristics

Location	Approximate Area of Treatment Required (m^2)	Average Width of Creek Top (m)	6 Month 5-Day Winter Velocity	25-Year 5-Day Winter Velocity
Site 1	120	15	0.59	0.27
Site 2	100	20	0.32	0.21
Site 3	80	17	0.64	0.37
Site 4	640	35	0.51	0.26

5 DESIGN PRESCRIPTION

Based on the baseline assessment, site visit, and site-specific considerations and constraints, **Table 5-1** summarizes the bioengineering prescriptions and design for S-CR-14 on Lagace Creek. Channel design velocities and shear stress estimates were also reviewed by the design team. Modelled velocities and shear stress for design were compared to the estimated permissible shear stress and velocities for live stakes (100.5-148.4 N/m^2, 0.91-3.05 m/s, respectively, AMEC 2012) and deemed within acceptable limits. An initial set of bioengineering drawings was then developed. These drawings, developed in consultation with the design team (see attached), underwent several reviews and iterations before being finalized and issued in the RFP (Request for Proposals) package.

Table 5-1 S-CR-14 Soil Bioengineering Design Prescriptions

Channel Bank Location	Site Description	Site Prescription	Design Description
Dale Road Bridge Bank Protection (left bank protection upstream of Dale Road bridge)	Sediment deposition area directly upstream of the bridge	Sediment removal, installation of sand recovery stations, slope regrading, coconut matting and live stake clusters	Installation of live stake clusters (4 stakes per cluster), one cluster per 3 m^2, 0.5 m below the top of the bank, and above water levels at the time of installation in the fall.
All Sites	Over steepened and undercut failing channel banks, erosion at the toe of the slope, sandy substrates, low or no woody vegetation cover	Dense live toe staking	Installation of live stakes spaced 25 cm apart, in 1-4 m wide sections (depending on field conditions) at the toe of the slope. The average density

Channel Bank Location	Site Description	Site Prescription	Design Description
			of stakes was 12 per m^2, for a total of 490 linear meters.

6 CLOSURE

This technical memorandum was prepared for the Government of British Columbia to assess erosion and flooding risks at sites in the Hatzic Valley area that were damaged or disturbed during the November 2021 Atmospheric River Event and to outline restoration concepts to return the sites to their pre-event condition.

Bioengineering is a nature-based solution that is dependant upon the viability of the prescribed materials, the experience of the installers, and post-installation watering and weeding. Said viability is contingent on many factors outside the designer's control such as climactic conditions, environmental factors and human interactions. The noted design above meets the project design intent; however, no guarantees are inferred or implied.
The services provided by **Associated Environmental Consultants Inc.**, in the preparation of this report, was conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions. No other warranty expressed or implied is made.

Prepared By:

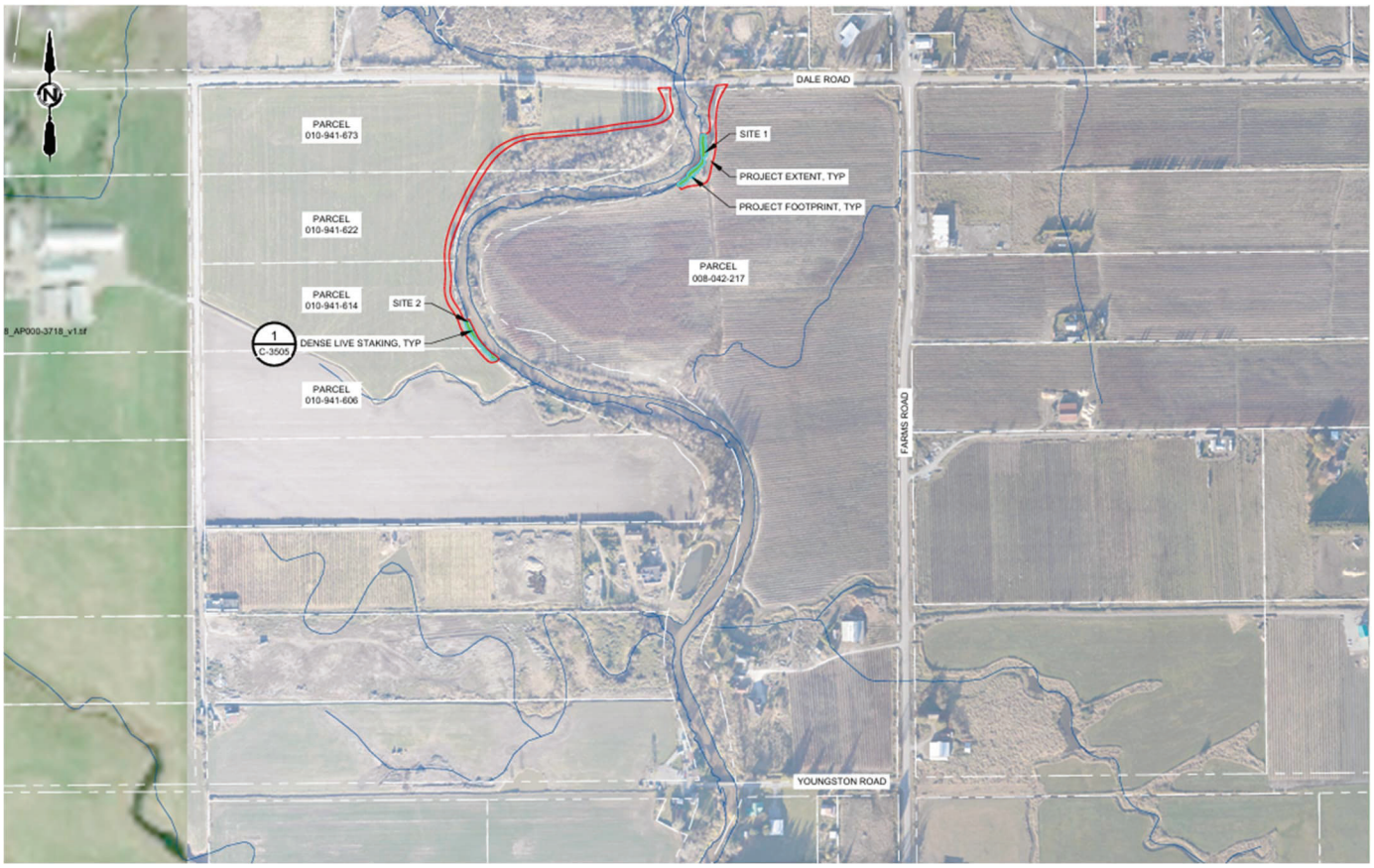
COLLEGE OF APPLIED BIOLOGISTS
Carrie-Lynn Nadeau
RPBio
2026
CAB

Carrie Nadeau, R.P.Bio.
Certified Ecological Restoration Practitioner

Reviewed By:

Ryan Karsgaard, P.Eng.
Engineer-of-Record

Attachments:
Treatment Location Maps
Dense live toe staking sketch
Live stake cluster sketch


DALE ROAD
PARCEL 010-941-673
SITE 1
PROJECT EXTENT, TYP
PROJECT FOOTPRINT, TYP
PARCEL 010-941-622
PARCEL 008-042-217
PARCEL 010-941-614
SITE 2
1
C-3505
DENSE LIVE STAKING, TYP
PARCEL 010-941-606
FARMS ROAD
YOUNGSTON ROAD

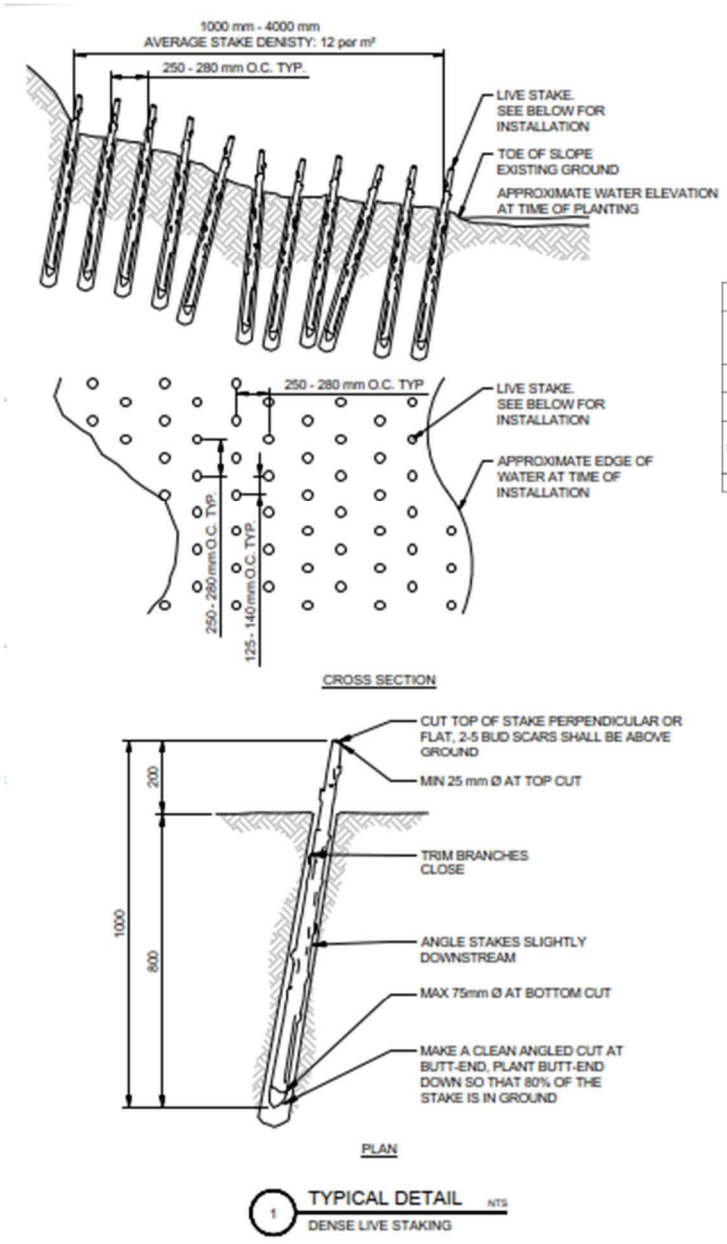


TABLE 4: DENSE LIVE STAKING TREATMENT SUMMARY

LOCATION	APPROXIMATE AREA	APPROXIMATE LINEAR METERS	STAKE DENSITY	APPROXIMATE NUMBER OF STAKES	TREATMENT
SITE 1	60.2 m²	67 m	12 PER m²	722.4	DENSE LIVE TOE STAKING
SITE 2	100 m²	60 m	12 PER m²	1200	DENSE LIVE TOE STAKING
SAND RECOVER STATIONS UPSTREAM OF DALE ROAD	96 m²	44 m	3 PER m²	128	LIVE STAKE CLUSTERS
TOTALS	256.2 m²	171 m		2050.4	

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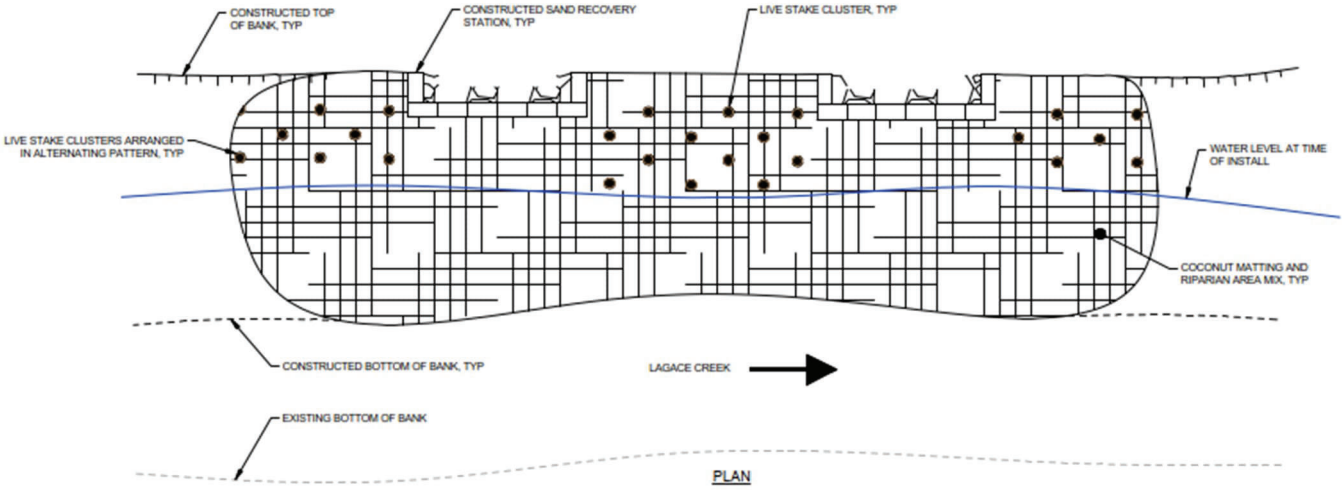

NOTE:
THE TARGET NUMBER OF CLUSTERS WAS ONE CLUSTER PER 3 m², 0.5 m BELOW TOP OF BANK, AND 0.25 m ABOVE WATER LEVEL AT TIME OF INSTALL.

DISCLAIMER:
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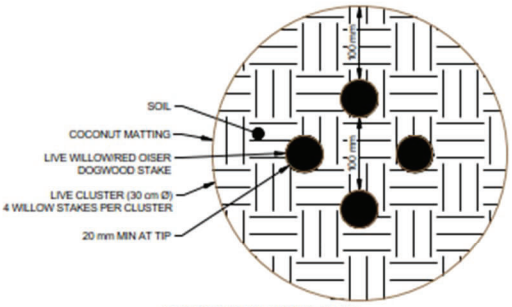
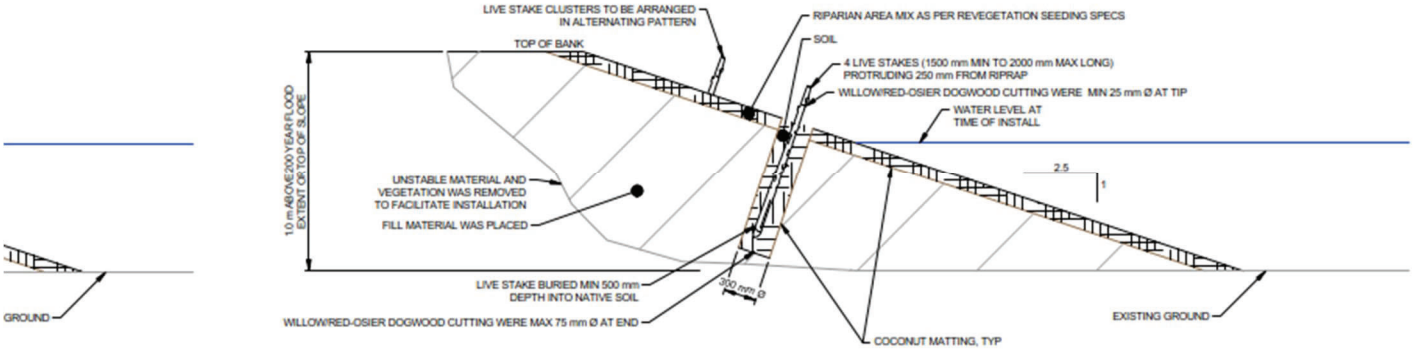


LIVE STAKE CLUSTER PLAN



VEGETATED RIPRAP SECTION

2 TYPICAL DETAIL NTS
VEGETATED RIPRAP

APPENDIX G – MODELLING REPORT



REPORT

Hatzic Emergency Works Program Hydrology and 2D Hydraulic Model Overview

April 2024

BRITISH COLUMBIA | Ministry of Environment and Climate Change Strategy

Associated Engineering

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1 INTRODUCTION

The BC Ministry of Environment and Climate Change Strategy (ENV) retained Associated Engineering (B.C.) Ltd. (Associated) to restore flood damaged sites on watercourses within the Hatzic Valley area east of Mission, BC. These sites were damaged or disturbed during the November 2021 Atmospheric River Event (ARE). The project objective is to protect the sites from further erosion and bank retreat which may cause additional damage to riverbeds, banks, and infrastructure, and pose a significant threat to the safety of people, properties, infrastructure, and the environment.

As part of this project a 2D hydraulic model was developed. The objective of this model build and analysis is to support the hydraulic assessment and recovery works for the 12 identified projects. Individual sites may require localized model updates and enhancements, depending on the proposed scope of work, as well as more detailed hydraulic evaluation as part of design phase.

Our report summarizes the following:

- Hydrologic analysis of the Hatzic Valley, focussed on the 12 project sites and Hatzic Prairie.
- Estimation of the design flows for the 12 project sites and Hatzic Prairie.
- Development of a 2D hydraulic model for the Hatzic Prairie drainage system.

The report also discusses sources of flood risk within the Hatzic Valley, all of which contributed to the impacts of the 2021 ARE:

- Geomorphology.
- Geomorphic Hazards.
- Sediment Transport.
- Historic Climate and Climate Change.
- Fraser River Dike and Drainage Infrastructure.

2 STUDY AREA AND FLOOD HAZARDS

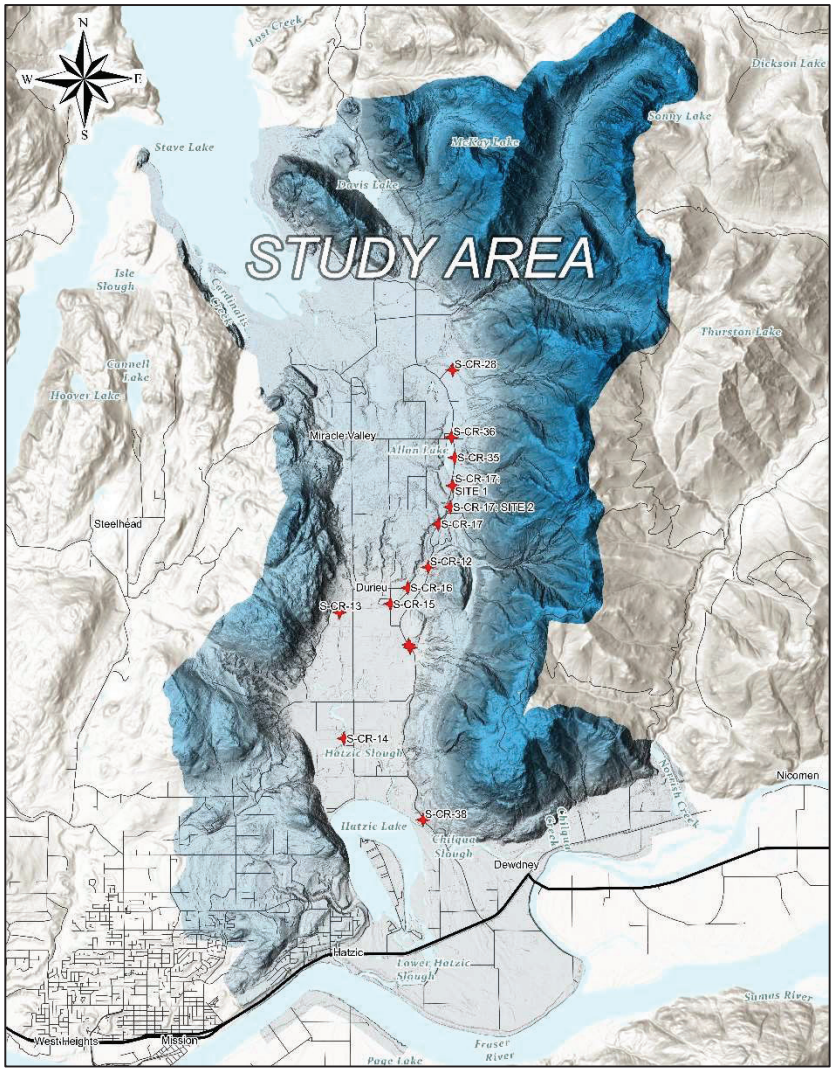
The Hatzic Valley is located on the north side of the Fraser River Valley in British Columbia, approximately 3.5 km east of Mission. It is part of the Fraser Valley Regional District (FVRD) Electoral Area “F” and includes the unincorporated communities of McConnell Creek, Hatzic Prairie and Durieu. The valley is the part of the traditional lands of the Coastal Salish peoples. It is currently home to approximately 1,300 people (FVRD, 2023).

Hatzic Valley runs from north to south, extending from the southeast point of Stave Lake in the northwest to Hatzic Lake and the Fraser River in the south. The midlands located south of Stave Lake serve as a valley drainage divide. Creeks north of the divide flow to the northwest into Stave Lake. The remainder of the valley drains to the south, entering Hatzic Slough in the Hatzic Prairie lowlands, then Hatzic Lake.

Hatzic Lake in turn drains through the Fraser River dike and into the Fraser River. The Dewdney Area Improvement District (DAID) serves as Diking Authority for the Hatzic reach of the Fraser River dike, extending from Dewdney Trunk Road and Lougheed Highway in Mission, BC to Bell Road in Dewdney, BC. This dike prevents the Fraser River from directly flooding the properties on the floodplain north of the river (DAID, 2023).

Figure 2-1 shows Hatzic Valley and the 12 site locations.

Figure 2-1 Study Area and 12 Project Sites

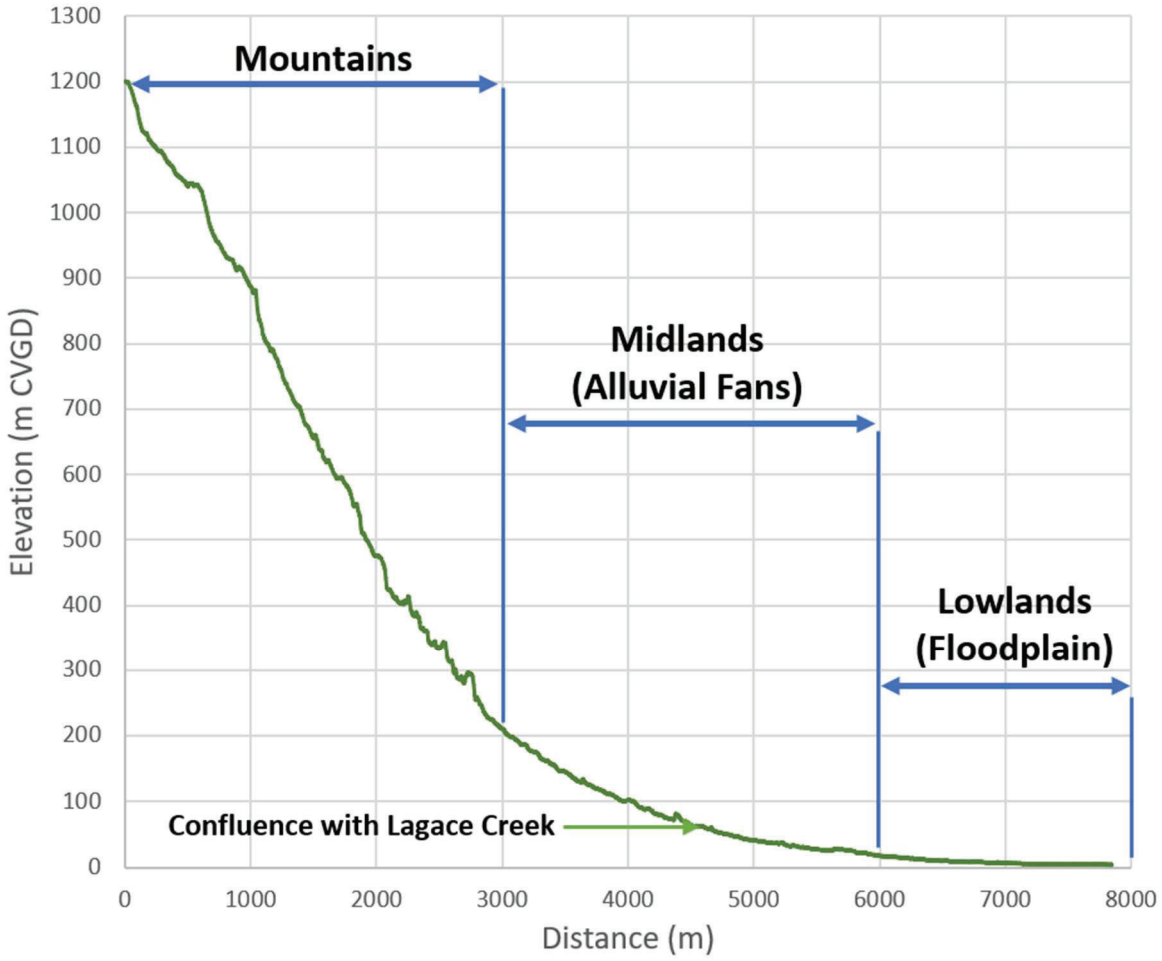


Of the 12 project sites damaged or disturbed during the 2021 ARE, 11 are south of the Hatzic Valley drainage divide and outlet into Hatzic Lake and the Fraser River. The remaining site is located on Carratt Creek, a tributary of Cascade Creek which outlets in Stave Lake.

2.1 Geomorphology and Geomorphic Hazards

Hatzic Valley was carved by glacial action; it is a glacial trough which runs north to south, connecting Stave Lake to the Fraser River floodplain (MFLNRO, 2013). The area has three distinct topographic / geomorphological zones, discussed below. **Figure 2-2** shows a topographic profile along Pattison Creek and into its confluence with Lagace Creek illustrating these zones.

Figure 2-2 Hatzic Valley Topographic Profile (Pattison Creek into Lagace Creek)



Mountains / Uplands

The Hatzic Valley trough is bounded to the east by the Douglas Ranges, part of the Pacific Ranges of the Coast Mountains. The Douglas Ranges adjacent to Hatzic Valley run from Gregory Peak to Dewdney Peak along the Durieu Ridge, with peak elevations ranging from 800 m to over 1300 m (MFLNRO, 2013). These eastern mountains are characterized by extremely steep slopes (some more than 70%) and a high frequency of debris flow and debris flood events. The western side of the valley features the much more subdued Mission uplands, with a maximum elevation of 600 m.

Many of the eastern mountains and some parts of the Mission uplands have extensive alluvial / colluvial fans at their bases from repeated debris flood and debris flow events. The mountain slopes are also at risk of landslides, channel blockage and channel avulsions. In some areas, potentially damaging events may happen as often as every 5 to 15 years (BGC, 2023).

Midlands / Alluvial Fans

Debris flows, debris floods and landslides from the mountains and uplands have deposited multiple alluvial / colluvial fans that act as a transition zone between the steep mountain slopes and the valley floor. Previous glaciation has also left deposits of glacial till and deglacial deposition. This material forms heavy deposits on the midlands within the glacial trough which separate Hatzic Prairie from the northern end of the valley (MFLNRO, 2013). The midlands form the drainage divide between the Hatzic Watershed, draining south, and the Cascade and Marino Watersheds which drain north to Stave Lake.

The midlands include extensive alluvial / colluvial fans subject to debris floods, debris flow events, channel blockage and channel avulsions. Eleven of the twelve project sites are located on or directly downstream of active colluvial / alluvial fans and are at risk of debris flows / floods and increased flood events. In some areas, potentially damaging events may happen as often as every 5 to 15 years (BGC, 2023). See Table 2-1.

Table 2-1 Alluvial / Colluvial Fans and Impacted Project Sites (BGC. 2023)

Alluvial / Colluvial Fan	Likelihood of Debris Flood / Flows	Impacted Project Site
Carratt Creek	High	S-CR-28
Eng Creek	High	S-CR-36
McNab Creek	High	S-CR-35
Pattison Creek	High	S-CR-12, S-CR-16, S-CR-15, S-CR-18
South Herford Creek	Moderate	S-CR-34
Davies Creek	Low	S-CR-19
Field Creek	Low	S-CR-28
North Dale Creek	Low	-
North Herford Creek	Low	S-CR-37
Saporano Creek	Low	S-CR-17
South Dale Creek	Low	-
Upper Dale Creek	Low	-

Lowlands

South of the midlands lie the lowlands: Hatzic Prairie, Hatzic Slough and Hatzic Lake. The lowlands are part of the Fraser River floodplain and have very low slopes (0.01% to 0.6%) and limited hydraulic conveyance. This area is now protected from direct flooding on the Fraser River by the Fraser River dike. However, the floodplain still experiences frequent flooding due to the limited drainage system conveyance, sediment deposition (discussed in **Section 2.2**) and the downstream dike structures (**Section 2.4**).

Five of the sites (including the only one not directly impacted by an alluvial fan) are within the historic Fraser River floodplain and at risk from lowland flooding from Hatzic Lake and Hatzic Slough.

2.2 Sediment Transport

The steep mountain slopes and large glacial deposits within Hatzic provide large volumes of sediments and debris to the downstream creeks, midlands, Hatzic Prairie and Hatzic Floodplain. Debris and sediments are transferred throughout the year, with more material movement corresponding to larger storm events with high flows (BGC, 2023). In some areas on the mountain slopes, the sediment availability is characterized as "supply-unlimited":

"Debris available for transport is not a limiting factor in the magnitude or frequency of steep creek events [in supply-unlimited Hatzic creeks] … In other words, there is always an abundance of debris along a channel and in source areas so that whenever a critical hydro-climatic threshold is exceeded, an event will occur. The more severe the hydro-climatic event, the higher the resulting magnitude of debris flow or debris flood."- (BGC, 2023)

Sediment and debris deposition and channel aggradation are consistent challenges within the Hatzic Valley drainage systems. Regular sediment removal maintenance is required to maintain channel capacity in many of the mountain, midland and alluvial fan creeks, as well as within Hatzic Slough and the Hatzic Prairie ditches. **Larger rock and debris are deposited on the upper midlands and alluvial fans from steep creek landslides, debris floods and debris flows. Finer sediments (sand and gravels) are deposited further downstream within lower Lagace Creek and the Hatzic Prairie floodplain.**

Sediment deposition timing, volumes and locations are highly variable. It is difficult to estimate an "annual sediment load" for this drainage system, as up to 50% of sediment transport may take place only during larger events with Annual Exceedance Probabilities (AEP) in the range of 2.5% to 10% (BGC, 2023).

- **Timing** – Sediment transport and deposition are tied to high intensity rainfall events / high creek flows, and debris floods / flows. This means that some years will have very low sediment loads and in other years, the drainage system will infill rapidly.
- **Volume** – Volume of sediment deposition is also tied to high intensity rainfall events / high creek flows, and debris floods / flows.
- **Locations** – Sediment deposition is heavily dependent on the channel slope and topography. Mountain slopes experience the highest volumes and largest material depositions, followed by alluvial fans / midlands. The lowlands and floodplains receive the small sediment material sizes and lower deposition volumes.

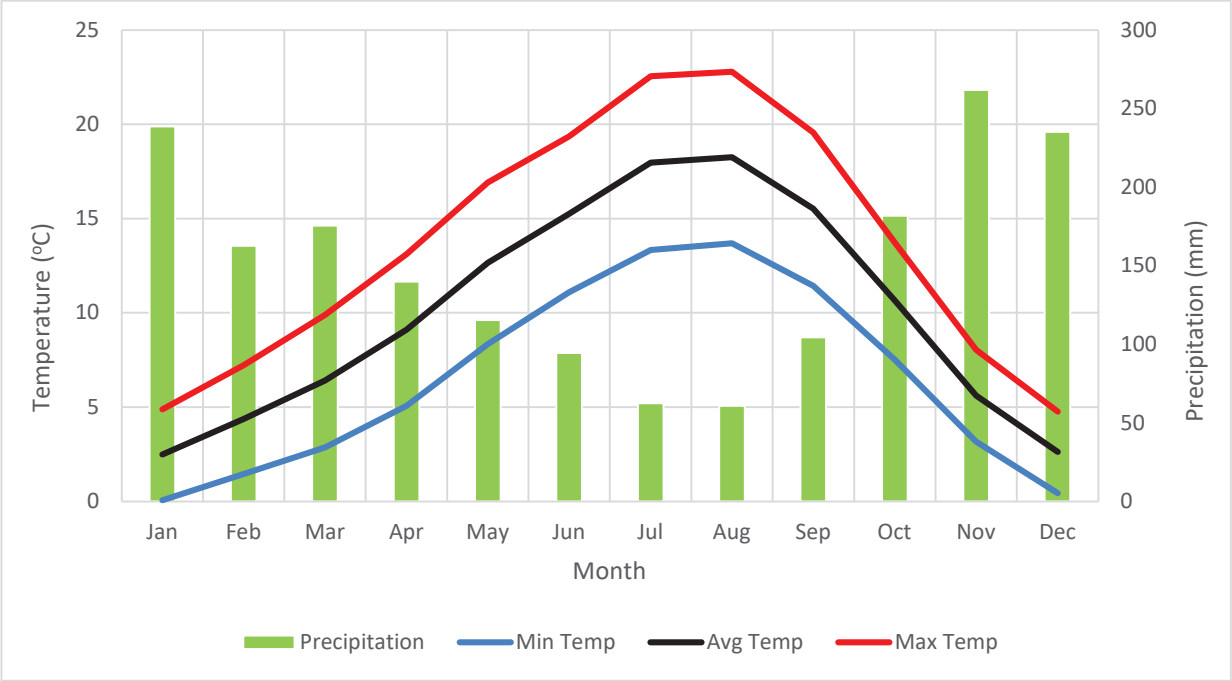
As an illustrative example, Pattison Creek experienced high intensity rainfall and a landslide event in November of 1990. The mountain slope above the alluvial fan experienced a 130,000 m^3 debris flow. Another 60,000 m^3 of sediment deposited on the alluvial fan upstream of Sylvester Road Bridge and another 40,000 m^3 deposited between the bridge and the Pattison Creek / Lagace Creek confluence. Continuing heavy rain following this debris flow eroded the material and transported more of it downstream along Legace Creek. In the end, nearly 40,000 m^3 of sand and gravel had to be removed from Lagace Creek / Hatzic Slough in the floodplain during the following summer (AE, 1992). **The creek reaches in this example were also impacted in the 2021 ARE, and include project sites S-CR-12, S-CR-16, S-CR-15, and S-CR-18. They correspond to an alluvial fan with a High geohazard likelihood.**

All 12 project sites were impacted by sediment deposition and reduced channel hydraulic capacity from the 2021 ARE.

2.3 Climate and Climate Change

The Hatzic Valley has an oceanic climate, typical of the coastal Pacific Northwest. Climatic data for the valley has been characterized using the Mission West Abbey climate station, located 3.5 km away. Average monthly temperatures and rainfall for 62 years of data are shown in **Figure 2-3**. (For further information on data sources, see **Section 3**, below).

Figure 2-3 Hatzic Valley Temperature and Precipitation (Mission West Abbey Station)



The valley floor has an average annual precipitation of approximately 1,764 mm. Precipitation falls primarily as rainfall, with peak storm intensities and volumes during the winter rainy season from October through March. Peak creek flows are generated by these winter storms, the largest of which are frequently in November. Average daily maximum and minimum temperatures at the valley floor remain above 0 °C year around. Snowpack forms on upper reaches of the Eastern mountains only; it is present approximately from January to May. Historic landslide and flood records suggest that localized, higher intensity rain events take place on the eastern mountain slopes due to orographic effects (MFLNRO, 2013).

The valley experiences some rainfall in the summer months as well. While these events are typically much smaller than the winter storms, they can still take place over several days and generate relatively large flow volumes. Summer storms may coincide with the peak water levels on the Fraser River downstream; implications of these coincident events (Hatzic summer storm and high river levels) are discussed in **Section 2.4**.

Hatzic Valley is projected to experience large climatic changes within this century. Climate projections from the Pacific Climate Impacts Consortium (PCIC) and Climate Data Canada suggest the following changes by the 2100 time horizon:

- A 6.1°C increase in average annual temperatures
- A 5.4°C increase in winter temperatures
- A 51% increase in precipitation volumes

It is likely that the Hatzic Valley will experience a 51% increase in precipitation volumes and a similar increase in peak flows. Increasing winter temperatures may also encourage more rapid snowmelt during rain-on-snow events in the late winter months. **This is likely to cause a substantial increase in drainage system flooding and flood events, triggering more frequent debris flows and debris floods and increasing sedimentation challenges.**

Climate change will also impact the downstream boundary of the Hatzic Valley drainage system, the Fraser River. As with Hatzic, the Fraser River will be impacted by changes in precipitation and temperatures. This reach of the Fraser River is also tidally influenced and local sea level rise is projected to increase by 0.56 m by the year 2100 (Climate Data Canada, 2023). Further information about climate change and the climate change analysis are discussed throughout the remainder of this report.

2.4 Fraser River Dike and Drainage Infrastructure

The Hatzic Valley drainage system outlets to the Fraser River through the Fraser River dike, which protects the valley from direct flooding by the Fraser River. Dike drainage structures include:

- Four flood boxes which drain via gravity.
- Two pump stations (built in 1948 and 2014).
- Five drainage pumps.

Most of the year, water flowing south through Hatzic Prairie exits Hatzic Lake via the four flood boxes. However, if Fraser River water levels are too high, drainage is limited to the much lower capacity of the drainage pumps. This occurs during:

- Peak Fraser River freshet (between May and July) which closes the flood boxes for several months.
- High tides in the fall, winter and spring, closing the flood boxes for several hours at a time.
- Large winter storm events, such as the 2021 ARE, can close the flood boxes for several days.

If flood boxes are closed during large storm events, flows still runs down the mountain creeks and into Hatzic Lake. However, without open flood boxes, Hatzic Lake fills, causing water levels to rise in Hatzic Slough. **Above a certain depth, water levels in the lake and the slough rise together, causing flooding around the lake and in the Hatzic Prairie lowlands. As sea levels rise, so will the Fraser River water levels, and therefore the frequency of flood box closures and the risk of lowland flooding will increase.**

Further analysis of water levels on the Fraser River at Hatzic, flood box operation and drainage pump operations is included in the remainder of this report.

3 DATA AND OTHER RESOURCES

A variety of reports, mapping, data and other resources were used throughout this assessment. These resources are listed below.

3.1 Climate Data

Climate data provided by Environment and Climate Change Canada (ECCC) was used for a variety of analyses throughout this project. The stations and their applications are summarized in **Table 3-1**, below.

Table 3-1 Climate Stations

Station Name and ID	Data Type	Coordinates	Distance to Hatzic (km)	Project Application
Mission West Abbey (ID No. 1105192)	Daily Precipitation, IDF, Temperature	49.15 N 122.27 W	3.15	Climate Characterization, Design Storm Development, Calibration Event Daily Precipitation
Cultus Lake (ID No. 1102221)	Hourly Precipitation	49.08 N 121.98 W	22.77	ARE Precipitation Extents Assessment
Pitt Meadows CS (ID No. 1106178)	Hourly Precipitation	49.21 N 122.69 W	31.12	ARE Precipitation Extents Assessment
Agassiz RCS (ID No. 1100119)	Hourly Precipitation	49.24 N 121.76 W	38.42	ARE Precipitation Extents Assessment / Calibration Event Sub-daily Precipitation
White Rock Campbell Scientific (ID No. 1108910)	Hourly Precipitation	49.02 N 122.78 W	49.51	ARE Precipitation Extents Assessment
N Van Wharves (ID No. 1105669)	Annual Precipitation	49.31 N 123.12 W	65.54	Orographic Effects (Elevation vs. Precipitation)
N Van 2nd Narrows (ID No. 1105666)	Annual Precipitation	49.30 N 123.01 W	57.53	Orographic Effects (Elevation vs. Precipitation)
Hollyburn Ridge (ID No. 1103510)	Annual Precipitation	49.38 N 123.18 W	71.86	Orographic Effects (Elevation vs. Precipitation)
W Van Millstream (ID No. 1108840)	Annual Precipitation	49.37 N 123.13 W	68.08	Orographic Effects (Elevation vs. Precipitation)
Cleveland (ID No. 110EF56)	Annual Precipitation	49.36 N 123.11 W	66.35	Orographic Effects (Elevation vs. Precipitation)
Dickson Lake (ID No. 1D16)	Snowpillow/Snow Water Equivalent	49.32 N 122.07 W	20.72	Snow Pack Availability Assessment

3.2 Climate Change Projections

Climate change projections were provided by the Pacific Climate Impacts Consortiums (PCIC) *Plan 2 Adapt* tool and Climate Data Canada by ECCC. Both sources provided a range of possible climate projections with a corresponding range of possible temperature increases in the Hatzic Valley. Climate Data Canada also provided sea level rise (SLR) projections for the Fraser River, specifically at the Gulf of Georgia Cannery, Sturgeon Bank and Roberts Bank. All projections are to the 2100 time horizon.

3.3 Hydrometric Data

Hydrometric data within the watershed provided by the FVRD for five creeks. However, data was limited to a two-year period from 2021 to 2022 and one of the gauges was destroyed during the ARE. Historic hydrometric data on the Fraser River at Mission was provided by ECCC. The gauges are summarized in **Table 3-2**, below.

Table 3-2 Hydrometric Stations

Station Name and ID	Data Type	Coordinates	Years of Data	Project Application
Lagace Creek	Flow		2021 - 2022	Hydrologic Model and Design Flow Calibration
Durieu Creek	Flow	49.18 N 122.239 W	2021 - 2022	Informed Hydrologic Model Build: Small Midland Subcatchments
Seux Brook	Flow	49.22 N 122.239 W	2021 - 2022	Informed Hydrologic Model Build: Small Midland Subcatchments
Oru Creek	Flow	49.22 N 122.24 W	2021 - 2022	Informed Hydrologic Model Build: Small Midland Subcatchments
Belcharton Creek	Flow	49.22 N 122.25 W	2021	N/A (Destroyed)
Fraser River at Mission (ID No. 08MH024)	Water Level, Flow	49° 07' 39" N 122° 18' 10" W	1969 - 2022	Downstream Tidal Boundary Assessment and Winter Design Events

3.4 Dike Infrastructure Operational Data

DAID provided operational data on the Hatzic section of the Fraser River dike and its drainage infrastucture, including lake levels, river levels and pump utilization.

- Daily water surface elevation (WSE) measurements on both sides of the Fraser River dike (Fraser River and Lower Hatzic Lake) for 2018 to 2023.
- Sub-daily information was supplied for November 2021 and the 2021 ARE, including WSE measurements on both sides of the Fraser River dike as well as Upper Hatzic Lake and pump use for all five pumps.

DAID Operations Manager, Dave Scott, participated in several interviews with Associated staff and provided further information, including:

- Pump capacities, minimum draw-down points and typical on/off levels.
- Pump operations during flood events.
- Flood box operations / use.
- Lake level characterization for both winter and summer.

Summer lake level information was also provided by Barbara Sutherland, a Senior Authorization Specialist in the Ministry of Forests Stream Management Authorizations.

3.5 Topographic and Survey Data

LiDAR was gathered for the entire Hatzic Valley and all contributing watersheds between November 16 and November 19, 2022; data was collected at a 0.5 m x 0.5 m density. Bathymetric cross-section surveys of the lakes and creeks were collected between January 18 to February 9, 2023. All topographic data, bathymetry and surveys were collected by TerraRemote. The LiDAR data was post-processed to produce a bare earth surface with integrated bathymetric data. Building outlines were also produced.

TerraRemote also completed a survey of major drainage infrastructure (bridges and culverts) pertinent to this project and developed a survey report with dimensions and photographs. The compiled survey photo summary can be found in **Appendix B.**

3.6 GIS / Mapping Resources

Primary GIS / mapping resources for this project were provided by FVRD and iMap BC. Surficial soils data, 20 m contours and preliminary watershed boundaries were provided by iMap BC. FVRD Hatzic Valley mapping included:

- Waterbodies
- Creeks
- Watersheds
- Roads
- Geohazard Zones
- Land Use

3.7 Reports

Several previous reports provided background information or supported the hydrologic and hydraulic analysis of the Hatzic Valley:

- Area F – OCP Bylaw 999 – Hatzic Valley - FVRD, 2010.
- Hatzic Prairie Drainage Study Volumes 1 and 2 - Associated Engineering, 1992.
- Hatzic Valley Preliminary Steep Creek Harad Assessment (Draft) – BGC Engineering Inc., 2023.
- Hatzic Valley Preliminary Debris Flow Hazard Assessments - BGC Engineering Inc., 2003.
- Simulating the Effects of Sea Level Rise and Climate Change on Fraser River Flood Scenarios – BC Ministry of Forests, Lands and Natural Resource Operations (MFLNRO), 2014.
- Operations Manual – Hatzic Lake Slide Gates - Letts Environmental Consultants Ltd.
- Operations Manual – Hatzic Lake Drainage Pump Station – Associated Engineering, 2014.

4 FLOOD SCENARIOS

Flood scenarios for the Hatzic Valley drainage system assessment are summarized below in **Table 4-2** These include four design event scenarios and two validation events. Scenarios were modelled first in the hydrologic model to develop flows. Once hydrologic calibration was completed, flows were input into the hydraulic model.

Table 4-1 Flood Scenarios

Flood Scenario	Precipitation	Initial Lake WSE	Fraser Dike Drainage Infrastructure	Fraser River Water Levels
10-year 5-day Summer Event	10-year 5-day Summer Design Storm with CC[1]	2.72 m CVGD	DAID flood scenario pump operations. Flood boxes closed due to Freshet.	Fraser Freshet Level with SLR[2] and CC 8.77 m CVGD[4]
200-year 5-day Summer Event	200-year 5-day Summer Design Storm with CC[1]	2.72 m CVGD	DAID flood scenario pump operations. Flood boxes closed due to Freshet.	200-year Fraser Freshet Level with SLR and CC 9.81 m CVGD[4]
10-year 4-day Winter Event	10-year 4-day Winter Design Storm with CC[1]	1.74 m CVGD	DAID flood scenario pump operations. Flood boxes operating via gravity.	10-year Winter River Tidal Series with SLR
200-year 4-day Winter Event	200-year 4-day Winter Design Storm with CC[1]	1.74 m CVGD	DAID flood scenario pump operations. Flood boxes operating via gravity.	200-year Winter River Tidal Series with SLR
2021 ARE Validation Event	2021 ARE Hourly Precipitation	1.74 m CVGD	DAID flood scenario pump operations. Flood boxes operating via gravity.	2021 ARE Hourly Fraser River Water Levels
2022 Summer Validation Event[3]	2022 Summer Event Hourly Precipitation	N/A	N/A (Hydrologic Model Use Only)	N/A (Hydrologic Model Use Only)

1. Climate Change (CC)
2. Sea Level Rise (SLR)
3. 2022 Summer Validation Event was used for the Hydrologic Model only.
4. See hydraulic model limitations.

4.1 Design Storm Development

Precipitation Analysis

Precipitation and other climate data for the valley has been characterized using the Mission West Abbey climate station, located 3.5 km away. Historic intensity-duration-frequency analyses (IDF) were completed on the Mission West Abbey hourly precipitation data, available from 1963 to 2018, for a total of 55 years. Data was separated into seasons, with winter conditions extending from October through to March and summer freshet from May through the end of June. Peak annual maxima were extracted for sub-daily and multi-day durations to develop IDF information for both summer and winter design storms. Typical and maximum storm durations were also analysed using the 55 years of data, with rolling averages used to assess the total maximum number of consecutive days of precipitation. Results for the analyses are given in **Table 4-2.**

Table 4-2 Historic Seasonal IDF Analysis

Duration	Winter Precipitation (mm)		Summer Precipitation (mm)	
	10-year Event	200-year Event	10-year Event	200-year Event
15 min	10.2	14.8	-	-
30 min	13.4	20.9	-	-
1 hr	19.2	29.5	12.6	19.5
2 hr	27.9	41.7	19.2	29.8
6 hr	45.9	72.3	34.0	51.8
12 hr	67.7	102.2	49.0	77.3
24 hr	99.2	144.5	64.7	105.2
2 day	126.8	212.9	75.0	132.4
3 day	145.4	239.6	83.8	169.4
5 day	181.9	257.8	106.1	210.1
10 day	255.0	346.1	-	-
14 day	298.7	466.2	-	-

Our winter precipitation statistical analysis revealed the following:

- It is not unusual for rainfall to take place continuously for many weeks, especially in November through January.
- High intensity rainfall typically occurs in durations of two-days or less. Past this point, each additional day represents a volume increase of approximately 2% to 5%. This is true for at least two weeks.
- Our sub-daily analysis yielded identical peak data and statistical fittings as the current Mission IDF curve. As the ECCC curve is a standard and has durations as low as 15 minutes, it was used in place of our analysis for sub-daily durations for the winter analysis.

Results from the summer precipitation include:

- A design duration of five days.
- High intensity rainfall is typically limited to two-days or less.
- Summer IDF development has a minimum duration of one hour due to more limited data historic data.

Climate Change Impacts on Temperature and Precipitation

Climate change projections were provided by the Pacific Climate Impacts Consortiums (PCIC) *Plan 2 Adapt* tool for the Fraser Valley Region and Climate Data Canada for Mission, BC. Projections provided a range of possible annual and seasonal increases in temperature. Estimated increase in rainfall intensity was calculated using the Clausius-Clapeyron Relation to correlate projected temperature to increases in rainfall intensity. We used the CSA Group Technical Guide: Development, interpretation, and use of rainfall IDF information: Guideline for Canadian water resources practitioners approach and increased rainfall by 7% per each degree of temperature increase (CSA, 2019). This approach is in line with Climate Data Canada recommendations.

Average climate projections from PCIC and Climate Data Canada suggest the following changes by the Year 2100 time horizon:

- A 6.1°C increase in average annual temperatures.
- A 5.4°C increase in winter temperatures.
- A 51% increase in precipitation volumes.

The average 51% increase in precipitation due to climate change was applied to all historic precipitation design storm volumes. The projected 5.4°C increase in winter temperatures was used for snowmelt calculations (see below).

Design Storm Shape

The peak 24-hour storm shapes were based on the United States Soil Conservation Service (SCS) Type 1A 24-hour storm distribution recommended for the coastal Pacific Northwest. However, the peak durations were scaled to the seasonal IDF analysis (i.e. peak 15 min, 30 min, 1 hr, 2 hr etc. coincide with the seasonal IDF values). Beyond the 24-hour storm, storm shape was taken from representative winter and summer events. Winter event shape was based on the 2021 ARE hourly data from Agassiz RCP. The summer event was based on a sample five-day hourly storm from May 2022 which was also used for summer hydrologic model validation.

Design storms for the Hatzic Valley floor are shown in **Figure 4-1** and **Figure 4-2**.

Figure 4-1 Summer Design Storms

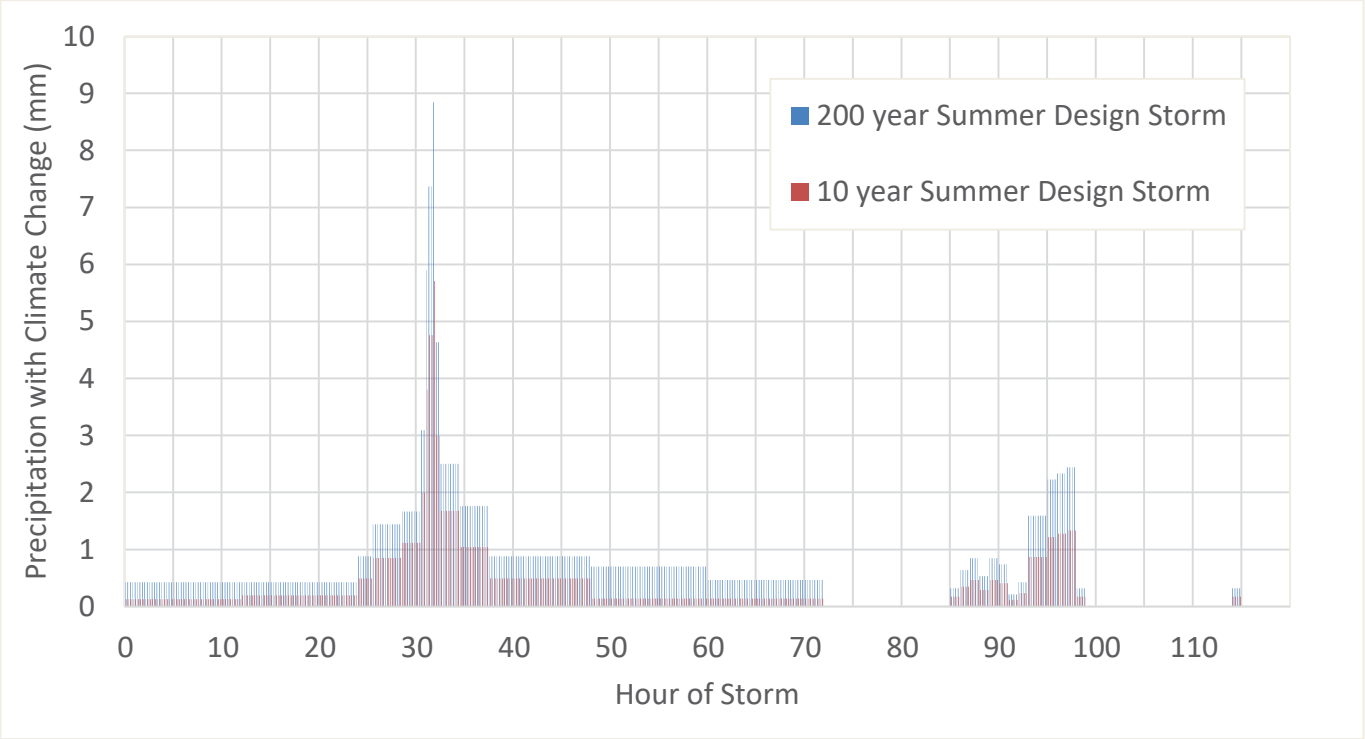
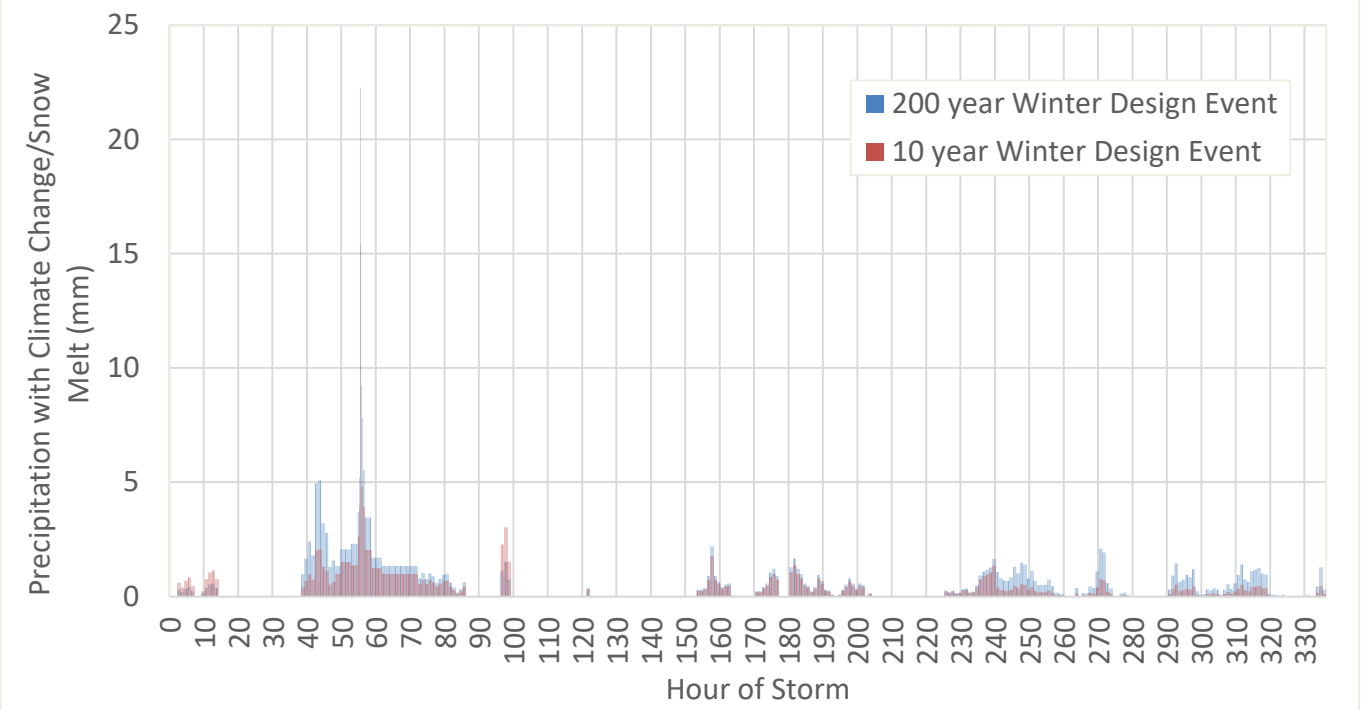


Figure 4-2 Winter Design Storms



Orographic Effects

Mission climate station is located at an elevation of 197 m, which is relatively representative of the lower Hatzic Valley. However, as discussed in **Section 2**, historic landslide and flood records suggest that localized, higher intensity rain events take place on the eastern mountain slopes due to orographic effects (MFLNRO, 2013). No higher elevation precipitation data is available within the Hatzic watershed.

To approximate the increase in rainfall volumes with elevation, we completed an analysis of annual precipitation data for a group of ECCC stations in North Vancouver. While the average distance from these stations to Hatzic Valley is approximately 66 km and analysis at this location is not ideal for the Hatzic Valley effects, the North Vancouver area has a large concentration of stations. The variety of station options allowed us to screen for matching aspect orientation (receiving direct winds from the prevailing ocean storm direction off the Georgia Straight), overlapping data sets and collect data from a variety of elevations. The five selected stations are summarized in **Table 3-2**.

Results of this simplified orographic estimate are summarized in **Figure 4-3** and **Table 4-3** below. The percentage increases in precipitation were applied to design storms for the mountain watersheds, which were binned by average watershed elevation. Further discussion of elevation binning and the distribution of average watershed elevations is included in **Section 5**.

Figure 4-3 Analysis of North Vancouver Precipitation vs Elevation

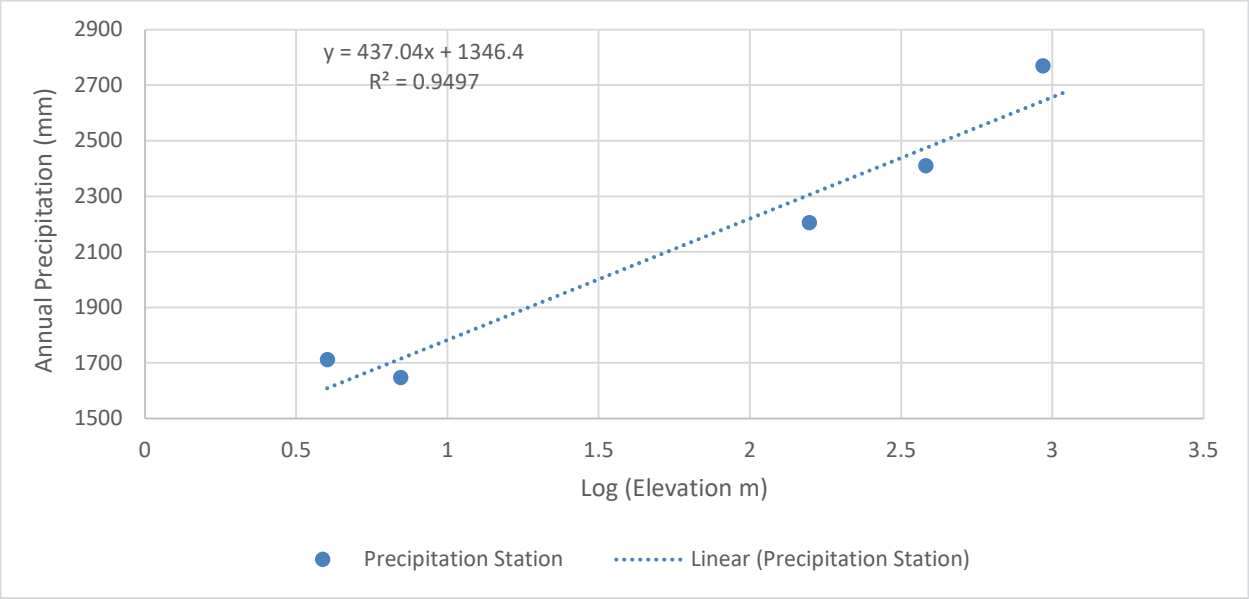


Table 4-3 Estimated Increase in Rainfall with Elevation

Average Watershed Elevation (m)	% Increase with Elevation from Mission Climate Station
197	0.0 %
500	7.5 %
600	9.0 %
700	10.2 %

Snowmelt

Snowmelt was applied to all winter design storm events as snow water equivalent (SWE). Snowmelt was calculated for each 24-hour period based on average temperature and total daily rainfall for the Year 2100 time horizon. The 24-hour total snowmelt was then distributed evenly in millimeters as SWE over the course of the day.

Snowmelt was included only for the high elevation watersheds on Hatzic Valley's eastern mountains. This area is sufficiently high to accumulate an observed snowpack. We reviewed data from the nearest ECCC snow survey station, Dickson Lake, which is located at an elevation of 1160 m CVGD. This is similar in elevation to the ridgeline along these mountains. Data at this snow survey station suggests that snowpack development begins in January. Snowpack at this station typically lasts from January through May. By February, the average snowpack is approximately 0.8 m of SWE. **This suggests there is a risk of a mid-to-late winter rain-on-snow event with both high intensity rain and significant snowmelt.**

Anecdotal information about rain-on-snow flood events in Hatzic were provided during interviews with DAID Operations Manager, Dave Scott. According to Mr. Scott, who monitors lake levels and flood risk, and is also a long-term resident of the valley, **late winter high intensity rain-on-snow events with significant snowpack are infrequent but cause substantially increased flow volumes**

Snowmelt rates were calculated using snowmelt rate calculators from *Hydrology of Floods* by National Resources Council Canada. The more conservative Energy Budget Method was used for the highest intensity rainfall days (i.e. days with rainfall greater than 50 mm). Temperature Index Method was used for the remaining storm days. All snowmelt calculations were completed with the historic average daily temperature for the month of February with a 5.4°C temperature increase due to climate change. Peak daily snowmelt rates are shown in **Table 4-4.**

Table 4-4 Maximum Daily Snowmelt Rates on Mountain Watersheds Under Climate Change Conditions

Watersheds By Elevation	10-year Winter Peak 24-hr SWE (mm)	200-year Winter Peak 24-hr SWE (mm)
Lower Valley Watersheds	0	0
500 m	42	49
600 m	40	46
Over 700 m	38	45

4.2 Lake Levels

Hatzic Lake levels vary throughout the year and from one end of the lake to the other. The lake is divided in two by a railway berm with four culverts which allow water to drain from Upper Hatzic Lake to Lower Hatzic Lake. Due to the railway berm, Upper Hatzic Lake often has substantially higher WSEs than Lower Hatzic Lake during flood events; this is recorded in years of WSE data collected on each side of the berm and noted by DAID staff. During dry or low-flow periods, the two sides of the lake have a similar WSE.

Lake WSE is controlled by DAID operations at the Fraser River dike using the flood boxes and drainage pumps. Operations procedures and WSEs vary depending on the season and flow conditions.

Winter Flood Scenarios

Initial lake levels were set to 1.74 m Canadian Vertical Geodetic Datum (CGVD) during winter flood scenarios for both the Upper and Lower Hatzic Lake. This was the initial lake elevation during the November 2021 ARE. Communication with the DAID Operations Manager suggests that while water levels often exceed this elevation during typical winter conditions, the staff draw down lake water levels to this elevation range in preparation for large incoming storms.

Summer Flood Scenarios

Initial lake levels were set to 2.72 m CVGD for both the Upper and Lower Hatzic Lake during summer flood scenarios. During the summer, the lake is held at elevations ranging from 2.55 m CVGD to 2.72 m CVGD in order to allow for recreational use. The maximum value of 2.72 m CVGD is a threshold approved via short term use applications by the Ministry of Forests; it applies for the summer months until the September long weekend.

4.3 Fraser River Drainage Infrastructure

The Fraser River drainage infrastructure impacting flood scenarios includes four flood boxes and five drainage pumps.

Flood Boxes

The four flood boxes have dimensions of 1.83 m x 1.83 m, are 45.7 m in length, and have invert elevations of approximately 0.54 m CVGD. All are gravity draining based on differential water levels between Hatzic Lake and the Fraser River. When the Fraser River levels are lower, gravity drainage occurs, and when the Fraser River is higher, the floodbox outlet gates close automatically. During the Fraser River freshet, the flood boxes are closed due to the elevated river levels in the Fraser River.

Drainage Pumps

There are five drainage pumps associated with two separate pump stations. Operations are controlled manually by DAID staff. Pump capacity and flood scenario operations are discussed below. While DAID provided information for more typical, low flow conditions as well, this has not been included in this analysis as it did not apply to flood scenarios.

Pumps 1 and 2 are part of the 1948 pump station. The available details are as follows:

- Each pump has a capacity of 3.0 m^3/s (total of 6.0 m^3/s for the 1948 pump station).
- During flood conditions, Pumps 1 and 2 are manually engaged at an Upper Hatzic Lake WSE of 2.60 m CVGD.
- Pumps remain on throughout the flood duration until they are turned off manually when the WSE on the Lower Hatzic Lake is lowered to 2.60 m CVGD.

Pumps 3, 4 and 5 are part of the 2014 pump station. Their details are as follows:

- Each pump has a capacity of 3.1 m^3/s (total of 9.3 m^3/s for the 2014 pump station).
- During flood conditions, Pumps 3, 4 and 5 are manually engaged at an Upper Hatzic Lake WSE of 2.35 m CVGD.
- Pumps remain on throughout the flood scenario and are turned off manually when the WSE on the Lower Hatzic Lake is drawn down to 2.30 m CVGD.

There are some limitations and assumptions for the drainage pump use:

- Detailed pump curves were not available for the five pumps, instead, pumps have been simplified and are assumed to run consistently at their maximum flow rate.
- Pump on and off settings are based on DAID staff discretion and vary slightly between different events. This analysis has taken guidance regarding pump operation from the available 2021 ARE records and discussions with DAID staff.
- If flood boxes open and drainage improves rapidly, operations staff may choose to turn off the pumps earlier. This was not included in flood scenario modelling or analysis.

4.4 Fraser River Water Levels

Fraser River water levels were assessed for two separate seasonal conditions, one for winter (November through February) and one for summer (May to July).

Winter Conditions

During the winter months, the Fraser River at Hatzic Lake is tidally influenced, with larger storm events raising water levels above the tidal range. Analysis for Fraser River near Hatzic Lake was completed using ECCC water level data from the Fraser River at Mission hydrometric station. The station is located 5.6 km downstream of the Hatzic Lake reach of interest. A total of 53 years (1969 to 2022) of hourly data was analysed.

Tidal data for two historic periods were chosen to approximate Fraser River stage hydrographs during the Hatzic Lake flood scenarios. These were selected following a statistical analysis to assess the annual maxima of average WSE taken from the winter months. Average maximum WSE was determined for 2-day, 5-day and 14-day periods.

- The 200-year Fraser River stage hydrograph for the winter flood scenario used data from the 2021 ARE.
- The 10-year winter Fraser River stage hydrograph for the winter flood scenario used data from November 9 - 14, 1989.

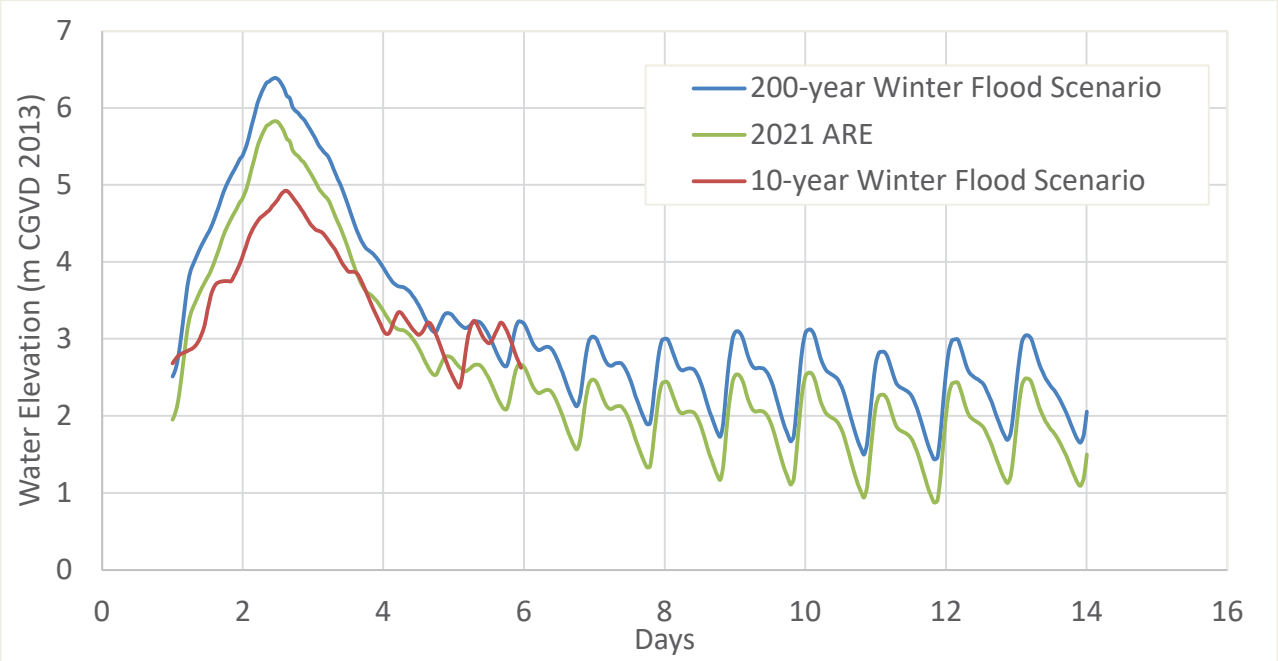
Water level data at the Fraser River at Mission was converted from the local datum to CVGD. Following this, the Fraser River hydraulic gradient between Hatzic Lake and the Mission Bridge was assessed. This assessment was completed by reviewing the following data:

- Comparison of Fraser River at Mission WSEs to Fraser River WSEs collected by DAID at the Hatzic pump stations, and
- The difference in modelled water level shown between those two reaches of the Fraser River in *Simulating the Effects of Sea Level Rise and Climate Change on Fraser River Flood Scenarios* (MFLNRO, 2014) for winter flood events.

This information indicated that a 0.26 m increase in Fraser River levels occurs between the Mission Bridge and the Hatzic Lake outlet which is located 5.6 km upstream. **This elevation-adjustment is only an approximation.**

As discussed, this reach of the Fraser River is tidally influenced and will be impacted by SLR. Using the Climate Data Canada median projection for RCP 8.5, local sea level rise is projected to increase the Fraser River levels at Hatzic Lake by 0.56 m by the Year 2100. This value was added to the entirety of the 10-year and 200-year water level stage hydrographs for the Fraser River as a simple and conservative estimate for the Year 2100 outlet boundary condition for Hatzic Lake. The resulting stage hydrographs were used in flood scenario analysis and are shown in **Figure 4-4.**

Figure 4-4 Tidal Stage Hydrographs for Flood Scenarios



Summer Freshet Conditions

Fraser River levels reach their peak during freshet, and are highest from May to July. Fraser River Freshet WSEs are published in *Simulating the Effects of Sea Level Rise and Climate Change on Fraser River Flood Scenarios* (MFLNRO, 2014). Results were extracted at Hatzic Lake for the hydrologic Moderate Climate Change Scenario A. As the model includes the results for SLR conditions of 0.5 m and 1.0 m, values for the current projection of 0.56 m were interpolated between these values. They are as follows:

- One in 50 year event (minimum modelled return period): 8.77 m CVGD.
- One in 200 year event: 9.81 m CVGD.

5 HYDROLOGIC MODEL BUILD

Software

The United States Army Corps of Engineers (USACE) HEC-HMS modelling software Version 4.11 was used to analyze Hatzic Valley hydrology and design flows. HEC-HMS is an industry standard software for hydrologic modelling and design flow development in rural and most undeveloped watershed settings.

Model Spatial Extents

The hydrologic model extents are limited to the Hatzic Valley watershed which drains to the Fraser River and the Carrat Creek / Upper Cascade Creek basin. Watershed extents and subcatchments are shown in Map Figures 1 to 3 in **Appendix A.**

Watershed Delineation and Characteristics

The Hatzic Lake watershed has a total drainage area of approximately 66 km^2. However, for the purposes of valley-wide modelling and site-specific analysis, this area was divided into 76 different subcatchments. Modelling also included two subcatchments draining north to Stave Lake to include the Carratt Creek project site. Watershed delineation was completed using the 2022 LiDAR, FVRD creek / waterbody mapping, hydraulic structure survey, aerial imagery and ground-truthing. Results were compared to previous FVRD and provincial watershed delineations as a check.

Subcatchments and their general characteristics divide into the following categories:

- Eastern Mountain Slopes.
- Midlands.
- Mission Uplands.
- Hatzic Prairie / floodplain.

A summary of the typical subcatchment characteristics for these areas is included in **Table 5-1**, below.

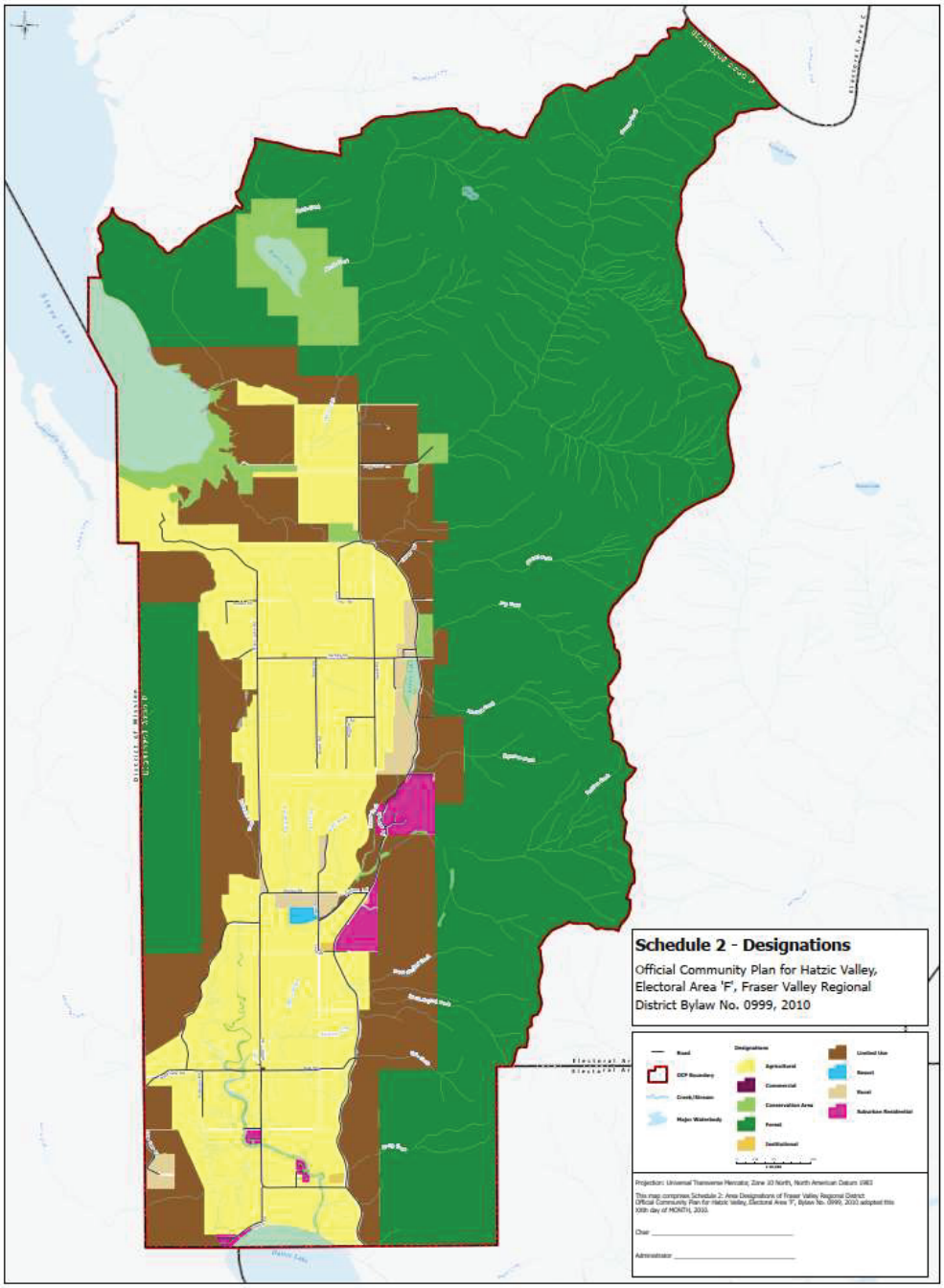
Table 5-1 Subcatchment Characteristics By Watershed Category

Watershed Type	Average Slope (%)	Minimum Elevation (m)	Maximum Elevation (m)	Average Elevation (m)	Total Area (km^2)	Primary Land Cover
Eastern Mountains	47%	9.2	1354	477	32	Forest
Haztic Prairie	0.7%	0.7	101	5.8	23	Agricultural / Grass
Midlands	11%	6.3	144	92	6	Forest
Mission Uplands	26%	2.1	604	202	21	Forest

The Hatzic Valley slopes are primarily forested (approximately 89%); only the southwest corner of the valley which overlaps Mission has substantially different land use. The valley floor (the midlands and Hatzic Prairie) is a mixture of forest (31.3%), agricultural lands (63.3%) and impervious surfaces (5.4%). Zoning of the valley floor is primarily

agricultural land (marked as yellow on **Figure 5-1**). There are several suburban residential areas on Sylvester Road (purple) and general rural land use areas (light brown) along Durieu Road and Allan Lake in the midlands. Some of the suburban residential areas and general rural land use areas are located in close proximity to steep mountain slopes. The upper mountain slopes themselves are zoned as forest or limited use only.

Figure 5-1 Hatzic Valley Zoning



Surficial soils within the project area reflect the valley's geomorphological history. Mountain slopes, Mission uplands and the midlands are covered in heavy glacial and colluvial deposits. These areas have relatively high infiltration rates, with an estimated maximum of 30 mm/hr for loamy sand. Hatzic Prairie, the historic Fraser River floodplain, has alluvial deposits of fine silts, with lower infiltration rates of 3.3 mm/hr to 6.6 mm/hr for silt loam and loam.

Model Parameters

Watershed model parameters are summarized in **Table 5-2**.

Table 5-2 HEC-HMS Model Parameters

Parameter Type	Parameter Selection	Source
Canopy	Simple Canopy	Canopy extents calculated from 2022 LiDAR data. Crop Coefficient = 1.0 Evapotranspiration in Dry Periods only.
Surface	Simple Surface	Initial storage set for each season.
Losses	Green and Ampt	Initial Type: Moisture Deficit Soil characteristics from iMapBC.
Transform	Clark Unit Hydrograph	Time Area Method Constant for all Subasins Time of Concentration calculated from LiDAR data. Storage Coefficient adjusted during validation process.
Baseflow	Recession	Discharge per Area calculated from Lagace Creek flow gauge. Recession constant adjusted during validation process.

Two basins were developed, one with winter antecedent moisture conditions and one with summer conditions. For the winter basin, all surficial soils within the watersheds were assumed to be completely saturated. All initial deficits were set to zero, and infiltration rates were assumed to be negligible throughout the study area due to the continuous rain and high groundwater table. For the summer basin, antecedent moisture conditions were assumed to be completely dry. Typical initial deficits and losses to canopy and surfaces were included for each subcatchment. Infiltration rates were set to the values in keeping with soils mapping.

In-Model Hydraulic Routing

Lag-routing was used to connect the 76 subcatchments present within the model. However, this form of routing is extremely simplified compared to the capabilities of the 2D hydraulic model. It was considered inappropriate for providing any hydraulic routing in the lower reaches of the alluvial fans, Hatzic Slough, Hatzic Lake and the Fraser River floodplain. Those areas experience complex backwater effects which are better represented in a 2D hydraulic model.

Instead, hydrologic modelling of flows was completed for drainage areas upstream of the lower system drainage system. Within the hydrologic model, the lower valley system was allowed to flow freely into a basin sink as an alternative to reservoir routing through Upper and Lower Hatzic Lake. The hydraulic model was then used for routing the model flows to determine water levels and flood extents. This 2D HEC-RAS model can be used to extract design flows and water levels for individual sites.

6 HYDRAULIC MODEL BUILD

Software

The United States Army Corps of Engineers (USACE) HEC-RAS 2D modelling software Version 6.3 was used to analyze the Hatzic Valley drainage system hydraulics. HEC-RAS is an industry standard software used to perform one-dimensional steady flow, 1- and 2-dimensional unsteady flow calculations, sediment transport/mobile bed computations, and water temperature/water quality modelling. The 2D module was used due to following:

- Drainage system complexity.
- Multiple flow paths, flow directions and inflow sources.
- Extensive lowland ponding and backwater effects.

Model Spatial Extents

The 2D hydraulic model extents are limited to the Hatzic Valley basin that drains into the Fraser River and shown in Map Figure 4 of **Appendix A.** The northern limits of the model are north of Allan Lake and its tributary area. The west and east extents of the model are the base of the mountain slopes on both sides of the Hatzic Valley and the southern (downstream) limit is the Fraser River. It should be noted that this 2D hydraulic model does not currently include the project site (S-CR-28) on Carratt Creek as it drains north into Stave Lake. Carratt Creek may be added if additional works are contemplated which require hydraulic modelling.

Terrain

The Digital Elevation Model (DEM) surface was constructed using LiDAR (2022), topographic survey of hydraulic structures and bathymetry (see **Section 3**). As part of the DEM construction, additional terrain modifications were completed. These modifications included topography around bridge decks, roadway and culvert locations, and tie in locations between LiDAR and the survey.

Surface Roughness

Manning's roughness (n) values were assigned to the terrain based on land cover which was defined using the LiDAR data, FVRD road mapping and the 2022 / 2023 aerial imagery. The adopted roughness values are summarized in **Table 6-1.**

Table 6-1 Manning's Roughness Coefficients

Land Cover Classification	Manning's Roughness (n)
Trees	0.120
Bare Earth	0.035
Range	0.045
Developed	0.035
Crops	0.050
Water/Flooded	0.035

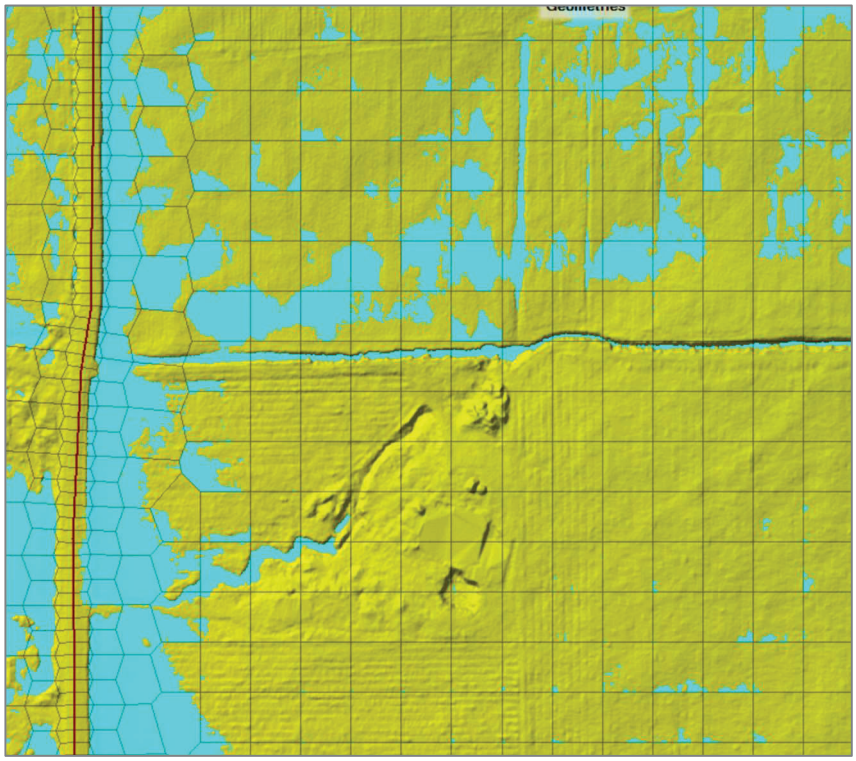
Hydraulic Structures

Bridges and culverts throughout the valley were included within the model. A total of 42 structures were modelled. A complete list of the structures, location descriptions and model notes are included in Table 1 of **Appendix C**. The table lists the hydraulic structures from north to south. The model also included dike drainage infrastructure, specifically the five pumps and four flood boxes which cross the Fraser River dike. Hydraulic structures are also identified on maps in **Appendix A.**

2D Mesh Development

The 2D flow area was generally represented by 5 m x 5 m cells within the creek channels and 20 m x 20 m cells within the floodplain. Additional refinements were made along roadways, dikes, and other important terrain features at varying cell sizes to describe these features. Smaller cells were also used at the 1D/2D connection points for hydraulic structures (i.e., bridges, culverts). Due to the nature of HEC-RAS mesh, which uses a Finite-Volume solution scheme and implicit mesh design, large mesh cells still retain detail from the far more refined 0.5 m x 0.5 m DEM surface which is derived from the LiDAR data. **Figure 6-1** shows a sample of the developed mesh within the Hatzic Prairie, with detailed surface drainage conveyance and ponding within each mesh cell.

Figure 6-1 Hydraulic Model Mesh with Sub-Cell Details



Computational Settings

The model was simulated with unsteady flows conditions (i.e. where flow changes with time) using a full momentum method, specifically the Shallow Water Equations, Eulerian-Lagrangian Method (SWE ELM) equation set. A time step of 0.5 seconds was used for all model runs. Simulation durations varied depending on the flood event and are summarized in **Table 4-1**.

Boundary Conditions / Initial Conditions

The boundary and initial conditions applied within the developed model varied with each modelled flood scenario. These conditions are summarized in **Table 4-1**.

Model Assumptions and Limitations

A variety of assumptions and simplifications were made during the model build due to information limitations. These are listed below.

Survey and LiDAR Assumptions

- Due to the depth of water, safety, and accessibility at some bridge and culvert locations during survey.
  - Photos were used to estimate locations and sizing of abutment and piers.
  - Inverts were occasionally estimated based on top of culvert shots and dimensions obtained during survey.
  - Some culvert ends could not be accessed (upstream or downstream side inaccessible). Therefore, alignment and length of culvert, as well as missing invert elevations were estimated based on aerial imagery and LiDAR.
- Channels inverts were full of water and vegetation when LiDAR was flown. Some elevations differed between LiDAR and survey for the channel and culvert inverts.
  - Terrain alterations was implemented to smooth the transition between the estimated true ground below the water surface in LiDAR and inverts within the model where necessary.
- In locations where there are minor drainage crossings (culvert etc.) beyond the scope of survey and our analysis, the terrain was altered to create an opening and allow flow to pass through.
- The flood boxes that separate Fraser River and Lower Hatzic Slough were not surveyed. Therefore, the locations of the flood boxes were estimated using the LiDAR and aerial imagery. Flood box dimensions and invert elevations were obtained from the *Operations Manual – Hatzic Lake Slide Gates*.

Due to the above noted assumptions and limitations, it is important that further model validation occur during concept design to confirm model validity as well as additional sediment deposition and bank erosion, if any, which occurred after the survey.

Hydraulic Conveyance

- Hydraulic model extents and model mesh do not extend up the valley mountain slopes. The mesh was extended only as far as necessary to avoid the impediment of flood extents.
- Due to the limited height of the existing dikes, it was not possible to run future Freshet values with SLR without overtopping the existing dike crest elevations within the modeland flooding the valley. Instead, a constant value of 8.77 m was used to represent both Freshet scenarios; this is sufficient to keep the flood boxes closed and generate reasonable estimates of internal flood levels and extents.
- Due to lack of detailed pump curve characteristics, pumps representation within the model was simplified. Each pump was simulated with a constant flow at its maximum pumping capacity, regardless of elevation head.

7 MODEL VALIDATION

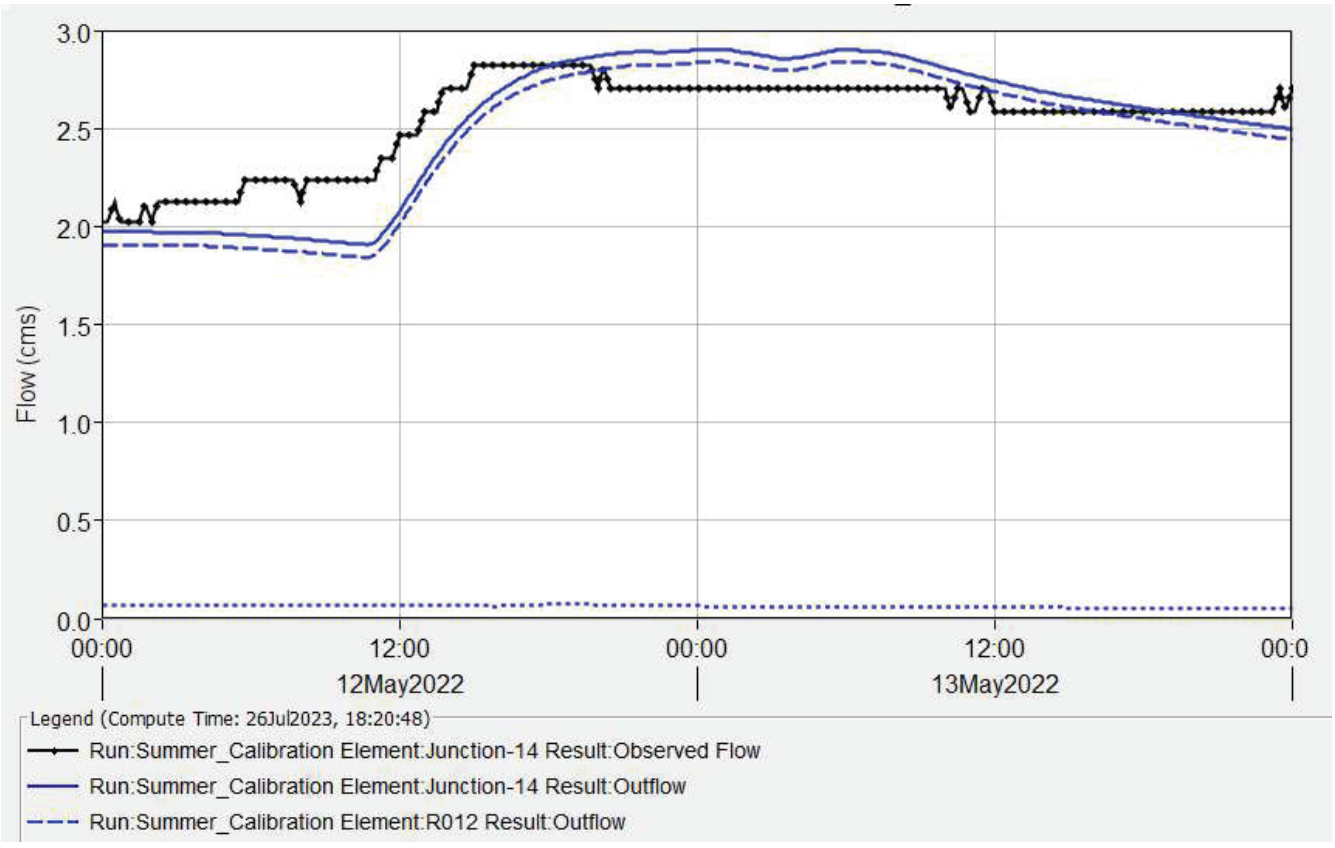
7.1 Hydrologic Model (Design Flows)

The summer condition model for Hatzic hydrologic modelling and summer design flows was validated using a summer storm from May 2022. Daily precipitation was taken from the Mission West Abbey climate station and used to scale hourly data from Agassiz RCP. This rainfall applied to the summer condition model. Results were compared to hydrometric data at the Lagace Creek hydrometric station at the Farms Road Bridge.

The purpose of this validation is to assess the level of confidence in the hydrologic modelling of the eastern mountain ranges and midland reaches of the Hatzic Valley. However, flow gauging data was only available for a two-year period of record; the selected validation event only has a return period of 1.25 years. If possible, future calibration should be undertaken using a much larger event is recommended for future calibration in order to obtain a more reliable estimate of the rainfall-runoff response.

There is very good volume and peak flow agreement between the hydrologic model results and the observed data at Lagace Creek at the northernmost Farms Road bridge crossing. Model results include a peak discharge of 2.9 m^3/s and total event volume of 431,000 m^3. Observed flow gauge has a peak discharge of 2.8 m^3/s and a volume of 440,200 m^3, a difference in total event volume of 2%.

Figure 7-1 Hydrology – Summer Basin Validation



There is a discrepancy in the timing of the response of the peak of approximately six hours. However, HEC-HMS's hydraulic routing is simplistic. To overcome this limitation, summer design flows were entered into the hydraulic model at the downstream extents of the modelled watersheds to utilize the much more accurate routing in the 2D model.

Winter Validation Event (2021 ARE)

The winter condition model for Hatzic hydrologic modelling was validated using the 2021 ARE event. Daily precipitation was taken from the Mission West Abbey climate station and used to scale hourly data from Agassiz RCP. This rainfall was run through the winter basin model. Results were compared to hydrometric data at the Lagace Creek hydrometric station at the Farms Road Bridge.

The purpose of this validation is to assess the level of confidence in the modelling of the eastern mountain ranges and midland reaches of the Hatzic Valley. However, there are several challenges with this observed data:

- The Lagace Creek gauge rating curve developed by FVRD covers only relatively small flow events. The 200 year ARE is well in excess of the rating curve making approximate flow estimates difficult.
- The ARE was an extremely large event with high volumes of sediment transport and significant sediment deposition. It is likely that bed load was suspended through this event and there were continuous substantial bedform changes, further decreasing the accuracy of the Lagace Creek rating curve.
- Emergency reporting from adjacent property owners and post-ARE aerial imagery (see **Figure 7-2**) show that water broke through the berm to the south side of the creek, diverting across the fields to the southwest and circumventing the Lagace Creek gauge at Farms Road.
- The berm on the south side of Lagace creek between Seux Road and Farms Road is not an engineered dike, has a variable crest height and width and is likely made of excavated gravel (e.g., permeable) materials. It is likely that a large volume of water seeped through the dike during the event as well.

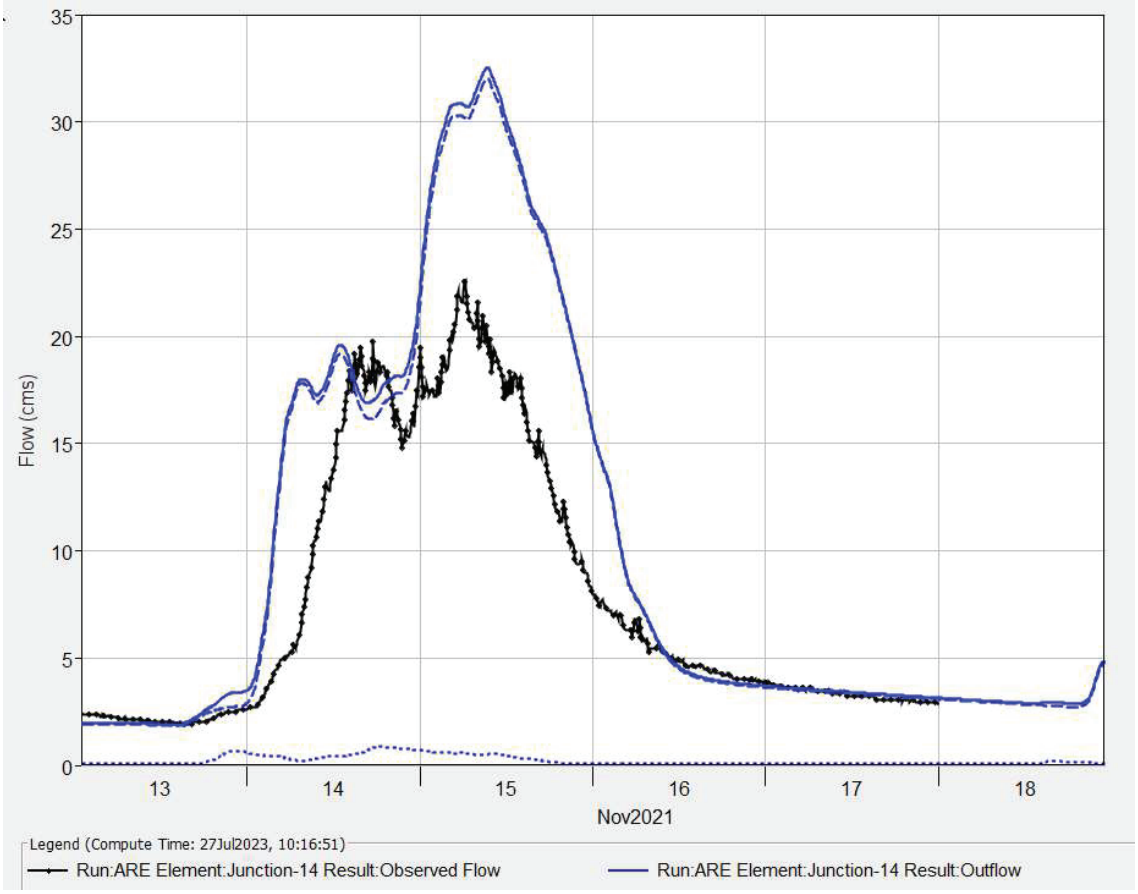
Figure 7-2 Lagace Creek Berm Breach and Evidence of Flow Diversion Around Farms Road Bridge



As a large portion of the flow was diverted around the Lagace Creek gauge, no attempt was made to calibrate the model flows to the gauge peak. Model results for the 2021 ARE include a peak discharge of 32.5 m^3/s and total event volume of 5,000,000 m^3. The observed flow gauge has a peak discharge of 22.6 m^3/s and a volume of 3,400,000 m^3. Accordingly, the model shows 148% of the observed volume at this crossing, which is considered acceptable due to the challenges with the gauge measurements and the observed flooding outside of the channel as discussed above.

Groundwater behavior, as well as of the timing of the peak are similar for both the gauge and modeled flows (**Figure 7-3**). Total ARE volumes for the entire Hatzic Lake Watershed were assessed using the 2D hydraulic model and Hatzic Lake DAID operations data. Results suggest that the model overestimates volumes during a four-day simulation of the ARE by about 12%. This is discussed further in the hydraulic validation section below.

Figure 7-3 Hydrology – Winter Basin Validation



Regional Analysis Flow Validation

In order to confirm peak instantaneous flows for the small, very steep eastern mountain watersheds of the Hatzic Valley, model results for six of these watersheds were compared to a flow frequency analysis for the ECCC hydrometric station MacKay Creek at Montroyal Boulevard. This hydrometric station was selected due to its proximity, similar drainage size, similar elevation range, and steep slopes. Station information is summarized in **Table 7-1** below. Comparisons of the peak instantaneous flows from the watersheds within the model to the Montroyal regional analysis are included in **Table 7-2**.

Table 7-1 Station Information for MacKay Creek at Montroyal Boulevard

Characteristic	MacKay Creek at Montroyal Boulevard
ID	08GA061
Lat	49°21'22" N
Long	123°05'59" W
Drainage Area (km2)	3.63
Highest Elevation (m)	1070

Characteristic	MacKay Creek at Montroyal Boulevard
Lowest Elevation (m)	150
Avg Slope (%)	26.80%
Years of Data	22

Table 7-2 Comparisons of Mountain Peak Instantaneous Flows

Watershed Name	Site Number	Watershed Number	Regional Analysis Flow Estimate (using MacKay Creek data) with 51% CC		Modelled Flow Results (with CC)		Comparison (%)	
			10-year	200-year	10-year	200-year	10-year	200-year
Eng Creek	SCR_36	S106	9.67	19.23	11.3	16.8	86%	114%
McNab	SCR_35	S112	7.06	14.05	8.4	12.5	84%	112%
Carratt	SCR_28	S103	11.85	23.57	14.1	21.0	84%	112%
Pattinson	SCR_12	S121	20.85	41.47	23.7	35.1	88%	118%
Legace Trib	SCR_17	S116	6.04	12.01	7.2	10.8	84%	111%

There is good agreement between the model and the flows at the MacKay Creek gauge (our model is estimating 15% lower than the flow gauging data for a ten-year and 14% higher for a 200-year).

7.2 Hatzic Valley Hydraulic Model

The November 2021 ARE historical event was modelled to compare the performance of the 2D hydraulic model to the real event. ARE flows were developed within the hydrologic model and then applied within the 2D hydraulic model.

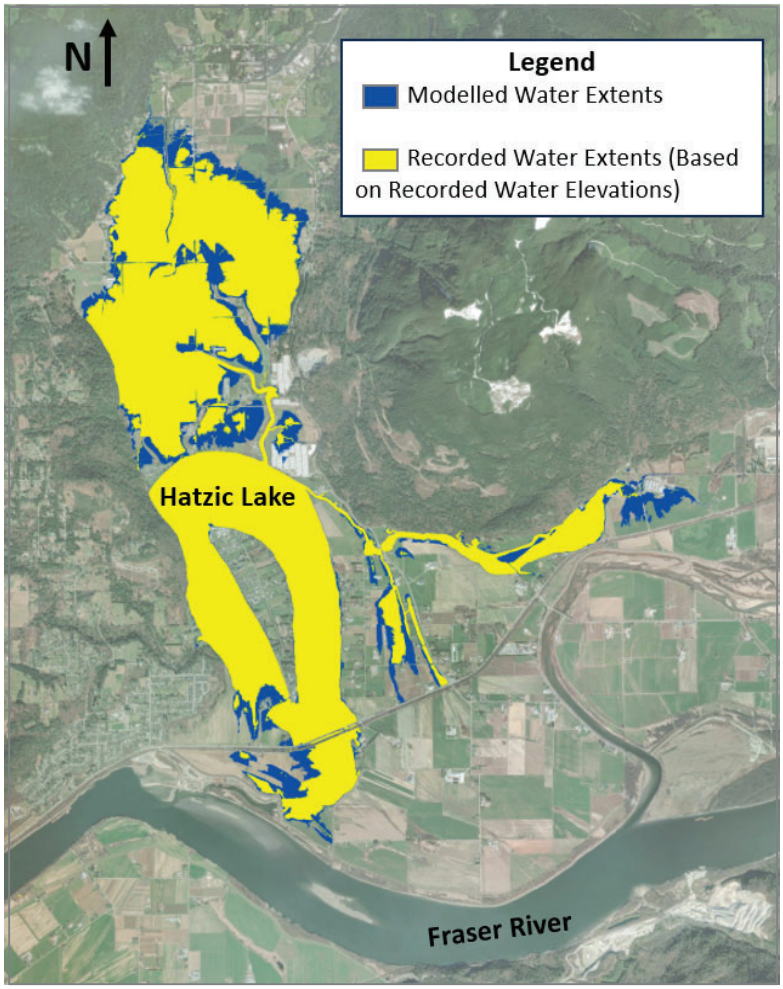
Model results were compared to WSE records for Upper Hatzic Lake and Lower Hatzic Lake collected by DAID staff. WSEs were recorded two to four times a day during the event, however, the exact times of measurement were not recorded. Records also included pump on and off times and the open and closing of the flood boxes.

Water Levels and Flood Extents

Modelled average daily WSEs on the Upper and Lower Hatzic Lake were compared to the recorded data. Results showed very good agreement and nearly identical levels (different in water level of 4 cm or less) for the first 48 hours of the storm. However, as peak flood volumes reached the Hatzic Lake, the values began to diverge. At the peak of flooding, recorded levels within the lake reached approximately 4.1 m CVGD, while the maximum level in the model was approximately 4.7 m CVGD.

A comparison of daily average water levels was used to estimate a total volume discrepancy of 12% over the course of the five-day ARE analysis. The maximum difference in lake levels of 0.6 m resulted in an overestimation of impacted flood areas of approximately 14%. The difference in maximum flood extents based on Hatzic Lake water surface elevations between the model and the recorded data is show in **Figure 7-3**, below. This difference in modelled versus observed events was considered reasonable and conservative given the limited hydrologic data and modelling uncertainty. Additional hydrologic and hydrometric monitoring could be used to improve model calibration results, if desired.

Figure 7-4 Maximum Water Elevation Extents During the ARE - Model vs Recorded Lake Levels



8 RESULTS

Flood extents mapping for all four of the design flood scenarios are shown in the map figures in **Appendix A.**

The modelling results, presented in the **Appendix A** figures, replicate observed flood progression following heavy rainfall events. Generally speaking, this results in the following sequence of events:

- Rainfall, potentially combined with snowmelt, results in runoff across the valley.
- Increased stream flow within the mountain slopes results in sediment and debris mobilization which is transported downstream. The coarser material (e.g. gravels, cobbles and boulders, etc.) is deposited within the alluvial fans while floatable debris and finer material (e.g. clays, silts, and sand) are carried further downstream.
- Channel avulsions and elevated flood levels may occur through the system depending on the volumes of mobilized sediment and debris.
- Low-lying agricultural areas north of Dale Road appear to flood first. These areas have poor stream confinement and also have ground elevations below key Hatzic Lake flood elevations.
- The flooding extents within the low-lying agricultural areas are influenced by two main factors:
    - Runoff volumes from upstream.
    - Hatzic Lake levels.
- Hatzic Lake levels are influenced primarily by three main factors:
    - Upstream inflows which are typically attenuated by flooding within the low-lying agricultural areas.
    - Pumping capacity.
    - Floodbox capacity resulting from differential water levels between Hatzic Lake and the Fraser River.

Limitations Due to Sediment Deposition / Removal

This assessment was completed using the topographic and channel information available in November and December 2022. We expect that future sediment deposition, sediment transport, bank erosion, channel avulsions, site restoration and activities by local residents will result in changes to the topography. As a result, important information should be validated to confirm that it is appropriate for subsequent analysis and concept design activities.

Climate Change Implications

The hydraulic results for the 200-year winter climate change flood scenario, presented in **Map Figures 44 to 56**, show extensive flooding across the Hatzic Valley. There are two key climate change factors which influence the increased flooding; increased precipitation volumes and sea level rise.

The 51% increase in precipitation results in larger volumes of runoff during the design storm events. However, the pump station capacity in the model reflects current pump capacities which are no longer adequate to protect infrastructure based on the climate change projections and watershed analysis.

The increase in sea level results in higher Fraser River winter flood levels which in turn further reduces the duration of flood box opening. As a result, the Hatzic Valley will become increasingly dependent on pumping in order to protect low-lying areas and infrastructure.

Suggestions for Future Calibration

The climate change analysis has been completed based on currently available data. We anticipate that additional refinement may be possibly through the following tasks:

- Long-term (e.g. years) flow monitoring, lake level monitoring and rainfall data collection at multiple locations.
  - Collection of this data may be used for calibrating the rainfall-runoff response which in turn influences total runoff volumes.
  - A preliminary sensitivity assessment may be appropriate to determine the expected range of runoff response from flow monitoring refinement and its potential influence on infrastructure upgrades.
  - The current model is over estimating runoff volumes by about 12%. Reducing this value would result in a reduction in infrastructure requirements for future flood protection.
  - Current runoff response modelling has been completed using professional judgement and represents the standard approach for runoff estimation for similar circumstances.
- Fraser River hydraulic analysis, using the existing Lower Fraser River hydraulic model to further refine the tidal cycles during the winter design storms. This activity is expected to cost significantly less than flow monitoring and also require significantly less time. At present due to schedule and budget limitations, we have simply shifted the observed ARE event Fraser River levels up by 0.56 m as a simplified approach in order to account for projected increases to due SLR.

Both of these activities are intended to reduce uncertainty in the model results and provide increased confidence in the subsequent infrastructure needs assessment.

9 FUTURE USE OF THE MODELLING TOOLS

The hydrologic and hydraulic models were assembled with the data that was available in the fall of 2022. We expect topographic and bathymetric changes throughout the watershed for various reasons, including:

- Landslides, debris flows, and debris floods which affect the mountain slopes, alluvial fan areas and downstream watercourses, including Hatzic Lake.
- Sediment and debris deposition within watercourses and within overbank areas.
- Channel modifications, including flood recovery activities, as well as unregulated:
  - Sediment import and placement.
  - Sediment removal.
  - Channel and berm modifications.
- Drainage infrastructure modifications.

The above noted issues will result in changes to the topography and the watercourses over time, including channel capacity. As a result, model users are responsible for using engineering judgment and for collecting additional information, where appropriate, to update and/or verify the suitability of the model within the project area of interest and areas of hydraulic influence.

CERTIFICATION PAGE

This report was prepared for the B.C. Ministry of Environment and Climate Change Strategy to support the Hatzic Valley Emergency Works hydraulic assessment and remediation works and to provide a wholistic assessment of the drainage system.

The services provided by Associated Engineering (B.C.) Ltd. in the preparation of this report were conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions. No other warranty expressed or implied is made.

Respectfully submitted,
Associated Engineering (B.C.) Ltd.
Engineers & Geoscientists BC Permit Number 1000163



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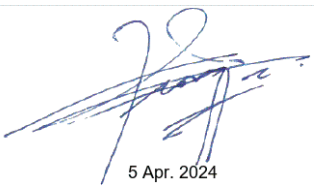
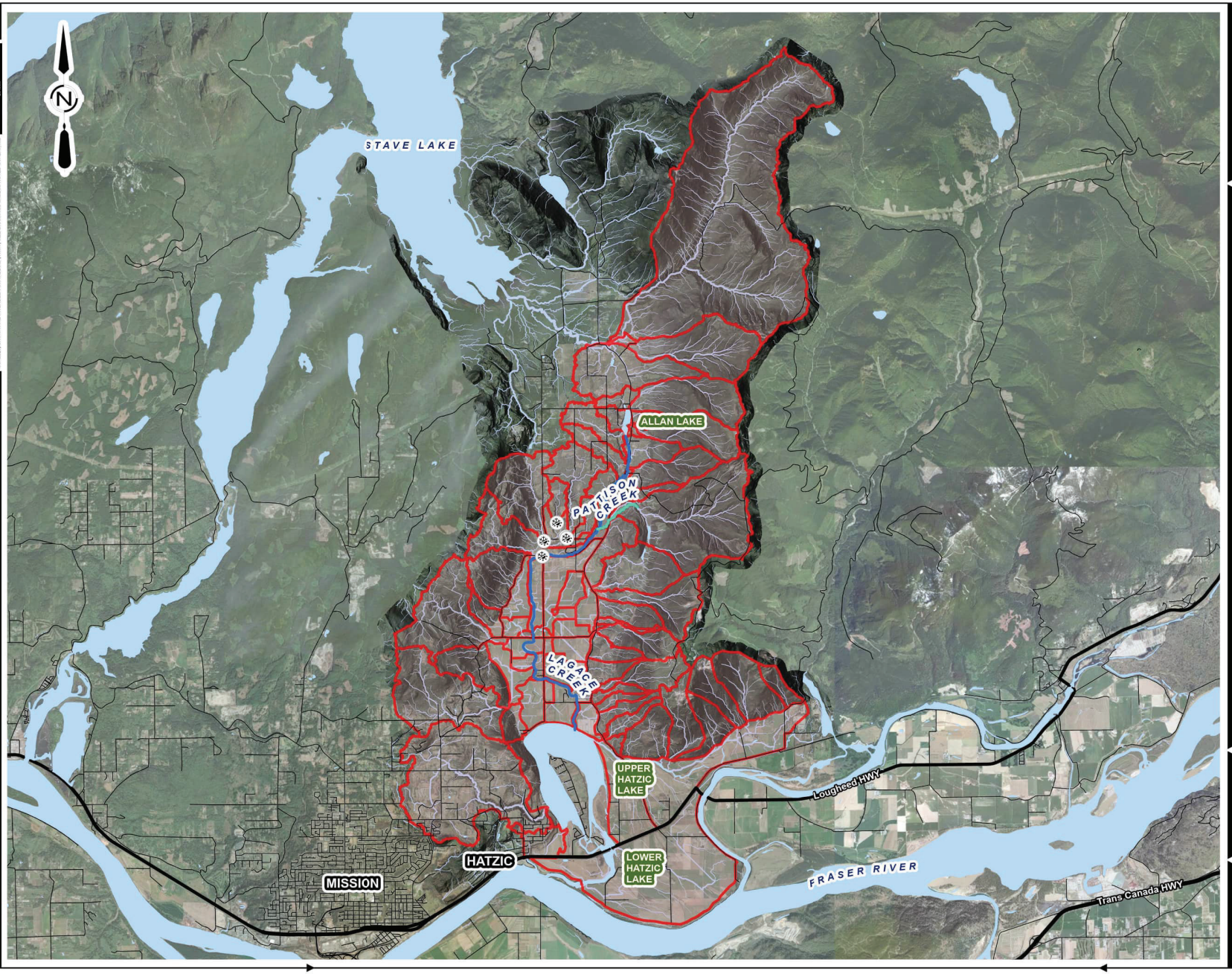


Akinbola George, M.A.Sc., P.Eng.
Senior Water Resources Engineer
Hydraulics Review

APPENDIX A – MAP FIGURES



Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

- HYDROMETRIC STATION
- WATERSHED
- LAGACE CREEK
- PATTISON CREEK
- LAKES AND RIVERS
- PRIMARY ROADS
- MINOR ROADS

STREAM ORDER

- LOWER VOLUMETRIC FLOW
- HIGHER VOLUMETRIC FLOW

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 1

BC MINISTRY OF ENVIRONMENT
AND CLIMATE CHANGE STRATEGY

CIVIL
WATERSHEDS
OVERVIEW

AE PROJECT No.	20222632-00
SCALE	1:90,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 0.5 1 2 3 Kilometers

IF NOT 25 mm ADJUST SCALES
23 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

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SAVE DATE: 2024-03-22 3:07 PM SAVED BY: JORDON ROZON
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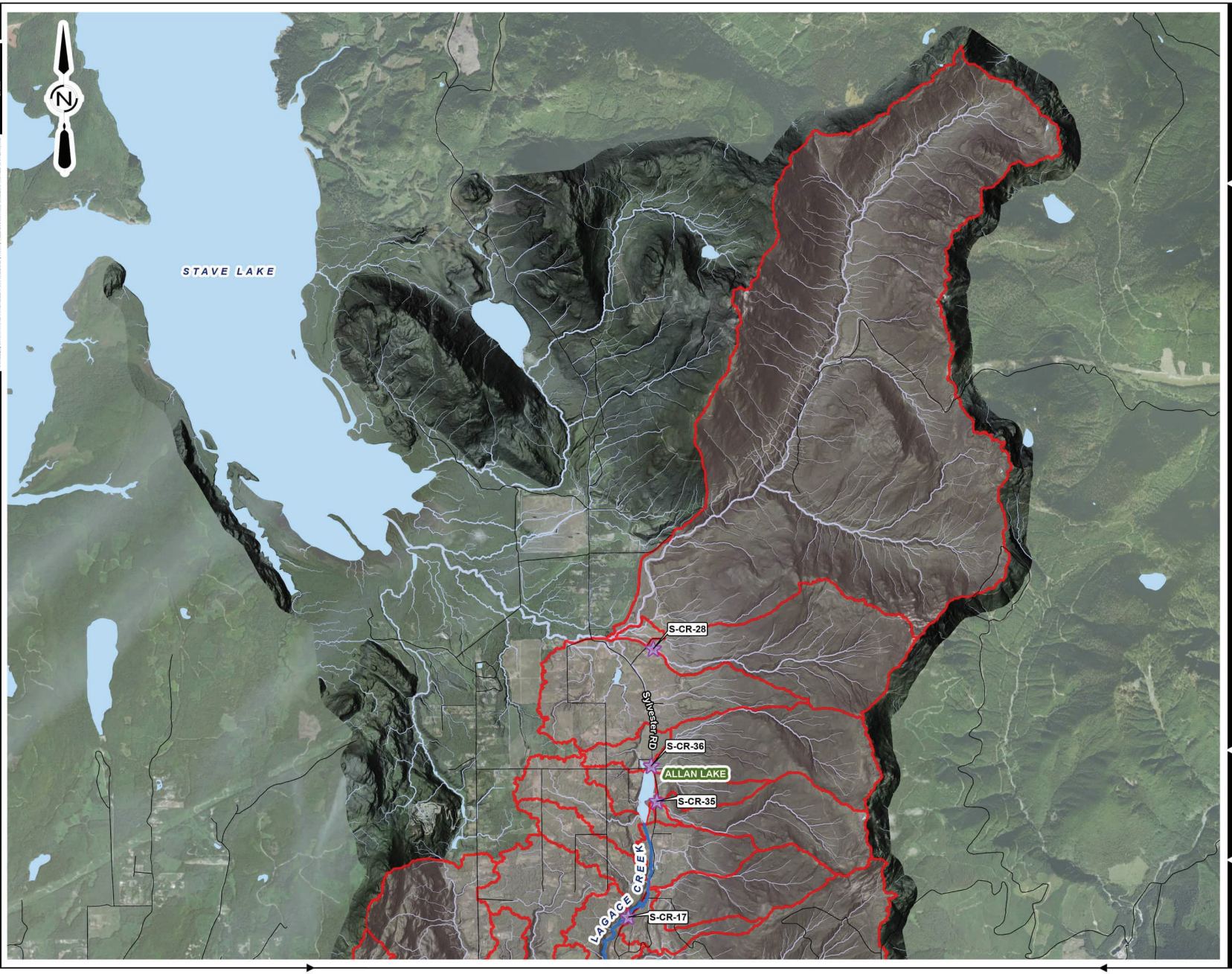

Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

- HYDROMETRIC STATION
- WATERSHED
- LAGACE CREEK
- PATTISON CREEK
- LAKES AND RIVERS
- PRIMARY ROADS
- MINOR ROADS

STREAM ORDER

- LOWER VOLUMETRIC FLOW
- HIGHER VOLUMETRIC FLOW



BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 2

BC MINISTRY OF ENVIRONMENT
AND CLIMATE CHANGE STRATEGY

CIVIL
WATERSHEDS
UPPER REGION

AE PROJECT No.	20222632-00
SCALE	1:45,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 220 440 880 1,320 1,760 Meters

IF NOT 25 mm ADJUST SCALES 23 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 2024-04-03 3:10 PM
SAVE DATE: 2024-03-22 3:10 PM SAVED BY: JORDON ROZON
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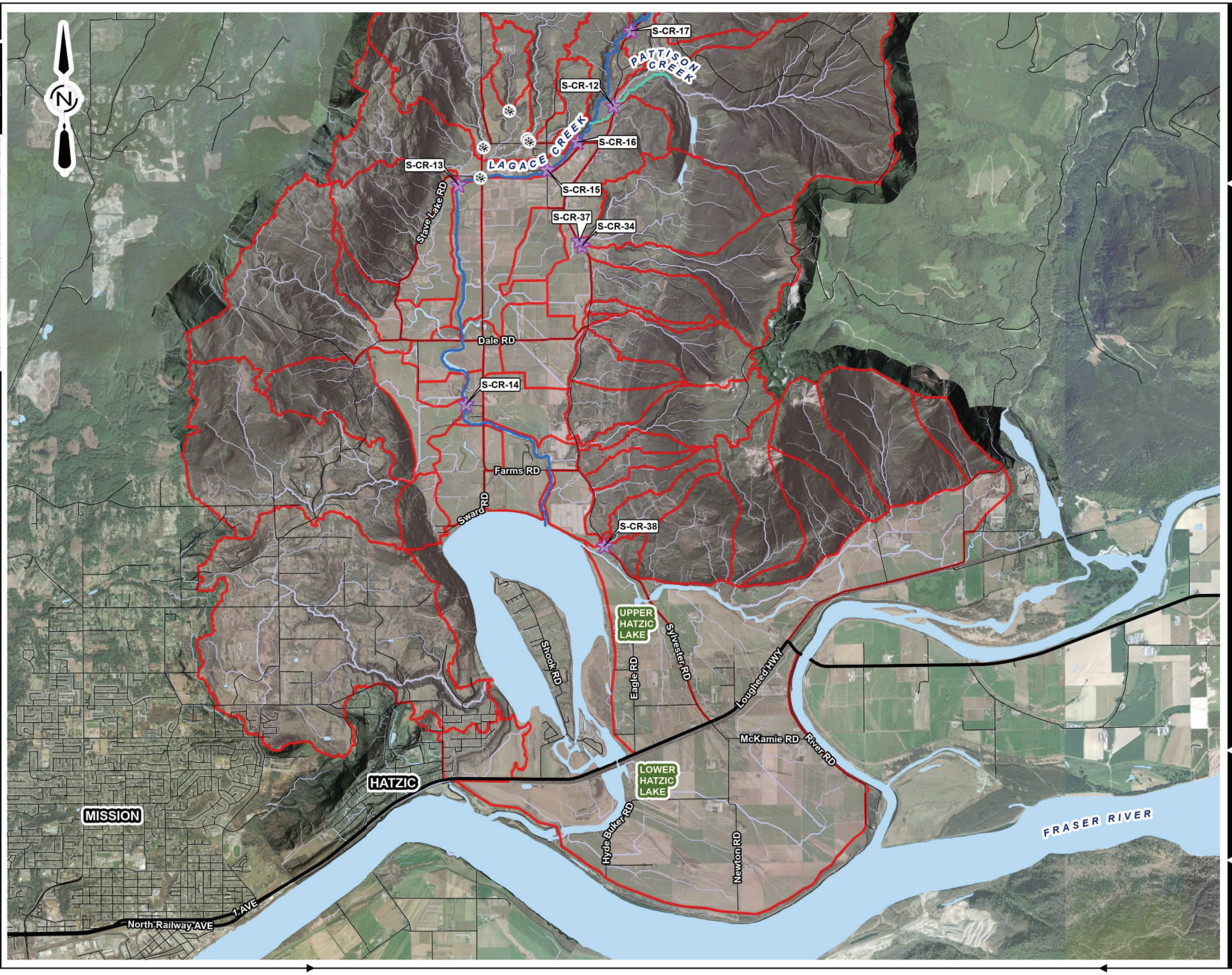


Associated Engineering

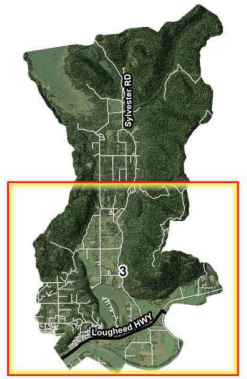
BEST MANAGED COMPANIES
Platinum member

LEGEND:

- HYDROMETRIC STATION
- WATERSHED
- LAGACE CREEK
- PATTISON CREEK
- LAKES AND RIVERS
- PRIMARY ROADS
- MINOR ROADS

STREAM ORDER

- LOWER VOLUMETRIC FLOW
- HIGHER VOLUMETRIC FLOW



BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 3

BC MINISTRY OF ENVIRONMENT
AND CLIMATE CHANGE STRATEGY

CIVIL
WATERSHEDS
LOWER REGION

AE PROJECT No.	20222632-00
SCALE	1:45,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 220 440 880 1,320 1,760 Meters

IF NOT 25 mm ADJUST SCALES 25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 2024-04-03 3:12 PM
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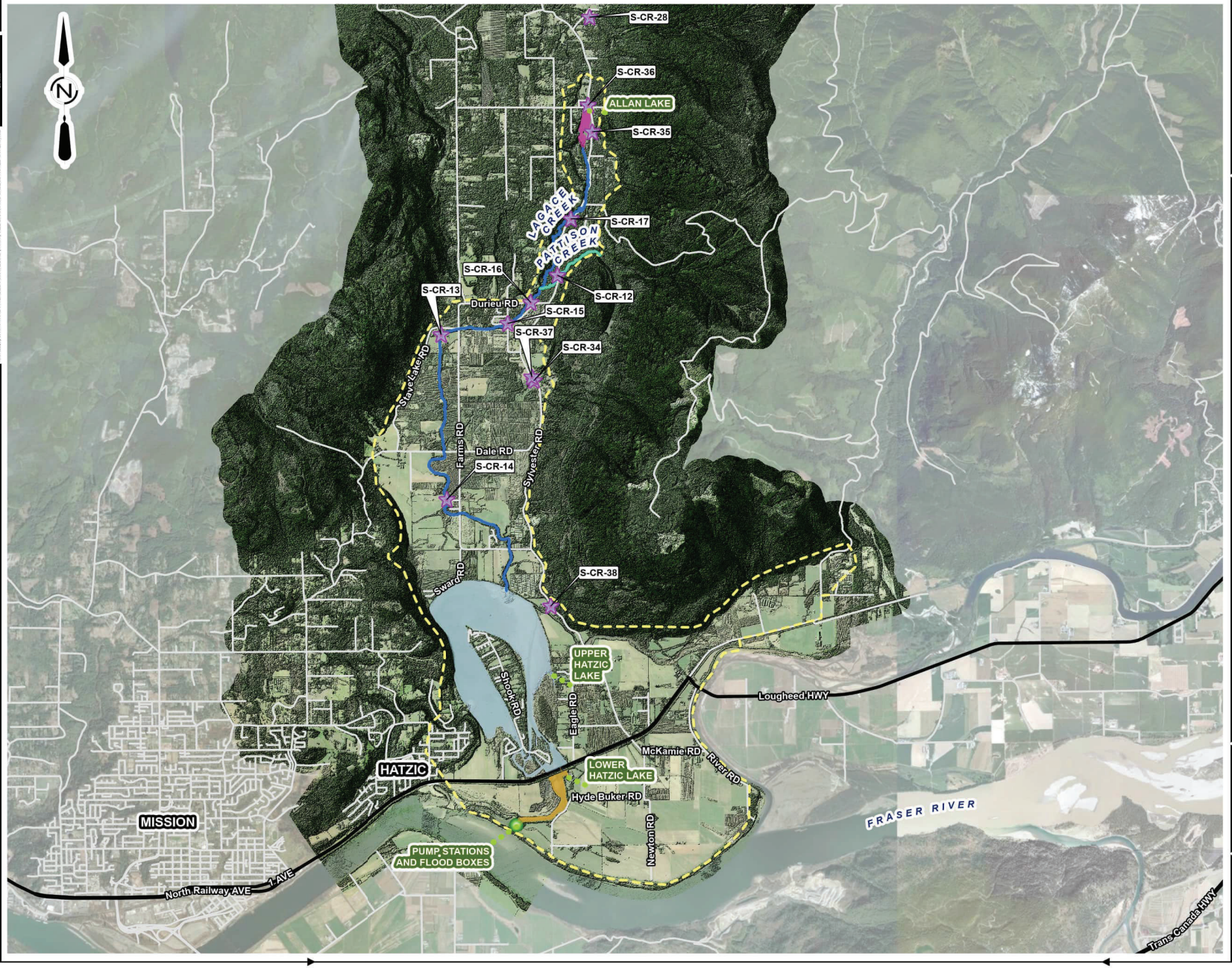


Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

- SITE LOCATIONS
- PUMP STATIONS AND FLOOD BOXES
- LAGACE CREEK
- PATTISON CREEK
- ALLAN LAKE
- UPPER HATZIC LAKE
- LOWER HATZIC LAKE
- 2D MODEL EXTENTS
- PRIMARY ROADS
- MINOR ROADS

NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 4

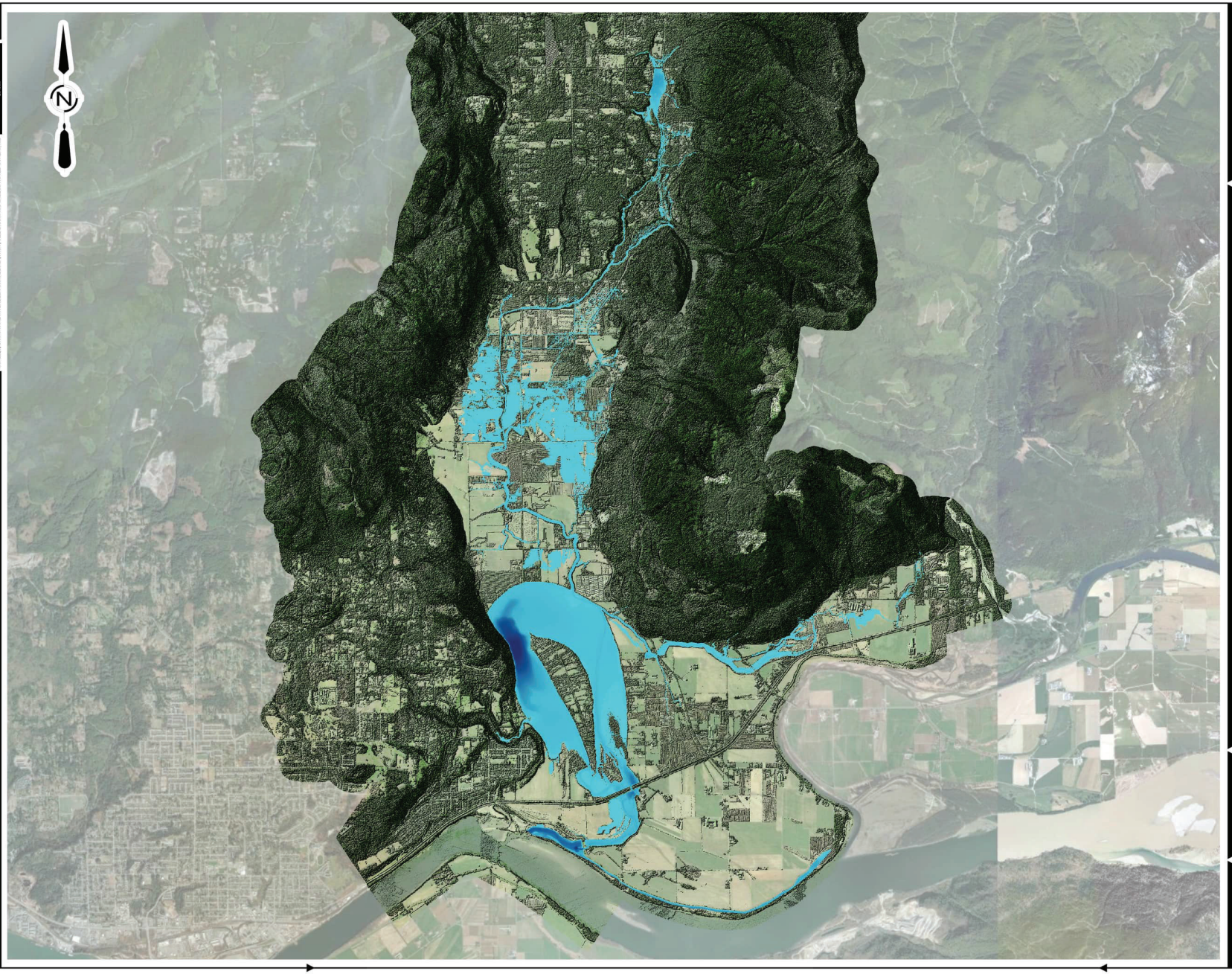
BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

PROJECT AREA EXTENTS OVERVIEW

AE PROJECT No.	20222632-00
SCALE	1:60,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

PLOT DATE: 2024-04-03 3:20 PM
SAVE DATE: 2024-03-22 3:20 PM SAVED BY: JORDON ROZON
DWG PATH: \\ae.ca\data\working\van\2022-2632-00\gis\analysis\2022-2632 - Hatzic Emergency Works\2022-2632 - Hatzic Emergency Works.aprx

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE
IF NOT 25 mm ADJUST SCALES
25 mm



Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH SUMMER 10 YEAR 5 DAY

DEPTH

17.0 m

0.0 m

SITE LOCATIONS

BRIDGE

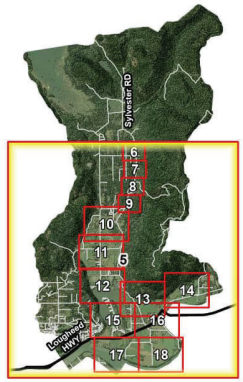
WEIR/GATE/CULVERT

PRIMARY ROADS

MINOR ROADS

BUILDINGS

2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 5

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

SUMMER 10-YEAR 5-DAY DESIGN EVENT MAXIMUM FLOOD EXTENT AND DEPTH

AE PROJECT No.	20222632-00
SCALE	1:55,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 270 540 1,080 1,620 2,160 Meters

IF NOT 25 mm ADJUST SCALES 25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 2024-04-03 4:42 PM
SAVE DATE: 2024-04-03 4:42 PM SAVED BY: JORDON ROZON
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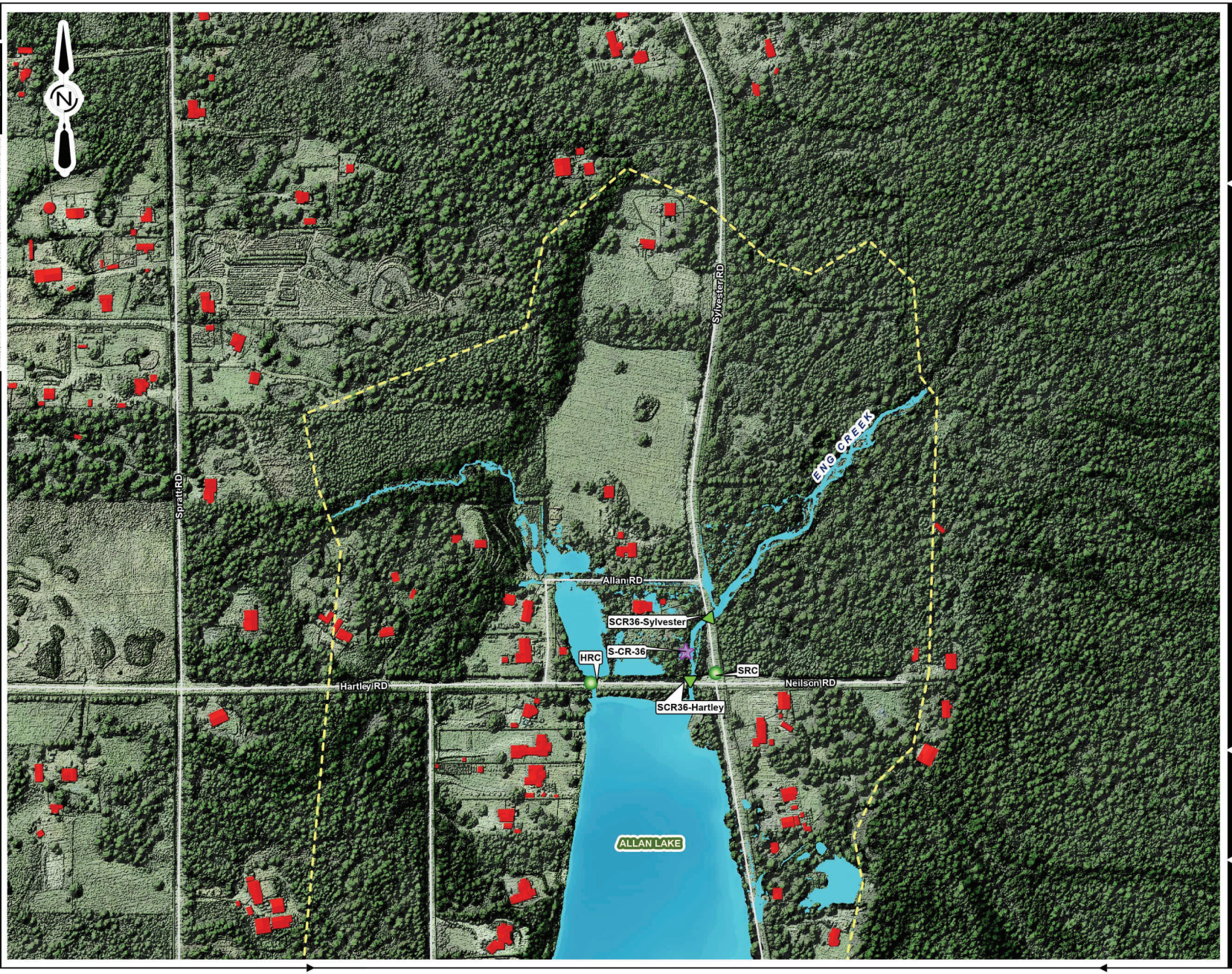


Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH SUMMER 10 YEAR 5 DAY

DEPTH

17.0 m

0.0 m

SITE LOCATIONS

BRIDGE

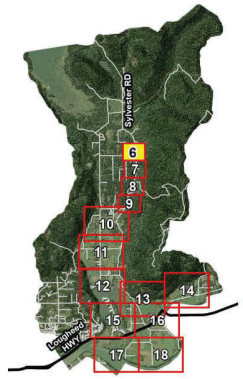
WEIR/GATE/CULVERT

PRIMARY ROADS

MINOR ROADS

BUILDINGS

2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 6

BC MINISTRY OF ENVIRONMENT
AND CLIMATE CHANGE STRATEGY

SUMMER 10-YEAR 5-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

AE PROJECT No.	20222632-00
SCALE	1:4,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 15 30 60 90 120 Meters

IF NOT 279 mm AS LIST SCALES SHOWN
SCALES SHOWN ARE INTENDED FOR TABLOID (11x17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 2024-04-03 4:42 PM
SAVE DATE: 2024-04-03 4:42 PM SAVED BY: JORDON ROZON
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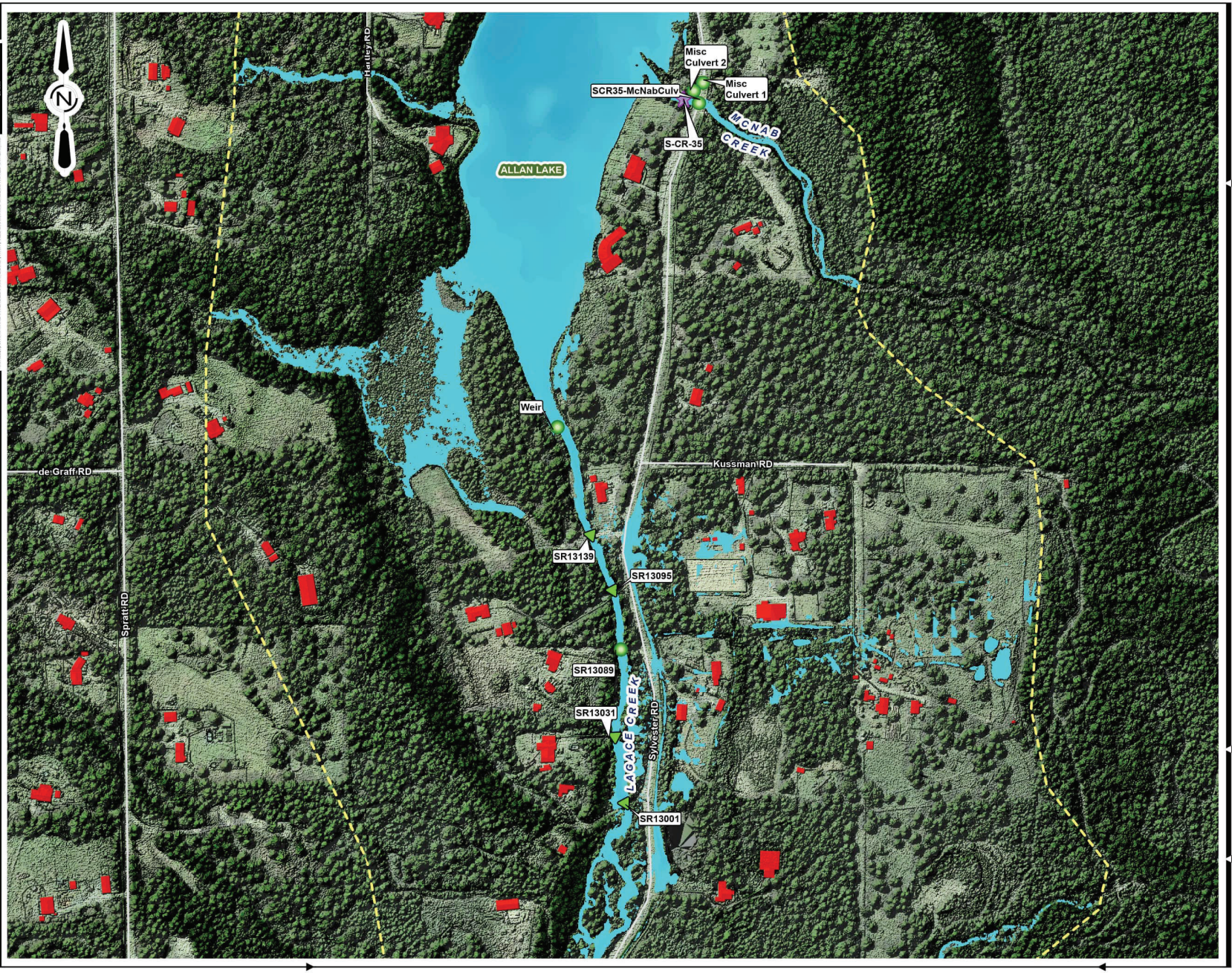


Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH SUMMER 10 YEAR 5 DAY

DEPTH

17.0 m

0.0 m

SITE LOCATIONS

BRIDGE

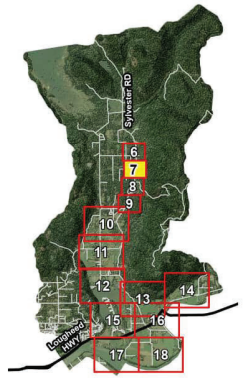
WEIR/GATE/CULVERT

PRIMARY ROADS

MINOR ROADS

BUILDINGS

2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 7

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

SUMMER 10-YEAR 5-DAY DESIGN EVENT MAXIMUM FLOOD EXTENT AND DEPTH

AE PROJECT No.	20222632-00
SCALE	1:4,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 15 30 60 90 120 Meters

IF NOT 25 mm ADJUST SCALES
25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 2024-04-03 4:42 PM
SAVE DATE: 2024-04-03 4:42 PM SAVED BY: JORDON ROZON
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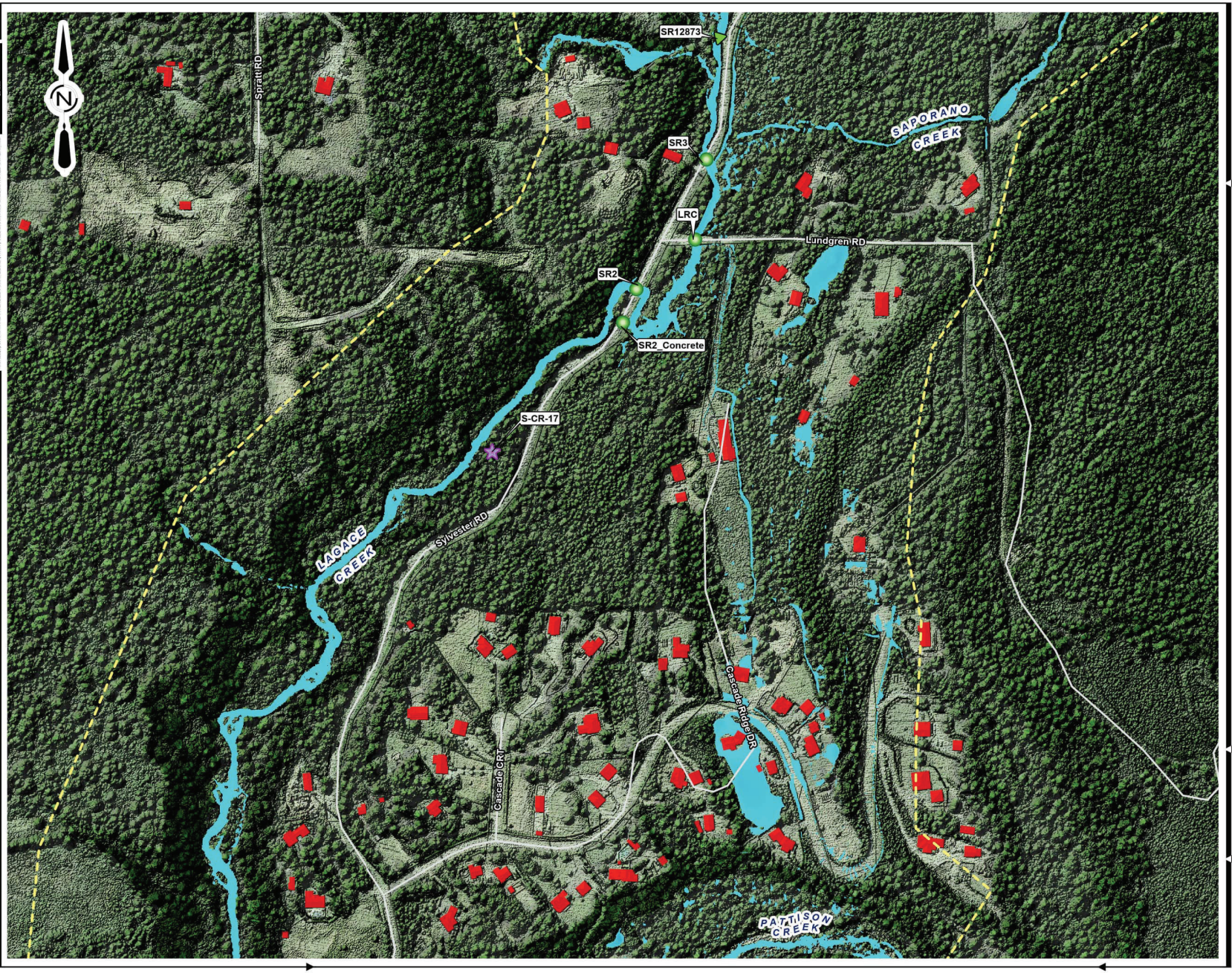


Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH SUMMER 10 YEAR 5 DAY

DEPTH

17.0 m

0.0 m

SITE LOCATIONS

BRIDGE

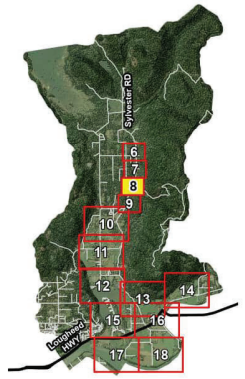
WEIR/GATE/CULVERT

PRIMARY ROADS

MINOR ROADS

BUILDINGS

2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 8

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

SUMMER 10-YEAR 5-DAY DESIGN EVENT MAXIMUM FLOOD EXTENT AND DEPTH

AE PROJECT No.	20222632-00
SCALE	1:4,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 15 30 60 90 120 Meters

IF NOT 279 mm AS LIST SCALES SHOWN
SCALES SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE
PLOT DATE: 2024-04-03 4:43 PM
SAVE DATE: 2024-04-03 4:43 PM SAVED BY: JORDON ROZON
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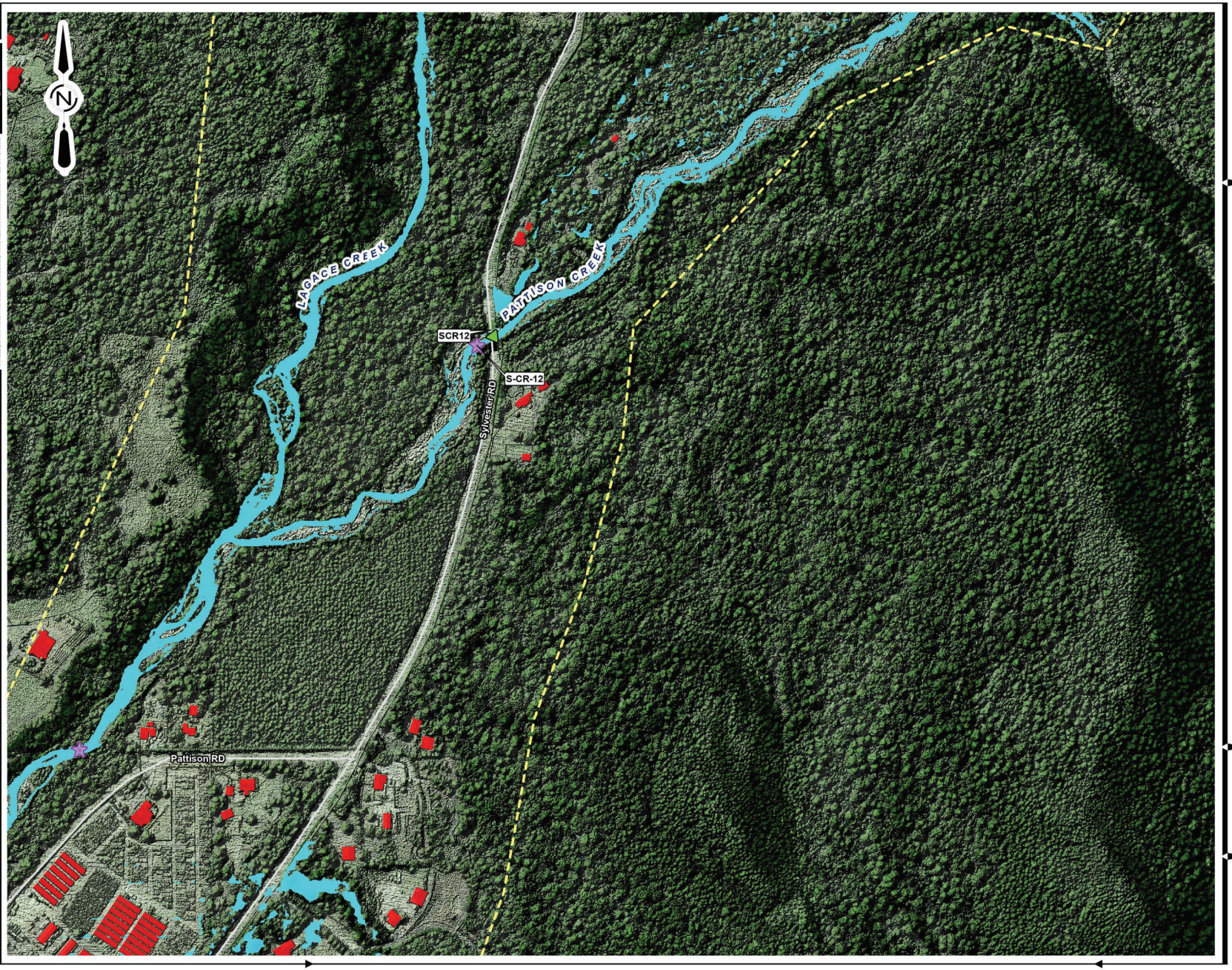


Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH SUMMER 10 YEAR 5 DAY

DEPTH

17.0 m

0.0 m

SITE LOCATIONS

BRIDGE

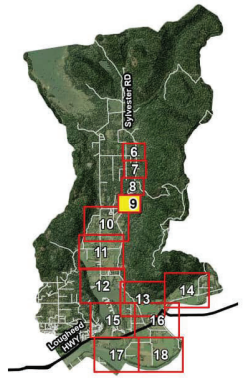
WEIR/GATE/CULVERT

PRIMARY ROADS

MINOR ROADS

BUILDINGS

2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 9

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

SUMMER 10-YEAR 5-DAY DESIGN EVENT MAXIMUM FLOOD EXTENT AND DEPTH

AE PROJECT No.	20222632-00
SCALE	1:4,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 15 30 60 90 120 Meters

IF NOT 25 mm ADJUST SCALES
25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 2024-04-03 4:43 PM
SAVE DATE: 2024-04-03 4:43 PM SAVED BY: JORDON ROZON
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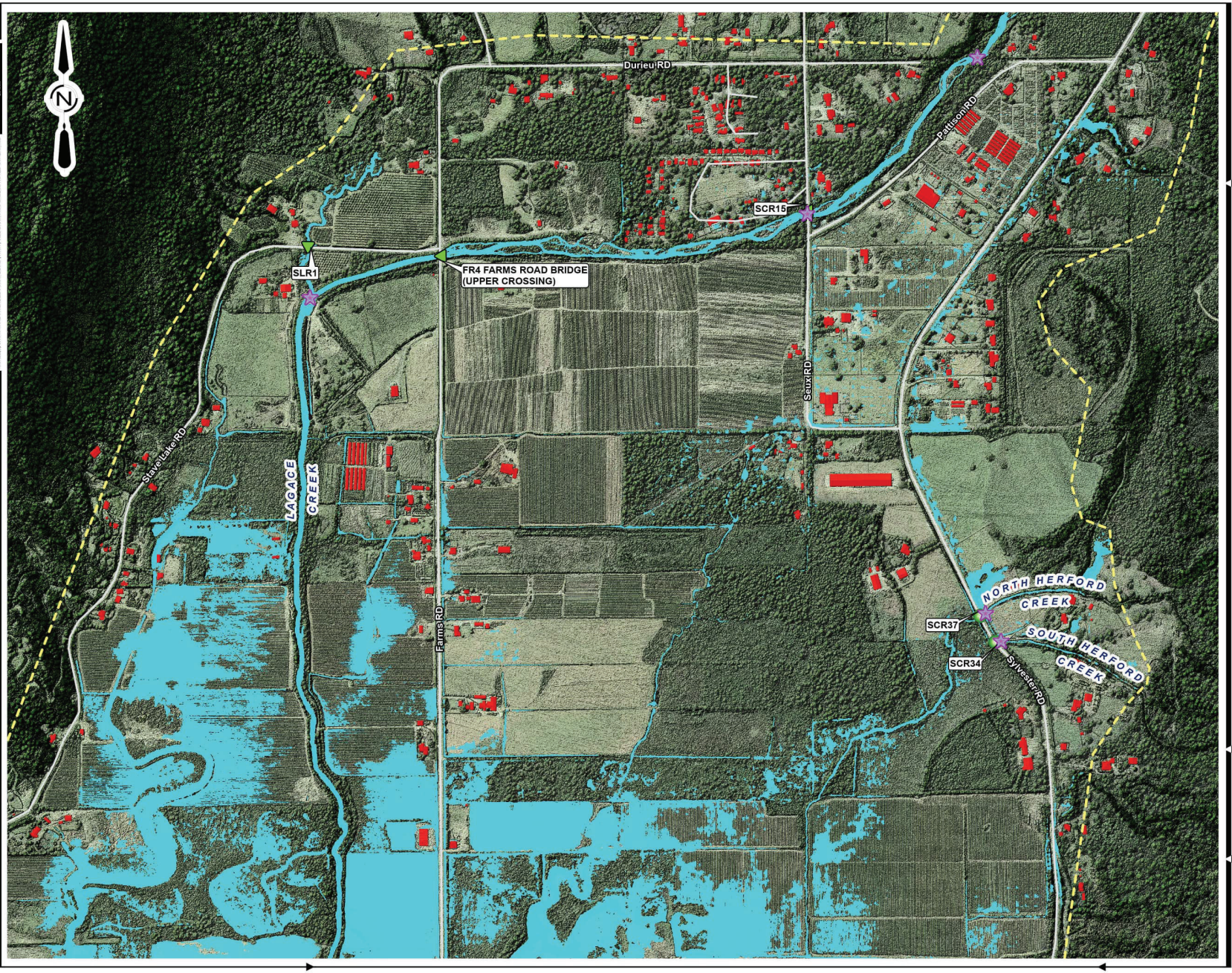


Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH SUMMER 10 YEAR 5 DAY

DEPTH

17.0 m

0.0 m

SITE LOCATIONS

BRIDGE

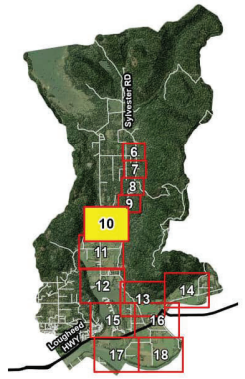
WEIR/GATE/CULVERT

PRIMARY ROADS

MINOR ROADS

BUILDINGS

2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 10

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

SUMMER 10-YEAR 5-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

AE PROJECT No.	20222632-00
SCALE	1:8,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 37.5 75 150 225 300 Meters

IF NOT 25 mm ADJUST SCALES 25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 2024-04-03 4:43 PM
SAVE DATE: 2024-04-03 4:43 PM SAVED BY: JORDON ROZON
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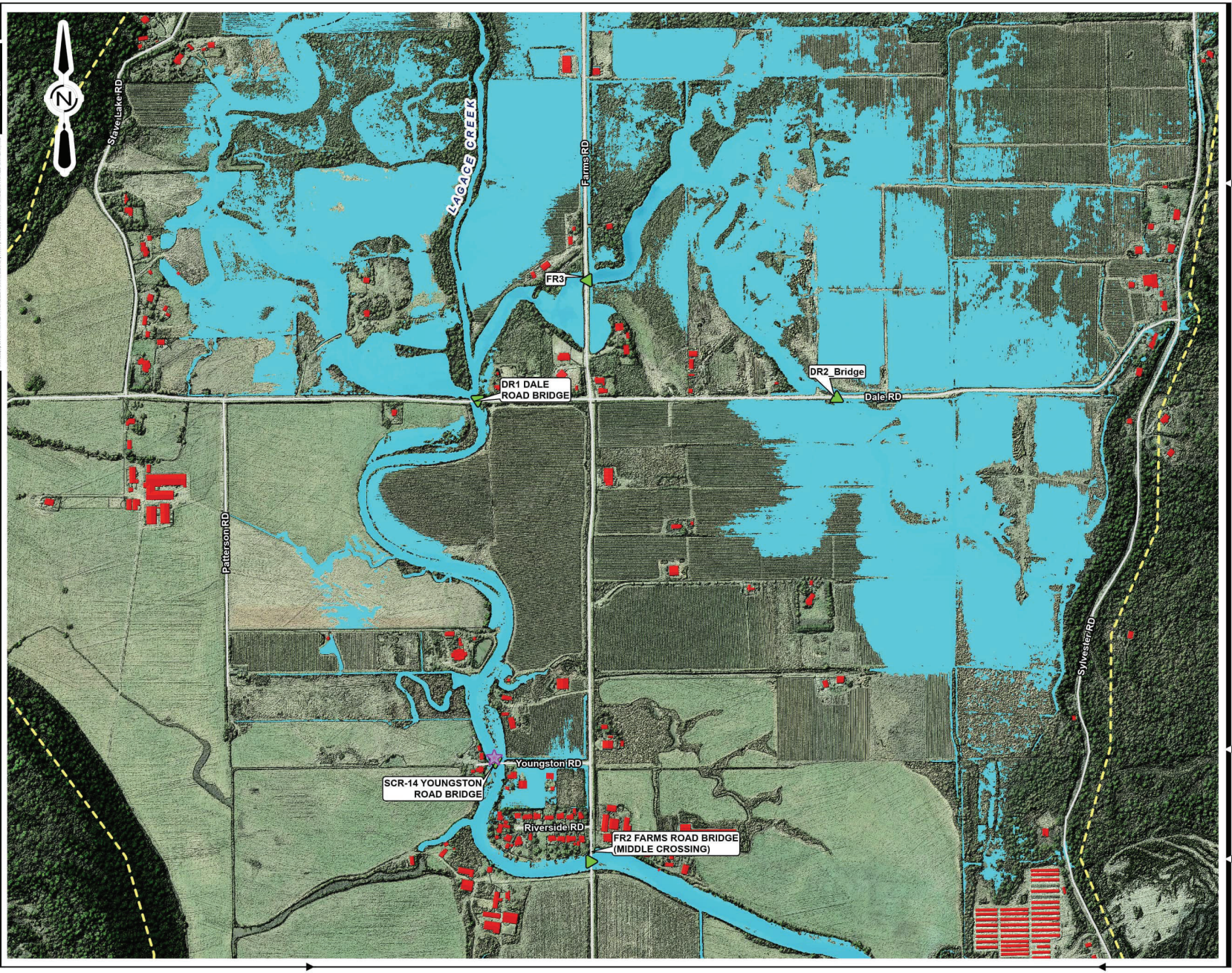


Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH SUMMER 10 YEAR 5 DAY

DEPTH

17.0 m

0.0 m

SITE LOCATIONS

BRIDGE

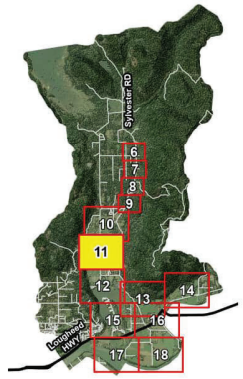
WEIR/GATE/CULVERT

PRIMARY ROADS

MINOR ROADS

BUILDINGS

2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 11

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

SUMMER 10-YEAR 5-DAY DESIGN EVENT MAXIMUM FLOOD EXTENT AND DEPTH

AE PROJECT No.	20222632-00
SCALE	1:8,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 37.5 75 150 225 300 Meters

IF NOT 25 mm ADJUST SCALES 25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 2024-04-03 4:44 PM
SAVE DATE: 2024-04-03 4:44 PM SAVED BY: JORDON ROZON
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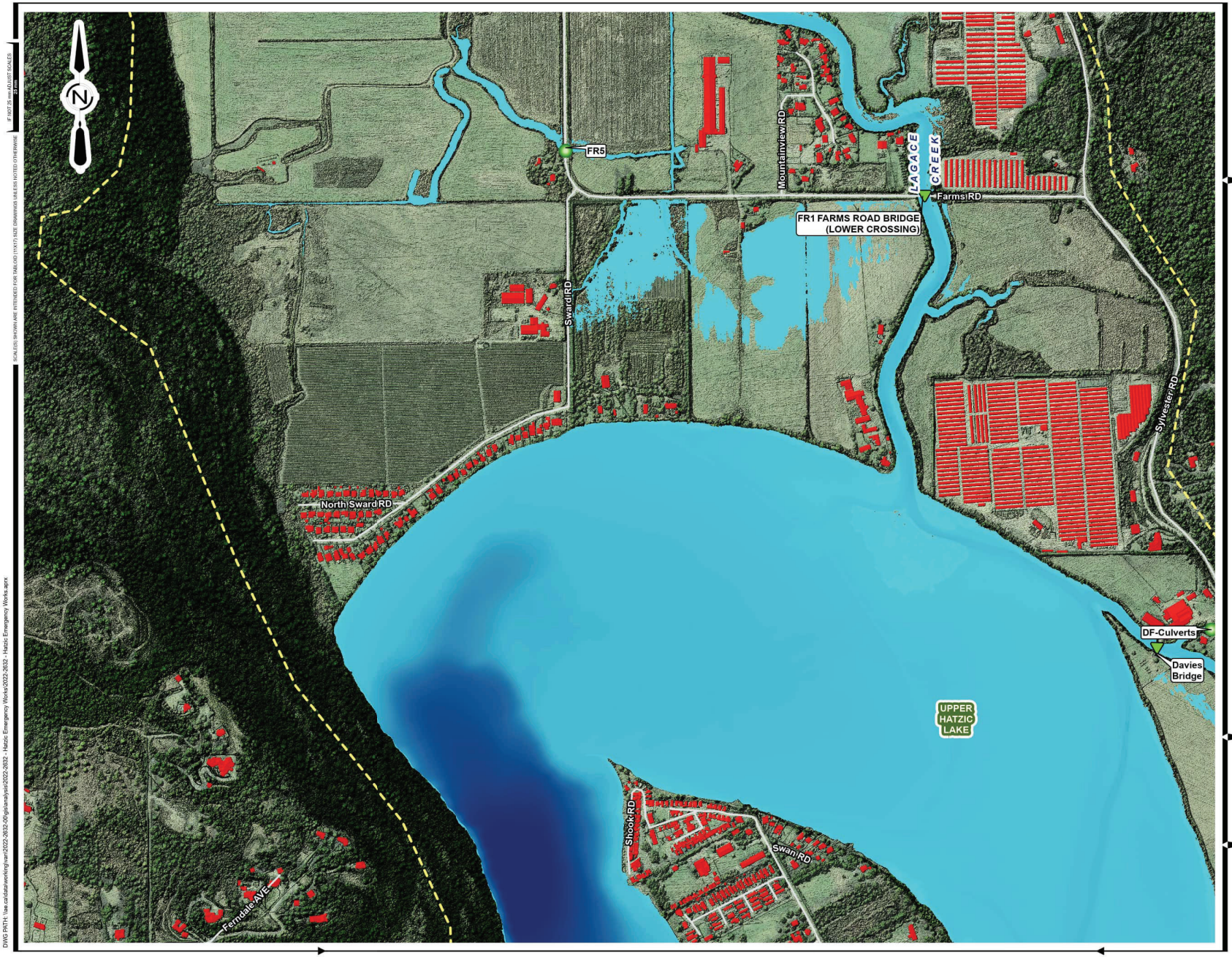


Associated Engineering

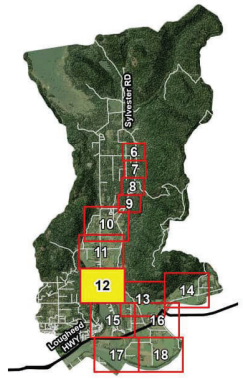
CANADA'S BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH SUMMER 10 YEAR 5 DAY

DEPTH
- 17.0 m
- 0.0 m

SITE LOCATIONS
BRIDGE
WEIR/GATE/CULVERT
PRIMARY ROADS
MINOR ROADS
BUILDINGS
2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 12

BC MINISTRY OF ENVIRONMENT
AND CLIMATE CHANGE STRATEGY

SUMMER 10-YEAR 5-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

AE PROJECT No.	20222632-00
SCALE	1:8,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 37.5 75 150 225 300 Meters

IF NOT 75 mm AS LIST SCALES ARE WRONG

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11x17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 2024-04-03 4:44 PM
SAVE DATE: 2024-04-03 4:44 PM SAVED BY: JORDON ROZON
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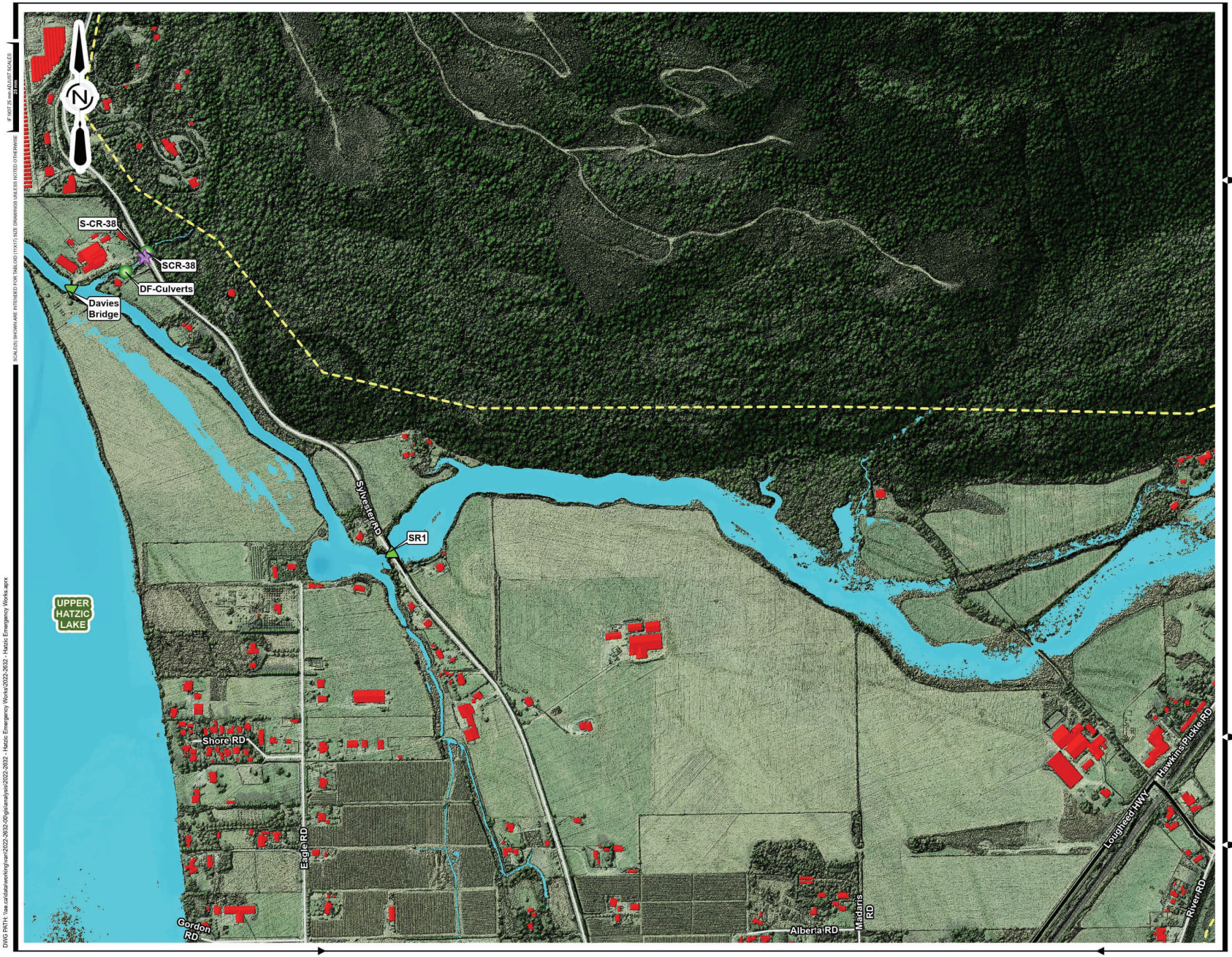


Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH SUMMER 10 YEAR 5 DAY

DEPTH

17.0 m

0.0 m

SITE LOCATIONS

BRIDGE

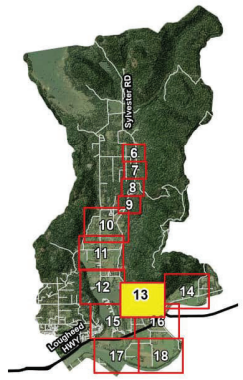
WEIR/GATE/CULVERT

PRIMARY ROADS

MINOR ROADS

BUILDINGS

2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 13

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

SUMMER 10-YEAR 5-DAY DESIGN EVENT MAXIMUM FLOOD EXTENT AND DEPTH

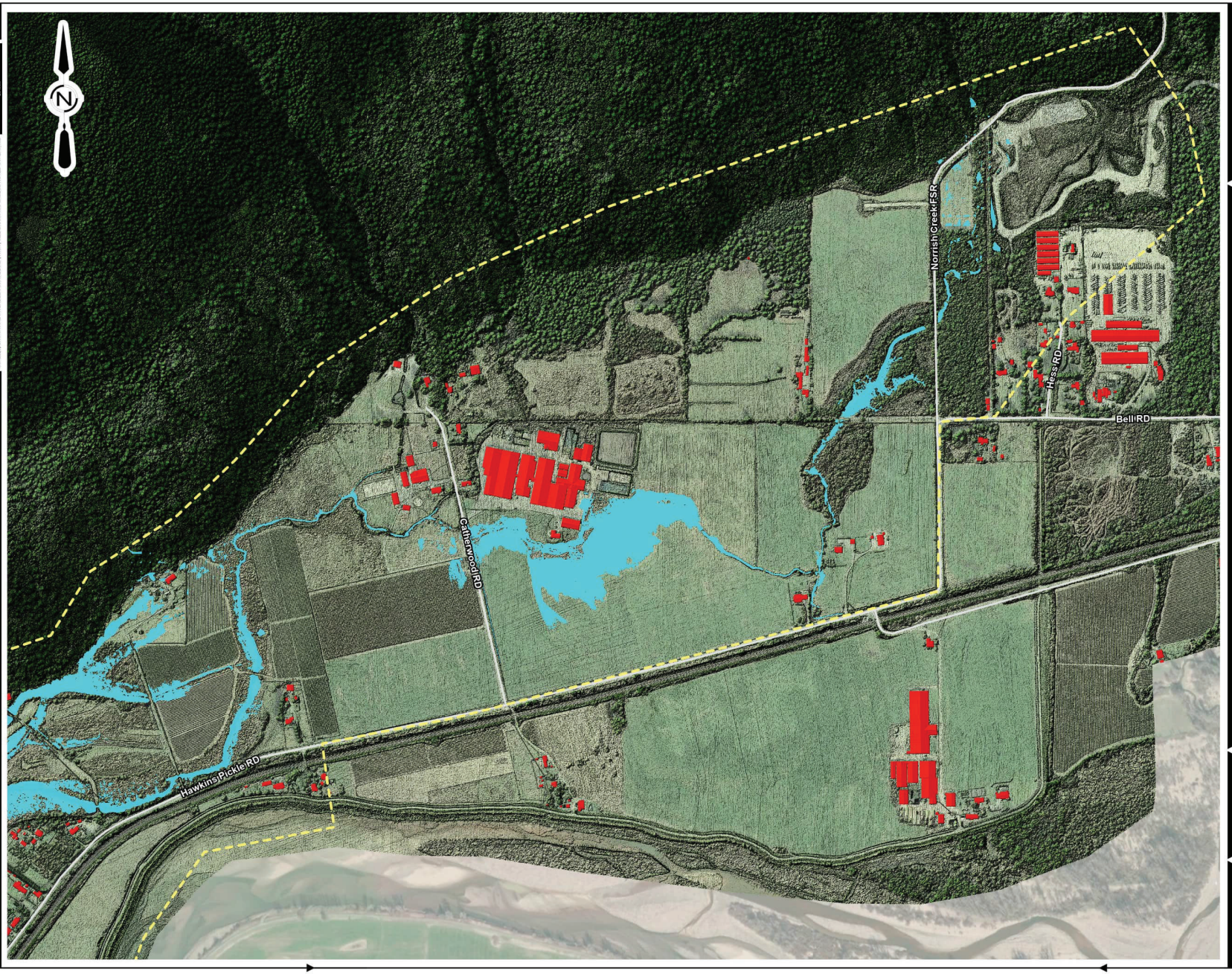
AE PROJECT No.	20222632-00
SCALE	1:8,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 37.5 75 150 225 300 Meters

IF NOT 25 mm ADJUST SCALES 23 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 2024-04-03 4:44 PM
SAVE DATE: 2024-04-03 4:44 PM SAVED BY: JORDON ROZON
DWG PATH: \\ae.ca\data\working\van\2022-2632-00\gis\analysis\2022-2632 - Hatzic Emergency Works\2022-2632 - Hatzic Emergency Works.aprx



Associated Engineering

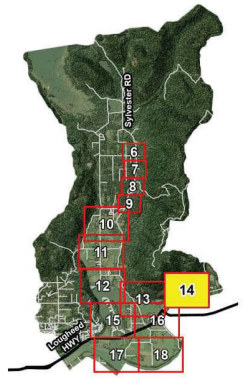
BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH SUMMER 10 YEAR 5 DAY

DEPTH
- 17.0 m
- 0.0 m

SITE LOCATIONS
BRIDGE
WEIR/GATE/CULVERT
PRIMARY ROADS
MINOR ROADS
BUILDINGS
2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 14

BC MINISTRY OF ENVIRONMENT
AND CLIMATE CHANGE STRATEGY

SUMMER 10-YEAR 5-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

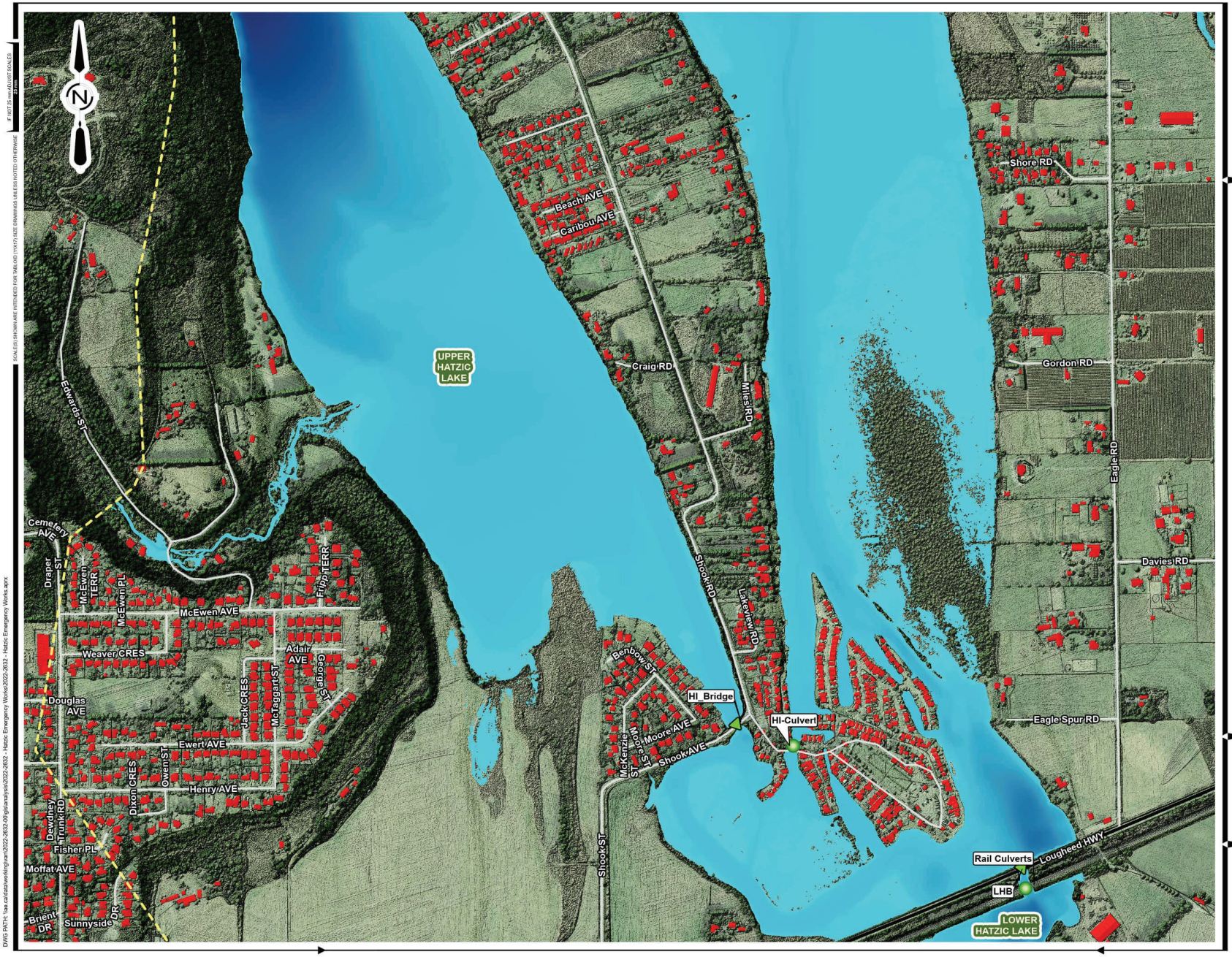
AE PROJECT No.	20222632-00
SCALE	1:8,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 37.5 75 150 225 300 Meters

IF NOT 25 mm AS LIST SCALES ARE WRONG

SCALES SHOWN ARE INTENDED FOR TABLOID (11x17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 2024-04-03 4:44 PM
SAVE DATE: 2024-04-03 4:44 PM SAVED BY: JORDON ROZON
DWG PATH: \\ae.ca\data\working\van\2022-2632-00\gis\analysis\2022-2632 - Hatzic Emergency Works\2022-2632 - Hatzic Emergency Works.aprx



Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH SUMMER 10 YEAR 5 DAY

DEPTH

17.0 m

0.0 m

SITE LOCATIONS

BRIDGE

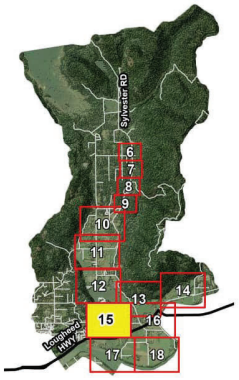
WEIR/GATE/CULVERT

PRIMARY ROADS

MINOR ROADS

BUILDINGS

2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 15

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

SUMMER 10-YEAR 5-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

AE PROJECT No.	20222632-00
SCALE	1:8,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 37.5 75 150 225 300 Meters

IF NOT 25 mm ADJUST SCALES 25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 2024-04-03 4:45 PM
SAVE DATE: 2024-04-03 4:45 PM SAVED BY: JORDON ROZON
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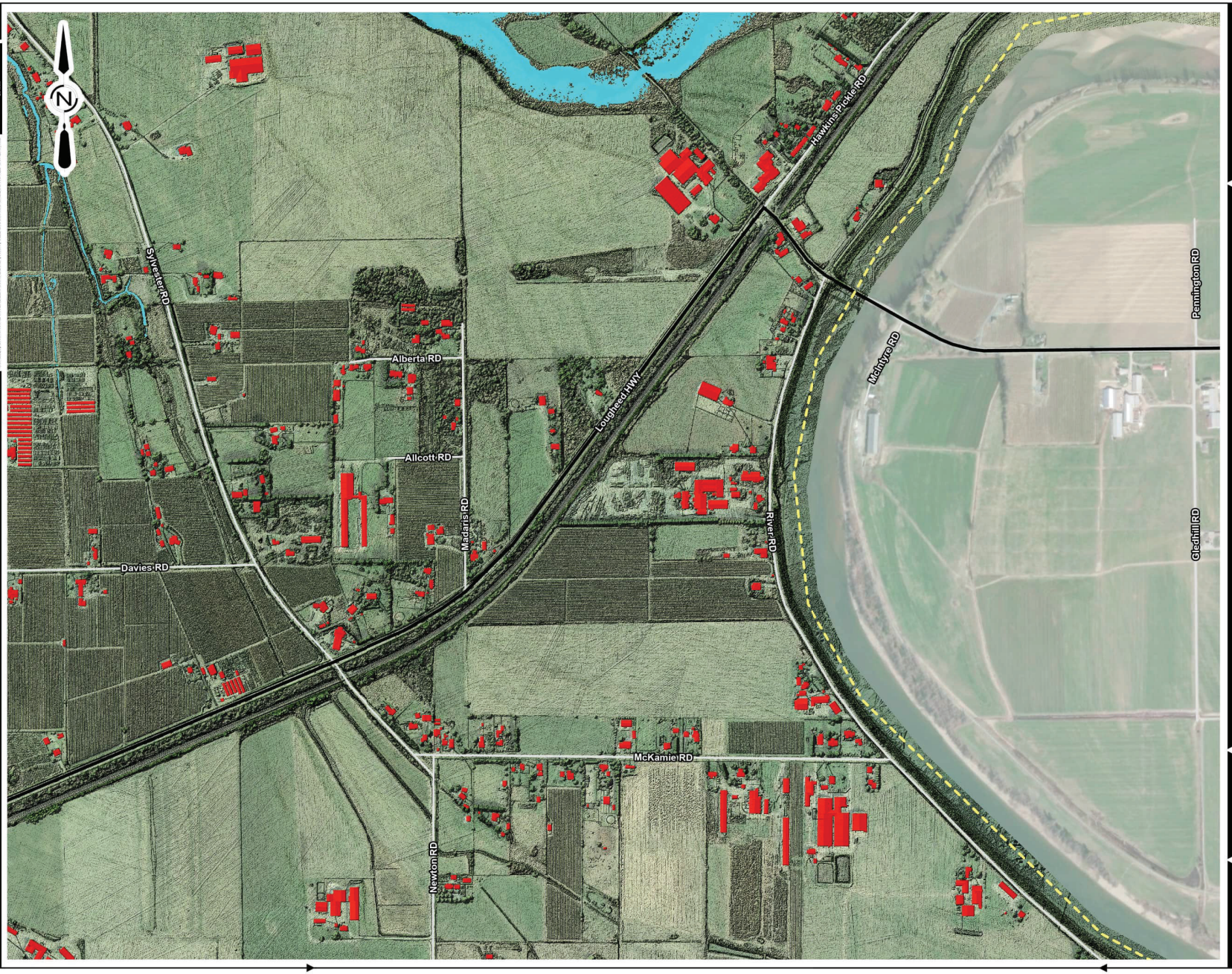


Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH SUMMER 10 YEAR 5 DAY

DEPTH

17.0 m

0.0 m

SITE LOCATIONS

BRIDGE

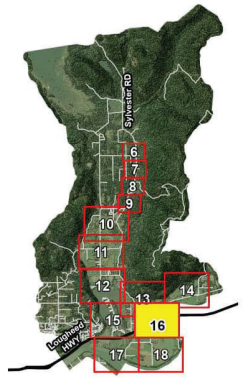
WEIR/GATE/CULVERT

PRIMARY ROADS

MINOR ROADS

BUILDINGS

2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 16

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

SUMMER 10-YEAR 5-DAY DESIGN EVENT MAXIMUM FLOOD EXTENT AND DEPTH

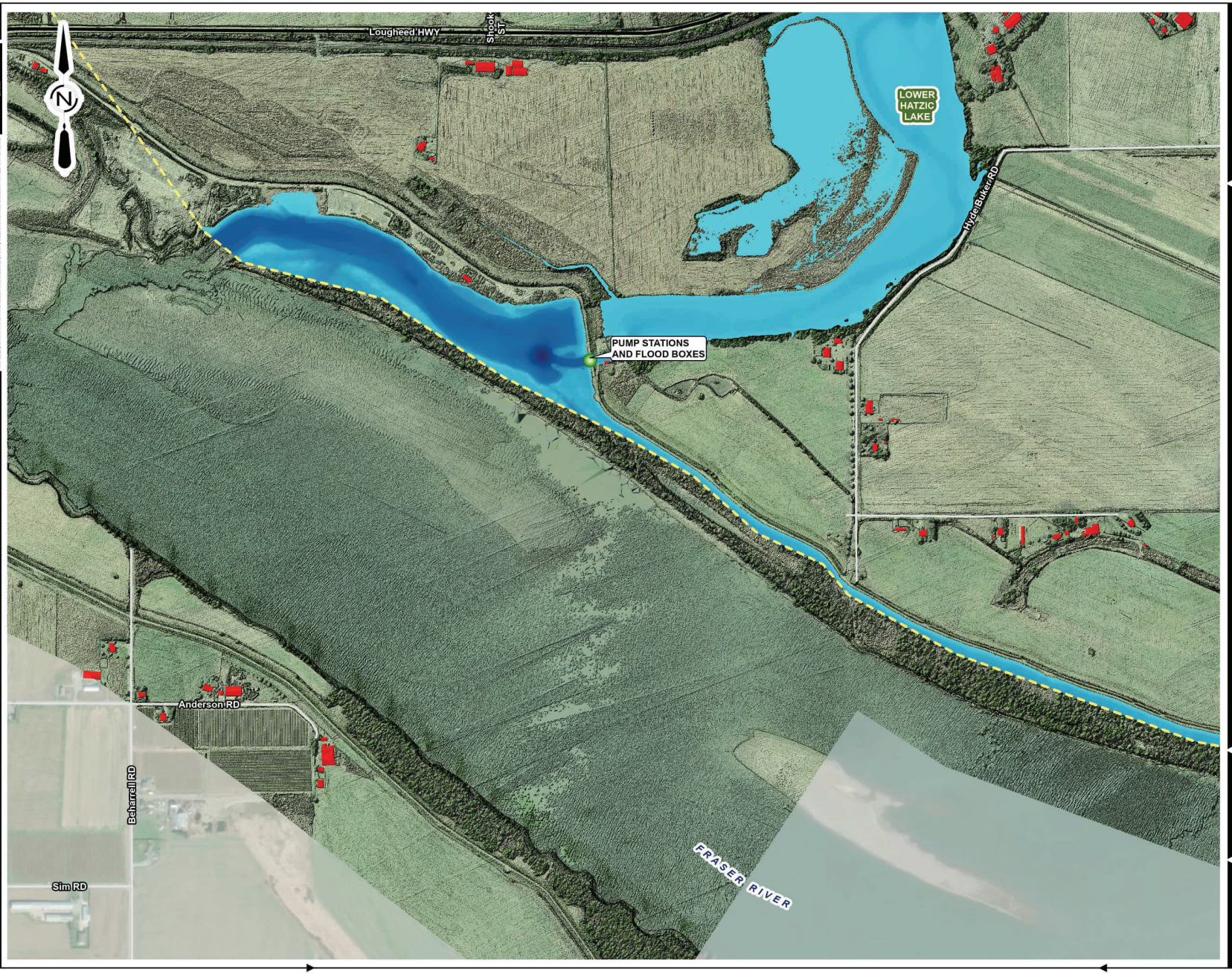
AE PROJECT No.	20222632-00
SCALE	1:8,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 37.5 75 150 225 300 Meters

IF NOT 25 mm ADJUST SCALES 25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 2024-04-03 4:45 PM
SAVE DATE: 2024-04-03 4:45 PM SAVED BY: JORDON ROZON
DWG PATH: \\ae.ca\data\working\van\2022-2632-00\gis\analysis\2022-2632 - Hatzic Emergency Works\2022-2632 - Hatzic Emergency Works.aprx



Associated Engineering

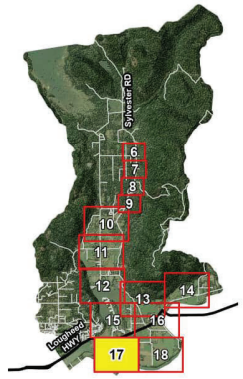
BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH SUMMER 10 YEAR 5 DAY

DEPTH

- 17.0 m
- 0.0 m
- SITE LOCATIONS
- BRIDGE
- WEIR/GATE/CULVERT
- PRIMARY ROADS
- MINOR ROADS
- BUILDINGS
- 2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 17

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

SUMMER 10-YEAR 5-DAY DESIGN EVENT MAXIMUM FLOOD EXTENT AND DEPTH

AE PROJECT No.	20222632-00
SCALE	1:8,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 37.5 75 150 225 300 Meters

IF NOT 25 mm ADJUST SCALES 25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 2024-04-03 4:45 PM
SAVE DATE: 2024-04-03 4:45 PM SAVED BY: JORDON ROZON
DWG PATH: \\ae.ca\data\working\van\2022-2632-00\gis\analysis\2022-2632 - Hatzic Emergency Works\2022-2632 - Hatzic Emergency Works.aprx



Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH SUMMER 10 YEAR 5 DAY

DEPTH

17.0 m

0.0 m

SITE LOCATIONS

BRIDGE

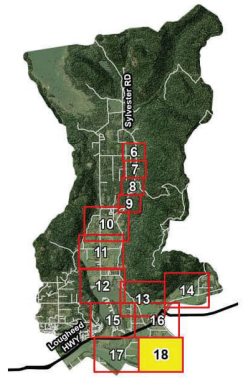
WEIR/GATE/CULVERT

PRIMARY ROADS

MINOR ROADS

BUILDINGS

2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 18

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

SUMMER 10-YEAR 5-DAY DESIGN EVENT MAXIMUM FLOOD EXTENT AND DEPTH

AE PROJECT No.	20222632-00
SCALE	1:8,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 37.5 75 150 225 300 Meters

IF NOT 25 mm ADJUST SCALES 25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 2024-04-03 4:46 PM
SAVE DATE: 2024-04-03 4:46 PM SAVED BY: JORDON ROZON
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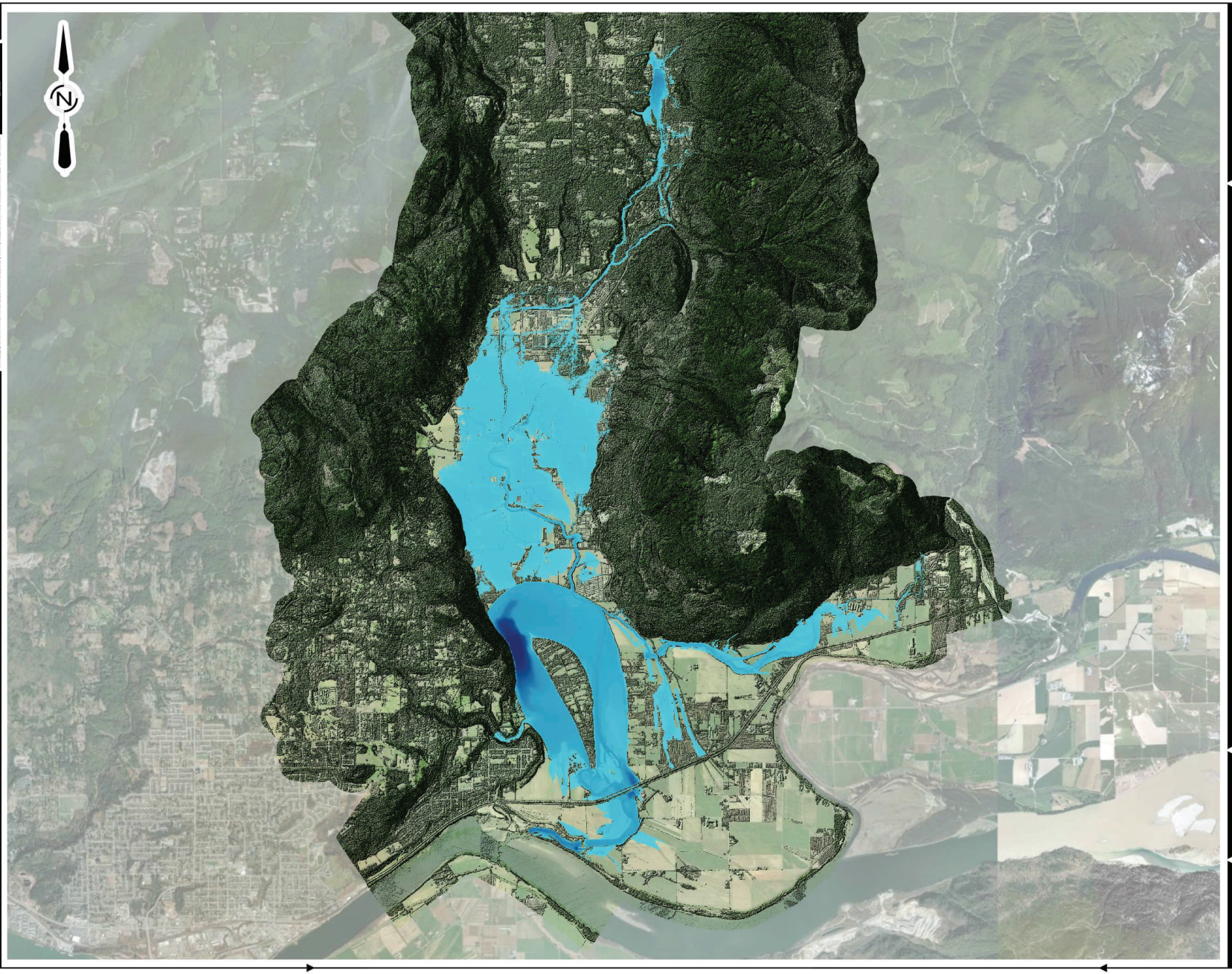


Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH WINTER 10 YEAR 4 DAY

DEPTH

18.9 m

0.0 m

SITE LOCATIONS

BRIDGE

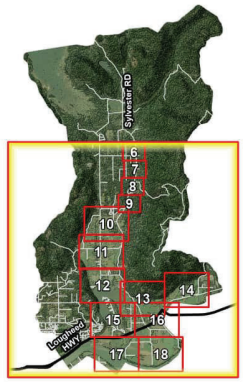
WEIR/GATE/CULVERT

PRIMARY ROADS

MINOR ROADS

BUILDINGS

2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 33

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

CIVIL
WINTER 10-YEAR 4-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

AE PROJECT No.	20222632-00
SCALE	1:55,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 270 540 1,080 1,620 2,160 Meters

IF NOT 25 mm ADJUST SCALES 25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 2024-04-03 4:49 PM
SAVE DATE: 2024-04-03 4:49 PM SAVED BY: JORDON ROZON
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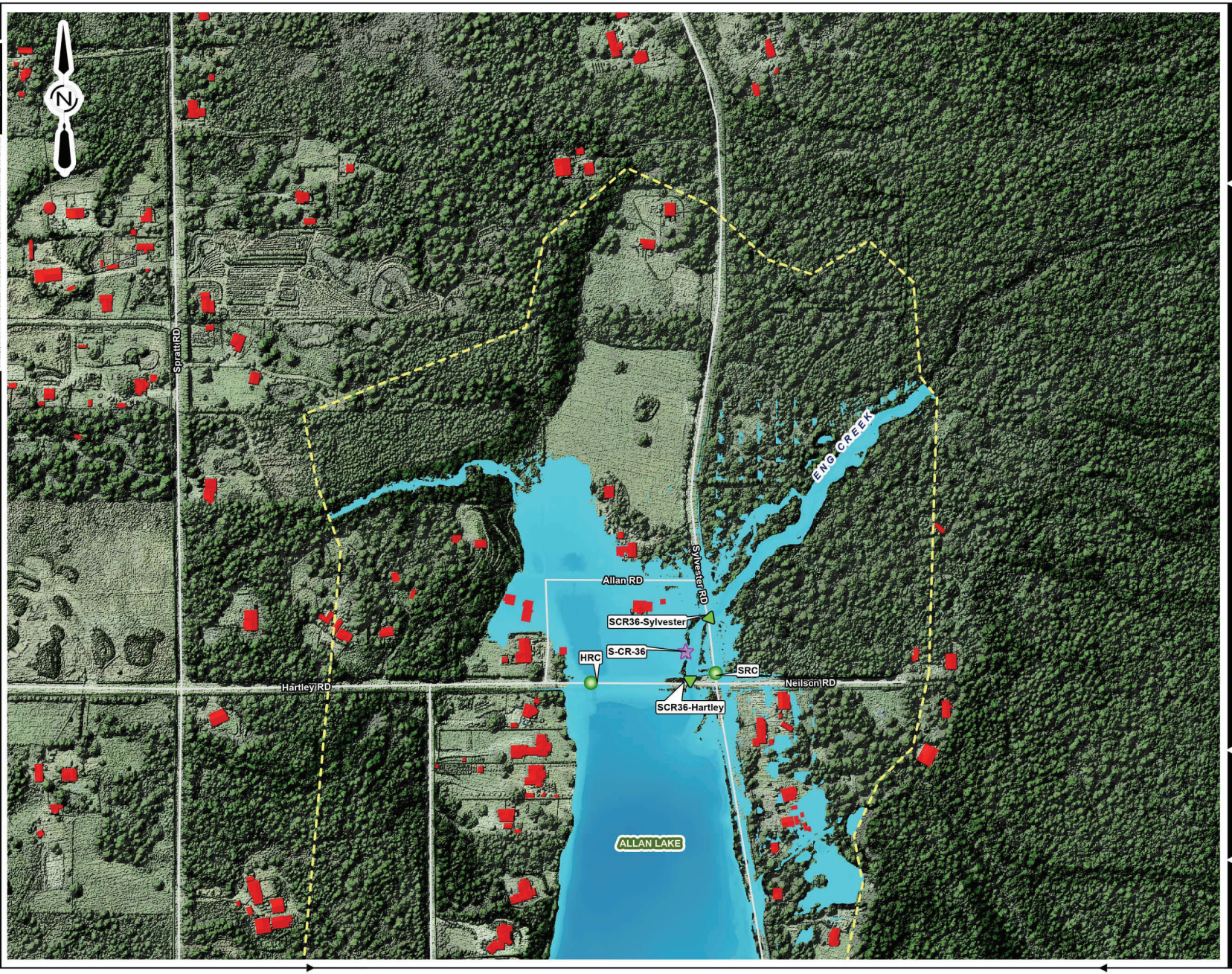


Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH WINTER 10 YEAR 4 DAY

DEPTH

18.9 m

0.0 m

SITE LOCATIONS

BRIDGE

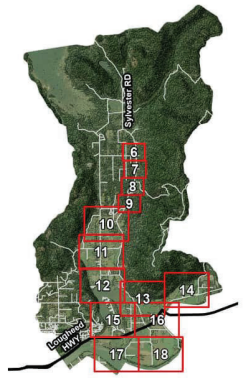
WEIR/GATE/CULVERT

PRIMARY ROADS

MINOR ROADS

BUILDINGS

2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 34

BC MINISTRY OF ENVIRONMENT
AND CLIMATE CHANGE STRATEGY

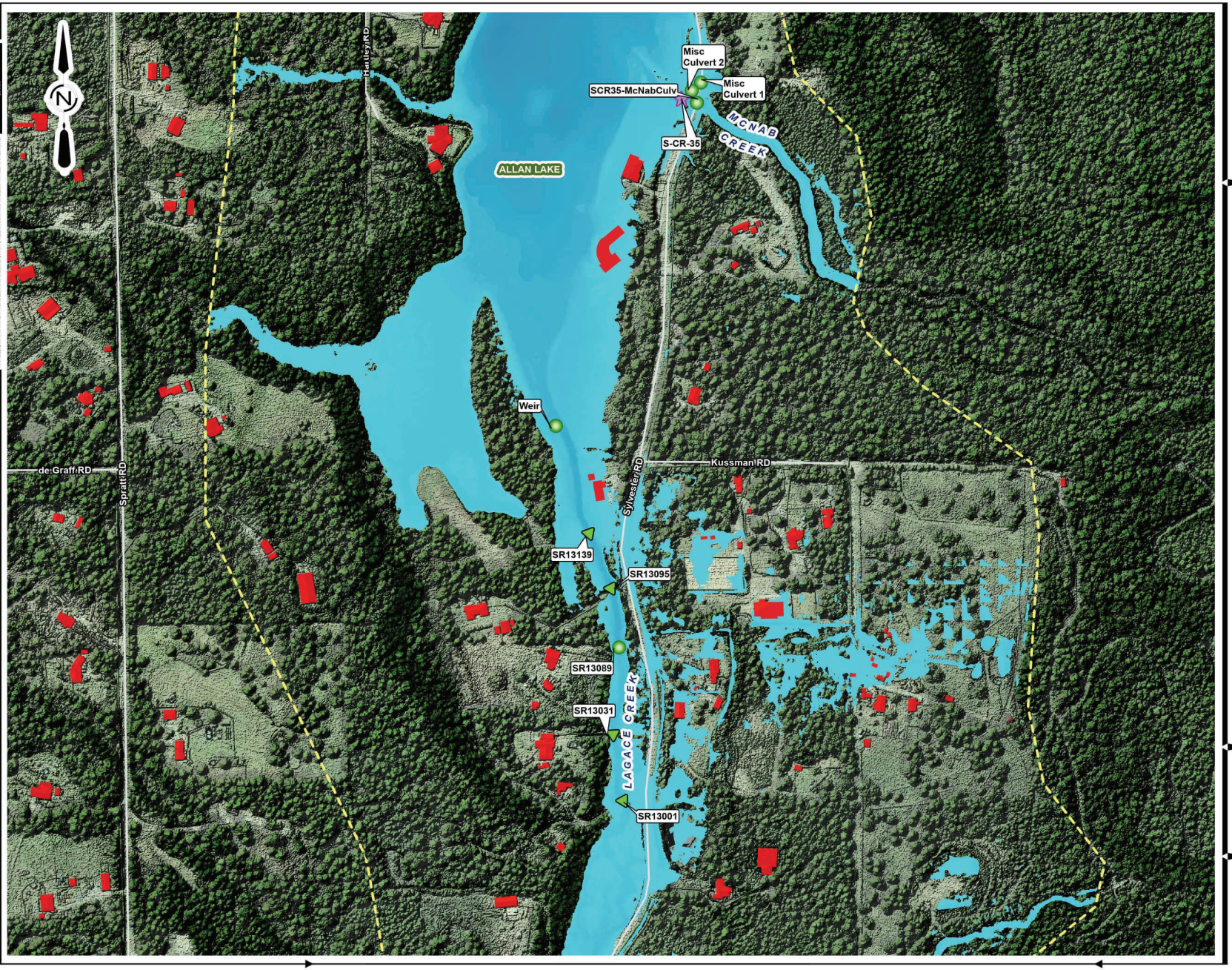
CIVIL
WINTER 10-YEAR 4-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

AE PROJECT No.	20222632-00
SCALE	1:4,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 15 30 60 90 120 Meters

IF NOT 76.2mm AS LIST SCALES SHOWN
SCALES SHOWN ARE INTENDED FOR TABLOID (11x17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 2024-04-03 4:49 PM
SAVE DATE: 2024-04-03 4:49 PM SAVED BY: JORDON ROZON
DWG PATH: \\ae.ca\data\working\van\2022-2632-00\gis\analysis\2022-2632 - Hatzic Emergency Works\2022-2632 - Hatzic Emergency Works.aprx



Associated Engineering

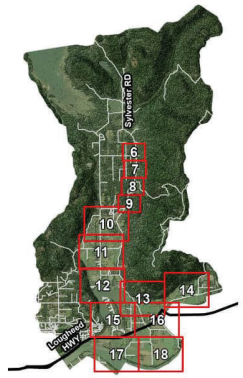
BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH WINTER 10 YEAR 4 DAY

DEPTH
18.9 m
0.0 m

SITE LOCATIONS
BRIDGE
WEIR/GATE/CULVERT
PRIMARY ROADS
MINOR ROADS
BUILDINGS
2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 35

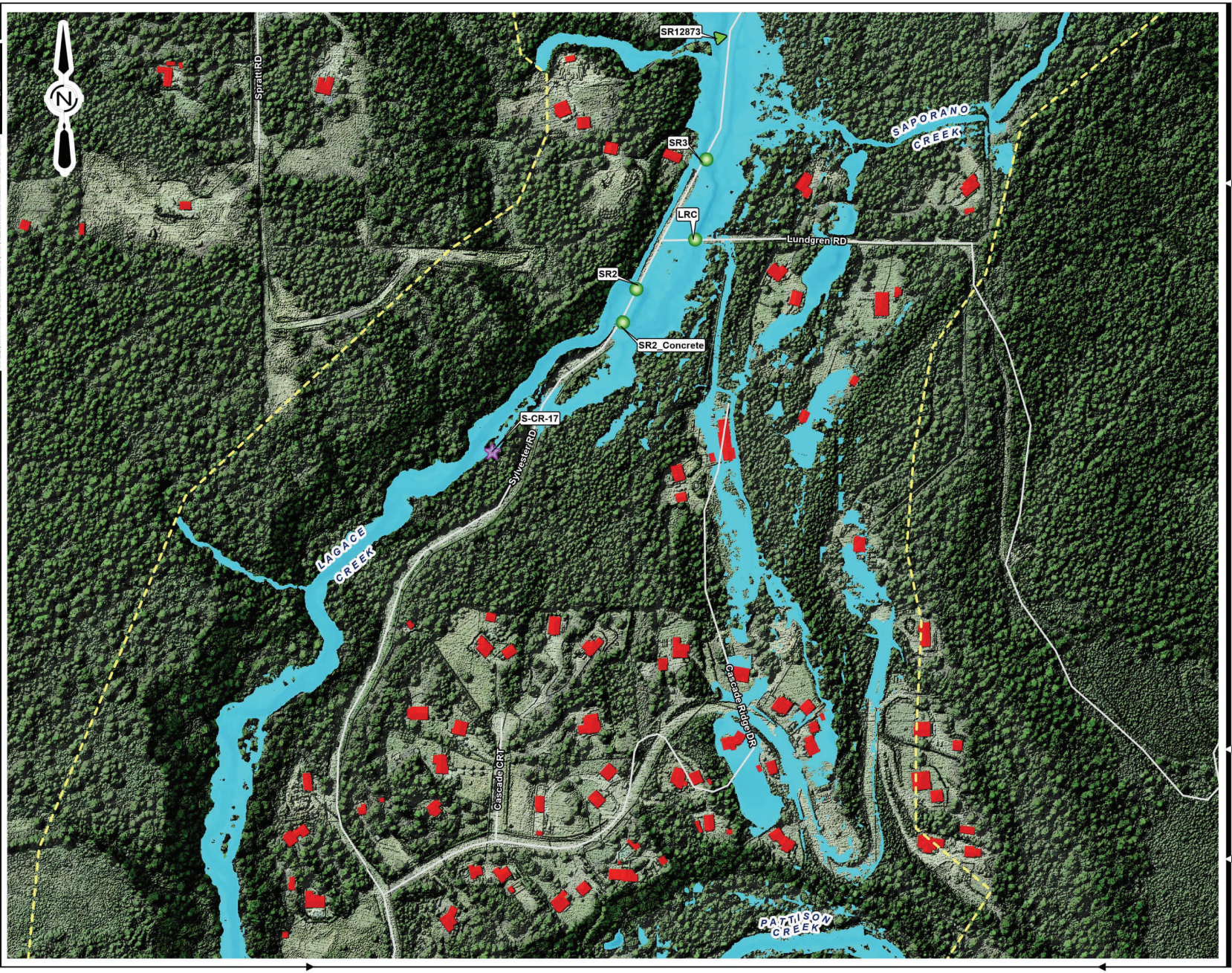
BC MINISTRY OF ENVIRONMENT
AND CLIMATE CHANGE STRATEGY

CIVIL
WINTER 10-YEAR 4-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

AE PROJECT No.	20222632-00
SCALE	1:4,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 15 30 60 90 120 Meters

IF NOT 75 mm AS LIST SCALES ARE WRONG
SCALES SHOWN ARE INTENDED FOR TABLOID (11x17) SIZE DRAWINGS UNLESS NOTED OTHERWISE
PLOT DATE: 2024-04-03 4:50 PM
SAVE DATE: 2024-04-03 4:50 PM SAVED BY: JORDON ROZON
DWG PATH: \\ae.ca\data\working\van\2022-2632-00\gis\analysis\2022-2632 - Hatzic Emergency Works\2022-2632 - Hatzic Emergency Works.aprx



Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH WINTER 10 YEAR 4 DAY

DEPTH

18.9 m

0.0 m

SITE LOCATIONS

BRIDGE

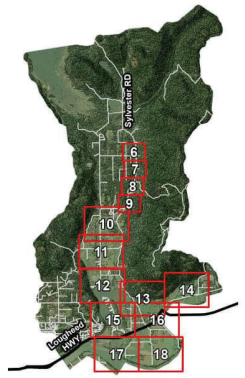
WEIR/GATE/CULVERT

PRIMARY ROADS

MINOR ROADS

BUILDINGS

2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 36

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

CIVIL
WINTER 10-YEAR 4-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

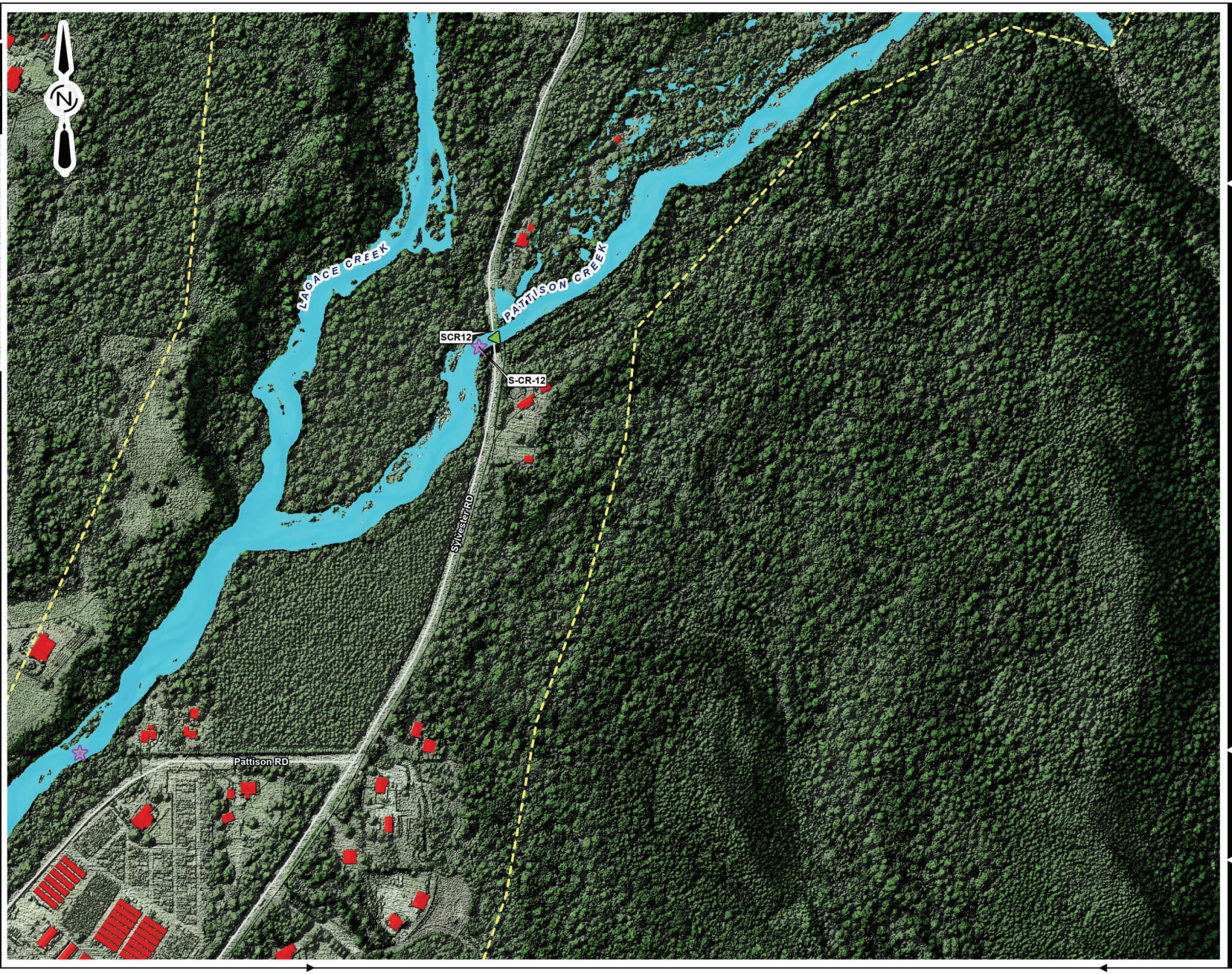
AE PROJECT No.	20222632-00
SCALE	1:4,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 15 30 60 90 120 Meters

IF NOT 25 mm ADJUST SCALES 25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 2024-04-03 4:50 PM
SAVE DATE: 2024-04-03 4:50 PM SAVED BY: JORDON ROZON
DWG PATH: \\ae.ca\data\working\van\2022-2632-00\gis\analysis\2022-2632 - Hatzic Emergency Works\2022-2632 - Hatzic Emergency Works.aprx



Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH WINTER 10 YEAR 4 DAY

DEPTH

18.9 m

0.0 m

SITE LOCATIONS

BRIDGE

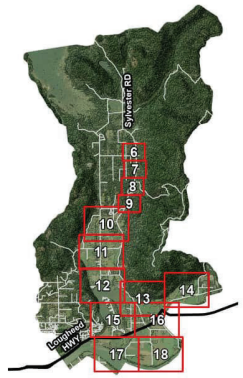
WEIR/GATE/CULVERT

PRIMARY ROADS

MINOR ROADS

BUILDINGS

2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 37

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

CIVIL
WINTER 10-YEAR 4-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

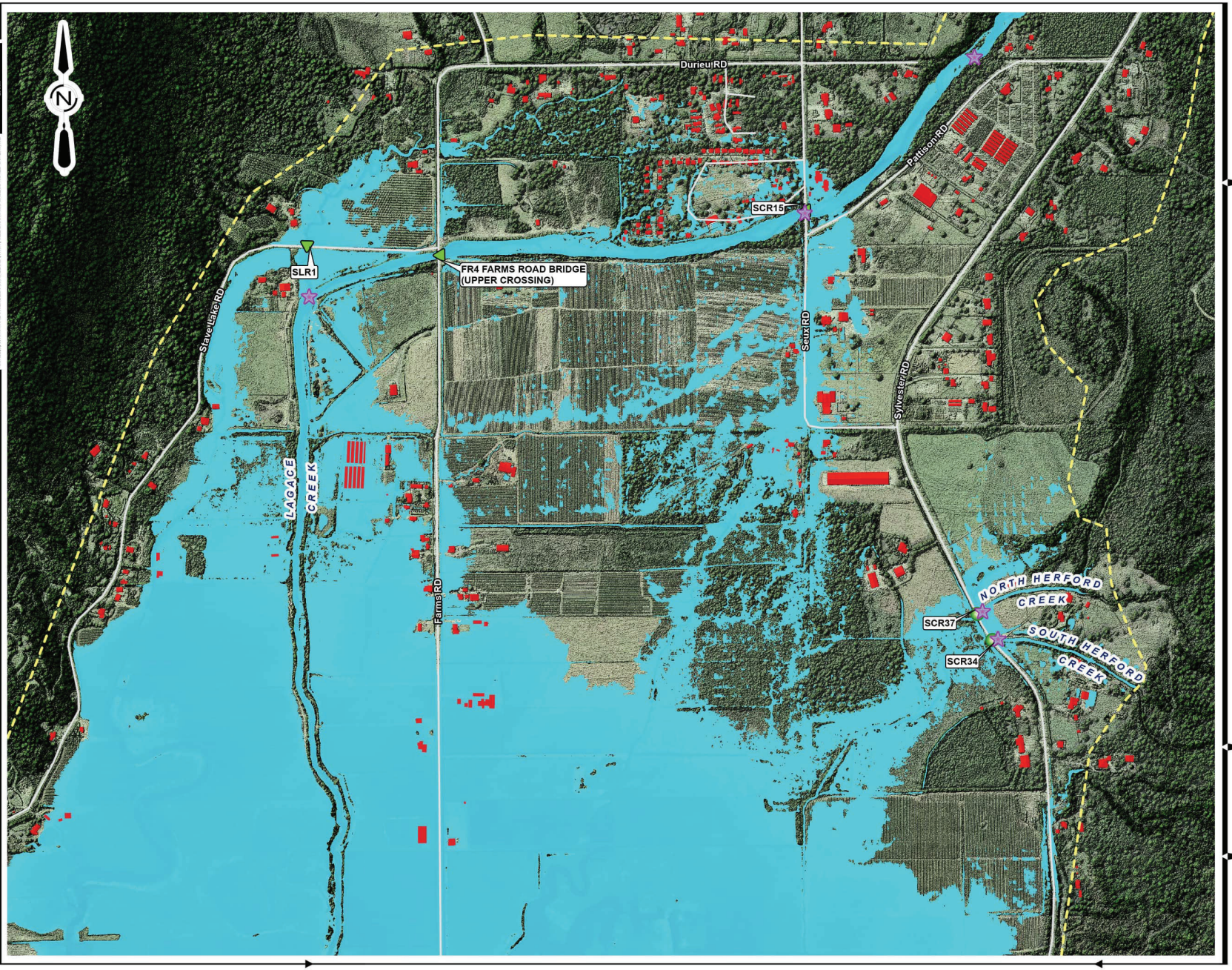
AE PROJECT No.	20222632-00
SCALE	1:4,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 15 30 60 90 120 Meters

IF NOT 25 mm ADJUST SCALES
25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 2024-04-03 4:50 PM
SAVE DATE: 2024-04-03 4:50 PM SAVED BY: JORDON ROZON
DWG PATH: \\ae.ca\data\working\van\2022-2632-00\gis\analysis\2022-2632 - Hatzic Emergency Works\2022-2632 - Hatzic Emergency Works.aprx



Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH WINTER 10 YEAR 4 DAY

DEPTH

18.9 m

0.0 m

SITE LOCATIONS

BRIDGE

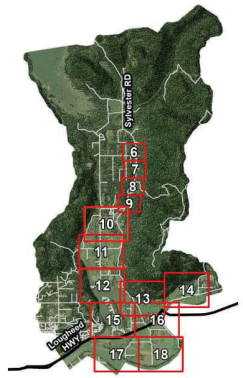
WEIR/GATE/CULVERT

PRIMARY ROADS

MINOR ROADS

BUILDINGS

2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 38

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

CIVIL
WINTER 10-YEAR 4-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

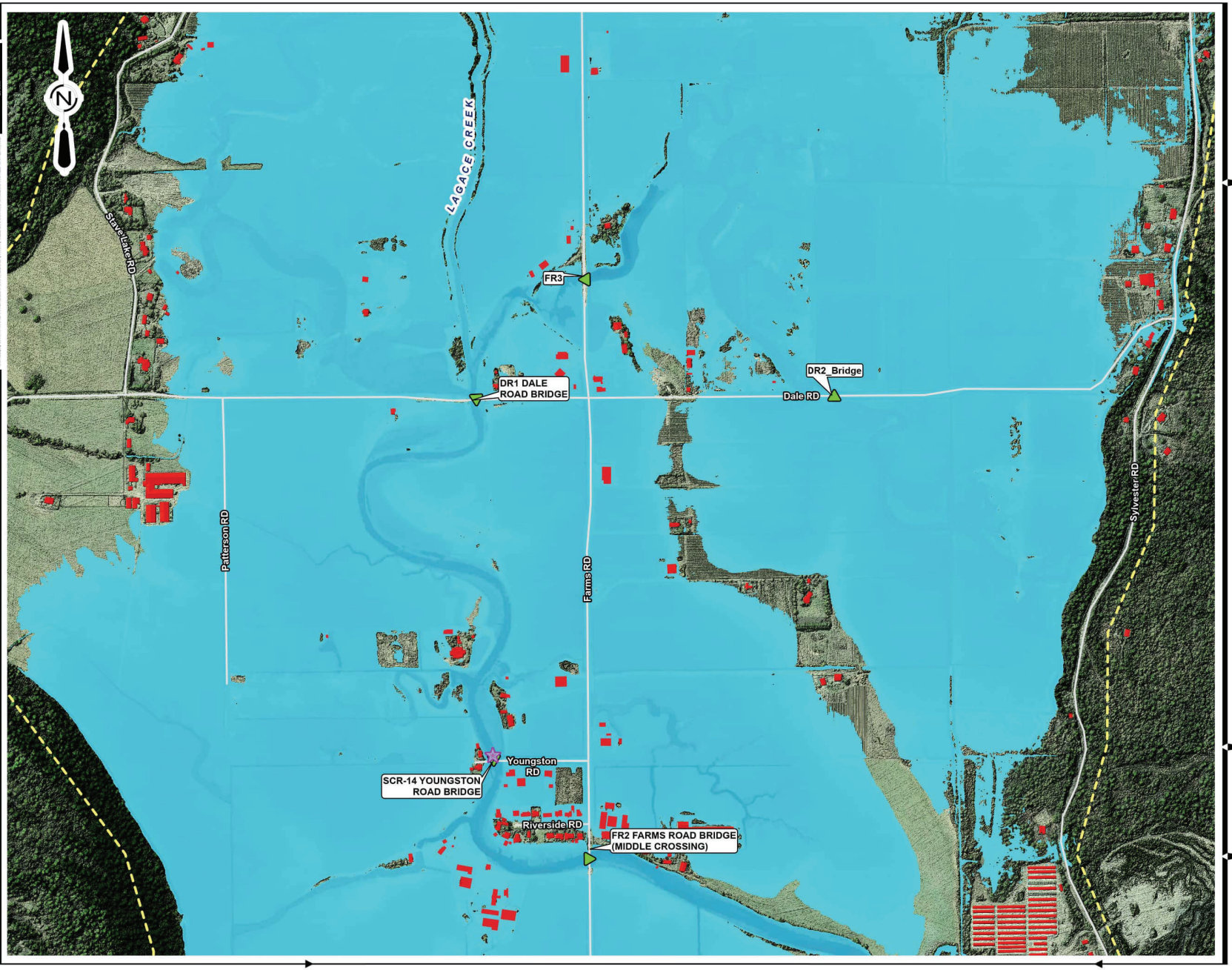
AE PROJECT No.	20222632-00
SCALE	1:8,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 37.5 75 150 225 300 Meters

IF NOT 25 mm ADJUST SCALES 23 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 2024-04-03 4:50 PM
SAVE DATE: 2024-04-03 4:50 PM SAVED BY: JORDON ROZON
DWG PATH: \\ae.ca\data\working\van\2022-2632-00\gis\analysis\2022-2632 - Hatzic Emergency Works\2022-2632 - Hatzic Emergency Works.aprx



Associated Engineering

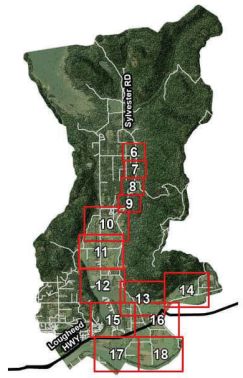
BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH WINTER 10 YEAR 4 DAY

DEPTH
18.9 m
0.0 m

SITE LOCATIONS
BRIDGE
WEIR/GATE/CULVERT
PRIMARY ROADS
MINOR ROADS
BUILDINGS
2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 39

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

CIVIL
WINTER 10-YEAR 4-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

AE PROJECT No.	20222632-00
SCALE	1:8,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 37.5 75 150 225 300 Meters

IF NOT 75 mm AS LIST SCALES ARE WRONG
SCALES SHOWN ARE INTENDED FOR TABLOID (11x17) SIZE DRAWINGS UNLESS NOTED OTHERWISE
PLOT DATE: 2024-04-03 4:51 PM
SAVE DATE: 2024-04-03 4:51 PM SAVED BY: JORDON ROZON
DWG PATH: \\ae.ca\data\working\van\2022-2632-00\gis\analysis\2022-2632 - Hatzic Emergency Works\2022-2632 - Hatzic Emergency Works.aprx



Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH WINTER 10 YEAR 4 DAY

DEPTH

18.9 m

0.0 m

SITE LOCATIONS

BRIDGE

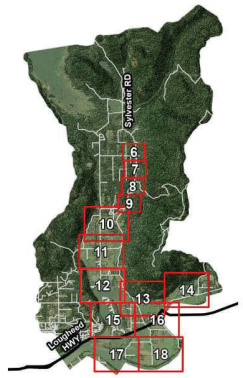
WEIR/GATE/CULVERT

PRIMARY ROADS

MINOR ROADS

BUILDINGS

2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 40

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

CIVIL
WINTER 10-YEAR 4-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

AE PROJECT No.	20222632-00
SCALE	1:8,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 37.5 75 150 225 300 Meters

IF NOT 25 mm ADJUST SCALES 25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 2024-04-03 4:51 PM
SAVE DATE: 2024-04-03 4:51 PM SAVED BY: JORDON ROZON
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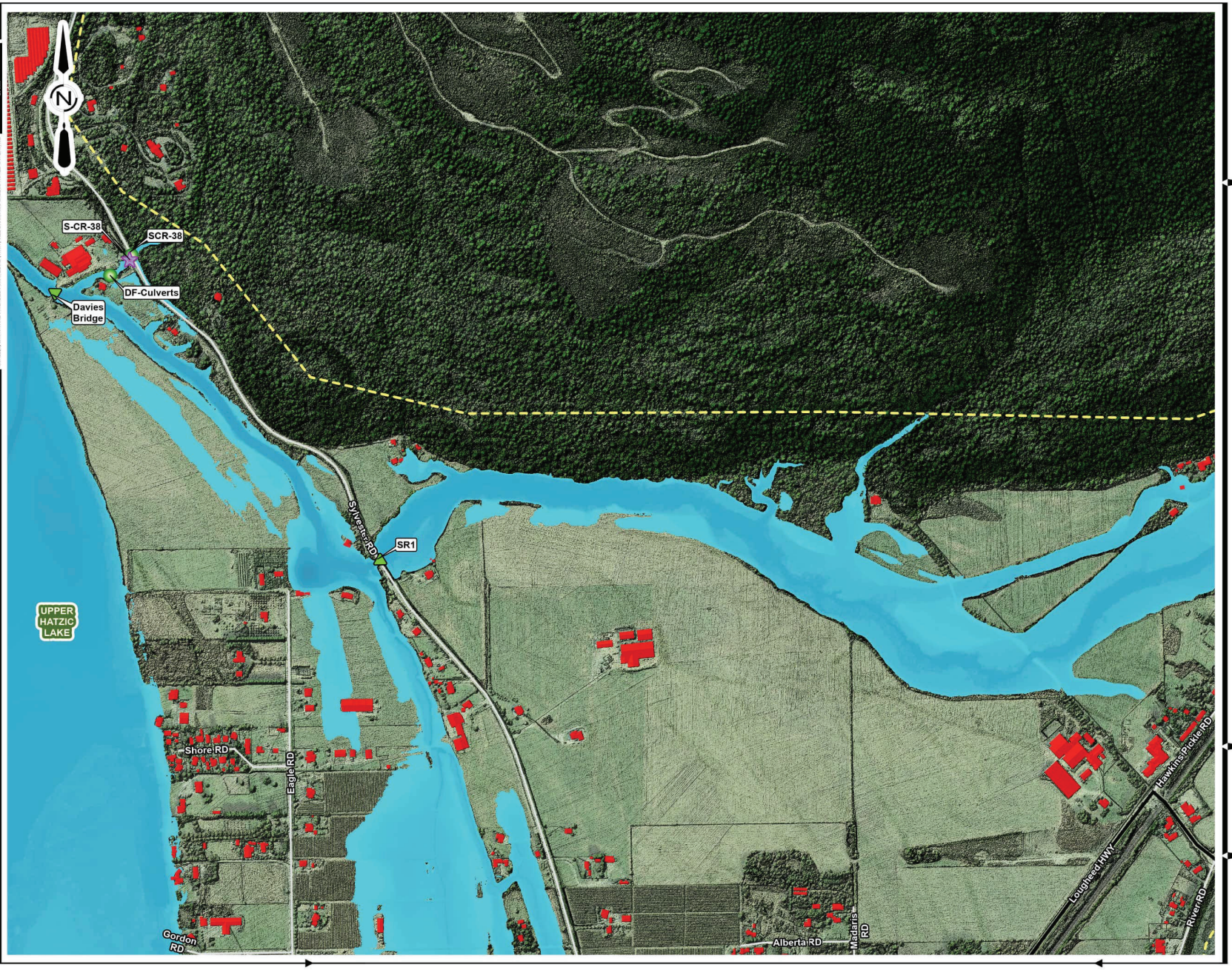


Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH WINTER 10 YEAR 4 DAY

DEPTH

18.9 m

0.0 m

SITE LOCATIONS

BRIDGE

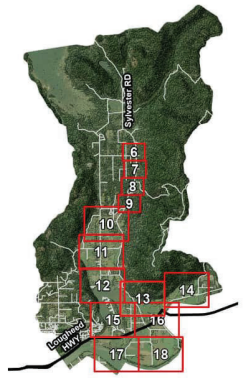
WEIR/GATE/CULVERT

PRIMARY ROADS

MINOR ROADS

BUILDINGS

2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 41

BC MINISTRY OF ENVIRONMENT
AND CLIMATE CHANGE STRATEGY

CIVIL
WINTER 10-YEAR 4-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

AE PROJECT No.	20222632-00
SCALE	1:8,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 37.5 75 150 225 300 Meters

IF NOT 279 mm AS LIST SCALES ARE WRONG

SCALES SHOWN ARE INTENDED FOR TABLOID (11x17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 2024-04-03 4:51 PM
SAVE DATE: 2024-04-03 4:51 PM SAVED BY: JORDON ROZON
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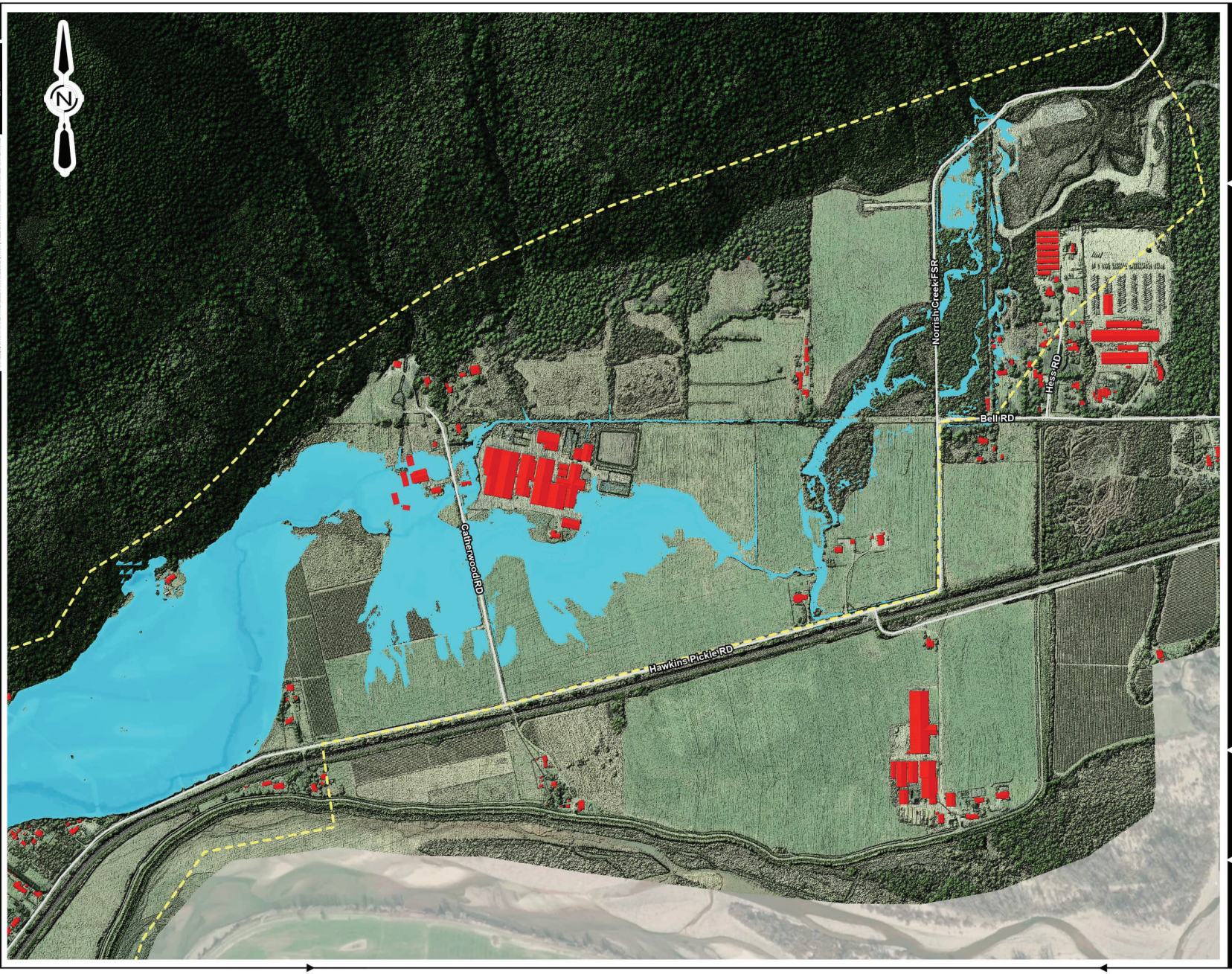


Associated Engineering

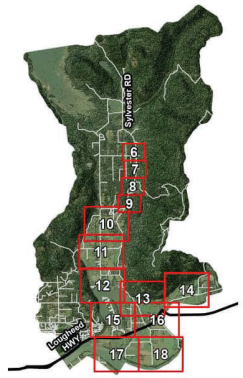
BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH WINTER 10 YEAR 4 DAY

DEPTH
- 18.9 m
- 0.0 m

SITE LOCATIONS
BRIDGE
WEIR/GATE/CULVERT
PRIMARY ROADS
MINOR ROADS
BUILDINGS
2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 42

BC MINISTRY OF ENVIRONMENT
AND CLIMATE CHANGE STRATEGY

CIVIL
WINTER 10-YEAR 4-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

AE PROJECT No.	20222632-00
SCALE	1:8,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 37.5 75 150 225 300 Meters

IF NOT 25 mm AS LIST SCALES ARE WRONG

SCALES SHOWN ARE INTENDED FOR TABLOID (11x17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 2024-04-03 4:51 PM
SAVE DATE: 2024-04-03 4:51 PM SAVED BY: JORDON ROZON
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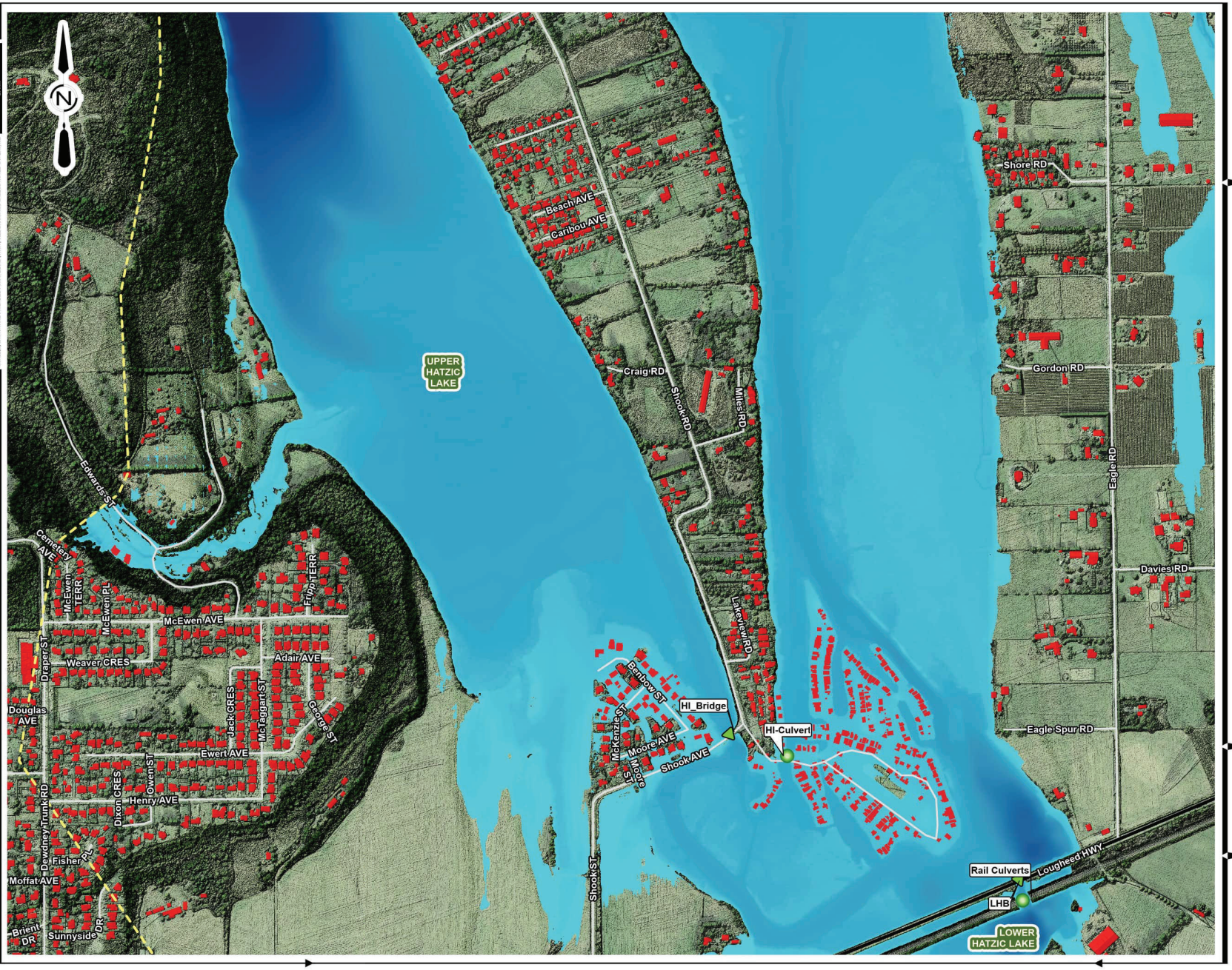


Associated Engineering

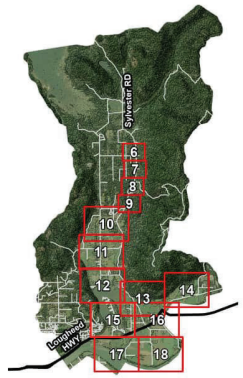
BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH WINTER 10 YEAR 4 DAY

DEPTH
- 18.9 m
- 0.0 m

SITE LOCATIONS
BRIDGE
WEIR/GATE/CULVERT
PRIMARY ROADS
MINOR ROADS
BUILDINGS
2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 43

BC MINISTRY OF ENVIRONMENT
AND CLIMATE CHANGE STRATEGY

CIVIL
WINTER 10-YEAR 4-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

AE PROJECT No.	20222632-00
SCALE	1:8,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 37.5 75 150 225 300 Meters

IF NOT 215 mm AS LIST SCALES ARE WRONG
SCALES SHOWN ARE INTENDED FOR TABLOID (11 X 17) SIZE DRAWINGS UNLESS NOTED OTHERWISE
PLOT DATE: 2024-04-03 4:51 PM
SAVE DATE: 2024-04-03 4:51 PM SAVED BY: JORDON ROZON
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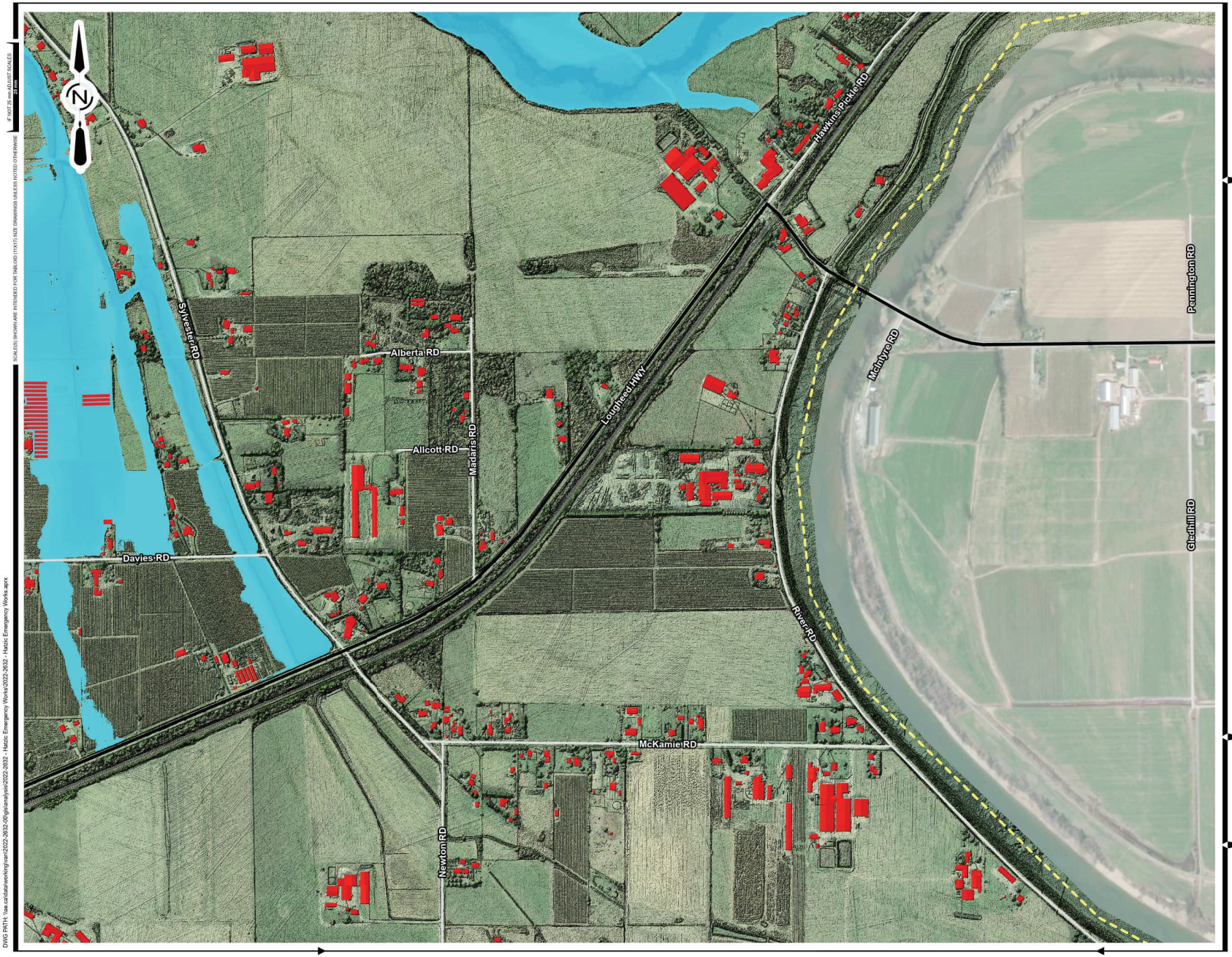


Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH WINTER 10 YEAR 4 DAY

DEPTH

18.9 m

0.0 m

SITE LOCATIONS

BRIDGE

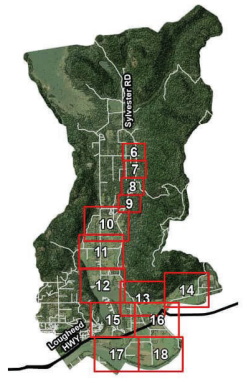
WEIR/GATE/CULVERT

PRIMARY ROADS

MINOR ROADS

BUILDINGS

2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 44

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

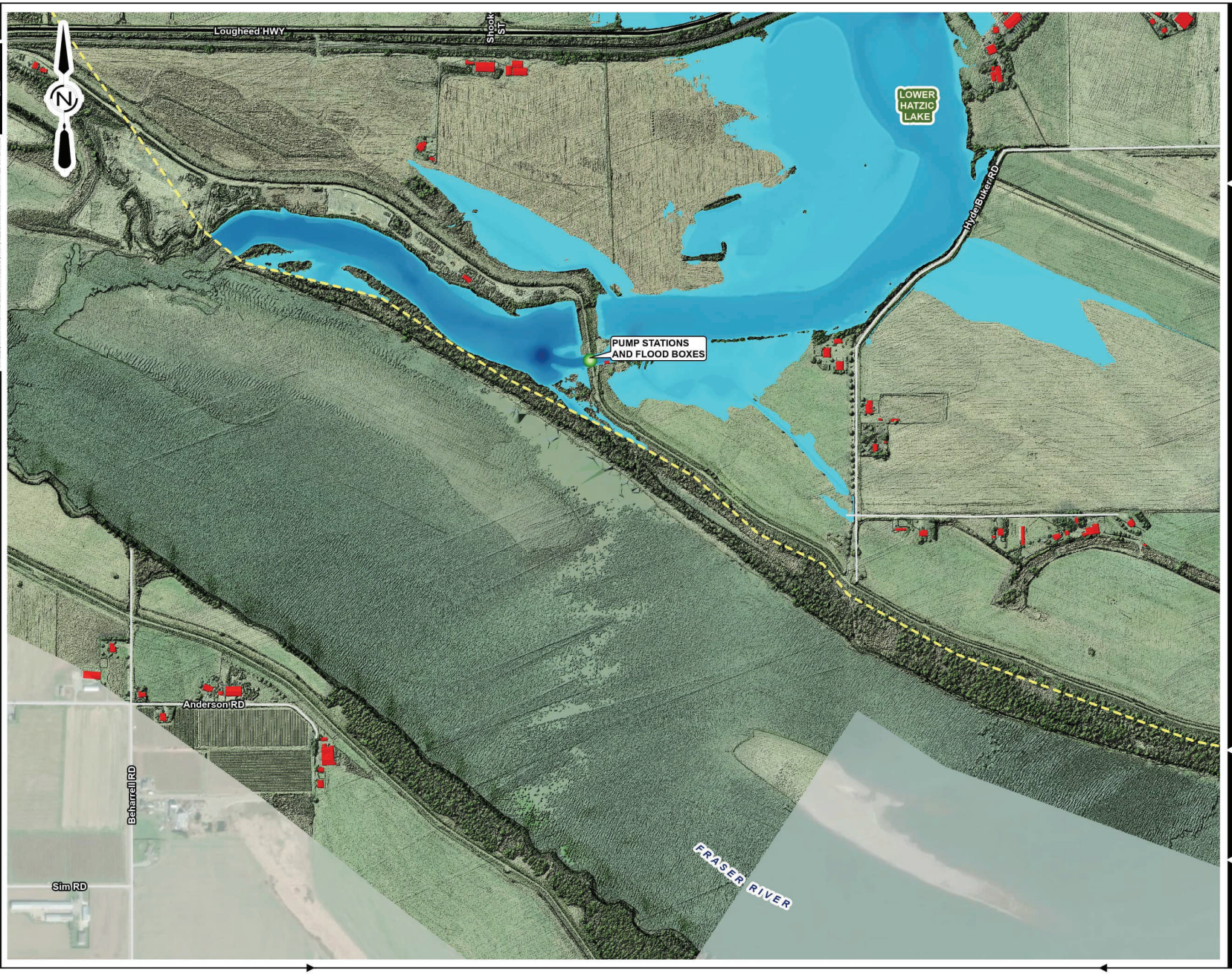
CIVIL
WINTER 10-YEAR 4-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

AE PROJECT No.	20222632-00
SCALE	1:8,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 37.5 75 150 225 300 Meters

PLOT DATE: 2024-04-03 4:52 PM
SAVE DATE: 2024-04-03 4:52 PM SAVED BY: JORDON ROZON
DWG PATH: \\ae.ca\data\working\van\2022-2632-00\gis\analysis\2022-2632 - Hatzic Emergency Works\2022-2632 - Hatzic Emergency Works.aprx

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE
IF NOT 25 mm ADJUST SCALES
25 mm



Associated Engineering

BEST MANAGED COMPANIES Platinum member

LEGEND:

DEPTH WINTER 10 YEAR 4 DAY

DEPTH

18.9 m

0.0 m

SITE LOCATIONS

BRIDGE

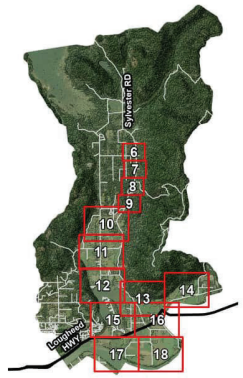
WEIR/GATE/CULVERT

PRIMARY ROADS

MINOR ROADS

BUILDINGS

2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 45

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

CIVIL
WINTER 10-YEAR 4-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

AE PROJECT No.	20222632-00
SCALE	1:8,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 37.5 75 150 225 300 Meters

IF NOT 76.2mm AS LIST SCALES ARE WRONG

SCALES SHOWN ARE INTENDED FOR TABLOID (11 X 17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 2024-04-03 4:52 PM
SAVE DATE: 2024-04-03 4:52 PM SAVED BY: JORDON ROZON
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Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH WINTER 10 YEAR 4 DAY

DEPTH

18.9 m

0.0 m

SITE LOCATIONS

BRIDGE

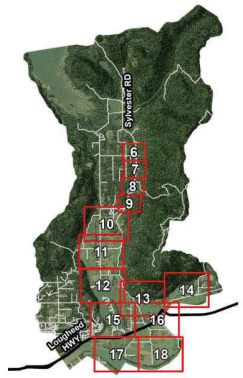
WEIR/GATE/CULVERT

PRIMARY ROADS

MINOR ROADS

BUILDINGS

2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 46

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

CIVIL
WINTER 10-YEAR 4-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

AE PROJECT No.	20222632-00
SCALE	1:8,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 37.5 75 150 225 300 Meters

IF NOT 25 mm ADJUST SCALES 25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 2024-04-03 4:52 PM
SAVE DATE: 2024-04-03 4:52 PM SAVED BY: JORDON ROZON
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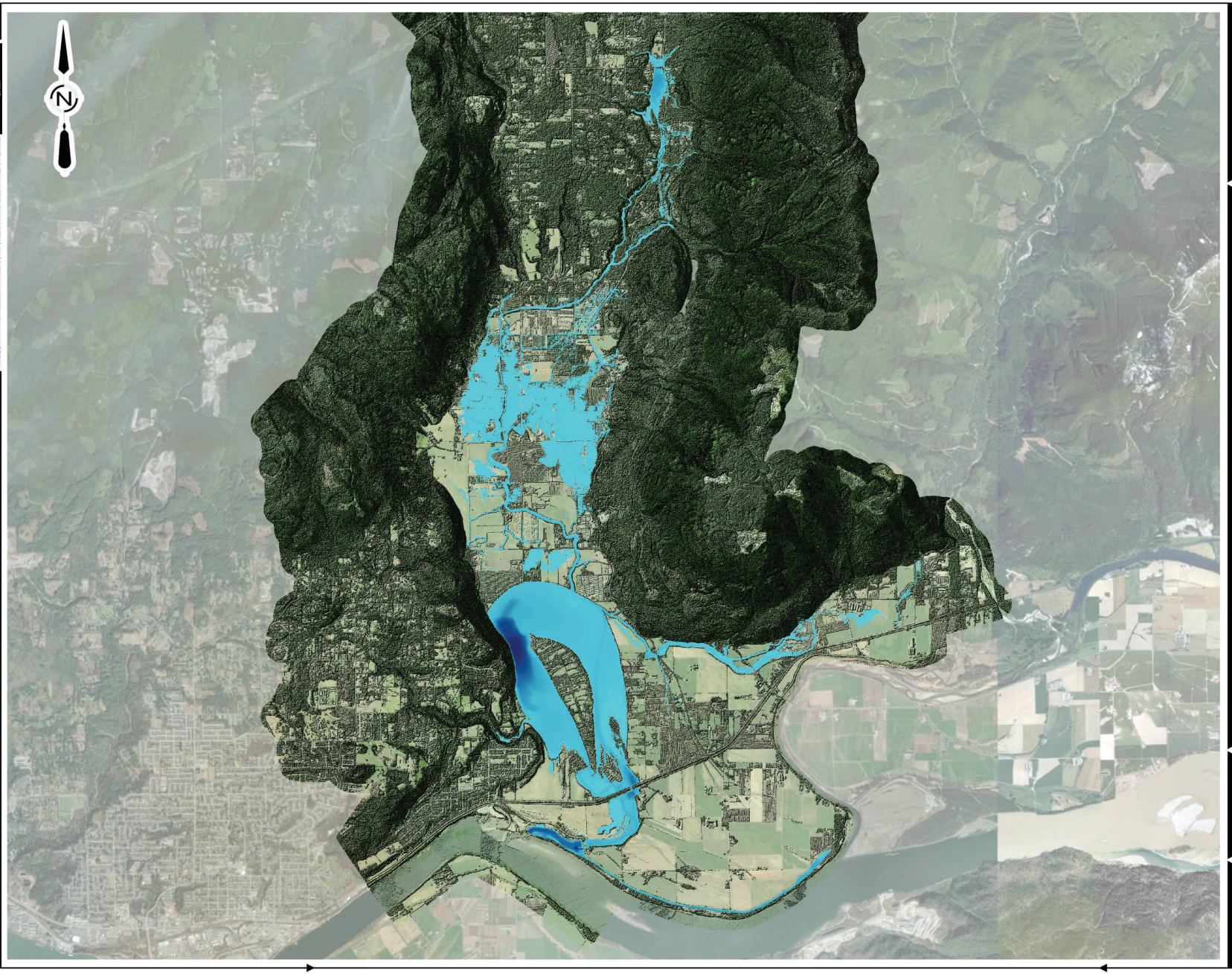


Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH SUMMER 200 YEAR 5 DAY

DEPTH

17.0 m

0.0 m

SITE LOCATIONS

BRIDGE

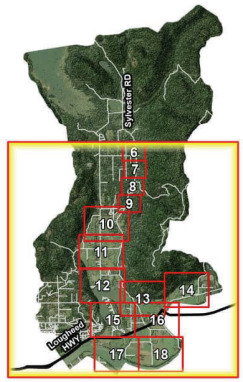
WEIR/GATE/CULVERT

PRIMARY ROADS

MINOR ROADS

BUILDINGS

2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 19

BC MINISTRY OF ENVIRONMENT
AND CLIMATE CHANGE STRATEGY

CIVIL
SUMMER 200-YEAR 5-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

AE PROJECT No.	20222632-00
SCALE	1:55,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 270 540 1,080 1,620 2,160 Meters

IF NOT 25 mm ADJUST SCALES 25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 2024-04-03 4:54 PM
SAVE DATE: 2024-04-03 4:54 PM SAVED BY: JORDON ROZON
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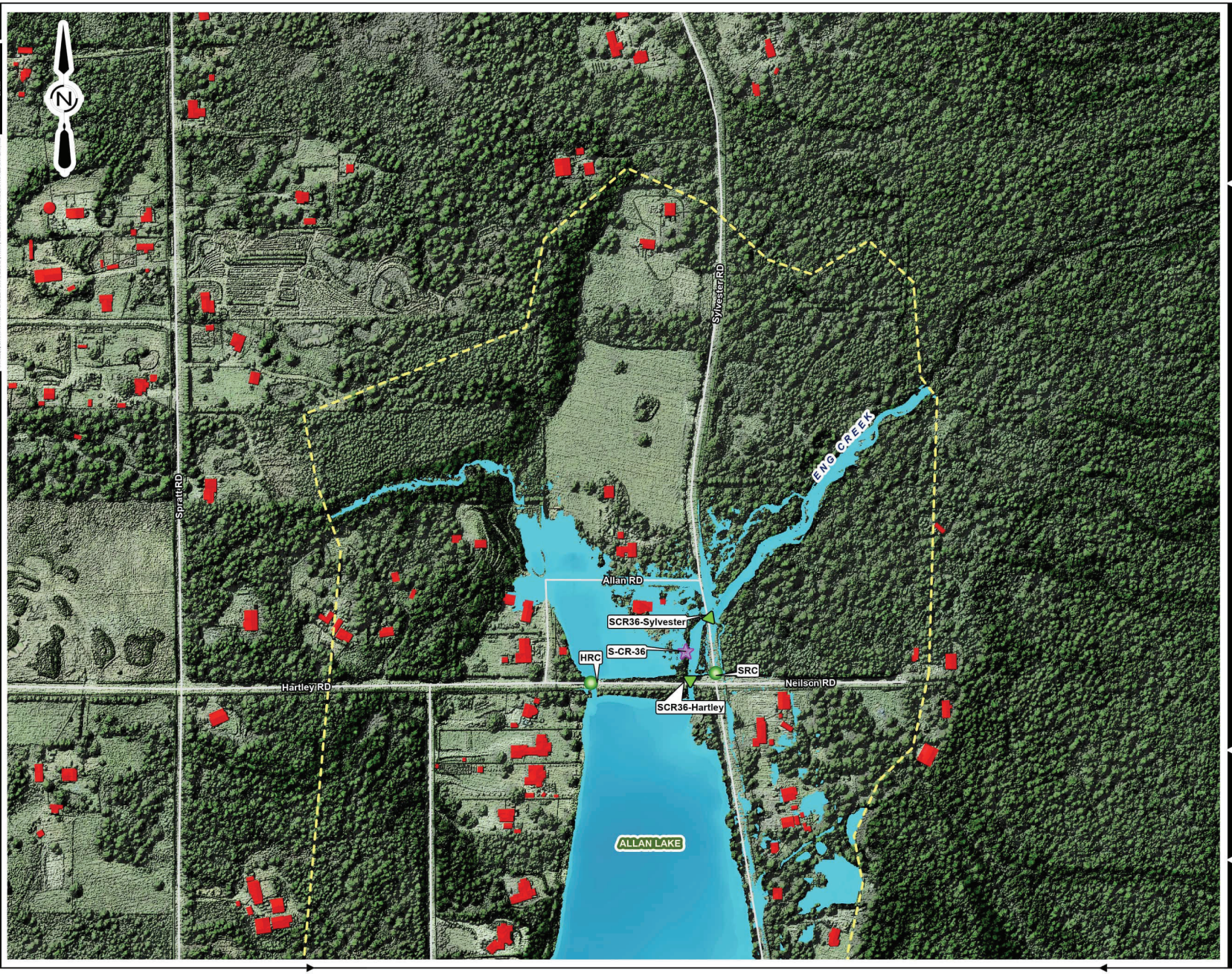


Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH SUMMER 200 YEAR 5 DAY

DEPTH

17.0 m

0.0 m

SITE LOCATIONS

BRIDGE

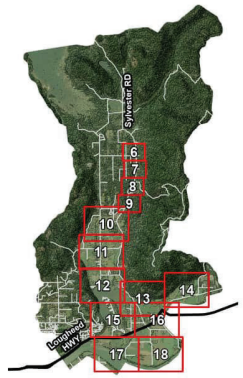
WEIR/GATE/CULVERT

PRIMARY ROADS

MINOR ROADS

BUILDINGS

2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 20

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

CIVIL
SUMMER 200-YEAR 5-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

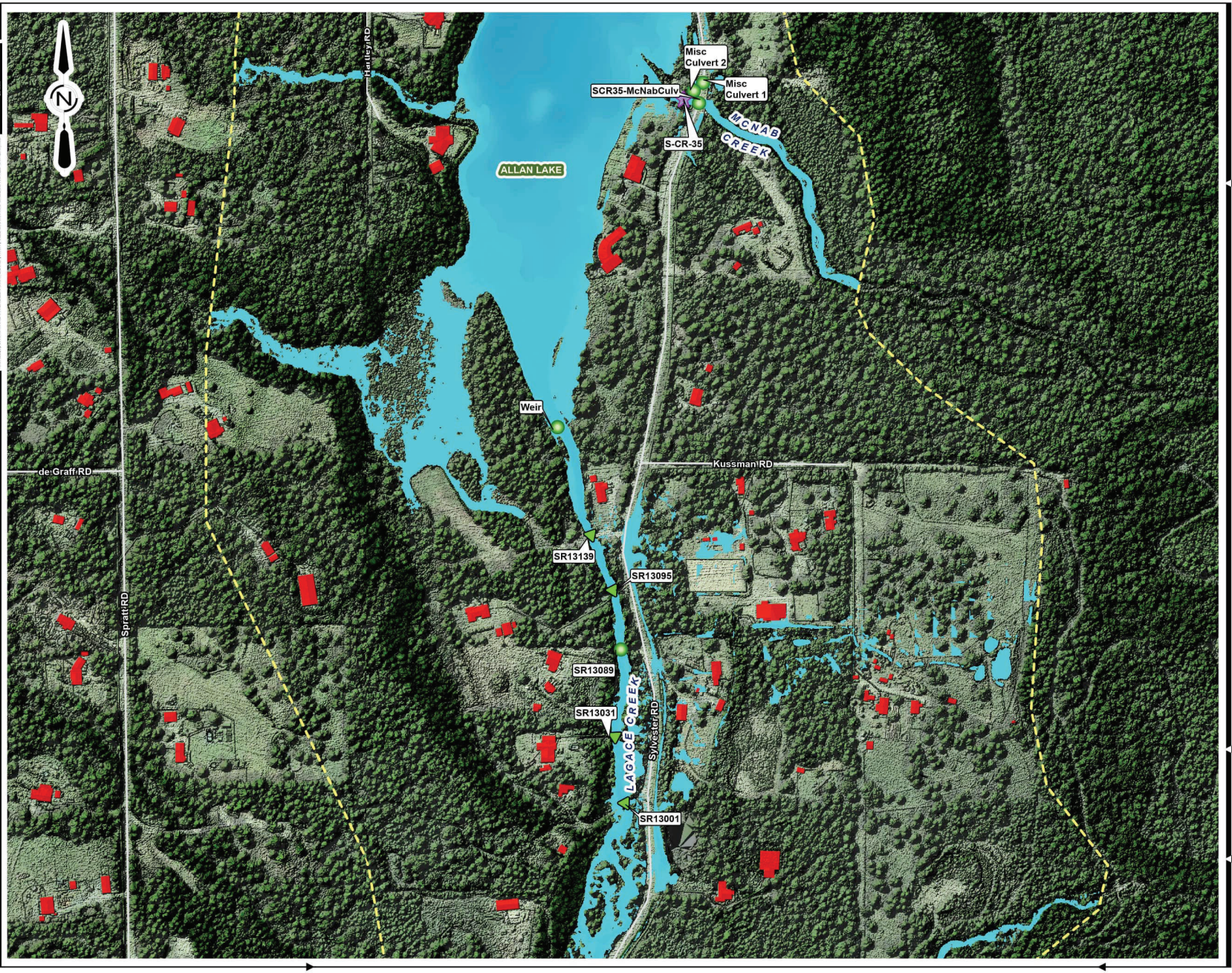
AE PROJECT No.	20222632-00
SCALE	1:4,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 15 30 60 90 120 Meters

IF NOT 25 mm ADJUST SCALES 25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 2024-04-03 4:54 PM
SAVE DATE: 2024-04-03 4:54 PM SAVED BY: JORDON ROZON
DWG PATH: \\ae.ca\data\working\van\2022-2632-00\gis\analysis\2022-2632 - Hatzic Emergency Works\2022-2632 - Hatzic Emergency Works.aprx



Associated Engineering

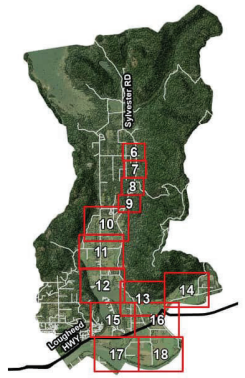
BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH SUMMER 200 YEAR 5 DAY

DEPTH
17.0 m
0.0 m

SITE LOCATIONS
BRIDGE
WEIR/GATE/CULVERT
PRIMARY ROADS
MINOR ROADS
BUILDINGS
2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 21

BC MINISTRY OF ENVIRONMENT
AND CLIMATE CHANGE STRATEGY

CIVIL
SUMMER 200-YEAR 5-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

AE PROJECT No.	20222632-00
SCALE	1:4,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 15 30 60 90 120 Meters

IF NOT 25 mm AS JUST SCALES
SCALES SHOWN ARE INTENDED FOR TABLOID (11x17) SIZE DRAWINGS UNLESS NOTED OTHERWISE
PLOT DATE: 2024-04-03 4:54 PM
SAVE DATE: 2024-04-03 4:54 PM SAVED BY: JORDON ROZON
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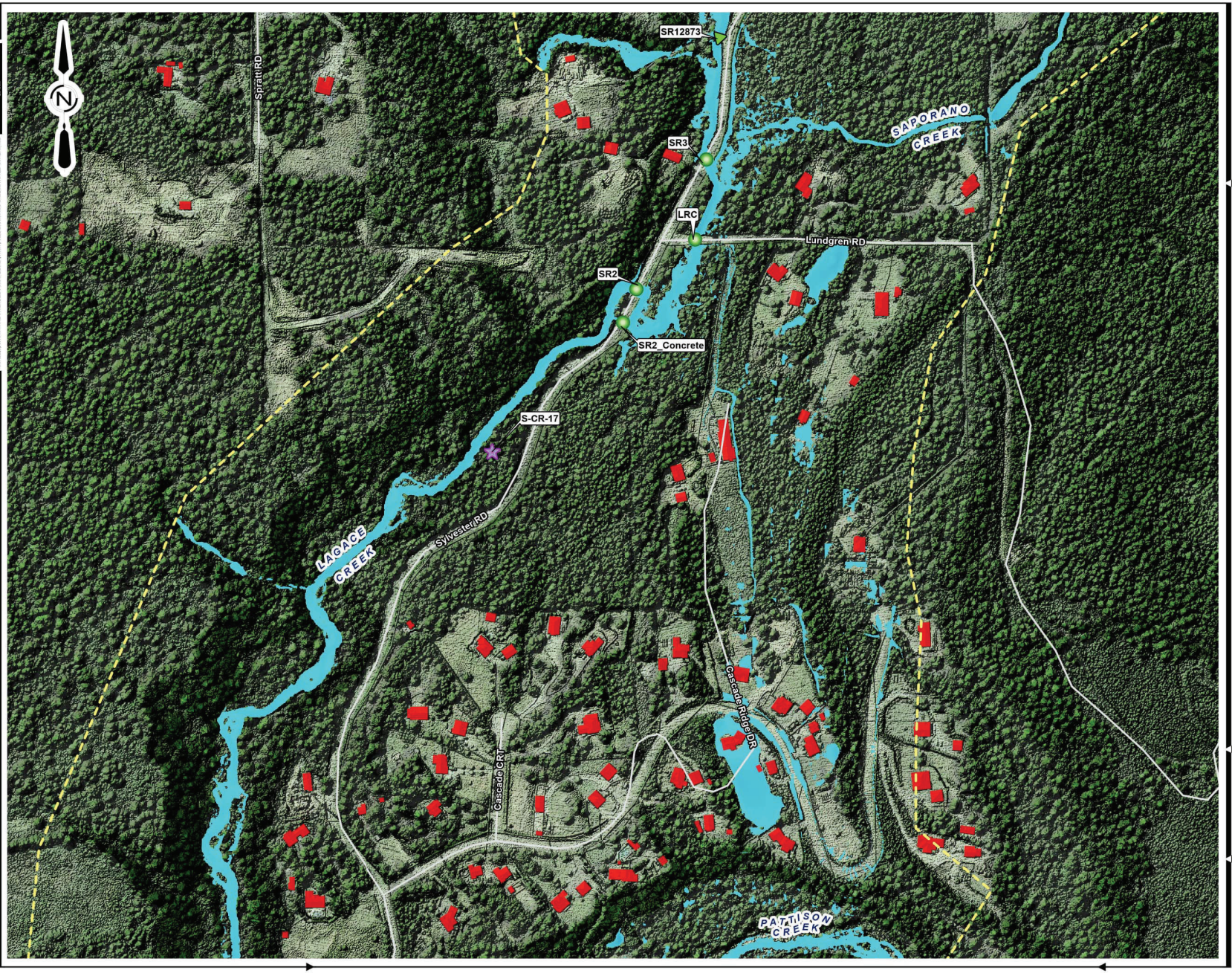


Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH SUMMER 200 YEAR 5 DAY

DEPTH

17.0 m

0.0 m

SITE LOCATIONS

BRIDGE

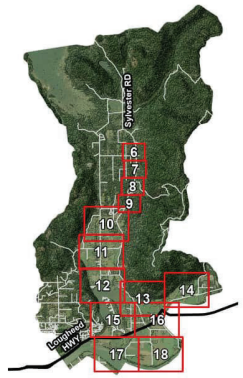
WEIR/GATE/CULVERT

PRIMARY ROADS

MINOR ROADS

BUILDINGS

2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 22

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

CIVIL
SUMMER 200-YEAR 5-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

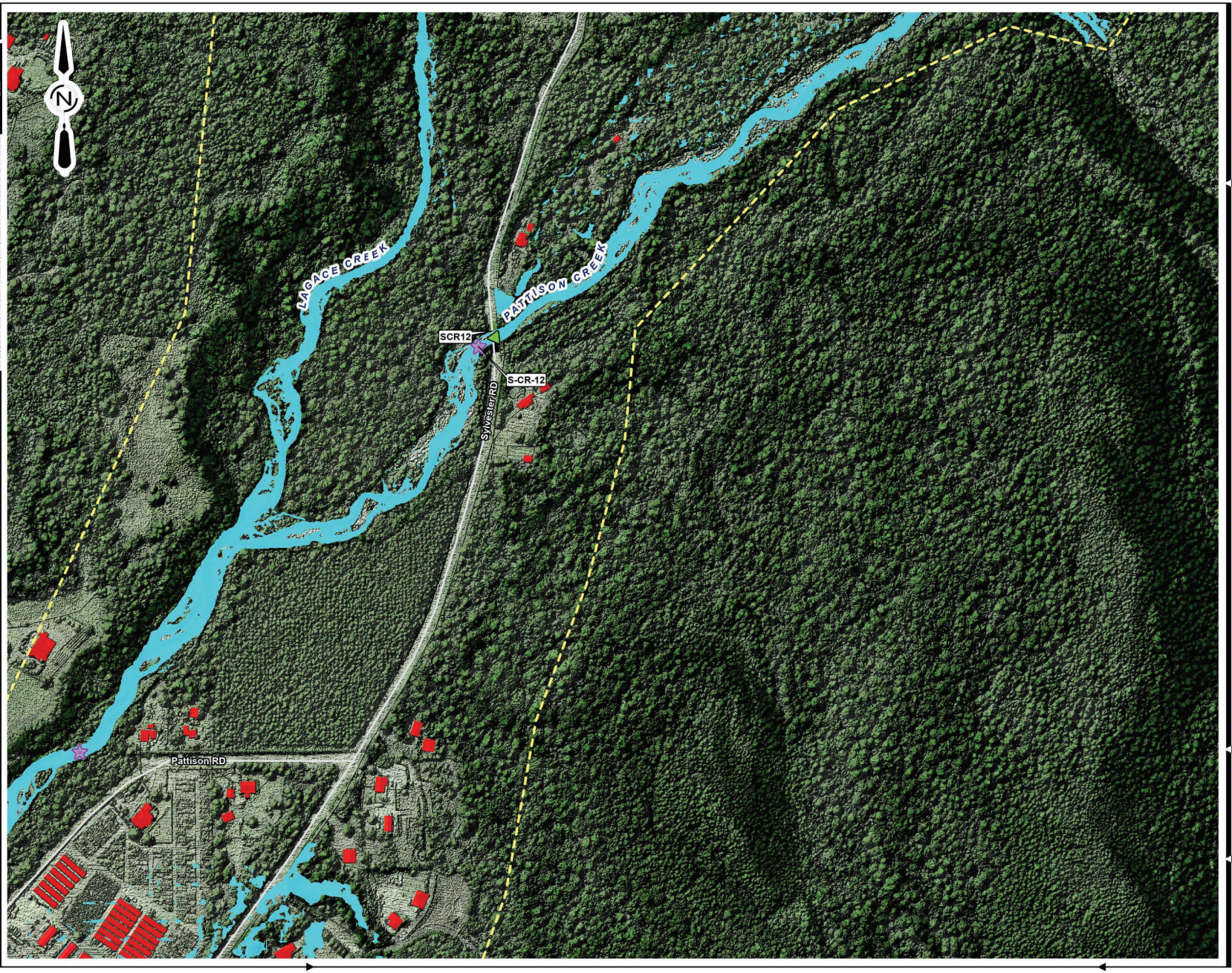
AE PROJECT No.	20222632-00
SCALE	1:4,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 15 30 60 90 120 Meters

IF NOT 25 mm ADJUST SCALES
25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 2024-04-03 4:54 PM
SAVE DATE: 2024-04-03 4:54 PM SAVED BY: JORDON ROZON
DWG PATH: \\ae.ca\data\working\van\2022-2632-00\gis\analysis\2022-2632 - Hatzic Emergency Works\2022-2632 - Hatzic Emergency Works.aprx



Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH SUMMER 200 YEAR 5 DAY

DEPTH

17.0 m

0.0 m

SITE LOCATIONS

BRIDGE

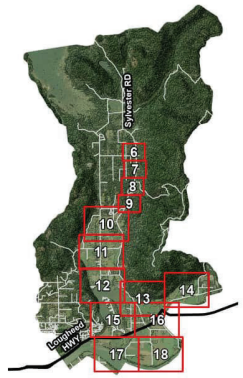
WEIR/GATE/CULVERT

PRIMARY ROADS

MINOR ROADS

BUILDINGS

2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 23

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

CIVIL
SUMMER 200-YEAR 5-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

AE PROJECT No.	20222632-00
SCALE	1:4,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 15 30 60 90 120 Meters

IF NOT 25 mm ADJUST SCALES 25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 2024-04-03 4:54 PM
SAVE DATE: 2024-04-03 4:54 PM SAVED BY: JORDON ROZON
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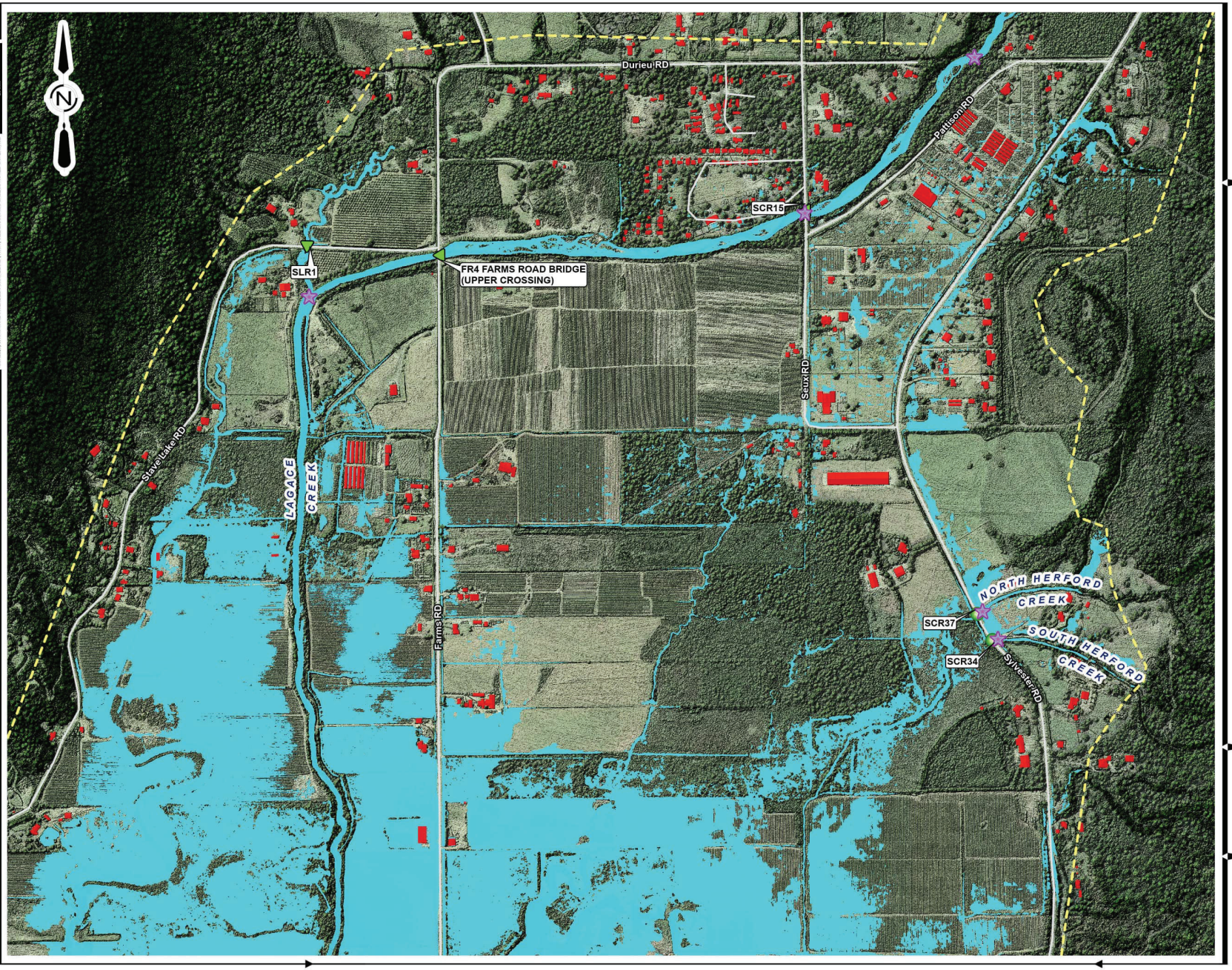


Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH SUMMER 200 YEAR 5 DAY

DEPTH

17.0 m

0.0 m

SITE LOCATIONS

BRIDGE

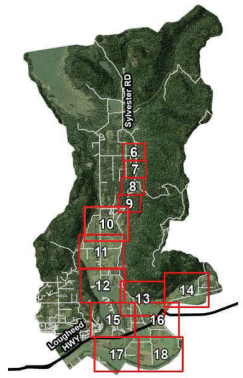
WEIR/GATE/CULVERT

PRIMARY ROADS

MINOR ROADS

BUILDINGS

2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 24

BC MINISTRY OF ENVIRONMENT
AND CLIMATE CHANGE STRATEGY

CIVIL
SUMMER 200-YEAR 5-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

AE PROJECT No.	20222632-00
SCALE	1:8,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 37.5 75 150 225 300 Meters

IF NOT 25 mm ADJUST SCALES 25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 2024-04-03 4:55 PM
SAVE DATE: 2024-04-03 4:55 PM SAVED BY: JORDON ROZON
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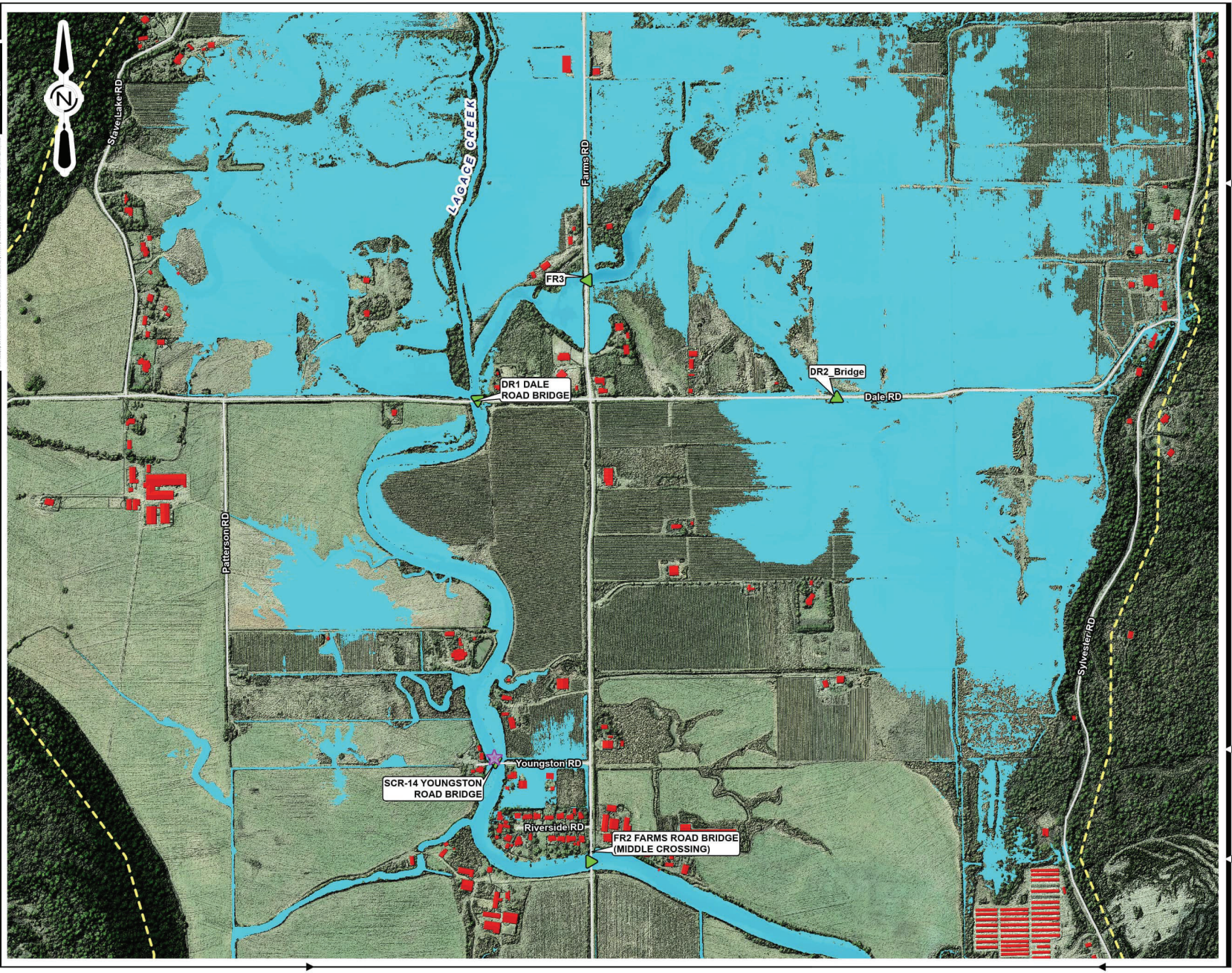


Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH SUMMER 200 YEAR 5 DAY

DEPTH

17.0 m

0.0 m

SITE LOCATIONS

BRIDGE

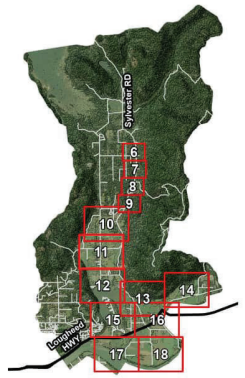
WEIR/GATE/CULVERT

PRIMARY ROADS

MINOR ROADS

BUILDINGS

2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 25

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

CIVIL
SUMMER 200-YEAR 5-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

AE PROJECT No.	20222632-00
SCALE	1:8,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 37.5 75 150 225 300 Meters

IF NOT 25 mm ADJUST SCALES
25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 2024-04-03 4:55 PM
SAVE DATE: 2024-04-03 4:55 PM SAVED BY: JORDON ROZON
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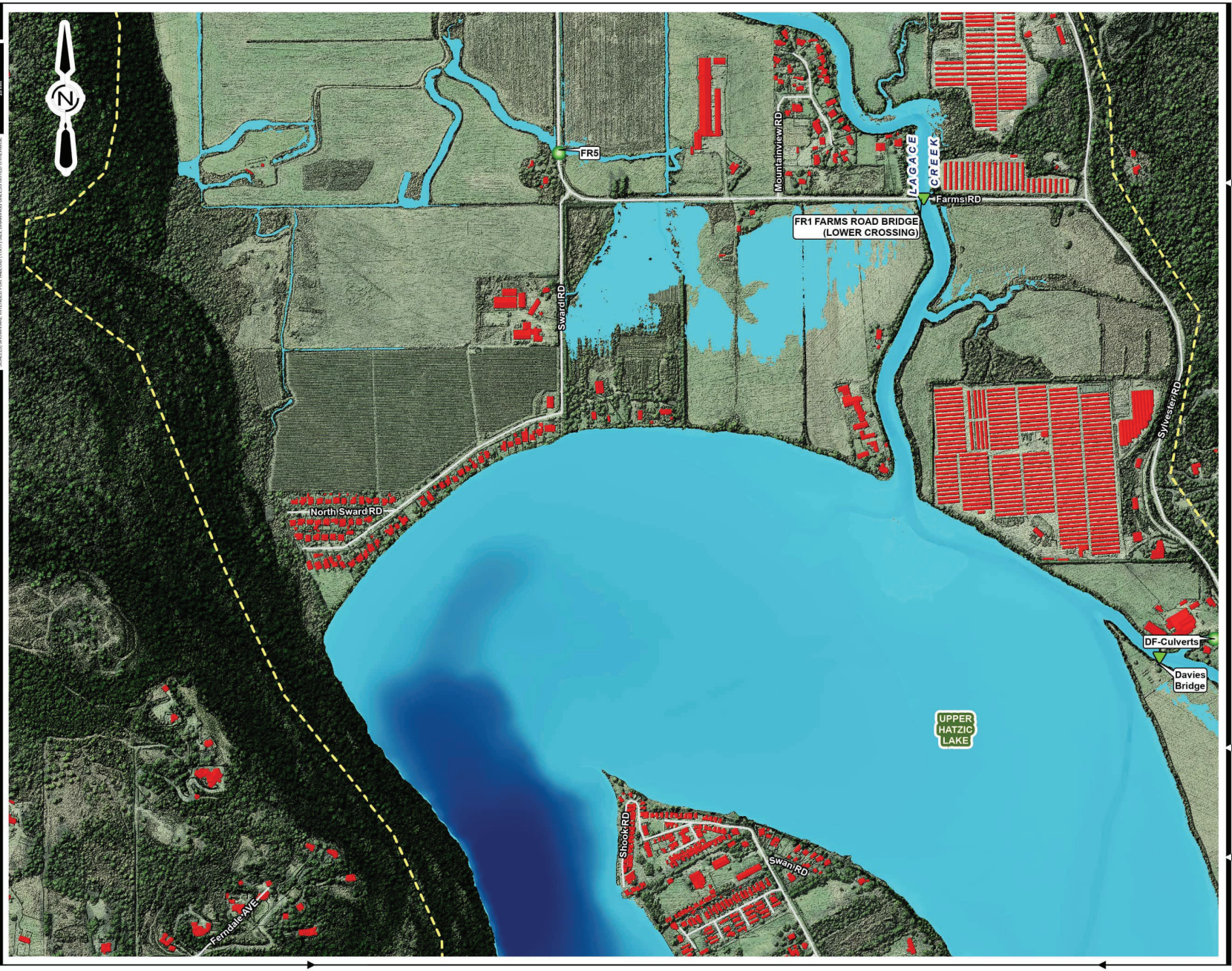


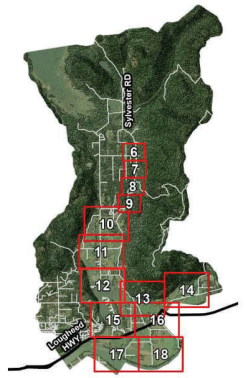
Associated Engineering

CANADA'S BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH SUMMER 200 YEAR 5 DAY

DEPTH
- 17.0 m
- 0.0 m
- SITE LOCATIONS
- BRIDGE
- WEIR/GATE/CULVERT
- PRIMARY ROADS
- MINOR ROADS
- BUILDINGS
- 2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 26

BC MINISTRY OF ENVIRONMENT
AND CLIMATE CHANGE STRATEGY

CIVIL
SUMMER 200-YEAR 5-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

AE PROJECT No.	20222632-00
SCALE	1:8,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 37.5 75 150 225 300 Meters

IF NOT 25 mm AS LIST SCALES ARE WRONG

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11 X 17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 2024-04-03 4:55 PM
SAVE DATE: 2024-04-03 4:55 PM SAVED BY: JORDON ROZON
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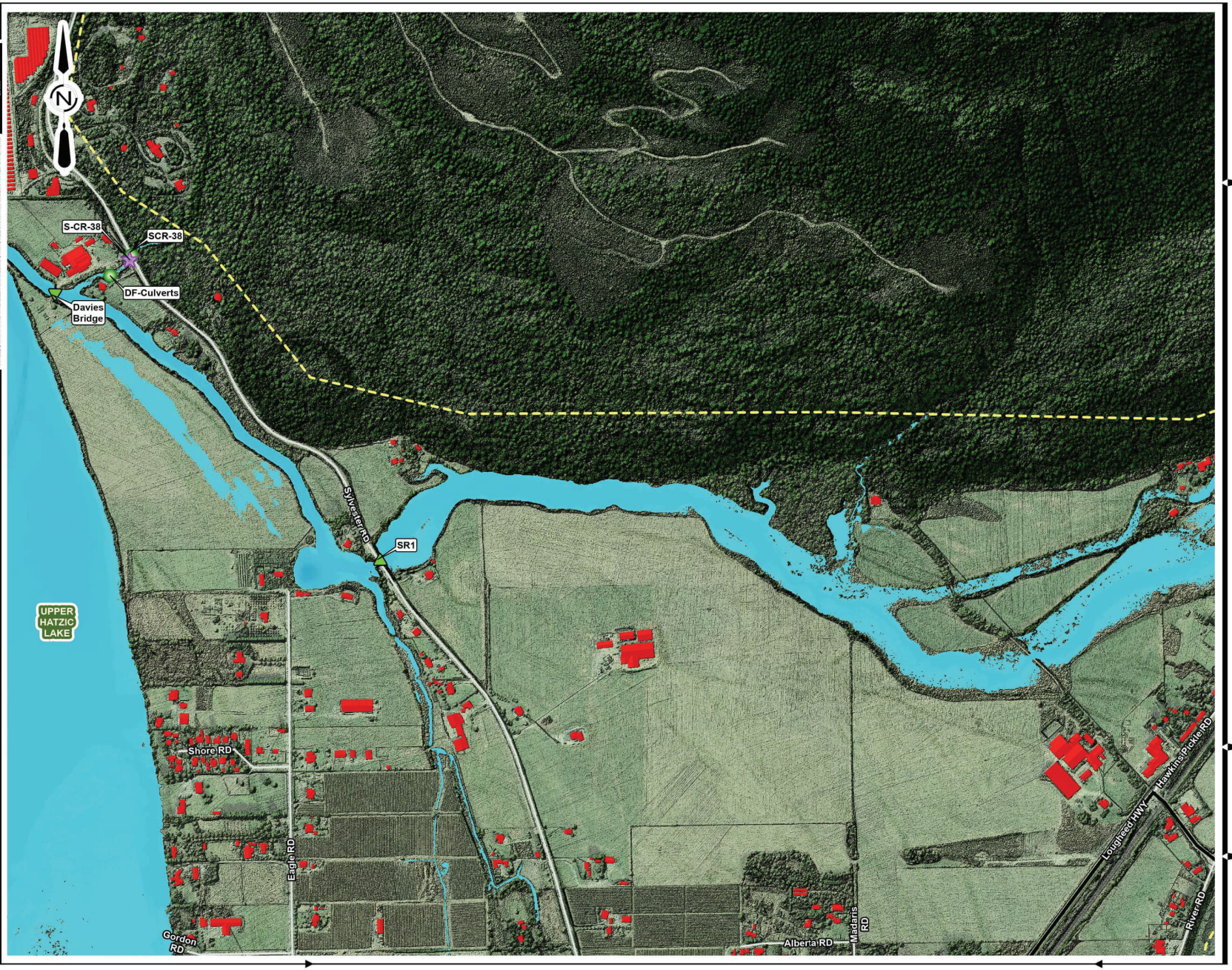


Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH SUMMER 200 YEAR 5 DAY

DEPTH

17.0 m

0.0 m

SITE LOCATIONS

BRIDGE

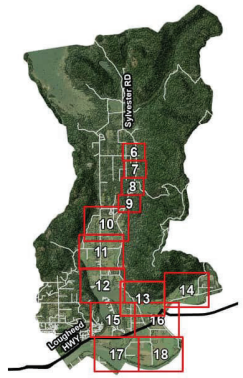
WEIR/GATE/CULVERT

PRIMARY ROADS

MINOR ROADS

BUILDINGS

2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 27

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

CIVIL
SUMMER 200-YEAR 5-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

AE PROJECT No.	20222632-00
SCALE	1:8,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 37.5 75 150 225 300 Meters

IF NOT 25 mm ADJUST SCALES
25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 2024-04-03 4:55 PM
SAVE DATE: 2024-04-03 4:55 PM SAVED BY: JORDON ROZON
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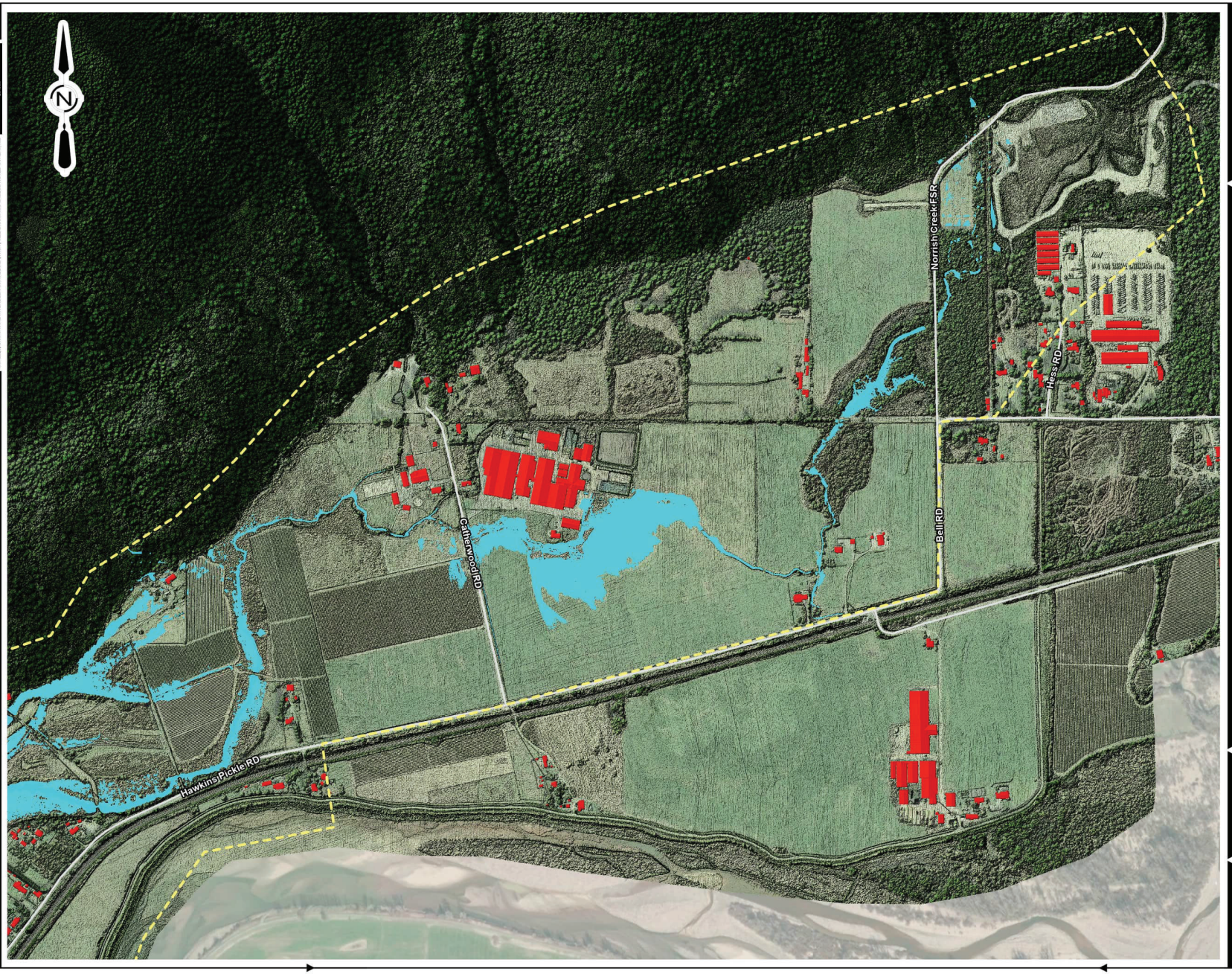

IF NOT 35 mm AS LIST SCALES
SCALES SHOWN ARE INTENDED FOR TABLOID (11x17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

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SAVE DATE: 2024-04-03 4:56 PM SAVED BY: JORDON ROZON
DWG PATH: \\ae.ca\data\working\van\2022-2632-00\gis\analysis\2022-2632 - Hatzic Emergency Works\2022-2632 - Hatzic Emergency Works.aprx

Associated Engineering

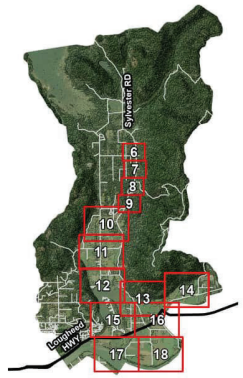
BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH SUMMER 200 YEAR 5 DAY

DEPTH
- 17.0 m
- 0.0 m

SITE LOCATIONS
BRIDGE
WEIR/GATE/CULVERT
PRIMARY ROADS
MINOR ROADS
BUILDINGS
2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

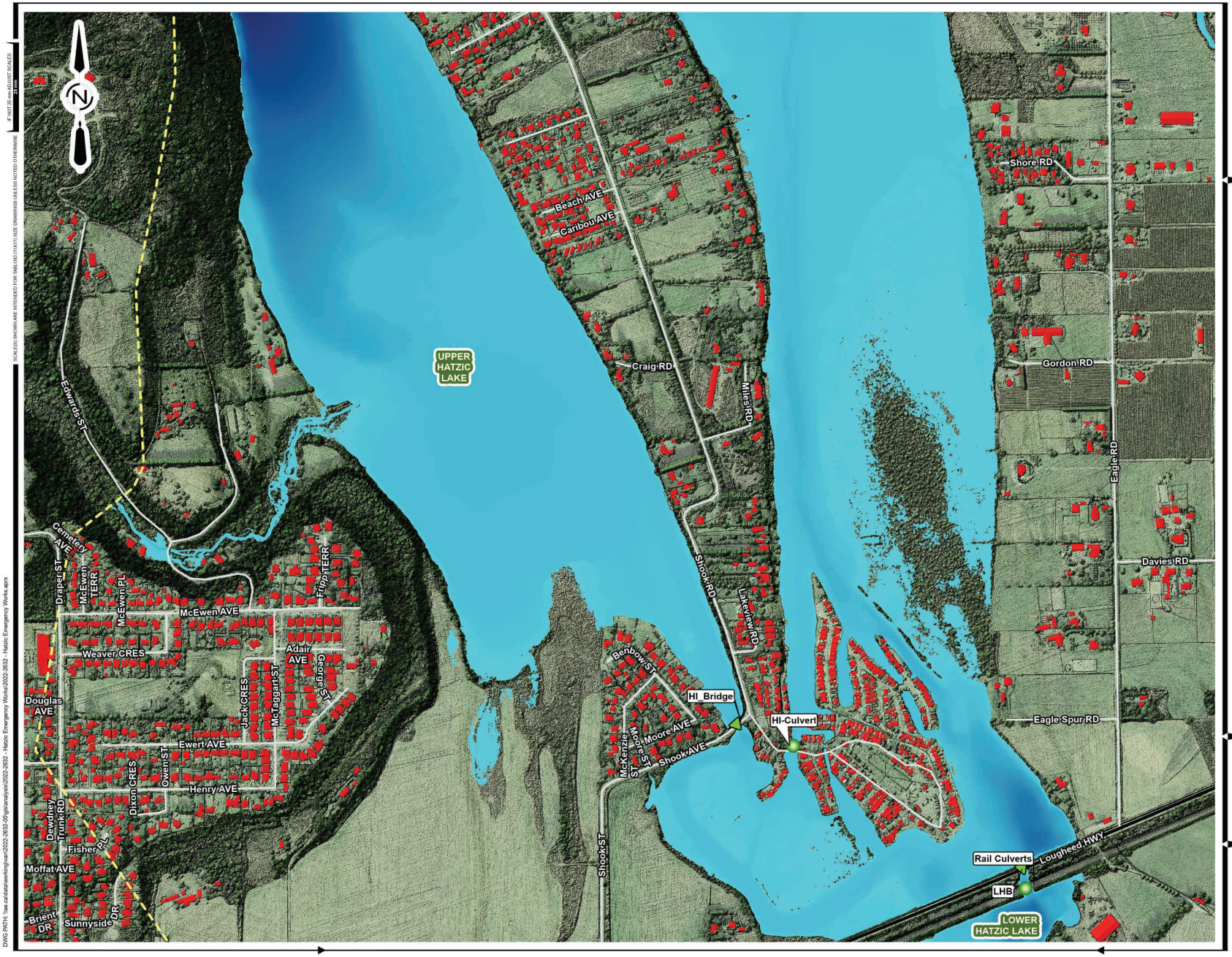
MAP FIGURE 28

BC MINISTRY OF ENVIRONMENT
AND CLIMATE CHANGE STRATEGY

CIVIL
SUMMER 200-YEAR 5-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

AE PROJECT No.	20222632-00
SCALE	1:8,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 37.5 75 150 225 300 Meters



Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH SUMMER 200 YEAR 5 DAY

DEPTH

17.0 m

0.0 m

SITE LOCATIONS

BRIDGE

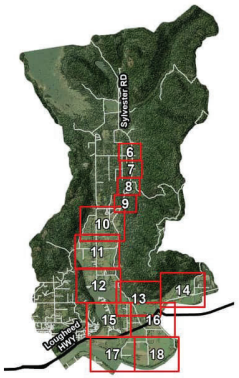
WEIR/GATE/CULVERT

PRIMARY ROADS

MINOR ROADS

BUILDINGS

2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 29

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

CIVIL
SUMMER 200-YEAR 5-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

AE PROJECT No.	20222632-00
SCALE	1:8,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 37.5 75 150 225 300 Meters

IF NOT 25 mm ADJUST SCALES 23 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 2024-04-03 4:56 PM
SAVE DATE: 2024-04-03 4:56 PM SAVED BY: JORDON ROZON
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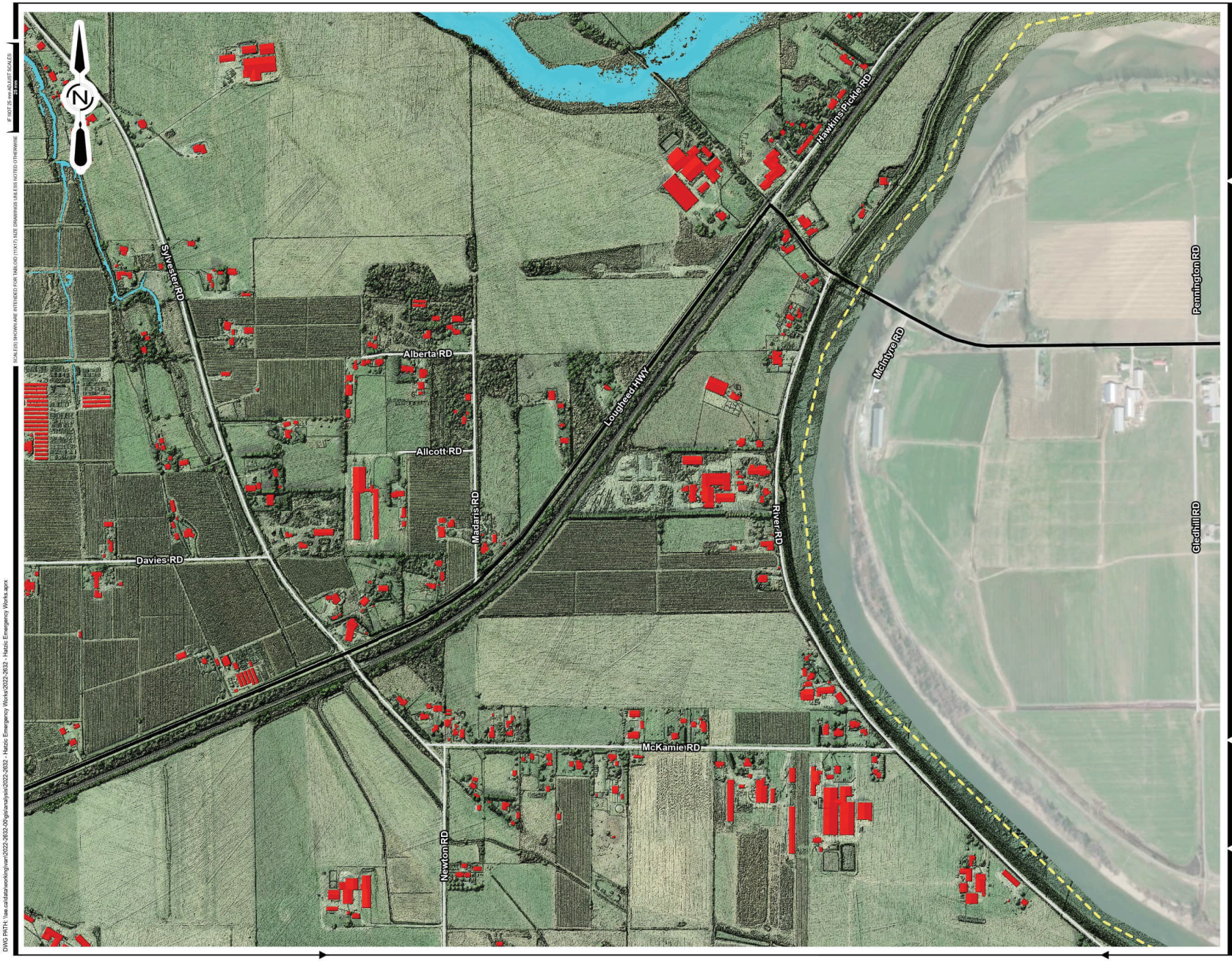


Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH SUMMER 200 YEAR 5 DAY

DEPTH

17.0 m

0.0 m

SITE LOCATIONS

BRIDGE

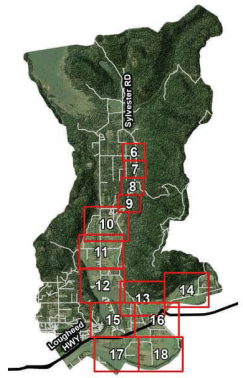
WEIR/GATE/CULVERT

PRIMARY ROADS

MINOR ROADS

BUILDINGS

2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 30

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

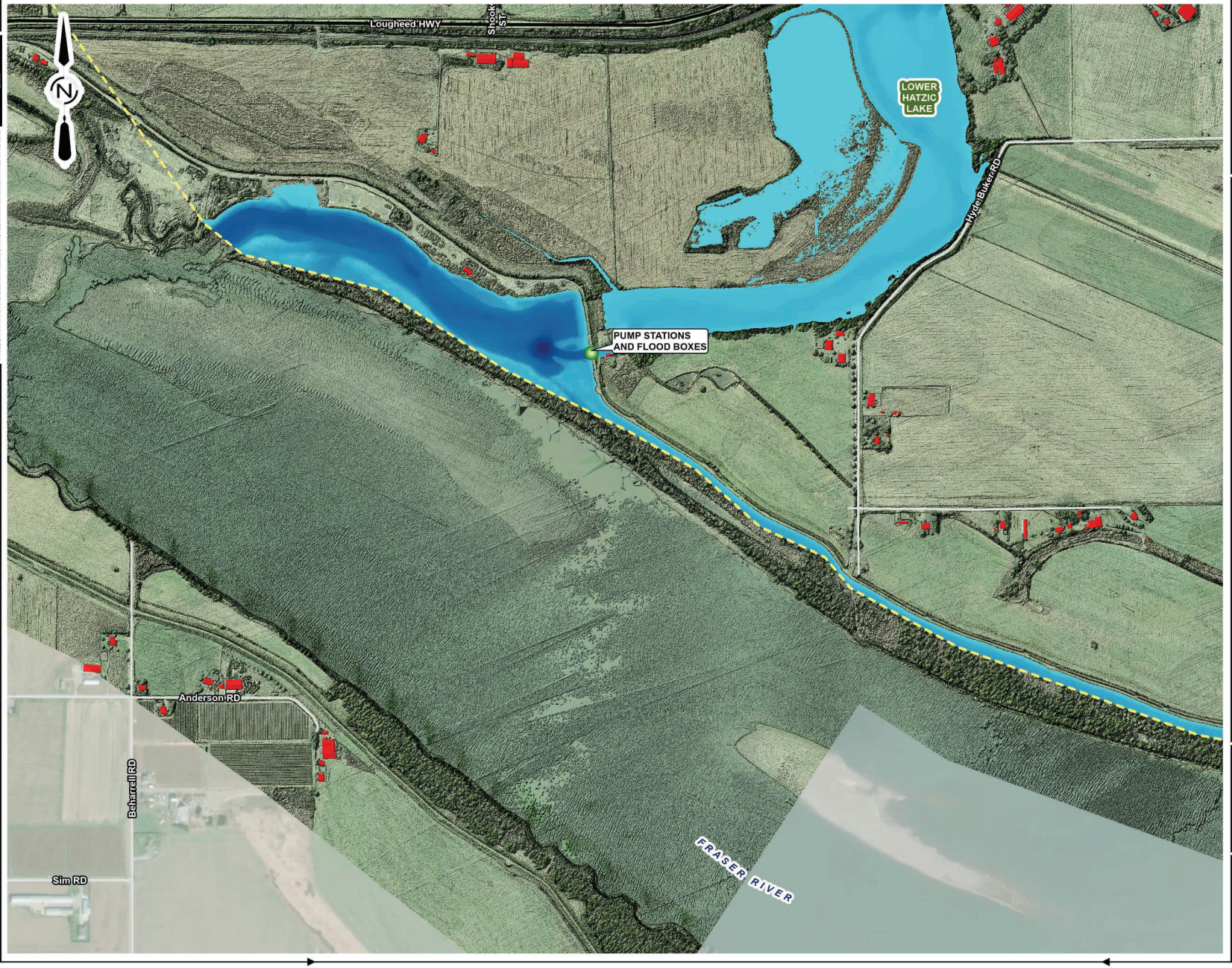
CIVIL
SUMMER 200-YEAR 5-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

AE PROJECT No.	20222632-00
SCALE	1:8,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 37.5 75 150 225 300 Meters

PLOT DATE: 2024-04-03 4:56 PM
SAVE DATE: 2024-04-03 4:56 PM SAVED BY: JORDON ROZON
DWG PATH: \\ae.ca\data\working\van\2022-2632-00\gis\analysis\2022-2632 - Hatzic Emergency Works\2022-2632 - Hatzic Emergency Works.aprx

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE
IF NOT 25 mm ADJUST SCALES
25 mm



Associated Engineering

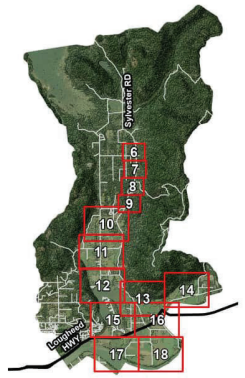
BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH SUMMER 200 YEAR 5 DAY

DEPTH

- 17.0 m
- 0.0 m
- SITE LOCATIONS
- BRIDGE
- WEIR/GATE/CULVERT
- PRIMARY ROADS
- MINOR ROADS
- BUILDINGS
- 2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 31

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

CIVIL
SUMMER 200-YEAR 5-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

AE PROJECT No.	20222632-00
SCALE	1:8,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 37.5 75 150 225 300 Meters

IF NOT 25 mm ADJUST SCALES 25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 2024-04-03 4:56 PM
SAVE DATE: 2024-04-03 4:56 PM SAVED BY: JORDON ROZON
DWG PATH: \\ae.ca\data\working\van\2022-2632-00\gis\analysis\2022-2632 - Hatzic Emergency Works\2022-2632 - Hatzic Emergency Works.aprx



Associated Engineering

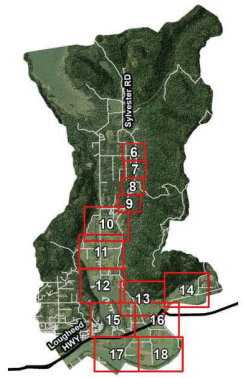
CANADA'S BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH SUMMER 200 YEAR 5 DAY

DEPTH
- 17.0 m
- 0.0 m

SITE LOCATIONS
BRIDGE
WEIR/GATE/CULVERT
PRIMARY ROADS
MINOR ROADS
BUILDINGS
2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 32

BC MINISTRY OF ENVIRONMENT
AND CLIMATE CHANGE STRATEGY

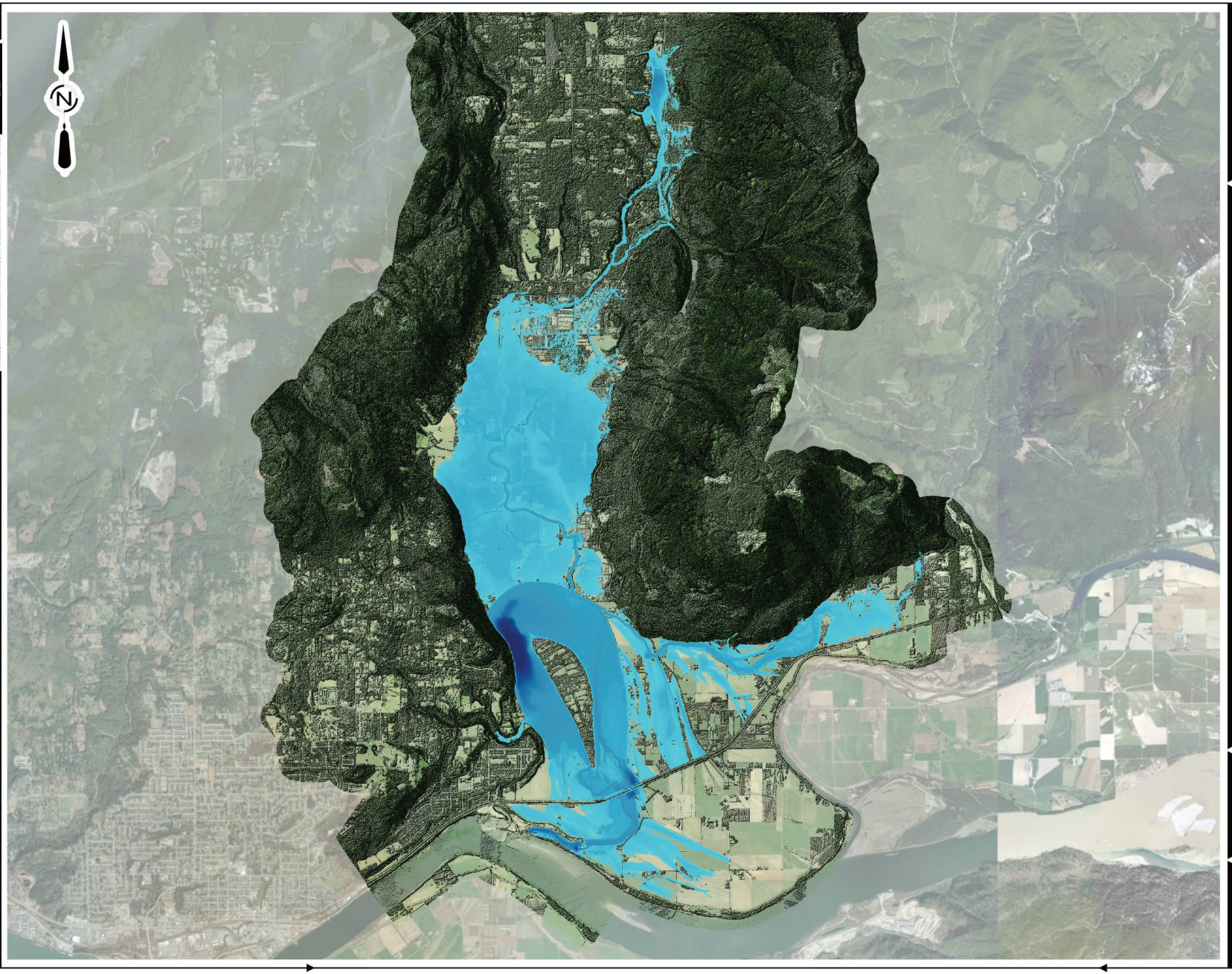
CIVIL
SUMMER 200-YEAR 5-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

AE PROJECT No.	20222632-00
SCALE	1:8,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 37.5 75 150 225 300 Meters

SCALES SHOWN ARE INTENDED FOR TABLOID (11x17) SIZE DRAWINGS UNLESS NOTED OTHERWISE
IF NOT 25 mm AT LIST SCALES
0 25mm

PLOT DATE: 2024-04-03 4:57 PM
SAVE DATE: 2024-04-03 4:57 PM SAVED BY: JORDON ROZON
DWG PATH: \\ae.ca\data\working\van\2022-2632-00\gis\analysis\2022-2632 - Hatzic Emergency Works\2022-2632 - Hatzic Emergency Works.aprx



Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH WINTER 200 YEAR 4 DAY

DEPTH

19.9 m

0.0 m

SITE LOCATIONS

BRIDGE

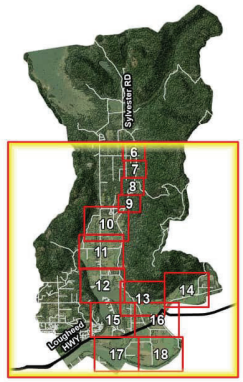
WEIR/GATE/CULVERT

PRIMARY ROADS

MINOR ROADS

BUILDINGS

2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 47

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

CIVIL
WINTER 200-YEAR 4-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

AE PROJECT No.	20222632-00
SCALE	1:55,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 270 540 1,080 1,620 2,160 Meters

IF NOT 25 mm ADJUST SCALES 25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 2024-04-03 4:58 PM
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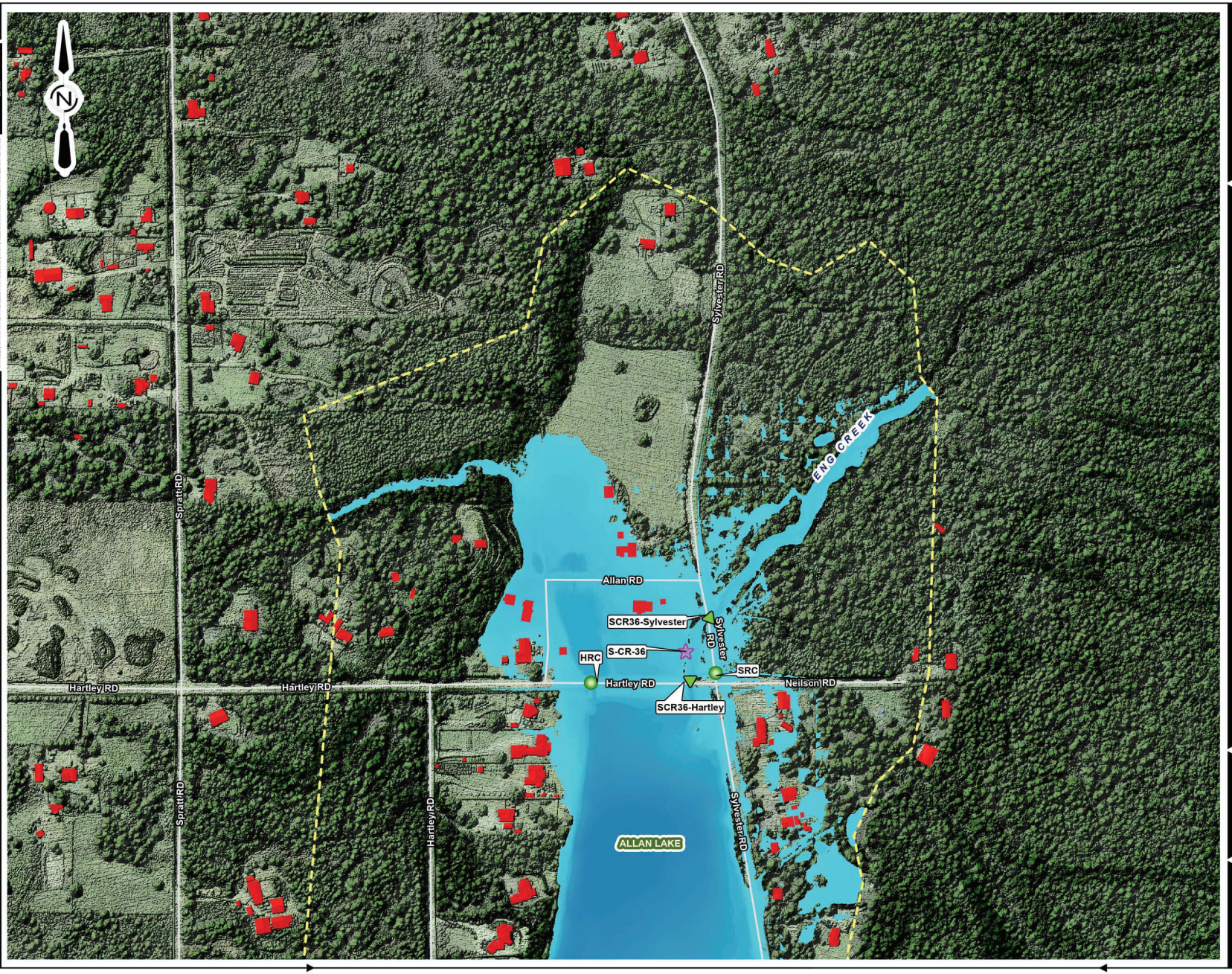


Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH WINTER 200 YEAR 4 DAY

DEPTH

19.9 m

0.0 m

SITE LOCATIONS

BRIDGE

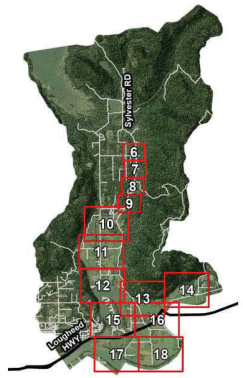
WEIR/GATE/CULVERT

PRIMARY ROADS

MINOR ROADS

BUILDINGS

2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 48

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

CIVIL
WINTER 200-YEAR 4-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

AE PROJECT No.	20222632-00
SCALE	1:4,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 15 30 60 90 120 Meters

IF NOT 25 mm ADJUST SCALES 25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 2024-04-03 4:58 PM
SAVE DATE: 2024-04-03 4:58 PM SAVED BY: JORDON ROZON
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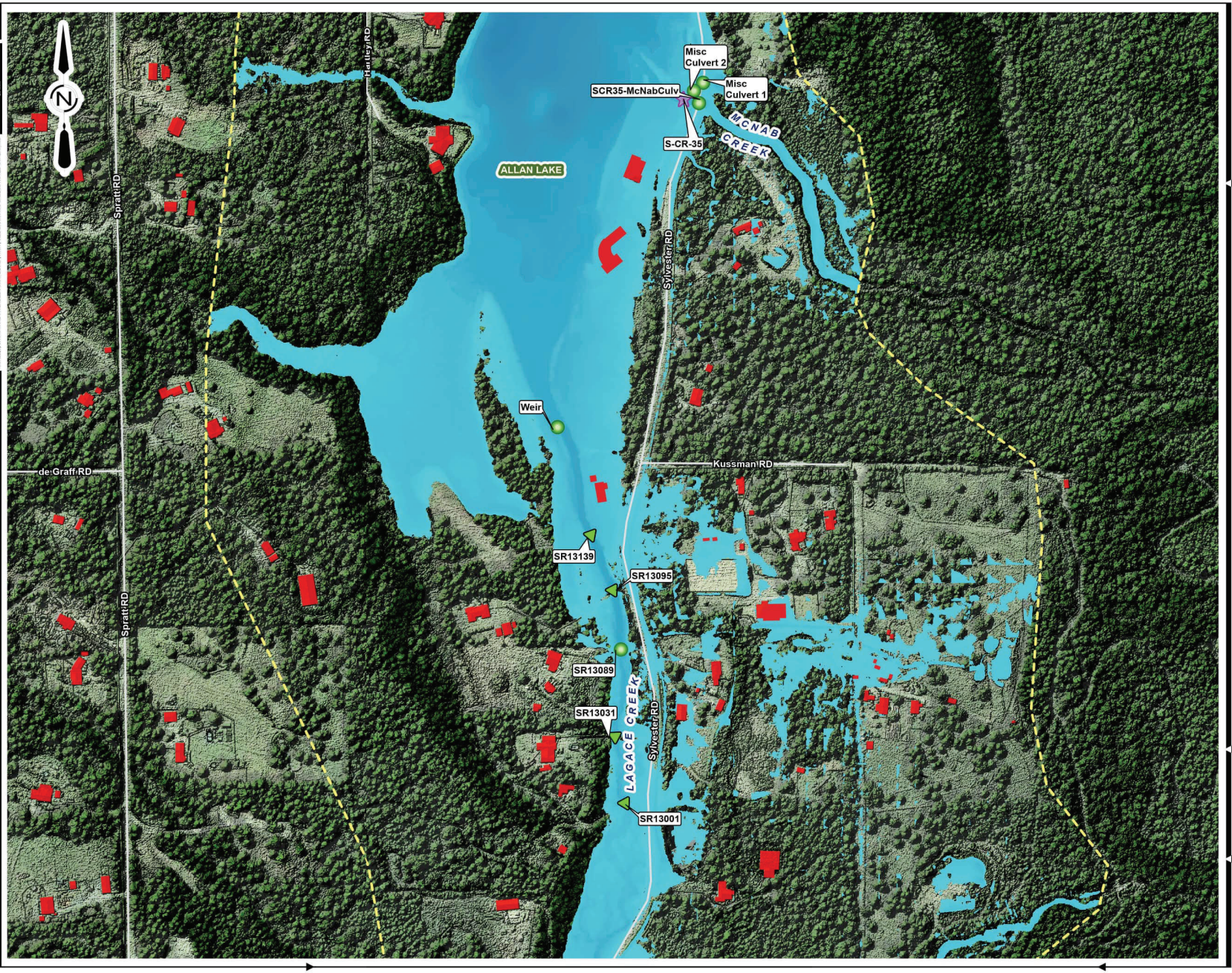


Associated Engineering

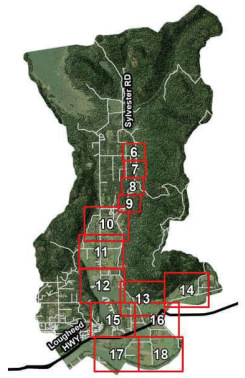
BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH WINTER 200 YEAR 4 DAY

DEPTH
19.9 m
0.0 m

SITE LOCATIONS
BRIDGE
WEIR/GATE/CULVERT
PRIMARY ROADS
MINOR ROADS
BUILDINGS
2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 49

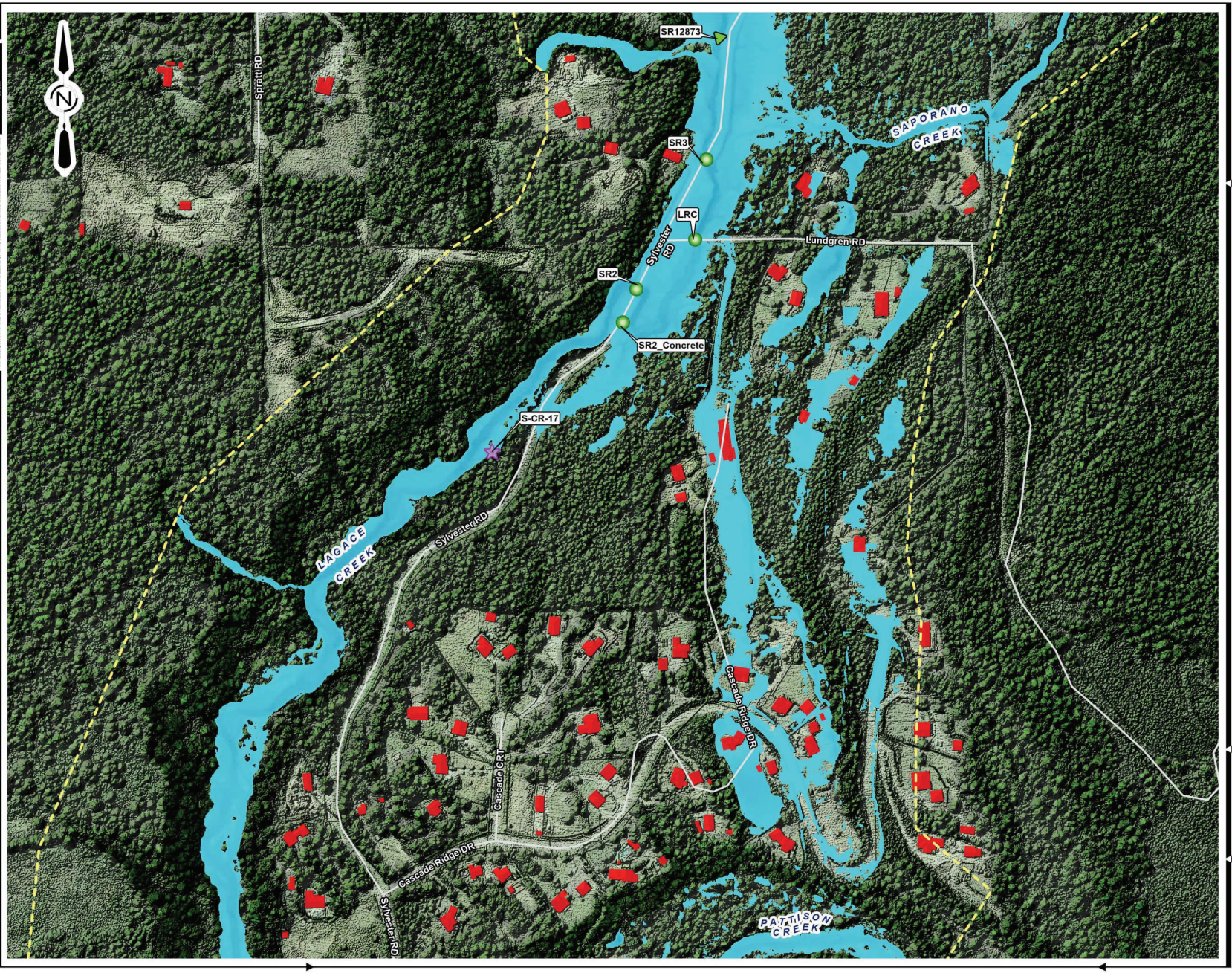
BC MINISTRY OF ENVIRONMENT
AND CLIMATE CHANGE STRATEGY

CIVIL
WINTER 200-YEAR 4-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

AE PROJECT No.	20222632-00
SCALE	1:4,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 15 30 60 90 120 Meters

IF NOT 75 mm AS LIST SCALES ARE WRONG
SCALES SHOWN ARE INTENDED FOR TABLOID (11x17) SIZE DRAWINGS UNLESS NOTED OTHERWISE
PLOT DATE: 2024-04-03 4:58 PM
SAVE DATE: 2024-04-03 4:58 PM SAVED BY: JORDON ROZON
DWG PATH: \\ae.ca\data\working\van\2022-2632-00\gis\analysis\2022-2632 - Hatzic Emergency Works\2022-2632 - Hatzic Emergency Works.aprx



Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH WINTER 200 YEAR 4 DAY

DEPTH

19.9 m

0.0 m

SITE LOCATIONS

BRIDGE

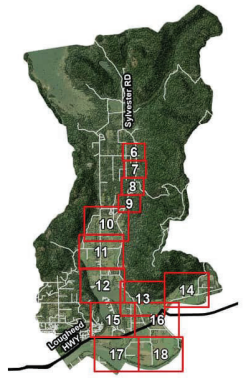
WEIR/GATE/CULVERT

PRIMARY ROADS

MINOR ROADS

BUILDINGS

2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 50

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

CIVIL
WINTER 200-YEAR 4-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

AE PROJECT No.	20222632-00
SCALE	1:4,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 15 30 60 90 120 Meters

IF NOT 25 mm ADJUST SCALES 25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 2024-04-03 4:58 PM
SAVE DATE: 2024-04-03 4:58 PM SAVED BY: JORDON ROZON
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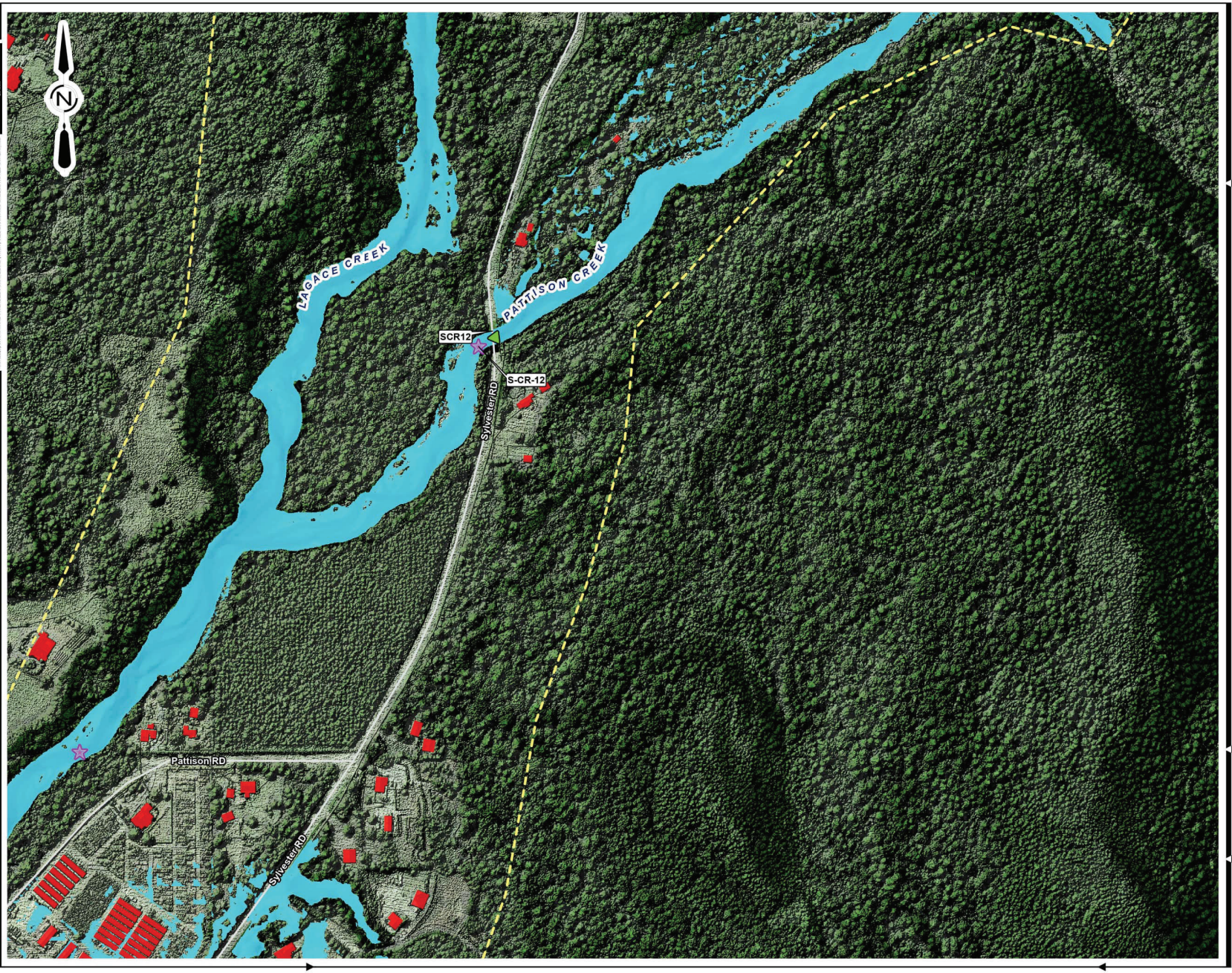


Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH WINTER 200 YEAR 4 DAY

DEPTH

19.9 m

0.0 m

SITE LOCATIONS

BRIDGE

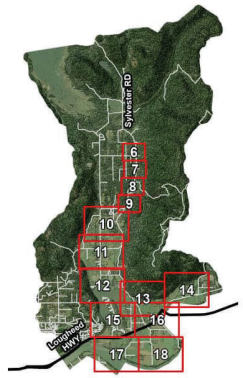
WEIR/GATE/CULVERT

PRIMARY ROADS

MINOR ROADS

BUILDINGS

2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 51

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

CIVIL
WINTER 200-YEAR 4-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

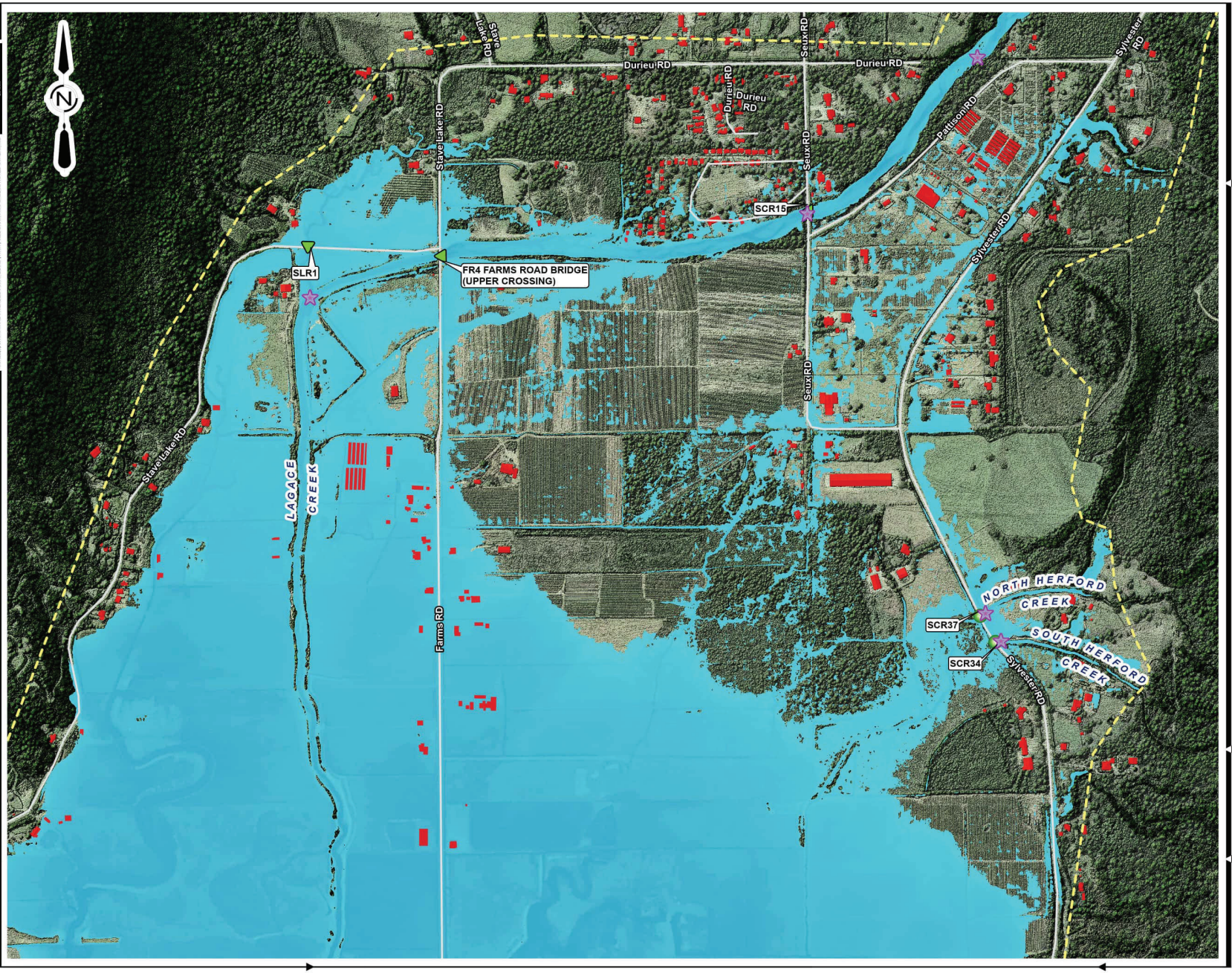
AE PROJECT No.	20222632-00
SCALE	1:4,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 15 30 60 90 120 Meters

IF NOT 25 mm ADJUST SCALES
25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 2024-04-03 4:59 PM
SAVE DATE: 2024-04-03 4:59 PM SAVED BY: JORDON ROZON
DWG PATH: \\ae.ca\data\working\van\2022-2632-00\gis\analysis\2022-2632 - Hatzic Emergency Works\2022-2632 - Hatzic Emergency Works.aprx



Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH WINTER 200 YEAR 4 DAY

DEPTH

19.9 m

0.0 m

SITE LOCATIONS

BRIDGE

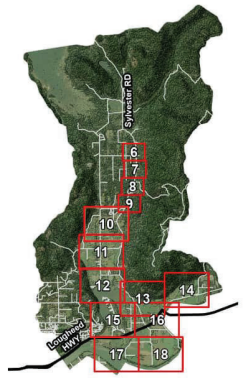
WEIR/GATE/CULVERT

PRIMARY ROADS

MINOR ROADS

BUILDINGS

2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 52

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

CIVIL
WINTER 200-YEAR 4-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

AE PROJECT No.	20222632-00
SCALE	1:8,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 37.5 75 150 225 300 Meters

IF NOT 25 mm ADJUST SCALES 25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 2024-04-03 4:59 PM
SAVE DATE: 2024-04-03 4:59 PM SAVED BY: JORDON ROZON
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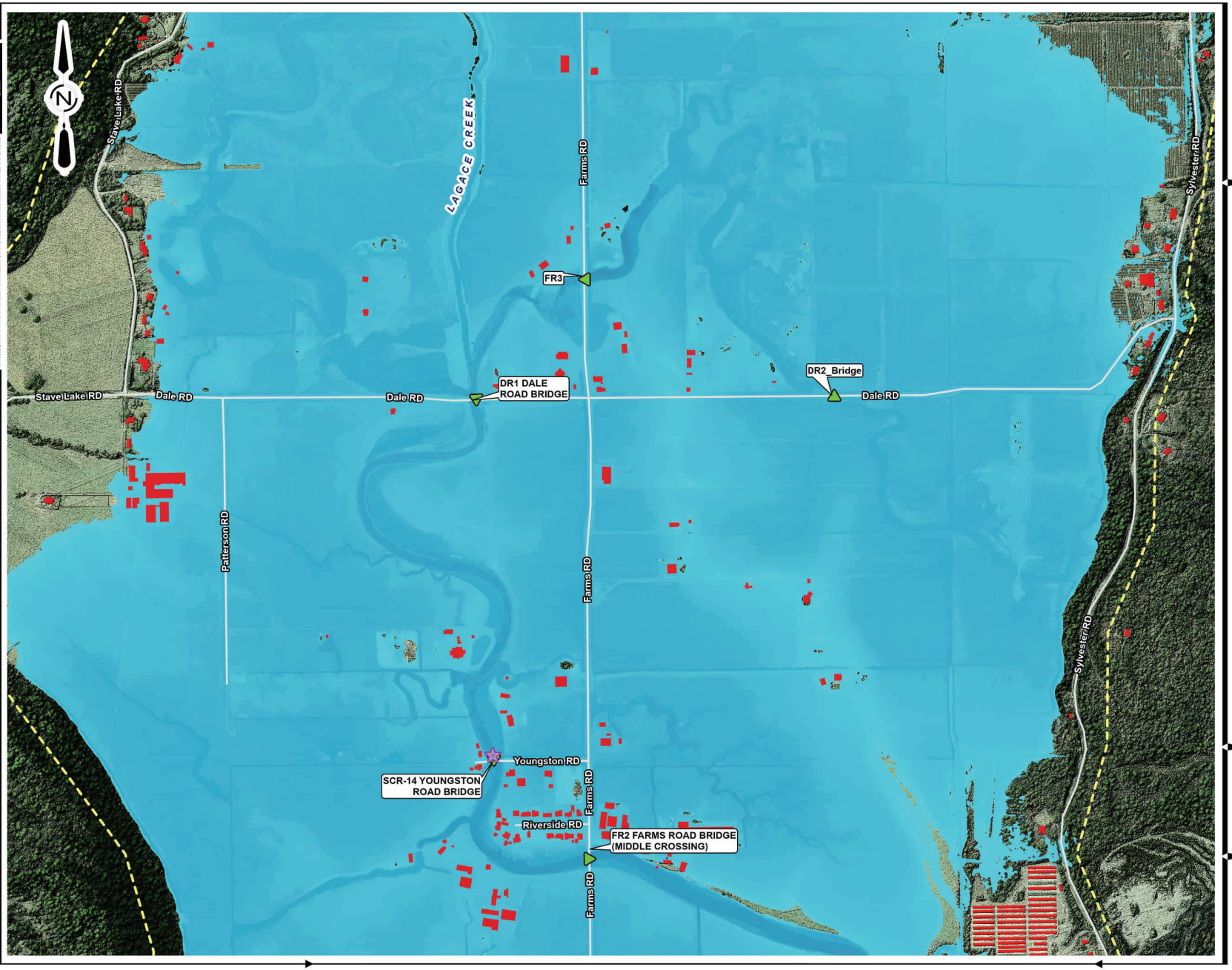


Associated Engineering

BEST MANAGED COMPANIES Platinum member

LEGEND:

DEPTH WINTER 200 YEAR 4 DAY

DEPTH

19.9 m

0.0 m

SITE LOCATIONS

BRIDGE

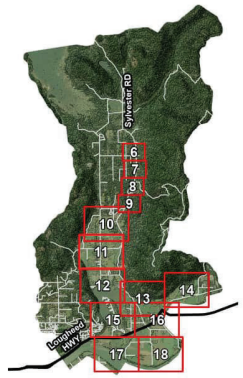
WEIR/GATE/CULVERT

PRIMARY ROADS

MINOR ROADS

BUILDINGS

2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 53

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

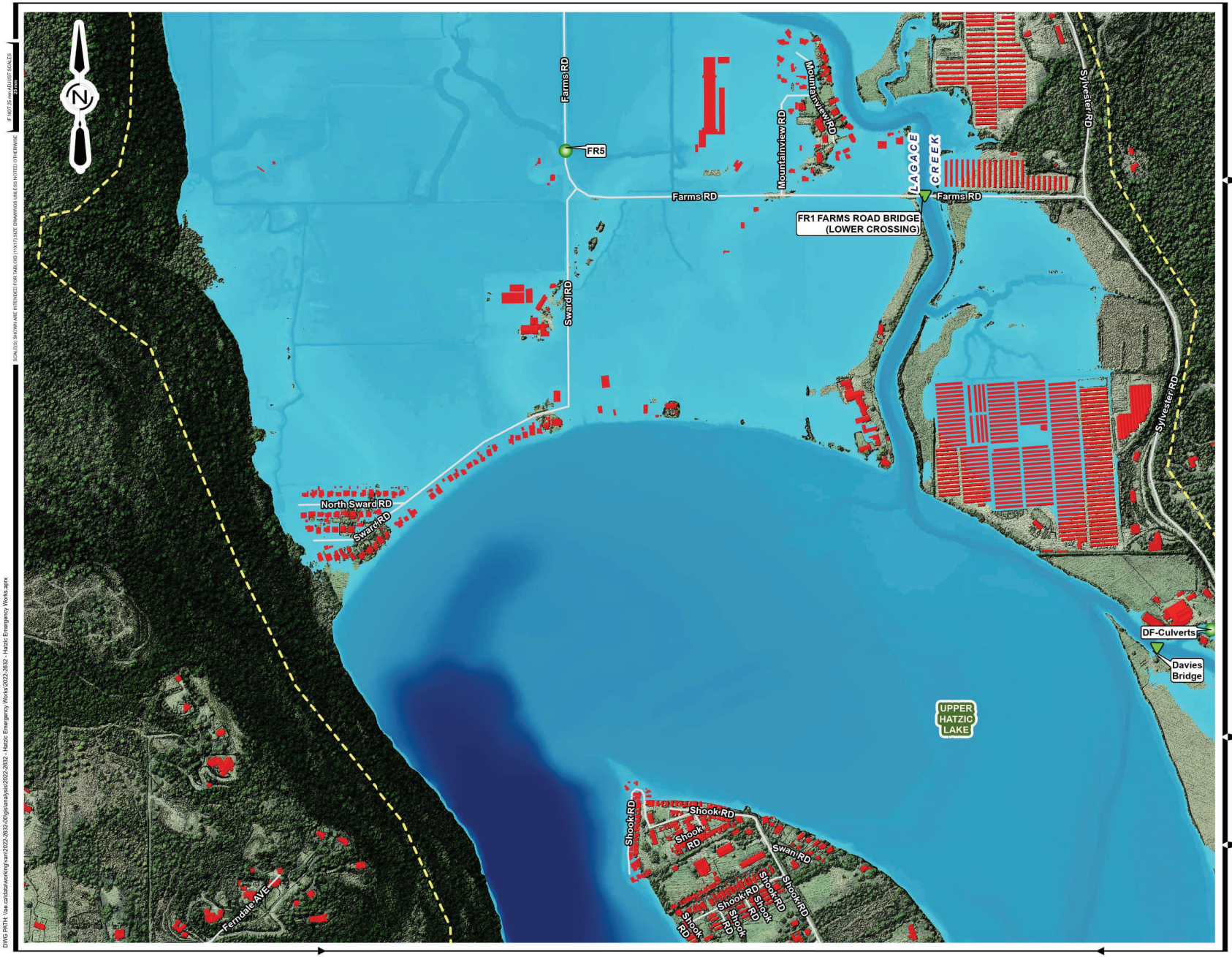
CIVIL
WINTER 200-YEAR 4-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

AE PROJECT No.	20222632-00
SCALE	1:8,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 37.5 75 150 225 300 Meters

SCALES SHOWN ARE INTENDED FOR TABLOID (11x17) SIZE DRAWINGS UNLESS NOTED OTHERWISE
IF NOT 75 mm AD JUST SCALES

PLOT DATE: 2024-04-03 4:59 PM
SAVE DATE: 2024-04-03 4:59 PM SAVED BY: JORDON ROZON
DWG PATH: \\ae.ca\data\working\van\2022-2632-00\gis\analysis\2022-2632 - Hatzic Emergency Works\2022-2632 - Hatzic Emergency Works.aprx



Associated Engineering

CANADA'S BEST MANAGED COMPANIES Platinum member

LEGEND:

DEPTH WINTER 200 YEAR 4 DAY

DEPTH

19.9 m

0.0 m

SITE LOCATIONS

BRIDGE

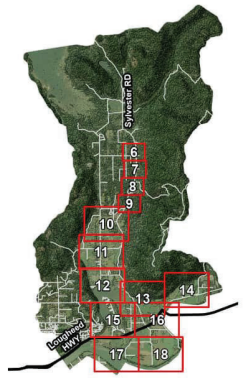
WEIR/GATE/CULVERT

PRIMARY ROADS

MINOR ROADS

BUILDINGS

2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 54

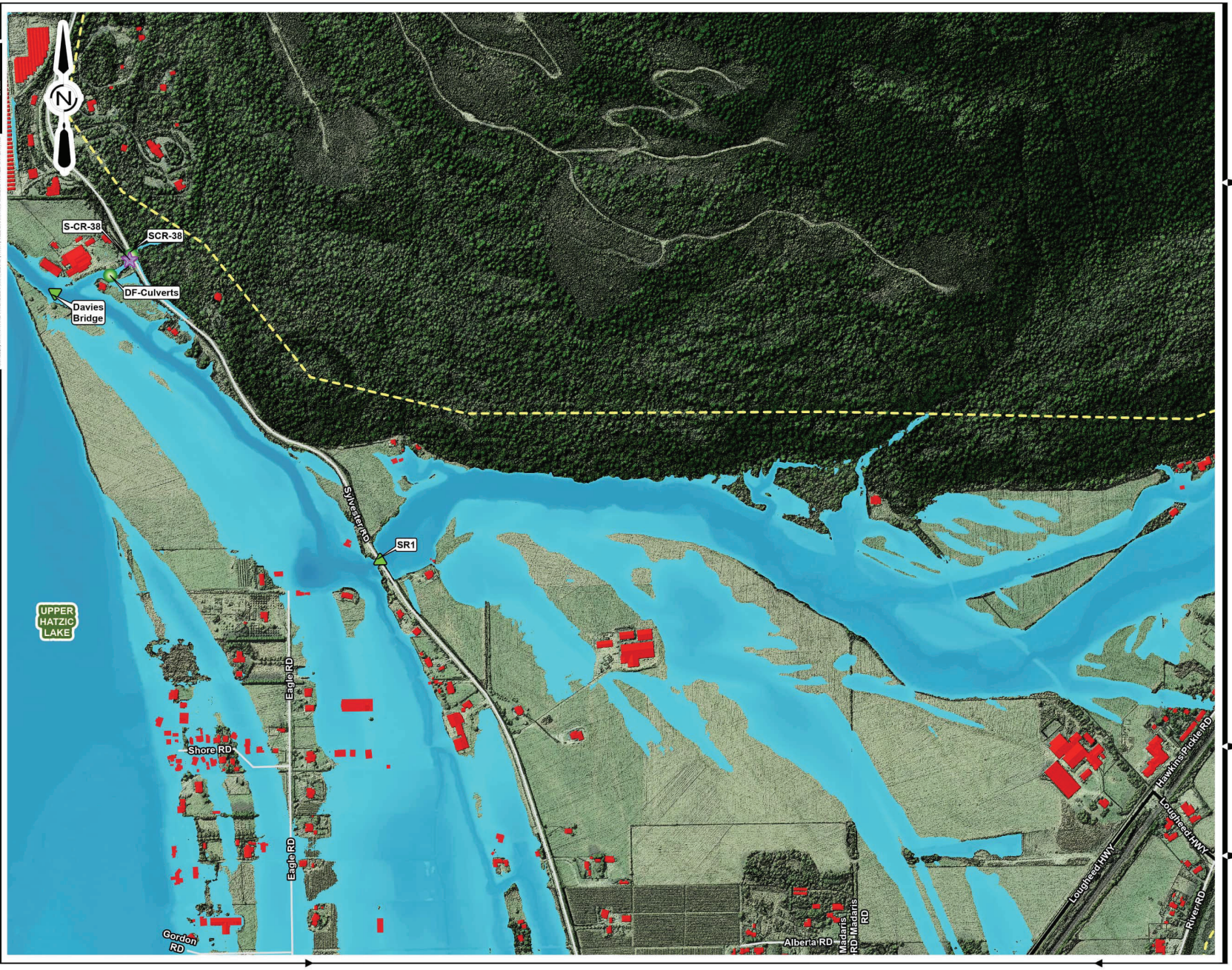
BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

CIVIL
WINTER 200-YEAR 4-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

AE PROJECT No.	20222632-00
SCALE	1:8,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 37.5 75 150 225 300 Meters

SCALES SHOWN ARE INTENDED FOR TABLOID (11x17) SIZE DRAWINGS UNLESS NOTED OTHERWISE
IF NOT 75 mm AS JUST SCALES
PLOT DATE: 2024-04-03 4:59 PM
SAVE DATE: 2024-04-03 4:59 PM SAVED BY: JORDON ROZON
DWG PATH: \\ae.ca\data\working\van\2022-2632-00\gis\analysis\2022-2632 - Hatzic Emergency Works\2022-2632 - Hatzic Emergency Works.aprx



Associated Engineering

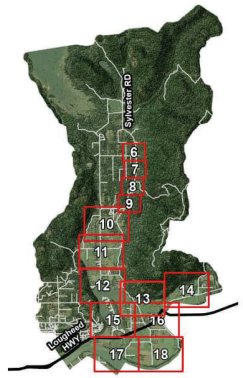
BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH WINTER 200 YEAR 4 DAY

DEPTH
- 19.9 m
- 0.0 m

SITE LOCATIONS
BRIDGE
WEIR/GATE/CULVERT
PRIMARY ROADS
MINOR ROADS
BUILDINGS
2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 55

BC MINISTRY OF ENVIRONMENT
AND CLIMATE CHANGE STRATEGY

CIVIL
WINTER 200-YEAR 4-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

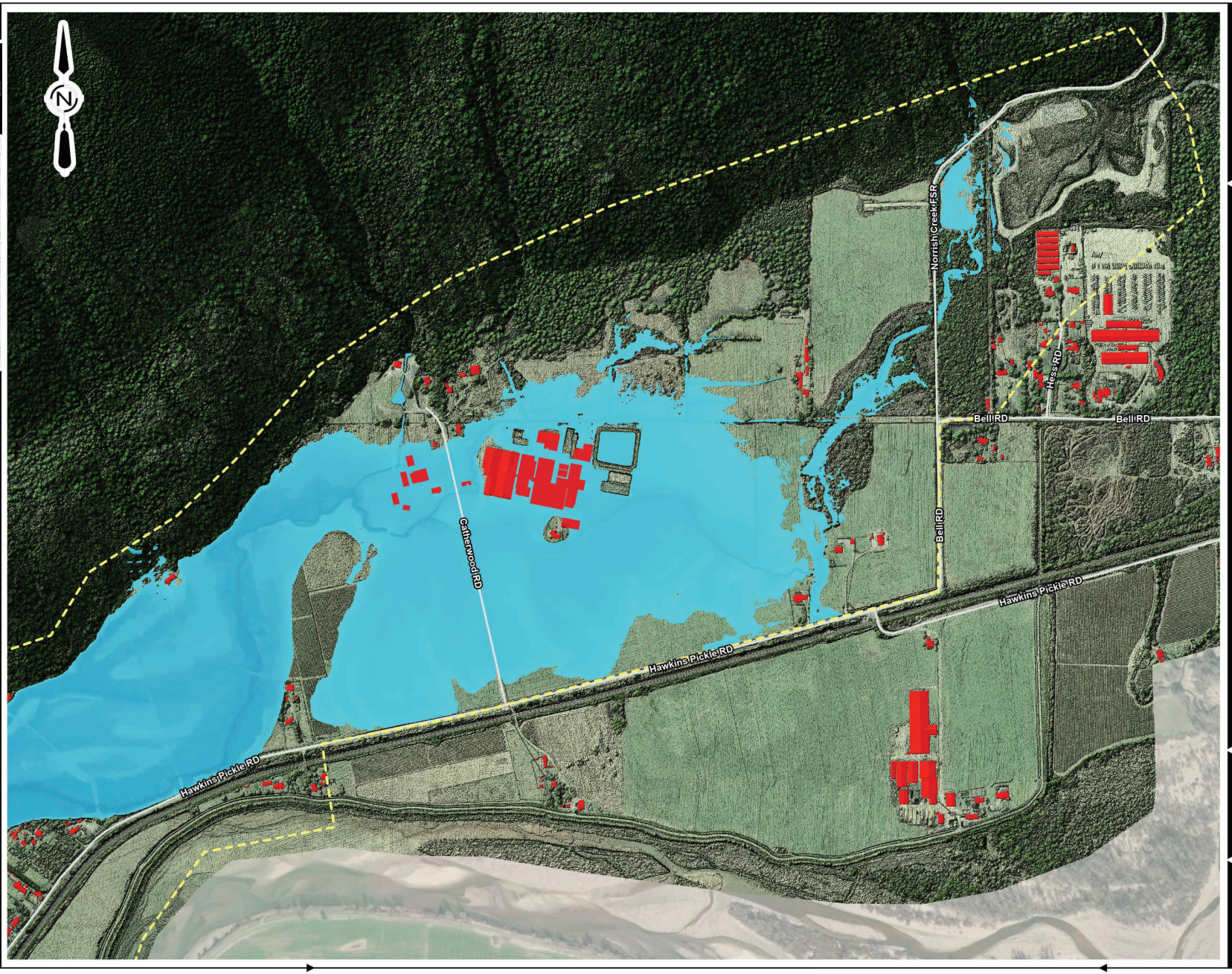
AE PROJECT No.	20222632-00
SCALE	1:8,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 37.5 75 150 225 300 Meters

IF NOT 279 mm AS LIST SCALES ARE WRONG

SCALES SHOWN ARE INTENDED FOR TABLOID (11 X 17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 2024-04-03 5:00 PM
SAVE DATE: 2024-04-03 5:00 PM SAVED BY: JORDON ROZON
DWG PATH: \\ae.ca\data\working\van\2022-2632-00\gis\analysis\2022-2632 - Hatzic Emergency Works\2022-2632 - Hatzic Emergency Works.aprx



Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH WINTER 200 YEAR 4 DAY

DEPTH

19.9 m

0.0 m

SITE LOCATIONS

BRIDGE

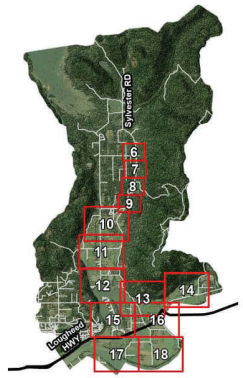
WEIR/GATE/CULVERT

PRIMARY ROADS

MINOR ROADS

BUILDINGS

2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 56

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

CIVIL
WINTER 200-YEAR 4-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

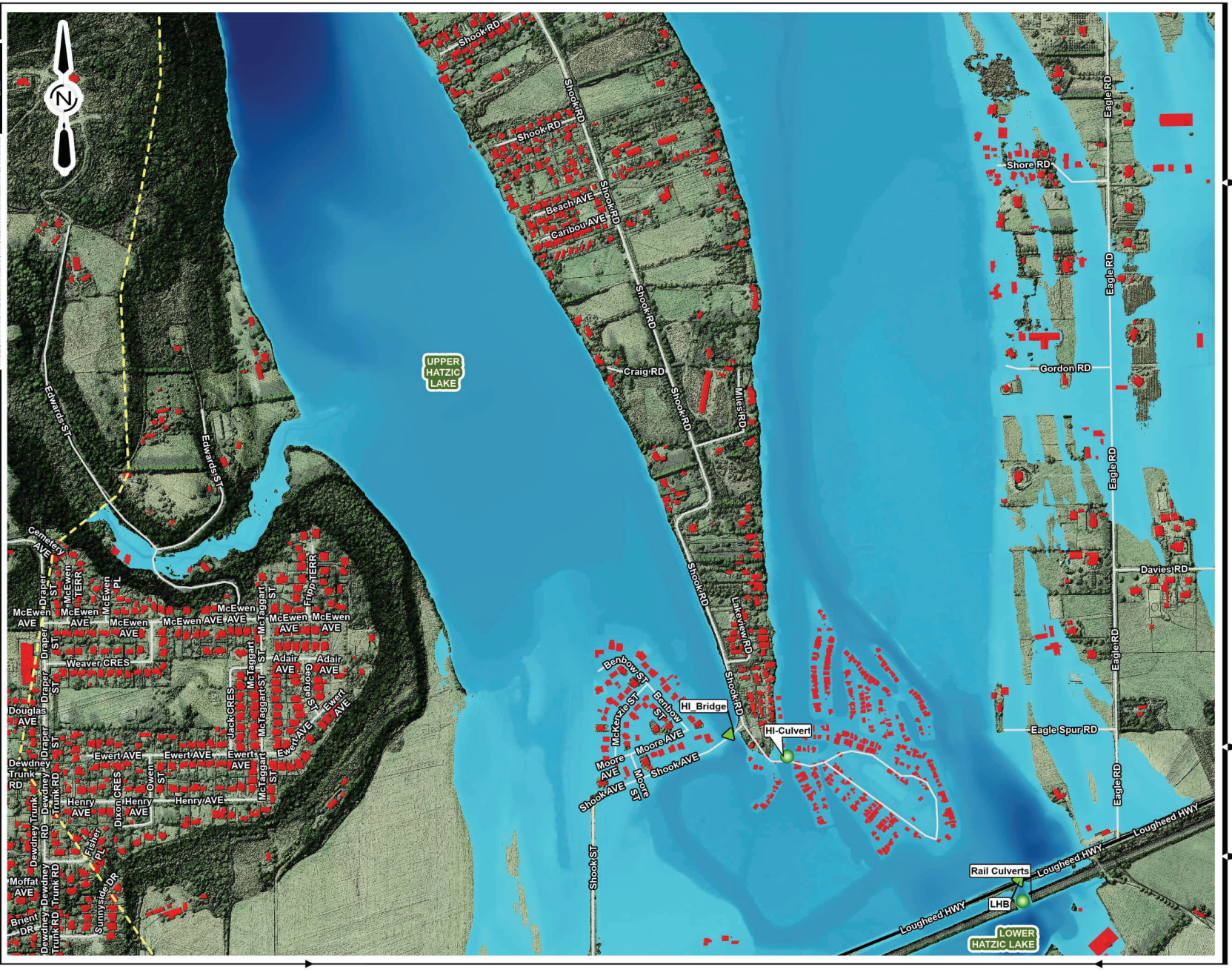
AE PROJECT No.	20222632-00
SCALE	1:8,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 37.5 75 150 225 300 Meters

IF NOT 25 mm ADJUST SCALES 25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 2024-04-03 5:00 PM
SAVE DATE: 2024-04-03 5:00 PM SAVED BY: JORDON ROZON
DWG PATH: \\ae.ca\data\working\van\2022-2632-00\gis\analysis\2022-2632 - Hatzic Emergency Works\2022-2632 - Hatzic Emergency Works.aprx



Associated Engineering

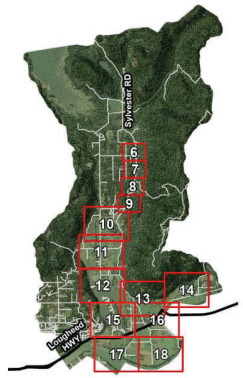
BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH WINTER 200 YEAR 4 DAY

DEPTH
- 19.9 m
- 0.0 m

SITE LOCATIONS
BRIDGE
WEIR/GATE/CULVERT
PRIMARY ROADS
MINOR ROADS
BUILDINGS
2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 57

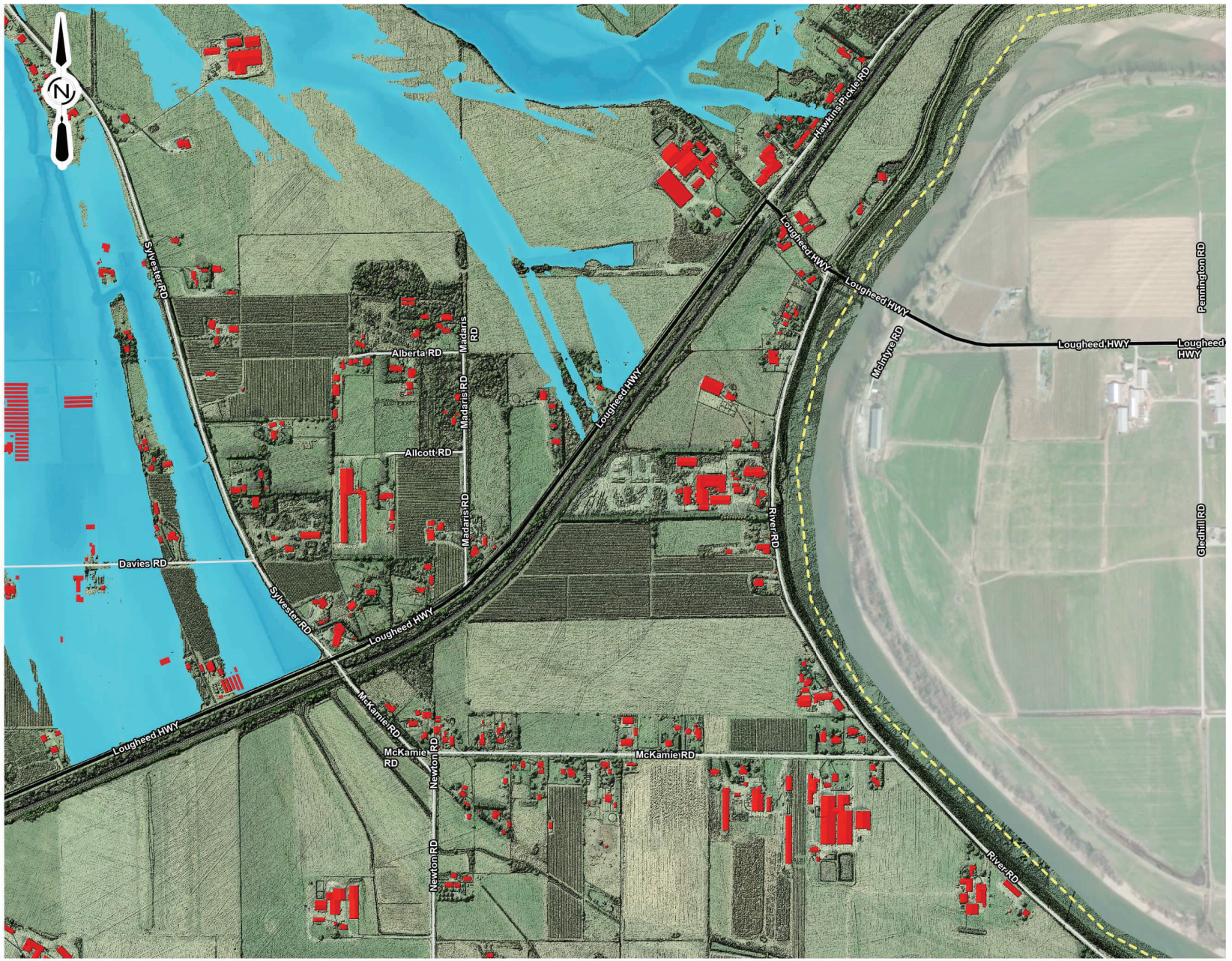
BC MINISTRY OF ENVIRONMENT
AND CLIMATE CHANGE STRATEGY

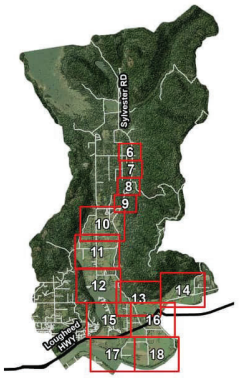
CIVIL
WINTER 200-YEAR 4-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

AE PROJECT No.	20222632-00
SCALE	1:8,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 37.5 75 150 225 300 Meters

IF NOT 25 mm AS LIST SCALES ARE WRONG
SCALES SHOWN ARE INTENDED FOR TABLOID (11 X 17) SIZE DRAWINGS UNLESS NOTED OTHERWISE
PLOT DATE: 2024-04-03 5:00 PM
SAVE DATE: 2024-04-03 5:00 PM SAVED BY: JORDON ROZON
DWG PATH: \\ae.ca\data\working\van\2022-2632-00\gis\analysis\2022-2632 - Hatzic Emergency Works.aprx





Associated Engineering

CANADA'S BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH WINTER 200 YEAR 4 DAY

DEPTH
19.9 m
0.0 m

SITE LOCATIONS
BRIDGE
WEIR/GATE/CULVERT
PRIMARY ROADS
MINOR ROADS
BUILDINGS
2D MODEL EXTENTS

NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 58

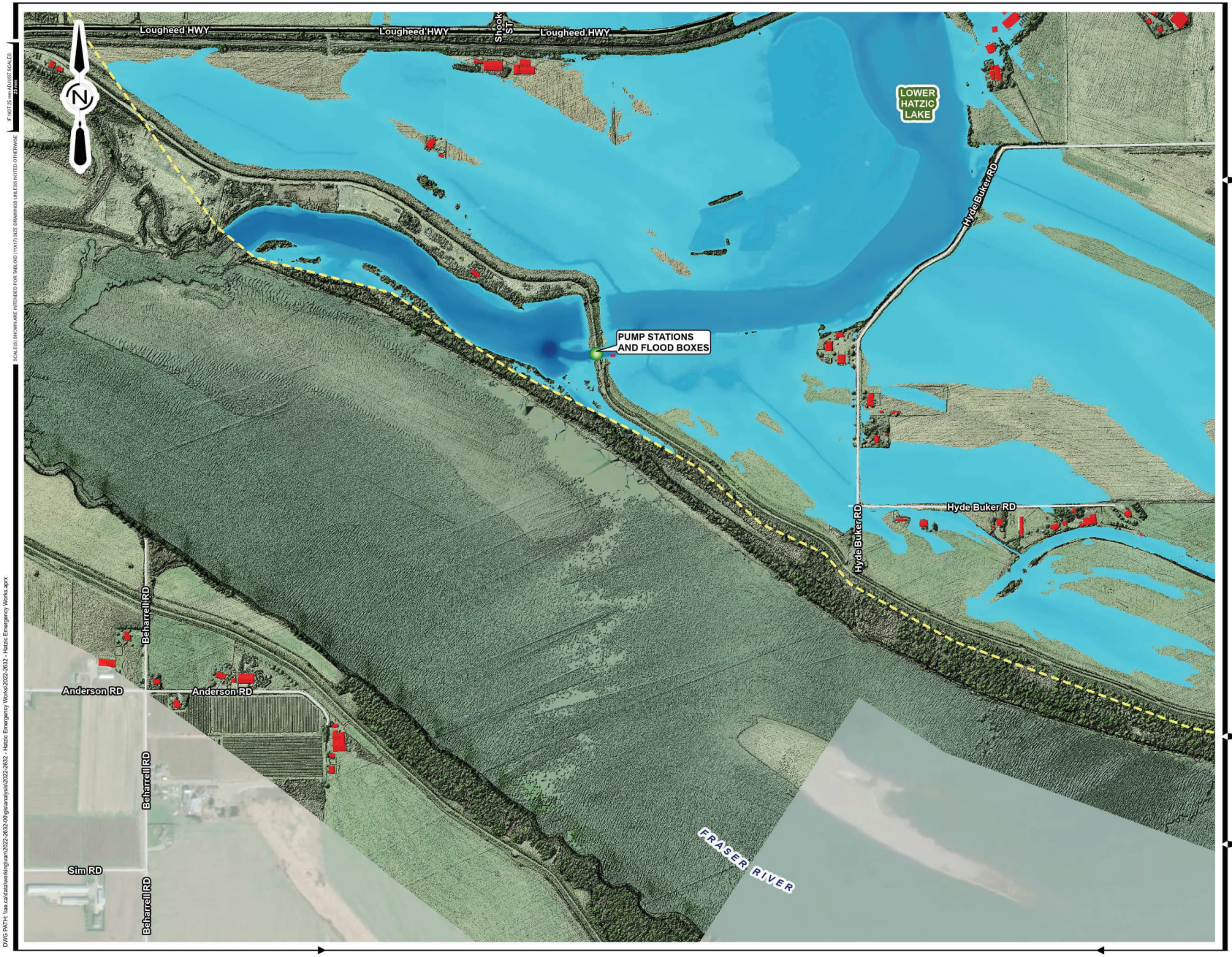
BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

CIVIL
WINTER 200-YEAR 4-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

AE PROJECT No.	20222632-00
SCALE	1:8,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 37.5 75 150 225 300 Meters

IF NOT 75 mm AS LIST SCALES ARE WRONG
SCALES SHOWN ARE INTENDED FOR TABLOID (11x17) SIZE DRAWINGS UNLESS NOTED OTHERWISE
PLOT DATE: 2024-04-03 5:00 PM
SAVE DATE: 2024-04-03 5:00 PM SAVED BY: JORDON ROZON
DWG PATH: \\ae.ca\data\working\van\2022-2632-00\gis\analysis\2022-2632 - Hatzic Emergency Works\2022-2632 - Hatzic Emergency Works.aprx



Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH WINTER 200 YEAR 4 DAY

DEPTH

19.9 m

0.0 m

SITE LOCATIONS

BRIDGE

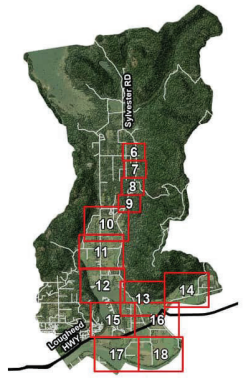
WEIR/GATE/CULVERT

PRIMARY ROADS

MINOR ROADS

BUILDINGS

2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 59

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

CIVIL
WINTER 200-YEAR 4-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

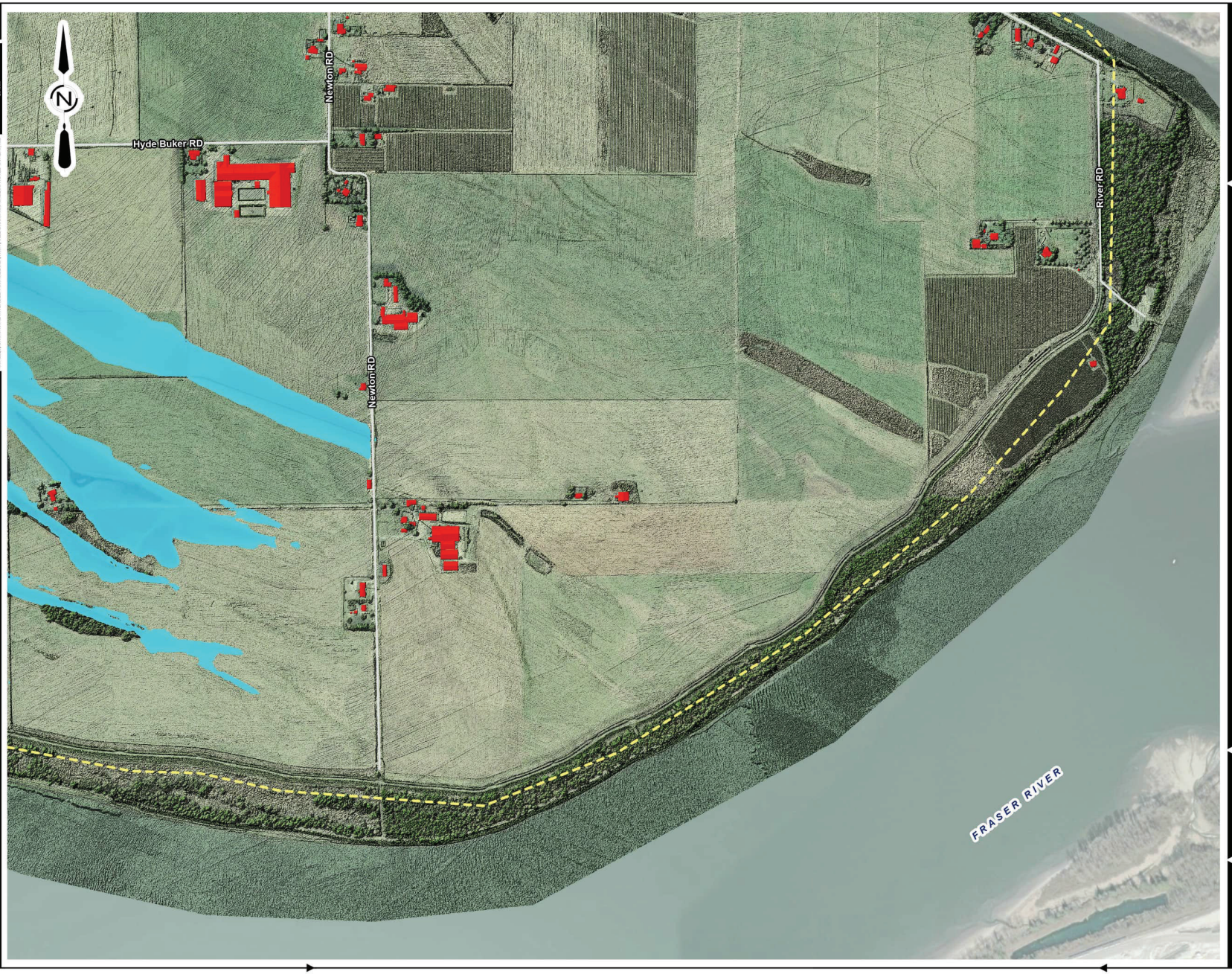
AE PROJECT No.	20222632-00
SCALE	1:8,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 37.5 75 150 225 300 Meters

IF NOT 25 mm ADJUST SCALES
23 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 2024-04-03 5:01 PM
SAVE DATE: 2024-04-03 5:01 PM SAVED BY: JORDON ROZON
DWG PATH: \\ae.ca\data\working\van\2022-2632-00\gis\analysis\2022-2632 - Hatzic Emergency Works\2022-2632 - Hatzic Emergency Works.aprx



Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

DEPTH WINTER 200 YEAR 4 DAY

DEPTH

19.9 m

0.0 m

SITE LOCATIONS

BRIDGE

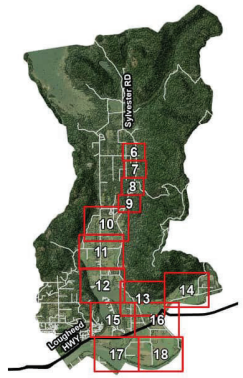
WEIR/GATE/CULVERT

PRIMARY ROADS

MINOR ROADS

BUILDINGS

2D MODEL EXTENTS



NOTE:
SEE SECTION 9 IN THE HYDROLOGY AND 2D HYDRAULIC MODEL OVERVIEW REPORT FOR LIMITATIONS

BRITISH COLUMBIA | Ministry of Environment

MAP FIGURE 60

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

CIVIL
WINTER 200-YEAR 4-DAY DESIGN EVENT
MAXIMUM FLOOD EXTENT AND DEPTH

AE PROJECT No.	20222632-00
SCALE	1:8,000
APPROVED	A. WIENS
DATE	2024APR03
REV	0
DESCRIPTION	FINAL

0 37.5 75 150 225 300 Meters

IF NOT 25 mm ADJUST SCALES 25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 2024-04-03 5:01 PM
SAVE DATE: 2024-04-03 5:01 PM SAVED BY: JORDON ROZON
DWG PATH: \\ae.ca\data\working\van\2022-2632-00\gis\analysis\2022-2632 - Hatzic Emergency Works\2022-2632 - Hatzic Emergency Works.aprx

APPENDIX B - HATZIC VALLEY SURVEY REPORT

terra
remote sensing

Photo Appendix
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Site: SR1, Sylvester Rd.

Structure: Bridge
Deck Thickness: 0.615m



Figure 1 - SR1 Road Alignment SE



Figure 2 - SR1 Road Alignment NW



Figure 3 - SR1 Creek Alignment Downstream NE



Figure 4 - SR1 Creek Alignment Upstream SW



Figure 5 - SR1 Creek Alignment Downstream NE



Figure 6 - SR1 Creek Alignment Upstream SW

Site: SCR38 - Davies Creek
Structure: Culverts X3
Culvert Diameters: C1 upstream=0.920m OD / C2,C3 downstream =0.800m OD



Figure 7 - SCR38 Centerline Upstream NE



Figure 9 - SCR38 Upstream SW



Figure 8 - SCR38 Centerline Downstream SW



Figure 10 - SCR38 Downstream NE

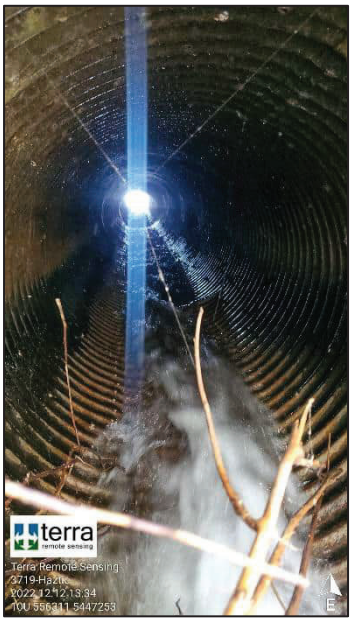

Figure 12 - SCR38 Downstream E



Figure 11 - SCR38 Upstream N

Site: FR1 - Farms Road
Structure: Bridge
Deck Thickness:0.610m



Figure 13:-FR1 Road Alignment W

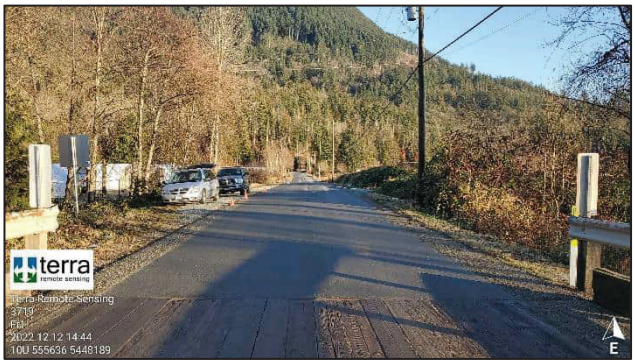

Figure 13 - FR1 Road Alignment E



Figure 14 - FR1 Creek Alignment Downstream NW



Figure 15 - FR1 Creek Alignment Upstream S



Figure 16 - FR1 Creek Alignment Downstream W



Figure 17 - FR1 Creek Alignment Upstream SW

Site: SCR14 - 10491 Farms Road
Structure: Bridge
Deck Thickness: 0.615m



Figure 18 - SCR14 Road Alignment W



Figure 19 - SCR14 - Road Alignment E



Figure 20 - SCR14 Creek Alignment Downstream SE

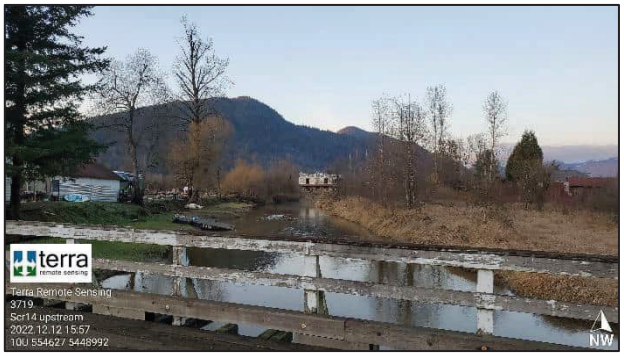

Figure 21 - SCR14 Creek Alignment Upstream NW



Figure 22 - SCR14 Creek Alignment Downstream N



Figure 23 - SCR14 Creek Alignment Downstream NW



Figure 24 - SCR14 Creek Alignment Downstream N



Figure 25 - SCR14 Creek Alignment Upstream SE



Figure 26 - SCR14 Creek Alignment Upstream SE



Figure 27 - SCR14 Creek Alignment Upstream S



Figure 28 - SCR14 Abutment River Right E

Site: FR2 – Farms Road
Structure: Bridge
Deck Thickness: 0.615m



Figure 29 - FR2 Road Alignment N



Figure 30 - FR2 Road Alignment S



Figure 31 - FR2 Creek Alignment Downstream E



Figure 32 – FR2 Creek Alignment Upstream W



Figure 33 - FR2 Creek Alignment Downstream SW



Figure 34 - FR2 Creek Alignment Downstream SW



Figure 35 - FR2 Creek Alignment Downstream W



Figure 36 - FR2 Creek Alignment Upstream NE



Figure 37 - FR2 Creek Alignment Upstream E



Figure 38 - FR2 Creek Alignment Upstream E



Figure 39 - FR2 Abutment River Right SE



Figure 40 - FR2 Abutment River Right SW



Figure 41- FR2 Abutment River Left N

Site: FR3 - Farms Road
Structure: Bridge
Deck Thickness: 0.8m



Figure 42 - FR3 Bridge Alignment N



Figure 43 - FR3 Bridge Alignment S



Figure 44- FR3 Creek Alignment Downstream W



Figure 45 - FR3 Creek Alignment Downstream W



Figure 46 - FR3 Creek Alignment Upstream NE



Figure 47 - FR3 Creek Alignment Upstream E



Figure 48 – FR3 Creek Alignment Downstream



Figure 49 – FR3 Abutment River Left Downstream SE



Figure 50 - FR3 Abutment River Left Upstream S



Figure 51 - FR3 Abutment River Right Downstream N



Figure 52 - FR3 Abutment River Right Upstream N

Site: FR4 - Farms Road
Structure: Bridge and Culvert
Deck Thickness: 1.273m



Figure 53 - FR4 Bridge Alignment N



Figure 54 - FR4 Bridge Alignment S



Figure 55 - Creek Alignment Downstream 1 SW



Figure 56 - Creek Alignment Downstream 2 W



Figure 57 - Creek Alignment Upstream 1 NE



Figure 58 - Creek Alignment Upstream 2 E



Figure 59 - FR4 Creek Alignment Downstream 1 NE



Figure 60 - FR4 Creek Alignment Downstream 2 E



Figure 61 - FR4 Creek Alignment Upstream 1 NE



Figure 62 - FR4 Creek Alignment Upstream 2 E



Figure 63 - FR4 Abutment River Left Downstream S



Figure 64 - FR4 Abutment River Left Upstream S



Figure 65 - FR4 Abutment River Right Downstream N



Figure 66 - FR4 Abutment River Right Upstream N



Figure 67 - FR4 Upstream Culvert SE



Figure 68 - FR4 Downstream Culvert N



Figure 69 - Downstream Culvert N

Site: FR5 – Farms Road
Structure: Culvert
Culvert diameter: 1.400m



Figure 70 - FR5 Centerline Downstream NE



Figure 71 - FR5 Centerline Upstream SW



Figure 72 - FR5 Downstream SW



Figure 73 - FR5 Upstream E



Figure 74 - FR5 Downstream W



Figure 75 - FR5 Upstream NE

Site: DR1 – Dale Road
Structure: Bridge
Deck Thickness: 0.580m



Figure 76 - DR1 Bridge Alignment E



Figure 77 - DR1 Bridge Alignment W



Figure 78 - DR1 Creek Alignment Upstream N



Figure 79 - DR1 Creek Alignment Downstream S



Figure 80 - DR1 Creek Alignment Downstream 1 NW



Figure 81 - DR1 Creek Alignment Downstream 2 N



Figure 82 -DR1 Creek Alignment Upstream 1 E



Figure 83- DR1 Creek Alignment Upstream 2 SE



Figure 83 - DR1 Creek Alignment Upstream 3 S



Figure 84 - DR1 Abutment River Left Downstream NE



Figure 85 - DR1 Abutment River Left Upstream NE



Figure 86 - DR1 Abutment River Right Downstream W



Figure 87 - DR2 Abutment River Right Upstream W

Site: DR2 – Dale Road
Structure: Bridge and Culvert X4
Deck Thickness: 0.610m
Culvert Diameters: from North to South: 0.600m, 0.560m, 0.650m, 0.400m



Figure 88 – DR2 Bridge Alignment NE



Figure 89 - DR2 Bridge Alignment W



Figure 90 - DR2 Creek Alignment Downstream N



Figure 91 - DR2 Creek Alignment Upstream SE



Figure 92 - DR2 Creek Alignment Upstream 1 W



Figure 93 – DR2 Creek Alignment Upstream 2 N



Figure 94 - DR2 Creek Alignment Downstream 1 SE



Figure 95 – DR2 Creek Alignment Downstream 2 SW



Figure 96 - DR2C Culvert Alignment Downstream SW

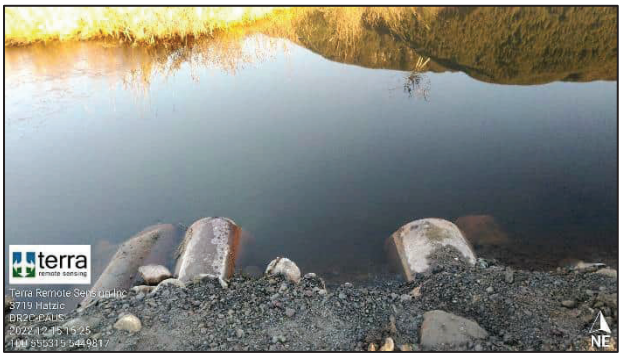

Figure 97 - DR2C Culvert Alignment Downstream NE



Figure 97 - DR2C Road Alignment NW



Figure 98 – DR2C Road Alignment S



Figure 99 - DR2C Road Alignment E

Site: SLR1 – Stave Lake Road
Structure: Bridge
Deck Thickness: 0.620m



Figure 100 - SLR1 Bridge Alignment E



Figure 101 - SLR1 Bridge Alignment W



Figure 102 - SLR1 Creek Alignment Downstream 1 S



Figure 103 - SLR1 Creek Alignment Downstream 2 SW



Figure 104 - SLR1 Creek Alignment Upstream 1 NW



Figure 105 - SLR1 Creek Alignment Upstream 2 N



Figure 106 - SLR1 Creek Alignment Downstream SW

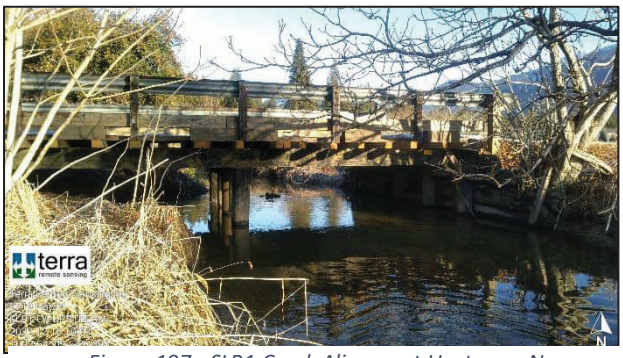

Figure 107 - SLR1 Creek Alignment Upstream N



Figure 108 - SLR1 Abutment River Left Downstream NE



Figure 109 - SLR1 Abutment River Left Upstream E



Figure 110 - SLR1 Abutment River Right Downstream NW



Figure 111 - SLR1 Abutment River Right Downstream W

Site: SR2 – Sylvester Road
Structure: Culvert X3 Diameters: C1=2.300m/C2=2.000m/C3=1.000m



Figure 112 - SR2 Culvert 1 Centerline Downstream W



Figure 113 - SR2 Culvert 1 Centerline Upstream SE



Figure 114 - SR2 Culvert 1 Downstream SE



Figure 115 - SR2 Culvert 1 Upstream W



Figure 116 - SR2 Culvert 1 Downstream E



Figure 117 - SR2 Culvert 1 Upstream W

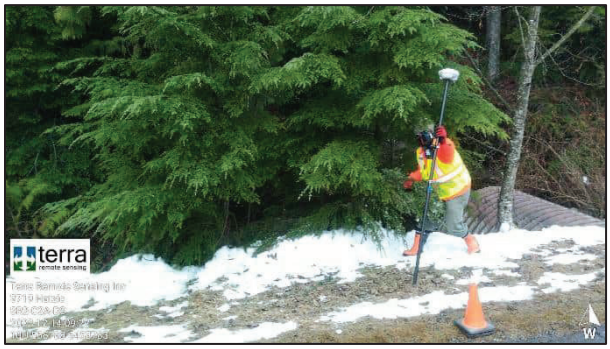

Figure 118 - SR2 Culvert 2 Centerline Downstream W



Figure 119 - SR2 Culvert 2 Centerline Upstream SE



Figure 120 - SR2 Culvert 2 Downstream E



Figure 121 - SR2 Culvert 2 Upstream W



Figure 122 - SR2 Culvert 2 Downstream E



Figure 123 - SR2 Culvert 2 Upstream W



Figure 126 - SR2 Culvert 3 Downstream SE



Figure 127 - SR2 Culvert 3 Upstream W



Figure 128 - SR2 Culvert 3 Downstream E



Figure 129 - SR2 Culvert 3 Upstream W

Site: SR3 – Sylvester Road
Structure: Culvert X2
Culvert diameters: C1=0.950m / C2=2.450m



Figure 130 - SR3 Culvert Centerline Downstream SE



Figure 131 - SR3 Culvert Centerline Upstream NW



Figure 132 - SR3 Culvert 1 & 2 Downstream NW



Figure 133 - SR3 Culvert 1 & 2 Upstream S



Figure 134 - SR3 Culvert 1 Downstream NW



Figure 135 - SR3 Culvert 1 Upstream S



Figure 136 - SR3 Culvert 2 Downstream NW



Figure 137 - SR3 Culvert 2 Upstream SE

Site: SCR12 – Pattison Creek at Sylvester Road Bridge
Structure: Bridge
Deck Thickness: 1.200m

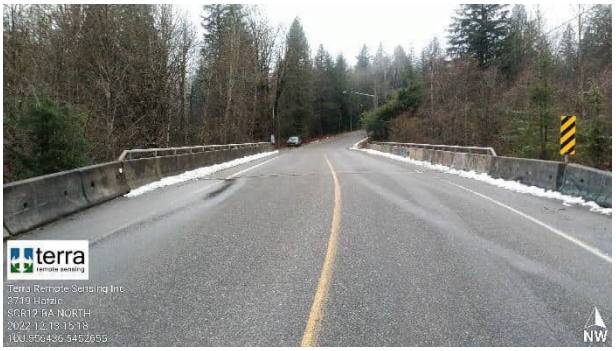

Figure 138 - SCR12 Bridge Alignment NW

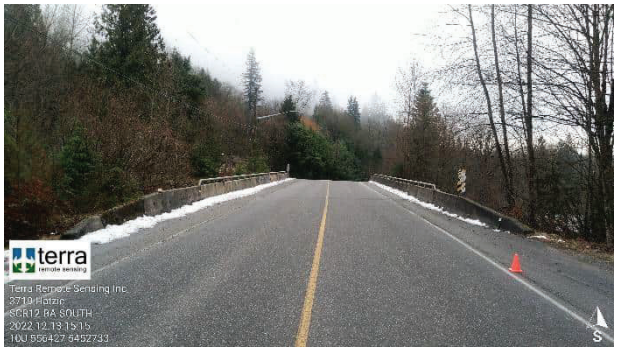

Figure 139 - SCR12 Bridge Alignment S



Figure 140 - SCR12 Creek Alignment Downstream 1 SW



Figure 141 - SCR12 Creek Alignment Downstream 2 SW



Figure 142 - SCR12 Creek Alignment Downstream 3 W



Figure 143 - SCR12 Creek Alignment Downstream 4 S

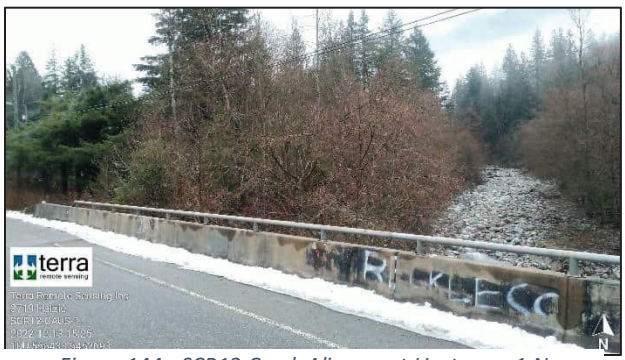

Figure 144 - SCR12 Creek Alignment Upstream 1 N



Figure 145 - SCR12 Creek Alignment Upstream 2 NE



Figure 146 - SCR12 Creek Alignment Upstream 3 E



Figure 147 - SCR12 Creek Alignment Downstream 1 NE



Figure 148 - SCR12 Creek Alignment Downstream 2 NE



Figure 149 - SCR12 Creek Alignment Downstream 3 E



Figure 150 - SCR12 Creek Alignment Upstream 1 NW



Figure 151 - SCR12 Creek Alignment Upstream 2 NW



Figure 152 - SCR12 Creek Alignment Upstream 3 NW



Figure 153 - SCR12 Abutment River Left Downstream S



Figure 154 - SCR12 Abutment River Left Upstream S



Figure 154 - SCR12 Abutment River Right Downstream NW



Figure 154 - SCR12 Abutment River Right Upstream W

Site: SCR15 – Lagace Creek at Seux Road Bridge
Structure: Bridge
Deck Thickness: 0.850m on midsection. 0.630m on end sections



Figure 155 - SCR15 Bridge Alignment NW



Figure 156 - SCR15 Bridge Alignment SW



Figure 157 - SCR15 Creek Alignment Downstream W



Figure 158 - SCR15 Creek Alignment Upstream N



Figure 159 - SCR15 Creek Alignment Downstream 1 NE



Figure 160 - SCR15 Creek Alignment Downstream 2 E



Figure 161 - SCR15 Creek Alignment Downstream 3 E



Figure 162 - SCR15 Creek Alignment Upstream 1 SW



Figure 163 - SCR15 Creek Alignment Upstream 2 W



Figure 164 - SCR15 Creek Alignment Upstream 3 W



Figure 165 - SCR15 Abutment River Left Downstream S



Figure 166 - SCR15 Abutment River Left Upstream SW



Figure 167 – SCR15 Abutment River Right Downstream N



Figure 168 – Abutment River Right Upstream NW

Site: SCR34 – South Hereford Creek Culverts – 11290 Sylvester Road
Structure: Culvert
Culvert Diameter: 1.200m



Figure 169 - SCR34 Culvert Centerline Downstream W



Figure 170 - SCR34 Culvert Centerline Upstream NE



Figure 171 - SCR34 Culvert Downstream NE



Figure 172 - SCR34 Culvert Upstream W



Figure 173 - SCR34 Culvert Upstream N

Site: SCR35 – McNab Creek Culverts
Structure: Culvert X2 **Culvert diameters**: both oblong W=1.650m H=1.150m



Figure 174 - SCR35 Culvert 1 & 2 Centerline Downstream W



Figure 175 - SCR35 Culvert 1 & 2 Centerline Upstream E



Figure 176 - SCR35 Culvert 1 & 2 Downstream E



Figure 177 - SCR35 Culvert 1 & 2 Upstream W



Figure 178 - SCR35 Culvert 1 Downstream E



Figure 179 - SCR35 Culvert 1 Upstream NW



Figure 180 - SCR35 Culvert 2 Downstream E



Figure 181 - SCR35 Culvert 2 Downstream NW

Site: SCR36 – Eng Creek Bridge and Culvert
Structure: Bridge X2, Culvert
Deck Thickness: Hartley Road Bridge: 0.600m / Sylvester Road Bridge: 0.750m
Culvert Diameter: Hartley Rd Culvert:0.600m

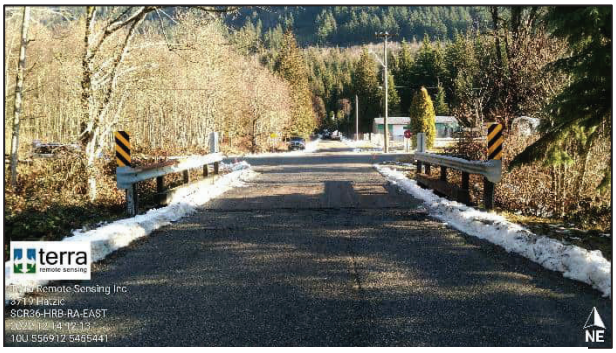

Figure 182 - SCR36 HRB Bridge Alignment E



Figure 183 - SCR36 HRB Bridge Alignment W



Figure 184 - SCR36 HRB Creek Alignment N



Figure 185 - SCR36 HRB Creek Alignment S



Figure 186 - SCR36 HRB Creek Alignment Downstream 1 NW



Figure 187 - SCR36 HRB Creek Alignment Downstream 2 NE



Figure 188 - SCR36 HRB Creek Alignment Upstream 1 SE



Figure 189 - SCR36 HRB Creek Alignment Upstream 2 S



Figure 190 - SCR36 HRB Creek Alignment Upstream 1 S



Figure 191 – SCR36 HRB Abutment River Left Downstream NE



Figure 192 - SCR36 HRB Abutment River Left Upstream E



Figure 193 -SCR36 HRB Abutment River Right Downstream W



Figure 194 - SCR36 HRB Abutment River Right Upstream W



Figure 195 -SCR36 HRC Culvert Centerline Upstream NW



Figure 196 - SCR36 HRC Culvert Centerline Downstream E



Figure 197 – SCR36 HRC Culvert Downstream NW



Figure 198 – SCR36 HRC Culvert Downstream N



Figure 199 - SCR36 HRC Culvert Upstream S



Figure 200 – SCR36 HRC Culvert Upstream S



Figure 201 - SCR36 SRB Bridge Alignment SE



Figure 202 - SCR36 SRB Bridge Alignment NW



Figure 203 - SCR36 SRB Creek Alignment Downstream 1 SW



Figure 204 - SCR36 SRB Creek Alignment Downstream 2 W



Figure 205 - SCR36 SRB Creek Alignment Upstream 1 N



Figure 206 - SCR36 SRB Creek Alignment Upstream 2 NE



Figure 207 – SCR36 SRB Creek Alignment Downstream 1 NE



Figure 208 – SCR36 SRB Creek Alignment Downstream 2 NE



Figure 209 – SCR36 SRB Creek Alignment Downstream 3 NE



Figure 210 – SCR36 SRB Creek Alignment Upstream 1 SW



Figure 211 – SCR36 SRB Creek Alignment Upstream 2 SW



Figure 212 – SCR36 SRB Creek Alignment Upstream 3 SW



Figure 213 – SCR36 SRB Abutment River Left Downstream SE



Figure 214 – SCR36 SRB Abutment River Left Upstream SE



Figure 215 – SCR36 SRB Abutment River Right Upstream NW



Figure 216 – SCR36 SRB Abutment River Right Upstream NW



Figure 217 – SCR36 SRC Culvert Centerline Downstream W



Figure 217 – SCR36 SRC Culvert Centerline Upstream E



Figure 218 – SCR36 SRC Culvert Downstream E



Figure 219 – SCR36 SRC Culvert Downstream NE



Figure 220 – SCR36 SRC Culvert Upstream W



Figure 221 – SCR36 SRC Culvert Upstream SW

Site: SCR37 – North Hereford Creek Culverts – 11426 Sylvester Road
Structure: Culvert
Culvert Diameter: 2.000m



Figure 222 – SCR37 Culvert Centerline Downstream W



Figure 223 – SCR37 Culvert Centerline Upstream NE



Figure 224 – SCR37 Culvert Downstream NE



Figure 225 – SCR37 Culvert Upstream SW



Figure 226 – SCR37 Culvert Downstream N



Figure 227 – SCR37 Culvert Upstream SW

Site: SCR28 - Carratt Creek Bridge
Structure: Bridge
Deck Thickness: 0.900m



Figure 228 – CCC Bridge Alignment NE



Figure 229 – CCC Bridge Alignment S



Figure 230 – CCC Creek Alignment Downstream W



Figure 231 – CCC Creek Alignment Upstream SE



Figure 232 – CCC Creek Alignment Downstream W



Figure 233 – CCC Creek Alignment Upstream SE



Figure 234 – CCC Abutment River Left Downstream SE



Figure 235 – CCC Abutment River Left Upstream SW



Figure 236 – Abutment River Right Downstream NE



Figure 237 – Abutment River Right Upstream N

Site: Carrot Creek Culvert
Structure: Culvert
Culvert Diameter: 0.920m



Figure 238 – CCC Culvert Road Alignment NW



Figure 239– CCC Culvert Road Alignment SE



Figure 240 – CCC Culvert Upstream E



Figure 241 – CCC Culvert Upstream NE



Figure 242 – CCC Culvert Downstream SW

Site: SR13139 – Sylvester Road 13139
Structure: Bridge
Deck Thickness: 0.300m



Figure 243: SR13139 Creek Alignment Downstream



Figure 244: SR13139 Creek Alignment Upstream



Figure 245: SR13139 Road Alignment W



Figure 246: SR13139 Road Alignment E

Site: SR13095 – Sylvester Road 13095
Structure: Bridge
Deck Thickness: 0.870m



Figure 247: SR13095 Road Alignment E



Figure 248: SR13095 Road Alignment W



Figure 249: SR13095 Creek Alignment



Figure 250: SR13095 Creek Alignment



Figure 5: SR13095 Creek Alignment



Figure 252: SR13095 Creek Alignment



Figure 6:SR13095 Creek Alignment



Figure 254: SR13095 Alignment

Site: SR13089 – Sylvester Road 13089
Structure: Culverts X3
Culverts Diameters: C1=1.200m / C2=1.200m / C3=1.200m



Figure 7: Culverts looking upstream



Figure 256: Culverts C1 downstream

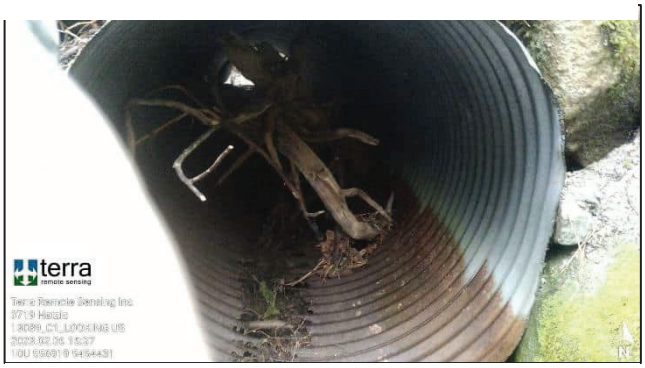

Figure 257: Culvert C1 looking upstream



Figure 258: C1 Looking downstream



Figure 259: C2 looking upstream



Figure 260: C2 looking downstream



Figure 261: C3 Looking upstream



Figure 262: C3 Looking downstream

Site: SR13031 – Sylvester Road 13031
Structure: Bridge
Deck Thickness: 0.920m



Figure 263: SR13031 Bridge E



Figure 10: SR13031 Bridge @



Figure 265: SR13031 Bridge



Figure 9: SR13031 Downstream



Figure 267: SR13031 Downstream



Figure 88: SR13031 Upstream



Figure 269: SR13031 Upstream

Site: SR13001 – Sylvester Road 13001
Structure: Bridge
Deck Thickness: 0.400m



Figure 270: SR13001 Bridge alignment E



Figure 271: SR13001 Bridge alignment W



Figure 272: SR13001 Bridge upstream



Figure 273: SR13001 Bridge downstream

Site: SR12873 – Sylvester Road 12873
Structure: Bridge
Deck Thickness: 0.300m / Deck to water = 2.100m



Figure 274: SR12873 Bridge alignment E

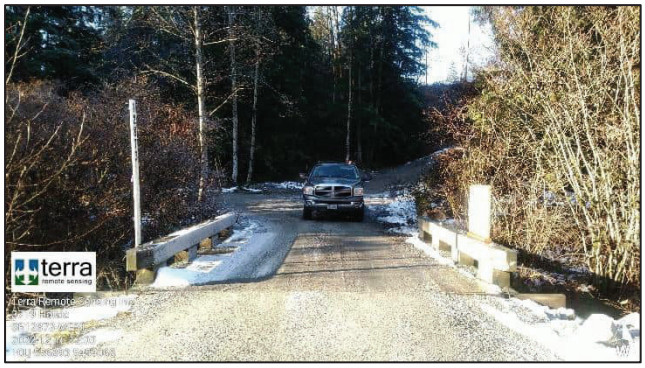

Figure 275: SR12873 Bridge alignment W



Figure 276: Creek alignment upstream



Figure 277: Creek alignment upstream



Figure278: SR12873Unknown address downstream



Figure 279: SR12873Unknown address West

Site: SCR13 – Lagace Creek – 11744 Stave Lake Road



Figure 280: SCR13 Lagace Creek



Figure 281: SCR13 Lagace Creek



Figure 282: SCR13 Lagace Creek looking downstream



Figure 283: SCR13 Lagace Creek looking upstream



Figure 284: SCR13 River



Figure 285: SCR13 River

Site: RRC – Rail Road Culvert
Structure: Culverts X 3
Culvert diameters:
C1 (eastern) 2.100m,
C2 (middle) 2.300m
C3 (western) 1.950m



Figure 286: RRC Culverts



Figure 287: RRC Culverts downstream

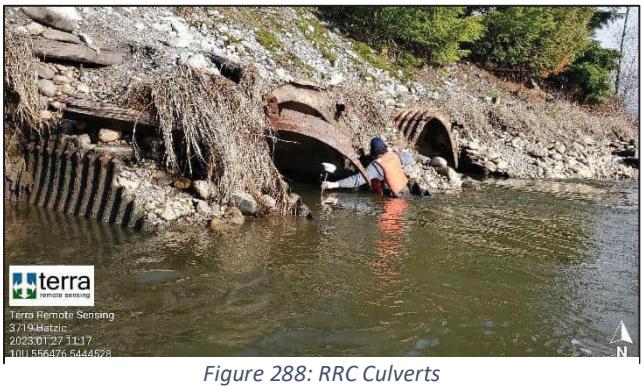

Figure 288: RRC Culverts



Figure 289: RRC Culvert#1 looking upstream



Figure 290: RRC Culvert #2 looking upstream



Figure 291: RRC Culvert #3 looking upstream

Site: LRC – Lundgren Road Culverts
Structure: Culverts
Culvert diameters:
C#1= 2.500m / C#=2: 0.900m



Figure 292: LRC Road alignment E



Figure 293: LRC Road alignment W



Figure 294: LRC Culverts #1 (left) and #2



Figure 295: LRC Culverts

Site: LHB – Lougheed Highway Bridge
Structure: Bridge
Deck Thickness: 1.460m



Figure 297: LHB -Bridge looking downstream



Figure 298: LHB looking upstream



Figure 299: LHB downstream



Figure 300: LHB upstream



Figure 301: LHB downstream



Figure 302: LHB upstream

Site: HIB – Hatzic Island Bridge
Structure: Bridge
Deck Thickness: 0.920m



Figure 303: HIB -Bridge alignment E



Figure 304: HIB Bridge alignment W



Figure 305: HIB looking downstream



Figure 306: HIB looking upstream



Figure 307: HIB downstream



Figure 308: HIB downstream



Figure 309: HIB upstream

Site: ECC – Hatzic Island Culvert
Structure: Culvert
Culvert diameter: 2.150m



Figure 310: Hatzic Island Culvert



Figure 311: Hatzic Island Culvert



Figure 312: Hatzic Island Culvert



Figure 313: Hatzic Island Culvert



Figure 314: Hatzic Island Culvert

Site: DFC – Davies Farm Culvert
Structure: Culvert
Culvert Diameter: 0.750m



Figure 315: DFC culverts upstream



Figure 316: DFC culverts downstream



Figure 317: DFC culverts downstream



Figure 318: DF Looking north

Site: DFC – Davies Farm Bridge
Structure: Bridge
Deck Thickness: Not measured



Figure 319: DFC Bridge alignment W



Figure 320: DFC Bridge alignment E



Figure 321: Creek looking downstream



Figure 322: Creek looking upstream

Site: DFC – Davies Farm Dam
Structure: Dam



Figure 323: DFC – Davies Farm Dam



Figure 324: DFC - Davies Farm Dam



Figure 325: DFC – Davies Farm Dam upstream



Figure 326: DFC – Davies Farm Dam upstream





Figure 329: DFC - upstream



Figure 328: DFC – Davies Farm Dam upstream

APPENDIX C - HYDRAULIC MODEL TABLE

Table 1 2D Hydraulic Model Hyraulic Structures

Model Structure Name	Location	River/Creek/Stream	Model Notes
SCR36-Sylvester	Sylvester Road Bridge at S-CR-36	Eng Creek	
SRC	Culvert Crossing Sylvester Road to S-CR-36, upstream of Hartley Road Bridge Crossing	Eng Creek	Downstream elevation adjusted slightly due to surface elevation
HRC	Culvert Crossing Hartley Road connecting upstream pond to downstream Allan Lake	Allan Lake	Upstream elevation adjusted slightly due to surface elevation
SCR36-Hartley	Hartley Road Bridge at S-CR-36	Eng Creek	
Misc Culvert 1	Crossing Sylvester Road North of Macnab Creek		
Misc Culvert 2	Northwest of Misc Culvert 1		
SCR35-McNabCulv	Crossing Sylvester Road, S-CR-35	McNab Creek	Downstream invert of south culvert adjusted slightly due to surface elevation
Weir	Weir south of Allan Lake	Allan Lake/Lagace Creek	Weir elevation 100.40m
SR13139	Private road bridge off of Sylvester Road	Lagace Creek	
SR13095	Private road bridge off of Sylvester Road	Lagace Creek	
SR13089	Private road culverts off of Sylvester Road	Lagace Creek	
SR13031	Private road bridge off of Sylvester Road	Lagace Creek	
SR13001	Private road bridge off of Sylvester Road	Lagace Creek	
SR12873	Private road bridge off of Sylvester Road	Lagace Creek	
SR3	Sylvester Road culverts north of Lundgren Road	Lagace Creek	Terrain modification required to lower LiDAR surface between SR3

Model Structure Name	Location	River/Creek/Stream	Model Notes
			and LRC to better reflect survey at culverts
LRC	Lundgren Road Culverts	Lagace Creek	Terrain modification required to lower LiDAR surface between SR3 and LRC to better reflect survey at culverts
SR2	Sylvester Road culverts south of Lundgren Road	Lagace Creek	Terrain modifications required to Lower LiDAR surface upstream and downstream to tie into survey shots
SR2_Concrete	Sylvester Road culverts south of SR2	Lagace Creek	Terrain modifications required to lower LiDAR surface between SR2_Concrete and SR2 to tie into survey shots
SCR12	Sylvester Road Bridge at S-CR-12	Pattison Creek	
SCR15	Seux Road Bridge at S-CR-15	Lagace Creek	Width of piers estimated from survey
FR4	Farms Road Bridge, north of FR3	Lagace Creek	
SLR1	Stave Lake Road Bridge	Belcharton Creek	Width of pier estimated from photos
SCR37	Sylvester Road Culvert, S-CR-37	North Hereford Creek	Adjusted inverts slightly due to surface elevation. Modeled as ellipse due to shape/deformation
SCR34	Sylvester Road Culvert, S-CR-34	South Hereford Creek	Modeled as ellipse due to shape/deformation
FR3	Farms Road Bridge, north of FR2	Hatzic Slough	
DR1	Dale Road Bridge west of Farms Road	Lagace Creek	Width of piers estimated from photos
DR2	Dale Road Bridge east of Farms Road	Dale Creek	
SCR14	10491 private road bridge off of Farms Road	Lagace Creek	Width of piers estimated from photos
FR2	Farms Road Bridge (north-south section of Farms	Lagace Creek	Width of piers estimated from photos

Model Structure Name	Location	River/Creek/Stream	Model Notes
	Road) Crossing Lagace Creek, north of FR1		
FR5	Farms Road culvert, south of FR2	Unnamed	Adjusted inverts due to surface elevation
FR1	Farms Road Bridge (east-west section of Farms Road) Crossing Lagace Creek	Lagace Creek	Width of piers estimated from photos
SCR38	Culverts crossing Sylvester Road, S-CR-38	Davies Creek	Downstream invert location and elevation based on photos and surface elevation
DFC – Culverts	Davies Farm Culverts	Davies Creek	North culvert inverts adjusted due to surface elevation
DFC - Bridge	Davies Farm Bridge	Davies Creek	Thickness was not measured, and photos were not taken from below bridge, thickness was estimated based on bridges in the area
SR1	Sylvester Road Bridge east of Hatzic Lake	Chilqua Slough	
HIB	Hatzic Island Bridge	Hatzic Lake	
HIC	Hatzic Island Culvert	Hatzic Lake	
LHB	Lougheed Highway Bridge	Hatzic Lake to Lower Hatzic Slough	
RRC	Railroad Culverts	Hatzic Lake to Lower Hatzic Slough	Upstream inverts were not surveyed, inverts estimated from crown and measurement.
Flood Boxes	Dewdney Area Improvement District Dike	Lower Hatzic Slough to Fraser River	Elevations and dimensions based on “Operations Manual – Hatzic Lake Slide Gates” by Letts Environmental Consultants Ltd., flood boxes not surveyed.

APPENDIX H – MODELLING MEMO

Issue Date:	April 10, 2025	Reference/Project No.:	2022-2632-00
To:	Design Team	Previous Issue Date:	
From:	Hadi Bali, EIT		
Client:	Government of British Columbia		
Project Name:	Hatzic Emergency Works Program		
Subject:	Phase 1 - Site 17 Numerical Model (1D)		

1 INTRODUCTION

High flows have resulted in significant flooding, channel erosion and widespread sediment deposition in the Hatzic Valley. As part of the Hatzic Emergency Works Program Phase 1, various one-dimensional hydraulic models were completed for selected sites. These models were developed to assess the capacities of the hydraulic structures and support the detailed design. This technical memorandum summarizes the assessment completed for site S-CR-17.

Site S-CR-17 is located along Lagace Creek between Allan Lake and the confluence of Lagace Creek and Pattison Creek, as illustrated in Figure 1-1. Within the model reach extent, this creek has an average slope of 2%.

Figure 1-1 Model Reach Extents



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2 EXISTING STRUCTURE CHARACTERISTICS

Within the extent of the model, 10 structures stretch between Alan Lake and the confluence of Lagace Creek and Pattison Creek. Figure 2-1 (next page) depicts the locations of the existing structures while the characteristics of each structure follow from upstream to downstream.

2.1 Allan Lake Weir

Allan Lake weir is situated approximately 100 m downstream from Allan Lake. The concrete structure is approximately 1.5 m in height, with significant debris accumulation both upstream and downstream. Additionally, abundant vegetation overgrowth surrounds the structure.

Associated Engineering inspected the weir in August 2023 (Figure 2-2). During the site visit, substantial deposits of rocks, sediment, and debris were observed on the downstream side of the weir. Observations suggest that the weir has been displaced downstream due to pressure exerted by upstream flow and sediment accumulation. Structural cracks were identified in the weir which, in combination with sustained upstream pressure, indicates the potential for compromised structural integrity of the weir.

This assessment highlights critical issues affecting the functionality and stability of the Allan Lake weir, emphasizing the need for further evaluation and potential remedial actions to restore its integrity.

Figure 2-1 Allan Lake Weir Downstream Side



IF NOT 25 mm ADJUST SCALES
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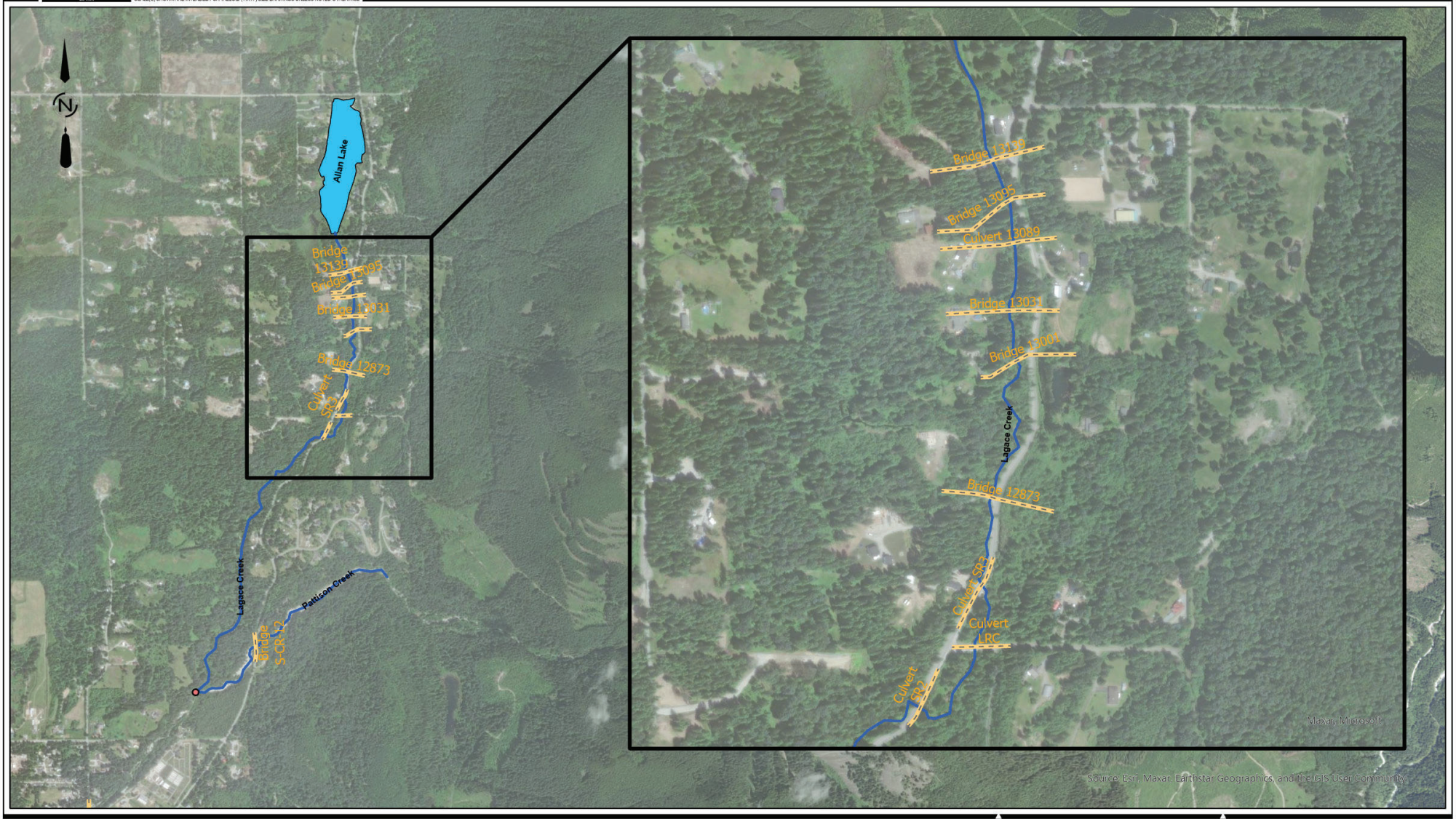
SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE



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LEGEND:

- Junction
- Bridges
- Pattison Creek
- Lagace Creek
- Allan_Lake_Reservoir

AE PROJECT No.	2022-2632-00
SCALE	1:17,735
APPROVED	
DATE	2025APR08
REV	01
DESCRIPTION	HATZIC S-CR-17

FIGURE 2-1

GOVERNMENT OF BRITISH COLOMBIA

HATZIC S-CR-17
INFRASTRUCTURE

2.2 Private Driveway – Bridge 1313

Bridge 13139 is a single-span wooden structure. It measures approximately 4.3 m wide, has a 0.3 m thick deck, and spans 6.2 m. Abutments are protected by rip rap. Sediment deposition upstream of the bridge consists of medium to large size cobbles (Figure 2-3). No significant sediment deposition is present on the downstream side; however, the channel beneath the bridge is narrow, reducing the hydraulic capacity of the structure (Figure 2-4).

Figure 2-3 Bridge 1313 Upstream Side



Figure 2-4 Bridge 1313 Downstream Side



2.3 Private Driveway – Bridge 130 5

Bridge 13095 is a single-span wooden structure. It measures approximately 4.3 m wide, has a 0.9 m thick deck, and spans 8.5 m. Abutments are protected by rip rap, with the upstream rip rap appearing to be in good condition (Figure 2-5). There is no significant accumulation of sediment deposition observed on either the upstream or downstream sides (Figure 2-6).

Figure 2-5 Bridge 130 5 Upstream Side



Figure 2-6 Bridge 130 5 Downstream Side



2.4 Private Driveway – Culvert 1308

Culvert 13089 consists of three approximately 1200 mm diameter CSP (corrugated steel pipe) barrels. On the upstream side of the crossing, there is a concrete headwall (Figure 2-7). The culverts are twisted, corroded, and obstructed by debris (Figures 2-8 and 2-). The bottoms of all three culverts are corroded, suggesting that they are at or near their serviceable lifespan. Per the Associated Risk Assessment completed in 2022, the hydraulic capacity of this crossing has significantly decreased due to extensive sediment deposition.

Figure 2-7 Culvert 1308 Upstream Side



Figure 2-8 Culvert 1308 Debris



Figure 2- Culvert 1308 Debris



2.5 Private Driveway – Bridge 13031

Bridge 13031 is a single-span wooden structure. It measures approximately 3.4 m wide, has a 0.9 m thick deck, and spans 9.2 m. Significant sediment deposition was observed both upstream and downstream (Figures 2-10 and 2-11). The centreline of Lagace Creek appears to have shifted towards the east abutment, which could undermine the structural integrity of the bridge over time.

Figure 2-10 Bridge 13031 Upstream Side



Figure 2-11 Bridge 13031 Downstream Side



2.6 Private Driveway – Bridge 13001

Bridge 13001 is a single-span wooden structure. It measures approximately 3.6 m wide, has a 0.4 m thick deck, and spans 5.2 m. Large rip rap and sediment deposition, along with heavy scour, are present on the upstream side of the bridge (Figure 2-12). Small to medium size sediment has been deposited downstream of the bridge (Figure 2-13). Erosion around and underneath the concrete abutments has likely compromised the structural integrity of the bridge.

Figure 2-12 Bridge 13001 Upstream Side



Figure 2-13 Bridge 13001 Downstream Side



2.7 Private Driveway – Bridge 12873

Bridge 12873 is a single-span wooden structure. It measures approximately 4.4 m wide, has a 0.3 m thick deck, and spans 6.1 m. Substantial sediment accumulation, including cobbles, has been identified at the upstream (Figure 2-14) and downstream (Figure 2-15) sides of the bridge. These accumulations appear to constrict the primary river channel, reducing its hydraulic capacity and potentially impacting flow efficiency.

Figure 2-14 Bridge 12873 Upstream Side



Figure 2-15 Bridge 12873 Downstream Side



2.8 Sylvester Road – Culvert SR3

Culvert SR3 consists of two barrels. Barrel one is an 8 m long concrete box culvert with a 2400 mm span and 1500 mm rise. Barrel two is an 8 m long corrugated HDPE culvert, 1200 mm in diameter. The upstream ends of the culverts are clean with no debris (Figure 2-16). Slight sediment deposition is observed at the outlets of both culverts (Figure 2-17), which can be attributed to Saporano Creek (the outlets are located at the confluence of Lagace Creek with Saporano Creek). The culvert structures appear stable, with no evidence of clogging. Sediment deposits in the ditch and at the outlets may warrant monitoring and maintenance to ensure long-term hydraulic performance.

Figure 2-16 Culvert SR3 Upstream Side



Figure 2-17 Culvert SR3 Downstream Side



2. Lundgren Road – Culvert LRC

Culvert LRC consists of two barrels (Figure 2-18). Barrel one is a CSP pipe arch measuring 1830 mm rise by 2500 mm span. Barrel two is a round 900 mm diameter CSP. The pipe arch shows signs of corrosion and a large scour pit has developed at the downstream outlet, while the round pipe appears to be in good condition overall, with only minor rust observed at the invert.

Figure 2-18 LRC Road Crossing Culvert (Photo taken by AE site visit, Summer 2024)



2.10 Sylvert Road – Culvert SR2

Culvert SR2 consists of three barrels. Barrel one is a round 2000 mm diameter CSP (Figure 2-1). Barrel two is a CSP pipe arch measuring 1530 mm rise by 2010 mm span that is lined with concrete (Figure 2-20). Barrel three is a round 1000 mm concrete pipe (Figure 2-21). No sediment or debris is present at any of the barrels. However, the structural integrity of the third barrel is questionable as it appears to have shifted as evidenced by the offset joints.

Figure 2-1 Culvert SR2 Upstream Side



Figure 2-20 Culvert SR2 Upstream Side



Figure 2-21 Culvert SR2 Inside Pipe



3 HYDRAULIC CAPACITY

To simulate key hydraulic processes along creeks and sites during open water conditions, a one-dimensional (1D) numerical model was developed using the HEC-RAS software. HEC-RAS is a 1D commercially available software developed by the United States Army Corps of Engineers. The software is used to simulate steady and unsteady flow conditions within open channels.

3.1 Model Development

A 1D model was developed for S-CR-17 to determine the capacity of the creek and existing structures during a 1:10-year and 1:200-year peak flow. The following inputs and assumptions were adopted:

- Manning's n for the channel[1] – 0.05 (Based on Chow's table (1959) for mountain streams with gravels and cobbles)
- Manning's n for overbanks:
  - 0.10 (Based on Chow's table (1959) for heavy stand of timber)
  - 0.04 (Based on Chow's table (1959) for cultivated areas with mature field crops)
- Contraction loss coefficient – 0.1 (cross-sections); 0.3 (upstream and downstream of bridge)
- Expansion loss coefficient – 0.3 (cross-sections); 0.5 (upstream and downstream of bridge)
- Bulk factor – 30% (applied to design flows for sediment transport)

The modelled reach of Lagace Creek spans approximately 3.4 km long. The cross-sections were extracted from 0.5 m resolution LiDAR (Light Detection and Ranging) data and were spaced approximately 40 m apart along the reach. The LiDAR was acquired in November 2022 and was merged with bathymetry data that was acquired in January and February of 2023. Properties of the hydraulic structure properties incorporated into the model were based on topographical survey points collected in December 2022.

A mixed flow regime was assigned to calculate water profiles. Peak instantaneous flows for the 10-year and 200-year design flows were determined using results from a hydrological HEC-HMS model and applied to the site. A known inflow was applied to the upstream boundary of Lagace Creek, extending from Allan Lake downstream to the confluence of Lagace Creek with Pattison Creek. Table 3-1 provides details on the boundary conditions and inflows used in the model.

[1] Chow, V.T. (1959). Open-Channel Hydraulics. McGraw-Hill Book Company

Table 3-1 Boundary Conditions and Inflows

	Boundary Conditions	
Location	Upstream Boundary	Downstream Boundary
Lagace Creek	Known Water Surface 10-Year 102.36 200-Year 102.76	Junction
Pattison Creek	Normal Depth 0.0571	Junction
	Inflows	
Location	10-Year (m^3/s)	200-Year (m^3/s)
Lagace Upstream (Allan Lake)	28.73	43.29
Lagace Upstream (Tributary Stream)	34.45	51.22
Lagace Upstream (Saporano Creek)	36.92	54.73
Lagace Downstream - confluence of Lagace and Pattison Creek	54.21	80.21
Pattison Creek	30.81	45.63

3.2 Existing Site Assessment

The boundary conditions for Allan Lake were set to a known water surface elevation derived from the flow profiles generated from HEC-HMS. Further, the design flow in Lagace Creek changes at each point where a tributary joins the main channel (Figure 3-1). Consequently, the modelled stretch of Lagace Creek has been split into three reaches. The first reach extends from Allan Lake downstream to the Saporano Creek tributary. The second reach extends from the Saporano Creek tributary to an unnamed tributary. The third reach extends from the unnamed tributary to the confluence of Lagace Creek with Pattison Creek.

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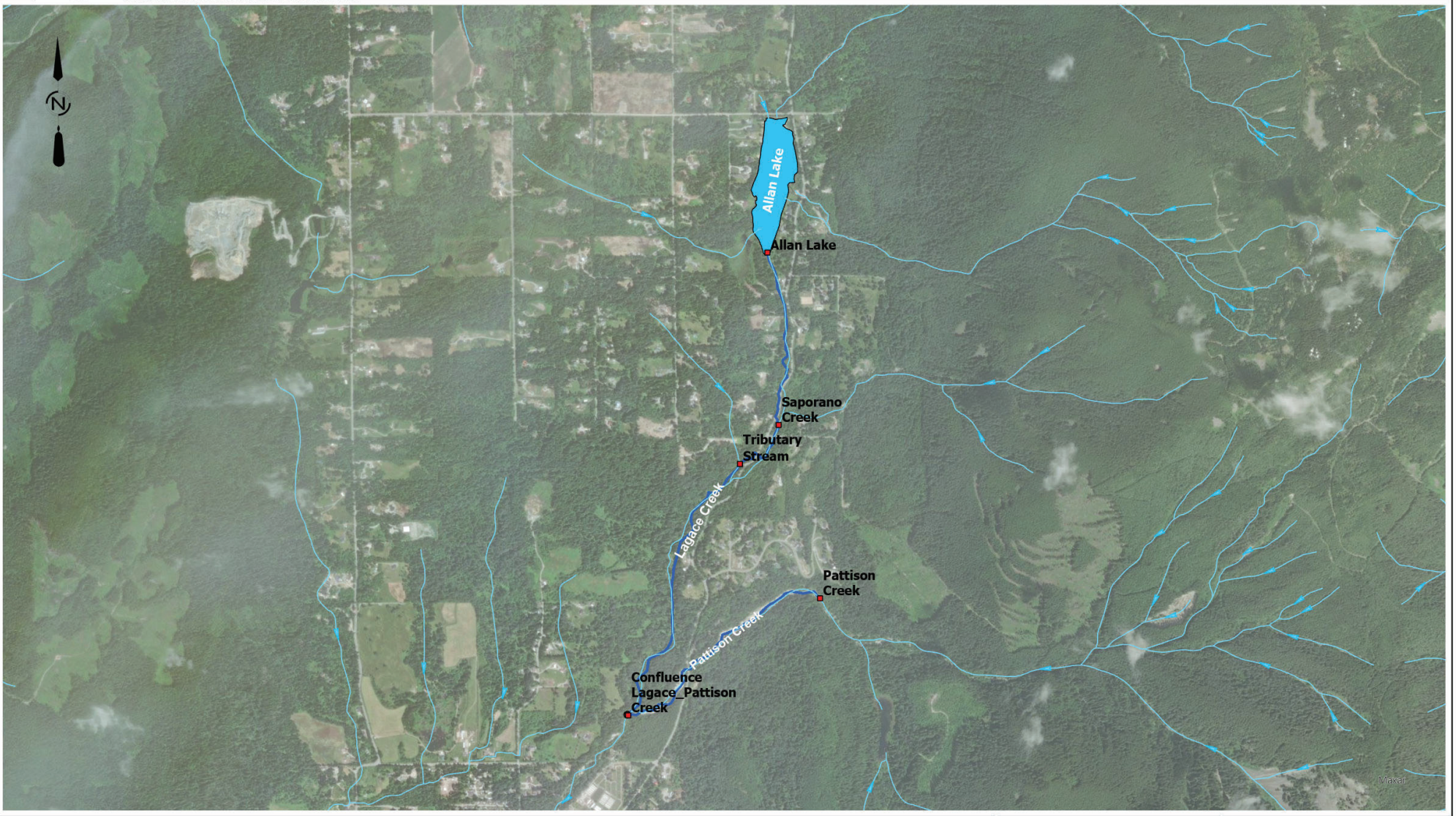

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LEGEND:

- Flow Change Points
- Streams
- Junction
- Pattison Creek
- Lagace Creek
- Allan_Lake_Reservoir

AE PROJECT No.	2022-2632-00
SCALE	1:17,735
APPROVED	
DATE	2025APR03
REV	01
DESCRIPTION	HATZIC S-CR-17

FIGURE 3-1

GOVERNMENT OF BRITISH COLOMBIA

HATZIC S-CR-17
FLOW PROFILE CHANGE MAP

Private Driveway – Bridge 13139

Table 3-2 presents the characteristics and capacity of the existing structure. Based on the results of the 1D model, the bridge does not have any freeboard and the water level in Lagace Creek exceeds the bottom chord elevation during the 10-year and 200-year design flows. Given the 0.3 m thick bridge deck, results confirm that this driveway crossing is likely to be overtopped during both the 10-year and 200-year design flows.

Table 3-2 Bridge 1313 Model Results

Description	10-Year	200-Year
Flow (m^3/s)	28.73	43.29
Span	Single span, 6.2 m long	
Bridge Deck Thickness (m)	0.3	
Bridge Width	4.3	
HWL (High Water Line) Elevation (m)	102.47	102.85
Bottom Chord Elevation (m)	101.28	
Freeboard (m)	-1.19	-1.57
Velocity (m/s)	0.80	0.82

3.2.1 Private Driveway – Bridge 130 5

Table 3-3 presents the characteristics and capacity of the existing structure. Based on the results of the 1D model, the bridge does not have any freeboard and the water level in Lagace Creek exceeds the bottom chord elevation during the 10-year and 200-year design flows. Given the 0.9 m thick bridge deck, results confirm that this driveway crossing is likely to be overtopped during the 200-year design flow.

Table 3-3 Bridge 130 5 Model Results

Description	10-Year	200-Year
Flow (m^3/s)	28.73	43.29
Span	Single span, 8.5 m long	
Bridge Deck Thickness (m)	0.9	
Bridge Width	4.3	
HWL Elevation (m)	102.35	102.73
Bottom Chord Elevation (m)	101.80	

Description	10-Year	200-Year
Freeboard (m)	-0.55	-0.93
Velocity (m/s)	1.46	1.90

3.2.2 Private Driveway – Culvert 1308

Table 3-4 presents the characteristics and capacity of the existing structure. Based on the results from the 1D model, the water level in Lagace Creek overtops the road during both the 10-year and 200-year design flows. The velocity in the 10-year design flow exceeds 3 m/s, making the upstream area and infrastructure susceptible to erosion.

Table 3-4 Culvert 1308 Model Results

Description	10-Year	200-Year
Flow (m^3/s)	28.73	43.29
Dimension/Material	3x 1200 mm diameter CSP	
Upstream Invert Elevation (m)	99.00	
Downstream Invert Elevation (m)	98.77	
Road Elevation (m)	101.08	
HWL Elevation (m)	102.19	102.48
Freeboard (m)	-1.11	-1.40
Velocity (m/s)	3.30	1.42

3.2.3 Private Driveway – Bridge 13031

Table 3-5 presents the characteristics and capacity of the existing structure. Based on the results of the 1D model, the bridge does not have any freeboard in the 200-year design flow; however, no overtopping occurs. The upstream velocity for the 200-year design flow exceeds 3 m/s, making the upstream area and infrastructure susceptible to erosion.

Table 3-5 Bridge 13031 Model Results

Description	10-Year	200-Year
Flow (m^3/s)	28.73	43.29
Span	Single span, 9.2 m long	
Bridge Deck Thickness (m)	0.9	
Bridge Width	3.4	
HWL Elevation (m)	98.95	99.60
Bottom Chord Elevation (m)	99.25	
Freeboard (m)	0.30	-0.35
Velocity (m/s)	2.67	3.02

3.2.4 Private Driveway – Bridge 13001

Table 3-6 presents the characteristics and capacity of the existing structure. Based on the results of the 1D model, the bridge does not have any freeboard, and the water level in Lagace Creek exceeds the bottom chord elevation during the 10-year and 200-year design flows. Given the 0.4 m thick bridge deck, results confirm that this driveway crossing is likely to be overtopped during both the 10-year and 200-year design flows.

Table 3-6 Bridge 13001 Model Results

Description	10-Year	200-Year
Flow (m^3/s)	28.73	43.29
Span	Single span, 5.2 m long	
Bridge Deck Thickness (m)	0.4	
Bridge Width	3.6	
HWL Elevation (m)	98.72	98.84
Bottom Chord Elevation (m)	97.72	
Freeboard (m)	-1.00	-1.12
Velocity (m/s)	1.13	1.31

3.2.5 Private Driveway – Bridge 12873

Table 3-7 presents the characteristics and capacity of the existing structure. Based on the results of the 1D model, the bridge does not have any freeboard, and the water level in Lagace Creek water exceeds the bottom chord elevation during the 10-year and 200-year design flows. The velocity in the 10-year design flow exceeds 3 m/s, making the upstream area and infrastructure susceptible to erosion. Flow velocity results are lower during a 200-year event because the crossing is overtopped and flows are no longer contained within the channel.

Table 3-7 Bridge 12873 Model Results

Description	10-Year	200-Year
Flow (m^3/s)	28.73	43.29
Span	Single span, 6.1 m long	
Bridge Deck Thickness (m)	0.3	
Bridge Width	4.4	
HWL Elevation (m)	96.06	96.95
Bottom Chord Elevation (m)	95.93	
Freeboard (m)	-0.13	-1.02
Velocity (m/s)	3.51	0.96

3.2.6 Sylvester Road – Culvert SR3

Table 3-8 provides the characteristics and capacity of the existing structure. Based on results from the 1D model, the water level in Lagace Creek overtops the road during both the 10-year and 200-year design flows.

Table 3-8 Culvert SR3 Model Results

Description	10-Year	200-Year
Flow (m^3/s)	34.45	51.22
Dimension/Material	2400 mm x 1500 mm Concrete Box 1200 mm diameter HDPE	
Upstream Invert Elevation (m)	93.10 93.19	
Downstream Invert Elevation (m)	93.05 93.08	

Description	10-Year	200-Year
Road Elevation (m)	95.16	
HWL Elevation (m)	95.23	95.36
Freeboard (m)	-0.07	-0.20
Velocity (m/s)	1.58 1.93	1.67 2.04

3.2.7 Lundgren Road – Culvert LRC

Table 3- provides the characteristics and capacity of the existing structure. Based on the results from the 1D model, the water level in Lagace Creek overtops the road during both the 10-year and 200-year design flows.

Table 3- Culvert LRC Model Results

Site 17 – LRC culverts	10-Year	200-Year
Flow (m^3/s)	34.45	51.22
Dimension/Material	1830 mm x 2500 mm CSP Pipe Arch 900 mm diameter CSP	
Upstream Invert Elevation (m)	91.90 92.76	
Downstream Invert Elevation (m)	91.70 92.63	
Road Elevation (m)	94.28	
HWL Elevation (m)	94.45	94.61
Freeboard (m)	-0.17	-0.33
Velocity (m/s)	2.37 2.02	2.45 2.14

3.2.8 Sylvert Road – Culvert SR2

Table 3-10 provides the characteristics and capacity of the existing structure. Based on the results from the 1D model, the water level in Lagace Creek overtops the road during both the 10-year and 200-year design flows. The velocity in two of the barrels in both the 10-year and 200-year design flows exceeds 3 m/s, making the upstream area and infrastructure susceptible to erosion.

Table 3-10 Culvert SR2 Model Results

Site 17 – SR2 culvert	10-Year	200-Year
Flow (m^3/s)	34.45	51.22
Dimension/Material	2000 mm diameter CSP 1530 mm x 2010 mm CSP Pipe Arch 1000 mm diameter CSP	
Upstream Invert Elevation (m)	91.30 91.60 92.10	
Downstream Invert Elevation (m)	91.20 91.20 92.05	
Road Elevation (m)	93.36	
HWL Elevation (m)	93.56	93.67
Freeboard (m)	-0.20	-0.31
Velocity (m/s)	3.47 3.47 2.66	3.60 3.65 2.67

4 CONCLUSIONS

- The model results confirm that infrastructure does not have enough freeboard during both the 10-year and 200-year design flows. Bridges 13139 and 13001 along with all of the culverts are overtopped during both the 10-year and 200-year design flow, while bridges 13095 and 12873 are overtopped only under the 200-year design flow. Overtopping of the structures can be attributed to the following:
  - Lack of sufficient hydraulic capacity in the driveway crossings due to sediment deposition or insufficient openings.
  - Culvert pipe sizes appear inadequate to provide enough hydraulic capacity for water passage during 10-year and 200-year design flow, leading to backflow and water accumulation upstream, which can submerge the upstream driveways.
- The 10-year velocity analysis indicates a limited temporary local increase in velocity to over 3 m/s immediately after each bridge, which decreases before reaching the next structure. As the river profile slope increases downstream, velocity also increases. The temporary velocity increase results in local erosion, while the subsequent velocity decrease causes sediment deposition, explaining sediment accumulation around driveway crossings.

- The rate of flow velocity increase during the 10-year design flow is higher at the downstream Sylvester Road crossing culverts due to the steeper river profile. This can lead to significant erosion in this area near the confluence of Lagace Creek and Pattison Creek.
- The 200-year velocity analysis shows a similar rate of velocity increase in steep sections of the river, resulting in greater erosion upstream and sediment deposition downstream.
- Frequent crossings of Sylvester and Lundgren Roads create a risk of water overtopping and are likely the primary cause of Sylvester Road flooding both upstream and downstream of Lundgren Road during the 10-year and 200-year design flow.
- Flow velocity varies significantly in Lagace Creek, causing embankment erosion and sediment deposition in some sections. However, Pattison Creek contributes a much larger sediment load to Lagace Creek's downstream reach. Given the higher flow velocities in Lagace Creek downstream and the sediment load from Pattison Creek, Lagace Creek's downstream section is more susceptible to scour.

Prepared by:

Hadi Bali

Hadi Bali, EIT
Water Resources Engineer-in-Training

Reviewed by:



2025-04-10

Ryan Karsgaard, P.Eng.
Project Engineer

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APPENDIX I – ENVIRONMENTAL CONSTRAINTS ASSESSMENT

TECHNICAL MEMORANDUM

Issue Date:	November 10, 2023	**File:**	AERIS
To:	**Ryan Karsgaard, Design Lead**	**Previous Issue Date:**	
From:	Michaela Burke, R.B.Tech., Dave Muhlert, R.B.Tech., and Naomi Sands, R.P.Bio.		
Client:	Ministry of Environment and Climate Change Strategy		
Project Name:	Hatzic Emergency Works Program: Sites 13 & 14	**Project No.:**	2022-2632
Subject:	Environmental Constraints Review of Lower Lagace Creek		

1 INTRODUCTION

BC Ministry of Environment and Climate Change Strategy retained Associated Engineering (B.C.) Ltd. to design emergency flood mitigation works at Lagace Creek in Hatzic, BC (Figure 1-1, inset). Flood mitigation works in the Hatzic Valley are proposed for 12 discrete sites based on their locations on the watercourses or sections of watercourses. Works in lower Lagace Creek, associated with Sites 13 and 14 (the Sites), are anticipated to comprise sediment removal and bank protection (the Project). Associated Environmental Consultants Inc. (Associated), the environmental division of the Associated Engineering group of companies, prepared this environmental constraints review to characterize the existing conditions at the Sites, including significant environmental features, and to identify potential interactions between the environment and the proposed scope of work to inform the design. Measures to mitigate and/or avoid anticipated impacts to the environment, from the proposed scope of work, are also recommended where relevant.

2 METHODS

Associated completed an environmental constraints assessment within a broad Study Area associated with Sites 13 and 14, both located in the lower portion of Lagace Creek. The purpose of this assessment was to characterize the environmental features present in the Study Area and how those features may potentially impact the Project design. Highlighting environmental features at an early stage of engineering design provides opportunities to minimize disturbance to natural areas in the Project footprint. If necessary, detailed engineering designs can be modified to avoid these features, so that impacts to the environment can be mitigated or avoided.

The Study Area for this assessment encompassed the instream channel from the Farms Road crossing on Hatzic Slough, south of Riverside Road, to the Farms Road crossing on Lagace Creek south of Stave Lake Road. The upstream extent of Site 14 starts where Site 15 ends (Associated 2023). The Study Area includes riparian habitat 20 m from the centreline of either side of the creek, to encompass access and staging.

The purpose of defining the Study Area is to understand how the environment functions within the Project setting and how the Project may interact with the larger ecosystem. The scope of the constraints assessment for the Project included:

- Fish and aquatic habitat;
- Vegetation and broad ecosystems;
- Wildlife and wildlife habitat;
- Species at risk; and
- Surface water users.

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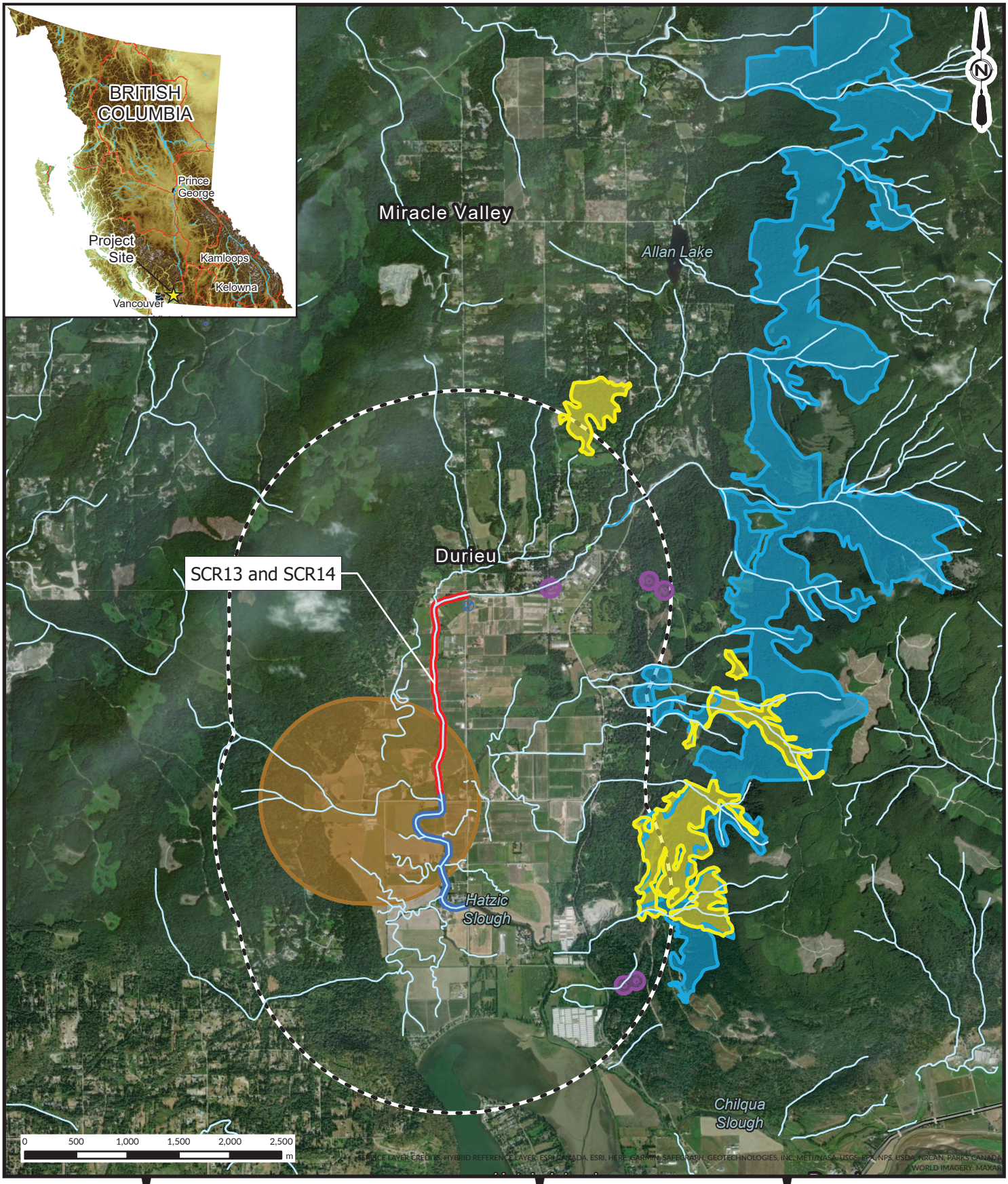

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Associated Environmental

BRITISH COLUMBIA Ministry of Environment and Climate Change Strategy

LEGEND

- Site 13 (Hatzic Slough)
- Site 14 (Lower Lagace Creek)
- 2km Buffer

Marked Known Occurences

- Northern Red-legged Frog
- Oregon Forestsnail
- Pacific Water Shrew

Critical Habitat

- Barn Owl
- Marbled Murrelet
- Oregon Forestsnail
- Spotted Owl caurina subspecies

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FIGURE 1-1
CRITICAL HABITAT AND SPECIES AT RISK

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM (SCR13 AND SCR14)

The assessment involved a desktop review of:

- Background information, including maps, aerial photographs, and relevant reports;
- Fisheries, critical habitat, and species at risk databases; and
- Broad ecosystems, environmentally sensitive areas, and/or tributaries.

Associated's Dave Muhlert, R.B.Tech., and Michaela Burke, R.B.Tech., surveyed Site 13 on October 17, 2023, and Site 14 on October 20, 2023. Field methods for the instream habitat portion of the survey were adapted from the Fish and Fish Habitat Inventory Standards and Procedures (RISC 2001) and Fish Habitat Assessment Procedures (Johnston and Slaney 1996) and were tailored to the Project. At each watercourse, observations included average wetted width and depth, bankfull channel width and depth, gradient, channel morphology, substrate composition, large woody debris, cover, and salmonid fish spawning, rearing, and quality of overwintering habitat. Additionally, riparian habitat quality was assessed by observing the left and right banks and included documenting forest type, stage, and dominant species.

The terrestrial assessment consisted of a visual encounter survey to opportunistically search for vegetation and wildlife species of interest and their habitat features (FLNRO 2016, RIC 1998). The survey was conducted by walking the length of each site, including up to 20 m from the creek centreline, to characterize wildlife habitat (including suitability for species at risk), identify significant wildlife features (e.g., dens, nests, cavities), and document rare and invasive plant species.

Representative photographs were taken of aquatic and terrestrial habitat and anthropogenic features in the Study Area and are provided in Appendix A.

3 EXISTING CONDITIONS

3.1 Climate

The Study Area is located in the Coastal Western Hemlock dry maritime biogeoclimatic subzone (CWHdm), at an elevation of approximately 200 m above mean sea level. The CWH is one of Canada's wettest biogeoclimatic zones and has the most productive forest areas. The weather includes moist Pacific winds, extensive cloud cover and mist, and frequent drizzle. The climate is generally moderate (cool mesothermal), with cool summers and mild winters. The mean annual temperature in the CWH zone is 5.5°C, and the mean precipitation is 2,200 mm (Pojar et al. 1991).

3.2 Vegetation and Broad Ecosystems

The riparian area along the part of Lagace Creek that is in the Study Area comprises a narrow corridor of riparian shrub vegetation, with occasional small forest stands, largely surrounded by agricultural land. Riparian shrub vegetation is dominated by red-osier dogwood (*Cornus sericea*), Pacific ninebark (*Physocarpus capitatus*), salmonberry (*Rubus spectabilis*), and willow (*Salix* sp.). Forest stands are dominated by red alder (*Alnus rubra*) and black cottonwood (*Populus trichocarpa*), and also contain occasional Douglas-fir (*Pseudotsuga menziesii*), shore pine (*Pinus contorta* var. *contorta*), and western redcedar (*Thuja plicata*) trees. Riparian vegetation was generally denser, with more shrubs and trees, in the

northern end of the Study Area (i.e., Site 14), and less dense, with more open areas dominated by grasses, at the southern end of the Study Area (Site 13, Photo 1, Photo 2).

Approximately 600 m downstream from the Dale Road bridge, some typical wetland vegetation such as cattail (*Typha* sp.) and sedge (*Carex* sp.), is present in a large off-channel habitat that appears to be disconnected from the main creek channel at the upstream end and connected by a narrow channel at the downstream end (Figure 3-1, Photo 3, Photo 4). This off-channel habitat measures approximately 8 m wide by 50 m long.

3.2.1 Rare Plants/Listed Ecosystems

No mapped known occurrences of rare plants or ecological communities at risk exist within 2 km of Lagace Creek (CDC 2023a).

3.2.2 Invasive Species

A total of 12 invasive plant species were documented along Lagace Creek within the Study Area, including numerous large patches of the highly invasive Japanese knotweed (*Reynoutria japonica* var. *japonica*) along the creek banks and up to the edge of the channel in many places (Photo 5). Japanese knotweed is designated as a noxious weed by the provincial *Weed Control Regulation* (BC Reg. 66/85) (Figure 3-1, Figure 3-2). Himalayan blackberry (*Rubus armeniacus*) was abundant throughout the corridor and formed dense thickets in some areas. A complete list of the invasive plant species documented during the field visits is provided in Table 3-1.

Table 3-1 Invasive Plant Species Observed in the Lagace Creek Sites 13 and 14 Study Area

Common Name	Scientific Name	Provincial Management Objective[1]	Noxious Weed[2]
Butterfly-bush	*Buddleja davidii*	N/A	N/A
Common foxglove	*Digitalis purpurea* ssp. *purpurea*	N/A	N/A
Common tansy	*Tanacetum vulgare*	Regional containment/control	Regionally noxious (not applicable in Study Area)[3]
Cutleaf evergreen blackberry	*Rubus laciniatus*	N/A	N/A
English holly	*Ilex aquifolium*	Management	N/A
European bittersweet	*Solanum dulcamara*	N/A	N/A
Himalayan blackberry	*Rubus armeniacus*	Regional containment/control	N/A
Japanese knotweed	*Reynoutria japonica* var. *japonica*	Regional containment/control	Provincially noxious
Policeman's helmet	*Impatiens glandulifera*	Regional containment/control	N/A
Robert's geranium	*Geranium robertianum*	N/A	N/A
Scotch broom	*Cytisus scoparius*	Regional containment/control	N/A
Yellow archangel	*Lamium galeobdolon*	Regional containment/control	N/A

[1] Provincial priority invasive species management category (BC GOV 2023). [2] Designation under the provincial *Weed Control Regulation* (BC Reg. 66/85). N/A – not applicable. [3] Schedule A, Part II of the *Weed Control Regulation* designates some plant species as noxious weeds only in specific regions; common tansy is a noxious weed in Bulkley-Nechako, Central Kootenay, Columbia-Shuswap, East Kootenay, and North Okanagan, but not in the Fraser Valley region.

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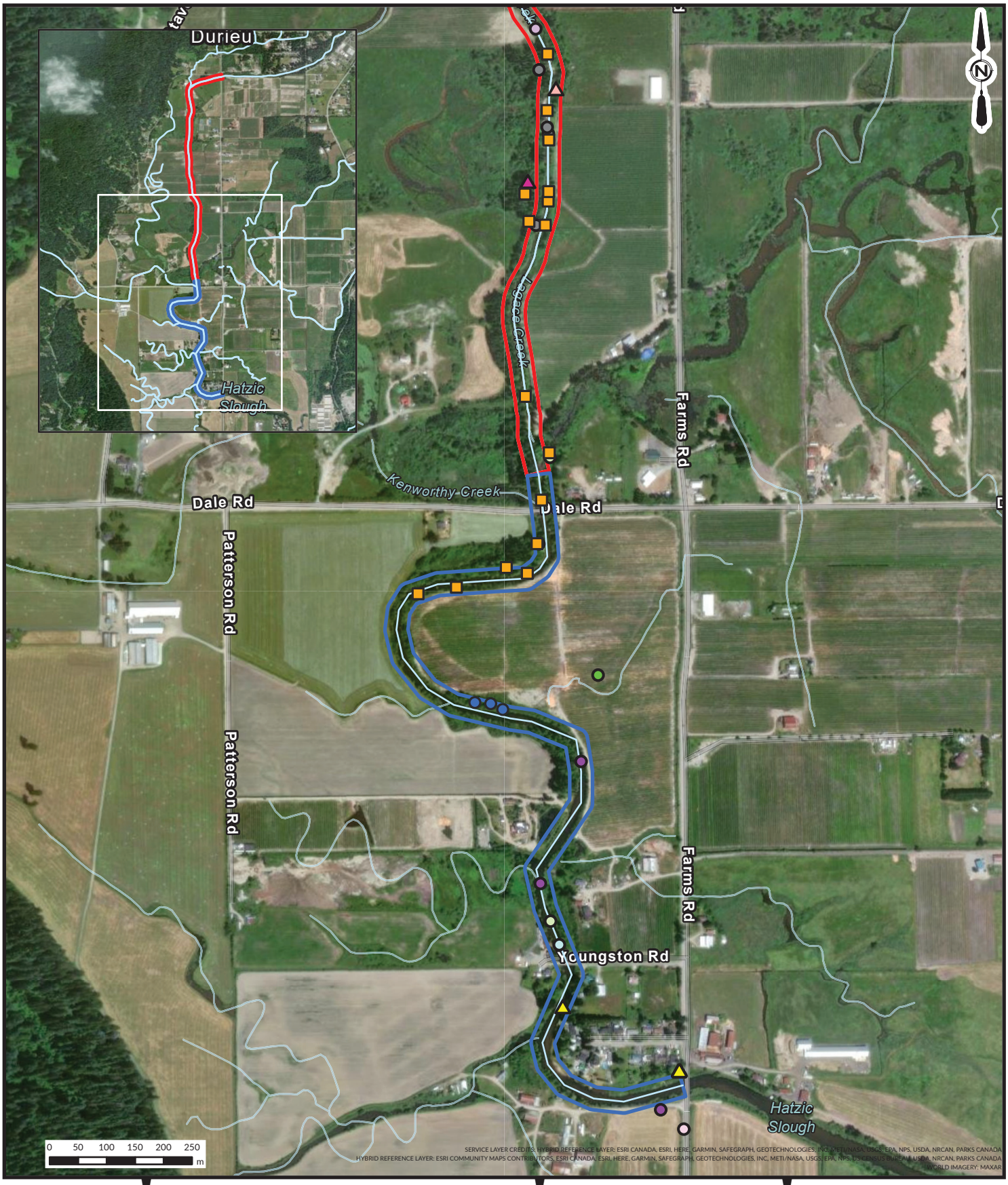

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Associated Environmental

BRITISH COLUMBIA Ministry of Environment and Climate Change Strategy

LEGEND

- Wetland/Off-channel Habitat
- Japanese Knotweed
- American beaver
- American black bear
- Great blue heron
- Hairy woodpecker
- Northern harrier
- Pacific chorus frog
- Pileated woodpecker
- Potential Raptor nest
- Stick nest
- Unidentified Raptor
- Site 13 (Hatzic Slough)
- Site 14 (Lower Lagace Creek)
- Watercourses

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FIGURE 3-1
VEGETATION AND WILDLIFE OBSERVATIONS

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
(SCR13 AND SCR14)

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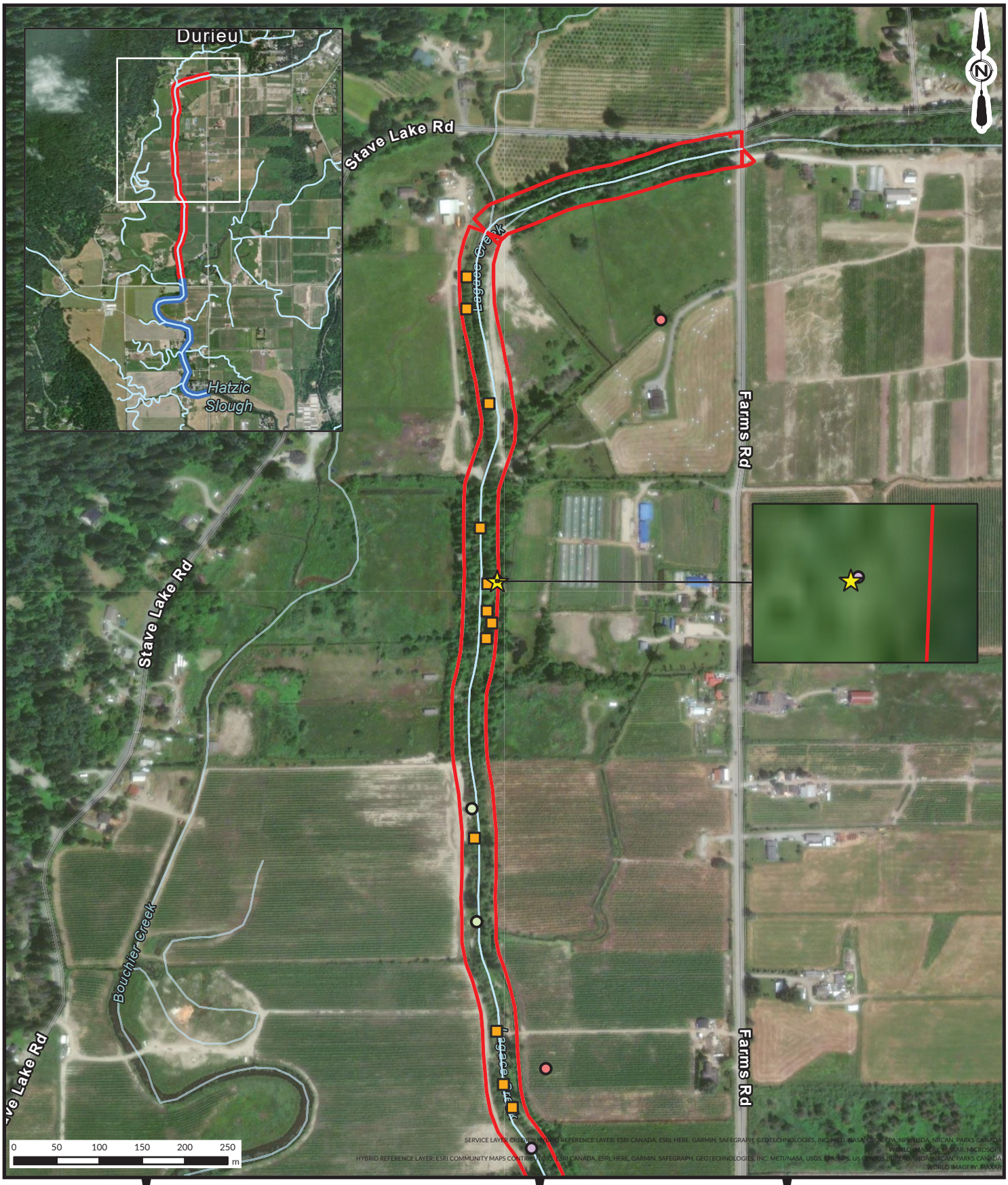

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Associated Environmental

BRITISH COLUMBIA Ministry of Environment and Climate Change Strategy

LEGEND

- Japanese Knotweed
- American beaver
- Pacific chorus frog
- Potential Pileated woodpecker nest cavitity
- Red-tailed hawk
- Site 14 (Lower Lagace Creek)
- Watercourses

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FIGURE 3-2
VEGETATION AND WILDLIFE OBSERVATIONS

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
(SCR13 AND SCR14)

3.3 Fish and Aquatic Habitat

Lagace Creek is a third-order stream (ENV 2023a) and its headwaters are in a mountainous region 5.2 km directly east of the Study Area. Lagace Creek flows into Hatzic Slough just north of the Dale Road crossing, and Site 13 is located almost entirely within Hatzic Slough (Figure 3-3). Flow from this watershed eventually ends up in Hatzic Lake and continues into the Fraser River. Approximately 4 km of instream channel was surveyed, encompassing Sites 13 and 14. The channel in the Study Area is partially confined by farms, access roads, and residential lands.

Lagace Creek is fish bearing and has been documented to contain the following species: rainbow trout (*Oncorhynchus mykiss*), cutthroat trout (*O. clarkii clarkii*), chum salmon (*O. keta*), coho salmon (*O. kisutch*), sockeye salmon (*O. nerka)*, lamprey (*Entosphenus* spp.), three-spine stickleback *(Gasterosteus aculeatus*), and prickly sculpin (*Cottus asper*) (ENV 2023a, ENV 2023b). Fish and fish carcasses were observed along both sites over the course of the survey.

Lagace Creek is bordered by residential homes and agricultural land to the east and west within the Study Area. Sedimentation appears to be an ongoing issue in Lagace Creek, evidenced by the amount of sediment and silt found in the lower reach of Lagace Creek, where it flows into Hatzic Slough. While sandy bars, islands, and troughs were found along the length of the Study Area, gravel and cobble became more abundant moving upstream. Undercut banks, irregular instream islands, and small amounts of large woody debris were noted throughout.

3.3.1 Site 13 (Hatzic Slough)

In Site 13, the watercourse has an average wetted width of 19 m and the depth ranges from 0.3 to 0.6 m. The channel has a slight meandering morphology, straightening out as it continues upstream to the north (Figure 3-3). Undercut banks provide deeper pockets of water with a higher flow, providing refuge for migrating salmonids. The channel substrate largely consists of sand and silt, which can be easily shifted and shaped according to flow pathways and rates in the slough, resulting in a convex channel bed morphology, with shallow water along the centreline and deeper water along the banks. Pool habitat is limited in this reach; only four or five pools were noted along this section (Photo 8), created by large woody debris along the banks, undercut banks (Photo 9), and at the outlet of drainage channels. Large woody debris (i.e., pieces of wood ≥10 cm in diameter and at least 2.0 m in length) was extremely sparse (Photos 6–10).

Riparian vegetation along Hatzic Slough within the Study Area comprises shrubs and few trees, which limits the input of large woody debris into the creek (Photos 6–10). This segment has little to no overhanging vegetation along the banks. Further, it appears that the banks of the creek have been modified along this stretch of Hatzic Slough (Photos 6 and 7). On some properties, vegetation along the banks had been cleared all the way to the water's edge, while at other properties, the banks have been modified to create shallow pools or to construct docks. Small, motorized boats were observed tied up along the banks. A low retaining wall had been built along the length of one property, just above the water's edge.

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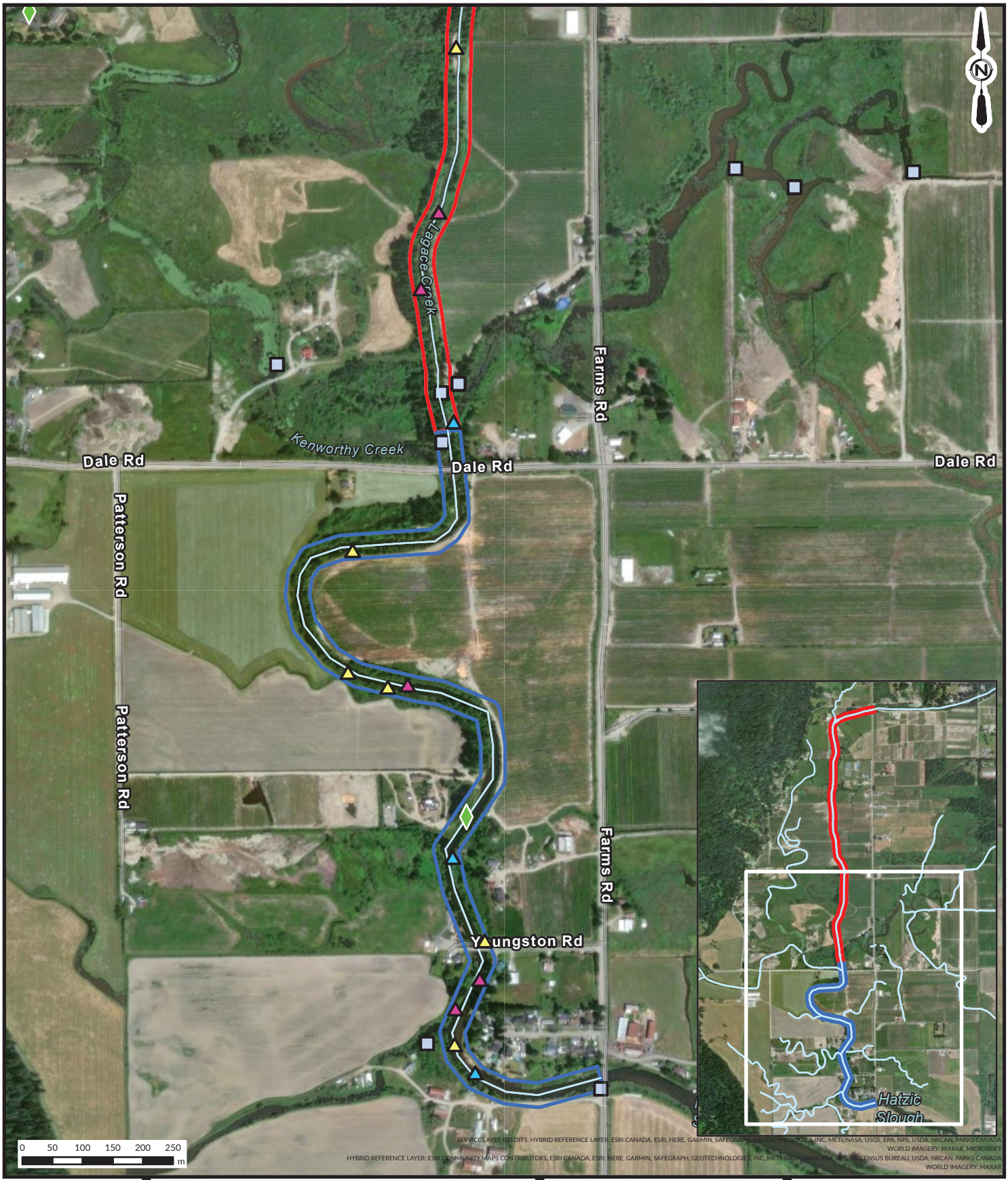

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Associated Environmental

BRITISH COLUMBIA Ministry of Environment and Climate Change Strategy

LEGEND

- Live or Dead Fish
- Pool Habitat
- Tributaries
- Fish Historical Records

Water Licenses

- Active
- Site 13 (Hatzic Slough)
- Site 14 (Lower Lagace Creek)
- Watercourse

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FIGURE 3-3
FISH AND AQUATIC HABITAT

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
(SCR13 AND SCR14)

Hatzic Slough has a gradient of 1 to 3%, and its flow rate is generally slower than that in Lagace Creek. Hatzic Slough has several tributaries, or off-channels, including several inputs that appear to be drainage ditches for nearby farms. Beaver activity was noted just above the Farms Road bridge, where a beaver dam had created a channel on the left bank (looking downstream) and a large off-channel habitat (Photo 19).

Several fish carcasses were encountered during the survey on October 17, likely washed down from upstream; no live fish were observed in Hatzic Slough. No redds were identified; channel substrate along this reach is primarily sand and silt and is not suitable for egg laying.

Adult salmonids are reported to migrate through this area in large numbers, supported by documented fish presence and spawning activity upstream. The lack of pool habitat and overhead cover would make the area a poor choice for overwintering, and the almost complete lack of spawning substrate, such as clean gravels and smaller cobbles, would preclude spawning in this area. Further, Site 13 provides limited rearing habitat for juvenile salmonids in the form of protected, slow moving off-channel habitat.

3.3.2 Site 14 (Lower Lagace Creek)

Site 14 extends from approximately 100 m upstream of the Dale Road bridge crossing to the Farms Road bridge crossing. The channel is narrower in this reach (Photo 12), with an average wetted width of 11 m and shallow depths averaging 0.4 m. The channel gradient is between 1 and 4% over the length of Site 14. Channel substrate transitioned from sand and silt to gravel and cobble upstream of the confluence with Hatzic Slough. Large woody debris was slightly more abundant in this reach, however, pool habitat was still lacking. Undercut banks were noted throughout approximately 60% of the channel, and several adult chum salmon were noted resting in these areas. The riparian cover increased moving upstream; as the channel narrowed, the riparian vegetation reached further out over the creek and covered larger portions of it.

As the substrate began to change to gravel and cobble, increasing numbers of adult salmonids were observed in the stream (Photo 13–15). Approximately 1.3 km upstream of the Dale Road bridge, salmonid activity was abundant; adult chum pairs were observed resting in undercut bank areas, defending potential redd sites. This section of Lagace Creek had an equal distribution of sand and gravel areas. Chum pairs were guarding areas of gravel patches that appeared cleaner than the surrounding gravel (Photo 13), which is indicative of recent nesting activity, when gravels are dug out to form a hollow or a cup, eggs are laid and fertilized, and the area is then covered with the newly clean gravel. Spawning and guarding behaviour were observed throughout a 500 m stretch of creek and over a dozen mating pairs were counted (Figure 3-4).

Two barbed wire fences were noted crossing the creek (Figure 3-4, Photo 14), approximately 200 m apart, likely to keep cattle from wandering up or downstream. The instream channel between these two fences supported much of the spawning hot spots, increasing to almost 30 m wide, just below the upstream fence (Photo 16, Photo 17). This section of the creek passes through what is likely a cattle farm, as the mid-channel islands showed evidence of livestock use. Belcharton Creek flows into Lagace Creek here from the east, forming a large pool area at the inlet that was too deep (>1.5 m) to measure.

A flap-gate culvert was found on the west bank, just upstream of the Dale Road bridge, and a lock block wall was noted approximately 800 m further upstream. Otherwise, this reach of the creek appears to be free of artificial modifications or structures.

Lower Lagace Creek clearly provides excellent spawning habitat, and redds were found within the gravels throughout this section. Chum salmon was the only species observed on October 20; however, the spawning habitat is likely used by several species at different times of the season. This reach is also a vital migration route for adult salmon moving to suitable habitat further upstream. Due to a general lack of ponds, overhead coverage, and slow-moving off-channel habitat, Site 14 likely provides only low to moderate rearing and overwintering habitat.

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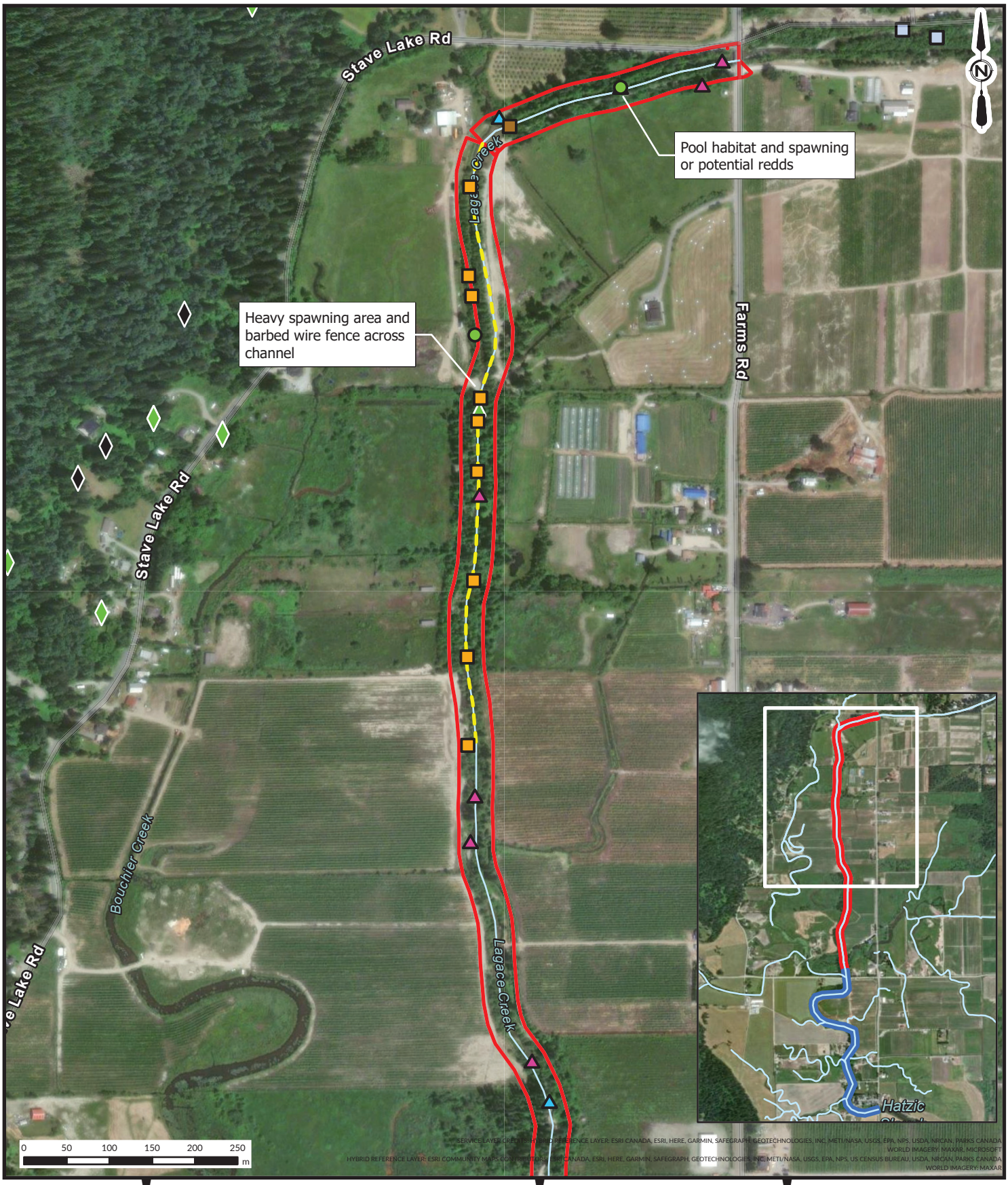

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Associated Environmental

BRITISH COLUMBIA Ministry of Environment and Climate Change Strategy

LEGEND

- Live or Dead Fish
- Pool Habitat
- Tributaries
- Spawning or Potential Redds
- Heavy Spawning Area
- Barbed Wire Fence Across Channel
- Fish Historical Records

Water Licenses

- Active
- Inactive
- Site 14 (Lower Lagace Creek)
- Heavy Spawning Activity
- Watercourse

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SCALE	1:6,000
COORD. SYSTEM	NAD 1983 UTM ZONE 10N
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FIGURE 3-4
FISH AND AQUATIC HABITAT

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
(SCR13 AND SCR14)

3.4 Wildlife and Wildlife Habitat

The habitat along Lagace Creek comprises a complex of forest stands, riparian vegetation, and agricultural land, and has the potential to support a diversity of wildlife. The riparian fringe and young deciduous forest provide extensive foraging and nesting opportunities for passerine birds. Numerous passerines were detected during the field visit, including American crow (*Corvus brachyrhynchos*), American dipper (*Cinclus mexicanus*), black-capped chickadee (*Poecile atricapillus*), common raven (*Corvus corax*), dark-eyed junco (*Junco hyemalis*), European starling (*Sturnus vulgaris*), pine siskin (*Spinus pinus*), red-winged blackbird (*Agelaius phoeniceus*), spotted towhee (*Pipilo maculatus*), and Steller's jay (*Cyanocitta stelleri*). Great blue herons (*Ardea herodias* ssp. *fannini*), northern flicker (*Colaptes auratus*), belted kingfisher (*Megaceryle alcyon*), and hairy woodpecker (*Dryobates villosus*) were also observed flying over or foraging within the Study Area. One nest with the size, construction, and placement typical of passerines was detected approximately 700 m north of Dale Road (Photo 18). No birds or nesting activity were detected around this nest during the field visit.

Deer and other mammals likely use the narrow riparian areas for foraging and as a travel corridor. Beaver (*Castor canadensis*) activity was noted in several places along the creek, and a potential beaver den was noted by a local resident approximately 70 m north of Youngston Road. An intact beaver dam and an associated pond are present in Hatzic Slough, just upstream of its confluence with Lagace Creek (i.e., approximately 150 m north of Dale Road) (Photo 19). American black bear (*Ursus americanus*) scat and marked trees were also detected in several locations within the Study Area.

Scattered snags were noted throughout the Study Area, with signs of woodpecker foraging, including one snag approximately 500 m north of Stave Lake Road. The snag contained a cavity with the size, shape, and placement typical of a pileated woodpecker (*Dryocopus pileatus*) nest cavity (Figure 3-1) (Photo 20). Approximately 600 m south of this potential nest cavity, another snag was observed with two large circular cavities indicative of pileated woodpecker roosting. In addition, pileated woodpecker calls were detected from several locations along Lagace Creek, and pileated woodpeckers were visually observed foraging in trees at two locations near the intersection of Farms Road and Riverside Road. Therefore, it is highly likely that pileated woodpecker nest cavities are present within the Study Area.

Several raptors were observed flying and/or calling from within the Study Area, including red-tailed hawk (*Buteo jamaicensis*), northern harrier (*Circus hudsonius*), and a suspected American kestrel (*Falco sparverius*). A large stick nest, potentially a raptor's, was detected approximately 600 m north of Dale Road (Figure 3-1) (Photo 21). No raptor activity was detected in or around this nest during the field visit.

Pacific chorus frogs (*Pseudacris regilla*) were heard calling from several locations within the Study Area. Off-channel habitats and slow-moving tributaries provide highly suitable breeding habitat for amphibians.

3.4.1 Species at Risk

Based on a search of the BC Conservation Data Centre online database, critical habitat and marked known occurrences of species at risk were identified within 2 km of the Study Area (CDC 2023a) (Figure 1-1, Table 3-2).

Table 3-2 Wildlife Species at Risk with Critical Habitat or Marked Known Occurrences Within 2 km of the Study Area

Common Name	Scientific Name	BC List[1]	SARA Status[2]	Presence in Study Area and Potential Interaction with Project
Oregon forestsnail	*Allogona townsendiana*	Red	Endangered	There are several occurrence records and mapped critical habitat for this species near the Study Area, including further upstream on Lagace Creek, where two snails were found in 2006. This site borders agricultural land and may have been mowed. This species is most commonly associated with deciduous forest canopy dominated by bigleaf maple (*Acer macrophyllum*), with stinging nettle in the understorey. Suitable habitat for this species was not detected in the Study Area.
Northern red-legged frog	*Rana aurora*	Blue	Special concern	There is one record of this species in a small tributary that flows parallel to Lagace Creek, approximately 1.2 km east-northeast of the Study Area. This species will breed in lotic habitat with little to no flow. Suitable habitat for this species exists in the Study Area.
Pacific water shrew	*Sorex bendirii*	Red	Endangered	There is an occurrence record for this species from a wetland on Farms Road, approximately 100 m south of Lagace Creek, in 2016. Suitable habitat for this species is found in riparian habitats associated with streams, creeks, and wetlands in mature coniferous or deciduous forests. While the high flow in the mainstem of Lagace Creek likely renders it unsuitable for Pacific water shrew, the adjacent riparian and off-channel habitat are highly suitable for this species.
Barn owl	*Tyto alba*	Blue	Threatened	Critical habitat for this species has been mapped in the agricultural lowland along Hatzic Slough, within an area that overlaps the southern end of the Study Area.

Common Name	Scientific Name	BC List[1]	SARA Status[2]	Presence in Study Area and Potential Interaction with Project
				This species typically nests in buildings (e.g., barns and silos) and forages over fields of dense grass. Suitable habitat for barn owl exists near Lagace Creek but is unlikely to be affected by in-channel works.
Spotted owl, *caurina* subspecies	*Strix occidentalis* ssp. *caurina*	Red	Endangered	Proposed critical habitat for this species exists approximately 1.7 km east of the Study Area, on the forested mountain slopes. This area is considered potential future critical habitat, defined as "habitat that either already possesses, or is expected to develop (within a 50-year period), the features required by the owls to successfully nest, roost, forage and move safely" (ECCC 2023). Suitable habitat for this species is old-growth or old-growth–like forests with multilayered canopies, and where there are large-diameter trees with existing cavities for nesting. Forests where small mammal prey animals are abundant are likely to be preferred as nesting sites (CDC 2023b). Suitable habitat for spotted owl is not present within the Study Area.
Marbled murrelet	*Brachyramphus marmoratus*	Blue	Threatened	Critical habitat for this species has been mapped in forest habitat approximately 1.9 km northeast of the Study Area, and approximately 1.9 km east of the Study Area. Suitable habitat for this species comprises mature and/or old-growth coniferous forest near the coast. The riparian forest habitat within the Study Area does not provide the necessary biophysical attributes for this species.
Great blue heron, *fannini* subspecies	*Ardea herodias* ssp. *fannini*	Blue	Special concern	Great blue herons forage for fish in various aquatic habitats, including wetlands and riparian areas, that are generally less than 0.5 m deep. Herons typically forage within 5 km of nest sites, although they can travel as far as 33 km for foraging (CDC 2023b). Great blue herons were observed in three locations at the southernmost end of the Study Area, indicating that herons

Common Name	Scientific Name	BC List[1]	SARA Status[2]	Presence in Study Area and Potential Interaction with Project
				use the creek for foraging. No great blue heron nests were detected during the field visit.

[1] Provincial status codes: Yellow: Secure or apparently secure; Blue: Of special concern; Red: Extirpated, Endangered, or Threatened.
[2] *Species At Risk Act*, Schedule 1 status.

3.5 Surface Water Licences

Based on a search of iMapBC (CDC 2023a), many surface water licences exist on Lagace Creek and Hatzic Slough within Sites 13 and 14 (Figure 3-3, Figure 3-4, Table 3-3).

Table 3-3 Surface Water Licences Near Lagace Creek

Licence Number	Status	Use Type	Source
C115129	Current	Greenhouse & Nursery	Hatzic Slough
C037353	Current	Pond & Aquaculture	Lagace Creek
C037353	Current	Pond & Aquaculture	Lagace Creek
C132892	Current	Irrigation: Private	Belcharton Creek
C049447	Abandoned	Land Improve: General	Belcharton Creek
F052147	Abandoned	Domestic	Durieu Creek
C064498	Current	Irrigation: Private	Lagace Creek
F019931	Current	Domestic	Lagace Creek
C114253	Current	Greenhouse & Nursery	Hatzic Slough

4 REGULATORY FRAMEWORK

The regulatory requirements will depend on the final detailed design chosen for the Project. Given the species and habitats present in the Study Area, the following regulatory instruments have the potential to apply to the Project:

- *Fisheries Act* (RSC 1985, c. F-14), administered by Fisheries and Oceans Canada (DFO);
- *Water Sustainability Act* (SBC 2014, c. 15), administered by the BC Ministry of Forests (MOF);
- *Riparian Areas Protection Act* (SBC 1997, c. 21), administered by MOF;
- *Weed Control Act* (RSBC 1996, c. 487) and *Weed Control Regulation* (BC Reg. 66/85), administered by MOF;
- *Wildlife Act* (RSBC 1996, c. 488) and *Wildlife Amendment Act* (Bill 51 – 2004), administered by MOF;
- *Migratory Birds Convention Act, 1994* (SC 1994, c. 22), administered by Environment and Climate Change Canada (ECCC); and

- *Species at Risk Act* (SC 2002, c. 29), administered by ECCC, MOF, and DFO.

After the potential Project footprint is established, including access routes, Associated recommends a second site visit to take a closer look at the habitat likely to be affected. A second field assessment during a different flow regime would also be helpful and can help define the work timing windows for the Project. A definitive list of the regulatory requirements can then be established.

5 CONSTRAINTS ANALYSIS AND ASSOCIATED MITIGATION

Lagace Creek is fish bearing; fish have been documented throughout Sites 13 and 14 (CDC 2023a, CDC 2023b, ENV 2023a, ENV 2023b), and the creek is an important migration corridor and sensitive spawning site (Figure 3-3, Figure 3-4). Based on the fish species found in Lagace Creek (e.g., cutthroat trout, Pacific salmon species, rainbow trout), the least-risk window for works is August 1 to September 15 (MOE 2006); instream works should be restricted to this window. If instream works are necessary outside the least-risk window, upstream fish passage must be maintained, either via a diversion channel or ongoing fish salvage. Further, sites must be isolated before fall staging and initiation of spawning. Standard best management practices (BMPs) and mitigation measures must be implemented to prevent the migration of sediment downstream and the death of fish (e.g., as a result of stranding).

Invasive plant species were documented throughout the riparian corridor on Lagace Creek, including numerous patches of Japanese knotweed and Scotch broom; both are priority species requiring special management to prevent their spread. Japanese knotweed is designated as a noxious weed in Schedule A of the provincial *Weed Control Regulation*. Under the *Weed Control Act*, the occupier of a property "must control noxious weeds growing or located on land and premises, and on any other property located on land and premises, occupied by that person." The Project should be sited to avoid these invasive plant locations, where possible. Site-specific measures will be required during construction to prevent encroachment and to mitigate the potential spread of these and other invasive species.

Pileated woodpeckers were detected during the field visit, and one cavity that has the potential to be used for pileated woodpecker nesting was observed. Pileated woodpeckers are listed in Schedule 1 of the *Migratory Birds Regulations, 2022*, and cavity nests of this species are afforded enhanced nest protection, including designated wait times for the declaration of an abandoned nest before tree removal. This cavity should be revisited during the nesting season to assess its status, and access routes and laydown areas should be sited to avoid this potential nest. Further, if construction work within 30 m of the potential nest is anticipated, additional monitoring may be required before construction begins to determine whether the nest is occupied and to develop a plan to avoid disturbing nesting birds.

One potential raptor nest was detected during the field visit. The nest should be revisited during the raptor breeding season to assess the status of the nest and ascertain the species. If the nest is active, a minimum no-disturbance buffer should be established to protect nesting raptors from unnecessary disturbance. The minimum recommended buffers vary depending on the raptor species, surrounding land use, and time of year (BC GOV 2013). The nests of some raptor species, listed under Section 35 of the *Wildlife Act*, are protected year-round.

In general, vegetation clearing will need to consider the presence of nesting birds and should be timed to avoid the peak bird nesting season of March 12 to August 17 (Government of Canada 2023). If clearing during the bird breeding season is unavoidable, nest surveys by a qualified environmental professional will be required before construction.

Wetlands have the potential to support species at risk and should be avoided to the extent possible. If impacts to wetlands are anticipated and/or if vegetation clearing is required, wildlife salvage may be necessary. Beaver houses, dens, and dams are protected under Section 9 of the *Wildlife Act*, except where dams occur on diked land. The Project will need to consider the presence of beavers in the Study Area and manage the instream works accordingly.

5.1 Permitting Requirements

Based on the anticipated scope of instream works (e.g., sediment removal), a change approval under Section 11 of the *Water Sustainability Act* will be required. An emergency *Fisheries Act* authorization has already been obtained from DFO for flood mitigation works in Lagace Creek; however, works under this authorization must be completed by December 31, 2023. An amendment to the emergency authorization to extend the window to December 31, 2024, has been submitted and is currently under DFO review. Fish salvage is anticipated, and a scientific fish collection permit and a scientific licence will be required.

Depending on the scope of clearing, if a wildlife salvage is deemed necessary, a general wildlife permit is required under the *Wildlife Act*. If impacts to a beaver den are anticipated, a general wildlife permit is required under Section 3 of the Act. If the nest of a protected raptor (per Section 34b of the *Wildlife Act*) is identified in the Project footprint and its removal is required (although nest removal is not anticipated at this time), a general wildlife permit to possess, take, or destroy a bird nest and/or egg must be obtained. These specialized permits require negotiation with MOF to determine appropriate compensation and/or the location for a replacement nest. Associated recommends that the Project allow up to 1 year to complete this process.

One cavity with the potential to be used for pileated woodpecker nesting was detected in the Study Area. The designated wait time (i.e., 36 months) under Schedule 1 of the *Migratory Bird Regulations, 2022* applies before the nest can be considered abandoned and the tree removed. If certain conditions are met, a Damage or Danger Permit for Nest Destruction may be an option. These specialized permits will likely also require negotiation with ECCC to determine an appropriate location for relocation of the nest cavity.

5.2 General Mitigation Measures

In addition to standard BMPs anticipated to be implemented during construction, other mitigation measures are recommended during design and construction to avoid, minimize, restore, and/or offset potential effects of the Project on the environment.

The following mitigation measures are recommended for consideration during the development of the Project design:

- Locate access and staging areas away from sensitive habitats (e.g., bird nests, wetlands, invasive plant sites, beaver houses, dens and dams).

- To the extent possible, choose access routes to minimize removal of trees and clearing of native vegetation, and to avoid invasive plants.
- Design instream works to minimize disturbance outside the least-risk window for fish.
- After detailed design is drafted, survey again any sensitive habitat that falls within the Project footprint.
- Incorporate large woody debris into post-construction channel design.

Associated recommends the following mitigation measures for inclusion during the development of construction methodologies:

- Retain an appropriately qualified environmental monitor to develop and implement an environmental management plan.
- Isolate the instream works area and divert flow around the works area.
- Install appropriate sediment and erosion control measures to prevent sediment transport downstream and monitor turbidity during construction.
- Salvage any fish that are observed within the Study Area and transfer to them to wetted habitat in the channel outside of the works area. Temperature and transportation times may affect where captured fish are released (upstream or downstream of the Study Area).
- Specify that barriers be established along the construction limits to prevent accidental intrusion and encroachment on the adjacent forest habitat.
- Specify that disturbed areas outside the permanent Project footprint are restored to their baseline condition. Use native plants in the restoration plan.
- Delineate invasive plant areas and implement appropriate BMPs to prevent encroachment and spread of invasive species.
- Specify that areas of invasive plants (e.g., Japanese knotweed, Scotch broom) within the Project footprint are identified and removed according to their special management procedures and that they are disposed of at an appropriate receiving facility. Soils near these identified areas will potentially be contaminated (i.e., contain seeds, root material) and should be disposed of accordingly.
- Survey for pileated woodpecker nest cavities and protected raptor nests within the proposed clearing footprints before works begin.
- Schedule construction timing to avoid clearing and grubbing within the peak migratory bird nesting window of March 12 to August 17 (Government of Canada 2023). If clearing during the nesting period is unavoidable, specify that a nest survey be conducted in advance by an appropriately qualified professional to confirm there will be no disturbance to occupied bird nests and/or eggs.
- Revisit potential raptor nests during the raptor breeding season to assess the potential for raptor breeding activity. If the nest is determined to be active, establish an appropriate buffer zone according to BMPs for raptors (BC GOV 2013).
- Salvage for wildlife species at risk (e.g., northern red-legged frog, Pacific water shrew), before construction begins, where any are confirmed in the Project footprint.
- Educate the contractor and crew about species at risk that have the potential to occur in the area (e.g., Pacific water shrew, northern red-legged frog). If any species at risk are encountered, halt works, contact the environmental monitor, and salvage if appropriate.

- Avoid instream works in wetlands, tributaries, or off-channel habitats when amphibians are overwintering (i.e., October 31 to March 1).
- Specify that whenever possible, construction avoid typical high-activity periods for wildlife, such as dawn or dusk.
- Specify the implementation of standard construction BMPs to minimize construction noise.
- Restore instream habitat after sediment removal to provide the same complex, or better, of overwintering, spawning, and rearing habitat that was present before construction.

6 SUMMARY AND NEXT STEPS

The following key constraints should be addressed during Project design and construction planning:

- Presence of fish and fish habitat;
- Potential bird nesting activity (including raptors and pileated woodpeckers);
- Potential amphibian breeding in slow-moving tributaries or in the off-channel habitat identified during the field visit;
- Invasive plants;
- Potential presence of species at risk; and
- Associated regulatory requirements.

These constraints are expected to be manageable by taking appropriate care and consideration during design to avoid negative effects on environmental features and habitats, and by implementing standard approaches and BMPs during construction.

An environmental assessment should be carried out after the detailed design is sufficiently progressed to provide detailed drawings of the proposed Project footprint. If the proposed Project footprint overlaps sensitive fish or wildlife habitat, additional field surveys may be required to adequately assess the potential impacts to the environment that are associated with the Project.

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APPENDIX A – PHOTOS

Photo 1. Typical young mixed forest stand on the banks of Lagace Creek



Photo 2. Riparian vegetation at the north end of the Study Area, looking downstream from the Farms Road bridge



Photo 3. **Cattails (*Typha* sp.) and sedges (*Carex* sp.) in a wetland/off-channel habitat connected to Lagace Creek**



Photo 4. **Large pool in off-channel habitat connected to Lagace Creek**



Photo 5. Large patch of Japanese knotweed (*Reynoutria japonica* var. *japonica*) on the bank of Lagace Creek

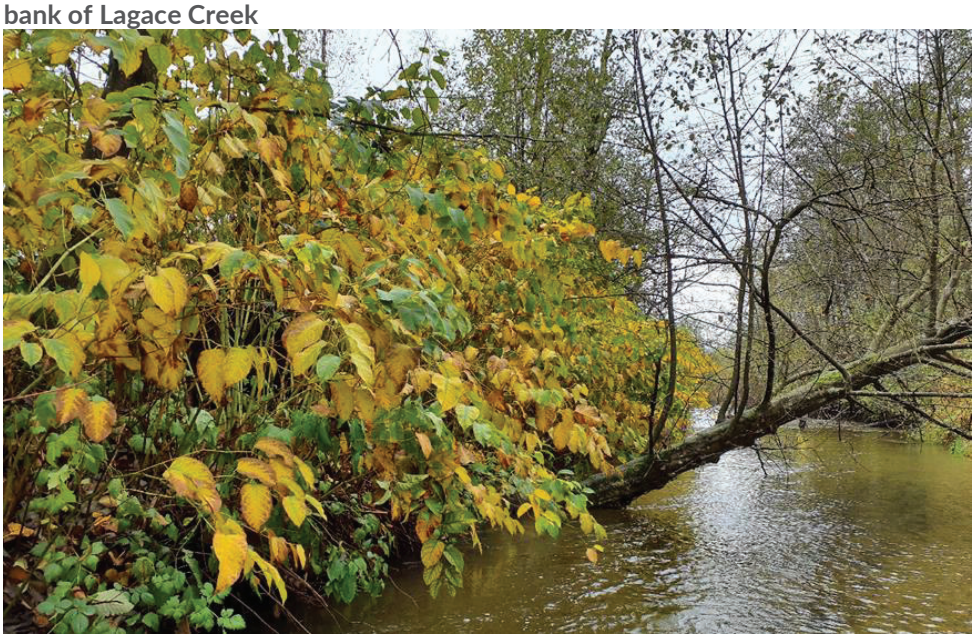

Photo 6. Vegetation cleared to the water line behind a home. Note the sandy substrate (Site 13, Hatzic Slough)



Photo 7. **Left bank of Hatzic Slough has been modified to create a lawn, beach area, and dock (Site 13)**



Photo 8. **Representative photo of large woody debris found in Sites 13 and 14. Deep pool found downstream of the large woody debris (Site 13)**



Photo 9. **Example of undercut banks found throughout Sites 13 and 14, and lack of overhead cover**



Photo 10. **Representative photo of Site 13. Laminar flow, no habitat complexity, no overhead cover**



Photo 11. Vegetated islands mid-channel below Dale Road bridge



Photo 12. Upstream view of Site 14. Substrate becoming more solid (gravels increasing), undercut banks, little overhead cover, no habitat complexity, laminar flow



Photo 13. Adult chum salmon (*Oncorhynchus keta*) likely guarding a new redd

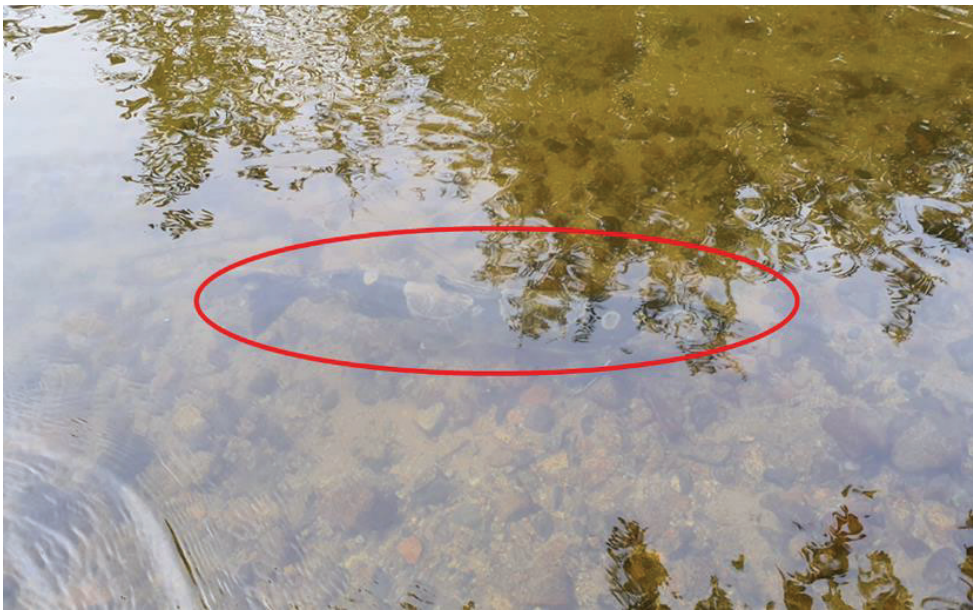

Photo 14. Downstream barbed wire fence. Fish activity hot spots both up and downstream of here



Photo 15. Redd (circled), adult chum pair guarding nearby (arrow)



Photo 16. Ideal substrate for spawning found in a salmon (*Oncorhynchus* sp.) activity hot spot

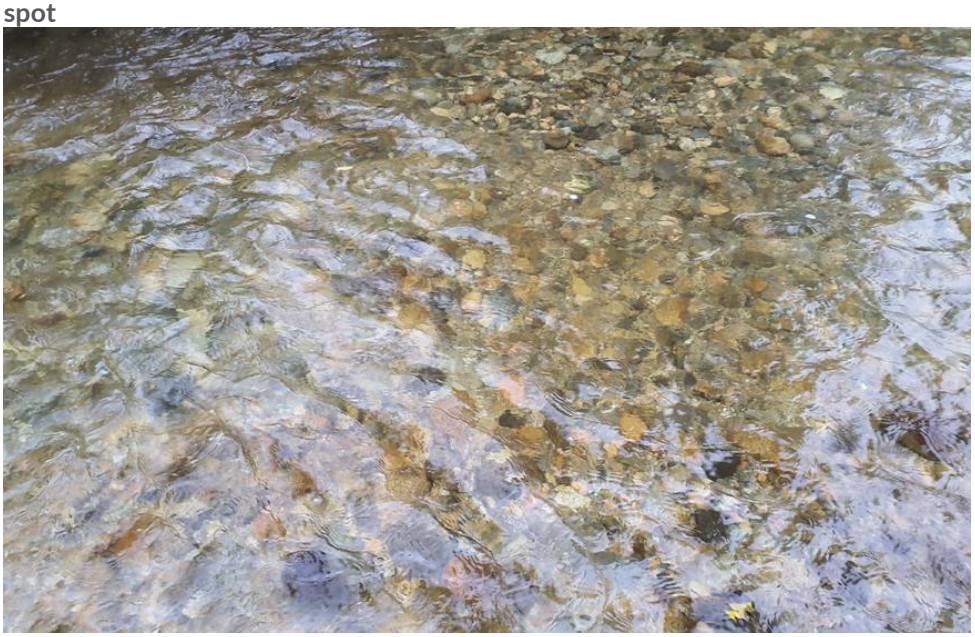

Photo 17. **Downstream view of wide area below the upstream barbed wire fence, through the wide ponded area**



Photo 18 **Passerine bird nest observed in riparian shrubs near Lagace Creek**



Photo 19. Beaver dam in Hatzic Slough, near its confluence with Lagace Creek



Photo 20. Potential pileated woodpecker (*Dryocopus pileatus*) nest near Lagace Creek



Photo 21. Potential raptor nest near Lagace Creek



APPENDIX J – ARCHAEOLOGICAL OVERVIEW ASSESSMENT

Archaeological Overview Assessment and Preliminary Field Reconnaissance of Proposed Mission Flood Restoration Works

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Management Summary

Ursus Heritage Consulting Ltd. was requested by the Associated Environmental Consultants Inc. (Associated Environmental) to conduct an Archaeological Overview Assessment (AOA) and Preliminary Field Reconnaissance (PFR) of the proposed Mission Flood Restoration Works Project (the Project). The project is located generally within the Hatzic Valley on the eastern side and the valley floor. It is focused along watercourses, including Lagace Creek, that drain into Hatzic Lake, Stave Lake, and Allan Lake, on a combination of provincial and private property. It is the understating of Ursus that Associated Environmental Consultants Inc. intends to complete restoration works along the watercourses within the selected areas that were impacted by the atmospheric river events in 2021. Development plans do not exist at the time of this AOA/PFR.

This report presents the results of the AOA and PFR of the proposed Mission Flood Restoration Works Project. The objectives of the AOA are to:

- Identify areas within the Project Area with the potential to contain archaeological sites;
- Prepare predictions regarding archaeological site type, distribution, density, and variability; and
- Recommendations for managing potential impacts to archaeological and heritage materials in advance of a provincial permit application for the proponent.

The AOA was undertaken in accordance with the *British Columbia Archaeological Impact Assessment Guidelines* (2001) issued by the Archaeology Branch, and will further be referred to as "the Branch", and *Archaeological Overview Assessments as General Land Use Planning Tools – Provincial Standards and Guidelines* (2009). This AOA was conducted under Stó:lō Heritage Investigation Permit (SHIP) #2023-123. The current AOA is not concerned with identifying traditional use sites as the identification of traditional use sites is beyond the scope of the current research project. The AOA was conducted without prejudice to First Nations treaty negotiations, aboriginal rights, or aboriginal title.

This AOA consists of a desktop review of the archaeological, ethnographic, historic, and environmental literature pertaining to the study area and the surrounding region and does not include any fieldwork. In addition, further analysis of biophysical, topographic, satellite imagery, and data of the study area was conducted.

Based on the results of the AOA the following recommendations are presented:

- Due to the project location being entirely within a modelled area of high potential, it is considered highly likely that there are as yet undiscovered archaeological materials; and
- Based on the results of the PFR, conduct an AIA under a *Heritage Conservation Act* (*HCA*) Section 12.2 Heritage Inspection Permit for all areas of moderate and high archaeological potential that are likely to be impacted by future developments within the Project Area.

Acknowledgments

Ursus Heritage Consulting Ltd. (Ursus) would like to thank Paul Hague of Associated Environmental Consultants Inc. for he opportunity to conduct this study. Ursus would also like to thank Kwantlen First Nation, Stó:lō Research & Resource Management Centre, and Leq'á:mel First Nation. Additionally, the BC Consultative Areas Database identifies the project as being located within the consultative area of the Halalt First Nation, Lyackson First Nation, Matsqui First Nation, Penelakut Tribe, Peters First Nation, Sema:th (Sumas) First Nation First Nation, Semiahmoo First Nation, Stz'uminus First Nation, and Ts'uubaa-asatx First Nation. Ursus would like to thank them for the opportunity to conduct this review within their asserted traditional territories and claim areas. Finally, Ursus would like to thank Janna Bucsis, Joey Antone, and Jason Thompson for their valued input and assistance during the PFR.

The opinions expressed in this document are those of the authors. The authors are solely responsible for its contents and any omissions and errors that it may contain.

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1.0. Introduction and Project Background

Ursus Heritage Consulting Ltd. was requested by the Associated Environmental Consultants Inc. (Associated Environmental) to conduct an Archaeological Overview Assessment (AOA) and Preliminary Field Reconnaissance (PFR) of the proposed Mission Flood Restoration Works Project (the Project). The project is located generally within the Hatzic Valley on the eastern side and the valley floor. It is focused along watercourses, including Lagace Creek, that drain into Hatzic Lake, Stave Lake, and Allan Lake, on a combination of provincial and private property (Figures 1 and 2). It is the understating of Ursus that Associated Environmental Consultants Inc. intends to complete restoration works along the watercourses within the selected areas that were impacted by the atmospheric river events in 2021. Development plans do not exist at the time that this report was written. However, Ursus has assumed that potential ground disturbing activities including grubbing and clearing of brush and trees, updating and creating road and machine access, removal of materials including sediments and rock, importing of boulders and riprap for bank reinforcement, and excavations represent the minimum anticipated ground disturbance impacts within the extent of the Project boundaries.

This report presents the results of the AOA of the proposed Mission Flood Restoration Work Project. The objectives of the AOA are to:

- Identify areas within the Project Area with the potential to contain archaeological sites and heritage materials;
- Prepare predictions regarding archaeological site type, distribution, density, and variability; and
- Recommend the need and appropriate scope of future archaeological research within the Project Area.

The AOA was undertaken in accordance with the British Columbia Archaeological Impact Assessment Guidelines (2001) issued by the Branch and Archaeological Overview Assessments as General Land Use Planning Tools – Provincial Standards and Guidelines (2009). This AOA/PFR was conducted under Stó:lō Heritage Investigation Permit (SHIP) # 2023-123.

The current AOA consists of a desktop review of the archaeological, ethnographic, historic, and environmental literature pertaining to the study area and surrounding region. In addition, analysis of biophysical, topographic, and satellite imagery data of the study area was conducted. The information garnered from these reviews was utilized to evaluate the potential for the presence of archaeological sites within the Project Area. At the proponent's request, a preliminary field reconnaissance was conducted to ground-truth the AOA results. The findings from both phases are presented in this report.

The assessment described in this report is concerned with the identification and management of archaeological sites. An archaeological site is any location that contains the remains of past human activity. This report provides background data regarding the context of the research in terms of its biophysical and cultural setting, describes the objectives of the research, describes the methodology of the research, and provides recommendations regarding the need and appropriate scope of future archaeological research for the proposed development area.

2.0. Definitions

An archaeological site can be defined as a location that contains identifiable physical traces of past human activities and/or behaviours. Several different archaeological site types may be found in the study area and more than one line of archaeological evidence may be present at these sites. Specific to the

surrounding Project Area, typical sites common to the Stave Lake, Hatzic Valley and Fraser Valley include habitation sites (both plank and pit house), temporary camp/shelter sites, cache pits, burials (including subsurface and mound internment), lithic scatters and isolated artifacts, and rock art sites (pictographs and petroglyphs) or lithic raw material quarry sites. Culturally Modified Trees (CMTs) are also common in the region, however these are less likely to be identified in areas with limited stands of mature trees resulting from historic land use. Although there is a history of logging within the Project area, it should be noted, that naturally regenerating trees, including cedars, are present in the Project Area. Cedar has in many locations continually been gathered for traditional uses.

Archaeological sites that pre-date 1846 are automatically protected under the *Heritage Conservation Act* (the *Act*) whether on public or private land. Sites that are of an unknown age and that have a likelihood of dating prior to 1846 (i.e., lithic scatters) as well as aboriginal pictographs, petroglyphs and burials which are considered to have historical or archaeological value are also automatically protected. Sites that are protected under the *Act* may not be altered, damaged, moved, excavated in, or desecrated in any way without a permit issued under Section 12 of the *Act*.

3.0. Without Prejudice

The Project Area is within the traditional territory of Kwantlen First Nation, the Stó:lō Nation, and Leq'á:mel First Nations. Additionally, the BC Consultative Areas Database identifies the project as being located within the consultative area of the Halalt First Nation, Lyackson First Nation, Matsqui First Nation, Penelakut Tribe, Peters First Nation, Sema:th (Sumas) First Nation First Nation, Semiahmoo First Nation, Stz'uminus First Nation, and Ts'uubaa-asatx First Nation.

The AOA was conducted without prejudice to First Nations treaty negotiations, aboriginal rights, or aboriginal title. Nothing in this report is intended to affect the scope or justify infringement of aboriginal title or rights or prevent the above listed First Nations governmental organizations from exercising their aboriginal rights. This report is without prejudice to the positions any parties may assert in court proceedings or in treaty negotiations and is not an admission of fact or liability for the purposes of such proceedings and processes. The archaeological investigations were undertaken solely for the purpose of gathering information about cultural heritage and archaeological materials. In no way will such studies replace the need for the provincial government to consult with the above listed First Nations governmental organizations nor do they attempt to address Aboriginal rights issues. The sole purpose of this study was to identify the potential for archaeological sites located within the assessment area. The current AOA is not concerned with identifying traditional use sites as the identification of traditional use sites is beyond the scope of the current research project.



Figure 1: Mission Flood Restoration Works Overview Map

Client: Associated Environmental Consultants Inc.		
Project: 23SC002		
Mapped	2023-10-18	CV
Field Visit	2023-05-11	CS
Borden # n/a Permit # Non-Permit NTS 092G01/08		

Legend: Study Area, Wetland, Stream, River, Contour (100 m), Lake

1:54,000,000

0 2 4 6 8 10 12 km

1:150,000

NAD83 / UTM zone 10N
Basemap: ESRI World Topo, Bing Satellite
Sources: Administrative Features, BC Gazetteer, Canadian Digital Elevation Dataset, Digital Road Atlas, Freshwater Atlas, LiDAR BC, RAAD



Figure 2: Mission Flood Restoration Works Midrange Map

Client: Associated Environmental Consultants Inc.		
Project: 23SC002		
Mapped	2023-10-18	CV
Field Visit	2023-05-11	CS
Borden # n/a Permit # Non-Permit NTS 092G01/08		

Legend

- Proposed Development
- Registered Archaeological Site
- Road - Main
- Road - Resource
- Road - Recreational
- Highways
- Railway
- Stream
- River
- Lake
- Wetland
- Contour (100 m)

1:54,000,000

0 1 2 3 4 5 6 km

1:70,000

4.0. Background Information

4.1. Project Description

This AOA/PFR report is for the proposed restoration works along the watercourses within the selected areas that were impacted by the atmospheric river events in 2021 located generally within the Hatzic Valley on the eastern side and the valley floor. The project location is focused along watercourses including Lagace Creek, that drain into Hatzic Lake, Stave Lake, and Allan Lake, on a combination of provincial and private properties that abut the watercourses.

At the time this AOA report was written, there are no development plans available. However, potential ground disturbing activities including grubbing and clearing of brush and trees, updating and creating road and machine access, removal of materials including sediments and rock, importing of boulders and riprap for bank reinforcement, and excavations represent the minimum anticipated ground disturbance impacts within the extent of the Project boundaries.

4.2. Project Area

The Project Area is located within the Hatzic Valley, predominantly on the eastern side with a central area extending to the valley floor (Figures 1 and 2). The project area is focused on watercourses, including Lagace Creek, that drain into Hatzic Lake, Stave Lake, and Allan Lake and spans approximately 9.9 km N/S x 3 km E/W within the eastern side of the Hatzic Valley. It is approximately 3.2 km southeast of the southeastern shore of Stave Lake, 2.3 km west of Dewdney Peak and 160 m east of the eastern shore of Hatzic Lake. Sumas Mountain (*taxqe'l*) is a significant landmark that figures heavily within several First Nation's traditional histories and more recent ethnographies and historical atlases (Duff 1952; Stó:lō 2006), is located 8.8 km southeast of the project and should be acknowledged as a significant area. In addition, the nearest archaeological site, DhRn-6, is located approximately 1.1 km south from the restoration area of S-CR-14 which is central within the project.

4.3. Physiographic and Environmental Setting

The study area is located within the Dry Maritime (CWHdm) and the Very Wet Martime (CWHvm1) subzones of the Coastal Western Hemlock biogeoclimatic zones (Pojar, Klinka, and DeMarchi 1991). The CWH occurs at low to mid-elevations, from sea-level to 1000 m above sea level, and is characterized by a cool, mesothermal climate comprised of warm summers and mild winters. The Coastal Western Hemlock zone (CWH) has an annual mean temperature of 8° Celsius which ranges 5.2 to 10.5º Celsius among the CWH subzones. The CWH zone has an annual average precipitation of 2228 mm. Vegetation typical of this zone and subzone includes a canopy typically dominated by western hemlock, Douglas fir, western redcedar, and an understory of red huckleberry, blueberry, salmonberry, salal, vine maple, trailing blackberry, devil's club, and various moss and fern species (Pojar, Klinka and DeMarchi 1991).

The CWH subzones typically supported black bear, grey wolf, cougar, black-tailed (mule) deer, river otter, elk, beaver, various rodents (Nagorsen 1990), and many species of birds, including raptors such as osprey, golden eagle, bald eagle, red-tailed hawk, as well as tundra swan, sandhill crane, and others (Kavanagh & Leung 2005). A wide variety of fish, particularly salmon are supported in the nearby Fraser River and its many tributaries. It is generally known that there are trout in the nearby Sumas River and that prior to widespread development in the area there were salmon runs, eulachon, and sturgeon in the surrounding waterways as well.

4.4. Regional Paleogeography

At the end of the Fraser Glaciation, sea levels were approximately 200 m higher than the present. The study area would have been submerged during this time under ice or seawater. Isostatic rebound occurred between 12,000 and 9,000 years before present (B.P.) and, during this time, relative sea levels fell to near their present levels. Locher and Clague (2007:9) report that previous geomorphological and palynological studies indicate that the late Pleistocene landscape of southern coastal British Columbia was suitable for habitation by early maritime/estuarine adapted human populations and that although this evidence alone does not demonstrate that humans inhabited the landscape, it favours that possibility. The possibility that early archaeological sites were buried by fluvial aggradation triggered by sea-level rise during the early and middle Holocene, combined with a low-visibility lithic culture, makes identification of early postglacial occupations difficult. An extensive review of the palaeogeography and glacial history for the area can be found in Locher (2006) and Locher and Clague (2007).

Most sediments in the nearby Chilliwack-Abbotsford area are Fraser River sediments that are a mix of deltaic, estuarine, and overbank silts and silt clay loams deposited during the Quaternary Period, 11,000 years ago to present day (Armstrong 1961).

5.0. Cultural Setting

5.1. Traditional & Ethnographic Context

The Project Area falls the traditional territory of several First Nations groups. The Project Area is within the traditional territory of Kwantlen First Nation, the Stó:lō Nation, and Leq'á:mel First Nations, whose current reserve lands are located closest to the project area. Additionally, the Project Area is located within the traditional territoris of the Halalt First Nation, Lyackson First Nation, Matsqui First Nation, Penelakut Tribe, Peters First Nation, Sema:th (Sumas) First Nation First Nation, Semiahmoo First Nation, Stz'uminus First Nation, and Ts'uubaa-asatx First Nation. All these First Nations speak a dialect of the Coast Salish language known as Halq'emeylem (Suttles 1955:8).

Ethnographically, traditional Coast Salish culture was characterized by a semi-sedentary lifestyle dependent upon fishing, hunting, and gathering for subsistence. Society was slightly stratified, and three classes of people were usually present; a large upper class, a smaller lower class, and a small class of slaves. Kinship was reckoned bilaterally, and residence was usually patrilocal (Suttles 1990). Each house group owned its house, ritual property, and resource rights. These rights were acquired through inheritance and normally held by the most important members of the household. The primary socio-economic unit was the house group, with each consisting of one or more extended families living in plankhouses and pithouses villages. Villages were usually comprised of one or more houses and leadership was provided by heads of households and kin groups in the village. Each village was linked through ties of kinship with other villages to form a broad social network.

The availability and seasonality of resources in Coast Salish territory played a major part in population dynamics and settlement patterns. For First Nations groups along the lower Fraser River, these resources would have included: (1) anadromous salmon (Oncorhynchus sp.) and eulachon runs in the Fraser River and tributary streams; (2) waterfowl, including ducks and geese in nearby wetlands and estuaries; (3) larger land mammals including deer, elk, mountain goats, and bears; (4) smaller game and fur-bearing mammals, including beaver, muskrat, mink and otters, and (5) plant resources including red and yellow-cedar trees for timber and bark, various berries (chokecherry, huckleberry, bog, and highbush cranberries, blueberries), cat-tail and other plants used for medicinal purposes. A more detailed

description of plants that were traditionally used by First Nation's people in the region can be found in Turner (1975, 1979, and 1998).

For further ethnographic and archaeological references to this topic consult Boas (1894), Duff (1952), Barnett (1955), and Suttles (1990).

5.2. Language and Territory

The First Nations whose traditional territory is within the Project Area speak a dialect of a Coast Salish language known as Halq'emeylem, other dialects of which are spoken from Nanoose south to Malahat on Vancouver Island, and the mainland from the present-day Yale area to the mouth of the Fraser River (Suttles 1955:8).

5.2.1. Sustenance by the Season

The typical Stó:lō year consisted of 10 months, and two supernumerary months that roughly coincides with the contemporary 12-month calendar (Duff 1952). Generally, the Stó:lō spent half the year at their winter villages and the remaining months of the year traveling to various resource harvesting areas throughout their territory (Suttles (1955:10). The Stó:lō seasonal round is briefly summarized below. For more detailed information regarding Coast Salish lifeways consult (Barnett 1955; Boas 1894; Duff 1952; Suttles 1987, 1990).

During the early to mid-summer months (June and July), the Stó:lō people traveled from their winter villages to various hunting and fishing locales throughout their territory (Duff 1952). The men were primarily engaged in hunting for large game including elk, deer, and mountain goat, and fishing for sturgeon, trout, and spring salmon. The women spent this period gathering salmonberries, huckleberries, and other wild fruits, and collecting large amounts of cedar-bark to use in the manufacture of various clothing and household items (Duff 1952). By mid to late summer the Stó:lō traveled once again to their main village sites to prepare for the sockeye salmon run. Late summer and early fall (August to early September) were spent netting, drying, and storing sockeye salmon. During this time the women, in addition to assisting with the salmon fishery, gathered large amounts of salal berries, huckleberries, and other seasonal fruit.

In September, the close of the sockeye season was celebrated with a feast after which the Stó:lō left the villages and traveled in smaller groups to various locations to fish for dog-salmon. The dog-salmon were speared, dried, and stored in cedar baskets for the winter. In October, the hunt for deer and other game was resumed. Stó:lō women spent this part of the year harvesting cranberry and crab-apple (Duff 1952). Cranberries were another important dietary item to the Stó:lō. The wild cranberries grew in bogs throughout the territory and became ripe in September (Duff 1952: 74).

With plenty of stored food collected for the winter, the early winter months of November and December were reserved for potlatching. During this period, the Stó:lō returned to their winter villages. The men continued to supplement stored foods with fish, particularly sturgeon, and game. The women typically engaged in making garments, mats, and other household items (Duff 1952). The mid-winter months of January and February were reserved for religious dances and ceremonies. The ceremonies took place nightly until the end of February. The stored winter diet was supplemented with fresh game caught relatively close to the villages (Duff 1952).

The arrival of thousands of sandhill cranes marked the beginning of "Sand-hill Crane Month," which roughly coincided with the contemporary month of March. At this time, the winter dances ceased, and groups comprised of 2 or 3 families departed from the winter villages and traveled to various fishing and

hunting grounds throughout Stó:lō territory. During this time of year was noted for the abundance of sturgeon in the shallower sloughs the territory.

The emphasis on fishing continued in the early spring. April brought the 2–3-week Fraser River eulachon run. At this time, the Stó:lō gathered once again at their village site on the Fraser and using a special rake, caught the eulachon from the eddy in the front of the village (Duff 1952). Beginning in early May through to early June, the Fraser River's spring freshet flooded the villages; however, at this time the Stó:lō were sturgeon fishing at the many sloughs and drainages throughout the valley.

5.3. Archaeological Cultural Material Chronology

There are over a hundred years of archaeological research in the Fraser Valley Region. A century of excavations and studies have shown that the archaeological record for the Fraser Valley is over 8000 years old. During the 1950s, under archaeologist Charles Borden, the first long chronology was established for this region of the Province (Table 1). Since then, research and excavation methods have improved; environmental processes and relationships are better understood; dating techniques have advanced, and a great deal more excavation have refined the culture history sequences that are used by archaeologists today. However, the last fifty years have also seen a dramatic increase in industrial, agricultural, and residential development that has contributed to landscape alterations and the irretrievable loss of archaeological sites. While the potential has increased to understand and describe regional milieus; cultural developments; and influences between and among people that left us these sites, archaeologists have fewer opportunities to conduct research because few sites remain.

This is certainly true of sites in the vicinity of the Project area where we are left to generalize from a handful of sites. Only a few excavations have been undertaken in the Sumas Mountain area, and of those, only a portion of their components have been securely dated. Archaeologists rely on the results of excavations at sites that are in similar environs to the study area's environs, or in neighbouring areas (for instance farther west to the coast, or east to the interior) to provide benchmarks with which to better understand prehistory here. In some cases, however, a comparison of sites only highlights how unique the upper Fraser Valley sites are.

Cultural traditions, for the purposes of this summary, are defined on the bases of the way of life of ancient peoples as indicated by their environment and subsistence remains found in archaeological sites, and by the uniqueness of associated types and styles of artifacts.

Table 1: Summary of the Cultural History of the Upper Fraser Valley.

Early Period Prehistoric	9000 –6500 RCYBP (Radiocarbon Years Before Present)	Pebble Tool Tradition - Old Cordilleran Tradition Basal sites, Peopling of Lower Fraser, Coast and Canyons; expedient tools, procurement of fine materials; generalized diet with land focus (Carlson 1983).
	circa 4500-3300 BP (Before Present)	Charles Phase (also *St Mungo* at the Delta and *Mayne* on the Gulf Islands) Increased site size and complexity; semi-sedentary dwellings.

Middle Period Prehistoric	circa 3300-3500 to 2350 BP	Locarno Beach Phase (Borden 1970, Mitchell 1971, 1990, Matson and Coupland 1995) Social complexity; ground stone and bone are prominent; soft stone carving personal adornment; strategic food resource procurement.
	circa 2400-1500 BP	Marpole Phase (Borden 1970, Burley 1980, Mitchell 1985, Fladmark 1982) Large, deep cultural shell deposits; Pre-storage to storage of resources particularly increased prominence of salmon in the diet (Croes and Hackenberger 1988). Wide variety of tool types – finer smaller tools, uniform ground slate knives; 'heavy-duty' wood-working toolkit; seasonal round well developed, artistic expression is at a climax.
Late Prehistoric and Historic Periods	1500- 200 BP	Developed Coast Salish (also Gulf of Georgia Culture Type) (Matson and Coupland 1995) Regional variants are Stselax, San Juan, Esilao, and Whalen II. Distinctive characteristics include multifamily households, large populations, social stratification, and presumed ownership of resources.

5.3.1. Pebble Tool/Old Cordilleran Tradition: 9000 – 6500 with variants to 4500 Years BP

The Pebble Tool/Old Cordilleran Tradition is currently the oldest known archaeological culture in the Lower Fraser Valley[1]. The bearers of this tradition are considered to be the original people to inhabit what is now the study area. The period associated with this Tradition was geographically dynamic in the lower Fraser River delta.

The oldest sites in the region are in what would have been early-deglaciated and resource-rich ecotones of the Fraser River Delta and 'refuge' valley uplands that at the time of their occupation would have resembled modern mid-coast fjord lands (Matson 1996, Porter and Copp 1993, Wright 1996).

Pebble Tool/Old Cordilleran people that first colonized ice-free areas had sea and land mammal hunting as well as fishing adaptations. It is inferred that small family groups were mobile 'foragers' utilizing diverse and readily available resources, expedient tools like split cobbles or flake tools that give this tradition its name. Inland and coastal sites show that technological adaptations focused on intertidal

[1] Roy Carlson sums up the reason to use the combination Pebble Tool/Old Cordilleran rather than refer to each separately. He writes that archaeologists that use the term Old Cordilleran interpret the bearers to be interior hunters who spread out of the mountains and adapted to coastal life as they moved northward and westward, the Pebble Tool view is that these people were coastally adapted people who spread down the coast from the north and then spread up the river valleys into the interior as salmon became a principle resource (Carlson 1983; 1996:8)

resources, salt and freshwater fishing, small marine, and terrestrial mammal hunting (Carlson 1996, Matson 1996). Because so many kinds of resources were taken even in these seasonal camps, it is assumed that an equally diverse technology had to be present. It is likely that the ubiquitous and relatively unimpressive pebble tools were used to make more perishable technologies (Matson 1996).

Pebble Tool/Old Cordilleran sites contain expedient tools that include cobble choppers, leaf shaped chipped bifaces as well as scrapers and burins (Glenrose Cannery DgRr-6). Glenrose Cannery has one of the most informative assemblages of this period on the Northwest Coast. Glenrose is interpreted as a small, seasonally occupied site whose subsistence strategy was a variant on a large land-mammal oriented pattern (Matson 1976). No specialized maritime adaptation is discerned, though foreshore resources, bay mussels, and a variety of fish were harvested.

Landscape changes continued through the end of the Pebble Tool/Old Cordilleran Tradition. Streams and rivers eroded glacial deposits from the mountain valleys and transported them downstream. Highland areas, including Sumas Mountain, would continue to be important throughout prehistory as refuges from floods, places to settle, camp, gather, and process resources.

5.3.2. Charles Phase: 5500-3300 BP [Also St Mungo Culture at the Delta and Eayem in Fraser Canyon]

The Charles Phase is defined by type-sites St. Mungo (DgRr-2) and Glenrose Cannery (DgRr-6) on the Lower Fraser River, and the Clayburn (DgRn-25) site located in modern community of Abbotsford at the base of Sumas Mountain. Compared to older sites, the Charles Culture assemblages show greater complexity. They are larger, have more components and features, and have artifacts of varied manufacture and materials. Perhaps most significantly, they show the beginnings of intensive resource procurement and sedentism.

Pebble Tool/Old Cordilleran artifacts types continue into the Charles Phase, but appear in different proportions from earlier times. Flaked stone is predominant, in the form of leaf shaped points, pebble tools, and expedient flake tools. Several significant artifacts and features appear during the Charles Phase. These are cultural shell deposits (not a significant feature in the upper Fraser Valley); bone and antler industries (at sites where they are preserved); simple art and sculpture; more substantial dwellings; riverine and marine subsistence strategies that emphasized fish (particularly salmon) and shellfish; a significant woodworking industry, and; evidence of increasing social complexity (Matson and Coupland 1995).

New tool types (e.g., points with shoulders, drills, and scrapers) show novel manufacturing techniques, like pecking and grinding. A wider range of materials is also evident, including several exotic or imported materials, suggesting at least limited trade or mobility (Matson and Coupland 1995). Ground stone appears in greater frequency (with more polished knives in the Fraser Canyon), as do abrasive stones, disk beads, and simple decorated ground objects, often discs with notches or ‘denticulate’ pieces.

Seasonal resource procurement sites show a unique combined marine/inland resource exploitation pattern also known in the historic period (Matson and Coupland 1995) which differs from the classic Charles Phase pattern of coastal marine reliance. As well, the near-by Maurer and Xa:ytem sites have architectural remains that support the interpretation of a shift toward a semi-sedentary settlement pattern; this pattern appears to be underway at the beginning of Charles, circa 3000 -4950 BP (Leclair 1976; Schaepe 2003).

Little can be gleaned of Charles Phase subsistence as the faunal assemblages are meagrely preserved at sites within the study area. Sites of similar age elsewhere show the use of both marine and riverine

resources. Salmon are the most numerous species preserved, while shellfish either equaled or exceeded both land and sea mammals in economic importance.

The appearance of art objects, substantial architecture, ground stone, and bone/antler industries indicate that considerable material culture change was underway during the Charles Phase. It is expected that social changes, such as labour specialization and social stratification, correlate with these developments, but direct evidence is limited from these sites. Mortuary data is suggestive of social complexity; Charles period burials from in the Lower Fraser are limited but have been described as 'emerging'.

5.3.3. Locarno Beach Tradition: 3450-2450 years BP

Originally identified by Charles Borden as a unique and distinctive occupation of the Fraser River Delta area, site distribution of the Locarno Beach Tradition has since been extended to Vancouver Islands, the Gulf Islands, and south to Puget Sound. All these regions share a core marine subsistence focus. Inland, in the Fraser Canyon, the coeval tradition is called Baldwin (Mitchell 1990).

Recent research suggests that there are continuities (Matson and Coupland 1995, Mitchell 1971) in the technological and subsistence systems between the Locarno Tradition and the preceding Charles and the succeeding Marpole Culture types. This continuity is seen in artifact assemblages, features, and faunal remains. In the Lower Fraser region, these continuities are seen in the excavated sites which are smallish, seasonal resource camps where presumably consistent and predictable resources were taken.

Faunal remains are generally poorly preserved from this period. At the excavated sites in the study area, the remains are often calcined or burnt and in fragmentary condition. Where direct bone remains are absent, subsistence is inferred from artifact or feature function. For instance, processing artifacts (slate knives, microblades), hunting artifacts (harpoons, points), and features such as shell dumps, pits, and postholes from drying racks or caches are indirect evidence of fishing, hunting, and cooking or processing.

We know from similarly dated sites that subsistence during the Locarno Phase continues to be broadly based. There is, however, a shift toward the intensification of fish, predominately salmon. Other resources include flatfish (flounder and sole), and herring; shellfish (bay mussel); sea mammals, land mammal, and birds, particularly waterfowl. Dog is found at Locarno sites, though presumably not as part of the diet.

Matson (1992) assessed Locarno Beach as the "first culture type in the region to have engaged in the preservation storage of salmon for later consumption" (also see Mitchell 1990). With storage of food come increasingly complex social and economic dimensions such as specialization, social stratification, and ownership. Definite evidence of social complexity is lacking, however, until several hundred years later.

Artifact categories from Locarno Beach include: hunting tools of flaked basalt projectile points with contracting stems for hafting to spears or atlatl; butchering tools as evident by quartz and obsidian microblades and cores; small utilized cryptocrystalline (like chert, chalcedony) flake tools, pebble tools; crudely fashioned slate and sandstone bifaces, faceted ground slate points, woodworking tools like nephrite and jadeite celts; sea mussel celts; decorative items such as labrets, small disk beads of slate shale; fishing artifacts like notched or grooved stone sinkers; composite toggling harpoon heads of antler, unilaterally barbed bone points, single and bone points, bird bone needles; and, shaped and decorated abrasive stones. There is a general increase in bone tool assemblages during this phase (Gibbon 1998:468).

Decorative objects and status indicators from Locarno Beach are more distinct than in previous phases. Items include carved antler in humanoid and zoomorphic shapes (as collected by Carlson at Pender Island's canal site). Additional distinctive and enigmatic of Locarno Type is the Gulf Islands Complex artifacts (Duff 1956). These are very well made, often polished, items made of soft stone, coal, or bone. They are small bars with a series of holes or pairs of holes or notches; their function is unknown but is likely related to social or group identity, or markers of wealth and status. Other indications of social developments such as 'class' or status during Locarno include cranial shaping and labret wearing (Fladmark 1982). There is an increase in the number of burials, burial inclusions, and burial cairns.

5.3.4. Marpole Culture Type:2350-700 years BP

The Marpole Culture type is considered to be an evolution from the Locarno Beach type (Ames and Maschner 1999; Fladmark 1982; Matson and Coupland 1995; Mitchell 1971, 1990). This culture type is named by Borden after the assemblage from *c̓əsnaʔəm* in the south Marpole region of Vancouver.

It has been hypothesized that Marpole subsistence and the social organization that accompanied it, grew out of the earlier Charles and Locarno Phases. While the assemblages are similar to Locarno, what has distinguished the Marpole Phase from these earlier periods is the development of complex hierarchical societies with higher levels of social stratification and greater emphasis on the storage of food resources, larger and more elaborate village architecture, and a detectable change in the material culture. Burley (1980) has demonstrated temporal variation in artifact frequencies during Marpole as well as spatial variation between the Lower Fraser, Interior, and the Gulf Islands and southern Vancouver Island. These artifactual differences may reflect variation in resource exploitation, the influence of neighbours through trade, or distinctive settlement patterns. Diagnostic features of Marpole period sites include processing and storage structures and large post and beam houses with cultural shell deposits between and behind. These large sites exhibit the historic pattern of multi-family 'winter nucleated' settlements.

Marpole artifact assemblages show an increase in the variety of tools, but a decrease in the refinement of their manufacture (the most often cited example being a move from toggling to uni-barbed harpoons [cf. Burley 1980]). Harpoons are part of a larger antler industry. The frequency of chipped tools decreases. Ground stone, particularly basalt, increases markedly in frequency, presumably for fish butchery. A significant woodworking tool kit is present in Marpole and is comparable to known ethnographic technologies (Mitchell [1990] calls it a 'heavy-duty' tool kit including large celts, hand mauls, and antler wedges). These tools point to a concentrated demand for forest resources, particularly cedar, for housing, carved poles, canoes, and other monumental constructions. Waterlogged sites of Marpole age have produced a range of organic artifacts like wedges, weirs, basketry, cordage, netting, mats of cedar. The fishing economy is well represented in the artifact data in the appearance of perforated sinker stones, harpoon points, and antler and bone points for fishhooks. Other materials suggest textile maintenance and manufacture, small flake scrapers, uni-barbed points, awls, and needles.

Several status indicators appear in the Marpole Phase. Distinctive stone sculpture is seen in the form of elaborate seated human figures and decorating tools. Exotic trade goods like native copper, Oregon obsidian, dentalia shells, slate, and shell beads are relatively common in the archaeological record. There is a general increase in personal ornaments like labrets, ear spools, and pendants. Cranial deformation and ritual items including elaborate burials are evidence of increasingly complex social roles, social stratification, and social networks.

5.3.5. Gulf of Georgia /Developed Coast Salish Culture: 1500-200 BP

Gulf of Georgia, or the Developed Coast Salish Culture, is the most recent archaeological culture of the Coast Salish. First named in the 1940s at *c̓əsnaʔəm*, the archaeological distribution of Gulf of Georgia sites shows a more extensive Salish Nation than what was recorded in the historical period (Ham

1992:339). Most materials recovered from the Developed Coast Salish/Gulf of Georgia are from seasonal settlements.

Temporal and regional differences exhibited in the Gulf of Georgia Phase are usually accounted for by differential access to resources. These differences are thought to relate to wealth, status, and the shifting fortunes, influences, and alliances of the families that controlled access to resource areas be they salmon, berry grounds, quarries, or travel routes (Gibbon 1998:340).

A range of settlement types has been identified for the Developed Coast Salish culture. In the Sumas area, known settlements types include winter villages, seasonal camps, and resource extraction sites. More substantial plank structures could be "identified with several 'families' or 'tribes'." Other site types include trails, bathing pools, and menstruation dwellings; burial mounds, culturally modified trees, fortified and defense sites; weirs, and traps.

Fish dominates faunal assemblages throughout the late phase. The primary species is salmon, followed by sturgeon, flatfish, herring, eulachon, and rock cod. Wapiti and deer are dominant land mammals in faunal collections. Bird remains are largely waterfowl, ducks, and geese. Sea mammal is not common but is present (mostly seal). Plant foods, including the roots, stems, berries, fruits, and nuts from a wide variety of ecosystems, were important resources. Cranberries, hazelnuts were critical resources of the area that were held as individual or family property.

Ham (1992) has designated over one hundred artifact classes for the Developed Coast Salish/Gulf of Georgia culture type. Artifact forms remain consistent from the preceding Marpole Phase, but there is an overall increase in bone, antler, and ground slate artifacts. Chipped stone artifacts are rare at some sites, but in others are present as distinctive, tiny, arrow points. Bentwood boxes, cordage, and basketry are widespread. Fire-cracked rock is ubiquitous in assemblages. Trade was extensive and raw materials (nephrite), as well as finished artifacts, were traded throughout the region.

Art was widespread in the late pre-contact period, as would continue into the historic period. Examples are few, however, due in part to the nature of the mediums most popular, wood and colour. Stone carving is elaborate. Burial practices were varied as might be expected in a society with ranging social complexity.

5.4. Previously Recorded Sites in Proximity to the Project Area

Using the Remote Access to Archaeological Data (RAAD) application, a review of the Provincial Heritage Registry was undertaken to establish the location and nature of previously recorded sites recorded within the vicinity of the current project. There are currently no recorded archaeological sites visible on the Heritage Register within the Project Area.

There are seven (7) previously recorded archaeological sites located within a 2.5 km radius of the Project Area (Table 2). At a basic interpretive level, these and other varied regional archaeological site types reflect ancestral peoples' reliance on a broad diet of plant and animal, terrestrial, marine, riverine and estuarine resources and include: a) habitation sites with cultural depressions; b) seasonal campsites or food processing sites and lithic scatters; c) plant processing and cultivating locations with FCR features, palaeoethnobotanical evidence, wooden and lithic artifacts, and associated post-hole moulds; and d) Xexá:ls, or transformer sites. For a summary of the archaeological sites, see Table 2.

Table 2: Archaeological sites within 2.5 km proximity to the Project area

Site Name	Site Type	Distance from Study Area	Nearest Development	Heritage Inspection Permit(s)	Recorder
DhRn-6	Precontact surface lithics	1 km S	S-CR-14	1963 Non-Permit 1975-0006	UBC
DgRn-13	Precontact surface material (unspecified)	1.3 km SW	S-CR-38	1953 Non-Permit 1975-0006	Walter Kenyon (UBC)
DgRn-10	Precontact surface lithics	1.9 km SW	S-CR-38	1953 Non-Permit 1963 Non-Permit 1975-0006	Robert Kidd (University of British Columbia)
DgRn-58	Precontact subsistence feature (hearth), surface and subsurface lithics, surface and subsurface Fire Altered Rod (FAR), subsurface refuse.	2.0 km SW	S-CR-38	2017 Non-Permit 2017-0426	SRRMC
DgRn-12	Precontact cultural depression (function unassigned)	2.0 km WSW	S-CR-38	1953 Non-Permit 1975-0006	Walter Kenyon (UBC)
DgRn-71	Precontact subsurface lithics	2.1 km SW	S-CR-38	2018-0042	Terra Archaeology
DgRn-11	Precontact surface lithics	2.2 km SW	S-CR-38	1953 Non-Permit 1975-0006	Walter Kenyon (UBC)

5.5. Expected Site Types

Following a review of pertinent archaeological, historical, ethnographic data, an examination of previously recorded sites in the region and an assessment of the physical characteristics of the current project, including previous impacts to the landscape, the following site types could be expected within the study area:

- **Habitation Sites:** including transitory campsites (i.e., seasonal resource procurement and processing areas). These sites can be defined by the presence of structural features (post molds, floor surface, depressions etc.) and/or relatively extensive cultural matrices indicative of habitation (e.g., hearth features, pit roasting features, fire-cracked rock and/or charcoal, etc.)
- **Earthworks:** including human-made earth features such as mounds, defensive ditches, etc.
- **Culturally Modified Trees (CMTs):** including standing or fallen trees and stumps that have been modified by aboriginal tree, plank, and/or bark harvesting practices (Archaeology Branch 2001)
- **Trails:** including existing and/or historic trail routes known in oral historical or ethnographic records.
- **Rock Art:** Including both petroglyphs (images ground or pecked into a boulder or rock face) and pictographs (images painted onto a natural rock feature).
- **Burial Places:** including internments of ancestral remains in sub-surface mounds, cave, or surface environments.

- **Cultural Materials:** A broad category that includes isolated artifacts, deposits of cultural matrices (fire-cracked rock and charcoal, cultural shell deposits, etc.), and lithic (stone tools and flakes resulting from their manufacture) surface scatters, among others.
- **Historic Sites:** including deposits of cultural materials that correspond to the arrival and presence of non-Native cultures (primarily the proto-historic, fur trade, and colonial periods).

6.0. Methodology

6.1. Review of the Remote Access Archaeological Database

A further review of RAAD covers the permit area footprint of previous studies as well as predictive archaeological potential modelling. The model within the protected area is the Chilliwack Forest District AOA Potential Model developed by Golder in 1999 (the Model). Variables the Model references include slope gradient, elevation, forest age, and distances from water sources which is inclusive of variants for of lakes, rivers, streams, and confluences.

6.2. Review of Topographic and Biophysical Information

Topographic information was obtained from: (1) satellite imagery obtained from Google Earth, (3) ESRI imagery and TRIM data from RAAD. In addition to identifying topographic and landscape features, the imagery also provided information regarding the location of buildings and infrastructure and level of disturbance over the landscape. In addition to the review of regional biophysical literature, further information was obtained from the provincial Biogeoclimatic Maps and associated Biogeoclimatic Classification report (Meidinger and Pojar 1991).

6.3. Archaeological Site Potential Assessment Methodology

A correlation exists between landscape characteristics and the occurrence of archaeological sites and can be used to predict the likelihood of locations. Generally, people gravitate toward areas with access to water, shelter, and food and raw material resources, seeking out locations that are relatively level, well-drained, have a solar aspect, and provide a good vantage point.

As such the biophysical characteristics that are considered are:

- Presence and nature of water features;
- Wildlife and fish values;
- Slope, aspect, and topography;
- Presence of bedrock exposures, karst, talus, or boulders suitable for rock art locations, caves, rock shelters, or lithic raw material sources;
- Vegetation and forest cover composition and age.

Archaeologically it is important to not only examine these biophysical characteristics as they appear currently but to also consider the changes in these biophysical characteristics over time, from the Late Pleistocene through to the Holocene.

Further to the biophysical characteristics, several cultural and archaeological criteria are considered to further refine the archaeological site potential assessment included:

- Connection of study area to traditional use localities, oral history, and/or known traditional place names;

- Proximity of property to previously recorded archaeological sites;
- Prehistoric settlement and resource use of the region, especially in relation to traditional resource areas and transportation corridors;
- Level and type of past historic land use and the resulting impacts; and
- The previous archaeological experience of the researcher.

7.0. Results

Analysis of the bio-geoclimatic data and BC forest classifications indicates that the dominant tree species within the Project Area include western hemlock, western redcedar and Douglas-fir. The forest age classification puts the age range into Class 5, with the oldest predicted age of about 100 years. Given the prevalence of Class 5 western redcedar the presence of traditional use pre-1846 CMTs protected by the *Heritage Conservation Act* is likely. Pre-1846 CMTs (e.g., aboriginally-logged stump features, or historically logged bark-stripped features) protected by the *Heritage Conservation Act* could be present even within younger the tree stands and the current forest type.

A review of air and satellite imagery shows little change within the Project Area, except for forest cover. Available imagery only goes back to 1985, however, there are no distinguishable differences within the Project Area specifically in these images over time. The surrounding development evolves over time within the valley floor to indicate forested areas being turned into orchards and agricultural land and some additional houses being constructed. Within the immediate areas of the watercourses that Associated Environmental intends to restore, there was no observable change which suggests that any large-scale diking or water diversion was established in the valley prior to 1985. In relation to forest age classification, Hatzic Valley was likely historically logged in areas where farm and agriculture land appears today, as well as some areas on the valley sides. This means that any subsurface archaeological materials are still likely to be relatively intact as historical logging practices are far less destructive than current methods. However, this does increase the likelihood of encountering historic artifacts, although they will be unprotected by the *HCA*.

In reviewing the archaeological predictive modelling, the majority of the Project Area is located within areas modelled as high potential, notably the areas of the project within the valley floor and where the floor meets the eastern side. The remainder of the project is located in areas modelled as moderate potential. In the context of previously recorded archaeological sites, it is, therefore, moderately probable of encountering archaeological materials within the project footprint. Ground truthing via preliminary field reconnaissance (PFR) or an archaeological impact assessment (AIA) would be required, especially as the predicted moderate potential is in the context of ethnographic information.

No archaeological studies have been conducted in proximity (< 1km) of the Project area, however, several have occurred with two and a half (2.5 km) kilometres, and the general Hatzic and Mission areas. The study nearest to the Project Area occurred approximately 700 m west of the mouth of Hatzic Slough, on the north shore of Hatzic Lake (DhRn-6) and was recorded by D. G. Smith and Robert Kidd (1963 University of British Columbia). Unfortunately, records for this visit are sparse and it is unknown if any artifacts or features were encountered. A second study, conducted by Mike Cranny and Donald Bunyan of the University of British Columbia (UBC), took place in 1975 under Heritage Inspection Permit 1975-0006. It is noted on the 1975 site record that a nearby property owner, Mr. Bonn, had collected several lithic artifacts from the site and immediately surrounding areas. Additionally, based on recollections of Mr. Bonn, the 1975 site visit considered the site destroyed by property owners who graded the shoreline

to protect their shore from eroding. It was surmised that the site was ultimately washed away as a result of this work.

The location of the Project Area on the valley floor of Hatzic Valley, that trends north-south between the southeastern shore of Stave Lake and the northern shore of Hatzic Lake with the Fraser River approximately 3.3 km southwest should be considered high potential due to the numerous navigable waterways, resources, and favourable terrain.

8.0. PFR Methodology

The PFR consisted of a four-person archaeological field crew traversing the entirety of the proposed developments. Pedestrian visual surface inspection was employed for the purpose of locating, recording, and evaluating archaeological materials within the proposed development footprint. Full pedestrian visual surface inspection was conducted within the proposed development footprint, and evidence of cultural materials on the surface were sought, including but not limited to stone, bone, antler, or other artifacts; fire-altered rock; cultural features (e.g., depressions, mounds, or cairns); and historic cultural remains and debris. Existing subsurface exposures were examined for evidence of cultural deposits. Landforms, vegetation, aspect, and sources of potable water were recorded in field notes.

8.1. PFR Results

The Project area was subject to PFR by Crystal Sawyer (Ursus), Joey Antone (Kwantlen First Nation), Janna Bucsis (SRRMC), and Jason Thompson (Laq'á:mel First Nation on May 5 and 11, 2023. The entirety of the Project area was inspected.

The in-field observations found that a large portion (~90%) of the project area's proposed footprint could be fully assessed via pedestrian visual surface inspection. Observed terrain encountered was generally consistent throughout the project area and consisted of undifferentiated farmland and floodplain terrain, with some hummocky areas near the creek banks. There were no significant landforms (i.e. benches, terraces, rock bluffs) encountered. Throughout the project area there was a variable amount of ground disturbances observed including: historic logging, farming and cattle grazing, residential development and homesteads, previous flood event debris and past efforts to berm and dyke the waterways.

The in-field observations also revealed that a small portion (~10%) of the project area could not be fully assessed due to its overlap with private property which limited crew access.

At the time of the PFR, it was unclear the level of impacts to each waterway and proposed section would encounter during repair works. It was observed that most of the existing berms were not reinforced but that there were some sections that had more recent riprap and re-armouring present. As the level of impact was not well defined, the crew extended their survey off existing berms and access points in order to better capture any additional areas of potential.

No new archaeological materials, or surficial features were identified during the PFR; however, five (5) areas within the proposed Project are assessed as having high potential for the presence of archaeological sites. The high potential rating is based on the presence of level terrain and their proximity to two unnamed waterways and Lagace Creek, respectively. It should be recognized that due to the favourable terrain encountered and proximity to waterways (particularly navigable waterways between Stave Lake and Hatzic Lake) that the project area should all be considered high potential.

Table 3 provides detailed information for the identified areas of archaeological potential. Table 4 provides descriptions of the 12 proposed areas that require restoration works. Figure 3, 4 and 5 show the Results of the survey and assessment. Photos 1-16 provide views of the Project area.

Table 3: Description of Development Locations

Development ID	Associated Waterway	Dimensions (approximate)	In Field Observations	AOP (Y/N)
S-CR-28	Cascade Creek	~711 m E-W x 210 m N-S	Undifferentiated gently sloping northwestern aspect along creek bed. Additional creek bed observed to trend SE-NW. Sections previously re-armoured.	Y (AOP 1)
S-CR-36	Unnamed Creek	~285 m NE-SW x 40 m NW-SE	Undifferentiated flat terrain on northern and southern banks. Southern banks observed to have older sections of dykes and berm system.	N
S-CR-35	McNab Creek	~405 m NW-SE x 40 m NE-SW	Undifferentiated hummocky terrain with existing berms on both north and southern banks.	N
S-CR-17	Legace Creek	~728 m N-S x 40 m E-W	Flat terrain in areas adjacent to Sylvester Road. Low-lying wet areas at the southern terminus. Overall, steeply incised creek bed.	N
S-CR-12	Legace Creek	~412 m NE-SW x 40 m NW-SE	Flat and hummocky terrain with heavy urbanization on northern banks. Old dykes observed on northern/western banks with recent dykes occurring on private property on the southern/eastern banks. Previous restoration observed around the bridge area.	N
S-CR-16	Legace Creek	~686 m NE-SW x 40 m NW-SE	Undifferentiated flat terrain due to previous agricultural and residential activities. Existing berms were observed intermittently within this section.	Y (AOP 5)
S-CR-15	Legace Creek	~971 m E-W x 40 m N-S	Undifferentiated flat terrain due to previous agricultural and residential activities. Existing berms were observed intermittently within this section.	N
S-CR-13	Legace Creek	~580 m E-W/N-S x 40 m N-S/E-W	Undifferentiated flat terrain due to previous agricultural and residential activities. Existing berms were observed intermittently within this section.	N
S-CR-37	Unnamed Creek	~447 m E-W x 40 m N-S	Undifferentiated level terrain within residential setting. Recent existing berm on north bank.	N
S-CR-34	Unnamed Creek	~400 m NW-SE x 40 m NE-SW	Undifferentiated level terrain within residential setting. Existing berms observed on both banks.	N

S-CR-14	Hatzic Slough	~1.89 km N-S x 40 m E-W	Undifferentiated level terrain within agricultural and residential setting. Residential properties observed to be on slightly elevated land. Dense vegetation and steep banks observed.	N
S-CR-38	Unnamed Creek	~305 m NE-SW x 40 m NW-SE	Undifferentiated hummocky terrain with some level areas along creek bed. Disturbance observed include man-made dams. Mature western redcedar present.	Y (AOP 2, 3, 4)

Table 4: Areas of Archaeological Potenial

AOP	Development Location	UTM	Landform	Dimensions
1	S-CR-28	557337E, 5456638N	Level to hummocky bank above creek.	15 m NE-SW x 15 m NW-SE
2	S-CR-38	556361E, 5447269N	Level bank immediately above creek, at a bend in stream.	15 m N-S x 4 m E-W
3	S-CR-38	556333E, 5447289N	Level bank immediately above creek, at a bend in stream.	20 m NW-SE x 10 m NE-SW
4	S-CR-38	556457E, 5447328N	Level bank immediately above creek, at a bend in stream.	7 m NE-SW x 4 m NW-SE
5	S-CR-16	555850E, 5452050N	Terrace along creek.	65 m NE-SW x 51 m NE-W



Photo 1. View northwest of S-CR-28 showing existing berms on the left bank and armoured right bank with walking trails established.



Photo 2. View southwest of S-CR-36 showing typical terrain observed on both sides of the banks.



Photo 3. View south of S-CR-35 showing previously constructed berm on western bank of creek.



Photo 4. View southeast of S-CR-17 showing typical terrain encountered within the area with erosion on the exposed banks observed.



Photo 5. View southwest within S-CR-12 showing a newer dyke on the left and existing berm on the right bank along with residential development.



Photo 6. View south of S-CR-16 showing typical terrain, vegetation and disturbance (existing berms) encountered throughout this section.



Photo 7. View north of S-CR-15 showing residential development on the bank above the waterway. Typical of S-CR-15 which had numerous residential properties.



Photo 8. View southeast of S-CR-13 showing the existing raised berm above the waterway.



Photo 9. View east of S-CR-37 showing typical terrain encountered: existing berms and dykes, residential development and farmland. Photo taken from Sly Road as a private gate limited access. S-CR-34 out of frame to right, in similar setting.



Photo 10. View south of S-CR-14 showing high banks with no berming or riprap. This was typical of this section.



Photo 11. View southwest of S-CR-38 showing general terrain encountered east of Sylvester Road – note the natural banks. West of Sly Road was observed to have a residential setting.



Photo 12. View south of AOP 1 within S-CR-28 showing the level to slightly hummocky terrain above the creek bank.



Photo 13. View south of AOP 2 within S-CR-38 showing level terrain immediately next to bank.



Photo 14. View northwest of AOP 3 within S-CR-38 showing level terrain above bank.



Photo 15. View south of AOP 4 within S-CR-38 showing level terrain encountered above creek bank.



Photo 16. View south of AOP 5 within S-CR-16 showing a slightly raised terrace landform that is setback from the creekbank.

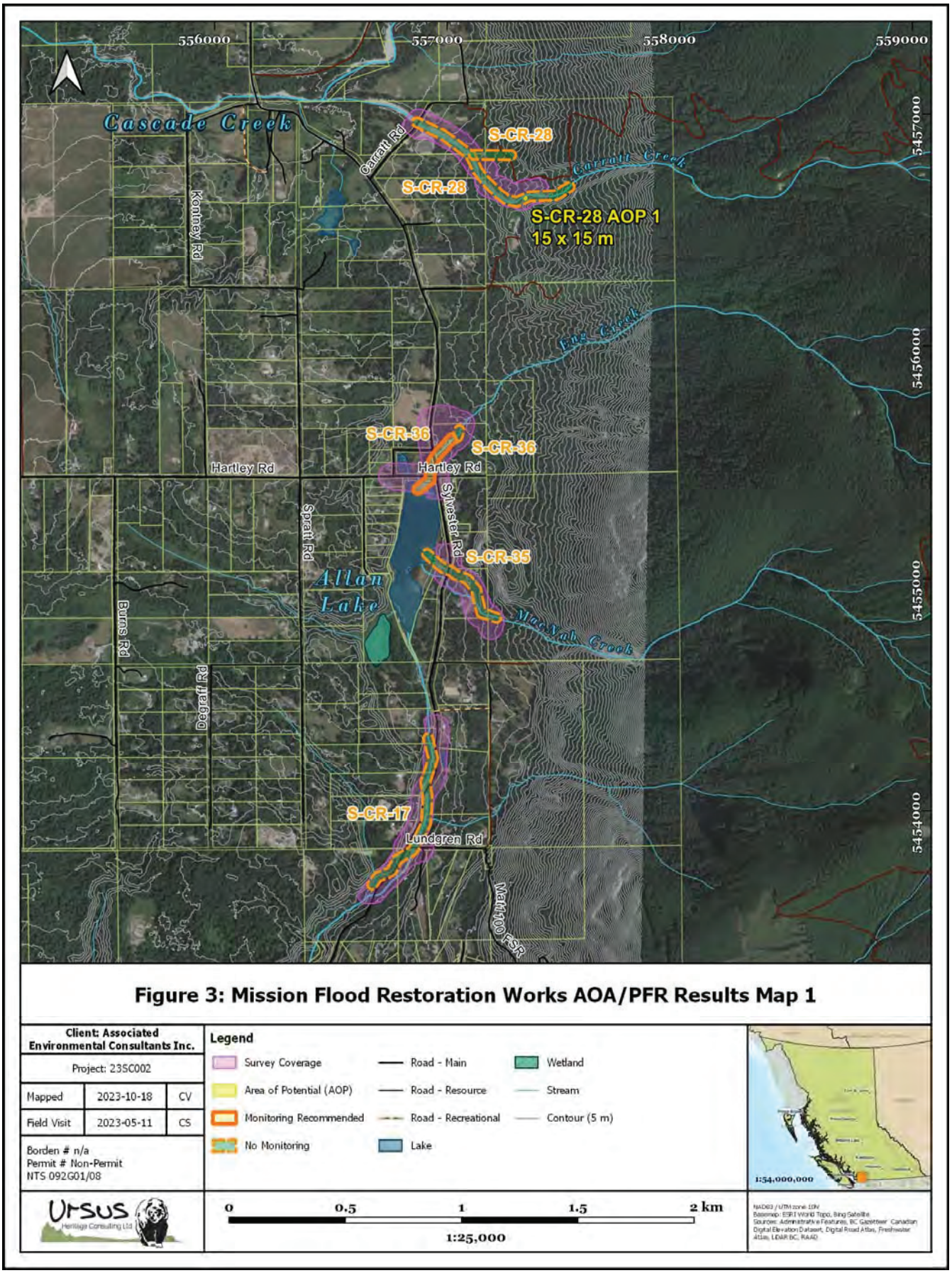

Figure 3: Mission Flood Restoration Works AOA/PFR Results Map 1

Client: Associated Environmental Consultants Inc.		
Project: 23SC002		
Mapped	2023-10-18	CV
Field Visit	2023-05-11	CS
Borden # n/a Permit # Non-Permit NTS 092G01/08		

Legend

- Survey Coverage
- Area of Potential (AOP)
- Monitoring Recommended
- No Monitoring
- Road - Main
- Road - Resource
- Road - Recreational
- Lake
- Wetland
- Stream
- Contour (5 m)

Ursus Heritage Consulting Ltd

0 0.5 1 1.5 2 km

1:25,000

NAD83 / UTM zone 10N
Basemap: ESRI World Topo, Bing Satellite
Sources: Administrative Features, BC Gazetteer, Canadian Digital Elevation Dataset, Digital Road Atlas, Freshwater Atlas, LiDAR BC, RAAD

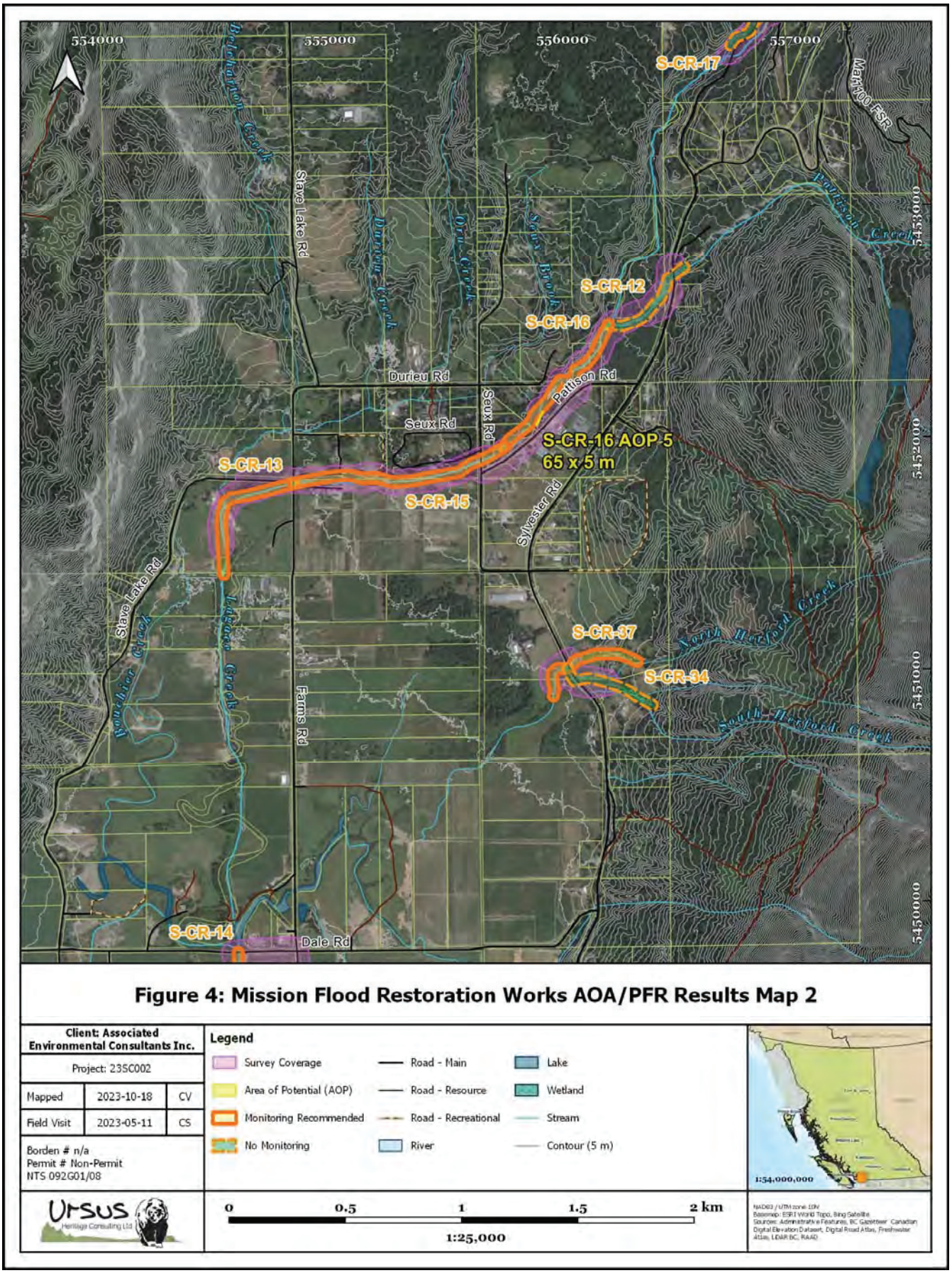

Figure 4: Mission Flood Restoration Works AOA/PFR Results Map 2

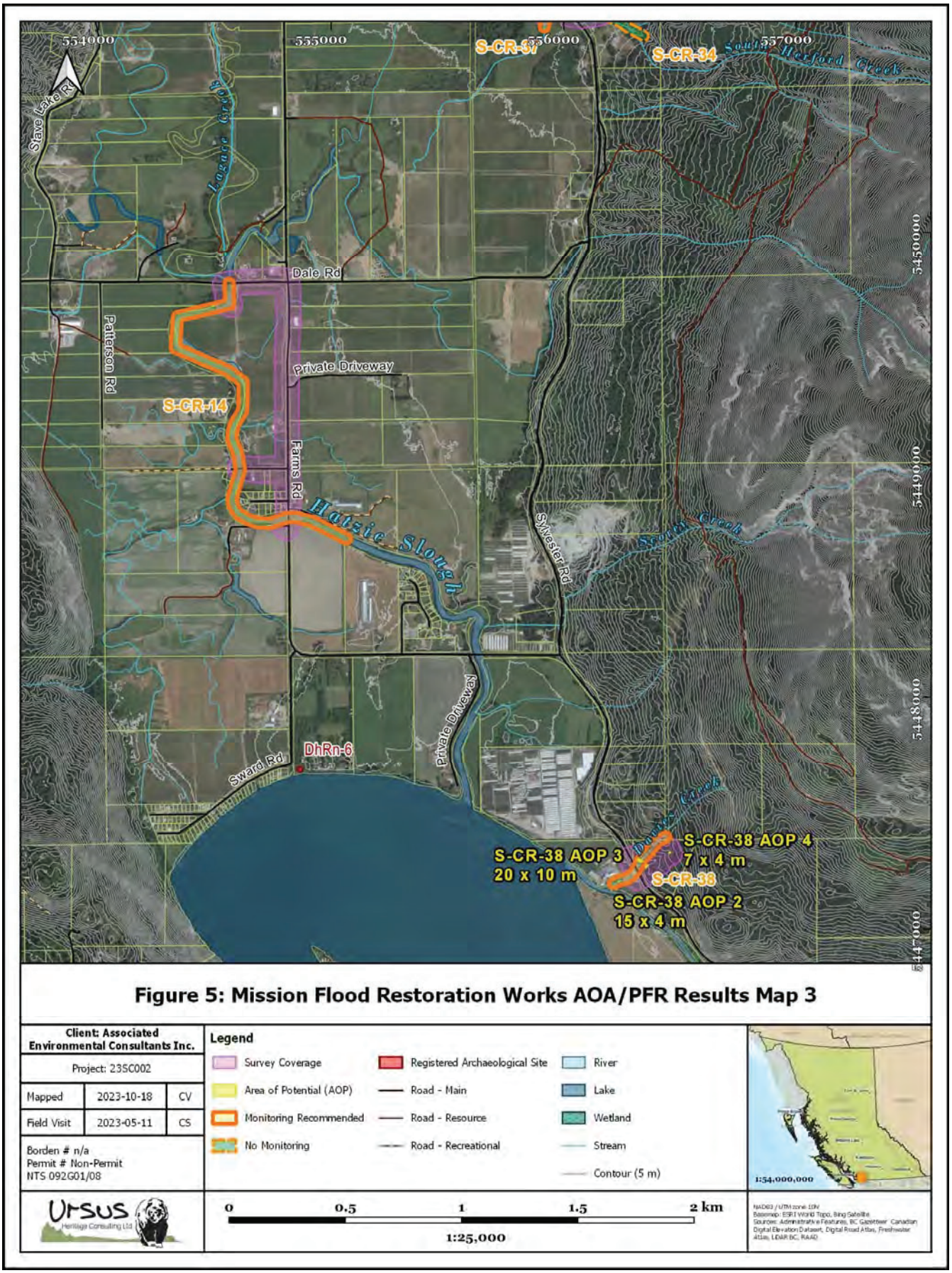

Figure 5: Mission Flood Restoration Works AOA/PFR Results Map 3

Client: Associated Environmental Consultants Inc.		
Project: 23SC002		
Mapped	2023-10-18	CV
Field Visit	2023-05-11	CS
Borden # n/a Permit # Non-Permit NTS 092G01/08		

Legend

- Survey Coverage
- Area of Potential (AOP)
- Monitoring Recommended
- No Monitoring
- Registered Archaeological Site
- Road - Main
- Road - Resource
- Road - Recreational
- River
- Lake
- Wetland
- Stream
- Contour (5 m)

1:54,000,000

0 0.5 1 1.5 2 km

1:25,000

NAD83 / UTM zone 10N
Basemap: ESRI World Topo, Bing Satellite
Sources: Administrative Features, BC Gazetteer, Canadian Digital Elevation Dataset, Digital Road Atlas, Freshwater Atlas, LiDAR BC, RAAD

9.0. Recommendations

Based on the results of the AOA and PFR the following recommendations are presented:

- If development plans confirm that no ground disturbance will occur outside of existing areas of disturbance, including riprap, berm, and dyke footprints, no further work is recommended.

- If development plans confirm that ground disturbance will extend beyond previously constructed riprap, berm and dyke footprints, then based on the results of the PFR, and current Project Area, it is recommended that an Archaeological Impact Assessment (AIA) be conducted under a *Heritage Conservation Act* (*HCA*) Section 12.2 Heritage Inspection Permit for the Project area in advance of any developments. The objectives of an AIA are to:
    - Identify and evaluate archaeological sites;
    - Identify and assess potential impacts to these sites as a result of the proposed development; and
    - Recommend alternatives for managing adverse impacts.

Based upon the results of the AIA, additional archaeological work may be required, including, but not limited to:

- Site conservation through avoidance by project redesign: this is the preferred archaeological site management tool, a cost-effective strategy recommended for long-term protection of significant sites or portions of sites threatened with destruction;
- Mitigative data recovery: archaeological salvage excavations may be recommended for significant archaeological or historic sites or portions of sites threatened by the project development which cannot be protected by project redesign;
- Archaeological monitoring: this may be recommended to ensure that appropriate emergency impact management actions are available if unanticipated important archaeological materials or features, such as ancestral remains, are encountered.

10.0. Closure

Users of this report should be aware that even the most thorough investigation may fail to reveal all archaeological remains, including sites protected by the BC *Heritage Conservation Act*, that exist in an area. All users of this report should also be aware that: (1) archaeological remains in BC are protected from disturbance, intentional or inadvertent, by the *Heritage Conservation Act*; (2) in the event that archaeological remains are encountered, all ground disturbance in the immediate vicinity must be suspended at once; (3) it is the individual's responsibility to inform the Archaeology Branch and appropriate First Nations as soon as possible, about the location of the archaeological remains and the nature of the disturbance; and (4) the *Heritage Conservation Act* may incur heavy fines and imprisonment for failing to comply with these requirements.

It is also recommended that the proponent inform their personnel and all contractors that archaeological remains are protected by the *Heritage Conservation Act*, and may not be altered, damaged, moved, excavated in, or desecrated in any way without a permit issued under Section 12 of the *Heritage Conservation Act*.

This AOA is concerned with the identification of locations of archaeological potential and archaeological sites within the proposed Project area. It does not address the potential for traditional use sites within the subject property. It is not the intent of this report to document First Nations' interest in the land. The study was conducted without prejudice to First Nations' treaty negotiations, Aboriginal rights, or Aboriginal title.

For more information on this review of archaeological potential, please contact Ursus Heritage Consulting Ltd.

With respect,



Emily Hails, MA
Archaeologist
Ursus Heritage Consulting Ltd.

Reviewed by:



Ian Cameron, MSc, RPCA
Director, Senior Archaeologist
Ursus Heritage Consulting Ltd.

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APPENDIX K – MOTI ENGAGEMENT

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

TECHNICAL MEMORANDUM

Issue Date:	March 25, 2024	**File No.:**	
To:	Phu Bui | DFAA Director Recovery	**Previous Issue Date:**	
From:	Ryan Karsgaard, P.Eng., and Andrew Wiens, P.Eng.	**Project No.:**	2022-2632-06
Client:	Ministry of Environment and Climate Change Strategy		
Project Name:	Hatzic Emergency Works Program		
Subject:	Lagace Creek - Site S-CR-17: MoTI Infrastructure Post-Improvement Vulnerability		

1 PURPOSE

The purpose of this memorandum is to provide the BC Ministry of Transportation and Infrastructure (MoTI) with a high-level, qualitative vulnerability assessment of the sites along Sylvester Road which are subject to proposed Disaster Financial Assistance (DFA) funded flood recovery efforts in the Hatzic Valley. This work is in response to the November 2021 Atmospheric River Event (ARE) and the objective is to restore the damaged watercourses to their pre-ARE condition.

1.1 BACKGROUND INFORMATION

The Fraser Valley Regional District (FVRD) identified 12 sites along watercourses across the Hatzic Valley immediately after the ARE. Several watercourses were damaged during the ARE event as a result of high flows, as well as sediment and debris deposition from debris flow/flood events. These sites were passed along to the Ministry of Environment and Climate Change Strategy (ENV) for flood recovery management. Associated Engineering (B.C.) Ltd. (Associated) was engaged to complete emergency site assessments in early 2022 and coordinate the emergency recovery works including engineering design, environmental services, and construction services.

The MoTI has participated in the Hatzic Area Task Force meetings along with other key stakeholders. During the Task Force meetings, Associated and ENV communicated the ongoing flood recovery efforts as well as upcoming proposed works. This includes the proposed works at S-CR-17 – Lagace Creek between Pattison Creek and Allan Lake which is the subject of this memo.

2 PROPOSED WORK

2.1 PROPOSED SCOPE

There is one proposed work area within the Sylvester Road right-of-way (ROW) as illustrated in **Figure 2-1.**The proposed recovery works consists of:

- **Sediment and debris removal (e.g. ditch / channel cleaning to restore pre-ARE ambient conditions)**
  - This sediment and debris removal will restore the pre-ARE channel capacity, improve fish passage, and provide room for future sediment deposition.

The existing riprap at this location will not be upgraded or replaced.

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carbon neutral since2009

CANADA BEST MANAGED COMPANIES Platinum member

IF NOT 25 mm ADJUST SCALES
25 mm

SCALE(S) SHOWN ARE INTENDED FOR LETTER (8.5x11) SIZE DRAWINGS UNLESS NOTED OTHERWISE



PARCEL 001905139
PARCEL 008489718
PARCEL 000439665
SITE 5
PARCEL 000533785
PARCEL 008799121
PARCEL 008392633
SITE 4
SAPORANO CREEK
NORTH CROSSING:
CULVERTS INCLUDE
1.5 m x 2.4 m CONCRETE BOX
1200 mm Ø HDPE
SITE 1
PARCEL 003723704
PARCEL 008392676
Sylvester Road
LAGACE CREEK
Lundgren Road
SOUTH CROSSING:
CULVERT INCLUDE
1000 mm Ø CSP
2000 mm Ø CSP
1.7 m x 2.23 m PIPE ARCH WITH CONCRETE LINING
PARCEL 017032211
PARCEL 017032245
PARCEL 008593973
PARCEL 013421662
SITE 2
SITE 3
PARCEL 008593931

LEGEND:

- EROSION/UNDERCUTTING - NOT IN DESIGN SCOPE
- SEDIMENTATION - IN DESIGN SCOPE
- CREEK

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DWG PATH: D:\PROGRAM_WORK\AcWork\2022-2632 - HATZIC EMERGENCY WORKS\2022-2632 - Hatzic AcPro\2022-2632 - Hatzic Emergency Works\2022-2632 - Hatzic Emergency Works_old.aprx

Associated Engineering

BEST MANAGED COMPANIES CANADA
Platinum member

AE PROJECT No.	2022-2632-06
SCALE	1:3,000
APPROVED	R. KARSGAARD
DATE	2024MAR21
REV	0
DESCRIPTION	ISSUED FOR MEMO

DRAFT

FIGURE 1-1

MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE

HATZIC EMERGENCY WORKS PROGRAM
SITE S-CR-17
PROPOSED WORK AREAS

Additional sediment removal was planned along Saporano Creek upstream of the Sylvester Road confluence. However, the property owner has recently indicated that they are not willing to participate in the flood recovery program. Without private property owner consent, we can't place riprap along Sylvester Road as this work requires channel widening outside of the MoTI ROW. As a result, we can only conduct sediment and debris removal within the MoTI ROW in this area.

Table 2-1 summarizes the proposed work location and scope.

Table 2-1: Proposed Works

Location Name	Location Description	Coordinates	Proposed Scope
Site 1	East ditch of Sylvester Road adjacent to Parcel 003-723-704 at the outlet of Saporano Creek	49.2356337, 122.2184864	Sediment and Debris Removal

2.2 ADDITIONAL AREAS OF CONCERN

A number of additional damaged sites were observed along Lagace Creek near Sylvester Road. However, through discussions with MoTI, we understand that MOTI prefers to defer repairs at these sites so that more comprehensive corridor improvements can be completed at a later date to current codes and standards. As a result, no work is proposed at these sites as part of the Hatzic Emergency Works Program and future improvements. If any work is completed in the future, it would be completed by MoTI via separate funding sources.

The damaged site locations and issues of concern are noted in **Table 2-2.**

Table 2-2: Additional Areas of Concern

Location Name	Location Description	Coordinates	Primary Concern
Site 2	West ditch of Sylvester Road within Parcel 013-421-662	49.2337729, 122.2202833	Lagace Creek has eroded the roadway embankment and created a risk to the roadway structure as well as public safety.
Site 3	East ditch of Sylvester Road adjacent to Parcel 008-593-931 South of the Lundgren Road intersection	49.2340712, 122.2197911	Lagace Creek has eroded the roadway embankment and created a risk to the roadway structure as well as public safety.

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Location Name	Location Description	Coordinates	Primary Concern
Site 4	West ditch of Sylvester Road adjacent to Parcel 008-392-633 just upstream of the existing box culvert	49.2357663, 122.2186503	Lagace Creek has eroded the roadway embankment and created a risk to the roadway structure as well as public safety.
Site 5	West ditch of Sylvester Road adjacent to Parcel 000-439-665	49.2378636, 122.2177021	Lagace Creek has eroded the roadway embankment and created a risk to the roadway structure as well as public safety.

2.3 Design Event

Sylvester Road is classified as a collector road. The MoTI design standards for collector roads are as follows:

1) Highway ditches: 10 to 25-year return period.
2) Culverts (<3 m span): 100-year return period.
3) Buried Structures and Culverts (>3 m span): 200-year return period.
4) Bridges: 200-year return period.
5) River Training and Channel Control Works: 200-year return period.

The proposed improvements are located within a fish-bearing watercourse and the Sylvester Road ROW. In some cases, the banks of the watercourse coincide with the Sylvester Road embankment.

The relevant MoTI design standards which apply to the proposed improvements consist of the 200-year event for sizing riprap (e.g. channel control works). The remaining MoTI criteria noted above are not considered relevant as the proposed improvements are located within fish-bearing watercourses.

In general, the Hatzic Valley Emergency Works objectives are to restore the watercourse capacity to the pre-event condition. Improvements are permissible, based on current codes and standards, under the DFA recovery criteria.

2.4 Hydraulic Analysis

Hydrologic and hydraulic modelling of the existing system was completed using HEC-HMS and HEC-RAS. The hydraulic analysis was completed for the 1 in 10-year and 1 in 200-year design events. The design flow includes:

1) 51% increase for climate change (year 2100).
2) 30% allowance for sediment and debris transport.

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Note that Saporano Creek upstream of Lagace Creek is located within debris flow/flood zones. Peak flows, including sediment and debris volumes, during debris flow/flood events are not considered as part of the design process. Substantial sediment deposition is expected during such an event, and in-stream maintenance will be required following the event.

The model results indicate that Lagace Creek will overtop the roadway at various locations between Allan Lake and the confluence with Pattison Creek for both the 1 in 10-year and 1 in 200-year design events. Additional information is available upon request.

3 POST IMPROVEMENT VULNERABILITY

The proposed sediment and debris removal activities are expected to restore the sites to the pre-ARE condition. However, the existing risks due to flooding, debris flows, debris floods, sediment and debris deposition, channel avulsions, erosion, and scour cannot be mitigated as part of this recovery project. As a result, MoTI infrastructure and the public are exposed to risks which exceed current standards.

Based on our understanding of the site issues for Lagace Creek and Saporano Creek, hydraulic analysis of the existing system, and our experience with similar sites in the Hatzic area, we anticipate that the MoTI infrastructure in the area will remain vulnerable to the following:

1) **Sediment and Debris deposition -** A large event may result in the inundation of the roadway, infilling of the Lagace Creek and Saporano watercourses, and damage to the roadway.
2) **Flooding -** The existing Lagace Creek watercourse and hydraulic structures crossing Sylester Road do not meet appear to current MoTI design standards. We anticipate flooding of the roadway and saturation of the road subgrade on a more frequent basis than current MoTI design standards.
3) **Culvert blockage -** Sediment and debris are expected to periodically fill and/or block the culverts near the confluence with Saporano and Lagace Creeks. This may include mobilization of existing riprap during high-flow as well as debris flow events.
4) **Channel erosion and scour -** The existing Lagace Creek and Saporano Creek watercourse dimensions cannot accommodate riprap which meets current codes and standards (e.g. 200-year instantaneous flow and velocity).
5) **Public Safety -** The existing flood and debris flood/flow risks create a public safety hazard, including the potential for loss of life.

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4 CLOSURE

Prior to proceeding with proposed works outlined above, we request confirmation from MoTI that the above work is acceptable.

If the proposed works are not considered acceptable, we may need to leave the damaged sites in their current condition which has an elevated risk profile to infrastructure, the environment and public safety.

Please contact Andrew Wiens at 403-863-4009 if you have any questions.

Prepared by:

Ryan Karsgaard, P.Eng.
Design Lead

Andrew Wiens, P.Eng.
Senior Water Resources Engineer

DRAFT

APPENDIX L – DETAILED OPINION OF PROBABLE COST

Conceptual Design Submission

Schedule of Approximate Quantities and Unit Prices

Project No: 2022-2632-03 **Date:** 2024-07-29

Project Nan Hatzic Emergency Works Program - S-CR-14 - Conceptual Design

TOTAL TENDER PRICE AND ASSOCIATED COST ESTIMATES - S-CR-14					
Item#	**Description of Work**	**Unit of Measure**	**Approx. Quantity**	**Unit Price**	**Extended Amount**
1.00	**General Requirements**				
1.01	Mobilization and Demobilization	Lump Sum	1	$138,178.93	$138,178.93
1.02	Traffic Accommodations along Dale Road	Lump Sum	1	$25,000.00	$25,000.00
	Total 1.0 - General Requirments				$163,178.93
2.00	**Incidental and Miscellaneous**				
2.01	Tree trimming, pruning, clearing, grubbing, and disposal	Square Meter	3500	$25.00	$87,500.00
2.02	Supply and Installation of chain link fence and rolling gate per Drawing C-3504	Lump Sum	1	$10,000.00	$10,000.00
2.03	Installation of temporary access approach per Drawing C-3102	Lump Sum	1	$10,000.00	$10,000.00
2.04	Supply and Installation of tree row per Drawing C-3102	Each	12	$1,000.00	$12,000.00
	Total 1.0 - Incidental and Miscellaneous				$119,500.00
3.00	**Environmental**				
3.01	Preparation and Approval of CEMP	Lump Sum	1	$5,000.00	$5,000.00
3.02	Environmental Monitoring and Reporting	Lump Sum	1	$64,191.54	$64,191.54
	Total 2.0 - Environmental				$69,191.54
4.00	**Earthworks**				
4.01	Restoration of Sand Recovery Station (SRS) per Drawing C-3501	Each	11	$5,000.00	$55,000.00
4.02	Supply and Installation of new Sand Recovery Station per Drawing C-3502	Each	3	$100,000.00	$300,000.00
4.03	Supply and Installation of Coconut Matting and Riparian Area Mix per Drawing C-3102	Square Meter	900	$25.00	$22,500.00
4.04	Excavation and Off-site Disposal of Sediment	Cubic Meter	8250	$78.41	$646,882.50
4.05	Excavation and Off-site Disposal of Contaminated Sediment	Cubic Meter	500	$331.56	$165,780.00
	Total 3.0 - Earthworks				$1,190,162.50
5.00	**Bioengineering**				
5.01	Supply and Installation of Dense Live Staking per Detail 1 on C-3505	Square Meter	720	$45.79	$32,968.80
5.02	Supply and Installation of Live Stake Cluster per Detail 2 on C-3503	Square Meter	200	$45.79	$9,158.00
	Total 4.0 - Bioengineering				$42,126.80
				SUB TOTAL (EXCL. GST)	**$1,584,159.77**
				CONTINGENCY @ 30%	**$475,247.93**
				TOTAL PRICE INC. CONTINGENCY	**$2,059,407.70**

Conceptual Design Submission

Schedule of Approximate Quantities and Unit Prices

Project No: 2022-2632-06 **Date:** 2024-07-29

Project Nam Hatzic Emergency Works Program - S-CR-17 - Conceptual Design

TOTAL TENDER PRICE AND ASSOCIATED COST ESTIMATES - S-CR-17					
Item#	**Description of Work**	**Unit of Measure**	**Approx. Quantity**	**Unit Price**	**Extended Amount**
1.00	**General Requirements**				
1.01	Mobilization and Demobilization	Lump Sum	1	$2,352.30	$2,352.30
1.02	Traffic Accommodations along Sylvester Road	Lump Sum	1	$25,000.00	$25,000.00
	Total 1.0 - General Requirments				$27,352.30
2.00	**Environmental**				
2.01	Preparation and Approval of CEMP	Lump Sum	1	$5,000.00	$5,000.00
2.03	Environmental Monitoring and Reporting	Lump Sum	1	$2,570.26	$2,570.26
	Total 2.0 - Environmental				$7,570.26
3.00	**Earthworks**				
3.01	Excavation and Off-site Disposal of Sediment per Drawings C-3106	Cubic Meter	300	$78.41	$23,523.00
	Total 3.0 - Earthworks				$23,523.00
				SUB TOTAL (EXCL. GST)	**$58,445.56**
				CONTINGENCY @ 30%	**$17,533.67**
				TOTAL PRICE INC. CONTINGENCY	**$75,979.23**

APPENDIX M – DESIGN DRAWINGS

SHEET LIST TABLE

SHEET	DRAWING NAME	REVISION	DRAWING TITLE	DRAWING DESCRIPTION
GENERAL				
1	2632-03-G-3001	1	COVER PAGE	
2	2632-03-G-3002	1	LEGEND	
CIVIL				
3	2632-03-C-3101	1	PLAN	S-CR-14 SEDIMENT REMOVAL
4	2632-03-C-3102	1	PLAN	S-CR-14 PROPOSED SAND RECOVERY STATIONS
5	2632-03-C-3103	1	PLAN	S-CR-14 SEDIMENT REMOVAL EXTENTS
6	2632-03-C-3104	1	PLAN	S-CR-14 EROSION PROTECTION
7	2632-03-C-3105	1	PLAN	S-CR-17 SEDIMENT REMOVAL
8	2632-03-C-3106	1	PLAN	S-CR-17 SEDIMENT REMOVAL
9	2632-03-C-3501	1	DETAIL 1 OF 6	EXISTING SAND RECOVERY STATION
10	2632-03-C-3502	1	DETAIL 2 OF 6	PROPOSED SAND RECOVERY STATION
11	2632-03-C-3503	1	DETAIL 3 OF 6	BANK PROTECTION
12	2632-03-C-3504	1	DETAIL 4 OF 6	FENCE AND GATE INSTALLATION
13	2632-03-C-3505	1	DETAIL 5 OF 6	DENSE LIVE STAKING
14	2632-03-C-3506	1	DETAIL 6 OF 6	SEDIMENT REMOVAL

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY HATZIC EMERGENCY WORKS PROGRAM LAGACE CREEK - SITE S-CR-14/17

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Associated Engineering

BEST MANAGED COMPANIES
Platinum member

BRITISH COLUMBIA

BC MINISTRY OF ENVIRONMENT
AND CLIMATE CHANGE STRATEGY
HATZIC EMERGENCY
WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

PERMIT TO PRACTICE
ASSOCIATED ENGINEERING (B.C.) LTD.
PERMIT NUMBER: 1000163
Engineers & Geoscientists BC

REV	DATE	DESIGN	DRAWN	DESCRIPTION
1	2024JUL11	R. KARSGAARD	J. ROZON	ISSUED FOR RFP AND PERMITTING
0	2024JUN14	R. KARSGAARD	J. ROZON	ISSUED FOR RFP

DRAWING	REVISION	SHEET
2632-03-G-3001	1	1

IF NOT 50 mm ADJUST SCALES
50 mm

SCALE(S) SHOWN ARE INTENDED FOR ANSI D (22X34) SIZE DRAWINGS, TABLOID (11;17) SIZE DRAWINGS ARE 1/2 OF SCALE(S) SHOWN UNLESS NOTED OTHERWISE

ROAD

EXISTING	DESIGN	
	100+000	CONTROL LINE
		GRAVEL ROAD
		EDGE OF PAVEMENT
		CURB (ACTUAL WIDTH)
		SIDEWALK (ACTUAL WIDTH)
		CURB DEPRESSION
		GUIDE RAIL

PROFILE VIEW

EXISTING	DESIGN	
		GROUND
		WATER MAIN
		SANITARY SEWER
		STORM SEWER

SURVEY

EXISTING	DESIGN	
HUB		SURVEY HUB
MON		MONUMENT
IP		IRON PIN
IPF		IRON PIN (FOUND)
LP		LEAD PLUG
U		UNIDENTIFIED MANHO,E
MW		MONITORING WELL
PZ		PIEZOMETER
OW		OBSERVATION WELL

CONTOUR

EXISTING	DESIGN	
		MAJOR
		MINOR

PROPERTY

EXISTING	DESIGN	
		PARCEL / LOT LINE
		EASEMENT
		STATUTORY ROW
		ROAD ROW

GAS / OIL

EXISTING	DESIGN	
G	G	GAS
OIL	OIL	OIL
F	F	VAULT BOX
V	V	VALVE BOX
G	G	MANHOLE
G	G	METER

WATER

EXISTING	DESIGN	
W	W	WATER MAIN
F	F	FIRE SUPPRESSION
IR	IR	IRRIGATION
RW	RW	RAW WATER
PW	PW	POTABLE WATER
W	W	VAULT BOX
FH	FH	FIRE HYDRANT
W	W	MANHOLE
W	W	METER CHAMBER
		CROSS FLANGE
		TEE FLANGE
		END CAP / PLUG
		GATE VALVE
		THRUST BLOCK
		45 DEGREE ELBOW
		90 DEGREE ELBOW
		WYE
EDS	EDS	ENCASEMENT
		WATER LEVEL
		COUPLING
		REDUCER
W	W	WELL
OCS	OCS	CURB STOP / CURB BOX

SANITARY SEWER

EXISTING	DESIGN	
SS	SS	SANITARY SEWER
FM	FM	SANITARY FORCEMAIN
COMB	COMB	SANITARY COMBINED SEWER
S	S	MANHOLE
CS	CS	COMBINED MANHOLE
VC	VC	VALVE CHAMBER
CO	CO	CLEANOUT
S	S	VALVE BOX
		FLOW DIRECTION
LS	LS	LIFT / PUMP STATION

COMMUNICATIONS / TELEPHONE

EXISTING	DESIGN	
CATV	CATV	CABLE
FO	FO	FIBRE OPTIC CABLE
T	T	TELEPHONE / LINE
UT	UT	UNDERGROUND TELEPHONE
C	C	COMMUNICATIONS VAULT BOX
T	T	TELEPHONE MANHOLE
T	T	TELEPHONE VAULT BOX
C	C	COMMUNICATIONS MANHOLE
T	T	TELEPHONE PEDESTAL

STORM DRAINAGE

EXISTING	DESIGN	
CP	CP	CULVERT (Ø AND TYPE)
D	D	STORM SEWER
CB	CB	CATCH BASIN
DCB	DCB	DOUBLE CATCH BASIN
DICB	DICB	DITCH INLET CATCH BASIN
CB	CB	CATCH BASIN / MANHOLE
LB	LB	LAWN BASIN
D	D	MANHOLE
STC	STC	STORMCEPTOR
OI	OI	OIL INTERCEPTOR
B	B	VALVE BOX
CI	CI	CULVERT INLET
CO	CO	CULVERT OUTLET
		HEADWALL
		DITCH FLOW

ELECTRICAL / POWER

EXISTING	DESIGN	
P	P	POWER / COMM / CONDUIT
OP	OP	OVERHEAD POWER
UP	UP	UNDERGROUND POWER
E	E	VAULT / HYDRO BOX
PB	PB	PULL BOX
J	J	JUNCTION BOX
TM	TM	TRANSFORMER VAULT MANHOLE
TP	TP	TRANSFORMER PAD
M	M	METER
E	E	MANHOLE
		LIGHT / LAMP STANDARD
		HYDRO / UTILITY POLE
		GUY WIRE
SIG	SIG	SIGNAL
SIG	SIG	SIGNAL WITH OVERHEAD ARM

MISCELLANEOUS

EXISTING	DESIGN	
X	X	FENCE
O	O	SILT FENCE
ABN		ABANDONED PIPE
		BOTTOM OF BANK
		TOP OF BANK
EW		EDGE OF WATER
		BUILDING
		200 YEAR FLOOD EXTENTS
		PROJECT EXTENTS
		PROJECT FOOTPRINT
		PROPOSED SAND RECOVERY STATION
		DENSE LIVE STAKING
		COCONUT MATTING

MISCELLANEOUS

EXISTING	DESIGN	
MAXIMUS CREEK		CREEK (OVER 3 m WIDE) (WIDTH OF CREEK SHOWN TO SCALE)
TP	TP	TEST PIT
BH	BH	BORE HOLE
FP	FP	FLAG POLE
PM	PM	PARKING METER
MB	MB	MAILBOX
		BOULDER
		RAILWAY SIGNAL LIGHT
BO	BO	POST/BOLLARD (ANNOTATE AS REQUIRED)
		NO POST BARRIER / JERSEY BARRIER (SCALE AS REQUIRED)
		SIGN
		GATE
		BUSH
		TREE (DECIDUOUS) (SCALE AS REQUIRED)
		TREE (CONIFEROUS) (SCALE AS REQUIRED)
EL1000	100.000	SPOT ELEVATION
% 2 1	% 2 1	SLOPE
2111.5 2094.8		GRID, CO-ORDINATE REGISTRATION

HATCH PATTERNS

- EXISTING SAND RECOVERY STATION
- PROPOSED SAND RECOVERY STATION
- EXISTING RIPRAP
- LIVE STAKE CLUSTERS
- SOIL
- SEDIMENT REMOVAL
- PERMANENT GRAVEL
- TEMPORARY GRAVEL
- COCONUT MATTING AND HYDRAULIC SEEDING

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Associated Engineering

BEST MANAGED COMPANIES Platinum member

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA R. T. KARSGAARD # 58691
2024-07-25

PERMIT TO PRACTICE
ASSOCIATED ENGINEERING (B.C.) LTD.
PERMIT NUMBER: 1000163
Engineers & Geoscientists BC

REV	DATE	DESIGN	DRAWN	DESCRIPTION
1	2024/JUL22	R. KARSGAARD	J. ROZON	ISSUED FOR RFP AND PERMITTING
0	2024/JUN14	R. KARSGAARD	J. ROZON	ISSUED FOR RFP

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: NTS

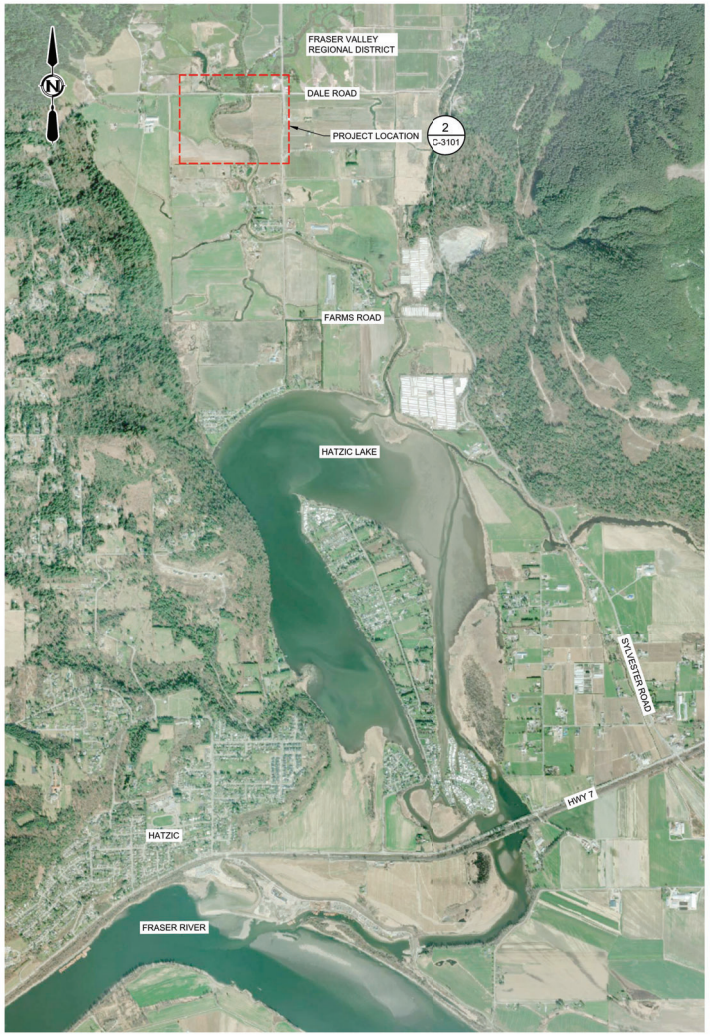
BRITISH COLUMBIA

GENERAL LEGEND

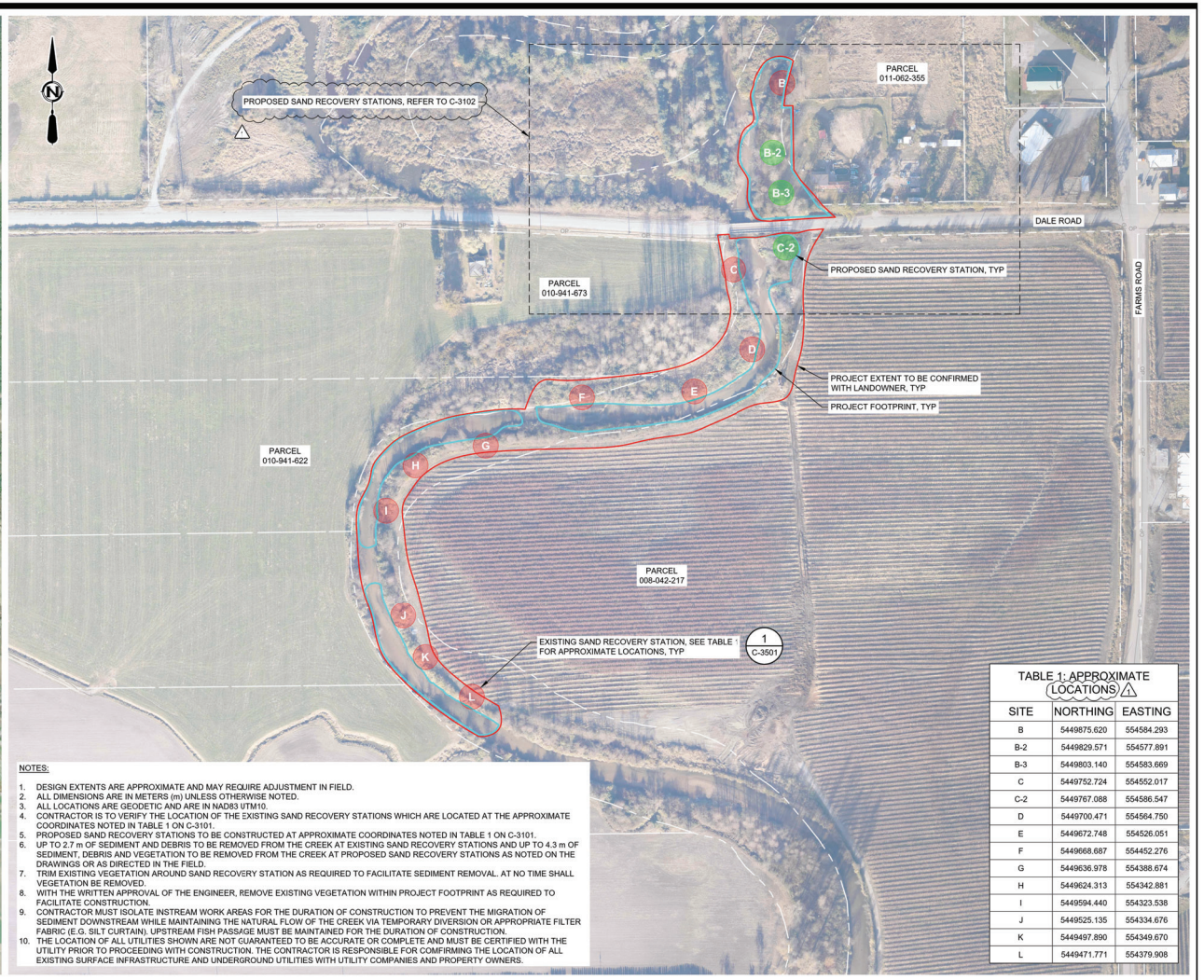
DRAWING	REVISION	SHEET
2632-03-G-3002	1	2

IF NOT 50 mm ADJUST SCALES — 50 mm

SCALE(S) SHOWN ARE INTENDED FOR ANSI D (22X34) SIZE DRAWINGS, TABLOID (11;17) SIZE DRAWINGS ARE 1/2 OF SCALE(S) SHOWN UNLESS NOTED OTHERWISE



1 C-3101 PLAN NTS
REGIONAL AREA



2 C-3101 PLAN 1:1500
PROJECT LOCATION

NOTES:

1. DESIGN EXTENTS ARE APPROXIMATE AND MAY REQUIRE ADJUSTMENT IN FIELD.
2. ALL DIMENSIONS ARE IN METERS (m) UNLESS OTHERWISE NOTED.
3. ALL LOCATIONS ARE GEODETIC AND ARE IN NAD83 UTM10.
4. CONTRACTOR IS TO VERIFY THE LOCATION OF THE EXISTING SAND RECOVERY STATIONS WHICH ARE LOCATED AT THE APPROXIMATE COORDINATES NOTED IN TABLE 1 ON C-3101.
5. PROPOSED SAND RECOVERY STATIONS TO BE CONSTRUCTED AT APPROXIMATE COORDINATES NOTED IN TABLE 1 ON C-3101.
6. UP TO 2.7 m OF SEDIMENT AND DEBRIS TO BE REMOVED FROM THE CREEK AT EXISTING SAND RECOVERY STATIONS AND UP TO 4.3 m OF SEDIMENT, DEBRIS AND VEGETATION TO BE REMOVED FROM THE CREEK AT PROPOSED SAND RECOVERY STATIONS AS NOTED ON THE DRAWINGS OR AS DIRECTED IN THE FIELD.
7. TRIM EXISTING VEGETATION AROUND SAND RECOVERY STATION AS REQUIRED TO FACILITATE SEDIMENT REMOVAL. AT NO TIME SHALL VEGETATION BE REMOVED.
8. WITH THE WRITTEN APPROVAL OF THE ENGINEER, REMOVE EXISTING VEGETATION WITHIN PROJECT FOOTPRINT AS REQUIRED TO FACILITATE CONSTRUCTION.
9. CONTRACTOR MUST ISOLATE INSTREAM WORK AREAS FOR THE DURATION OF CONSTRUCTION TO PREVENT THE MIGRATION OF SEDIMENT DOWNSTREAM WHILE MAINTAINING THE NATURAL FLOW OF THE CREEK VIA TEMPORARY DIVERSION OR APPROPRIATE FILTER FABRIC (E.G. SILT CURTAIN). UPSTREAM FISH PASSAGE MUST BE MAINTAINED FOR THE DURATION OF CONSTRUCTION.
10. THE LOCATION OF ALL UTILITIES SHOWN ARE NOT GUARANTEED TO BE ACCURATE OR COMPLETE AND MUST BE CERTIFIED WITH THE UTILITY PRIOR TO PROCEEDING WITH CONSTRUCTION. THE CONTRACTOR IS RESPONSIBLE FOR COMFIRMING THE LOCATION OF ALL EXISTING SURFACE INFRASTRUCTURE AND UNDERGROUND UTILITIES WITH UTILITY COMPANIES AND PROPERTY OWNERS.

TABLE 1: APPROXIMATE LOCATIONS (1)

SITE	NORTHING	EASTING
B	5449875.620	554584.293
B-2	5449829.571	554577.891
B-3	5449803.140	554583.669
C	5449752.724	554552.017
C-2	5449767.088	554586.547
D	5449700.471	554564.750
E	5449672.748	554526.051
F	5449668.687	554452.276
G	5449636.978	554388.674
H	5449624.313	554342.881
I	5449594.440	554323.538
J	5449525.135	554334.676
K	5449497.890	554349.670
L	5449471.771	554379.908

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Associated Engineering

BEST MANAGED COMPANIES Platinum member

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — R. T. KARSGAARD # 58691
2024-07-25

PERMIT TO PRACTICE
ASSOCIATED ENGINEERING (B.C.) LTD.
PERMIT NUMBER: 1000163
Engineers & Geoscientists BC

REV	DATE	DESIGN	DRAWN	DESCRIPTION
1	2024/JUL22	R. KARGAARD	J. ROZON	ISSUED FOR RFP AND PERMITTING
0	2024/JUN14	R. KARSGAARD	J. ROZON	ISSUED FOR RFP

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: AS SHOWN

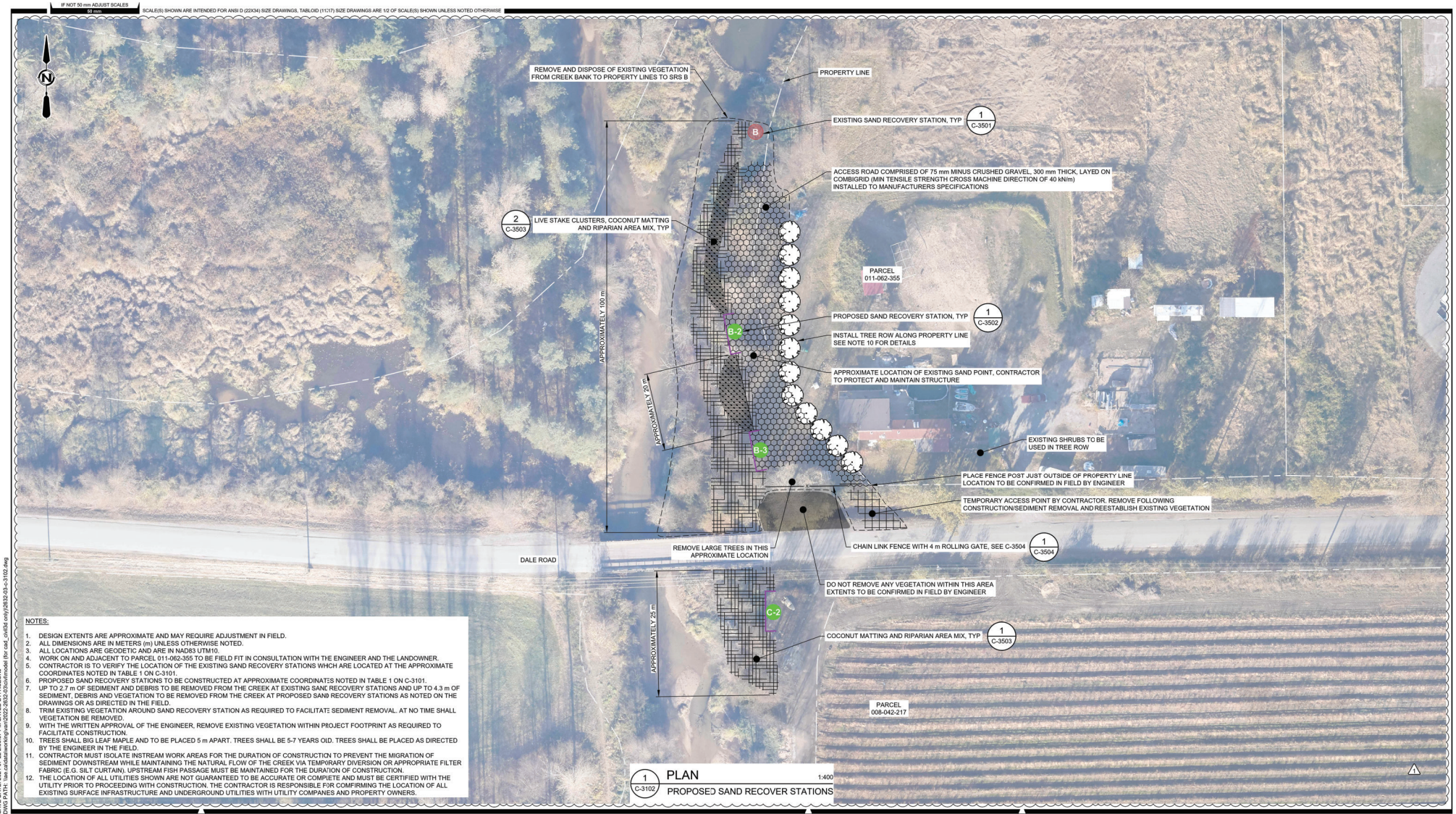
BRITISH COLUMBIA

CIVIL
PLAN
S-CR-14 SEDIMENT REMOVAL

DRAWING	REVISION	SHEET
2632-03-C-3101	1	3

IF NOT 50 mm ADJUST SCALES
50 mm

SCALE(S) SHOWN ARE INTENDED FOR ANSI D (22X34) SIZE DRAWINGS, TABLOID (11;17) SIZE DRAWINGS ARE 1/2 OF SCALE(S) SHOWN UNLESS NOTED OTHERWISE



1 C-3102 PLAN 1:400
PROPOSED SAND RECOVER STATIONS

NOTES:

1. DESIGN EXTENTS ARE APPROXIMATE AND MAY REQUIRE ADJUSTMENT IN FIELD.
2. ALL DIMENSIONS ARE IN METERS (m) UNLESS OTHERWISE NOTED.
3. ALL LOCATIONS ARE GEODETIC AND ARE IN NAD83 UTM10.
4. WORK ON AND ADJACENT TO PARCEL 011-062-355 TO BE FIELD FIT IN CONSULTATION WITH THE ENGINEER AND THE LANDOWNER.
5. CONTRACTOR IS TO VERIFY THE LOCATION OF THE EXISTING SAND RECOVERY STATIONS WHCH ARE LOCATED AT THE APPROXIMATE COORDINATES NOTED IN TABLE 1 ON C-3101.
6. PROPOSED SAND RECOVERY STATIONS TO BE CONSTRUCTED AT APPROXIMATE COORDINATES NOTED IN TABLE 1 ON C-3101.
7. UP TO 2.7 m OF SEDIMENT AND DEBRIS TO BE REMOVED FROM THE CREEK AT EXISTING SAND RECOVERY STATIONS AND UP TO 4.3 m OF SEDIMENT, DEBRIS AND VEGETATION TO BE REMOVED FROM THE CREEK AT PROPOSED SAND RECOVERY STATIONS AS NOTED ON THE DRAWINGS OR AS DIRECTED IN THE FIELD.
8. TRIM EXISTING VEGETATION AROUND SAND RECOVERY STATION AS REQUIRED TO FACILITATE SEDIMENT REMOVAL. AT NO TIME SHALL VEGETATION BE REMOVED.
9. WITH THE WRITTEN APPROVAL OF THE ENGINEER, REMOVE EXISTING VEGETATION WITHIN PROJECT FOOTPRINT AS REQUIRED TO FACILITATE CONSTRUCTION.
10. TREES SHALL BIG LEAF MAPLE AND TO BE PLACED 5 m APART. TREES SHALL BE 5-7 YEARS OLD. TREES SHALL BE PLACED AS DIRECTED BY THE ENGINEER IN THE FIELD.
11. CONTRACTOR MUST ISOLATE INSTREAM WORK AREAS FOR THE DURATION OF CONSTRUCTION TO PREVENT THE MIGRATION OF SEDIMENT DOWNSTREAM WHILE MAINTAINING THE NATURAL FLOW OF THE CREEK VIA TEMPORARY DIVERSION OR APPROPRIATE FILTER FABRIC (E.G. SILT CURTAIN). UPSTREAM FISH PASSAGE MUST BE MAINTAINED FOR THE DURATION OF CONSTRUCTION.
12. THE LOCATION OF ALL UTILITIES SHOWN ARE NOT GUARANTEED TO BE ACCURATE OR COMPLETE AND MUST BE CERTIFIED WITH THE UTILITY PRIOR TO PROCEEDING WITH CONSTRUCTION. THE CONTRACTOR IS RESPONSIBLE FOR COMFIRMING THE LOCATION OF ALL EXISTING SURFACE INFRASTRUCTURE AND UNDERGROUND UTILITIES WITH UTILITY COMPANES AND PROPERTY OWNERS.

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Associated Engineering

BEST MANAGED COMPANIES Platinum member

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA
R. T. KARSGAARD
58091
2024-07-25
FOR CIVIL

COLLEGE OF APPLIED BIOLOGISTS
Carrie-Lynn Nadeau
RPBio
2026
CAB
2024/Jul/26
FOR BIOENGINEERING

PERMIT TO PRACTICE
ASSOCIATED ENGINEERING (B.C.) LTD.
PERMIT NUMBER: 1000163
Engineers & Geoscientists BC

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0	2024/JUN14	R. KARSGAARD	J. ROZON	ISSUED FOR RFP

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: AS SHOWN

BRITISH COLUMBIA

CIVIL
PLAN
S-CR-14 PROPOSED SAND RECOVERY STATIONS

DRAWING	REVISION	SHEET
2632-03-C-3102	1	4

IF NOT 50 mm ADJUST SCALES
50 mm

SCALE(S) SHOWN ARE INTENDED FOR ANSI D (22X34) SIZE DRAWINGS, TABLOID (11;17) SIZE DRAWINGS ARE 1/2 OF SCALE(S) SHOWN UNLESS NOTED OTHERWISE



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TABLE 2: DEPTH RANGE

#		MIN.	MAX.
1		-2.8 m	-2.1 m
2		-2.1 m	-2.0 m
3		-2.0 m	-1.9 m
4		-1.9 m	-1.6 m
5		-1.6 m	-1.2 m
6		-1.2 m	-0.8 m
7		-0.8 m	-0.4 m
8		-0.4 m	-0.2 m
9		-0.2 m	0.8 m

TABLE 3: APPROXIMATE VOLUME REMOVAL

SITE	CUBIC METERS
B	250
B-2 AND B-3	950
C AND C-2	650
D	450
E	450
F	500
G	450
H	500
I	400
J	600
K	700
L	400
TOTAL	8250

PLOT DATE: 2024-07-25 11:53:46 AM
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Associated Engineering
BEST MANAGED COMPANIES Platinum member

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA R. T. KARSGAARD # 58691
2024-07-25

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ASSOCIATED ENGINEERING (B.C.) LTD.
PERMIT NUMBER: 1000163
Engineers & Geoscientists BC

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0	2024/JUN14	R. KARSGAARD	J. ROZON	ISSUED FOR RFP

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: AS SHOWN

BRITISH COLUMBIA

CIVIL
PLAN
S-CR-14 SEDIMENT REMOVAL EXTENTS

DRAWING	REVISION	SHEET
2632-03-C-3103	1	5

IF NOT 50 mm ADJUST SCALES
50 mm

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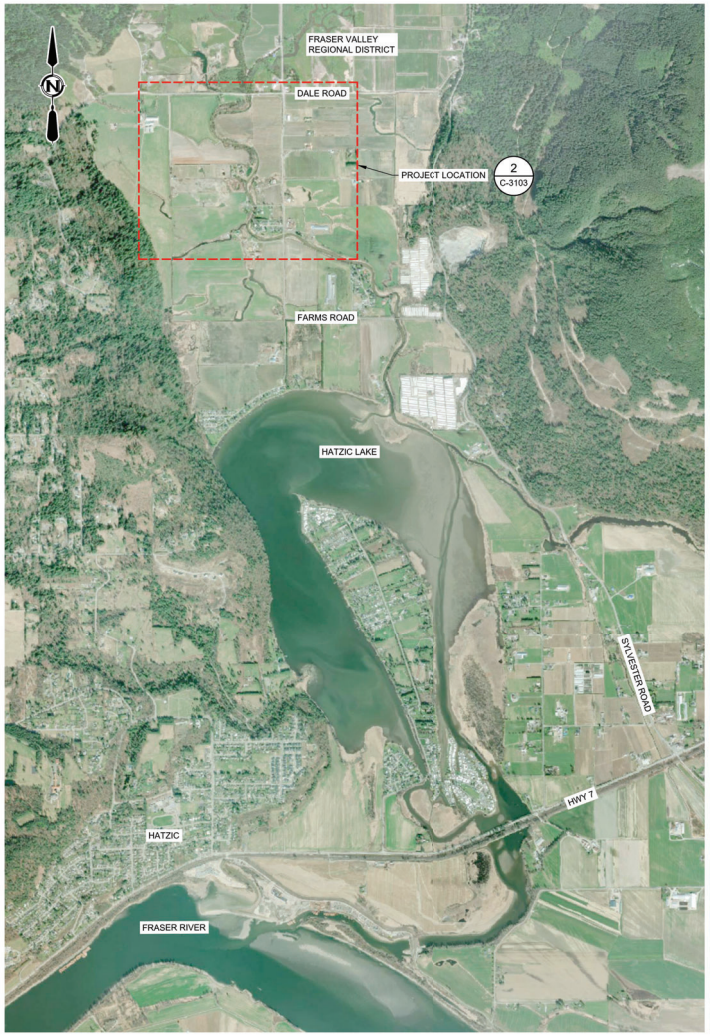
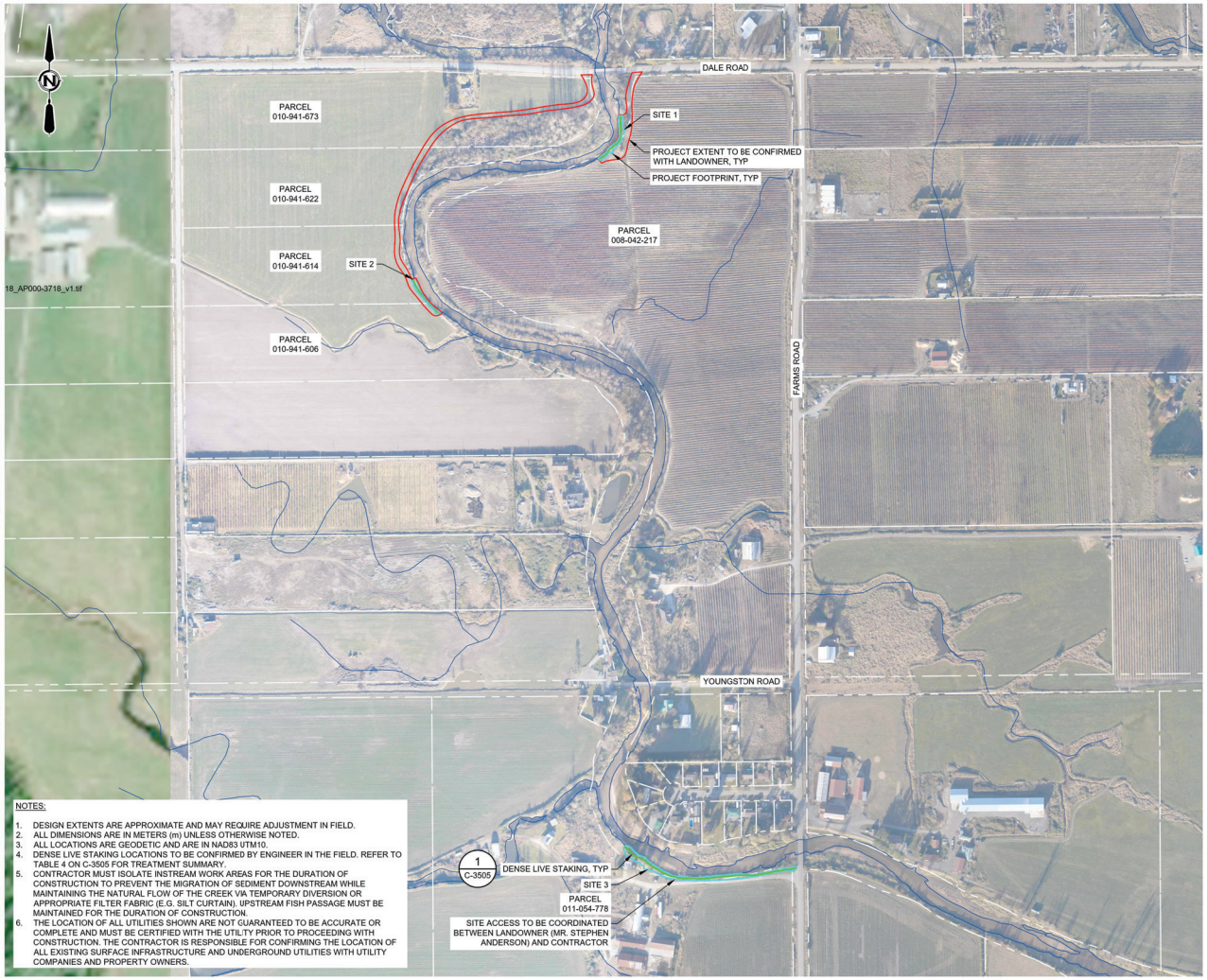


1 C-3103 PLAN NTS
REGIONAL AREA



NOTES:

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2. ALL DIMENSIONS ARE IN METERS (m) UNLESS OTHERWISE NOTED.
3. ALL LOCATIONS ARE GEODETIC AND ARE IN NAD83 UTM10.
4. DENSE LIVE STAKING LOCATIONS TO BE CONFIRMED BY ENGINEER IN THE FIELD. REFER TO TABLE 4 ON C-3505 FOR TREATMENT SUMMARY.
5. CONTRACTOR MUST ISOLATE INSTREAM WORK AREAS FOR THE DURATION OF CONSTRUCTION TO PREVENT THE MIGRATION OF SEDIMENT DOWNSTREAM WHILE MAINTAINING THE NATURAL FLOW OF THE CREEK VIA TEMPORARY DIVERSION OR APPROPRIATE FILTER FABRIC (E.G. SILT CURTAIN). UPSTREAM FISH PASSAGE MUST BE MAINTAINED FOR THE DURATION OF CONSTRUCTION.
6. THE LOCATION OF ALL UTILITIES SHOWN ARE NOT GUARANTEED TO BE ACCURATE OR COMPLETE AND MUST BE CERTIFIED WITH THE UTILITY PRIOR TO PROCEEDING WITH CONSTRUCTION. THE CONTRACTOR IS RESPONSIBLE FOR CONFIRMING THE LOCATION OF ALL EXISTING SURFACE INFRASTRUCTURE AND UNDERGROUND UTILITIES WITH UTILITY COMPANIES AND PROPERTY OWNERS.

2 C-3103 PLAN 1:3000
PROJECT LOCATION

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Carrie-Lynn Nadeau
RPBio
2026
CAB
2024/Jul/26

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ASSOCIATED ENGINEERING (B.C.) LTD.
PERMIT NUMBER: 1000163
Engineers & Geoscientists BC

REV	DATE	DESIGN	DRAWN	DESCRIPTION
1	2024JUL22	R. KARGAARD	J. ROZON	ISSUED FOR RFP AND PERMITTING
0	2024JUN14	R. KARSGAARD	J. ROZON	ISSUED FOR RFP

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: AS SHOWN

BRITISH COLUMBIA

CIVIL
PLAN
S-CR-14 EROSION PROTECTION

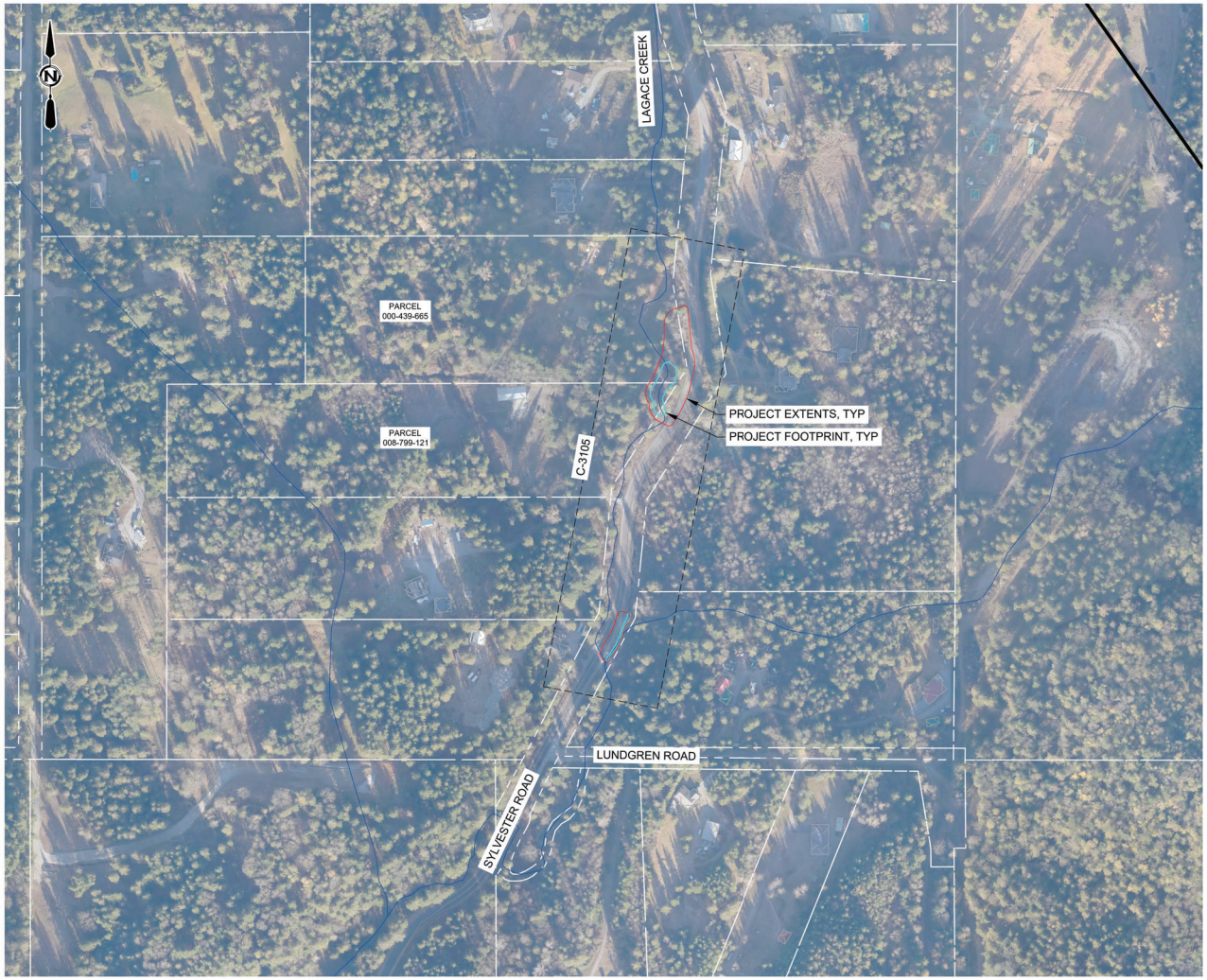
DRAWING	REVISION	SHEET
2632-03-C-3104	1	6

IF NOT 50 mm ADJUST SCALES
50 mm

SCALE(S) SHOWN ARE INTENDED FOR ANSI D (22X34) SIZE DRAWINGS, TABLOID (11:17) SIZE DRAWINGS ARE 1/2 OF SCALE(S) SHOWN UNLESS NOTED OTHERWISE



1 G-3104 PLAN NTS
REGIONAL AREA



2 G-3104 PLAN 1:2000
PROJECT LOCATION

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Associated Engineering

BEST MANAGED COMPANIES
Platinum member

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
R. T. KARSGAARD
58291
2024-07-25

PERMIT TO PRACTICE
ASSOCIATED ENGINEERING (B.C.) LTD.
PERMIT NUMBER: 1000163
Engineers & Geoscientists BC

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1	2024JUL05	R. KARGAARD	J. ROZON	ISSUED FOR RFP AND PERMITTING
0	2024JUN07	R. KARSGAARD	J. ROZON	ISSUED FOR RFP

BC MINISTRY OF ENVIRONMENT
AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY
WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: AS SHOWN

BRITISH COLUMBIA

CIVIL
PLAN
S-CR-17 SEDIMENT REMOVAL

DRAWING	REVISION	SHEET
2632-03-C-3105	1	7

IF NOT 50 mm ADJUST SCALES
50 mm

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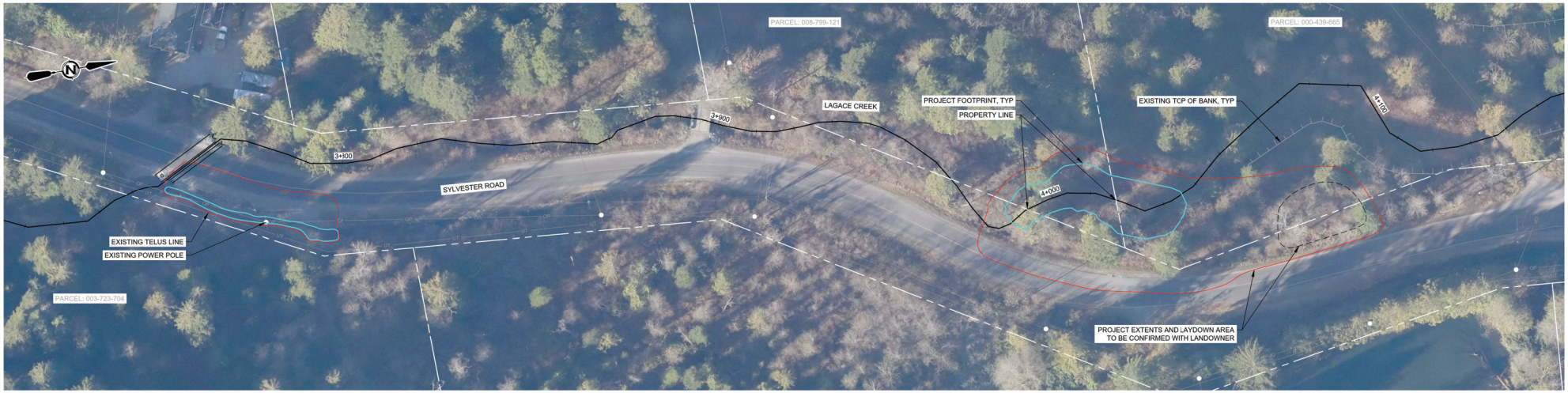
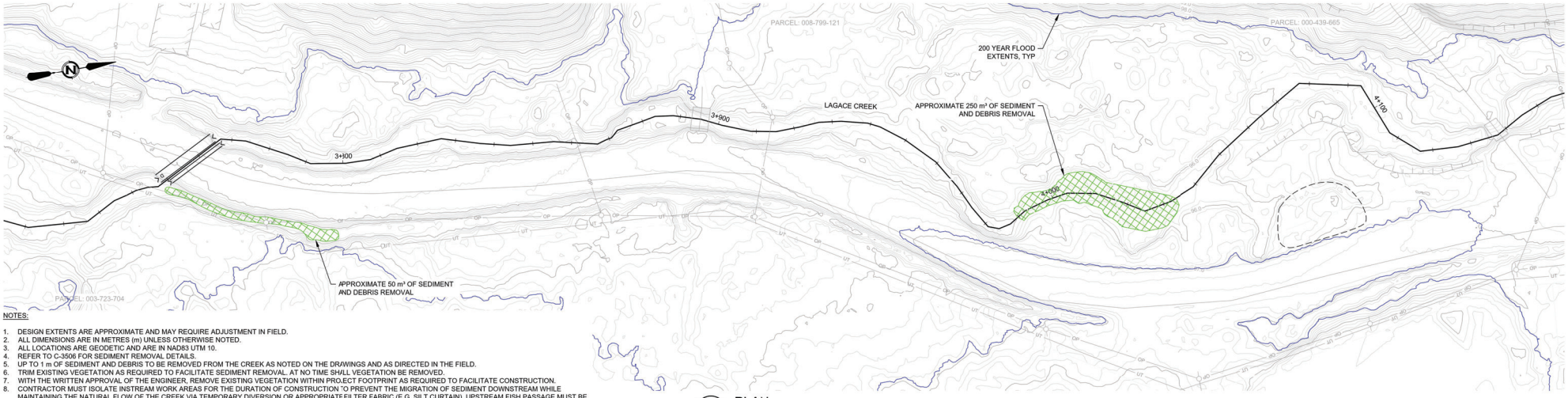


1 C-3105 PHOTO 1:500
EXISTING CONDITIONS



2 C-3105 PLAN 1:500
EXISTING CONDITIONS

NOTES:

1. DESIGN EXTENTS ARE APPROXIMATE AND MAY REQUIRE ADJUSTMENT IN FIELD.
2. ALL DIMENSIONS ARE IN METRES (m) UNLESS OTHERWISE NOTED.
3. ALL LOCATIONS ARE GEODETIC AND ARE IN NAD83 UTM 10.
4. REFER TO C-3506 FOR SEDIMENT REMOVAL DETAILS.
5. UP TO 1 m OF SEDIMENT AND DEBRIS TO BE REMOVED FROM THE CREEK AS NOTED ON THE DRAWINGS AND AS DIRECTED IN THE FIELD.
6. TRIM EXISTING VEGETATION AS REQUIRED TO FACILITATE SEDIMENT REMOVAL. AT NO TIME SHALL VEGETATION BE REMOVED.
7. WITH THE WRITTEN APPROVAL OF THE ENGINEER, REMOVE EXISTING VEGETATION WITHIN PROJECT FOOTPRINT AS REQUIRED TO FACILITATE CONSTRUCTION.
8. CONTRACTOR MUST ISOLATE INSTREAM WORK AREAS FOR THE DURATION OF CONSTRUCTION TO PREVENT THE MIGRATION OF SEDIMENT DOWNSTREAM WHILE MAINTAINING THE NATURAL FLOW OF THE CREEK VIA TEMPORARY DIVERSION OR APPROPRIATE FILTER FABRIC (E.G. SILT CURTAIN). UPSTREAM FISH PASSAGE MUST BE MAINTAINED FOR THE DURATION OF CONSTRUCTION.
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Associated Engineering

CANADA BEST MANAGED COMPANIES
Platinum member

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
R. T. KARSGAARD
58291
2024-07-25

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Engineers & Geoscientists BC

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BC MINISTRY OF ENVIRONMENT
AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY
WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: AS SHOWN

BRITISH COLUMBIA

CIVIL
PLAN
S-CR-17 SEDIMENT REMOVAL

DRAWING	REVISION	SHEET
2632-03-C-3106	1	8

IF NOT 50 mm ADJUST SCALES
50 mm

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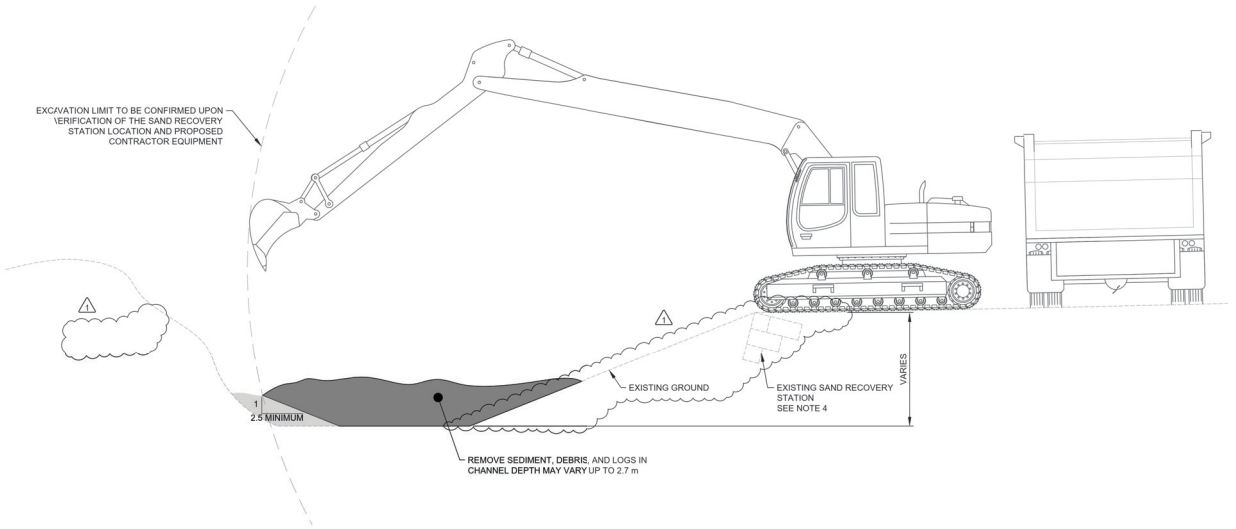

1 TYPICAL DETAIL NTS
EXISTING SAND RECOVERY STATION EXCAVATION

NOTES:

1. DESIGN EXTENTS ARE APPROXIMATE AND MAY REQUIRE ADJUSTMENT IN FIELD.
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R. T. KARSGAARD
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BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: AS SHOWN

BRITISH COLUMBIA

CIVIL
DETAIL 1 OF 6
EXISTING SAND RECOVERY STATION

DRAWING	REVISION	SHEET
2632-03-C-3501	1	9

IF NOT 50 mm ADJUST SCALES
50 mm
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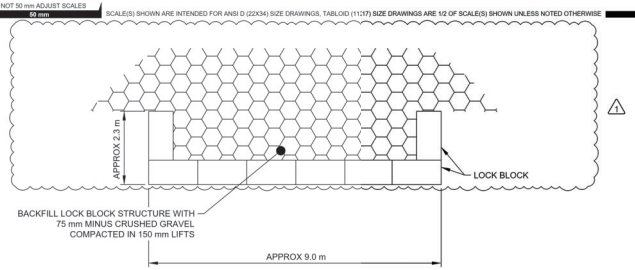
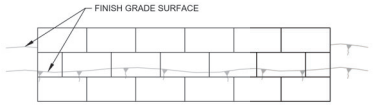


PLAN



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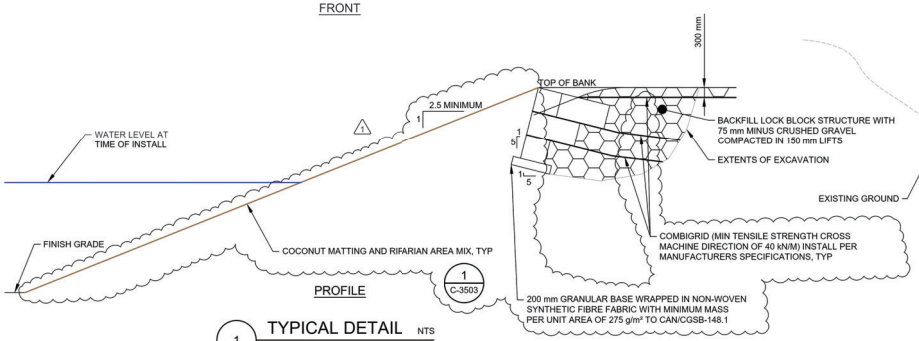
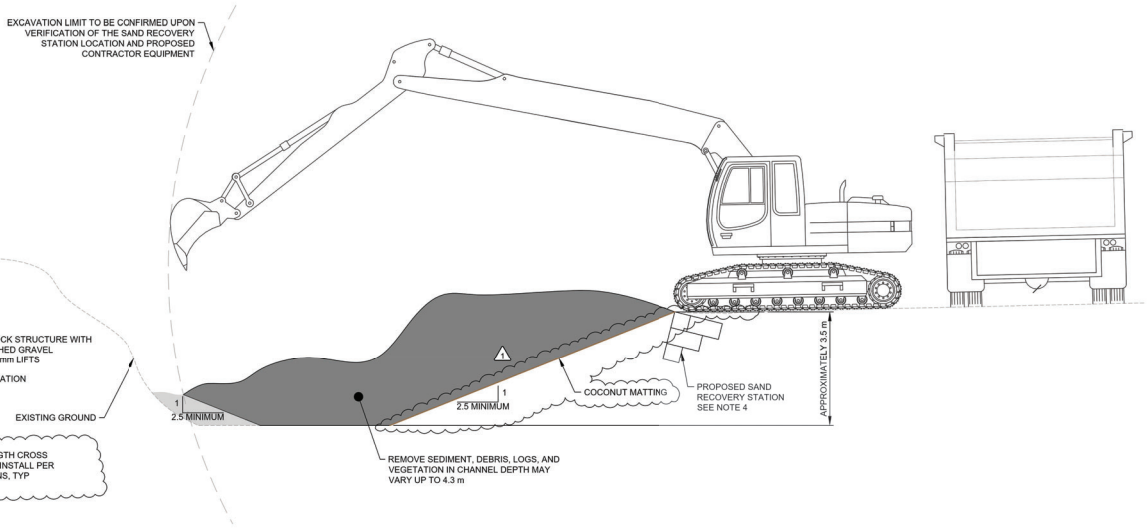


1 TYPICAL DETAIL NTS
LOCK BLOCK STRUCTURE



2 TYPICAL DETAIL NTS
PROPOSED SAND RECOVERY STATION EXCAVATION

NOTES:

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3. ALL LOCATIONS ARE GEODETIC AND ARE IN NAD83 UTM10.
4. CONTRACTOR IS TO VERIFY THE LOCATION OF THE EXISTING SAND RECOVERY STATIONS WHCH ARE LOCATED AT THE APPROXIMATE COORDINATES NOTED IN TABLE 1 ON C-3101.
5. PROPOSED SAND RECOVERY STATIONS TO BE CONSTRUCTED AT APPROXIMATE COORDINATES NOTED IN TABLE 1 ON C-3101.
6. UP TO 2.7 m OF SEDIMENT AND DEBRIS TO BE REMOVED FROM THE CREEK AT EXISTING SANE RECOVERY STATIONS AND UP TO 4.3 m OF SEDIMENT, DEBRIS AND VEGETATION TO BE REMOVED FROM THE CREEK AT PROPOSED SANE RECOVERY STATIONS AS NOTED ON THE DRAWINGS OR AS DIRECTED IN THE FIELD.
7. TRIM EXISTING VEGETATION AROUND SAND RECOVERY STATION AS REQUIRED TO FACILITATE SEDIMENT REMOVAL. AT NO TIME SHALL VEGETATION BE REMOVED.
8. WITH THE WRITTEN APPROVAL OF THE ENGINEER, REMOVE EXISTING VEGETATION WITHIN PROJECT FOOTPRINT AS REQUIRED TO FACILITATE CONSTRUCTION.
9. CONTRACTOR MUST ISOLATE INSTREAM WORK AREAS FOR THE DURATION OF CONSTRUCTION TO PREVENT THE MIGRATION OF SEDIMENT DOWNSTREAM WHILE MAINTAINING THE NATURAL FLOW OF THE CREEK VIA TEMPORARY DIVERSION OR APPROPRIATE FILTER FABRIC (E.G. SILT CURTAIN). UPSTREAM FISH PASSAGE MUST BE MAINTAINED FOR THE DURATION OF CONSTRUCTION.
10. THE LOCATION OF ALL UTILITIES SHOWN ARE NOT GUARANTEED TO BE ACCURATE OR COMPLETE AND MUST BE CERTIFIED WITH THE UTILITY PRIOR TO PROCEEDING WITH CONSTRUCTION. THE CONTRACTOR IS RESPONSIBLE FOR COMFIRMING THE LOCATION OF ALL EXISTING SURFACE INFRASTRUCTURE AND UNDERGROUND UTILITIES WITH UTILITY COMPANES AND PROPERTY OWNERS.

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PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA
R. T. KARSGAARD
58691
2024-07-25

PERMIT TO PRACTICE
ASSOCIATED ENGINEERING (B.C.) LTD.
PERMIT NUMBER: 1000163
Engineers & Geoscientists BC

REV	DATE	DESIGN	DRAWN	DESCRIPTION
1	2024/JUL22	R. KARGAARD	J. ROZON	ISSUED FOR RFP AND PERMITTING
0	2024/JUN14	R. KARSGAARD	J. ROZON	ISSUED FOR RFP

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: AS SHOWN

BRITISH COLUMBIA

CIVIL
DETAIL 2 OF 6
PROPOSED SAND RECOVERY STATION

DRAWING	REVISION	SHEET
2632-03-C-3502	1	10

IF NOT 50 mm ADJUST SCALES — 50 mm — SCALE(S) SHOWN ARE INTENDED FOR ANSI D (22X34) SIZE DRAWINGS, TABLOID (11X17) SIZE DRAWINGS ARE 1/2 OF SCALE(S) SHOWN UNLESS NOTED OTHERWISE

VEGETATED RIPRAP SPECIFICATIONS:

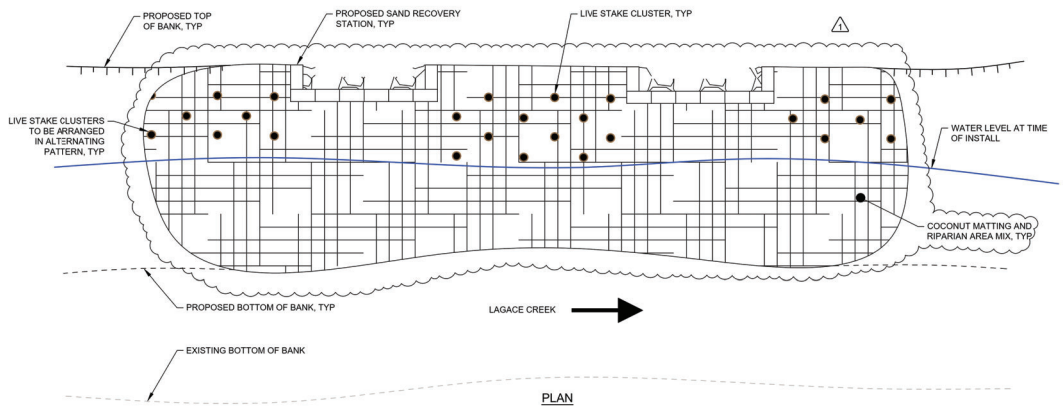
1. HARVESTING:
   - 1.1. THE HARVESTING OF LIVE STAKES IS TO BE CONDUCTED BY A LOCAL NURSERY OR QUALIFIED PROFESSIONAL EXPERIENCED WITH LIVE STAKING WITHIN 48 HOURS OF INSTALLATION. IF THIS TIME PERIOD IS NOT POSSIBLE, STAKES NEED TO BE PROPERLY STORED IN A COOL DARK LOCATION THAT IS CONSISTENTLY LESS THAN 5 DEGREES CELSIUS.
   - 1.2. HARVESTING SUITABLE NATIVE WILLOW AND RED OSIER-DOGWOOD SPECIES FROM WITHIN 100 KM OF THE PROPERTY AND WITHIN 300 M IN ELEVATION.
   - 1.3. SELECT NATIVE PLANTS GROWING IN SIMILAR CONDITIONS TO WHERE THEY WILL BE PLANTED: CONSIDER SUN EXPOSURE, DISTANCE TO WATER, AVAILABILITY OF SOIL NUTRIENTS
   - 1.4. DO NOT HARVEST FROM SENSITIVE AREAS, SUCH AS RIPARIAN AREAS WITH LIMITED VEGETATION OR PROTECTED AREAS.
   - 1.5. HARVESTING STRAIGHT CUTTINGS DURING THE DORMANT SEASON OCTOBER TO APRIL, AFTER LEAF DROP OR BEFORE LEAF OUT.
   - 1.6. SELECTING STRAIGHT STEMS 25 TO 75 MM IN DIAMETER AND 1.5 - 2M IN LENGTH.
   - 1.7. REMOVING SIDE BRANCHES BY CLIPPING THEM CLOSE TO THE MAIN STEM. USE AN AXE TO SHARPEN BOTTOM END OF THE STAKE ENSURING THAT BUD SCARS FACE UPWARD. AFTER INSTALL, CUT THE TOP END OF THE STEM HORIZONTALLY TO CREATE A FLAT SURFACE TO FACILITATE TAPPING IN STAKES, WHERE NEEDED.
   - 1.8. STORING LIVE STAKES IN CLEAN COOL WATER (IN A DRY DARK CELLAR OR A DRY COLD ROOM) FOR AT LEAST 24 HOURS UNTIL PLANTED FOR AT MOST 10 DAYS. IF YOU CANNOT PLANT THE CUTTINGS WITHIN 10 DAYS OF HARVESTING, CUTTINGS CAN BE STORED UNTIL YOU ARE READY TO PLANT THEM IN THE SHOULDER SEASONS (APRIL/MAY OR OCTOBER/NOVEMBER) FOR UP TO 8 WEEKS).

2. LIVE CLUSTER PREPARATION AND STAKING DURING CONSTRUCTION
   - 2.1. TO CREATE SOIL POCKETS FOR THE LIVE STAKE CLUSTERS DURING THE PREFERRED SHOULDER SEASON, SITE PREPARATION REQUIREMENTS INCLUDE:
     - 2.1.1. REMOVING ANY DEBRIS, ROCKS, OR OTHER OBSTRUCTIONS FROM THE PLANTING AREA ALONG THE RIPRAP SLOPE TO CREATE AN EASY PLANTING SURFACE.
     - 2.1.2. EXCAVATING THE SOIL FOR THE POCKET AREA TO A DEPTH OF 0.5 M DEPTH INTO NATIVE SOIL, TO ALLOW FOR ADEQUATE ROOT PENETRATION AND WATER ABSORPTION.
     - 2.1.3. STAGGERING THE PLACEMENT OF LIVE STAKE CLUSTERS SITES, AND SPACE STAKES 0.5 M APART, AS SHOWN IN TYPICAL DETAIL 2 ON C-3503, FOR AN ESTIMATED TOTAL OF 25 CLUSTERS.
     - 2.1.4. ENSURING THAT THE BASE OF THE SOIL POCKET EXCAVATION IS BETWEEN 0.5 m BELOW THE TOP OF BANK AND THE LOW WATER LEVEL AT TIME OF INSTALLATION, AS PER TYPICAL DETAIL 2 ON C-3503.
     - 2.1.5. ADDING TOPSOIL TO THE SOIL POCKET TO IMPROVE SOIL QUALITY AND FERTILITY. IMPORTING WEED-FREE TOPSOIL.
     - 2.1.6. STAKE CLUSTERS SHOULD BE PLACED APPROXIMATELY 0.25 m ABOVE THE TOE OF THE LOW WATER LEVEL AT TIME OF PLANTING.
     - 2.1.7. CUT COCONUT MATTING TO A LENGTH THAT WILL ENTIRELY WRAP AROUND THE SOIL POCKET ONCE BUILT (0.3 M DIAMETER), APPROXIMATELY 1 TO 2 M.
     - 2.1.8. ONCE RIPRAP IS INSTALLED TO THE CORRECT ELEVATION, CUT COCONUT MATTING IS TO BE LAID FLAT ON THE RIPRAP BELOW THE PREPARED SOIL POCKET EXCAVATION AREA.
     - 2.1.9. FOLLOWING TYPICAL DETAIL 2 ON C-3503, SOIL WILL BE PLACED ON THE COCONUT MATTING TO A DIAMETER OF 30 CM UP TO THE DEPTH OF THE RIPRAP. THE COCONUT MATTING ENDS ARE TO BE LEFT FREE TO BE WRAPPED AROUND THE SOIL POCKET.
     - 2.1.10. PLACE FOUR STAKES IN THE SOIL, AT 10 CM DISTANCE APART, THEN WRAP COCONUT MATTING AROUND THE SOIL AND STAKES MAKING A CIRCULAR CLUSTER THAT IS 30 CM IN DIAMETER. THEN CONTINUE PLACING RIPRAP.

3. INSTALLATION
   - 3.1. SUCCESSFUL INSTALLATION OF LIVE STAKING REQUIRES THAT:
   - 3.2. THE INSTALLATION OF LIVE STAKES IS COMPLETED WHILE THEY ARE DORMANT IN EARLY FALL TO MID-SPRING (OCTOBER TO MAY BEFORE LEAF-OUT OR AFTER LEAF DROP), IN UNFROZEN GROUND.
   - 3.3. LIVE STAKES SHOULD BE SOAKED FOR A MINIMUM OF 24 HOURS AND NO LONGER THAN 14 DAYS PRIOR TO PLANTING. CUTTINGS MAY BE SOAKED IN CONTAINERS. WHEN SOAKING, 100 PERCENT OF THE LENGTH OF THE CUTTING SHOULD BE IN CONTACT WITH WATER (ADDING WEIGHT MAY BE NECESSARY IF SOAKING IN HORIZONTAL POSITION). DO NOT STORE CUTTINGS ONSITE IN DRY AND/OR IN DIRECT SUNLIGHT CONDITIONS.
   - 3.4. AVOIDING THE SPLINTERING OR CRUSHING THE TOP OF CUTTINGS.
   - 3.5. A MINIMUM OF 80% BURIAL (CONTACT WITH SOIL) WITH AT LEAST 200 MM OF THE LIVE STAKE ABOVE THE RIPRAP.
   - 3.6. THAT FOUR LEAF BUDS SHOULD REMAIN ABOVE GROUND AND SHOULD BE FACING IN AN UPRIGHT DIRECTION.
   - 3.7. THAT IF CUTTINGS ARE DAMAGED DURING INSTALLATION, ONE IS TO REMOVE THE DAMAGED PORTION BY PROVIDING A CLEAN CUT BELOW THE DAMAGED SECTION.
   - 3.8. TAMPING SOIL AROUND LIVE STAKE AND ADDING SOIL, AS REQUIRED. WATER PRIOR TO AND AFTER INSTALLATION.

4. MAINTENANCE
   - 4.1. ALTHOUGH IT IS WEATHER AND STAKE ESTABLISHMENT DEPENDANT, MAINTENANCE OF THE LIVE STAKE CLUSTERS IS REQUIRED. A QUALIFIED ENVIRONMENTAL PROFESSIONAL (QEP) WILL BE CONSULTED WITH REGARDS TO A MAINTENANCE SCHEDULE. GENERALLY, MAINTENANCE OF THE LIVE STAKE CLUSTERS REQUIRES THAT PLANTINGS BE WATERED FROM APRIL 2024 THROUGH 2025 AT THE FOLLOWING FREQUENCY:
   - 4.2. TWICE PER MONTH APRIL TO MAY,
   - 4.3. ONCE PER WEEK FROM JUNE THROUGH THE END OF JULY,
   - 4.4. TWICE PER WEEK FROM AUGUST TO THE END OF SEPTEMBER, AND
   - 4.5. ONCE PER WEEK FROM EARLY OCT UNTIL PRECIPITATION EVENTS OCCUR (RAIN OR SNOW).

NOTE:
DEPENDING ON PRECIPITATION LEVELS FOR THE FIRST TWO GROWING SEASONS, WATERING MAY NEED TO OCCUR FOR THREE GROWING SEASONS. IN ADDITION TO REGULAR WATERING, REMOVAL OF INVASIVE WEEDS MAY BE REQUIRED.

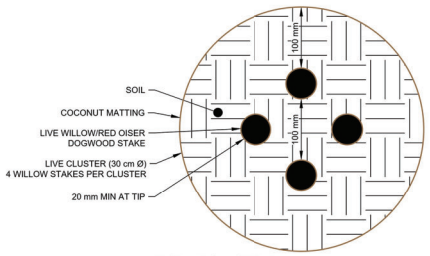


PLAN

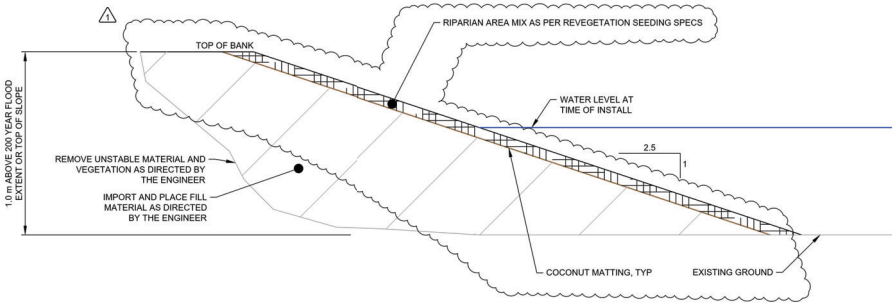
NOTE:
CLUSTER NUMBERS MAY CHANGE DUE TO CHANGING SITE CONDITIONS. THE TARGET IS ONE CLUSTER PER 3 m², 0.5 m BELOW TOP OF BANK, AND 0.25 m ABOVE WATER LEVEL AT TIME OF INSTALL.

1

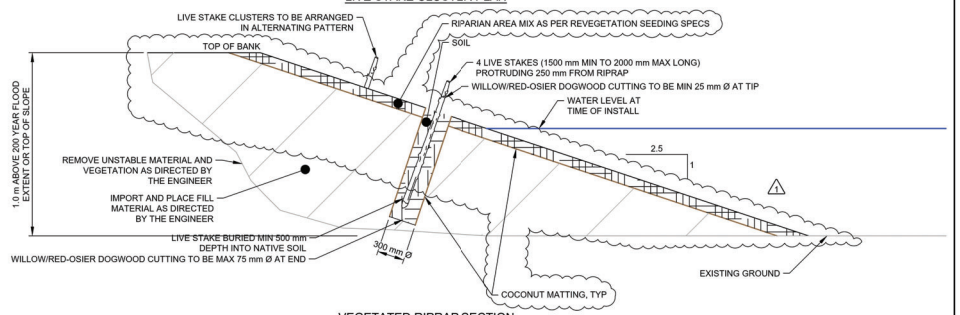
DISCLAIMER:
BIOENGINEERING IS A NATURE-BASED SOLUTION THAT IS DEPENDANT UPON THE VIABILITY OF THE PRESCRIBED MATERIALS, THE EXPERIENCE OF INSTALLERS, AND POST-INSTALLATION WATERING OR WEEDING. SAID VIABILITY IS CONTINGENT ON MANY FACTORS OUTSIDE OF THE DESIGNER'S CONTROL SUCH AS CLIMACTIC CONDITIONS, ENVIRONMENTAL FACTORS, AND HUMAN INTERACTIONS. THE NOTED DESIGN MEETS THE PROJECT DESIGN INTENT; HOWEVER, NO GUARANTIES ARE INFERRED OR IMPLIED.



LIVE STAKE CLUSTER PLAN



1 TYPICAL DETAIL NTS
100 kg CLASS RIPRAP



VEGETATED RIPRAP SECTION

2 TYPICAL DETAIL NTS
VEGETATED RIPRAP

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PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA R. T. KARSGAARD # 58691
2024-07-25
FOR CIVIL

COLLEGE OF APPLIED BIOLOGISTS Carrie-Lynn Nadeau RPBio 2026 CAB
2024/Jul/26
FOR BIOENGINEERING

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PERMIT NUMBER: 1000163
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0	2024/JUN14	R. KARSGAARD	J. ROZON	ISSUED FOR RFP

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

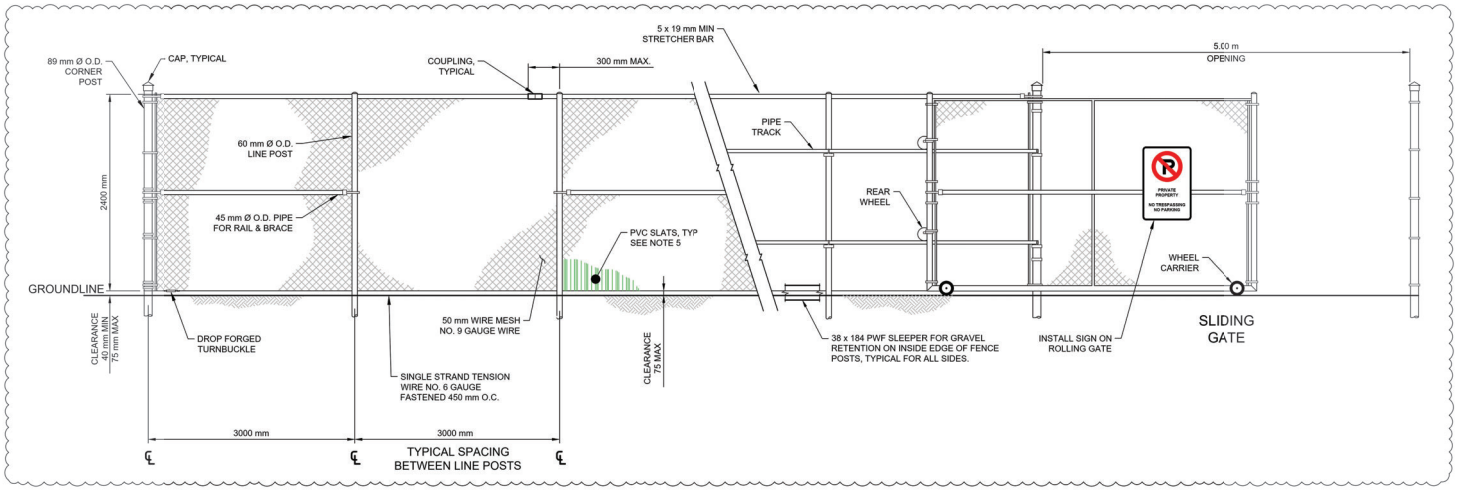
SCALE: AS SHOWN

BRITISH COLUMBIA

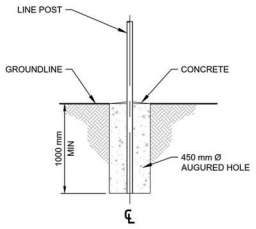
CIVIL
DETAIL 3 OF 6
BANK PROTECTION

DRAWING	REVISION	SHEET
2632-03-C-3503	1	11

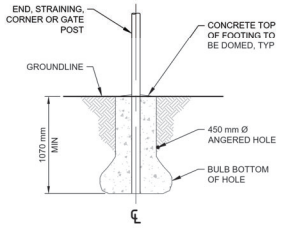
IF NOT 50 mm ADJUST SCALES
50 mm
SCALE(S) SHOWN ARE INTENDED FOR ANSI D (22X34) SIZE DRAWINGS, TABLOID (11:17) SIZE DRAWINGS ARE 1/2 OF SCALE(S) SHOWN UNLESS NOTED OTHERWISE



1 C-3102 DETAIL NTS
FENCE AND ROLLING GATE



2 TYPICAL DETAIL NTS
LINE POST SUPPORT IN EARTH



3 TYPICAL DETAIL NTS
CORNER, END AND GATE POST SUPPORT IN EARTH

NOTES:

1. DESIGN EXTENTS ARE APPROXIMATE AND MAY REQUIRE ADJUSTMENT IN FIELD.
2. ALL DIMENSIONS ARE IN METERS (m) UNLESS OTHERWISE NOTED.
3. ALL LOCATIONS ARE GEODETIC AND ARE IN NAD83 UTM10.
4. CONTRACTOR IS TO VERIFY THE PLACEMENT OF FENCE AND GATE WITH ENGINEER AND PROPERTY OWNER.
5. PVC SLATS SHALL BE PLACED WITHIN THE WIRE MESH. COLOUR TO BE GREEN THAT MATCHES THE SURROUNDING VEGETATION.
6. WITH THE WRITTEN APPROVAL OF THE ENGINEER, REMOVE EXISTING VEGETATION WITHIN PROJECT FOOTPRINT AS REQUIRED TO FACILITATE CONSTRUCTION.
7. THE LOCATION OF ALL UTILITIES SHOWN ARE NOT GUARANTEED TO BE ACCURATE OR COMPLETE AND MUST BE CERTIFIED WITH THE UTILITY PRIOR TO PROCEEDING WITH CONSTRUCTION. THE CONTRACTOR IS RESPONSIBLE FOR COMFIRMING THE LOCATION OF ALL EXISTING SURFACE INFRASTRUCTURE AND UNDERGROUND UTILITIES WITH UTILITY COMPANES AND PROPERTY OWNERS.

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PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
R. T. KARSGAARD
58291
2024-07-25

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PERMIT NUMBER: 1000163
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1	2024JUL22	R. KARGAARD	J. ROZON	ISSUED FOR RFP AND PERMITTING
0	2024JUN14	R. KARSGAARD	J. ROZON	ISSUED FOR RFP

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: AS SHOWN

BRITISH COLUMBIA

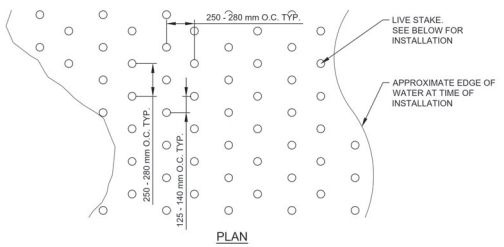
CIVIL
DETAIL 4 OF 6
FENCE AND GATE INSTALLATION

DRAWING	REVISION	SHEET
2632-03-C-3504	1	12

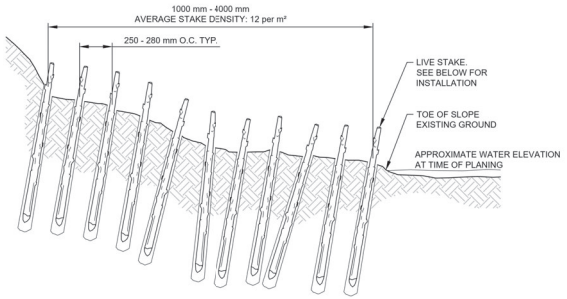
IF NOT 50 mm ADJUST SCALES
50 mm
SCALE(S) SHOWN ARE INTENDED FOR ANSI D (22X34) SIZE DRAWINGS, TABLOID (11;17) SIZE DRAWINGS ARE 1/2 OF SCALE(S) SHOWN UNLESS NOTED OTHERWISE

BIOENGINEERING SPECIFICATIONS:

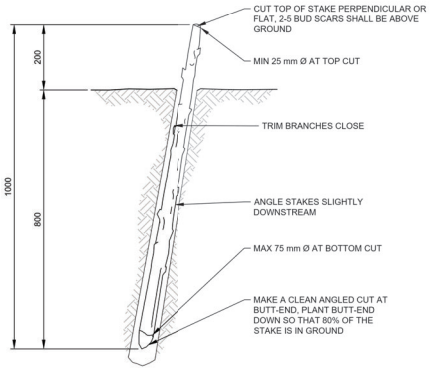
1. PLANT MATERIAL
   - 1.1. ONLY NATIVE SPECIES WILL BE INSTALLED. SOURCE NATIVE PLANT MATERIAL IN CLOSE PROXIMITY TO THE PROJECT SITE. PLANT MATERIAL WILL BE SOURCED FROM WITHIN 100 km OF LAGACE CREEK, SUBJECT TO APPROVAL OF THE OWNER.
   - 1.2. PLANTS SHALL BE GENERALLY TRUE TO TYPE AND STRUCTURALLY SOUND, HEALTHY AND VIGOROUS AND FREE OF DISEASE, INSECT INFESTATIONS, INSECT EGGS, WILDLIFE DAMAGE, SUNSCALD, FROST CRACKS AND MECHANICAL WOUNDS. STEMS SHALL BE COVERED IN SMOOTH BARK (I.E. NOT FURROWED). PRUNING CUTS SHALL SHOW VIGOROUS BARK ON ALL EDGES AND ALL PARTS SHALL BE MOIST AND SHOW LIVE, GREEN CAMBIUM TISSUE WHEN CUT.
   - 1.3. LIVE CUTTINGS FROM NATIVE STANDS:
     - 1.3.1. LOCATION OF CUTTINGS TO BE DOCUMENTED AND SUBMITTED TO THE OWNER PRIOR TO COLLECTION. TARGET HARVESTING FROM WITHIN LAGACE CREEK PROJECT FOOTPRINT (WITHIN THE DREDGING FOOTPRINT), IF THE TIMING WINDOW IS APPROPRIATE FOR HARVESTING, SEE NOTE 1.5.
     - 1.3.2. CUTTINGS WILL NOT BE TAKEN FROM WITHIN LAGACE CREEK CHANNEL MARGINS WHERE NO DREDGING IS OCCURRING.
     - 1.3.3. COLLECTION FOR LIVE STAKING WILL OCCUR UNDER SUPERVISION OF PERSONNEL WITH TRAINING AND EXPERIENCE IN LIVE STAKING.
   - 1.4. ACCEPTABLE SPECIES INCLUDE:
     - 1.4.1. NATIVE WILLOW SPECIES (SALIX SP)
   - 1.5. HARVESTING OF CUTTINGS
     - 1.5.1. HARVEST CUTTINGS ONLY DURING THE DORMANT SEASON (BETWEEN LEAF-OFF INFALL AND PRIOR TO SPRING BUD BREAK). SELECT STEMS THAT ARE A MINIMUM OF 25 mm AT THE TOP AND A MAXIMUM OF 75 mm AT THE BOTTOM IN DIAMETER, KEEPING THEM FULL LENGTH UNTIL THE TIME OF INSTALLATION WHERE POSSIBLE. DURING HARVEST, SIDE BRANCHES SHOULD BE REMOVED BY CLIPPING THEM CLOSE TO THE MAIN STEM.
     - 1.5.2. STAKE LENGTHS SHOULD BE A MINIMUM OF 1.25 m AND A MAXIMUM OF 2.0 m.
     - 1.5.3. CUT STEMS TO LENGTH BASED ON THE DETAIL DRAWINGS AFTER INSTALLATION.
     - 1.5.4. WRAP CUTTINGS INTO MANAGEABLE BUNDLES USING NATURAL TWINE, AND BURLAP. FOR FUTURE REFERENCE, MARK EACH BUNDLE WITH FLAGGING TAPE, AND RECORD THE SPECIES AND HARVESTING DATE AND GENERAL LOCATION.
     - 1.5.5. HARVEST HEALTHY, STRAIGHT AND LIVE WOOD AT LEAST 1 YEAR OLD.
   - 1.6. PREPARATION:
     - 1.6.1. PRIOR TO INSTALLATION, SOAK CUTTINGS FOR A MINIMUM OF 24 HOURS AND NO LONGER THAN 14 DAYS. CUTTINGS MAY BE SOAKED IN CONTAINERS. POTABLE OR CREEK WATER IS ACCEPTABLE, AND NO ADDITIVES ARE REQUIRED. WATER TEMPERATURE SHOULD MIMIC THE CREEK TEMPERATURE FOR THE TARGETED TIME OF INSTALLATION.
     - 1.6.2. APPROXIMATELY 80 TO 100 PERCENT OF THE LENGTH OF THE CUTTING SHOULD BE IN CONTACT WITH WATER (WEIGHT ON TOP IF SOAKING IN A HORIZONTAL POSITION).
   - 1.7. STORAGE:
     - 1.7.1. IF CUTTINGS ARE NOT INSTALLED WITHIN 14 DAYS, PLACE WRAPPED BUNDLES IN COLD STORAGE (BETWEEN -5 AND -1°C) WITH A MINIMUM OF 80% RELATIVE HUMIDITY. CUTTINGS IN STORAGE >-1°C CAN ONLY BE STORED FOR 1-3 MONTHS. STORAGE FOR OVER 3 MONTHS REQUIRES COLDER TEMPERATURES, STORE STAKES AT THE ULTIMATE MAXIMUM OF 180 DAYS (6 MONTHS); HOWEVER, THE PREFERRED MAXIMUM IS 120 DAYS (4 MONTHS). IF STAKES ARE TO BE STORED FOR MORE THAN 4 MONTHS, HARVEST 1/3 MORE THAN THE PRESCRIPTION REQUIRES TO ACCOUNT FOR DIE-OFF IN STORAGE.
     - 1.7.2. WHEN TAKING STAKES OUT OF STORAGE, PRIOR TO PREPARATION, ENSURE THE STEMS ARE LIVE BY SCRAPING A SMALL SECTION OF THE BARK, GREEN SHOULD BE REVEALED UNDERNEATH.
     - 1.7.3. TRANSPORT TO SITE AND SUBSEQUENT STORAGE PRIOR TO INSTALLATION SHALL OCCUR IN A COOL ENVIRONMENT. STAKES MUST BE INSTALLED WITHIN 24 HOURS OF DELIVERY TO THE SITE. SHOULD INSTALLATION BE DELAYED BEYOND THIS PERIOD, THE STAKES ARE TO BE STORED IN A SHADED AREA WHILE IMMERSED IN WATER.
2. ENVIRONMENTAL MANAGEMENT
   - 2.1. ONLY USE ACCESS POINTS INTO THE CHANNEL AS IDENTIFIED ON DRAWING C-3104.
   - 2.2. FOLLOW ALL BEST MANAGEMENT PRACTICES, EROSION CONTROL MITIGATION MEASURES, SITE ISOLATION METHODS AND ANY OTHER APPLICABLE MEASURES IN THE CEMP AT ALL TIMES.
   - 2.3. WORK "IN THE DRY" AND MAINTAIN AN ISOLATED WORKSITE FROM WATER AND FISH AT ALL TIMES, IF THE WORKSITE BECOMES WETTED FROM SURFACE OR GROUNDWATER SEEPING INTO THE SITE, STOP WORKS AND RE-ISOLATE THE SITE. FISH MUST BE SALVAGED FROM ISOLATED WORK ZONES.
   - 2.4. DO NOT DISTURB, DAMAGE OR REMOVE ANY EXISTING NATIVE VEGETATION. IF VEGETATION IS PRESENT, WORK AROUND THE STEMS WITHOUT DAMAGING THEM.
3. INSTALLATION
   - 3.1. DENSE LIVE STAKING:
     - 3.1.1. LIVE CUTTINGS WILL BE INSTALLED IN THE DORMANT SEASON (WHEN THE LEAVES HAVE DROPPED OFF THE STEMS IN THE LATE FALL, OR BEFORE BUDS START TO GROWN AND OPEN IN THE EARLY SPRING).
     - 3.1.2. ONLY WILLOW CUTTINGS WILL BE USED.
     - 3.1.3. CUTTINGS UP TO 1.25 m LONG ARE INSTALLED APPROXIMATELY 1.0 m DEEP.
     - 3.1.4. CUTTINGS MUST NOT PROTRUDE FROM THE SURFACE MORE THAN 25 cm IN LENGTH.
     - 3.1.5. APPLY THIS TREATMENT ALONG THE TOE OF THE CREEK BANKS SLOPES, IN LOCATIONS SHOWN ON C-3104, WHERE THE CHANNEL MARGIN IS UNVEGETATED. WIDTH OF TREATMENT WILL BE SELECTED IN THE FIELD AND DEPENDS ON SITE CHARACTERISTICS. INSTALL STAKES FROM THE WATERS EDGE UP THE BANK TO A MAXIMUM OF 4 m (HORIZONTAL) WIDTH.
     - 3.1.6. DO NOT INSTALL CUTTINGS WHERE VEGETATION IS GROWING.
     - 3.1.7. MAKE CLEAN CUTS AND DO NOT DAMAGE STAKES OR SPLIT ENDS DURING INSTALLATION; USE A PLANTING BAR (1.5 m LONG STRAIGHT HEAVY IRON BAR WITH A POINTED END) AND CREATE THE PILOT HOLE TO A DEPTH OF 1.0 m. DO NOT USE LIVE STAKES TO CREATE THE PILOT HOLES AS THIS WILL DAMAGE THEIR BARK AND COMPROMISE THE VIABILITY OF THE STAKE. PILOT HOLES CAN ALSO BE CREATED WITH A HAND DRILL AUGER BUT LIVE STAKES MUST BE PLANTED TO A MINIMUM DEPTH OF 0.8 m.
     - 3.1.8. HAND INSTALLATION ONLY.
     - 3.1.9. LIGHTLY TAMP THE STAKE INTO THE HOLE WITH A RUBBER MALLET, TAKING CARE NOT TO SPLIT THE END, TRIM THE STAKE TO DESIRED LENGTH, AND TAMP THE SEDIMENT AROUND THE STAKE FOLLOWING INSTALLATION.
     - 3.1.10. THE INSTALLATION ANGLE OF THE CUTTING IN THE SEDIMENT MAY VARY. SLIGHT ANGLE DOWNSTREAM IS PREFERRED.
     - 3.1.11. KEEP ALL ACTIVITY AND FOOT TRAFFIC ABOVE WATER TO PREVENT EROSION AND SEDIMENTATION.
     - 3.1.12. WIDTH OF TOE STAKING SHALL VARY BASED ON SITE CONDITIONS DURING INSTALLATION.
     - 3.1.13. START TOE STAKING JUST ABOVE WATER AT TIME OF CONSTRUCTION (TO BE INSTALLED DURING LOW FLOW.)
     - 3.1.14. DO NOT DISTURB OR DAMAGE EXISTING NATIVE WOOD VEGETATION GROWING IN TREATMENT AREA.
     - 3.1.15. INSTALL LIVE STAKES IN AND AROUND EXISTING NATIVE WOODY VEGETATION, ADJUST TREATMENT SPECIFICATIONS IN THE FIELD AS NECESSARY TO AVOID WOODY VEGETATION.
4. WATERING
   - 4.1. WATER THE CUTTINGS IMMEDIATELY AFTER INSTALLATION.
   - 4.2. A WATERING PROGRAM WILL BE IMPLEMENTED THE FIRST GROWING SEASON AFTER PLANTING (WHEN SOIL TEMPERATURES ARE 5°C OR ABOVE) AS PER THE SCHEDULE IN 4.5, UNLESS IT HAS RAINED OVER 5 mm WITHIN 2-3 DAYS OF PLANNED WATERING.
   - 4.3. THE CONTRACTOR IS RESPONSIBLE FOR ACQUIRING THE WATER SOURCE AND THE WATERING PROGRAM, ALONG WITH ALL REQUIRED PERMITS AND LAND PERMISSIONS.
   - 4.4. WATERING DEPTH TARGET IS BETWEEN 250 mm MINIMUM AND 500 mm MAXIMUM, TO BE ADJUSTED DEPENDING ON SOIL MOISTURE CONDITIONS. SOIL SHOULD BE MOIST UP TO 1500 mm MINIMUM AFTER WATERING.
   - 4.5. WATERING SCHEDULE:
     - 4.5.1. WATER ONCE PER MONTH WHEN WEEKLY TEMPERATURES ARE, ON DAILY AVERAGE, BETWEEN 5-10°C AT SITE.
     - 4.5.2. WATER TWICE PER MONTH WHEN WEEKLY TEMPERATURES ARE, ON DAILY AVERAGE, BETWEEN 11-15°C AT SITE.
     - 4.5.3. WATER WEEKLY, WHEN WEEKLY TEMPERATURES ARE, ON DAILY AVERAGE, BETWEEN 16-25°C AT SITE.
     - 4.5.4. WATER BI-WEEKLY, WHEN WEEKLY TEMPERATURES ARE, ON DAILY AVERAGE, BETWEEN 26-35°C AT SITE.
     - 4.5.5. WATER THREE TIMES PER WEEK WHEN WEEKLY TEMPERATURES ARE, ON DAILY AVERAGE, 36°C AND ABOVE AT SITE.
   - 4.6. THE SELECTED WATERING METHODOLOGY MUST NOT CAUSE EROSION.
   - 4.7. THE SELECTED WATERING METHODOLOGY MUST NOT CAUSE HARM OR DISTURB NATIVE VEGETATION GROWING ONSITE.



PLAN



CROSS SECTION



CROSS SECTION

1 TYPICAL DETAIL NTS
DENSE LIVE STAKING

TABLE 4: DENSE LIVE STAKING TREATMENT SUMMARY			
LOCATION	APPROXIMATE AREA	APPROXIMATE LINEAR METERS	AVERAGE DENSITY
SITE 1	120 m²	80 m	12 PER m²
SITE 2	100 m²	50 m	
SITE 3	500 m²	240 m	

NOTE:
CONTRACTOR IS SOLELY RESPONSIBLE FOR CONFIRMING THE NUMBER OF STEMS REQUIRED

1

DISCLAIMER:
BIOENGINEERING IS A NATURE-BASED SOLUTION THAT IS DEPENDANT UPON THE VIABILITY OF THE PRESCRIBED MATERIALS, THE EXPERIENCE OF INSTALLERS, AND POST-INSTALLATION WATERING OR WEEDING. SAID VIABILITY IS CONTINGENT ON MANY FACTORS OUTSIDE OF THE DESIGNER'S CONTROL SUCH AS CLIMACTIC CONDITIONS, ENVIRONMENTAL FACTORS, AND HUMAN INTERACTIONS. THE NOTED DESIGN MEETS THE PROJECT DESIGN INTENT; HOWEVER, NO GUARANTEES ARE INFERRED OR IMPLIED.

PLOT DATE: 2024-07-25 12:07:47 PM
SAVE DATE: 2024-07-24 9:07:24 AM SAVED BY: ELLINGSONJ
DWG PATH: \\ae.ca\data\work\kng\van\2022-2632-03\cad\model (for cad_civil)\34 only\2632-03-c-3505.dwg

Associated Engineering
BEST MANAGED COMPANIES Platinum member

COLLEGE OF APPLIED BIOLOGISTS
Carrie-Lynn Nadeau
RPBio
2026
CAB
2024/Jul/26

PERMIT TO PRACTICE
ASSOCIATED ENGINEERING (B.C.) LTD.
PERMIT NUMBER: 1000163
Engineers & Geoscientists BC

REV	DATE	DESIGN	DRAWN	DESCRIPTION
1	2024/JUL22	R. KARGAARD	J. ROZON	ISSUED FOR RFP AND PERMITTING
0	2024/JUN14	R. KARSGAARD	J. ROZON	ISSUED FOR RFP

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

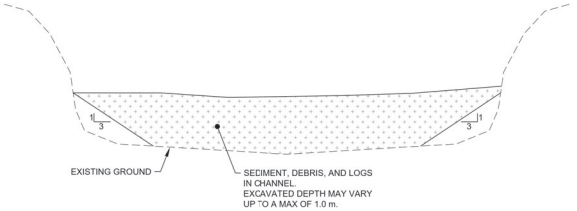
SCALE: AS SHOWN

BRITISH COLUMBIA

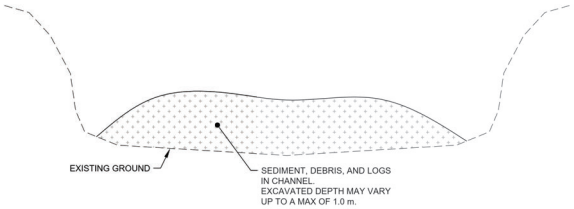
CIVIL
DETAIL 5 OF 6
DENSE LIVE STAKING

DRAWING	REVISION	SHEET
2632-03-C-3505	1	13

IF NOT 50 mm ADJUST SCALES
50 mm
SCALE(S) SHOWN ARE INTENDED FOR ANSI D (22X34) SIZE DRAWINGS, TABLOID (11;17) SIZE DRAWINGS ARE 1/2 OF SCALE(S) SHOWN UNLESS NOTED OTHERWISE



1 TYPICAL SECTION NTS
DEBRIS/SEDIMENT REMOVAL - FULL CHANNEL



2 TYPICAL SECTION NTS
DEBRIS/SEDIMENT REMOVAL - PARTIAL CHANNEL

PLOT DATE: 2024-07-25 12:08:02 PM
SAVE DATE: 2024-07-05 11:54:31 AM SAVED BY: ROZONJ
DWG PATH: \\ae-cal\data\working\van\2022-2632-03\civil\model (for cad_civil3d only)\2632-03-c-3506.dwg

Associated Engineering

BEST MANAGED COMPANIES
Platinum member

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
R. T. KARSGAARD
50691
2024-07-25

PERMIT TO PRACTICE
ASSOCIATED ENGINEERING (B.C.) LTD.
PERMIT NUMBER: 1000163
Engineers & Geoscientists BC

REV	DATE	DESIGN	DRAWN	DESCRIPTION
1	2024/JUL05	R. KARGAARD	J. ROZON	ISSUED FOR RFP AND PERMITTING
0	2024/JUN14	R. KARSGAARD	J. ROZON	ISSUED FOR RFP

BC MINISTRY OF ENVIRONMENT
AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY
WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: AS SHOWN

BRITISH COLUMBIA

CIVIL
DETAIL 6 OF 6
SEDIMENT REMOVAL

DRAWING	REVISION	SHEET
2632-03-C-3506	1	14

APPENDIX B – ENVIRONMENTAL APPROVAL DOCUMENTS

Fisheries and Oceans Canada
Pêches et Océans Canada

Regional Director General
Pacific Region
Suite 200 - 401 Burrard Street
Vancouver, BC
V6C 3S4

Directrice générale régionale
Région du Pacifique
Pièce 200 - 401 rue Burrard
Vancouver (C.-B.)
V6C 3S4

Our file *Notre référence*
22-HPAC-01308

Ministry of Environment and Climate Change Strategy,
Environmental Protection Division,
Environmental Emergencies and Land Remediation Branch
Attention: Thyren Jacobs
P.O. Box 9337
Victoria BC
V8W 9M1

Via email: thyren.jacobs@gov.bc.ca

Dear Thyren Jacobs:

Subject: BC Flood 2021: 22-HPAC-01308 – Sediment Removal and Bank Protection, Pattison, Carratt and Davies Creeks, Hatzic Valley – *Fisheries Act* Authorization (Emergency Circumstances)

Pursuant to Paragraphs 34.4(2)(b) and 35(2)(b) for the authorization for work, undertaking or activity resulting in death of fish and harmful alteration, disruption or destruction of fish habitat under the *Fisheries Act,* Fisheries and Oceans Canada (DFO) authorizes the carrying on of your proposed work, undertaking or activity that results in:

- the death of fish by means other than fishing and the harmful alteration, disruption or destruction of fish habitat which are prohibited under subsections 34.4(1) and 35(1) of the *Fisheries Act*.

This authorization to complete emergency debris removal works within multiple creeks (Carratt, Davies, Eng, Legace, McNab, North Herford, Pattison and South Herford) in response to the catastrophic flooding in mid-November 2021 under paragraphs 34.4(2)(b) and 35(2)(b) of the Fisheries Act is attached.

Failure to comply with any of the terms or conditions of the attached authorization may lead to prosecution under the *Fisheries Act* and *Species at Risk Act.*

A copy of this authorization should be kept on site while the work is in progress and upon request be provided to relevant federal or provincial officials. The authorization holder is responsible for ensuring work crews are familiar with, and able to adhere to, the conditions.

Please note that information submitted to DFO will be shared with Indigenous peoples with whom DFO has consulted in relation to the Crown's Duty to Consult if your proposed work(s), undertaking(s) or activity(ies) may adversely affect Aboriginal or treaty rights.

Information pertaining to this authorization will be posted to the *Fisheries Act* Registry Dataset and accessible from the Department's website at https://www.dfo-mpo.gc.ca/pnw-ppe/registry-registre-eng.html as well as from the Open Government DFO Registry Portal at: https://open.canada.ca/data/en/dataset/2c09d2fd-9a8e-4d8c-b5af-95747e36eaac. Projects-specific information will continue to be posted online, as the Department continues to develop its own Registry resources. Updates to the data set will be released monthly.

Any disclosure of information will be conducted in accordance with the *Access to Information Act* and the *Privacy Act*. Should you have any documents that contain sensitive or proprietary information that you believe should be protected from public disclosure, please contact us to discuss whether and how the information may be protected.

If you or anyone conducting work on your behalf have any questions please contact Nicci Zargarpour at our Vancouver office at Nicci.Zargarpour@dfo-mpo.gc.ca.

Yours sincerely,

Reid, Rebecca
Digitally signed by Reid, Rebecca
Date: 2022.10.27 11:20:49 -07'00'

Rebecca Reid
Regional Director General
Pacific Region
Fisheries and Oceans Canada

ATTACHMENT: AUTHORIZATION

c.c.: Associated Environmental Consultants Inc: Naomi Sands, sandsn@ae.ca; Jennifer Prive, privej@ae.ca; Andrew Wiens, wiensa@ae.ca; Tim Stanley, Price Waterhouse Coopers, tim.stanley@pwc.ca.

Fisheries and Oceans Canada | Pêches et Océans Canada

PATH No.: 22-HPAC-01308

Paragraphs 34.4(2)(b) and 35(2)(b) *Fisheries Act* Authorization
EMERGENCY AUTHORIZATION

Authorization issued to
BC Ministry of Environment and Climate Change Strategy (MoECCS)

Attention to:
Thyren Jacobs
PO Box 9337 Stn Prov Govt
Victoria, B.C.
V8W 9M1 *(hereafter referred to as the "Proponent")*

Location of Proposed Project

Nearest community (city, town, village): Mission
Municipality, district, township, county: Fraser Valley Regional District
Province: British Columbia
Name of watercourse, waterbody and coordinates:

Priority sites:

1. CR-12 - Pattison Creek (near Sylvester Road): 49.224318°, -122.225164°
2. CR-28 - Carratt Creek (at Carratt Road bridge): 49.262427°, -122.217317°
3. CR-38 - Davies Creek: 49.175456°, -122.227440°

Remaining nine (lower priority) sites:

4. CR-13 - Legace Creek (near 11744 Stave Lake Road): 49.215732°, -122.251508°
5. CR-14 - Legace Creek (at 10491 Farms Road): 49.191343°, -122.250592°
6. CR-15 - Legace Creek (at Seux Road): 49.217294°, -122.236456°
7. CR-16 - Legace Creek (from confluence with Pattison Creek to Seux Road Bridge): 49.131411°, `122.135081°
8. CR-17 - Legace Creek (between Pattison Creek and Allan Lake)
   Site 1 - Failed Driveway: 49.235909°, -122.218453°
   Site 2 - Legace Creek Tributary: 49.240045°, -122.217729°
9. CR-34 - South Herford Creek: 49.208806°, -122.230723°
10. CR-35 - McNab Creek: 49.245478°, -122.216991°
11. CR-36 - Eng Creek: 49.249415°, -122.217877°
12. CR-37 - North Herford Creek: 49.209358°, -122.231182°

Valid Authorization Period

This Authorization remains in force from the **Date of Issuance** until **December 31, 2030**.

Please note that this Authorization may contain more specific timing requirements and limitations. These are set out in the Conditions of Authorization section.

Canada

Description of Proposed Project

The proposed project of which the work, undertaking or activity authorized is a part of involves:

- Emergency works to remove accumulations of sediment, organic debris or anthropogenic debris ("debris") in locations where it poses a risk to downstream infrastructure (e.g., bridges or homes) under high flow conditions in the 2022 fall and 2023 spring periods; and/or
- Completing emergency works to stabilize bank slopes and implement erosion protection measures.

The project is described in the following documents, hereafter referred to collectively as the "Project Plan":

- Application Form and supporting documents for the Issuance of an Authorization under Paragraphs 34.4(2)(b) and 35(2)(b) of the *Fisheries Act* (Emergency Situation) received on October 13, 2022.
- The *Ministry of Environment and Climate Change Strategy: Pattison, Carratt and Davies Creeks – Sediment Removal and Bank Protection Environmental Management* Plan report produced by Associated Environmental Consultants Inc. dated October 2022.

Description of Authorized work(s), undertaking(s) or activity(ies) likely to result in the death of fish by means other than fishing and/or the harmful alteration, disruption or destruction of fish habitat:

- Site isolation using either pumps or temporary diversion channels;
- Removal of watercourse substrate (including sediment or debris) using excavators, large trucks, and hand tools;
- Relocation and/or removal of large woody debris from the watercourses using excavators, large trucks, and hand tools;
- Bank repairs and installation of erosion protection measures; and
- Removal of riparian vegetation for site access.

The authorized work(s), undertaking(s), or activity(ies) are likely to result in the following impacts to fish and fish habitat:

- Alteration, disruption and alteration of aquatic habitat including substrate removal and replacement likely to result in a reduction in habitat availability and complexity, and cause sedimentation.
- Site isolation leading to a temporary disruption to fish passage which may impact life history stages including spawning, migration, overwintering and rearing.
- Alteration and disruption to stream bank habitat likely to result in a reduction in habitat function of both the aquatic and riparian habitat.
- Alteration, disruption and destruction of riparian habitat for site access.

Riparian and aquatic footprints of the above WUAs for Pattison, Carratt and Davies Creeks shall not exceed what is described in the Project Plan. For the nine lower-priority sites, riparian and aquatic footprints shall not exceed what is required to alleviate flood risk based on the Risk Assessment Methodology of the Project Plan.

Conditions of Authorization

The above described work, undertaking or activity must be carried on in accordance with the following conditions.

1. **Conditions that relate to the period during which the work, undertaking or activity can be carried on**

   The work, undertaking or activity that is/are authorized to be carried on during the following period:

   FROM: Date of Issuance TO: December 31, 2023

   If the Proponent cannot complete the work, undertaking or activity during this period, Fisheries and Oceans Canada (DFO) must be notified in advance of the expiration of the above time period. An application for amendment, suspension or cancellation of the authorization should be submitted to DFO.

   The periods during which other conditions of this authorization must be complied with are provided in their respective sections below.

2. **Conditions that relate to measures and standards to avoid and mitigate impacts to fish and fish habitat**.

2.1 Works, undertakings, and activities shall be conducted in a manner that avoids the death of fish.

2.2 A Qualified Environmental Professional will be onsite during high-risk instream and riparian works (e.g., substrate removal, riparian vegetation removal) to oversee/direct avoidance and mitigation measures to reduce impacts to fish and fish habitat and avoid unauthorized death of fish by means other than fishing and harmful alteration, disruption and destruction of fish habitat.

2.2.1 Conduct full time observations for all fish species that may be present near and within the project footprint and modify or direct works to the extent possible to avoid or minimize potential injury and death of fish;

2.2.2 Prior to sediment removal and other instream disturbances, isolate work site(s) and salvage fish;

2.2.3 Fish salvage methodologies should consider the winter nocturnal activity of juvenile salmonids (e.g. Pacific salmon and trout species) that may spend the day concealed in the stream substrates. Where isolation occurs, conduct fish salvage between dusk and dawn (sunset/sunrise) when fish emerge to forage, to avoid and mitigate against the death of juvenile fish;

2.2.4 Relocate all salvaged fish species from the work area, or those holding below a work area, back to the same watercourse in a nearby area that is not impacted by construction or removal works or its zone of influence (i.e., areas of higher turbidity due to instream works);

2.2.5 Conduct full time monitoring for deleterious substance released during the removal of sediment and direct avoidance and mitigation measures to reduce impacts to fish and fish habitat and avoid unauthorized death of fish by means other than fishing and harmful alteration, disruption and destruction of fish habitat and to prevent their further movement into the watercourse; and

2.2.6 Monitor implementation of the conditions of this authorization.

2.3 Sediment and erosion control: Sediment and erosion control measures must be in place and shall be upgraded and maintained, such that release of sediment is avoided at the location of the authorized work, undertaking, or activity. Monitor the watercourse for signs of sedimentation resulting from the works, undertakings or activities and take corrective action if required.

2.3.1 Areas of streambank disturbed during the works shall be rehabilitated to a stable condition (e.g. re-sloped and contoured) and protected from erosion.

2.4 List of measures and standards to avoid and mitigate impacts to fish and fish habitat:

2.4.1 Every reasonable effort should be made to minimize the frequency and duration of instream works, including excavation. Work from established infrastructure, above the high water mark (i.e., top of bank), or at a minimum above the water line when possible. Restrict instream disturbance to the area(s) required to access and remove accumulations of sediment;

2.4.2 Fish passage is to be maintained around the isolated work zones through the implementation of a diversion channel where practicable. Sites with expected adult salmon presence with spawning and/or overwintering habitat upstream should be prioritized for a diversion channel. If a diversion channel is not practicable and fish are observed holding below the work zone, ongoing fish salvage is required to relocate fish around the work zone;

2.4.3 Large woody debris can only be removed from the floodplain if it poses imminent risk to downstream infrastructure and property. Where possible, stockpile the natural debris removed from the floodplain to an area that can be accessed for future restoration work. Reinstall root wads or large woody debris below the high water mark where practicable;

2.4.4 Do not stockpile materials such as rock, riprap, or dirt in areas where the material has the potential to enter fish-bearing waters;

2.4.5 Maintain all machinery on site in a clean condition and free of fluid leaks. All heavy equipment should use environmentally friendly oil ("enviro-oil");

2.4.6 Fuel should be stored a minimum of 30 m from any watercourse. Wash, refuel and service machinery and store fuel and other materials for the machinery in such a way as to prevent any deleterious substances from entering the watercourse;

2.4.7 Have spill containment and clean-up materials within operating machinery and vehicles and on site in case of leaking deleterious substances (e.g., fuel, oil, grease) from extracted anthropogenic debris. Report leaks or spills of deleterious substances that have caused, or are about to cause, the unauthorized death of fish by means other than fishing and/or the harmful alteration, disruption or destruction of fish habitat to DFO.PACViolations-infractionsPAC.MPO@dfo-mpo.gc.ca and to Observe, Record, Report at 1-800-465-4336 or DFO.ORR-ONS.MPO@dfo-mpo.gc.ca;

2.4.8 Dispose of all anthropogenic debris removed at an appropriate waste management facility as required; and

2.4.9 Works must be conducted in the dry. Follow DFO's interim Codes of Practice for Temporary Cofferdams and Diversion Channels (https://www.dfo-mpo.gc.ca/pnw-ppe/codes/cofferdams-batardeaux-eng.html), Temporary Stream Crossings (https://www.dfo-mpo.gc.ca/pnw-ppe/codes/temporary-crossings-traversees-temporaires-eng.html) and End-of-Pipe Fish Protection Screens for Small Water Intakes in Freshwater (https://www.dfo-mpo.gc.ca/pnw-

ppe/codes/screen-ecran-eng.html) if isolation and pumping is required. If works cannot be conducted in the dry due to high flow conditions, the work area must be decommissioned and fish passage reinitiated until conditions allow for site isolation.

2.5 Avoid removal of riparian vegetation, particularly mature trees, as much as possible. Where removal of riparian vegetation is not avoidable:

2.5.1 Prune or top the vegetation instead of grubbing/uprooting;

2.5.2 Construct access points and approaches perpendicular to the watercourse;

2.5.3 Rehabilitate areas of the streambank disturbed during the works to a stable condition (e.g., sloped and contoured and protected from erosion);

2.5.4 Re-vegetate disturbed areas with native trees, shrubs and grasses species suitable for the site; and

2.5.5 Where possible, incorporate bioengineering (i.e., pocket planting, live staking, root wad placement, etc.) within the bank restoration and erosion protection designs.

2.6 Avoid the installation of riprap bank slopes to the extent practicable.

2.7 Avoid works, undertakings or activities in Critical Habitat (as defined under the *Species at Risk Act*), or the handling or harm of species listed as Threatened or Endangered under the *Species at Risk Act*. If these aforementioned works, undertakings, or activities are required, works must stop and Proponent shall contact DFO for additional guidance and/or permitting.

2.8 Contingency measures shall be put in place if monitoring required in section 3 below indicates that the measures and standards to avoid and mitigate impacts to fish and fish habitat are not successful.

2.9 Dates by which these measures and standards shall be implemented: Measures and standards to avoid and mitigate impacts to fish and fish habitat shall be implemented prior to the initiation of works, undertakings or activities.

3. **Conditions that relate to monitoring and reporting of measures and standards to avoid and mitigate impacts to fish and fish habitat**.

3.1 Monitoring of avoidance and mitigation measures: The Proponent shall monitor the implementation of avoidance and mitigation measures referred to in section 2 of this authorization and report to DFO, **within 30 days post-construction**, and indicate whether the measures and standards to avoid and mitigate impacts to fish and fish habitat were conducted according to the conditions of this authorization. This shall be done by:

3.1.1 Demonstration of effective implementation and functioning: Providing dated photographs and inspection reports to demonstrate effective implementation and functioning of mitigation measures and standards described above to limit the impacts to fish and fish habitat to what is covered by this authorization; and

3.1.2 Contingency measures: Providing details of any contingency measures that were followed, to prevent impacts greater than those covered by this authorization in the event that mitigation measures did not function as described.

3.2 Other monitoring and reporting conditions:

3.2.1 Providing dated photographs of each debris removal, inspection reports and details outlining how each condition of this Authorization was met, and whether avoidance and mitigation measures were effective in reducing or limiting serious harm to fish to what is authorized herein;

3.2.2 Providing a geospatial polygon that accurately represents the completed HADD footprint(s). Geospatial polygon data should be collected using WGS 1984 to four (4) decimal places (e.g., 28.5234°N, 80.6830°W). Geospatial polygon data must be supplied in Shape File (.shp) format to ReferralsPacific@dfo-mpo.gc.ca with reference to DFO file: 22-HPAC-01308. In addition to the geospatial polygon, the following data must also be supplied in an Excel file (i.e., metadata):

- The date of sediment/debris removal, the type of debris removed (e.g., log jam, boulders etc.), the watercourse of removal, the coordinates of removal, if leaks or spills of deleterious substances were documented and mitigation measures to contain and clean leaks and spills;
- The type of HADD (e.g., riparian removal, aquatic footprint, etc.), the date of the HADD, and HADD area per habitat type (based on depth during high and low water seasons, high water mark); and
- Brand name and model of GPS unit, the coordinate system used, and guaranteed accuracy of GPS unit; and

3.2.3 Providing a summary of observational mortality for the death of fish (e.g., eggs, alevins, fry) by means other than fishing related to the works, undertakings or activities.

3.2.4 Providing a summary of the fish salvaged. The information summarized shall include dates, the number of individuals salvaged, the location of salvage and relocation, and the nature of any effects to fish salvaged (capture, death, sub-lethal harm, etc.).

3.2.5 Providing details of any contingency measures that were followed, should prescribed mitigations not function as intended, to contain the impacts to fish and fish habitat to that which is authorized herein.

4. Conditions that relate to offsetting

4.1 Upon receipt and review of the monitoring results and supporting documentation outlined in section 3 above, DFO will determine whether offsetting is required.

4.2 If offsetting is required, the Proponent shall prepare a draft offsetting plan, consistent with the DFO's *Policy for Applying Measures to Offset Adverse Effects on Fish and Fish Habitat Under the Fisheries Act* and *Applicant's Guide Supporting the "Authorizations Concerning Fish and Fish Habitat Protection Regulations"* and provide it to DFO within 45 days of receipt that an Offsetting Plan is required.

4.3 If offsetting is required, the offsetting plan shall include the information identified in Schedule 1, Section 16 of the *Authorizations Concerning Fish and Fish Habitat Protection Regulations,* including an offsetting effectiveness monitoring plan.

4.4 Once acceptable to DFO, the offsetting plan shall be implemented with any additional requirements from DFO.

Authorization Limitations and Application Conditions

The Proponent is solely responsible for plans and specifications relating to this authorization and for all design, safety and workmanship aspects of all the works associated with this authorization.

The holder of this authorization is hereby authorized under the authority of Paragraphs 34.4(2)(b) and 35(2)(b) of the *Fisheries Act*. R.S.C., 1985, c.F-14, to carry on the work(s), undertaking(s) and/or activity(ies) that are likely to result in impacts to fish and fish habitat as described herein.

This authorization does not purport to release the applicant from any obligation to obtain permission from or to comply with the requirements of any other regulatory agencies.

This authorization does not permit the deposit of a deleterious substance in water frequented by fish. Subsection 36(3) of the *Fisheries Act* prohibits the deposit of any deleterious substances into waters frequented by fish unless authorized by regulations made by Governor in Council.

It is also your *Duty to Notify* DFO if you have caused, or are about to cause, the unauthorized death of fish by means other than fishing and/or the harmful alteration, disruption or destruction of fish habitat. Such notifications should be directed to DFO.PACViolations-InfractionsPAC.MPO@dfo-mpo.gc.ca **and** to Observe, Record, Report at 1-800-465-4336 or DFO.ORR-ONS.MPO@dfo-mpo.gc.ca.

The failure to comply with any condition of this authorization constitutes an offence under Paragraph 40(3)(a) of the *Fisheries Act,* and may result in charges being laid under said Act.

A copy of this authorization should be kept on site while the work is in progress and upon request be provided to relevant federal or provincial officials. The authorization holder is responsible for ensuring work crews are familiar with, and able to adhere to, the conditions.

This authorization cannot be transferred or assigned to another party. If the work(s), undertaking(s) or activity(ies) authorized to be conducted pursuant to this authorization are expected to be sold or transferred, or other circumstances arise that are expected to result in a new Proponent taking over the work(s), undertaking(s) or activity(ies), the Proponent named in this authorization shall advise DFO in advance.

Date of Issuance:

Approved by: Reid, Rebecca Digitally signed by Reid, Rebecca Date: 2022.10.27 11:15:46 -07'00'

Rebecca Reid
Regional Director General
Pacific Region
Fisheries and Oceans Canada

Fisheries and Oceans Canada | Pêches et Océans Canada

Paragraphs 34.4(2)(b) and 35(2)(b) *Fisheries Act* Authorization
EMERGENCY AUTHORIZATION

November 2023 Amendment[1]

Authorization issued to
BC Ministry of Environment and Climate Change Strategy (MoECCS)

Attention to:
Thyren Jacobs
PO Box 9337 Stn Prov Govt
Victoria, B.C.
V8W 9M1 *(hereafter referred to as the "Proponent")*

Location of Proposed Project

Nearest community: Mission
District: Fraser Valley Regional District
Province: British Columbia
Name of watercourses and coordinates:

Priority sites:

1. CR-12 - Pattison Creek (near Sylvester Road): 49.224318°, -122.225164°
2. CR-28 - Carratt Creek (at Carratt Road bridge): 49.262427°, -122.217317°
3. CR-38 - Davies Creek: 49.175456°, -122.227440°

Remaining nine (lower priority) sites:

4. CR-13 - Legace Creek (near 11744 Stave Lake Road): 49.215732°, -122.251508°
5. CR-14 - Legace Creek (at 10491 Farms Road): 49.191343°, -122.250592°
6. CR-15 - Legace Creek (at Seux Road): 49.217294°, -122.236456°
7. CR-16 - Legace Creek (from confluence with Pattison Creek to Seux Road Bridge): 49.131411°, -122.135081°
8. CR-17 - Legace Creek (between Pattison Creek and Allan Lake)
   Site 1 - Failed Driveway: 49.235909°, -122.218453°
   Site 2 - Legace Creek Tributary: 49.240045°, -122.217729°
9. CR-34 - South Herford Creek: 49.208806°, -122.230723°
10. CR-35 - McNab Creek: 49.245478°, -122.216991°
11. CR-36 - Eng Creek: 49.249415°, -122.217877°
12. CR-37 - North Herford Creek: 49.209358°, -122.231182°

Valid Authorization Period

This Authorization remains in force from the **Date of Issuance** until **December 31, 2030**.

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[1] This is the first amendment to *Fisheries Act* Authorization 22-HPAC-01308 originally issued on October 27, 2022. Amendments to this Authorization will be highlighted in footnotes.

Please note that this Authorization may contain more specific timing requirements and limitations. These are set out in the Conditions of Authorization section.

Description of Proposed Project

The proposed project of which the work, undertaking or activity authorized is a part of involves:

- Emergency works to remove accumulations of sediment, organic debris or anthropogenic debris ("debris") in locations where it poses a risk to downstream infrastructure (e.g., bridges or homes) under high flow conditions between 2022 and 2024[2], and/or
- Completing emergency works to stabilize bank slopes and implement erosion protection measures.

The project is described in the following documents, hereafter referred to collectively as the "Project Plan":

- Application Form and supporting documents for the Issuance of an Authorization under Paragraphs 34.4(2)(b) and 35(2)(b) of the *Fisheries Act* (Emergency Situation) received on October 13, 2022.
- *The Ministry of Environment and Climate Change Strategy: Pattison, Carratt and Davies Creeks – Sediment Removal and Bank Protection Environmental Management Plan* report produced by Associated Environmental Consultants Inc. dated October 2022.

Description of Authorized work(s), undertaking(s) or activity(ies) likely to result in the death of fish by means other than fishing and/or the harmful alteration, disruption or destruction of fish habitat:

- Site isolation using either pumps or temporary diversion channels;
- Removal of watercourse substrate (including sediment or debris) using excavators, large trucks, and hand tools;
- Relocation and/or removal of large woody debris from the watercourses using excavators, large trucks, and hand tools;
- Bank repairs and installation of erosion protection measures; and
- Removal of riparian vegetation for site access.

The authorized work(s), undertaking(s), or activity(ies) are likely to result in the following impacts to fish and fish habitat:

- Alteration and disruption of aquatic habitat including substrate removal and replacement likely to result in a reduction in habitat availability and complexity, and cause sedimentation.
- Site isolation leading to a temporary disruption to fish passage which may impact life history stages including spawning, migration, overwintering and rearing.

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[2] November 2023 Amendment: Changed from "in the 2022 fall and 2023 spring periods" to "between 2022 and 2024".

- Alteration and disruption to stream bank habitat likely to result in a reduction in habitat function of both the aquatic and riparian habitat.
- Alteration, disruption and destruction of riparian habitat for site access.

Riparian and aquatic footprints of the above WUAs for Pattison, Carratt and Davies Creeks shall not exceed what is described in the Project Plan. For the nine lower-priority sites, riparian and aquatic footprints shall not exceed what is required to alleviate flood risk based on the Risk Assessment Methodology of the Project Plan.

Conditions of Authorization

The above-described work, undertaking or activity must be carried on in accordance with the following conditions.

1. **Conditions that relate to the period during which the work, undertaking or activity can be carried on**

   The work, undertaking or activity that is/are authorized to be carried on during the following period:

   FROM: Date or Issuance **TO: December 31, 2024**[3]

   If the Proponent cannot complete the work, undertaking or activity during this period, Fisheries and Oceans Canada (DFO) must be notified in advance of the expiration of the above time period. An application for amendment, suspension or cancellation of the authorization should be submitted to DFO.

   The periods during which other conditions of this authorization must be complied with are provided in their respective sections below.

2. **Conditions that relate to measures and standards to avoid and mitigate impacts to fish and fish habitat**

2.1 Works, undertakings, and activities shall be conducted in a manner that avoids the death of fish.

2.2 A Qualified Environmental Professional will be onsite during high-risk instream and riparian works (e.g., substrate removal, riparian vegetation removal) to oversee/direct avoidance and mitigation measures to reduce impacts to fish and fish habitat and avoid unauthorized death of fish by means other than fishing and harmful alteration, disruption and destruction of fish habitat.

2.2.1 Conduct full time observations for all fish species that may be present near and within the project footprint and modify or direct works to the extent possible to avoid or minimize potential injury and death of fish;

2.2.2 Prior to sediment removal and other instream disturbances, isolate work site(s) and salvage fish;

[3] November 2023 Amendment: Changed from December 31, 2023 to December, 31, 2024.

2.2.3 Fish salvage methodologies should consider the winter nocturnal activity of juvenile salmonids (e.g. Pacific salmon and trout species) that may spend the day concealed in the stream substrates. Where isolation occurs, conduct fish salvage between dusk and dawn (sunset/sunrise) when fish emerge to forage, to avoid and mitigate against the death of juvenile fish;

2.2.4 Relocate all salvaged fish species from the work area, or those holding below a work area, back to the same watercourse in a nearby area that is not impacted by construction or removal works or its zone of influence (i.e., areas of higher turbidity due to instream works);

2.2.5 Conduct full time monitoring for deleterious substance released during the removal of sediment and direct avoidance and mitigation measures to reduce impacts to fish and fish habitat and avoid unauthorized death of fish by means other than fishing and harmful alteration, disruption and destruction of fish habitat and to prevent their further movement into the watercourse; and

2.2.6 Monitor implementation of the conditions of this authorization.

2.3 Sediment and erosion control: Sediment and erosion control measures must be in place and shall be upgraded and maintained, such that release of sediment is avoided at the location of the authorized work, undertaking, or activity. Monitor the watercourse for signs of sedimentation resulting from the works, undertakings or activities and take corrective action if required.

2.3.1 Areas of streambank disturbed during the works shall be rehabilitated to a stable condition (e.g. re-sloped and contoured) and protected from erosion.

2.4 List of measures and standards to avoid and mitigate impacts to fish and fish habitat:

2.4.1 Every reasonable effort should be made to minimize the frequency and duration of instream works, including excavation. Work from established infrastructure, above the high water mark (i.e., top of bank), or at a minimum above the water line when possible. Restrict instream disturbance to the area(s) required to access and remove accumulations of sediment;

2.4.2 Fish passage is to be maintained around the isolated work zones through the implementation of a diversion channel where practicable. Sites with expected adult salmon presence with spawning and/or overwintering habitat upstream should be prioritized for a diversion channel. If a diversion channel is not practicable and fish are observed holding below the work zone, ongoing fish salvage is required to relocate fish around the work zone;

2.4.3 Large woody debris can only be removed from the floodplain if it poses imminent risk to downstream infrastructure and property. Where possible, stockpile the natural debris removed from the floodplain to an area that can be accessed for future restoration work. Reinstall root wads or large woody debris below the high water mark where practicable;

2.4.4 Do not stockpile materials such as rock, riprap, or dirt in areas where the material has the potential to enter fish-bearing waters;

2.4.5 Maintain all machinery on site in a clean condition and free of fluid leaks. All heavy equipment should use environmentally friendly oil ("enviro-oil");

2.4.6 Fuel should be stored a minimum of 30 m from any watercourse. Wash, refuel and service machinery and store fuel and other materials for the machinery in such a way as to prevent any deleterious substances from entering the watercourse;

2.4.7 Have spill containment and clean-up materials within operating machinery and vehicles and on site in case of leaking deleterious substances (e.g., fuel, oil, grease) from extracted anthropogenic debris. Report leaks or spills of deleterious substances that have caused, or are about to cause, the unauthorized death of fish by means other than fishing and/or the harmful alteration, disruption or destruction of fish habitat to DFO.PACViolations-infractionsPAC.MPO@dfo-mpo.gc.ca and to Observe, Record, Report at 1-800-465-4336 or DFO.ORR-ONS.MPO@dfo-mpo.gc.ca;

2.4.8 Dispose of all anthropogenic debris removed at an appropriate waste management facility as required; and

2.4.9 Works must be conducted in the dry. Follow DFO's interim Standard for In-Water Site Isolation: (https://www.dfo-mpo.gc.ca/pnw-ppe/codes/interim-provisoire/site-isolation-confinement-aire-travail-eng.html); DFO's interim Code of Practice for End-of-Pipe Fish Protection Screens for Small Water Intakes in Freshwater: (https://www.dfo-mpo.gc.ca/pnw-ppe/codes/screen-ecran-eng.html); and follow DFO's Code of Practice for Temporary Fords: (https://www.dfo-mpo.gc.ca/pnw-ppe/codes/temporary-fords-traversees-temporaires-eng.html)[4]. If works cannot be conducted in the dry due to high flow conditions, the work area must be decommissioned and fish passage reinitiated until conditions allow for site isolation.

2.5 Avoid removal of riparian vegetation, particularly mature trees, as much as possible. Where removal of riparian vegetation is not avoidable:

2.5.1 Prune or top the vegetation instead of grubbing/uprooting;

2.5.2 Construct access points and approaches perpendicular to the watercourse;

2.5.3 Rehabilitate areas of the streambank disturbed during the works to a stable condition (e.g., sloped and contoured and protected from erosion);

2.5.4 Re-vegetate disturbed areas with native trees, shrubs and grasses species suitable for the site; and

2.5.5 Where possible, incorporate bioengineering (i.e., pocket planting, live staking, root wad placement, etc.) within the bank restoration and erosion protection designs.

[4] November 2023 Amendment: Changed from "DFO's Interim Code of Practice for Temporary Cofferdams and Diversion Channels" to "DFO's interim Standard for In-Water Site Isolation". Also changed from "DFO's Interim Code of Practice for Temporary Stream Crossings" to "DFO's Code of Practice for Temporary Fords".

2.6 Avoid the installation of riprap bank slopes to the extent practicable.

2.7 Avoid works, undertakings or activities in Critical Habitat (as defined under the *Species at Risk Act*), or the handling or harm of species listed as Threatened or Endangered under the *Species at Risk Act*. If these aforementioned works, undertakings, or activities are required, works must stop and Proponent shall contact DFO for additional guidance and/or permitting.

2.8 Contingency measures shall be put in place if monitoring required in section 3 below indicates that the measures and standards to avoid and mitigate impacts to fish and fish habitat are not successful.

2.9 Dates by which these measures and standards shall be implemented: Measures and standards to avoid and mitigate impacts to fish and fish habitat shall be implemented prior to the initiation of works, undertakings or activities.

3. Conditions that relate to monitoring and reporting of measures and standards to avoid and mitigate impacts to fish and fish habitat.

3.1 Monitoring of avoidance and mitigation measures: The Proponent shall monitor the implementation of avoidance and mitigation measures referred to in section 2 of this authorization and report to DFO, within 30 days post-construction, and indicate whether the measures and standards to avoid and mitigate impacts to fish and fish habitat were conducted according to the conditions of this authorization. This shall be done by:

3.1.1 Demonstration of effective implementation and functioning: Providing dated photographs and inspection reports to demonstrate effective implementation and functioning of mitigation measures and standards described above to limit the impacts to fish and fish habitat to what is covered by this authorization; and

3.1.2 Contingency measures: Providing details of any contingency measures that were followed, to prevent impacts greater than those covered by this authorization in the event that mitigation measures did not function as described.

3.2 Other monitoring and reporting conditions:

3.2.1 Providing dated photographs of each debris removal, inspection reports and details outlining how each condition of this Authorization was met, and whether avoidance and mitigation measures were effective in reducing or limiting serious harm to fish to what is authorized herein;

3.2.2 Providing a geospatial polygon that accurately represents the completed HADD footprint(s). Geospatial polygon data should be collected using WGS 1984 to four (4) decimal places (e.g., 28.5234ºN, 80.6830ºW). Geospatial polygon data must be supplied in Shape File (.shp) format to ReferralsPacific@dfo-mpo.gc.ca with reference to DFO file: 22-HPAC-01308. In addition to the geospatial polygon, the following data must also be supplied in an Excel file (i.e., metadata):

- The date of sediment/debris removal, the type of debris removed (e.g., log jam, boulders etc.), the watercourse of removal, the coordinates of removal, if leaks or spills of deleterious substances were documented and mitigation measures to contain and clean leaks and spills;

- The type of HADD (e.g., riparian removal, aquatic footprint, etc.), the date of the HADD, and HADD area per habitat type (based on depth during high and low water seasons, high water mark); and

- Brand name and model of GPS unit, the coordinate system used, and guaranteed accuracy of GPS unit.

3.2.3 Providing a summary of observational mortality for the death of fish (e.g., eggs, alevins, fry) by means other than fishing related to the works, undertakings or activities.

3.2.4 Providing a summary of the fish salvaged. The information summarized shall include dates, the number of individuals salvaged, the location of salvage and relocation, and the nature of any effects to fish salvaged (capture, death, sub-lethal harm, etc.).

3.2.5 Providing details of any contingency measures that were followed, should prescribed mitigations not function as intended, to contain the impacts to fish and fish habitat to that which is authorized herein.

4. Conditions that relate to offsetting

4.1 Upon receipt and review of the monitoring results and supporting documentation outlined in section 3 above, DFO will determine whether offsetting is required.

4.2 If offsetting is required, the Proponent shall prepare a draft offsetting plan, consistent with the DFO's *Policy for Applying Measures to Offset Adverse Effects on Fish and Fish Habitat Under the Fisheries Act* and *Applicant's Guide Supporting the "Authorizations Concerning Fish and Fish Habitat Protection Regulations"* and provide it to DFO within 45 days of receipt that an Offsetting Plan is required.

4.3 If offsetting is required, the offsetting plan shall include the information identified in Schedule 1, Section 16 of the *Authorizations Concerning Fish and Fish Habitat Protection Regulations*, including an offsetting effectiveness monitoring plan.

4.4 Once acceptable to DFO, the offsetting plan shall be implemented with any additional requirements from DFO.

Authorization Limitations and Application Conditions

The Proponent is solely responsible for plans and specifications relating to this authorization and for all design, safety and workmanship aspects of all the works associated with this authorization.

The holder of this authorization is hereby authorized under the authority of Paragraphs 34.4(2)(b) and 35(2)(b) of the *Fisheries Act*. R.S.C., 1985, c.F-14, to carry on the work(s), undertaking(s) and/or activity(ies) that are likely to result in impacts to fish and fish habitat as described herein.

This authorization does not purport to release the applicant from any obligation to obtain permission from or to comply with the requirements of any other regulatory agencies.

This authorization does not permit the deposit of a deleterious substance in water frequented by fish. Subsection 36(3) of the *Fisheries Act* prohibits the deposit of any deleterious substances into waters frequented by fish unless authorized by regulations made by Governor in Council.

It is also your *Duty to Notify* DFO if you have caused, or are about to cause, the unauthorized death of fish by means other than fishing and/or the harmful alteration, disruption or destruction of fish habitat. Such notifications should be directed to DFO.PACViolations-InfractionsPAC.MPO@dfo-mpo.gc.ca **and** to Observe, Record, Report at 1-800-465-4336 or DFO.ORR-ONS.MPO@dfo-mpo.gc.ca.

The failure to comply with any condition of this authorization constitutes an offence under Paragraph 40(3)(a) of the *Fisheries Act*, and may result in charges being laid under said Act.

A copy of this authorization should be kept on site while the work is in progress and upon request be provided to relevant federal or provincial officials. The authorization holder is responsible for ensuring work crews are familiar with, and able to adhere to, the conditions.

This authorization cannot be transferred or assigned to another party. If the work(s), undertaking(s) or activity(ies) authorized to be conducted pursuant to this authorization are expected to be sold or transferred, or other circumstances arise that are expected to result in a new Proponent taking over the work(s), undertaking(s) or activity(ies), the Proponent named in this authorization shall advise DFO in advance.

Date of Issuance: November 23, 2023

Approved by: Rotinsky, Brenda

Digitally signed by Rotinsky, Brenda
Date: 2023.11.23 12:41:22 -08'00'
Foxit PDF Editor Version: 13.0.0

Brenda Rotinsky
Watershed Operations Regulatory Manager
Fish and Fish Habitat Protection Program, Pacific Region
Fisheries and Oceans Canada

August 23, 2024 File Number: 2011310

Ministry of Environment and Climate Change Strategy
PO BOX 9047 STN PROV GOVT
Victoria, BC V8W 9E2

Sent via email: Thyren.Jacobs@gov.bc.ca

Dear Thyren Jacobs,

Re: Application for approval to make changes in Lagace Creek Within, Lot 2, Except: Firstly: Parcel "A" (REFERENCE PLAN 6603) & "B" (Reference Plan 7565) Secondly: Parcel "A" (Explanatory Plan 17194) Plan 3529, 3942 & Plan 11344, Lot 3, Lot 5, Lot 6, Lot 7, Lot 8, Lot 27, Section 2, Section 11, Township 18, New Westminster District Plan 3529, 3942 & Plan 11344 and Unsurveyed Crown foreshore or Land Covered by Water being part of the Bed of Lagace Creek held under permit # 29886.

A Change Approval for the above application has been granted and a *Water Sustainability Act* Section 11(1) Changes In and About a Stream Approval document verifying this is attached.

This Change Approval does not authorize entry onto private or Crown owned land. Permission of the affected landowner must be obtained and should be in writing for your protection.

This Approval does not constitute authority of any other agency. The holder of this Approval shall have the necessary permits from other agencies concerned prior to the commencement of the works authorized herein. The permit holder is required to adhere to all other applicable Provincial and Federal Regulations.

A copy of this Approval (and associated plans/drawings listed on this Approval) must be available for inspection, upon request, at any location where the authorized changes in and about a stream are being undertaken.

The holder of this Approval must advise Water Authorizations at SouthCoastWSAReporting@gov.bc.ca with the Approval number in the subject line, five (5)

Ministry of Water, Land and Resource Stewardship
Mailing Address: 200-10428 153 Street, Surrey BC V3R1E1
Location: 200-10428 153 Street, Surrey BC V3R1E1
Phone: (604) 586-4400
Fax: (604) 586-4444
Web: https://www2.gov.bc.ca/gov/content/environment/air-land-water/water

working days prior to commencement and five (5) working days following completion of the authorized work to facilitate the timing of auditing.

The holder of this Approval must have permits or other written consent from any affected property/right-of-way holders before commencing work that could affect utilities or other structures within the property or rights-of-way.

The holder of this Approval is reminded that the Fraser Valley Regional District Crown Interface Policy's Appendix 1, General policies Section 18 Hatzic Prairie may be applicable to their proposed works.

This Approval requires the oversight of an appropriately Qualified Professional. For the purposes of this authorization, that professional must be registered with one of the five professional regulatory bodies named under the *Professional Governance Act* of British Columbia. They must be in good standing and acting under that professional regulatory body's code of ethics and subject to disciplinary action by that professional regulatory body.

Please ensure that machinery is free of invasive plant material that could potentially be transported throughout or between sites. In addition, ensure that invasive species removed from a site are disposed of appropriately.

For the protection of wildlife species, the Qualified Professional is responsible for planning and implementing fish and wildlife salvages prior to any instream and riparian works. *Wildlife Act* permits must be obtained from the Ministry of Water Land and Resource Stewardship. (https://portal.nrs.gov.bc.ca/web/client/home).

The holder of this Approval shall ensure that any proposed development and/or changes do not impact traditional or special sites in accordance with the *Heritage Conservation Act* or the ability of First Nation community members to participate in traditional activities on the land and water.

Archaeological sites (both recorded and unrecorded) are protected under the *Heritage Conservation Act* and must not be altered or damaged without a permit from the Archaeology Branch. The holder of this Approval must advise everyone who will be involved in ground-disturbance and construction that if archaeological materials are encountered, activities must be halted, and the Archaeology Branch contacted at 250-953-3334 for direction.

Section 105 of the *Water Sustainability Act* gives the recipient of this notice the right to appeal my decision. You may file an appeal within 30 days of the date indicated on this letter. Information on filing an appeal can be found on the Environmental Appeal Board website at http://www.eab.gov.bc.ca/ .

Ministry of Water, Land and Resource Stewardship
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Location: 200-10428 153 Street, Surrey BC V3R1E1
Phone: (604) 586-4400
Fax: (604) 586-4444
Web: https://www2.gov.bc.ca/gov/content/environment/air-land-water/water

If you have any questions or concerns regarding the document issued or the content of this letter, please contact the South Coast Office at WaterActReferrals.LowerMainland@gov.bc.ca.

Sincerely,



Michael Currie
Assistant Water Manager

pc: Naomi Sands, Associated Engineering, Email: sandsn@ae.ca
Pradeep Poudel, Ministry of Water, Land and Resource Stewardship, Email: Pradeep.1.Poudel@gov.bc.ca
Kwantlen First Nation
Leq'á:mel First Nation
Matsqui First Nation
Peters First Nation
PRRO
Semiahmoo First Nation

Ministry of Water, Land and Resource Stewardship
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August 23, 2024 File Number: 2011310

APPROVAL

WATER SUSTAINABILITY ACT - Subsection 11(1) and 11(2)
(Changes in and about a stream)

Ministry of Environment and Climate Change Strategy

is hereby authorized to make changes in and about a stream as follows:

(a) The name of the stream is Lagace Creek.

(b) The Changes to be made in and about the stream are:

1. Install temporary erosion and sediment control methods using silt curtain and/or fencing before instream works begin as required.
2. Isolate the instream work zones by diverting flow around the isolated areas via pumps or temporary diversion channels or by installing silt curtains.
3. Riparian vegetation removal over approximately 3000 square metres for access, lay down and installation of sand stations.
4. Construct three new sand recovery stations as outlined in the Environmental Management Plan and engineering drawings.
5. Sediment and debris removal at Lagace Creek over an area of approximately 5100 square metres, up to a maximum of approximately 8750 cubic metres of sediment. Maximum depth of excavation is not to exceed approximately 2.5 metres at the Sand Recovery Stations and 2.8 metres within other areas of the stream channel.
6. Restore the bank around the new sand recovery stations with native vegetation and riparian seed mix.

Within, Lot 2, Except: Firstly: Parcel “A" (REFERENCE PLAN 6603) &
"B" (Reference Plan 7565) Secondly: Parcel "A" (Explanatory Plan 17194) Plan 3529, 3942 & Plan 11344, Lot 3, Lot 5, Lot 6, Lot 7, Lot 8, Lot 27, Section 2, Section 11, Township 18, New Westminster District Plan 3529, 3942 & Plan 11344 and Unsurveyed Crown foreshore or Land Covered by Water being part of the Bed of Lagace Creek held under permit 29886.

(c) The location of the works is at the following coordinates, as provided by the applicant: 49.1956250, -122.2536030.

(d) The works authorized in this Approval shall be completed on or before. December 31, 2024.

(e) The holder of this Approval shall take reasonable care to avoid damaging any land, works, trees or other property and shall make full compensation to the owners for any damage or loss resulting from the exercise of rights granted hereunder.

(f) All works associated with the Effectiveness Monitoring Plan, as outlined in clause (aa) below, shall be completed by December 1, 2027, three years after the works are completed.

(g) As much as is practicable, the construction area(s) and access routes must be marked on-site prior to starting groundwork. Any vegetation removal must be minimized and limited only to the areas required for active construction, with consideration for the timing and scheduling of work.

(h) Work in the stream and stream channel must only occur during the periods outlined below, so that the fisheries interests are protected:

1. Instream work during the reduced risk instream work window must occur during the period of August 1 to September 15; or
2. Based on project justification and risk, instream work outside of the reduced risk instream work window (as stated above) must occur subject to the following:
    i. An appropriately Qualified Professional must provide advice to the holder of this Approval on the timing of the work based on: the nature of the works, environmental values (including fish, amphibians, wildlife, any listed species present), water quality, channel stability, weather conditions, water levels, and any other relevant factors);
    ii. The Qualified Professional must also provide additional construction mitigation advice to prevent adverse environmental impacts, and daily or full-time supervision of all work in or near the stream;
    iii. Work must be timed and planned appropriately, the stream must be completely dry or have marginal flows (naturally or achieved through appropriate isolation and diversion) for the duration of the construction activities; and
    iv. The advice of the Qualified Professional on construction timing (as per (i) above) and mitigation measures (as per (ii) above), as well as the timing of work and the presence of the Qualified Professional, must be documented in writing. This documentation must be submitted as part of the post construction reporting for this project.

(i) All works shall be completed within the designed project footprint and in accordance with the following:

1. Report “Lower Lagace Creek (SCR 14) Sediment Removal and Bank Stabilization Environmental Management Plan” prepared for Ministry of Environment and Climate Change Strategy by Associated Environmental May 2024.
2. Sealed Drawing Issued for RFP and Permitting for Hatzic Emergency Works Program Legace Creek- Sites S-CR-14 2022-2632-03 “ G-3002 General Legend” prepared for Ministry of Environment and Climate Change strategy by Associated Engineering dated July 22, 2024.
3. Sealed Drawing Issued for RFP and Permitting for Hatzic Emergency Works Program Legace Creek- Sites S-CR-14 2022-2632-03 “ C-3101 Civil Plan- S-CR-14 Sediment Removal” prepared for Ministry of Environment and Climate Change strategy by Associated Engineering dated July 22, 2024.
4. Sealed Drawing Issued for RFP and Permitting for Hatzic Emergency Works Program Legace Creek- Sites S-CR-14 2022-2632-03 “ C-3102 Civil Plan- S-CR-14 Proposed Sand Recovery Stations” prepared for Ministry of Environment and Climate Change strategy by Associated Engineering dated July 22, 2024.
5. Sealed Drawing Issued for RFP and Permitting for Hatzic Emergency Works Program Legace Creek- Sites S-CR-14 2022-2632-03 “ C-3103 Civil Plan- S-CR-14 Sediment Removal Extents” prepared for Ministry of Environment and Climate Change strategy by Associated Engineering dated July 22, 2024.
6. Sealed Drawing Issued for RFP and Permitting for Hatzic Emergency Works Program Legace Creek- Sites S-CR-14 2022-2632-03 “C-3104 Civil Plan- S-CR-14 Erosion Protection” prepared for Ministry of Environment and Climate Change strategy by Associated Engineering dated July 22, 2024.
7. Sealed Drawing Issued for RFP and Permitting for Hatzic Emergency Works Program Legace Creek- Sites S-CR-14 2022-2632-03 “C-3501 Civil Detail 1 of 6 Existing Sand Recovery Station ” prepared for Ministry of Environment and Climate Change strategy by Associated Engineering dated July 22, 2024.
8. Sealed Drawing Issued for RFP and Permitting for Hatzic Emergency Works Program Legace Creek- Sites S-CR-14 2022-2632-03 “C-3502 Civil Detail 2 of 6 Proposed Sand Recovery Station ” prepared for Ministry of Environment and Climate Change strategy by Associated Engineering dated July 22, 2024.
9. Sealed Drawing Issued for RFP and Permitting for Hatzic Emergency Works Program Legace Creek- Sites S-CR-14 2022-2632-03 “C-3503 Civil Detail 3 of 6 Bank Protection” prepared for Ministry of Environment and Climate Change strategy by Associated Engineering dated July 22, 2024.
10. Sealed Drawing Issued for RFP and Permitting for Hatzic Emergency Works Program Legace Creek- Sites S-CR-14 2022-2632-03 “C-3504 Civil Detail 4 of 6 Fence and Gate Installation” prepared for Ministry of Environment and Climate Change strategy by Associated Engineering dated July 22, 2024.
11. Sealed Drawing Issued for RFP and Permitting for Hatzic Emergency Works Program Legace Creek- Sites S-CR-14 2022-2632-03 “C-3505 Civil Detail 5 of 6 Dense Live Staking” prepared for Ministry of Environment and Climate Change strategy by Associated Engineering dated July 22, 2024.

(j) The holder of this Approval must hire an appropriately Qualified Professional to conduct Environmental Monitoring on all in-stream works authorized under this Approval. The Qualified Professional is responsible for observing the methods of construction and preparing information and reports on the compliance of the construction activities. The Qualified Professional shall:

1. Ensure all best management practices and mitigation measures are in place to avoid and minimize environmental impact on the land and on fish and fish habitat of the stream.
2. Where applicable, assist in the isolation of the stream prior to the commencement of works.
3. Implement and ensure erosion and sediment control measures are constructed, installed, and maintained appropriately for the full duration of instream works.
4. Supervise all instream works authorized under this Approval.
5. When the works involve temporary diversions to isolate the work site,
    i) Monitor all diversion works daily to ensure pumps & flow bypasses are in proper working condition;
    ii) Ensure diversion works that include pump intakes be screened for fish and aquatic species in accordance with the "Interim code of practice: End-of-pipe fish protection screens for small water intakes in freshwater" (Fisheries and Oceans Canada, 2020); and
    iii) Ensure fish are prevented from entering the works.
6. When the works involve dewatering or isolation of flow and the stream is known or suspected to contain fish and/or amphibians,
    i) Attend the site prior to conducting any instream works to complete fish and wildlife search and salvage(s);
    ii) Obtain any permits needed prior to undertaking the salvage(s); and
    iii) Inspect the extraction area for fish stranding at least once after water levels have declined.
    iv) Protect the species at risk and salvage under the direction of a Qualified Environmental Professional in the event of discovery of species at risk. The works shall not result in harm to species at risk.
7. Be granted authority to stop the work authorized under this Approval if deemed necessary to address risks to the environment. The Qualified Professional or their designate (specified in writing) must be on site during all phases of construction in and around the stream to ensure this component is upheld.
8. In the event of an environmental incident or non-compliance with any of the terms or conditions of this Approval, an appropriately Qualified Professional must immediately mitigate the situation. Within 48 hours, each incident must be reported to the Water Manager at SouthCoastWSAReporting@gov.bc.ca with the approval number in the subject line. The incident report shall describe mitigation measures employed and a rationale as to why works have resumed, or the next steps required before works may resume. The holder of this approval must follow the advice of the appropriately Qualified Professional.
9. Conduct a search and salvage (if required) for wildlife within the proposed clearing footprints before works occur.

(k) All work shall be carried out in accordance with the Provincial "Requirements and Best Management Practices for Making Changes In and About A Stream in British Columbia" (2022). The Provincial guidance document can be found at the following link: https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/working-around-water/wsa-cias-requirements-bmps.pdf .

(l) The holder of this Approval must provide as-built drawings post-construction within 60 days of completion of the works. The drawings shall include all modifications made from the initial drawings during the construction process and include justification for the modifications. The drawings must be labelled with this Approval file number and labelled in the subject line of the email and submitted to SouthCoastWSAReporting@gov.bc.ca.

(m) The holder of this Approval must ensure that a Construction Environmental Management Plan (CEMP) is developed and implemented by an appropriately Qualified Professional. A copy of the plan must be submitted to SouthCoastWSAReporting@gov.bc.ca with this Approval number in the subject line.

(n) Upon commencement of the project, work shall be pursued to completion as quickly as possible.

(o) All proposed works shall be completed in isolation of the stream flows.

(p) All equipment and machinery used in or near the stream channel:

1. Be in good operating condition and free of leaks, excess oil and grease.
2. Have a spill containment kit readily accessible on-site with operators and/or staff on site trained in handling and applying a spill kit appropriately to any spills/incidents.
3. Be refueled a minimum of 30 meters away from all streams.
4. Use environmentally sensitive hydraulic fluids which are non-toxic to aquatic life and which are readily or inherently bio-degradable.
5. Any spill of a substance that is toxic, polluting, or deleterious to aquatic life of reportable quantities must be reported to the Dangerous Goods Incident Report 24-hour phone line at 1-800-663-3456.

(q) Sediment and Erosion Control plans must be developed, designed, implemented and monitored by an appropriately qualified person. The plans, implementation and monitoring must also address stormwater pollution prevention for the duration of construction.

(r) Sediment and Erosion Control measures to prevent the release of silt, sediment or sediment-laden water must be in place before starting works that may result in sediment mobilization. Care shall be exercised during all phases of the work to prevent the release of silt, sediment, sediment-laden water, raw concrete, concrete leachate, or any

deleterious substances. All control measures must meet or surpass the Requirements and Best Management Practices for Making Changes in and About a Stream in British Columbia (2022) and the "Land Development Guidelines for the Protection of Aquatic Habitat" (Fisheries and Oceans Canada and the British Columbia, 1993).

(s) Discharge and runoff water from the site into any watercourse(s) must comply with the BC Approved Water Quality Guidelines for the Protection of Aquatic Life (https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-quality/water-quality-guidelines/approved-water-quality-guidelines) and/or the applicable Local Government Bylaw(s) .

Water quality monitoring must be conducted by an appropriately Qualified Professional or a designate (in writing) Environmental Monitor on every day in which instream works are being conducted. Measurements must be taken upstream of any works taking place and within the extent of the sedimentation downstream of where instream work is actively occurring. Measurements are to be taken immediately prior to works beginning, and then at regular intervals until the works are completed and may require additional frequency during wet weather conditions. Wet weather conditions will be defined as being equal to or greater than 25 millimetres of rainfall within a 24-hour period. All excavated material and debris shall be removed from the site or placed in a stable area above the high-water mark of the stream. Mitigative measures must be applied to protect the excavated material and debris from erosion and reintroduction into the watercourse. These measures may include covering the material with erosion blankets, seeding and planting with native vegetation, or as otherwise directed by a Qualified Professional.

(t) All excavated material and debris shall be removed from the site or placed in a stable area above the high-water mark of the stream. Mitigative measures must be applied to protect the excavated material and debris from erosion and reintroduction into the watercourse.

(u) The holder of this Approval shall ensure that instream works are designed and installed so as not to restrict fish passage and/or lead to fish stranding. The works shall not result in depressions that have the ability to trap fish and other aquatic life.

(v) All temporary works (including a ford, stream crossing, flow bypass, and erosion and sediment control measures) shall be removed on completion of the project, and the stream channel restored to its natural condition.

(w) All disturbed areas of the banks of the stream shall be restored using native vegetation suitable for the site conditions.

(x) All rock used in the works must be clean and free of sediment producing material, durable, non-acid generating and suitably graded. Any other engineering material required for the construction of the works shall be clean of any substances deleterious to aquatic life.

(y) Drought mitigation: Monitor current drought conditions as per the Provincial Drought Level Classification system (Level 0 – 5, Drought information – Province of British Columbia (gov.bc.ca)) during all instream works, undertakings and activities. Instream works shall cease if the Drought Level Classification is at Level 5. The proponent shall contact WLRS under this circumstance to evaluate current on-site conditions and additional avoidance and mitigation measures. Instream works may commence only after receiving written permission from WLRS.

1. If instream works are occurring during a period of drought or the dry summer period when the Drought Level Classification is below Level 5, and works involve the loss of habitat that provides cold water refugia for fish (e.g., deep pools), the QEP must ensure salvaged fish are relocated to an area that provides similar habitat conditions (e.g., well-shaded habitat, habitat with known ground-water upwelling, pools, or undercut banks).

2. Site isolation and fish salvage(s): Instream works, undertakings and activities where there is potential for fish presence shall only be carried out within previously isolated and salvaged areas. Incorporate applicable measures and standards from DFO's Interim standard: in-water site isolation and ensure pumps are screened to prevent entrainment or impingement of fish according to DFO's Interim Code of Practice for End-of-pipe Fish Protection Screens for Small Water Intakes. It is the Proponent's responsibility to obtain the necessary Federal and Provincial fish collection permits for fish salvage and follow the conditions therein. The isolation areas shall be inspected regularly and maintained throughout the project.

(z) The holder(s) of water license C114253, located downstream of the proposed works, and any other potential licensees who will be impacted, are to be advised as soon as practicable prior to commencement of construction. If the proposed works cause or are expected to cause an adverse impact to quality of quantity of water available to the license holders, the license holders are to be provided with an alternate supply of fresh water during the periods when water quality or availability will be adversely affected by the works.

(aa) The holder of this Approval must retain an appropriately Qualified Professional to develop and implement Three Year Effectiveness Monitoring plan that includes:

1. Maintenance and monitoring of plantings (including watering);
2. Replacement of plantings, where necessary, to ensure 100% tree survival and minimum 80% shrub and other vegetation survival rate.
3. Invasive species management;
4. Monitoring water flow and stream channel function with proposed adaptive management strategies to address shortfalls.

Annual reports must be submitted by December 1 of each calendar year following completion of construction to SouthCoastWSAReporting@gov.bc.ca. The reports and subject line of the email must be labelled with this Approval file number.

(bb) The holder of this Approval must provide a detailed post-construction report no later than December 1 of the year works were completed. The report must be submitted by email to SouthCoastWSAReporting@gov.bc.ca with the approval file number listed in the subject line of the email and the title of the report. The report shall include a signed statement from an appropriately Qualified Professional summarizing:

1. The in-stream works undertaken;
2. The timing of those works;
3. The total in-stream area directly affected;
4. The pre-construction and post-construction surveys if undertaken;
5. The quantity of gravel removed;
6. Representative site photographs;
7. Whether or not they observed or were otherwise aware of any non-compliance with the terms and conditions of this Approval; and
8. A description of any environmental incidents, non-compliance or other difficulties, and how these were addressed and reported.

Sincerely,



Michael Currie
Assistant Water Manager

Province of British Columbia
Water Sustainability Act

PERMIT AUTHORIZING THE OCCUPATION OF CROWN LAND

The holder of this permit, Ministry of Environment and Climate Change Strategy (29886), whose Change Approval authorizes changes in and about a stream (Lagace Creek), is hereby authorized to occupy Crown Land by constructing, maintaining and operating the works as authorized in the Change Approval (2011310).

(a) The Crown land which is authorized to be occupied under this permit is a portion of Unsurveyed Crown foreshore or Land Covered by Water being part of the Bed of Lagace Creek, the location of which is shown approximately on the plans associated with said Change Approval.

(b) The approximate dimensions of the Crown Land authorized to be occupied under this permit, are for approximately 0.722 hectares.

(c) Prior to cutting, destroying or clearing of any timber necessary to construct, maintain and operate the said works or the clearing of the said lands which may be flooded, the permittee shall apply for and obtain a licence to cut timber from the Ministry of Forests, District Manager. The amount of stumpage, royalty and/or compensation payable to the Crown in respect of trees, including merchantable or young growth, cut, removed, damaged, or destroyed by the permittee, shall be the sum or sums fixed by the Forest Service of the Province of British Columbia.

(d) This permit is appurtenant to the land, mine, or undertaking to which the aforesaid Change Approval is appurtenant.

(e) This permit shall become void if the Change Approval with respect to which the permit is issued should terminate, be abandoned or cancelled, or amended so as to render this permit unnecessary.

(f) This permit is issued and accepted on the understanding that the permittee shall indemnify and save harmless the Government of the Province of British Columbia for all loss, damage to works, cost or expense suffered by the permittee by reason of the Crown land or any portion thereof being submerged or damaged by erosion or otherwise affected by flooding.

(g) The holder of this permit shall not be entitled to compensation if the Crown grants permits to other persons to occupy the land affected by this permit.

(h) In the event of a dispute at any time with respect to the area or boundaries of the land affected by this permit, the holder shall, at his own expense, have the said land surveyed by a duly authorized surveyor.



Michael Currie
Assistant Water Manager

September 6, 2024 File Number: 2011242

Thyren Jacobs
Ministry of Environment and Climate Change Strategy - Surrey
200-14070 152 St
Surrey, BC V3R 0Y3
Sent via email: Thyren.Jacobs@gov.bc.ca

Dear Thyren Jacobs,

Re: Application for approval to make changes in Lagace Creek Within Parcel A, Explanatory Plan 25357, Except plan subdivided by plan 37358, Plan 34325, 38134, 20437 and 39696 of lot 2, Lot 7, Lot 13, Lot 15 South West, Section 30, North West Quarter Section 19, Township 21, New Westminster District and Unsurveyed Crown foreshore or Land Covered by Water being part of the Bed of Lagace Creek held under permit# 29877.

A Change Approval for the above application has been granted and a *Water Sustainability Act* Section 11(1) Changes In and About a Stream Approval document verifying this is attached.

This Change Approval does not authorize entry onto private or Crown owned land. Permission of the affected landowner must be obtained and should be in writing for your protection.

This Approval does not constitute authority of any other agency. The holder of this Approval must have the necessary permits from other agencies concerned prior to the commencement of the works authorized herein. The permit holder is required to adhere to all other applicable Provincial and Federal Regulations.

A copy of this Approval (and associated plans/drawings listed on this Approval) must be available for inspection, upon request, at any location where the authorized changes in and about a stream are being undertaken.

The holder of this Approval must have permits or other written consent from any affected property/right-of-way holders before commencing work that could affect utilities or other structures within the property or rights-of-way.

This Approval requires the oversight of an appropriately Qualified Professional. For the purposes of this authorization, that professional must be registered with one of the five professional regulatory bodies named under the *Professional Governance Act* of British Columbia. They must

Ministry of Water, Land and Resource Stewardship
Stream Management Authorizations – South Coast
Website: www.gov.bc.ca/water
Suite 200, 10428 - 153 St
Surrey, BC V3R 1E1
Phone: (604) 586-4400
Fax: (604) 586-4444

be in good standing and acting under that professional regulatory body's code of ethics and subject to disciplinary action by that professional regulatory body.

Please ensure that machinery is free of invasive plant material that could potentially be transported throughout or between sites. In addition, ensure that invasive species removed from a site are disposed of appropriately.

When choosing compensation/restoration locations, it is encouraged to avoid areas that are isolated or are discontinuous from existing habitat, to avoid creating habitat sinks, and enable wildlife access.

For the protection of wildlife species, the Qualified Professional is responsible for planning and implementing fish and wildlife salvages prior to any instream and riparian works. *Wildlife Act* permits must be obtained from the Ministry of Water Land and Resource Stewardship. (https://portal.nrs.gov.bc.ca/web/client/home).

The holder of this Approval must ensure that any proposed development and/or changes do not impact traditional or special sites in accordance with the *Heritage Conservation Act* or the ability of First Nation community members to participate in traditional activities on the land and water.

Archaeological sites (both recorded and unrecorded) are protected under the *Heritage Conservation Act* and must not be altered or damaged without a permit from the Archaeology Branch. The holder of this Approval must advise everyone who will be involved in ground-disturbance and construction that if archaeological materials are encountered, activities must be halted, and the Archaeology Branch contacted at 250-953-3334 for direction.

Section 105 of the Water Sustainability Act gives the recipient of this notice the right to appeal my decision. You may file an appeal within 30 days of the date indicated on this letter. Information on filing an appeal can be found on the Environmental Appeal Board website at http://www.eab.gov.bc.ca/ .

If you have any questions or concerns regarding the document issued or the content of this letter, please contact the South Coast Office at WaterActReferrals.LowerMainland@gov.bc.ca.

Sincerely,



Michael Currie
Assistant Water Manager

Cc: Naomi Sands, Associated Environmental, Email: sandsn@ae.ca

Pradeep Poudel, Ministry of Water, Land and Resource Stewardship, Email: Pradeep.1.Poudel@gov.bc.ca
Kwantlen First Nation
Leq'á:mel First Nation
Matsqui First Nation
Peters First Nation
PRRO
Semiahmoo First Nation

September 6, 2024 File Number: 2011242

APPROVAL

WATER SUSTAINABILITY ACT - Subsection 11(1) and 11(2)
(Changes in and about a stream)

Ministry of Environment and Climate Change Strategy

is hereby authorized to make changes in and about a stream as follows:

(a) The names of the stream is Lagace Creek, herein referred to as the stream.

(b) The Changes to be made in and about the stream are:

1. Removal of approximately 400 cubic metres of sediment and debris from the stream channel, impacting an area of approximately 400 square metres over 90 linear metres of the channel.
2. Clearing of riparian vegetation to facilitate laydown and access, impacting an area of approximately 275 square meters.

Within Parcel A, Explanatory Plan 25357, Except plan subdivided by plan 37358, Plan 34325, 38134, 20437 and 39696 of lot 2, Lot 7, Lot 13, Lot 15 South West, Section 30, North West Quarter Section 19, Township 21, New Westminster District and Unsurveyed Crown foreshore or Land Covered by Water being part of the Bed of Lagace Creek held under permit# 29877

(c) The location of the works is at the following coordinates, as provided by the applicant: 49.2410600, -122.2183400.

(d) The works authorized in this Approval must be completed on or before. December 31, 2024.

(e) The holder of this Approval must take reasonable care to avoid damaging any land, works, trees or other property and must make full compensation to the owners for any damage or loss resulting from the exercise of rights granted hereunder.

Ministry of Water, Land and Resource Stewardship
Stream Management Authorizations – South Coast
Website: www.gov.bc.ca/water
Suite 200, 10428 - 153 St
Surrey, BC V3R 1E1
Phone: (604) 586-4400
Fax: (604) 586-4444

(f) All works associated with the Effectiveness Monitoring Plan, as outlined in clause (aa) below, must be completed by December 1, 2027, three years after the works are completed.

(g) As much as is practicable, the construction area(s) and access routes must be marked on-site prior to starting groundwork. Any vegetation removal must be minimized and limited only to the areas required for active construction, with consideration for the timing and scheduling of work.

(h) Work in the stream and stream channel must occur only during the periods outlined below, so that the fisheries interests are protected:

1. Instream work during the reduced risk instream work window must occur during the period of August 1 to September 15; or
2. Based on project justification and risk, instream work outside of the reduced risk instream work window (as stated above), subject to the following:
    i) An appropriately qualified professional must provide advice to the holder of this Approval on the timing of the work based on the nature of the works, environmental values (including fish, amphibians, wildlife, any listed species present), water quality, channel stability, weather conditions, water levels, and any other relevant factors); and
    ii) The Qualified Professional must also provide additional construction mitigation advice to the holder of this Approval, and daily or full-time supervision of all work in or near the stream; and
    iii) Work must be timed and planned appropriately, the stream must be completely dry or have marginal flows for the duration of the construction activities; and
    iv) The advice of the Qualified Professional on construction timing (as per (i) above) and mitigation measures (as per (ii) above), as well as the timing of work and the presence of the Qualified Professional, must be documented in writing. This documentation must be submitted as part of the post construction reporting for this project.

(i) All works must be completed within the designed project footprint and in accordance with the following:

1. Report “Upper Lagace Creek (SCR 17) and Saporano Creek Bank Protection and Sediment Removal Environmental Management Plan ” prepared for Ministry of Environment and Climate Change Strategy by Associated Environmental February 2024.
2. Sealed Drawing Issued for RFP and Permitting Hatzic Emergency Works Program Lagace Creek- Site S-CR 14/17 2022-2632-03 “ Drawing C-3105 Civil Plan- SCR-17 Sediment Removal” prepared for Ministry of Environment and Climate Change Strategy by Associated Engineering dated July 5, 2024.
3. Sealed Drawing Issued for RFP and Permitting Hatzic Emergency Works Program Lagace Creek- Site S-CR 14/17 2022-2632-03 “ Drawing C-3106 Civil

Plan- SCR-17 Sediment Removal" prepared for Ministry of Environment and Climate Change Strategy by Associated Engineering dated July 5, 2024.

4. Sealed Drawing Issued for RFP and Permitting Hatzic Emergency Works Program Lagace Creek- Site S-CR 14/17 2022-2632-03 " Drawing C-3506 Civil Detail Sediment Removal" prepared for Ministry of Environment and Climate Change Strategy by Associated Engineering dated July 5, 2024.

(j) The holder of this Approval must hire an appropriately Qualified Professional to conduct Environmental Monitoring on all in-stream works authorized under this Approval. The Qualified Professional is responsible for observing the methods of construction and preparing information and reports on the compliance of the construction activities. The Qualified Professional must:

1. Ensure all best management practices and mitigation measures are in place to avoid and minimize environmental impact on the land and on fish and fish habitat of the stream.
2. Where applicable, assist in the isolation of the stream prior to the commencement of works.
3. Implement and ensure erosion and sediment control measures are constructed, installed, and maintained appropriately for the full duration of instream works.
4. Supervise all instream works authorized under this Approval.
5. Complete a sweep for wildlife species at risk prior to starting works.
6. When the works involve temporary diversions to isolate the work site,
   i) Monitor all diversion works daily to ensure pumps & flow bypasses are in proper working condition;
   ii) Ensure diversion works that include pump intakes be screened for fish and aquatic species in accordance with the "Interim code of practice: End-of-pipe fish protection screens for small water intakes in freshwater" (Fisheries and Oceans Canada, 2020); and
   iii) Ensure fish are prevented from entering the works.
7. When the works involve dewatering or isolation of flow and the stream is known or suspected to contain fish and/or amphibians,
   i) Attend the site prior to conducting any instream works to complete fish and wildlife search and salvage(s);
   ii) Obtain any permits needed prior to undertaking the salvage(s); and
   iii) Inspect the extraction area for fish stranding at least once after water levels have declined.
   iv) Protect the species at risk and salvage under the direction of a Qualified Environmental Professional in the event of discovery of species at risk. The works must not result in harm to species at risk.
8. Be granted authority to stop the work authorized under this Approval if deemed necessary to address risks to the environment. The Qualified Professional or their designate (specified in writing) must be on site during all phases of construction in and around the stream to ensure this component is upheld.
9. In the event of an environmental incident or non-compliance with any of the terms or conditions of this Approval, an appropriately Qualified Professional

must immediately mitigate the situation. Within 48 hours, each incident must be reported to the Water Manager at SouthCoastWSAReporting@gov.bc.ca with the approval number in the subject line. The incident report must describe mitigation measures employed and a rationale as to why works have resumed, or the next steps required before works may resume. The holder of this approval must follow the advice of the appropriately Qualified Professional.

(k) All work must be carried out in accordance with the Provincial "Requirements and Best Management Practices for Making Changes In and About A Stream in British Columbia" (2022). The Provincial guidance document can be found at the following link: https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/working-around-water/wsa-cias-requirements-bmps.pdf .

(l) The holder of this Approval must provide as-built drawings post-construction within 60 days of completion of the works. The drawings must include all modifications made from the initial drawings during the construction process and include justification for the modifications. The drawings must be labelled with this Approval file number and labelled in the subject line of the email and submitted to SouthCoastWSAReporting@gov.bc.ca.

(m) The holder of the Approval must submit a Construction Environmental Management Plan prepared or approved by an appropriately Qualified Professional to SouthCoastWSAReporting@gov.bc.ca with this Approval file number in the subject line of the email prior to commencing works.

(n) Upon commencement of the project, work must be pursued to completion as quickly as possible.

(o) All proposed works must be completed in isolation of the stream flows.

(p) All equipment and machinery used in or near the stream channel:

1. Be in good operating condition and free of leaks, excess oil and grease.
2. Have a spill containment kit readily accessible on-site with operators and/or staff on site trained in handling and applying a spill kit appropriately to any spills/incidents.
3. Be refueled a minimum of 30 meters away from all streams.
4. Use environmentally sensitive hydraulic fluids which are non-toxic to aquatic life and which are readily or inherently bio-degradable.
5. Any spill of a substance that is toxic, polluting, or deleterious to aquatic life of reportable quantities must be reported to the Dangerous Goods Incident Report 24-hour phone line at 1-800-663-3456.

(q) Sediment and Erosion Control plans must be developed, designed, implemented and monitored by an appropriately qualified person. The plans, implementation and

monitoring must also address stormwater pollution prevention for the duration of construction.

(r) Sediment and Erosion Control measures to prevent the release of silt, sediment or sediment-laden water must be in place before starting works that may result in sediment mobilization. Care must be exercised during all phases of the work to prevent the release of silt, sediment, sediment-laden water, raw concrete, concrete leachate, or any deleterious substances. All control measures must meet or surpass the Requirements and Best Management Practices for Making Changes in and About a Stream in British Columbia (2022) and the "Land Development Guidelines for the Protection of Aquatic Habitat" (Fisheries and Oceans Canada and the British Columbia, 1993).

(s) Discharge and runoff water from the site into any watercourse(s) must comply with the BC Approved Water Quality Guidelines for the Protection of Aquatic Life (https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-quality/water-quality-guidelines/approved-water-quality-guidelines) and/or the applicable Local Government Bylaw(s) .

Water quality monitoring must be conducted by an appropriately Qualified Professional or a designate (in writing) Environmental Monitor on every day in which instream works are being conducted. Measurements must be taken upstream of any works taking place and within the extent of the sedimentation downstream of where instream work is actively occurring. Measurements are to be taken immediately prior to works beginning, and then at regular intervals until the works are completed and may require additional frequency during wet weather conditions. Wet weather conditions will be defined as being equal to or greater than 25 millimetres of rainfall within a 24-hour period. All excavated material and debris must be removed from the site or placed in a stable area above the high water mark of the stream. Mitigative measures must be applied to protect the excavated material and debris from erosion and reintroduction into the watercourse. These measures may include covering the material with erosion blankets, seeding and planting with native vegetation, or as otherwise directed by a Qualified Professional.

(t) All excavated material and debris must be removed from the site or placed in a stable area above the high-water mark of the stream. Mitigative measures must be applied to protect the excavated material and debris from erosion and reintroduction into the watercourse.

(u) The holder of this Approval must ensure that instream works are designed and installed so as not to restrict fish passage and/or lead to fish stranding. The works must not result in depressions that have the ability to trap fish and other aquatic life.

(v) All temporary works (including a ford, stream crossing, flow bypass, and erosion and sediment control measures) must be removed on completion of the project, and the stream channel restored to its natural condition.

(w) All disturbed areas of the banks of the stream must be restored using native vegetation suitable for the site conditions.

(x) Rock used as riprap must be clean of any substances deleterious to aquatic life and must be durable, angular in shape and suitably graded and sized to resist movement by stream flow. Any other engineering material required for the construction of the works must be clean of any substances deleterious to aquatic life.

(y) Drought mitigation: Monitor current drought conditions as per the Provincial Drought Level Classification system (Level 0 – 5, Drought information – Province of British Columbia (gov.bc.ca)) during all instream works, undertakings and activities. Instream works must cease if the Drought Level Classification is at Level 5. The proponent must contact WLRS and DFO under this circumstance to evaluate current on-site conditions and additional avoidance and mitigation measures. Instream works may commence only after receiving written permission from WLRS.

1. If instream works are occurring during a period of drought or the dry summer period when the Drought Level Classification is below Level 5, and works involve the loss of habitat that provides cold water refugia for fish (e.g., deep pools), the QEP must ensure salvaged fish are relocated to an area that provides similar habitat conditions (e.g., well-shaded habitat, habitat with known ground-water upwelling, pools, or undercut banks).

2. Site isolation and fish salvage(s): Instream works, undertakings and activities where there is potential for fish presence must only be carried out within previously isolated and salvaged areas. Incorporate applicable measures and standards from DFO's Interim standard: in-water site isolation and ensure pumps are screened to prevent entrainment or impingement of fish according to DFO's Interim Code of Practice for End-of-pipe Fish Protection Screens for Small Water Intakes. It is the Proponent's responsibility to obtain the necessary Federal and Provincial fish collection permits for fish salvage and follow the conditions therein. The isolation areas must be inspected regularly and maintained throughout the project.

(z) The holder of this Approval must retain an appropriately Qualified Professional to develop and implement a Three-Year Effectiveness Monitoring Plan that includes:

1. Maintenance and monitoring of plantings (including watering);
2. Replacement of plantings, where necessary, to ensure 100% tree survival and minimum 80% shrub and other vegetation survival rate.
3. Invasive species management; and
4. Monitoring water flow and function with proposed adaptive management strategies to address shortfalls.

Annual reports must be submitted by December 1 of each calendar year following completion of construction to SouthCoastWSAReporting@gov.bc.ca. The reports and subject line of the email must be labelled with this Approval file number.

(aa) The holder of this Approval must provide a detailed post-construction report no later than December 1 of the year works were completed. The report must be submitted by email to SouthCoastWSAReporting@gov.bc.ca with the approval file number listed in the subject line of the email and the title of the report. The report must include a signed statement from an appropriately Qualified Professional summarizing:

5. The in-stream works undertaken;
6. The timing of those works;
7. The total in-stream area directly affected;
8. The pre-construction and post-construction surveys if undertaken;
9. The quantity of gravel removed;
10. Representative site photographs;
11. Whether or not they observed or were otherwise aware of any non-compliance with the terms and conditions of this Approval; and
12. A description of any environmental incidents, non-compliance or other difficulties, and how these were addressed and reported.

Sincerely,



Michael Currie
Assistant Water Manager

Province of British Columbia
Water Sustainability Act

PERMIT # 29877 AUTHORIZING THE OCCUPATION OF CROWN LAND

The holder of this permit, Ministry of Environment and Climate Change Strategy - Surrey (29877), whose Change Approval authorizes changes in and about a stream (Lagace Creek), is hereby authorized to occupy Crown Land by constructing, maintaining and operating the works as authorized in the Change Approval (2011242).

(a) The Crown land which is authorized to be occupied under this permit is a portion of Unsurveyed Crown foreshore or Land Covered by Water being part of the Bed of Lagace Creek, the location of which is shown approximately on the plans associated with said Change Approval.

(b) The approximate dimensions of the Crown Land authorized to be occupied under this permit, are for approximately 0.04 hectares.

(c) Prior to cutting, destroying or clearing of any timber necessary to construct, maintain and operate the said works or the clearing of the said lands which may be flooded, the permittee shall apply for and obtain a licence to cut timber from the Ministry of Forests, District Manager. The amount of stumpage, royalty and/or compensation payable to the Crown in respect of trees, including merchantable or young growth, cut, removed, damaged, or destroyed by the permittee, shall be the sum or sums fixed by the Forest Service of the Province of British Columbia.

(d) This permit is appurtenant to the land, mine, or undertaking to which the aforesaid Change Approval is appurtenant.

(e) This permit shall become void if the Change Approval with respect to which the permit is issued should terminate, be abandoned or cancelled, or amended so as to render this permit unnecessary.

(f) This permit is issued and accepted on the understanding that the permittee shall indemnify and save harmless the Government of the Province of British Columbia for all loss, damage to works, cost or expense suffered by the permittee by reason of the Crown land or any portion thereof being submerged or damaged by erosion or otherwise affected by flooding.

(g) The holder of this permit shall not be entitled to compensation if the Crown grants permits to other persons to occupy the land affected by this permit.

(h) In the event of a dispute at any time with respect to the area or boundaries of the land affected by this permit, the holder shall, at his own expense, have the said land surveyed by a duly authorized surveyor.



Michael Currie
Assistant Water Manager

Fisheries and Oceans Canada
Pêches et Océans Canada

Pacific Region
Ecosystem Management Branch
200 – 401 Burrard Street
Vancouver, BC
V6C 3S4

Région du Pacifique
Direction de la gestion des écosystèmes
Pièce 200 – 401 rue Burrard
Vancouver (C.-B.)
V6C 3S4

September 17, 2024

Our file *Notre référence*

22-HPAC-01308

Ministry of Environment and Climate Change Strategy
Environmental Protection Division
Attention : Thyren Jacobs
P.O. Box 9337
Victoria, BC V8W 9M1

Via email: thyren.jacobs@gov.bc.ca

Dear Thyren Jacobs:

Subject: Sediment Removal and Bank Protection, Pattison, Carratt and Davies Creeks, Hatzic Valley – *Fisheries Act* Authorization – Amendment

The Fish and Fish Habitat Protection Program of Fisheries and Oceans Canada (DFO) would like to acknowledge receipt on September 9, 2024 of your request made pursuant to section 5 of the *Authorizations Concerning Fish and Fish Habitat Protection Regulations* (the Regulations) to amend your authorization issued under paragraphs 34.4(2)(b) and 35(2)(b) of the *Fisheries Act*.

The Program has reviewed the content of your amendment request and is notifying you that it is complete and that the authorization is hereby amended effective on this date. The amendments to the authorization are noted as footnotes in the attached *Fisheries Act* Authorization (22-HPAC-01308), September 2024 Amendment.

Failure to comply with any of the terms or conditions of the authorization as amended may lead to prosecution under the *Fisheries Act.*

A copy of this authorization should be kept on site while the work is in progress and upon request be provided to relevant federal or provincial officials. The authorization holder is responsible for ensuring work crews are familiar with, and able to adhere to, the conditions.

Canada

.../2

Please note that information submitted to DFO may be shared with Indigenous peoples with whom DFO has consulted in relation to the Crown's Duty to Consult if your proposed work(s), undertaking(s) or activity(ies) may adversely affect Aboriginal or treaty rights.

Information pertaining to this authorization will be posted to the *Fisheries Act* Registry Dataset and accessible from the Department's website at https://www.dfo-mpo.gc.ca/pnw-ppe/registry-registre-eng.html as well as from the Open Government DFO Registry Portal at: https://open.canada.ca/data/en/dataset/2c09d2fd-9a8e-4d8c-b5af-95747e36eaac . Projects-specific information will continue to be posted online, as the Department continues to develop its own Registry resources. Updates to the data set will be released monthly.

Any disclosure of information will be conducted in accordance with the *Access to Information Act* and the *Privacy Act*. Should you have any documents that contain sensitive or proprietary information that you believe should be protected from public disclosure, please contact us to discuss whether and how the information may be protected.

If you, or anyone conducting work on your behalf, have any questions please contact Duncan Lanoville at our Vancouver office by email at Duncan.Lanoville@dfo-mpo.gc.ca. Please refer to the file number referenced above when corresponding with the Program.

Yours sincerely,

Rotinsky, Brenda

Digitally signed by Rotinsky, Brenda
Date: 2024.09.17 15:14:01-07'00'

Brenda Rotinsky
Watershed Operations Regulatory Manager
Fish and Fish Habitat Protection Program

Att. Paragraphs 34.4(2)(b) and 35(2)(b) *Fisheries Act* Authorization, (22-HPAC-01308), September 2024 Amendment

Cc: Naomi Sands, Associated Environmental Consultants Inc. sandsn@ae.ca.

Paragraphs 34.4(2)(b) and 35(2)(b) *Fisheries Act* Authorization
September 2024 Amendment[1]

Authorization issued to
BC Ministry of Environment and Climate Change Strategy (ENV) *(hereafter referred to as the "Proponent")*

Attention to:
Thyren Jacobs
PO Box 9337 Stn Prov Govt
Victoria, BC
V8W 9M1

Location of Proposed Project

Nearest community: Mission
District: Fraser Valley Regional District
Province: British Columbia
Name of watercourses and coordinates:

Priority sites:

1. CR-12 - Pattison Creek (near Sylvester Road): 49.224318°, -122.225164°
2. CR-28 - Carratt Creek (at Carratt Road bridge): 49.262427°, -122.217317°
3. CR-38 - Davies Creek: 49.175456°, -122.227440°

Remaining nine (lower priority) sites:

4. CR-13 - Legace Creek (near 11744 Stave Lake Road): 49.215732°, -122.251508°
5. CR-14 - Legace Creek (at 10491 Farms Road): 49.191343°, -122.250592°
6. CR-15 - Legace Creek (at Seux Road): 49.217294°, -122.236456°
7. CR-16 - Legace Creek (from confluence with Pattison Creek to Seux Road Bridge): 49.131411°, -122.135081°
8. CR-17 - Legace Creek (between Pattison Creek and Allan Lake)
   Site 1 - Failed Driveway: 49.235909°, -122.218453°
   Site 2 - Legace Creek Tributary: 49.240045°, -122.217729°
9. CR-34 - South Herford Creek: 49.208806°, -122.230723°
10. CR-35 - McNab Creek: 49.245478°, -122.216991°
11. CR-36 - Eng Creek: 49.249415°, -122.217877°
12. CR-37 - North Herford Creek: 49.209358°, -122.231182°

[1] September 2024 Amendment: This is the second amendment to *Fisheries Act* Authorization 22-HPAC-01308 originally issued on October 27, 2022. The previous amendment was issued on November 23, 2023. Amendments to this Authorization will be highlighted in footnotes. All previous Authorizations related to the Project are rescinded and no longer valid.

Valid Authorization Period

This Authorization remains in force from the Date of Issuance until Fisheries and Oceans Canada (DFO) confirms to you in writing that all of the requirements of this Authorization have been met, in particular those requirements relating to monitoring, offsetting measures and contingency measures[2].

Please note that this Authorization may contain more specific timing requirements and limitations. These are set out in the Conditions of Authorization section.

Description of Proposed Project

The proposed project of which the works, undertakings or activities authorized is a part of involves:

- Emergency works to remove accumulations of sediment, organic debris or anthropogenic debris ("debris") in locations where it poses a risk to downstream infrastructure (e.g., bridges or homes) under high flow conditions in the fall and spring periods between 2022 and 2024[3]; and/or
- Completing emergency works to stabilize bank slopes and implement erosion protection measures.

The project is described in the following documents, hereafter referred to collectively as the "Project Plan":

- Application Form and supporting documents for the Issuance of an Authorization under Paragraphs 34.4(2)(b) and 35(2)(b) of the *Fisheries Act* (Emergency Situation) received on October 13, 2022.
- The *Ministry of Environment and Climate Change Strategy: Pattison, Carratt and Davies Creeks – Sediment Removal and Bank Protection Environmental Management Plan* report produced by Associated Environmental Consultants Inc. dated October 2022.
- The *Form for Authorization Holders to Request an Amendment to an Authorization* dated June 16, 2023.
- The *Form for Authorization Holders to Request an Amendment to an Authorization* dated September 9, 2024[4].

Description of Authorized works, undertakings or activities likely to result in the death of fish by means other than fishing and/or the harmful alteration, disruption or destruction of fish habitat:

- Site isolation using either pumps or temporary diversion channels;
- Removal of watercourse substrate (including sediment or debris) using excavators, large trucks, and hand tools;

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[2] November 2023 Amendment: Changed from December 31, 2030 expiry to "This Authorization remains in force from the Date of Issuance until Fisheries and Oceans Canada (DFO) confirms to you in writing that all of the requirements of this Authorization have been met, in particular those requirements relating to monitoring, offsetting measures and contingency measures."
3 November 2023 Amendment: Changed from "in the 2022 fall and 2023 spring periods" to "in the fall and spring periods between 2022 and 2024".
[4] September 2024 Amendment: Project Plan document added.

- Relocation and/or removal of large woody debris from the watercourses using excavators, large trucks, and hand tools;
- Bank repairs and installation of erosion protection measures; and
- Removal of riparian vegetation for site access.

The authorized works, undertakings or activities are likely to result in the following impacts to fish and fish habitat:

- Alteration and disruption of aquatic habitat including substrate removal and replacement likely to result in a reduction in habitat availability and complexity, and cause sedimentation.
- Site isolation leading to a temporary disruption to fish passage which may impact life history stages including spawning, migration, overwintering and rearing.
- Alteration and disruption to stream bank habitat likely to result in a reduction in habitat function of both the aquatic and riparian habitat.
- Alteration, disruption and destruction of riparian habitat for site access.

Riparian and aquatic footprints of the above WUAs for Pattison, Carratt and Davies Creeks shall not exceed what is described in the Project Plan. For the nine lower-priority sites, riparian and aquatic footprints shall not exceed what is required to alleviate flood risk based on the Risk Assessment Methodology of the Project Plan.

Conditions of Authorization

The above-described work, undertaking or activity must be carried on in accordance with the following conditions.

1. **Conditions that relate to the period during which the work, undertaking or activity can be carried on**

   The work, undertaking or activity that is/are authorized to be carried on during the following period:

   FROM: Date or Issuance TO: December 31, 2025[5]

   If the Proponent cannot complete the work, undertaking or activity during this period, Fisheries and Oceans Canada (DFO) must be notified in advance of the expiration of the above time period. An application for amendment, suspension or cancellation of the authorization should be submitted to DFO.

   The periods during which other conditions of this authorization must be complied with are provided in their respective sections below.

[5] November 2023 Amendment: Changed from December 31, 2023 to December, 31, 2025.

2. Conditions that relate to measures and standards to avoid and mitigate impacts to fish and fish habitat

2.1 Works, undertakings or activities shall be conducted in a manner that avoids the death of fish.

2.2 A Qualified Environmental Professional will be onsite during high-risk instream and riparian works (e.g., substrate removal, riparian vegetation removal) to oversee/direct avoidance and mitigation measures to reduce impacts to fish and fish habitat and avoid unauthorized death of fish by means other than fishing and harmful alteration, disruption and destruction of fish habitat.

2.2.1 Conduct full time observations for all fish species that may be present near and within the project footprint and modify or direct works to the extent possible to avoid or minimize potential injury and death of fish;

2.2.2 Prior to sediment removal and other instream disturbances, isolate work site(s) and salvage fish;

2.2.3 Fish salvage methodologies should consider the winter nocturnal activity of juvenile salmonids (e.g. Pacific salmon and trout species) that may spend the day concealed in the stream substrates. Where isolation occurs, conduct fish salvage between dusk and dawn (sunset/sunrise) when fish emerge to forage, to avoid and mitigate against the death of juvenile fish;

2.2.4 Relocate all salvaged fish species from the work area, or those holding below a work area, back to the same watercourse in a nearby area that is not impacted by construction or removal works or its zone of influence (i.e., areas of higher turbidity due to instream works);

2.2.5 Conduct full time monitoring for deleterious substance released during the removal of sediment and direct avoidance and mitigation measures to reduce impacts to fish and fish habitat and avoid unauthorized death of fish by means other than fishing and harmful alteration, disruption and destruction of fish habitat and to prevent their further movement into the watercourse; and

2.2.6 Monitor implementation of the conditions of this authorization.

2.3 Sediment and erosion control: Sediment and erosion control measures must be in place and shall be upgraded and maintained, such that release of sediment is avoided at the location of the authorized work, undertaking, or activity. Monitor the watercourse for signs of sedimentation resulting from the works, undertakings or activities and take corrective action if required.

2.3.1 Areas of streambank disturbed during the works shall be rehabilitated to a stable condition (e.g. re-sloped and contoured) and protected from erosion.

2.4 List of measures and standards to avoid and mitigate impacts to fish and fish habitat:

2.4.1 Every reasonable effort should be made to minimize the frequency and duration of instream works, including excavation. Work from established infrastructure, above the high water mark (i.e., top of bank), or at a minimum above the water line when possible. Restrict instream disturbance to the area(s) required to access and remove accumulations of sediment;

2.4.2 Fish passage is to be maintained around the isolated work zones through the implementation of a diversion channel where practicable. Sites with expected adult salmon presence with spawning and/or overwintering habitat upstream should be prioritized for a diversion channel. If a diversion channel is not practicable and fish are observed holding below the work zone, ongoing fish salvage is required to relocate fish around the work zone;

2.4.3 Large woody debris can only be removed from the floodplain if it poses imminent risk to downstream infrastructure and property. Where possible, stockpile the natural debris removed from the floodplain to an area that can be accessed for future restoration work. Reinstall root wads or large woody debris below the high water mark where practicable;

2.4.4 Do not stockpile materials such as rock, riprap, or dirt in areas where the material has the potential to enter fish-bearing waters;

2.4.5 Maintain all machinery on site in a clean condition and free of fluid leaks. All heavy equipment should use environmentally friendly oil ("enviro-oil");

2.4.6 Store fuel a minimum of 30 m from any watercourse[6]. Wash, refuel and service machinery and store fuel and other materials for the machinery in such a way as to prevent any deleterious substances from entering the watercourse;

2.4.7 Have spill containment and clean-up materials within operating machinery and vehicles and on site in case of leaking deleterious substances (e.g., fuel, oil, grease) from extracted anthropogenic debris. Report leaks or spills of deleterious substances that have caused, or are about to cause, the unauthorized death of fish by means other than fishing and/or the harmful alteration, disruption or destruction of fish habitat to DFO.PACViolations-infractionsPAC.MPO@dfo-mpo.gc.ca and to Observe, Record, Report at 1-800-465-4336 or DFO.ORR-ONS.MPO@dfo-mpo.gc.ca;

2.4.8 Dispose of all anthropogenic debris removed at an appropriate waste management facility as required; and

2.4.9 Works must be conducted in the dry. Follow DFO's interim Codes of Practice for Temporary Cofferdams and Diversion Channels (https://www.dfo-mpo.gc.ca/pnw-ppe/codes/cofferdams-batardeaux-eng.html) and End-of-Pipe Fish Protection Screens for

[6] September 2024 Amendment: Condition 2.4.6 revised for clarity from "Fuel should be stored a minimum of 30 m from any watercourse" to "Store fuel a minimum of 30 m from any watercourse".

Small Water Intakes in Freshwater (https://www.dfo-mpo.gc.ca/pnw-ppe/codes/screen-ecran-eng.html) if isolation and pumping is required. Follow DFO's Code of Practice for Temporary Fords[5] (https://www.dfo-mpo.gc.ca/pnw-ppe/codes/temporary-fords-traversees-temporaires-eng.html).

If works cannot be conducted in the dry due to challenging instream conditions, sediment removal in the wet can occur if all other measures and conditions in Section 2 (as well as outlined in The *Form for Authorization Holders to Request an Amendment to an Authorization* dated September 9, 2024) have been applied[7].

2.5 Avoid removal of riparian vegetation, particularly mature trees, as much as possible. Where removal of riparian vegetation is not avoidable:

2.5.1 Prune or top the vegetation instead of grubbing/uprooting;

2.5.2 Construct access points and approaches perpendicular to the watercourse;

2.5.3 Rehabilitate areas of the streambank disturbed during the works to a stable condition (e.g., sloped and contoured and protected from erosion);

2.5.4 Re-vegetate disturbed areas with native trees, shrubs and grasses species suitable for the site; and

2.5.5 Where possible, incorporate bioengineering (i.e., pocket planting, live staking, root wad placement, etc.) within the bank restoration and erosion protection designs.

2.6 Avoid the installation of riprap bank slopes to the extent practicable.

2.7 Avoid works, undertakings or activities in Critical Habitat (as defined under the *Species at Risk Act*), or the handling or harm of species listed as Threatened or Endangered under the *Species at Risk Act*. If these aforementioned works, undertakings or activities are required, works must stop and Proponent shall contact DFO for additional guidance and/or permitting.

2.8 Contingency measures shall be put in place if monitoring required in section 3 below indicates that the measures and standards to avoid and mitigate impacts to fish and fish habitat are not successful.

2.9 Dates by which these measures and standards shall be implemented: Measures and standards to avoid and mitigate impacts to fish and fish habitat shall be implemented prior to the initiation of works, undertakings or activities.

[7] September 2024 Amendment: Condition 2.4.9 revised to allow for sediment removal in cases where only partial isolation can be obtained.

3. Conditions that relate to monitoring and reporting of measures and standards to avoid and mitigate impacts to fish and fish habitat.

3.1 Monitoring of avoidance and mitigation measures: The Proponent shall monitor the implementation of avoidance and mitigation measures referred to in section 2 of this authorization and report to DFO, within 30 days post-construction, and indicate whether the measures and standards to avoid and mitigate impacts to fish and fish habitat were conducted according to the conditions of this authorization. This shall be done by:

3.1.1 Demonstration of effective implementation and functioning: Providing dated photographs and inspection reports to demonstrate effective implementation and functioning of mitigation measures and standards described above to limit the impacts to fish and fish habitat to what is covered by this authorization; and

3.1.2 Contingency measures: Providing details of any contingency measures that were followed, to prevent impacts greater than those covered by this authorization in the event that mitigation measures did not function as described.

3.2 Other monitoring and reporting conditions:

3.2.1 Providing dated photographs of each debris removal, inspection reports and details outlining how each condition of this Authorization was met, and whether avoidance and mitigation measures were effective in reducing or limiting serious harm to fish to what is authorized herein;

3.2.2 Providing a geospatial polygon that accurately represents the completed HADD footprint(s). Geospatial polygon data should be collected using WGS 1984 to four (4) decimal places (e.g., 28.5234ºN, 80.6830ºW). Geospatial polygon data must be supplied in Shape File (.shp) format to ReferralsPacific@dfo-mpo.gc.ca with reference to DFO file: 22-HPAC-01308. In addition to the geospatial polygon, the following data must also be supplied in an Excel file (i.e., metadata):

- The date of sediment/debris removal, the type of debris removed (e.g., log jam, boulders etc.), the watercourse of removal, the coordinates of removal, if leaks or spills of deleterious substances were documented and mitigation measures to contain and clean leaks and spills;
- The type of HADD (e.g., riparian removal, aquatic footprint, etc.), the date of the HADD, and HADD area per habitat type (based on depth during high and low water seasons, high water mark); and
- Brand name and model of GPS unit, the coordinate system used, and guaranteed accuracy of GPS unit.

3.2.3 Providing a summary of observational mortality for the death of fish (e.g., eggs, alevins, fry) by means other than fishing related to the works, undertakings or activities.

3.2.4 Providing a summary of the fish salvaged. The information summarized shall include dates, the number of individuals salvaged, the location of salvage and relocation, and the nature of any effects to fish salvaged (capture, death, sub-lethal harm, etc.).

3.2.5 Providing details of any contingency measures that were followed, should prescribed mitigations not function as intended, to contain the impacts to fish and fish habitat to that which is authorized herein.

4. Conditions that relate to offsetting

4.1 Upon receipt and review of the monitoring results and supporting documentation outlined in section 3 above, DFO will determine whether offsetting is required.

4.2 If offsetting is required, the Proponent shall prepare a draft offsetting plan, consistent with the DFO's *Policy for Applying Measures to Offset Adverse Effects on Fish and Fish Habitat Under the Fisheries Act* and *Applicant's Guide Supporting the "Authorizations Concerning Fish and Fish Habitat Protection Regulations"* and provide it to DFO within 45 days of receipt that an Offsetting Plan is required.

4.3 If offsetting is required, the offsetting plan shall include the information identified in Schedule 1, Section 16 of the *Authorizations Concerning Fish and Fish Habitat Protection Regulations*, including an offsetting effectiveness monitoring plan.

4.4 Once acceptable to DFO, the offsetting plan shall be implemented with any additional requirements from DFO.

Authorization Limitations and Application Conditions

The Proponent is solely responsible for plans and specifications relating to this authorization and for all design, safety and workmanship aspects of all the works associated with this authorization.

The holder of this authorization is hereby authorized under the authority of Paragraphs 34.4(2)(b) and 35(2)(b) of the *Fisheries Act*. R.S.C., 1985, c.F-14, to carry on the work(s), undertaking(s) and/or activity(ies) that are likely to result in impacts to fish and fish habitat as described herein.

This authorization does not purport to release the applicant from any obligation to obtain permission from or to comply with the requirements of any other regulatory agencies.

This authorization does not permit the deposit of a deleterious substance in water frequented by fish. Subsection 36(3) of the *Fisheries Act* prohibits the deposit of any deleterious substances into waters frequented by fish unless authorized by regulations made by Governor in Council.

It is also your *Duty to Notify* DFO if you have caused, or are about to cause, the unauthorized death of fish by means other than fishing and/or the harmful alteration, disruption or destruction of fish habitat. Such

notifications should be directed to DFO.PACViolations-InfractionsPAC.MPO@dfo-mpo.gc.ca **and** to Observe, Record, Report at 1-800-465-4336 or DFO.ORR-ONS.MPO@dfo-mpo.gc.ca.

The failure to comply with any condition of this authorization constitutes an offence under Paragraph 40(3)(a) of the *Fisheries Act*, and may result in charges being laid under said Act.

A copy of this authorization should be kept on site while the work is in progress and upon request be provided to relevant federal or provincial officials. The authorization holder is responsible for ensuring work crews are familiar with, and able to adhere to, the conditions.

This authorization cannot be transferred or assigned to another party. If the work(s), undertaking(s) or activity(ies) authorized to be conducted pursuant to this authorization are expected to be sold or transferred, or other circumstances arise that are expected to result in a new Proponent taking over the work(s), undertaking(s) or activity(ies), the Proponent named in this authorization shall advise DFO in advance.

Date of Issuance: September 17, 2024

Approved by: Rotinsky, Brenda Digitally signed by Rotinsky, Brenda Date: 2024.09.17 15:22:34-07'00'

Brenda Rotinsky
Watershed Operations Regulatory Manager
Fish and Fish Habitat Protection Program
Fisheries and Oceans Canada

APPENDIX C – ARCHEOLOGICAL PERMITS

HERITAGE CONSERVATION ACT

APPLICATION FOR HERITAGE INVESTIGATION PERMIT

The undersigned hereby applies for a permit, under **Section 12.2** of the *Heritage Conservation Act*, to carry out a Heritage **Investigation** in accordance with the information requested on the reverse of this form.

Name: **Sarah Fraser, A/Associate Deputy Minister**	*Company:* **Ministry of Forests, Lands and Natural Resource Operations and Rural Development (FLNRORD)**
Address: 4th Floor, 545 Superior Capital Park, Victoria BC V8V 0C5	
Phone: 250-953-3334 (Archaeology Branch)	*Email:* Archpermitapp@gov.bc.ca

Permit expiry date:	**May 31, 2023**
Permit deliverables[1] due:	**May 31, 2023**

Financial responsibility for the assessment is assumed by the following proponent(s):

Name: **Jeff Sheldrake, A/Assistant Deputy Minister, Coast Area**	*Company:* **FLNRORD**
Address: 4th Floor - 2975 Jutland Road, Victoria, BC V8T 5J9	
Phone: (778) 974-5826	*Email:* Jeff.Sheldrake@gov.bc.ca

Name: **Brent Persello, Environmental Services Manager**	*Company:* **Ministry of Transportation and Infrastructure (MoTI)**
Address: 477 Columbia Street, Kamloops, BC V2C 2T3	
Phone: 778-362-4522	*Email:* Brent.Persello@gov.bc.ca

☒ Other Provincial Government or Local Government proponents with responsibilities for flood recovery activities may be added to this permit without an amendment, pending submission of a client certification and client endorsement, as appropriate, to the Archaeology Branch.

[1] Deliverables include: report(s), site records, shapefiles, repository acceptance as required – see Section 8

PERMIT APPLICANT'S CERTIFICATION

I certify that I am familiar with the provisions of the *Heritage Conservation Act* of British Columbia, and that I will abide by the terms and conditions listed herein, or any other conditions the Minister may impose, as empowered by said *Act*.

Permit Applicant's Certification

Date:	*Permit Applicant Name and title:*	*Signature:*
December 14, 2021	**Sarah Fraser** **A/Associate Deputy Minister,** **FLNRORD**	

APPLICATION FOR HERITAGE INVESTIGATION PERMIT

Briefly summarize the project: This Multi-Assessment Permit (MAP) will support government's response to and recovery from the widespread damage caused by 2021's catastrophic rain events and resulting flooding and landslides in the south and coastal regions of British Columbia. Various Provincial Ministries and Local Governments are tasked with responding to emergency events, restoring infrastructure, cleaning up debris and environmental contamination, and maintaining public health.

The Associate Deputy Minister of the Ministry of Forests Lands and Natural Resource Operations (FLNRORD), South Area will hold the permit. Proponents will include representatives from FLNRORD and the Ministry of Transportation and Infrastructure (MoTI). Additional government proponents may be added to the permit without amendment. To expedite work, Ministries may undertake work for each other where that is more practicable (e.g., FLNRORD for MOTI projects).

The original permit study area is defined by the fifteen Natural Resource Districts affected by flooding (Figures 1-7):

Table 1. Natural Resource Regions and Districts included in permit

Area	Region	District	Figure(s)
North	Skeena	Coast Mountains	1
Coast	West Coast	North Island – Central Coast	1
		Campbell River	1
		South Island	1 & 2
	South Coast	Sunshine Coast	1
		Sea to Sky	1
		Chilliwack	1 & 3
South	Thompson-Okanagan	Cascades	1 & 4
		Okanagan-Shuswap	1 & 5
		Thompson Rivers	1

Area	Region	District	Figure(s)
South	Kootenay-Boundary	Selkirk	1 & 5
		Rocky Mountain	1 & 6
	Cariboo	100 Mile House	1
		Cariboo-Chilcotin	1 & 7
		Quesnel	1 & 7

As of November 26, 2021, the province has identified 14 landslides and 102 flood events (Figures 1-7) impacting MoTI infrastructure. While additional projects may be added to the permit by Notice of Intent by the Delegated Archaeologist, emergent situations with immediate threats to public or environment health and safety can be added to this permit by proponents without notice of intent, following approval by the Archaeology Branch.

The permit authorizes the investigation of archaeological sites, and areas suspected to contain archaeological sites, which may be impacted by ongoing weather-related impacts requiring emergency impact management, or by recovery work. Recovery work includes but is not limited to:

- relocation of debris and soil,
- slope and bank stabilization,
- removal of contaminated sediments and materials,
- cleaning and repair of infrastructure (i.e., fences, poles, ditches, culverts, road, bridges),
- clean-up of surface debris,
- geotechnical investigation,
- repair or construction of dykes or levees,
- construction of temporary structures, roads and facilities while repairs are completed,
- blasting, and
- gravel extraction.

Specifics about the nature and extent of works and affected infrastructure will be identified in the Notice of Intent, or, if in response to significantly emergent work, in the report summarizing the assessment.

The permit scope is broad, recognizing the nature of impacts and required work is not fully understood at the time of this application, but will unfold through the winter season. This is balanced with the need complete timely infrastructure repairs and clean up. The use of Archaeological Overview Assessments (AOAs) and Preliminary Field Reconnaissances (PFRs) to support and prioritize Archaeological Impact Assessment (AIA) efforts are encouraged in light of the volume of work that needs to be done. To support analysis of the impacts the 2021 floods had on archaeological sites, the final report will include the results of AOAs and PFRs. When appropriate, archaeologists have flexibility around the timing, nature and methods of the assessment (i.e., emergency, in advance, during

monitoring work, or on a post-impact basis) depending on the local conditions, type of site, safety, visibility and/or contamination. These considerations should be part of a workplan.

The permit structure is unique but considers the lessons and approaches of the Wildfire permits (2018-0375 and 2020-0034), to facilitate archaeological assessments following natural disasters on a provincial scale. This investigation permit, held by the Province, allows for assessments as and when-needed; government agencies who sign on as proponents may hire any number of eligible archaeologists to work under the permit. The archaeologist, referred to as a delegated archaeologist, is responsible for all of the permit's terms and conditions related to their contracted scope of work. Delegated archaeologists must meet eligibility requirements. Field Directors and Supervisors (per Bulletin 17) may be utilized by the delegated archaeologist, who is responsible for their work.

Where feasible, new land alterations will require assessment prior to construction/earth moving. If infeasible, a program of concurrent monitoring or post-impact assessment should be completed under this permit.

The Archaeology Branch must review and approve mitigation plans for all sites, including recommendations for systematic data recovery or additional HCA permits.

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1. FIELD PERSONNEL

The Archaeology Branch (the 'Branch') may approve the addition of Delegated Archaeologists without an amendment to the permit. Documentation of personnel roles by the Delegated Archaeologist will comply with Bulletin 17 (*e.g.*, roles and dates assumed).

Given the size and scope of the impacts, government agencies who sign onto the permit may contract a number of archaeologists to conduct assessments to work under permit to support the response to the 2021 fall floods. The archaeologists are referred to as delegated archaeologists because the responsibilities under the permit are delegated from the Province, who holds the Heritage Investigation Permit. Consequently, delegated archaeologists must be qualified and eligible to hold HCA permits in the project areas.

The proponents and delegated archaeologist(s) will consider comments from First Nations when making in-field decisions and management recommendations.

Additional comments: At the time of application, no Field Directors had been added to this permit.
Delegated archaeologists must be qualified and eligible to hold multiple permits in the culture area they are working in (i.e., not a novice permit holder; no overdue obligations).

2. PROPOSED PROJECT

This project is for:

☐ Research ☒ Resource Management

Maps that comply with Provincial **standards** are attached to this application. Attached maps include appropriate information (*e.g.,* location of previous field studies, previously recorded archaeological sites, and/or modeled archaeological potential) as available.

Sector: Emergency Environmental Response

2.1 Location

Select land ownership type(s) and describe below.

Table 2. Location of Permit Area

Land Ownership	Description
☒ Other	*Locations affected by flooding and landslides under repair and remediation within the following Natural Resource Districts (Table 3; Figures 1-7), which may include private and Crown land*

Table 3. Natural Resource Districts of Permit

Area	Region	District	Figure(s)
North	Skeena	Coast Mountains	1
Coast	West Coast	North Island – Central Coast	1
		Campbell River	1
		South Island	1 & 2
	South Coast	Sunshine Coast	1
		Sea to Sky	1
		Chilliwack	1 & 3
South	Thompson-Okanagan	Cascades	1 & 4
		Okanagan-Shuswap	1 & 5
		Thompson Rivers	1
	Kootenay-Boundary	Selkirk	1 & 5
		Rocky Mountain	1 & 6
	Cariboo	100 Mile House	1
		Cariboo-Chilcotin	1 & 7
		Quesnel	1 & 7

2.2 Proposed Study Area

Describe project: Inventory and assessment of archaeological sites impacted by flooding and landslides as a result of 2021's catastrophic rainfall in southern and coastal British Columbia.

Are all locations to be assessed defined in this application?

☐ **Yes**. All spatial data (kml/kmz, shapefiles) submitted to the Branch via APTS.

☒ **No**. Explain how First Nations with an interest will be notified of proposed investigation areas:

The assessment locations are based on the extent of impacts from flooding, including areas adjacent required for repairs or clean up. At the time of application, additional "atmospheric rivers" are forecast, and further flooding events are anticipated in winter 2021/2022. As of November 26, 2021, the Province identified 15 landslides and 101 flood events, impacting MoTI infrastructure (Appendix 1; Figures 2-7), and more may be added as the extent of damage is identified.

Notifications will take the form of a "Notice of Intent" (NOI in accordance with the Multi-Assessment Permit Policy), with a minimum 30-day referral period, unless one of the following conditions occurs:

1) A project requires immediate action to support public or environmental health and safety,
2) A local consultation process with First Nations is established that waives or reduces the 30-day notification period

Note the following ***additional requirements*** for NOIs for this permit:

1. The NOI will clearly indicate the length of referral period.
    - Requests for expedited reviews will include a rationale.
2. NOIs will include a summary of recorded sites and related past archaeological studies. The summary will identify any concerns with the existing site record(s) for the project area.
3. NOIs will be sent to Indigenous Communities in the format they prefer, using their tracking numbers (when known), as well as via email to Archpermitapp@gov.bc.ca and archsiteform@gov.bc.ca, with the subject line "2021 Flood -NOI -**2021-0453**– Company - Project - <<Optional: unique identifier for company>>" to allow Branch staff to confirm the accuracy of the Provincial records in the vicinity of the project.
4. When AOAs or PFR studies have been conducted in response to these floods and landslides, a summary of those assessments will be included with the NOI, including mapping.
    - Non-permitted assessments relevant to the NOI (accessible by the delegated archaeologist) should also be included in NOIs.

☒ **Additional comments regarding permit area:** n/a

3. RELATED STUDIES

The following studies are known to exist within or near the proposed permit area: ☒

An Archaeological Overview Assessment (AOA):

☒ An archaeological predictive model

Details: Table 4 lists the GIS-based AOAs which can be accessed using the Remote Access to Archaeological Data (RAAD) by NRD. An AOA, developed for the Okanagan-Shuswap Natural Resource District, is under Provincial review, and an AOA for the Cariboo District, is under development and anticipated in 2023).

Table 4. AOAs within Permit Area

Area	Region	District	Archaeological Overview Assessment	Year
North	Skeena	Coast Mountains	An Archaeological Overview of the North Coast Timber Supply Area	2000
Coast	West Coast	North Island – Central Coast	AOA of Tree Farm License 25	2000
			Central Coast Land and Resource Management Plan AOA	1999
			GIS Modelling of Archaeological Potential for the TFL Forest Ltd. - Johnstone Strait Operation Area	2002
		Campbell River	Campbell River Forest District AOA	2007
		South Island	AOA Tree Farm License 44 Archaeological Potential Model	2009
			Archaeological Potential Modelling for the Capital Regional District	2008
			Checleset Bay and Outer Kyuquot Sound Cultural Heritage Resource Overview	2007
			City of Langford Archaeological Overview Assessment - Phase 1 Baseline Mapping	2007
			Archaeological Overview and Inventory of a Portion of Ditidaht First Nation	2001
			Hul'qumi'num Treaty Group AOA	2005
	South Coast	Sunshine Coast	n/a	n/a
		Sea to Sky	AOA of the Squamish Forest District	1997
		Chilliwack	Chilliwack Forest District AOA	1999
South	Thompson -Okanagan	Cascades	An AOA of Coldwater and Spius Landscape Units	2008
			Archaeological Overview Assessment Lillooet Forest District	1999
			Upper Similkameen Indian Band (USIMIL) AOA	2007
			AOA of a Portion of the Williams Lake Forest District	1998

Area	Region	District	Archaeological Overview Assessment	Year
South		Okanagan-Shuswap	Okanagan Timber Supply Area AOA (Salmon)	1997
			Okanagan Timber Supply Area AOA (Vernon)	1997
			Okanagan Timber Supply Area AOA (Penticton)	1997
		Thompson Rivers	AOA Northern Secwepemc Traditional Territory	1998
	Kootenay-Boundary	Selkirk	Archaeological Potential Mapping in Landscape Unit K11 Kootenay Lake Forest District	2009
			Arrow Timber Supply Area AOA	1996
			Boundary Timber Supply Area AOA	1997
			Columbia Forest District AOA	2008
			Columbia Forest District AOA	2007
			Columbia Forest District AOA	2008
			Columbia Forest District AOA	2006
			Landscape Unit K12 & K26 Meadow Creek AOA	2006
		Rocky Mountain	AOA of Landscape Units K12 and K26, K16-18 and K20-24, Kootenay Lake Forest District	2007
			AOA of Landscape Unit C20, Rocky Mountain Forest District	2008
			Cranbrook Timber Supply Area AOA	1997
			Moyie Lake AOA	2007
	Cariboo	100 Mile House	AOA Northern Secwepemc Traditional Territory	1998
		Cariboo-Chilcotin	Chilcotin Forest District AOA	1998
			AOA Northern Secwepemc Traditional Territory	1998
			AOA of a Portion of the Williams Lake Forest District	1998
		Quesnel	Quesnel Forest District GIS Model of Archaeological Potential	2009

☒ A desk-based assessment **Details:** See additional comments.

☒ Field studies. **Details:** Numerous studies have taken place within this area and will be considered in desktop assessments and field visits; see additional comments below.

AOAs and field studies which consider information from Indigenous Communities may contain more comprehensive information relevant to adequately assessing potential. Further, Indigenous Communities may have traditional knowledge and/or ethnographic studies _bookmark7to share with archaeologists.

Additional comments:

Desk-based AOAs: It is expected that development-specific reviews will be used to evaluate and prioritize field visits and that those assessments will, at a minimum, check the Provincial Heritage Register (PHR), and regional AOAs by accessing RAAD, and previous permitted assessments (accessed via the Provincial Archaeological Report Library – PARL). Archaeologists are encouraged to contact the Branch's Inventory section (archsiteform@gov.bc.ca) for unprocessed site records. The results of previous assessments that overlap with the development should be incorporated into desk-based AOAs.

PFRs: AOAs may be informed by PFRs conducted by non-field directors who have appropriate archaeological training and experience. PFRs involve field survey of the project area to precisely map areas of archaeological sensitivity. Areas of archaeological sensitivity are defined by the observation of either:

a) Archaeological sites (i.e., artifacts or features)

b) Areas of Potential (AOPs), which likely to contain buried archaeological resources.

Archaeological sites and AOPs may be submitted to the Branch based on the results of a PFR[2]. Archeological sites recorded as a result of the PFR must be reviewed by a field director to ensure that the appropriate information is collected to register the site

AOA/PFR Reporting: AOA or PFR reports used to identify recommend AIAs will be provided to the Branch and affected Indigenous Communities, and the results incorporated into the AIA report. For areas not assessed in the field due to a low potential assessment based on desktop and/or AOA model results, a rationale will be provided, for inclusion in the final report.

[2] Refer to the Branch's Site Form Guide (2021) and Mapping and Shapefile Requirements (2021) for additional details.

Table 5. Previous Field Studies Relevant to the Proposed Study

Type of Study	Direct Overlap with Development? (Y/N)	Distance, Direction from Proposed Development	Year Assessed	HCA Permit #	Comments Relevant to the Study
Investigation	Y	Various	2018-2020	2018-0275	Wildfire permits: adapting approach to support Province's responsibilities under HCA
Investigation	Y	Various	2020-Ongoing	2020-0034	

Additional comments: Numerous studies have taken place within this area and will be considered in desktop assessments and field visits.

Table 6. Previously Recorded Sites Relevant to Proposed Study

Proposed Development Component	Borden Number	Direct Overlap with Development? (Y/N)	Distance and Direction from Proposed Development[2]	Site Type	Permit # of Previous Visits [10]

Additional comments: As of November 26, at least 101 recorded sites are located within 1 km of MoTI infrastructure impacted by landslides and floods (Appendix 2: Archaeological Sites and MoTI infrastructure); while MoTI's projects do not presently overlap with any recorded sites, protected (unrecorded) resources may be present.

4. GOALS AND OBJECTIVES

4.1. Goals and Objectives

Specify proposed research goals:

This permit will support Provincial and Local Governments' response to manage and protect archaeological sites during remediation of lands affected by flooding and landslide events from 2021's catastrophic rainfall. Archaeological sites will be identified and assessed for significance and impacts, and management recommendations made. Emergency impact management response to ongoing impacts, or to support infrastructure, may be initiated without delay. The impacts of recovery from 2021's catastrophic flooding will be summarized in the final report. Archaeological assessments will be completed in advance of development or recovery activities where feasible. Given the post-impact environment, impacts to public and environmental health and safety, and challenges with worker safety and site visibility, the delegated archaeologist is authorized to implement the most effective

timing and methods for investigation.

4.2 Significance of Proposed Project

Describe significance of study: This permit approach is novel, by authorizing multiple proponents and archaeologists. This approach is intended to remove barriers associated with permitting for a project of unprecedented scope and urgency, allowing multiple government agencies to work together using several archaeological firms to mitigate impacts to archaeological sites. The final report will serve to summarize the impacts and consequences of the 2021 floods on archaeological sites.

4.3 Expected Outcomes:

Describe anticipated results: The assessments may result in the identification of new sites, as well as record the impacts to known sites. Management recommendations will be made for ongoing impacts, and the assessments will consider the impacts of future remediation actions. Salvage may be undertaken of sites under threat.

It is not expected that sites will be fully analyzed under this permit, unless flood clean-up efforts or infrastructure rehabilitation will result in permanent, unavoidable impacts to archaeological sites, and conditions allow for assessment.

5. METHODS

The delegated field director(s) will consider and document comments and concerns from Indigenous Communities when making in-field decisions and developing management recommendations under this permit.

Describe how areas will be selected for investigation:

All assessments are conducted at the request of the proponent(s), in accordance with a contracted scope of work, at locations impacted by flooding, landslides, or other events following the 2021 atmospheric rains.

Emergency response will be initiated to address ongoing, direct impacts to archaeological sites from flooding that must be undertaken to mitigate ongoing destruction. Projects may be prioritized based on public safety.

Other projects will be selected for assessment using a combination of GIS-based AOAs, desk-top AOAs, PFRs, advice from Indigenous Communities or archaeologists, or upon advice from the Branch. Ideally, areas identified to have high potential for archaeological sites will be surveyed in advance of remediation activities. If the PFR is completed by an experienced technician, any archeological sites recorded as a result of the PFR should be reviewed by a field director to ensure that the appropriate information is collected to register the site. Similarly, under the direction of a field director, diagnostic

artifacts, formed tools, and other cultural material may be collected.

It is anticipated most assessments will be limited to a defined development footprint (e.g., bridge replacement, fenceline, salvage polygon) in areas of high archaeological potential.

The field director is responsible to determine, implement, and document the methods employed and timing of assessment. For emergency works, the field director will determine the most effective site mitigation measure in consultation with the Archaeology Branch.

For remediation works such as removing debris or mud, the field director will determine the appropriate timing and method of inspection based on existing field conditions, taking safety and site visibility into consideration. If the local conditions do not allow for pre-impact inspection, then it is appropriate to monitor or conduct a post-impact assessment once the material has been cleared. If debris is suspected to contain archaeological material, it should be sampled as practical. The report will include a rationale for the timing of the assessment, and evaluation of the methods. Examples of factors considered to affect site visibility and worker safety include previous disturbance, debris, danger trees, mud deposit, moisture conditions, or soil stability. Assessments may also be delayed for those infrastructure projects requiring immediate replacement or remediation (e.g., installation of temporary bridges) to support public safety.

5.1. Archaeological Potential

Is archaeological potential a consideration?

☒ **Yes**

The assessment locations will be driven by flood and landslide recovery activities in conflict with known archaeological sites and areas evaluated to contain high potential. All in-field decisions about archaeological potential will be documented. Areas with low potential for archaeological resources may also be examined.

Potential for archaeological resources will be consider the following criteria.:

- Geological, terrain, or microtopographical features
- Proximity to potable water
- Slope
- Aspect
- Elevation
- Forest cover
- Soil drainage
- Proximity to sheltered areas (from wind or rain)
- Proximity to areas of potential cultural significance
- Shore lines
- Proximity to cultural resources (e.g., trails; berry patches; fishing sites; travel corridors)
- Any of the above conditions that existed in the past that are not present today (e.g., paleo landscapes, landforms obscured by agricultural practices)
- Previously recorded archaeological or heritage sites
- Areas identified by First Nations or other interested parties
- Significant disturbance

- Timber with potential for CMT sites
- Other (e.g., GPR)

5.2. Field Recording

Field notes will record in-field observations. Survey coverage and points of interest will be recorded (e.g., with a GPS or total station). A camera will be used to document in-field observations. When sites are identified, they will be mapped per Branch requirements[3].

Notes will document information provided by First Nations and observations to support the rationale behind in-field decisions regarding survey coverage, subsurface testing methods, and preliminary management recommendations for sites.

Polygons of negative subsurface test locations and areas of potential will be created for submission to the Branch. Notes will sufficiently describe sites to include necessary information to complete a site form[4] to Provincial standards.

5.3. Survey Coverage

Does this study include survey coverage?☒ **Yes**

The study area will be surveyed for archaeological features (e.g., cultural depressions, trees with modifications that may pre-date AD 1846), and areas exhibiting potential for archaeological resources (e.g., landforms and exposures). Surveyed terrain will be mapped in relation to the development footprint and described in the report.

Survey coverage will minimally address areas of anticipated archaeological potential identified by the AOA study (where they exist) and may be modified based on in-field observations. Areas of potential that are not surveyed will be mapped and rationale provided for why the area was not assessed and why it was evaluated to contain potential.

Select all that apply:

☒ Traverses or transects with crew members spaced at 10 m intervals or less in areas of high potential; at less than 25 m intervals in areas of moderate potential; at 10-40 m intervals in areas of low archaeological potential. **Additional details regarding approach:**

☒ The entire development will be surveyed with crew members spaced in less than 5 m intervals. **Additional details regarding approach:**

☒ Areas with high potential for surface artifacts will be surveyed with crew members spaced at 1-5 m intervals. **Additional details regarding approach:**

☒ Areas with terrain that has low potential for archaeological resources other than CMTs will be surveyed with crew members spaced at 5-50 m intervals. **Additional details regarding approach:**

[3] Defining Archaeological Site Boundaries & Protection Status: https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/archaeology/forms-publications/defining_archaeological_site_boundaries_protection_status.pdf
[4] Notes and photos are required by repositories and may be recalled by the Branch

☒ Areas of low archaeological potential may not be surveyed or will be surveyed en route to areas of high archaeological potential. **Additional details regarding approach:**

☒ **Other (provide details and rationale):** Areas subject to mass wasting events may not be accessible for systematic survey and/or sediments containing archaeological material displaced. The field director will develop a survey sampling plan to address local conditions.

Additional comments: Safety and environmental conditions will influence appropriate survey strategies The Field Director will explain why the survey coverage is appropriate, based on local conditions. It is understood that the project area may be loosely defined, based on the nature of the impacts (e.g., debris flow). The following guidance is intended to inform scope and level of effort:

- Where site material is found, inspection traverses and testing may be expanded up to 25 meters beyond the immediate permit area, except where impractical due to safety concerns or the limit of the permit authorization is reached (i.e., private or federal land), or where the level of assessment will extend the intent of this permit (e.g., 25 m along a linear development).
- If site material is observed to continue beyond the scope of the project area (e.g., 25 meters), detailed site mapping should stop and the boundary estimated, with recommendations for future work and appropriate AOP established.
- If site material is not observed in areas of adjacent potential, an AOP should be established.

It is recognized that pedestrian survey may not be feasible in flooded areas, and that surveys may require boats or other means to access or view project areas. Images from drone footage may be incorporated into PFRs.

Further to issues of access to subsurface deposits, the use of remote sensing technology such as ground penetrating radar may be considered in consultation with the Archaeology Branch.

5.4 Subsurface Testing

All AOPs and negative Subsurface Test Areas (STAs) will be mapped and shapefiles will be provided to the Branch, per the Mapping and Shapefile Requirements (i.e., shown as polygons with the number of tests, or each individual test shown).

Stratigraphic and subsurface descriptions will be recorded in the field and summarized in the report(s). Special attention will be paid to significant results, variations, and/or changes.

Reports will describe why the Field Director determined the sediments are culturally sterile. When the depth of culturally sterile deposits in the test was not determined, a rationale must be provided in the report.

The effectiveness of testing at each STA will be determined by a quantitative and/or qualitative evaluation of research. Assumptions about the type, size and artifact density of potential target sites will be described in this evaluation. Given the scope and intention of this permit, some STAs will not be fully assessed, but the full area should be reported as an AOP.

While the Branch generally recommends subsurface testing Areas of Potential (AOPs), they may be an appropriate approach under this permit. When not subjected to testing, reports will describe observations (e.g., microtopography, nearby drainages, vegetation); indicate how these characteristics affected the evaluation of potential; and provide management recommendations to avoid impacts to the AOPs until they can be fully assessed.

Select as appropriate:

☒ Tests will minimally measure 0.123 m^2 (e.g., 35 cm a side shovel test). Sediments will be screened through ¼" mesh or smaller. Tests will be excavated until culturally sterile sediments are confirmed (e.g., glacial till). **Additional details regarding approach:** none

☒ Soils believed to contain cultural materials will remain within the site boundary[5] and described in the site form and report. **Additional details regarding approach:** none

☒ STAs will be tested at 5 m intervals or less, within the STA. The field director will provide a rationale in instances where a different interval of testing is employed. **Additional details regarding approach:** none

☒ Soil probes may be used to confirm the presence of cultural deposits (e.g., midden; stratigraphy within cultural depressions). However, only mechanical augers or shovel testing can be used to demonstrate cultural deposits are not present to support site boundary definition. **Additional details regarding approach:** none

☒ Mechanical augers may be employed. **Describe approach**: Augers will be up to 40 cm in diameter, all sediments will be screened.

☒ Other methods will be followed. **Describe**: Given the variety of impacts and settings anticipated by the permit, the Field Director will consult with the Archaeology Branch if alternate methods are proposed.

Additional comments: Where wet screening is appropriate (e.g., waterlogged sediments) all displaced sediments will be screened through an appropriate sized screen (e.g., 1/4" or smaller). Sediments will be placed in the screen and washed through using a hand-held hose with a variable control nozzle. Contextual information will be maintained to ensure that levels, layers, and features are separated within evaluative units or shovel tests and cultural material recovered in the screens will be bagged by level, layer, and unit/test. Care must be taken to avoid environmental degradation from siltation in the screening area.

[5] Cultural deposits must be kept within site boundary and permit area

5.5 Wet Sites

Are wet sites anticipated?

☐ No. **Provide rationale:**

☒ Yes. **Describe specific methods:**

Additional comments: In the event a wet site is encountered, and safety conditions allow, the location will be stabilized and kept in a water-logged state in place until a research plan can be developed and appropriate stabilizing treatment of artifacts and repository confirmed (see Bernick 2019 for examples).

If the materials cannot be left in place due to risk of damage, they will be recovered and preserved by suitably qualified personnel with access to facilities for the recovery and passive conservation of materials pending permanent stabilization treatment. Wet site Specialists must be identified in advance. The Archaeology Branch will be contacted immediately to provide advice on procedures and consultation with First Nations when wet sites are found.

5.6 Machine-Assisted Investigations

Would you like to include provision for mechanical excavation (i.e., backhoes)?

☒ Yes (see below).

Machine-assisted inspection will comply with appropriate WorkSafe BC Requirements.

Machine-assisted inspections will be directed by a qualified archaeologist (i.e., field director).

In the event ancestral remains are identified, methods are described in Section 6.

Select as appropriate:

☒ Toothed buckets may be used to remove obstructions (pavement, boulders, etc.) prior to reaching potentially culture-bearing sediments. **Additional details regarding approach:** none

☒ Potentially culture-bearing sediments will be removed with a finishing bucket, in maximum 10 cm vertical lifts, to allow the archaeologist to observe any exposed features or intact deposits and collect artifact provenience in the most precise manner possible. The horizontal extent of lifts will not exceed 3 m. **Additional details regarding approach:** Field Director will document the extent of lifts, and describe circumstances where these increments are exceeded.

☒ The Field Director may use discretion to determine the amount of material to be processed; the report will include a summary of methods and the rationale behind in-field decisions. **Additional details regarding approach:** Processing will be limited to post-glacial deposits, where discernable. It is expected that at least 25% of material will be processed, unless required for immediate return to the location.

☒ In the event intact archaeological deposits or features are identified, mechanical excavation will cease, and excavation will proceed by hand or other methods in consultation with the Branch. **Additional details regarding approach:** Manual excavation will only proceed where safe and practical to do so. Site avoidance or other methods of investigation should be considered to make the area accessible.

☒ When non-intact archaeological deposits are identified, up to 3m^3 sediments will be excavated by hand. **Additional details regarding approach:** Where deposits are in excess of 3 m^3, manual excavation should be conducted on a sampling basis with 100% of excess mechanically excavated site material screened or raked.

☒ When greater than 3 m^3 of archaeological deposits are identified, the Branch and First Nations will be contacted. Work may not proceed without Branch approval. **Rationale and additional details regarding approach:** Given the variety of site types that may be encountered, it is expected that methods and approach will be vetted by the Archaeology Branch prior to implementation.

☒ Mechanically-displaced deposits will be inspected for cultural material (e.g., screening). **Describe methods:** Sediments suspected to contain archaeological material will be screened or raked on a sampling basis not to exceed 25% of post-glacial sediments. Sediments known to contain archaeological material will be 100% screened, except where midden deposits and/or human remains are encountered. Stockpiling Archaeological sites is not an ideal long term management option. It is expected that stockpile sites will not be created except in circumstances such as ancestral remains, or where First Nations support the use of a stockpile, or in emergency situations to support project feasibility.

☒ Alternate methods. **Provide detail:** Drill and auger flights will be 100% manually inspected. Geotechnical testing, such as mechanical test pitting, will be monitored and sample screened up to 25% of post-glacial sediments

☒ This section requires further discussion not outlined elsewhere in this section of the application. **Describe**: While standard methods may be followed, due to the nature of disturbed sediments resulting from floods and landslides, the Field Director is authorized to modify methods as deemed appropriate and provide a rationale in reports.

The preferred option for machinery type depends on local conditions. Rubber-tire mounted machinery is typically of lower impact than tracked machines but may be less effective for rutting in wetted areas, slopes or loose soils. Track-mounted machinery may be equally effective where vegetation is present, and conditions are dry, or may be necessary for safety. The archaeologist will consider local conditions and proposed machine works when designing the assessment plan.

5.7 Winter Assessments

Will winter assessment be employed?

☐ No (delete rest of the text in this section and proceed to next subsection)

☒ Yes. **Choose as appropriate:**

☒ Where test locations were initially visited under snow and frost-free conditions and evaluated to contain archaeological potential for subsurface archaeological resources. Methods may include evaluative units and systematic data recovery using artificial heating or other methods approved by the Branch to create snow and frost-free conditions.

☒ Winter survey may occur in areas evaluated to contain low potential for all archaeological resources, except culturally modified trees.

☐ This project is located within the Fort Nelson and/or Peace Natural Resource Districts (i.e., the Northeast Natural Resource Region).

☒ **Other:** `Winter assessments may be authorized for the purpose of geotechnical testing. Tests will be monitored, and excavated post-glacial sediments warmed and screened or raked.`

Testing strategies (and confidence in testing) will consider the degree in which microtopography was discernable.

Select as Appropriate:

☒ Snow will be removed as necessary, exposing the ground.
☒ Tools (e.g., concrete saws) may be employed to cut frozen ground.
☒ Subsurface tests will be excavated by shovel and/or pick-axe, etc.
☐ Subsurface test soils will be collected and bagged individually by test unit.
☐ Subsurface tests will be numbered and mapped; soils will be kept separate.
☐ Provisions will be made to transport the soils to facilities for screening.
☒ Sediments will be thawed and screened through ¼” mesh.
☒ Remaining cleaned clasts from the collection screen will be removed and visually inspected.
☒ Evaluative units may be excavated when the ground is heated, using excavation methods as discussed elsewhere in this application.
☒ If topography is difficult to discern, systematic testing will be employed and the methods employed will be outlined in the interim reports. Testing at smaller intervals may be required.
☐ Other. **Describe**:

Additional comments: Situations not covered by the application should be discussed with the Archaeology Branch to determine appropriate assessment strategy (e.g., frozen mud and debris flows).

5.8 Site Recording

Sites will be mapped using measuring tape, compass, GPS, total station, or similar. Archaeological features (e.g., cultural depressions) will be measured, mapped, and photographed. Sites and significant artifacts will be photographed in the field and detailed in a photo log.

Recognizing that conditions may not be ideal for site recording, these standard methods may be modified in consultation with the Archaeology Branch.

5.8.1. *Boundary Definition*

☒ **Standard methods will be followed regarding the definition of site boundaries:**

Site boundaries may be defined by subsurface testing, the extent of the landform, or administrative boundaries (*e.g.,* development boundary), per the *Defining Archaeological Site Boundaries* document.

When site boundaries are defined by subsurface testing, tests may be spaced 1-5 m apart on a grid, as appropriate. Additional testing may occur at the Field Director's discretion. Testing will continue until three negative tests are reached in each direction (*e.g.,* cardinal or ordinal), unless the site boundary is defined by the landform and/or administrative boundary.

For larger sites, "back testing" may be applied. The specific methods will be described in the report.

Where the site is comprised of one positive test, a minimum of four additional subsurface tests will be placed 1 m around the test.

5.8.2. *Collection of Archaeological Material*

All recovered archaeological materials including human remains, faunal remains, other fragile artifacts (e.g., wet site materials), will be handled with sufficient care during excavation, recording, transport, cleaning, analysis and storage to ensure no additional damage or negative impacts occur to the collections during these processes per Bulletin 26.

☒ Standard methods will be followed:

All archaeological materials from an archaeological context (e.g., artifacts, fauna) will be collected. Samples (e.g., radiocarbon, ethnobotanical) may be collected, as appropriate.

Exceptions:

- Large lithic scatters (>100 artifacts) may be sampled in consultation with the Branch; diagnostic artifacts will be collected, as well as artifacts at risk from proposed development or unauthorized collection.
- In midden contexts, all vertebrates and a representative sample of invertebrates will be collected;

- Fire Altered Rock (FAR) will be counted and weighed to the nearest 100 g in the field, but otherwise discarded. The location and distribution of FAR will be described, including by layer/level if appropriate.

Additional comments: It is anticipated that volumes of mixed material may be encountered. Stockpiling may be considered in exceptional circumstances based on the volume or nature of the material, such as ancestral remains. Stockpiling may be used as a temporary measure for project feasibility. The curation of stockpiles of site material is subject to approval of a management plan by the Archaeology Branch, and may require additional permitting.

5.8.3. *Flagging*

Will boundaries be flagged?

☐ No. **Provide rationale:**

☒ Yes. **Describe approach:** Sites will only be demarked in the field when required for impact avoidance during construction. All markings (e.g., snow fence, flagging) are considered temporary and specific to this project. No paint is to be applied to surface features for the purpose of site recording.

Additional comments: Given the variable ground conditions and potential for existing sites to be expanded or merged with new sites, it may be necessary to determine site boundaries after fieldwork is completed, in discussion with the Archaeology Branch.

5.9 CMT Survey

Are CMTs anticipated?

☐ No. **Provide rationale:**

☒ Yes. Following Bulletin 27[6], CMT sites will be recorded and samples will be analyzed in accordance with Branch standards[7]. Rationale and details regarding a sampling strategy[8] will be discussed in reports. CMTs presumed to post-date AD 1846 will be fully recorded and may be provided to the Archaeology Branch for addition for the Informed Contributor's Layer (ICL).

Additional comments: CMTs exposed landslides may be damaged or destroyed, but may be recognizable.

[6] https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/archaeology/forms-publications/bulletin_27_cmt_guidelines.pdf
[7] Defining Archaeological Site Boundaries; CMT Handbook
[8] I.e., Muir and Moon 2000

5.10 Evaluative Units

5.10.1. ***Systematic Data Recovery***

Will methods include systematic data recovery?

☐ **No**

☒ **Yes**

Describe under what circumstances evaluative units will be excavated: Up to 5 evaluative units may be excavated to assess the nature and extent of the site, where remediation plans do not allow for 100% site avoidance. If more than 5 evaluative units are considered necessary, the Archaeology Branch will be contacted prior to implementation to determine next steps: additional units may be authorized by the Archaeology Branch as part of an emergency response, or, if time allows, the excavation may be subject to discussion with affected Indigenous communities.

☒ **Standard methods will be followed:**

Evaluative units may be excavated in stratigraphic layers or arbitrary levels (5-10 cm). Features will be excavated by stratigraphic layer. Within thicker layers, 5-10 cm arbitrary levels will be excavated as appropriate.

3D provenience for features and artifacts found in situ will be recorded and cultural materials collected. For each unit, an illustrative representation to scale for two adjacent walls and floor plans will be prepared and labelled as appropriate. Photographs will be taken at the completion of each layer. Stratigraphy will be recorded.

Where wet screening is appropriate (*e.g.,* waterlogged sediments) all displaced sediments will be screened through an appropriate sized screen (*e.g.,* 1/4” or smaller). Sediments will be placed in the screen and washed through using a hand-held hose with a variable control nozzle. Contextual information will be maintained to ensure that levels, layers, and features are separated within evaluative units or shovel tests and cultural material recovered in the screens will be bagged by level, layer, and unit/test.

Additional comments: The site setting may need to be stabilized prior to undertaking controlled systematic excavation using measures such as caissons, tents or retaining structures.

5.10.2. ***Sampling***

☒ **Standard methods will be followed:**

If intact deposits are encountered, appropriate samples (*e.g.,* radiocarbon, column, bulk samples) will be taken. Description of methods and analysis will be provided in the report.

The provenience of all samples will be recorded. Samples will be labeled appropriately.

When column samples are taken, the volume from each stratigraphic component should be 1 L unless otherwise specified in the report. The samples will be dried and screened through nested geologic screens. The contents of the screens will be sorted and weighed to the nearest 0.01 g.

Samples will be processed by a qualified individual before the report deliverables are due. Samples will be analyzed in the lab using methods appropriate for geological, palaeobotanical, zooarchaeological, or micro debitage analysis, which will be described in the final report.

When samples are not processed, they will be stabilized for long-term storage, and their lack of analysis rationalized in the associated report(s).

Additional comments:

5.11 Ancestral Remains and Burial Features

In the event partial or complete human remains or burial features (*e.g.,* cairns and mounds) are identified in the field, nearby ground disturbance will cease. Ancestral remains and/or burial features will be protected in place. First Nations, the Branch, and other concerned parties will be immediately informed.

Where human remains of suspected forensic interest are encountered, local law enforcement and/or the Coroners Service will be notified.

☒ **Standard methods will be followed:**

Where suspected burial features are identified, the Field Director will record the rationale describing the basis for their identification. In addition to standard archaeological site recording human remains and burial features will be recorded to include, at minimum: horizontal and vertical extent, orientation and position, inventory of skeletal remains and grave inclusions, and integrity.

Where possible, basic osteological data will be recorded (*e.g.,* minimum number of individuals, sex, age, stature, and any evidence of trauma, disease and cultural modification).

Fragmentary or isolated human remains identified during post-field analysis will be kept in secure storage pending final disposition.

In consultation with all concerned parties, efforts will be made to rebury the remains in an appropriate area within the archaeological site boundary, in an area unlikely to be disturbed in the future. If the reburial location is within or near the original archaeological site, it will be mapped and recorded on the site form under that Borden number.

If the proposed reburial location is not in the vicinity of the original archaeological site, consultation will occur with the Branch to discuss what records are required.

In its description of the site, the report will cite the appropriate classification scheme(s) (*e.g.,* Mathews 2006).

5.12 Rock Art

If rock art is identified, it will be fully recorded (e.g., multiple overlapping photographs, sketches), whilst minimising damage, per Bulletin 26[9]. Rock art will not be subject to any procedure that involves physical contact with the image to make a recording of the image.

Additional comments: The location of rock art and its associated images are often considered sacred and confidential by First Nation communities; caution must be exercised accordingly to ensure the respectful collection and distribution of information. Photographs of features may be withheld from the interim and final report if requested by Indigenous Communities. Photographs are required for site records.

5.13 Significance Evaluation Scheme

Site significance will be evaluated following Section 3.5.2.2 and Appendix D of the AIA Guidelines. Archaeologists are encouraged to consider additional information that First Nations may have that will inform the significance evaluation.

5.14 Assessing Impacts

Assessing impacts to archaeological sites will follow 3.5.2.3 and Appendix F of the AIA Guidelines.

Mitigating Impacts

In order to determine the most appropriate mitigation plan, Field Directors will assign a low or high interpretive value to sites and compare that to the level of expected impact. While avoidance is always the preferred option, Table 7 summarizes the approach to be followed:

[9] https://www2.gov.bc.ca/gov/content/industry/natural-resource-use/archaeology/bulletins-policies

Table 7. Mitigating Impacts to Sites

Proposed Disturbance[10]	Low Interpretive Value[11]	High Interpretive Value
Light	Options include: no further work or, if warranted, monitoring or a post-impact assessment of the damaged portion of the site.	Monitoring or, if warranted, a post-impact assessment of the damaged portion of the site.
Heavy	Options include: no further work or, if warranted, monitoring or a post-impact assessment of the damaged portion of the site.	Any combination of systematic data recovery (SDR), additional subsurface inspection and/or monitoring, site protection measures.

Impacts may be mitigated through the use of geotextile fabric and overburden (e.g., clean fill), to temporarily protect archaeological sites from disturbance, under the direction of a Field Director.

A combination of recommendations (e.g., no further work; monitoring) can be proposed for sites with both low and high areas of interpretive value. Sites with high interpretive value, or activities not considered "urgent" may be subject to additional HCA permitting.

Any combination of emergency SDR, construction monitoring, site protection or post-impact assessment may be appropriate for sites (regardless of value) under immediate threat from a development that is required to mitigate further flooding or landslides.

6. METHODS AND TECHNIQUES FOR DATA ANALYSIS

Analysts must be qualified and named in report(s).

Select as appropriate:

☒ Ancestral remains will not be subjected to destructive testing nor out-of-Province analysis without approval from the Branch, following engagement with Indigenous Communities.

6.1. Artifact and Faunal Analysis

☒ **Standard methods will be followed:**

Artifacts will be sent out of the Province (even to other offices within the archaeological

[10] Light impacts include activities like removal of surface materials with minimal land alterations; heavy impacts include road and bridge construction, and land clearing activities.
[11] Interpretive value will consider artifact density, presence of exotic materials, presence of faunal materials, formed tools, diagnostic artifacts, and archaeological features.

firm) only with the permission of the Branch; the archaeologist will also contact Indigenous Communities with an interest in the site. The request to send artifacts out of the Province will include an artifact catalogue, photographs of tools and/or diagnostics, the reason for export, the destination and the length of time they will be out of Province.

All artifact assemblages will be analyzed with the intent of defining site function, activity areas and cultural chronology if possible (see Clark 2010, Mitchell 1971, and others).

Lithic analysis will use an established system (*e.g.,* Andrefsky 1998; Magne 1983). Interpretation of the assemblage will provide insight into technologies represented at the site (*e.g.,* core reduction, pressure flaking, heat treatment, etc.).

Tools will be measured and illustrated or photographed, with technological attributes noted.

Raw material sourcing analysis will be completed, where appropriate.

Faunal remains will be analyzed to the most specific taxa possible by a trained individual with access to an appropriate comparative collection or reference materials. Faunal elements will be identified by taxa, element, and side if possible, and any relevant cultural modifications or natural taphonomic processes noted, **with the aim of answering questions on site formation processes, subsistence strategies, environment, season of occupation, *etc.***

Additional comments:

6.2. Sample Analysis

☒ **Standard methods will be followed:**

Samples may be sent out of the province for analysis.

Where wet sites are encountered, monolith and/or specialist samples may be taken and processed.

Collected CMT samples (*i.e.,* stem rounds) will be analyzed. Per Bulletin 27, magnification will be used to improve the confidence of the results of tree-ring counting. Comparative collections will be used as appropriate for dendrochronology analysis.

The lab results from radiocarbon analysis will be appended to the report and site form(s). The report will present calibrated and conventional/standard dates.

Unprocessed samples will be stabilized for long-term storage.

Additional comments: none

7. DISPOSITION OF CULTURAL MATERIALS

Collected materials from archaeological sites (*e.g.,* wet site materials), will be handled with sufficient care during excavation, recording, transport, cleaning, analysis and storage to ensure no additional damage or negative impacts occur to the collections during these processes per Bulletin 26: Treatment of Archaeological Materials.

The permit report and site form(s) will identify the repository. Additional repositories may be added to the permit **upon completion of the study**, when it is known where materials originated, and if special curation measures are required. Additional repositories will require an amendment to the permit, subject to referral with affected Indigenous Communities.

Table 8. Permit Repository

Contact Name: Dr Genevieve Hill	*Repository:* Royal British Columbia Museum
Address: 675 Belleville Street, Victoria, BC V8W 9W2	
Phone: 250-893-8019	*Fax or Email:* GHill@royalbcmuseum.bc.ca

All artifacts recovered under permit must be labeled with a provincial catalogue number; the Province must be advised of the final catalogue number under this permit when cataloguing is complete.

Sediments believed to contain cultural materials will remain within the site boundary and a location specified in the site form and report. Samples may be collected for off-site analysis.

CMT samples will be analyzed and retained in-office for one year after the expiration of the permit and discarded.

Once the project is complete, all cultural materials and supporting documentation must be transferred to the designated repository prior to the permit expiry date, per their standards for packing and transport. Confirmation of acceptance of artifacts, samples, and record submission by the repository must be provided to the Branch prior to the expiration of the reporting period.

Materials to accompany the archaeological collection include:

- submission letter with box inventory
- artifacts and digital catalogue
- field notes (original and digital copies, including maps and sketches)
- photographs and photo log (copies of prints, if any, and digital), and
- interim report and specialized analysis appended (hardcopy and digital copy).

Additional comments: In the case of ancestral remains, collection and handling will be under the direction of and in consultation with Indigenous Communities. Human remains and suspected human remains are to be respectfully left in situ until recovery and disposition plans are made and confirmed by the affected parties. In emergency situations, in consultation with the Archaeology Branch, human remains, including ancestral remains, may be recovered or location stabilized to prevent ongoing direct impacts. Recovered ancestral remains will be held respectfully, in the territory, until direction can be received.

8. REPORTING

Reports, maps, and site records will comply with Branch standards. Electronic versions of reports will be provided to Indigenous Communities with an interest in the study area unless other arrangements are in place. Reports will include a distribution list to identify which Indigenous Communities were provided a copy of the report.

The Reference section will include relevant HCA permit number of previous studies. The titles of reports generated under this assessment will clearly identify the HCA permit number.

8.1. Site Records

Site forms and all related documentation (*e.g.,* maps, artifact catalogues) will comply with Branch requirements. Site forms will be submitted within 6 weeks of the completion of site investigations.

Additional comments: Archaeologists will provide the Archaeology Branch with a British Columbia Archaeological Site Inventory Form for all sites revisited or investigated under authority of this permit. To fulfill this condition, the site form, mapping, and related documentation must comply with Archaeology Branch directives for site record submission.

Archaeologists authorized to conduct assessments under this permit who fail to provide satisfactory site forms will be considered to have outstanding obligations, thereby affecting their ability to hold additional permits issued by the Archaeology Branch

For the purpose of this permit, all site forms submitted to the Archaeology Branch will be via email to archsiteform@gov.bc.ca, citing permit **2021-0453** in the subject line.

8.2. Reports

As appropriate, management summaries and recommendations will clearly articulate responsibilities under the *Heritage Conservation Act*.

Delegated archaeologists will submit interim reports to describe their assessments and the results under this permit.

Interim reports shall contain detailed descriptions of every part of each investigation area, in terms of the criteria used to evaluate archaeological potential. This includes all areas subjected to field inspection, as well as those areas reviewed solely through map and document review if the permit would have authorized field inspection of those developments.

Interim reports will provide a tabular description of shovel test areas (STA) in terms of size, stratigraphy, setting, and number of tests placed.

Interim reports will provide a tabular description of each area of archaeological potential (AOP) in terms of size, setting and recommended number of shovel tests.

Spatial data will be submitted to the Branch for STAs and AOPs.

All specialized analyses will be appended to the report.

Low potential areas, including areas assessed by desktop, will be described to support model development.

Unless otherwise discussed with Indigenous Communities or the Branch, all photographs of diagnostic artifacts, formed tools, and rock art will be included in the permit report.

Other details:

All deliverables must be submitted to the Archaeology Branch by email at archpermitapp@gov.bc.ca, citing permit **2021-0453** in the subject.

Proponents may require that non-permitted assessments are summarized and provided to the Archaeology Branch for inclusion in this report.

Archaeologists authorized to conduct assessments under this permit who fail to provide satisfactory interim reports will be considered to have outstanding obligations, thereby affecting their ability to hold additional permits issued by the Archaeology Branch.

Project tracking reports are required under this permit. See Appendix for the format of the report, which must be submitted in excel format.

Deliverables include:

- Project tracking report of field assessment and results
- Notice(s) of Intent
- Site records, including site forms, artifact catalogues, and other documentation
- PDF of finalized interim report(s). Appendices will include:
    - Specialized analyses (*e.g.,* radiocarbon dating)
    - Summary of notices of intent (as applicable).
- Shapefiles (as polygons):
    - study areas
    - shovel test locations
    - areas of potential not subjected to subsurface testing.

8.3. Schedule of deliverables

Is the report due within two years of the anticipated permit issuance?

☐ **Yes** (delete rest of text below and proceed to the next section).

☒ **No** (refer to Table 9409)

As the inability to access information from long-term projects impacts the efficiency and effectiveness of recourse management decisions for the project and archaeological activities in the general area of these studies, the following submissions will be due throughout the course of the permit:

Table 9. Schedule of Deliverables

Deliverable	Timelines (Choose as appropriate)	
	Standard	Other (Specify)
Project Tracking Report	☒ Monthly or Project completion	
Non-permitted PFR reports, including spatial data of survey coverage	☒ Project completion	
Interim reports	☒ For all developments assessed under the permit.	
Shapefiles	☐ Annually, on the anniversary of permit issuance	☒ Annually, on March 31
Summary reports		☒ Annually, on March 31

Site forms will be submitted within six weeks of the completion of site investigations.

A summary report is a status update of all projects by NOI, Interim Report and Site Inventory Records, and a forecast of outstanding work to be completed in the next year if possible, in a tabular format

Additional comments: The interim and summary report should utilize a tabular format.

9. APPLICANT

The applicant is an employee of the Province of British Columbia, Ministry of FLNRORD with the authority to sign on behalf of FLNRORD. This is his first permit.

Additional comments: Delegated Archaeologists will be added to the permit subject to review and authorization by the Archaeology Branch.

10. NOTICES

NOTICE REGARDING COPYRIGHT

At the time of report production, the owner(s) of the report copyright will be asked to grant a non-exclusive license to the Province of British Columbia for the purpose of copying and distributable ing the report. The original copyright owner will retain copyright ownership. The granting of this license will facilitate access to the archaeological data contained within the report and will therefore contribute to the protection of heritage resources throughout the Province. Copyright owners who refuse to grant a license to the Province, and anyone carrying out research on behalf of those copyright owners, will not be granted access to the Archaeology Branch's online library and will not be permitted to photocopy reports within the Branch office.

The following will be added to the first page of reports:

The copyright owner may be the corporate employer of the report author, the client for whom the report was written, the actual author, or the Province of British Columbia if written while employed by the Province. The Grant of License reads:

I_____confirm that I am the copyright owner (or a copyright owner) of this permit report, and for good and valuable consideration I irrevocably grant a non-exclusive license to the Province of British Columbia, for a term equal to the life of the copyright commencing on the date of execution below, to make copies of the reports, including all appendices and photos, and to provide such copies to anyone, at the discretion of the Province, either at no charge or at the cost incurred by the Province in making and distributing the copies. All parties, except the party for whom the report was prepared, acknowledge that any use or interpretation of this report is at the sole risk and liability of the subsequent user(s).

SAMPLE

Executed this____day of_____, 20XX, by

_____
Signature of Copyright Owner

_____
Affiliation

2020-0453
Permit Number

NOTICE REGARDING OTHER PERMITS

No permits or approvals, other than a *Heritage Conservation Act* permit, are required to carry out the inspections or investigations described in the permit application. However, licensees and property owners or developers may also require other approvals such as forestry cutting permits and municipal development permits.

11. REFERENCES

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GENERAL TERMS AND CONDITIONS OF PERMIT

1. Permits shall be valid for the term stipulated on the front of the permit unless otherwise suspended or cancelled. Extensions to the term of the permit, or other amendments, will be considered upon submission of an application to the Archaeology Branch at least 60 days prior to the expiry date of the permit.
2. The permit-holder or delegated archaeologist(s) shall provide the Archaeology Branch with one (1) bound copy and one (1) electronic copy in PDF format of a written report, in accordance with the standards required by the Minister, outlining the work carried out under the terms of the permit.
3. The delegated archaeologist(s) shall provide the Archaeology Branch with Project Tracking reports at the completion of each project.
4. The title page of all reports must indicate the name(s) of the copyright owner(s) and, where agreed to, a Grant of License statement completed and signed by the copyright owner(s).
5. A person appointed by the Archaeology Branch may at any time inspect any aspect of a project conducted under the terms of this permit. To further their inspection, the appointee may request field data, or conduct excavations within the study area. Unless other arrangements are made, data must be made available to the Archaeology Branch within five (5) days of their request. Notwithstanding the expiration or earlier termination of the term of the permit this provision will remain and continue in full force and effect.
6. Upon completion of any inspection or investigation involving excavations, the permit holder or delegated archaeologist(s) shall make reasonable efforts to ensure all sites are restored as nearly as possible to their former condition.
7. The permit holder or delegated archaeologist(s) shall arrange for a secure repository to curate any materials recovered under authority of the permit.
8. Heritage objects and associated materials recovered under authority of the permit may not be sold or exchanged for financial gain. Any other transfer of heritage objects, materials and records, or changes to the conditions identified under the "Disposition of materials collected..." section of the permit may only be carried out with prior consent of the Minister.
9. The permit holder or delegated archaeologist(s) shall conform to all requirements that may be imposed by the institution or organization named in the "Disposition of materials collected..." section of the permit.
10. Notwithstanding expiration or earlier termination of the term of the permit, provisions with respect to the "Disposition of materials collected ..." section shall remain and continue in full force and effect.
11. The permit holder or delegated archaeologist(s) shall utilize any site recording forms, formats or systems required by the minister. To fulfill this condition, the site form, mapping, and related documentation must comply with Archaeology Branch directives for site record submission. Failure to submit satisfactory site records will be considered an outstanding obligation, thereby affecting the archaeologists' ability to hold additional permits.
12. A Heritage Investigation permit issued under the HCA does not authorize entry onto land or into a building without the permission of the owner or occupier.
13. The permit holder or delegated archaeologist(s) shall submit spatial information (as a shapefile in accordance with the standards required by the Minister) of all study areas that were the subject of in-field inspections.
14. Where known, First Nation file numbers will be referenced in permit-related correspondence.
15. Unless other arrangements are made, First Nations will be provided electronic copies of reports for work conducted in their area of interest under the permit.

16. In the event ancestral remains are encountered, all work must cease in the vicinity of the remains and the Archaeology Branch must be contacted for direction, unless otherwise provided for in the permit application
17. Archaeologists qualified as a Permit Holders in the appropriate cultural area will be retained by the applicant, and act as a co-permittee, known as the delegated archaeologists.
18. The delegated archaeologist is responsible for all of the terms and conditions of the permit (e.g., site records, management recommendations, and interim reporting) for fieldwork conducted under the permit. The delegated archaeologist must be an eligible permit holder, having no outstanding obligations with the Archaeology Branch and sufficiently experienced to hold permits without conditions (i.e., not a novice permit holder).
19. The delegated archaeologist may utilize Field Directors per Bulletin 17.
20. All impact management recommendations must be reviewed and signed by the Delegated Archaeologist or similarly qualified Eligible Permit Holder, though emergent situations may be approved by Archaeology Branch staff.
21. Any ground-altering activities within known archaeological sites must be conducted under the direction of the archaeologist.
22. The permit holder shall conduct the inspection as described in the permit application, unless otherwise specified in the permit.
23. Any other conditions that may be specified in the permit.

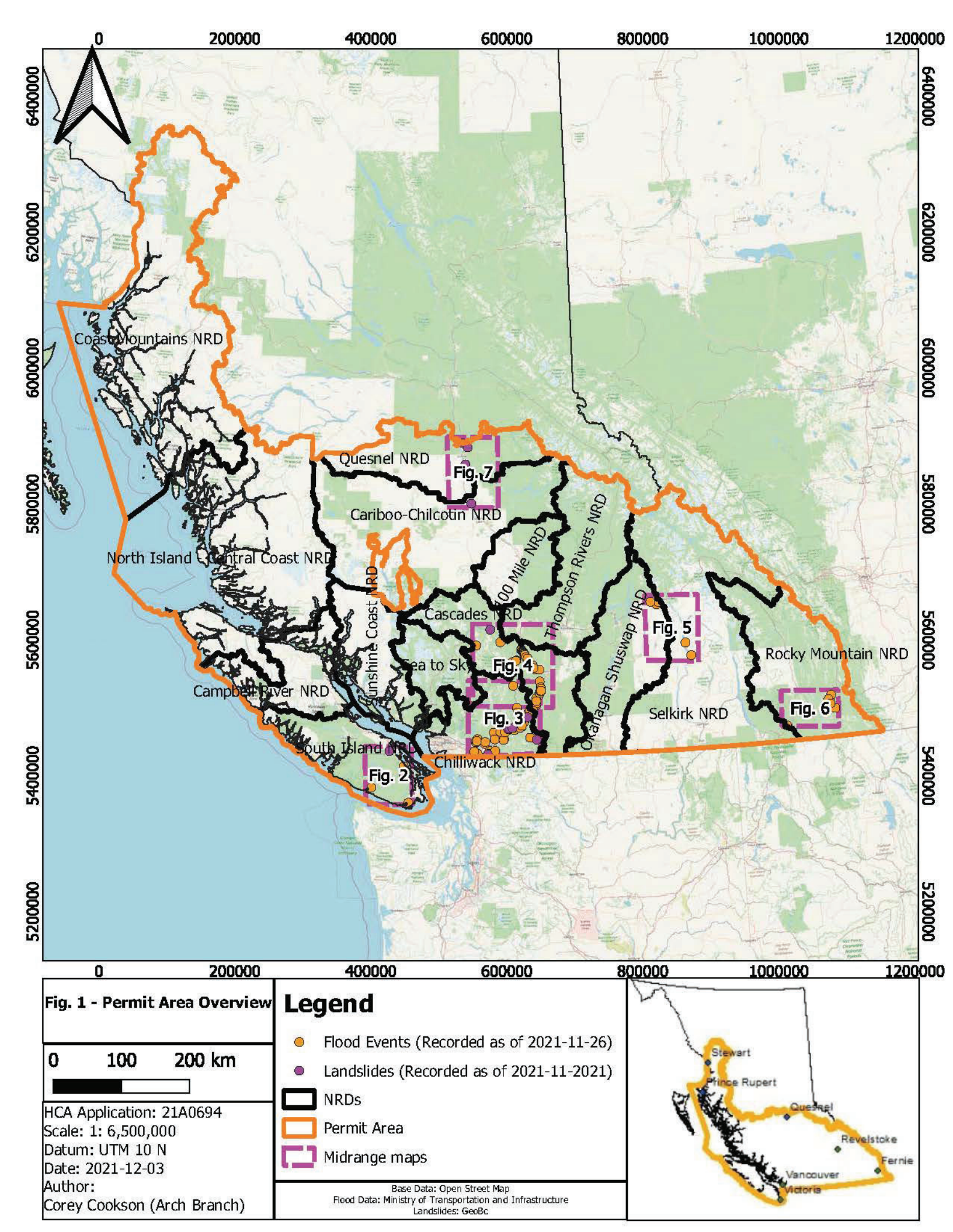


Fig. 1 - Permit Area Overview

0 100 200 km

HCA Application: 21A0694
Scale: 1: 6,500,000
Datum: UTM 10 N
Date: 2021-12-03
Author:
Corey Cookson (Arch Branch)

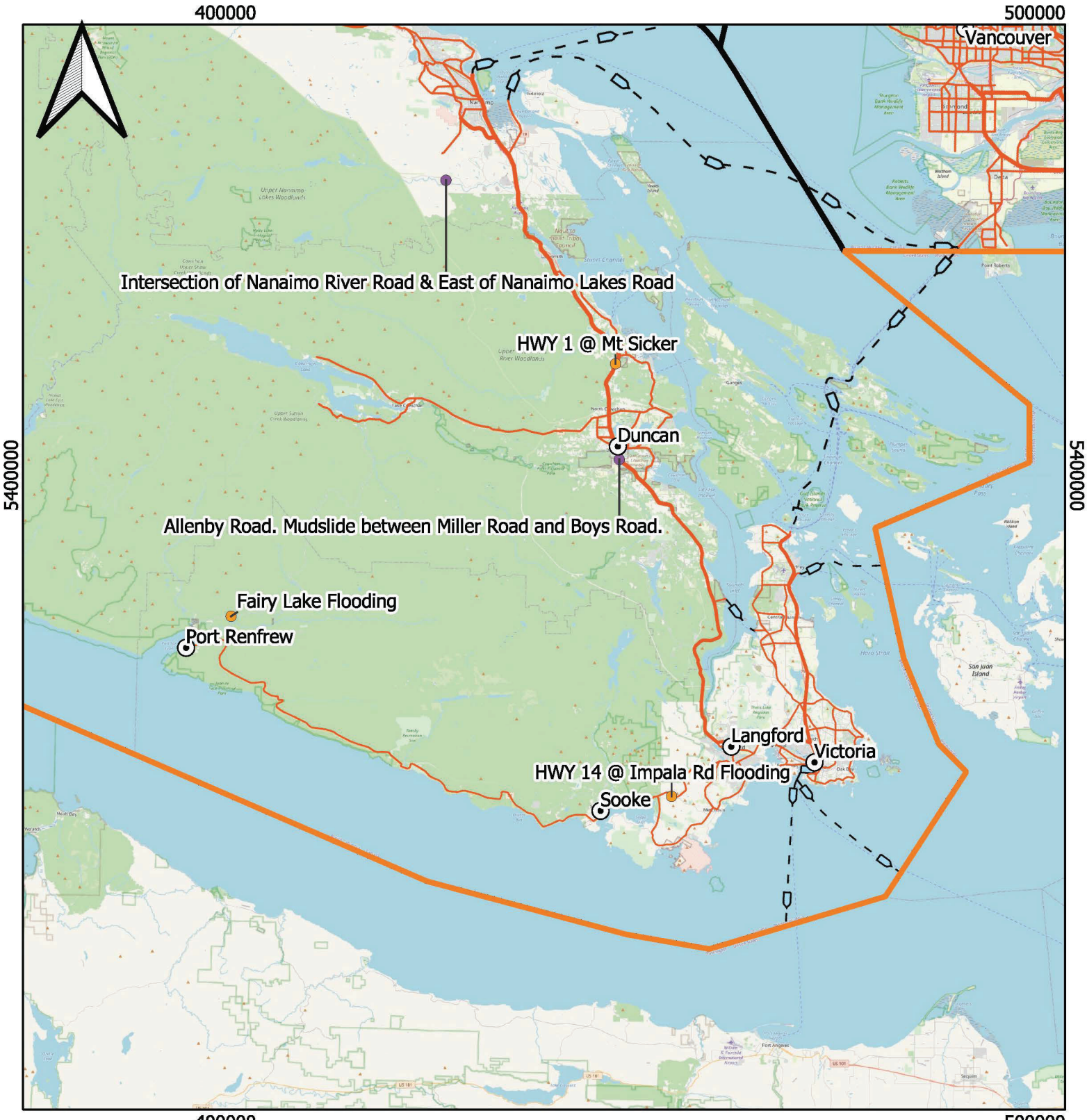


Fig. 2 Midrange - South Island

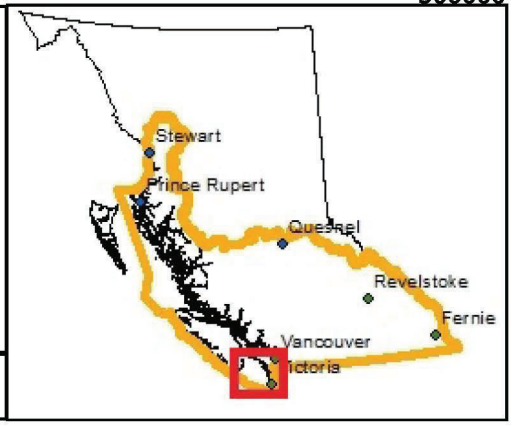
0 10 20 km

HCA Application: 21A0694
Scale: 1: 650,000
Datum: UTM 10 N
Date: 2021-11-26
Author:
Corey Cookson (Arch Branch)

Legend

- Permit Area
- Cities
- Highway
- Landslides (Recorded as of 2021-11-26)
- Flood Events (Recorded as of 2021-11-26)

Base Data: Open Street Map
Flood Events: Ministry of Transportation and Infrastructure
Landslides: GeoBC



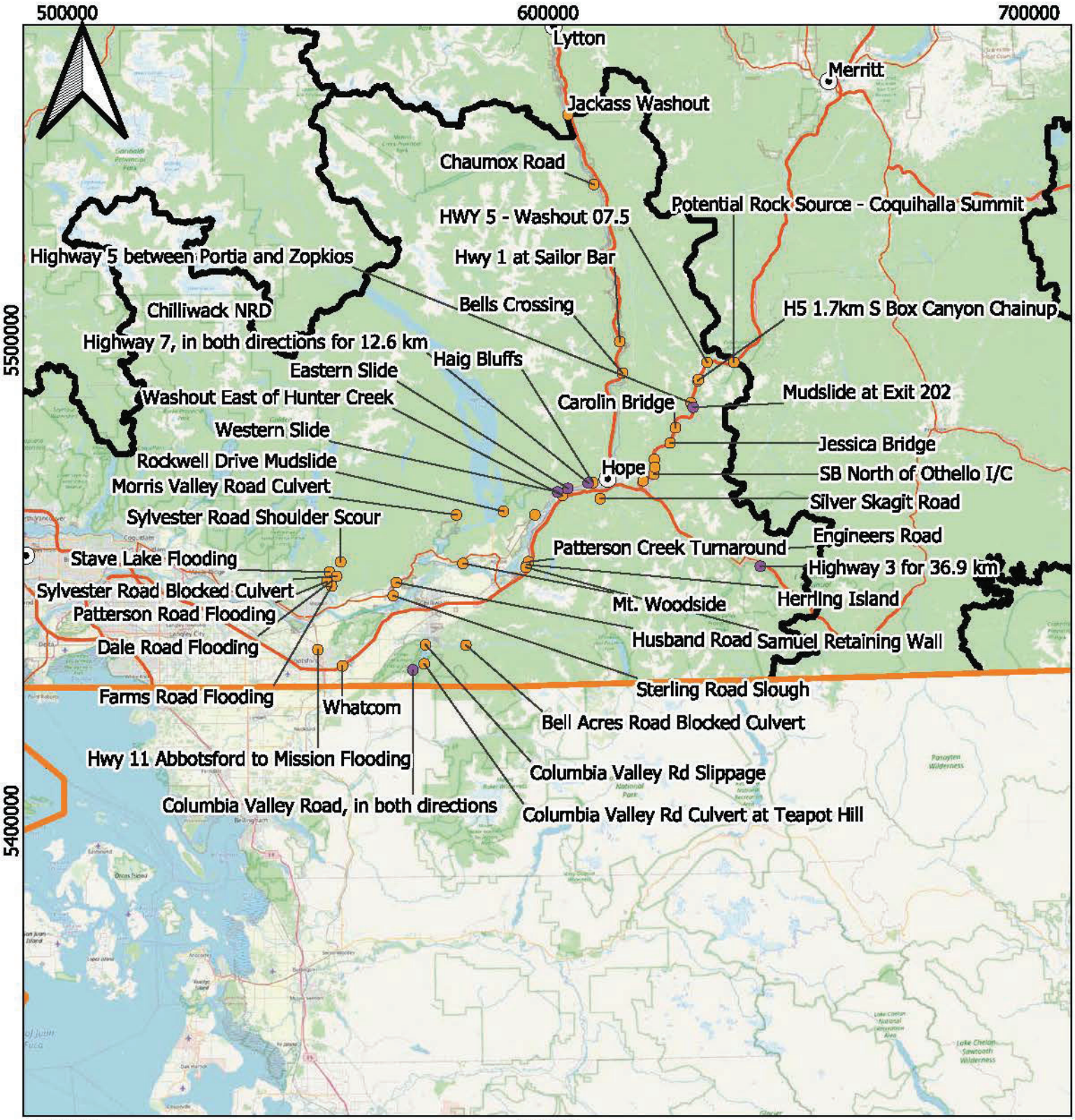


Fig. 3 Midrange - Chilliwack

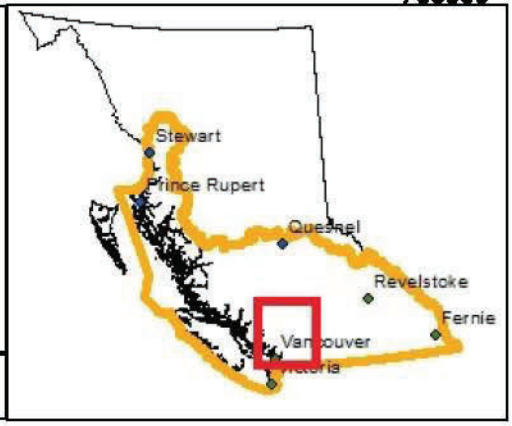
0 10 20 km

HCA Application: 21A0694
Scale: 1: 1,100,000
Datum: UTM 10 N
Date: 2021-11-26
Author:
Corey Cookson (Arch Branch)

Legend

- Permit Area
- Cities
- Highway
- Landslides (Recorded as of 2021-11-26)
- Flood Events (Recorded as of 2021-11-26)

Base Data: Open Street Map
Flood Events: Ministry of Transportation and Infrastructure
Landslides: GeoBC



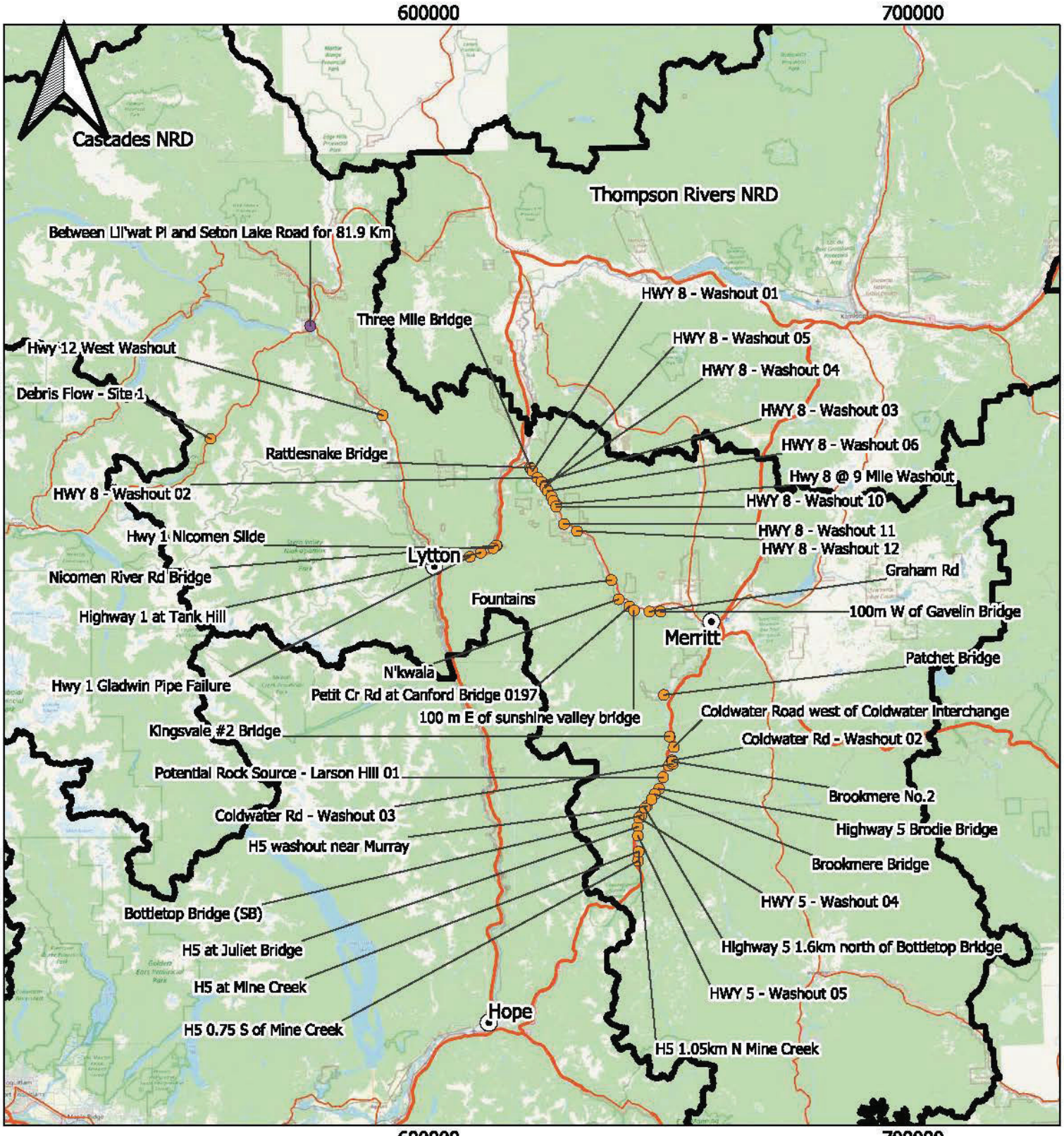


Fig. 4 Midrange - Cascades

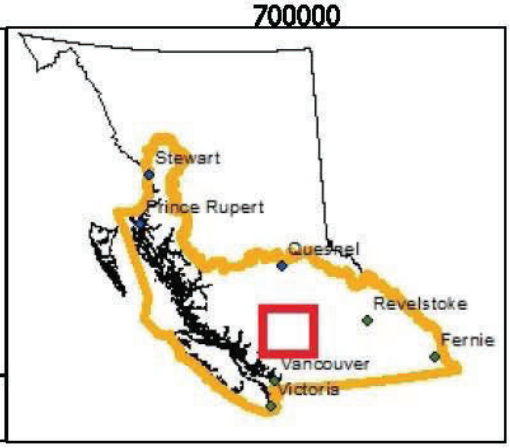
0 10 20 km

HCA Application: 21A0694
Scale: 1: 1,100,000
Datum: UTM 10 N
Date: 2021-11-26
Author:
Corey Cookson (Arch Branch)

Legend

- Permit Area
- Cities
- Highway
- Landslides (Recorded as of 2021-11-26)
- Flood Events (Recorded as of 2021-11-26)

Base Data: Open Street Map
Flood Events: Ministry of Transportation and Infrastructure
Landslides: GeoBC



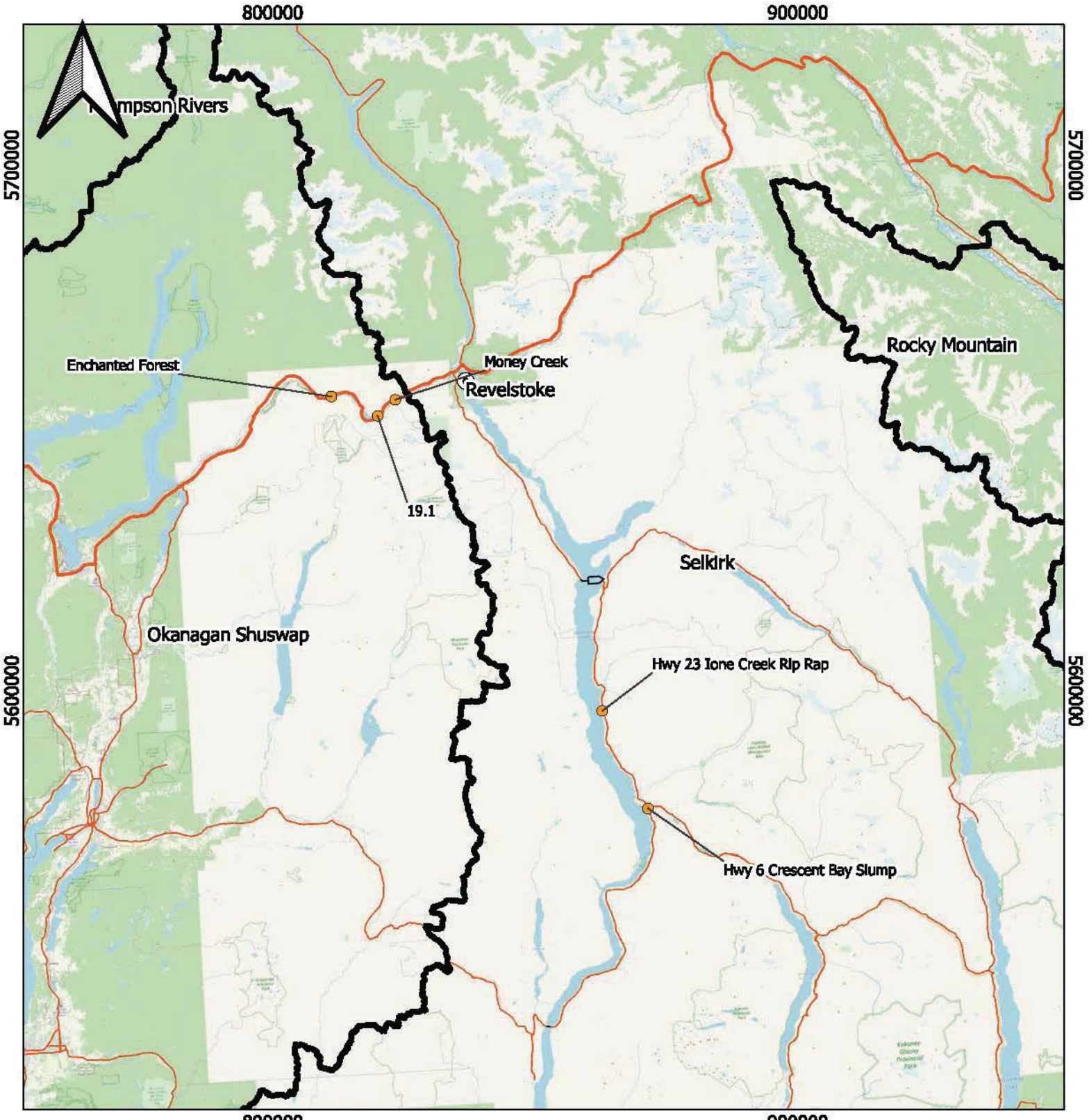


Fig. 5 Midrange - Okanagan Shuswap & Selkirk

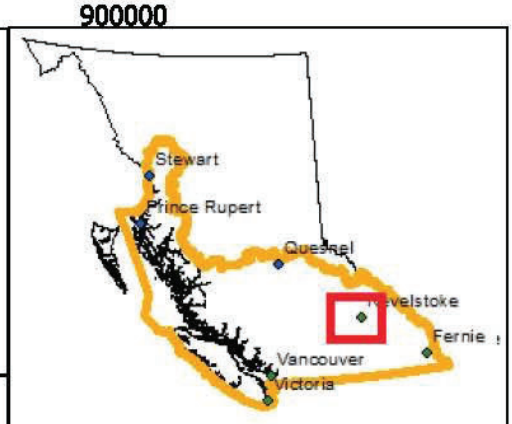
0 10 20 km

HCA Application: 21A0694
Scale: 1: 1,000,000
Datum: UTM 10 N
Date: 2021-11-24
Author:
Corey Cookson (Arch Branch)

Legend

- Permit Area
- Cities
- Highway
- Flood Events (As of Nov 23, 2021)
- Natural Resource Districts

Base Data: Open Street Map
Flood Events: Ministry of Transportation and Infrastructure



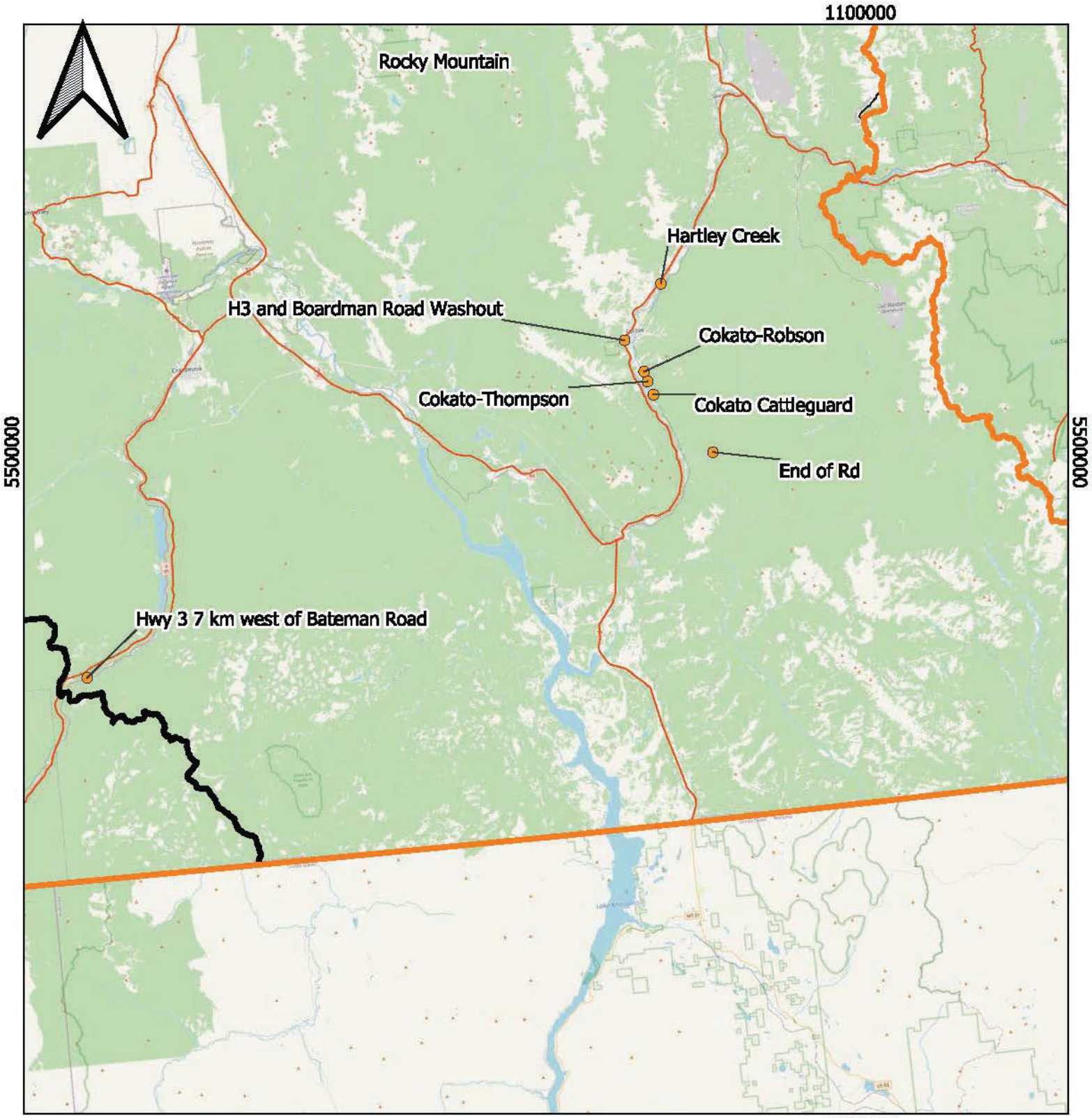


Fig. 6 Midrange - Rocky Mountain

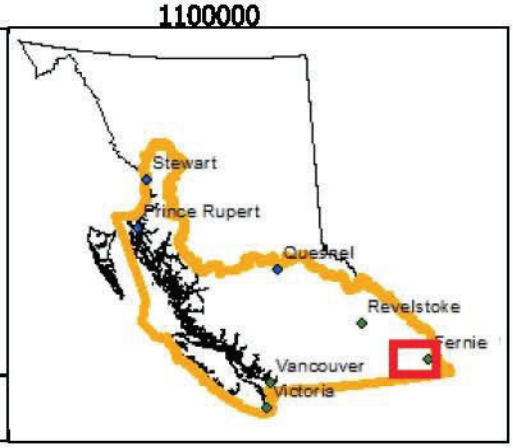
0 10 20 km

HCA Application: 21A0694
Scale: 1: 600,000
Datum: UTM 10 N
Date: 2021-11-24
Author:
Corey Cookson (Arch Branch)

Legend

- Permit Area
- Flood Events (As of Nov 24, 2021)
- Cities
- NRDs
- Highway

Base Data: Open Street Map
Flood Events: Ministry of Transportation and Infrastructure



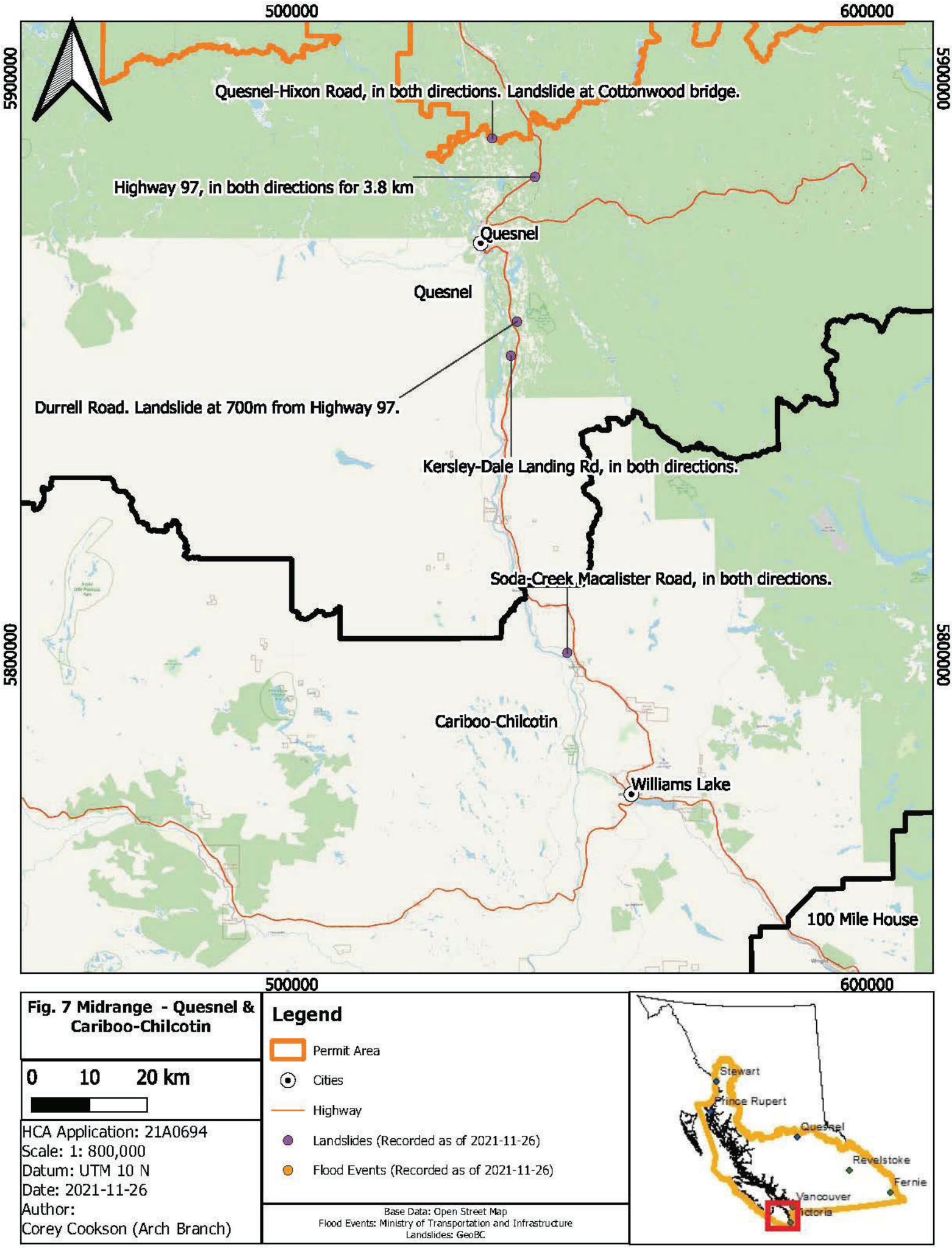


Fig. 7 Midrange - Quesnel & Cariboo-Chilcotin

0 10 20 km

HCA Application: 21A0694
Scale: 1: 800,000
Datum: UTM 10 N
Date: 2021-11-26
Author:
Corey Cookson (Arch Branch)

Legend

- Permit Area
- Cities
- Highway
- Landslides (Recorded as of 2021-11-26)
- Flood Events (Recorded as of 2021-11-26)

Base Data: Open Street Map
Flood Events: Ministry of Transportation and Infrastructure
Landslides: GeoBC

Appendix 1: Landslides and Floods impacting MoTI infrastructure

Data in the following tables is current to November 26, 2021

Table 10 MoTI Infrastructure impacted by Landslides and Flood Events

Area	Region	District	Event	Location
North	Skeena	Coast Mountains	N/A	
Coast	West Coast	North Island – Central Coast	N/A	
		Campbell River	N/A	
		South Island	Flood	Fairy Lake Flooding
			Flood	Hwy 1 @ Mt Sicker
			Landslide	Allenby Road. Mudslide between Miller Road and Boys Road.
			Landslide	Intersection of Nanaimo River Road & East of Nanaimo Lakes Road
			Flood	Hwy 14 @ Impala Rd Flooding
	South Coast	Sunshine Coast	N/A	
		Sea to Sky	N/A	
		Chilliwack	Flood	Bell Acres Road Blocked Culvert
			Flood	Bells Crossing
			Flood	Carolin Bridge
			Flood	Chaumox Road
			Flood	Columbia Valley Rd Culvert at Teapot Hill
			Flood	Columbia Valley Rd Slippage
			Landslide	Columbia Valley Road, in both directions
			Flood	Dale Road Flooding
			Landslide	Eastern Slide
			Flood	Engineers Road
			Flood	Farms Road Flooding
			Flood	Hwy 5 1.3km S Box Canyon Chainup
			Flood	Hwy 5 1.7km S Box Canyon Chainup
			Flood	Haig Bluffs
			Flood	Herrling Island
			Landslide	Highway 3, in both directions for 36.9 km
			Flood	Highway 5 between Portia and Zopkios
			Flood	Highway 5 - Washout 07.5
			Flood	Highway 5 - Washout 11
			Flood	Highway 5 - Debris 04
			Flood	Highway 5 - Debris 05
			Landslide	Highway 7, in both directions for 12.6 km
			Flood	Husband Road
			Flood	Hwy 1 at Sailor Bar
			Flood	Hwy 11 Abbotsford to Mission Flooding
			Flood	Jessica Bridge
			Flood	Morris Valley Road Culvert
			Flood	Mt. Woodside
			Landslide	Mudslide at Exit 202
			Flood	Patterson Creek Turnaround
			Flood	Patterson Road Flooding
			Flood	Potential Rock Source - Coquihalla Summit

Area	Region	District	Event	Location
Coast	South Coast	Chilliwack	Flood	Rockwell Drive Mudslide
			Flood	Samuel Retaining Wall
			Flood	SB North of Othello I/C
			Flood	Seabird Bluffs
			Flood	Silver Skagit Road
			Flood	Stave Lake Flooding
			Flood	Sterling Road Slough
			Flood	Sylvester Road Blocked Culvert
			Flood	Sylvester Road Shoulder Scour
			Flood	Washout East of Hunter Creek
			Landslide	Western Slide
			Flood	Whatcom
South	Thompson-Okanagan	Cascades	Flood	100 m E of sunshine valley bridge
			Flood	100 m W Gavelin Bridge
			Flood	Bottletop Bridge (SB)
			Flood	Brookmere Bridge
			Flood	Brookmere No.2
			Flood	Coldwater Road west of Coldwater interchange
			Flood	Coldwater Rd - Washout 02
			Flood	Coldwater Rd - Washout 03
			Flood	Debris Flow - Site 1
			Landslide	Eastern extent of mudslide between Lil'wat Pl and Seton Lake Road for 81.9 Km
			Flood	Fountains
			Flood	Graham Rd
			Flood	Hwy 1 at Nicomen Bridge
			Flood	Hwy 5 0.75 S of Mine Creek
			Flood	Hwy 5 1.05km N Mine Creek
			Flood	Hwy 5 at Juliet Bridge
			Flood	Hwy 5 at Mine Creek
			Flood	Hwy 5 washout near Murray
			Flood	HWY 5 - Washout 04
			Flood	HWY 5 - Washout 05
			Flood	HWY 8 - Washout 01
			Flood	HWY 8 - Washout 02
			Flood	HWY 8 - Washout 03
			Flood	HWY 8 - Washout 04
			Flood	HWY 8 - Washout 05
			Flood	HWY 8 - Washout 06
			Flood	HWY 8 - Washout 07
			Flood	HWY 8 - Washout 08
			Flood	HWY 8 - Washout 10
			Flood	HWY 8 - Washout 11
			Flood	HWY 8 - Washout 12
			Flood	Highway 1 at Tank Hill
			Flood	Highway 12 washout 2 Mud Slide
			Flood	Highway 5 1.6km north of Bottletop Bridge
			Flood	Highway 5 Brodie Bridge
			Flood	Hwy 1 Gladwin Pipe Failure
			Flood	Hwy 1 Nicomen Slide

Area	Region	District	Event	Location
South	Thompson-Okanagan	Cascades	Flood	Hwy 12 West Washout
			Flood	Hwy 8 @ 9 Mile Washout
			Flood	Jackass Washout
			Flood	Kingsvale #2 Bridge
			Flood	Murray Bridge
			Flood	N'kwala
			Flood	Nicomen River Rd Bridge
			Flood	Patchet Bridge
			Flood	Petit Cr Rd at Canford Bridge 0197
			Flood	Potential Rock Source - Larson Hill 01
			Flood	Potential Rock Source - Larson Hill 02
			Flood	Rattlesnake Bridge
			Flood	Three Mile Bridge
		Okanagan-Shuswap	Flood	19.1
			Flood	Enchanted Forest
			Flood	Money Creek
		Thompson Rivers	N/A	
	Kootenay-Boundary	Selkirk	Flood	Hwy 23 Ione Creek Rip Rap
			Flood	Hwy 6 Crescent Bay Slump
		Rocky Mountain	Flood	Cokato Cattleguard
			Flood	Cokato-Robson
			Flood	Cokato-Thompson
			Flood	End of Rd
			Flood	Hwy 3 and Boardman Road Washout
			Flood	Hartley Creek
			Flood	Hwy 3 7 km west of Bateman Road
	Cariboo	100 Mile House	N/A	
		Cariboo-Chilcotin	Landslide	Soda-Creek Macalister Road, in both directions.
		Quesnel	Landslide	Kersley-Dale Landing Rd, in both directions.
			Landslide	Durrell Road. Landslide at 700m from Highway 97.
			Landslide	Quesnel-Hixon Road, in both directions. Landslide at Cottonwood bridge.
			Landslide	Highway 97, in both directions for 3.8 km

Appendix 2: Archaeological Sites and MoTI infrastructure

Data in the following tables is current to November 26, 2021

Table 11. Summary of recorded archaeological sites within 1 km of impacted MoTI infrastructure by Natural Resource District

Area	Region	District	Table
North	Skeena	Coast Mountains	N/A
Coast	West Coast	North Island-Central Coast	N/A
		Campbell River	N/A
		South Island	Table
	South Coast	Sunshine Coast	N/A
		Sea to Sky	N/A
		Chilliwack	Table
South	Thompson-Okanagan	Cascades	Table
		Okanagan-Shuswap	N/A
		Thompson Rivers	N/A
	Kootenay-Boundary	Selkirk	Table
		Rocky Mountain	Table
	Cariboo	100 Mile House	N/A
		Cariboo-Chilcotin	N/A
		Quesnel	N/A

Table 12. Recorded sites within 1 km - South Island Natural Resource District

Impact	Location	Site	Site Type	Distance/Direction
Flood	Highway 1 @ Mt Sticker	DfRw-7	Subsurface, Shell midden; Surface lithics	460 m N
Flood	Highway 14 Impala Road	DcRv-45	Cultural Material, Surface	200 m S
Flood		DcRv-83	Cultural Material, Surface, Lithics	460 m E/SE

Table 13. Recorded sites within 1 km - Chilliwack Natural Resource District

Impact	Location	Site	Site Type	Distance/Direction
Flood	Bells Crossing	DjRi-12	Rock art, pictograph; Habitation, Rock Shelter; Subsurface and Surface Lithics	380 m SE
Flood		DjRi-16	Habitation, Rock Shelter	110 m SE
Flood		DjRi-2	Human Remains; Subsurface Lithics; Cultural Depression, Housepit	150 m N
Flood		DjRi-3	Human Remains; Subsurface Lithics	560 m N
Flood		DjRi-32	Cultural Material, Surface	600 m S
Flood		DjRi-53	Cultural Depression, Cache Pit; Cultural Material, Surface	380 m SE
Flood		DjRi-57	Cultural Material, Surface, Fire broken Rock; Habitation, Rock Shelter	380 m E
Flood		DjRi-63	Subsurface Lithics; Habitation, Rock Shelter	620 m SE
Flood		DjRi-65	Subsurface Lithics; Habitation, Rock Shelter	380 m SE
Flood		DjRi-79	Post Contact Human Remains	250 m NE
Flood		DjRi-87	Cultural Material, Surface, Lithics	500 m S/SE
Flood	Carolin Bridge	DiRh-9	Subsurface Lithics	200 m SE
Flood		DiRh-6	Subsurface Lithics	700 m NE
Flood		DiRh-3	Culturally Modified Tree	950 m NW
Flood	Highway 1 @ Sailor Bar	DjRi-25	Surface Lithics	440 m NE
Flood		DjRi-28	Surface Lithics	330 m NE
Flood		DjRi-66	Cultural Depressions, Cache Pit and Unassigned	580 m N/NE
Flood		DjRi-81	Cultural Depression, Cache Pit; Cultural Material, Surface	380 m NE
Flood		DjRi-83	Surface Lithics	700 m N/NE
Flood		DjRi-84	Surface Lithics	400 m N/NE
Flood	Jessica Bridge	DiRh-4	Cultural Depression, Undefined	980 m SW
Flood	Morris Valley Road Culvert	DhRl-53	Culturally Modified Tree	530 m N

Impact	Location	Site	Site Type	Distance/Direction
Flood	Washout East of Hunter Creek	DiRj-18	Surface Lithics	290 m N
Flood		DiRj-28	Cultural Depression, Cache Pit	480 m NE
Flood		DiRj-34	Subsurface Lithics and Faunal; Habitation, Rock Shelter	520 m E/NE
Flood		DiRj-5	Surface Lithics	260 m NE
Flood	Chaumoux Road	DlRi-11	Cultural Depression, Cache Pit	625 m NE
Flood		DlRi-14	Cultural Depression, undefined; Historic Building	625 m NE
Flood		DlRi-15	Cultural Depression, Cache Pit	625 m NE
Flood		DlRi-32	Historic Building	Direct overlap
Flood		DlRi-33	Cultural Depression, Cache Pit	600 m N
Flood	Haig Bluffs	DiRi-18	Post Contact Human Remains	730 m E
Flood		DiRi-38	Culturally Modified Tree	360 m SE
Flood	Highway 11 Abbotsford	DgRn-30	Surface Lithics	930 m E/SE
Flood	Silver Skagit Road	DiRi-105	Culturally Modified Tree	780 m SE
Flood		DiRi-123	Subsurface Lithics; Habitation, Rock Shelter	630 m N
Flood		DiRi-99	Subsurface Lithics; Habitation, Rock Shelter	930 m E
Landslide	Eastern Slide	DiRj-21	Lithics, cairn	Direct overlap
Landslide	Western Slide	DiRj-32	Rock Shelter	Direct overlap
Landslide	Highway 7, in both directions	DiRj-1	Cultural Depression, Housepit; Rock art, Petroglyph	Direct overlap
Flood	Sterling Road Slough	DhRm-2	Cultural Depression, undefined; Surface Lithics	760 m NW

Table 14. Recorded sites within 1 km - Cascades Natural Resource District

Impact	Location	Site	Site Type	Distance/Direction
Flood	100 m E of Sunshine Valley Bridge	EaRf-17	Surface Lithics	890 m E
Flood		EaRf-18	Surface Lithics	730 m NE
Flood		EaRf-7	Human Remains	650 m E
Landslide	Eastern extent of mudslide between Lil'wat Pl and Seton Lake Road for 81.9 Km	EeRl-120	Cultural Depression, Housepit; Surface, lithics	Direct overlap
Landslide		EeRl-217	Subsurface and Surface Lithics	Direct overlap
Flood	Fountains	EbRg-1	Cultural Depression, Housepit	290 m N/NW
Flood		EbRg-32	Cultural Depression, Housepit	350 m SW
Flood	Highway 1 @ Tank Hill	EbRi-37	Cultural Depression, Cache pit; Surface Lithics	900 m NE
Flood		EbRi-38	Cultural Depression, Cache pit; Surface Lithics	220 m N
Flood	Highway 1 Gladwin Pipe Failure	EbRi-44	Cultural Depression, undefined; Surface Lithics	700 m N
Flood	Highway 1 Nicomen Slide	EbRi-3	Cultural Depression, undefined; Surface Lithics	360 m NW
Flood		EbRi-49	Rock art, petroglyph	680 m NE
Flood	Highway 8 @ 9 mile washout	EcRh-1	Cultural Depression, Housepit and Cache pits; Human Remains	240 m NW
Flood		EcRh-26	Surface Lithics	260 m S
Flood		EcRh-3	Cultural Depression, Cache Pit; Habitation, Rock Shelter; Surface Lithics; Human Remains	645 m NW
Flood	Highway 8 Washout 01	EcRh-98	Surface Lithics	100 m NW
Flood		EcRh-92	Surface Lithics; Subsurface Lithics	300 m NW
Flood	Highway 8 Washout 03	EcRh-87	Surface Lithics	150 m W
Flood	Highway 8 Washout 04	EcRh-9	Rock art, pictograph	590 m SE
Flood	Highway 8 Washout 05	EcRh-9	Rock art, pictograph	270 m E/SE

Impact	Location	Site	Site Type	Distance/Direction
Flood	Highway 8 Washout 07	EcRh-2	Surface Lithics; Rock art, pictograph; Cultural Depression, Cache Pit	700 m SE
Flood	Highway 8 Washout 08	EcRh-1	Cultural Depression, Housepit and Cache pits; Human Remains	50 m S
Flood		EcRh-2&5	Surface Lithics; Rock art, pictograph; Cultural Depression, Cache Pit	110 m NW
Flood		EcRh-3	Cultural Depression, Cache Pit; Habitation, Rock Shelter; Surface Lithics; Human Remains	250 m E
Flood	Highway 8 Washout 09	EcRh-9	Rock art, pictograph	700 m N/NW
Flood	Highway 8 Washout 10	EcRh-26	Surface Lithics	220 m N
Flood		EcRh-1	Cultural Depression, Housepit and Cache pits; Human Remains	720 m N/NW
Flood	Highway 8 Washout 11	EbRh-24	Surface Lithics; Subsurface Lithics	180 m W (on Federal Reserve)
Flood		EbRh-4	Cultural Depression, Cache Pit and House pit; Subsurface, Faunal; Subsurface, Lithics	300 m SW
Flood		EbRh-23	Surface Lithics; Subsurface Lithics	420 m SE
Flood	Highway 8 Washout 12	EbRg-7	Cultural Depression, Cache Pit	160 m E/SE
Flood		EbRg-6	Cultural Depression, Cache pits; Human Remains	320 m SE
Flood		EbRg-26	Surface Lithics	360 m W
Flood		EbRg-8	Culturally Modified Tree	530 m W
Flood		EbRg-27&31	Surface Lithics; Subsurface Lithics	750 m SE
Flood		EbRg-25&27	Surface Lithics; Subsurface Lithics	650 m SW
Flood		EbRh-1	Cultural Depression, House Pit	620 m NW
Flood	Jackass	EaRj-49	Cultural Depression, Cache Pit	840 m NW
Flood		EaRj-63	Historic Log Cabin	890 m W/NW
Flood		EaRj-57	Historic Building; Surface Lithics	750 m S
Flood	Nicomen River Rd	EbRi-49	Rock art, petroglyph	240 m SW

Impact	Location	Site	Site Type	Distance/Direction
Flood		EbRi-7	Human Remains	100 m N
Flood	N'Kwala	EaRg-3	Cultural Material, Surface; Human Remains	1 km SE
Flood	Patchet Bridge	DlRf-1	Subsurface Lithics	950 m N
Flood	Petit Cr Road Canford Bridge	EaRg-4	Rock art, pictograph	925 m W/SW
Flood	Rattlesnake Bridge	EcRh-94	Subsurface Lithics	300 m W/NW
Flood		EcRh-92	Surface Lithics; Subsurface Lithics	670 m SE
Flood	Three Mile Bridge	EcRh-92	Surface Lithics; Subsurface Lithics	350 m S
Flood		EcRh-98	Surface Lithics	500 m S
Flood		EcRh-94	Subsurface Lithics	600 m NW

Table 15. Recorded sites within 1 km - Selkirk Natural Resource District

Impact	Location	Site	Site Type	Distance/Direction
Flood	Highway 6 Crescent Bay Slump	EbQk-1	Human Remains; Cultural Material, surface	650 m N
Flood		EbQk-2	Cultural Depression, sweat lodge	960 m S

Table 16. Recorded sites within 1 km - Rocky Mountain Natural Resource District

Impact	Location	Site	Site Type	Distance/Direction
Flood	Highway 3, 7 km west of Bateman Road	DhPx-1	Historic Transportation Trail; Subsurface Lithics	675 m NW
Flood		DhPx-3	Historic Transportation Trail; Subsurface Lithics	545 m SW

Appendix 3: Project Tracking

A project tracking log (in Excel) must be maintained and provided to the Archaeology Branch on a monthly basis during active project work. Forms should be submitted by email to ArchPermitApp@gov.bc.ca citing permit **2021-0453** in the subject line.

The log must minimally contain the following columns:

1. Firm Name
2. Delegated Archaeologist Name
3. Interim Report Number
4. Interim Report Name
5. Proponent
6. Proponent Contact person
7. Component Names
8. Notice of Intent Date
9. Date(s) of fieldwork
10. Number of assessment hours (field days x crew members)
11. Automatically Protected Sites found (yes/no)
12. Other cultural sites found (yes/no)
13. Temp site Number
14. Borden Number
15. Revisit (yes/no)

For each site:

16. Site Type
17. Significance Rating
18. Ongoing impacts?
19. Mitigation type(s): avoidance, protection, systematic data recovery
20. Archaeology Branch Approved Mitigation: Date
21. Mitigation approval by: Archaeology Branch Project Officer name

BRITISH COLUMBIA

Additional Client Certification for Permits Issued under Section 12.2 of the Heritage Conservation Act

Select as appropriate:

☒ An application for a Heritage Investigation Permit **21A0694** has been submitted to the Branch by: **Sarah Fraser, A/Associate Deputy Minister, Ministry of Forests, Land, Natural Resource Operations and Rural Development (FLNRORD).** It is currently described as: *Archaeological investigation of recovery activities undertaken in response to 2021's catastrophic rain resulting in widespread flooding and landslide events in British Columbia by the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD), the Ministry of Transportation and Infrastructure (MOTI) and other Provincial and/or Local Government proponents responsible to restore infrastructure in the affected areas*

Financial responsibility for assessments is assumed by the following proponent:

Name: **Jeff Sheldrake, Assistant Deputy Minister, Coast Area**	*Company:* **Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD)**
Address: 4th Floor - 2975 Jutland Road, Victoria, BC V8T 5J9	
Phone: (778) 974-5826	*Fax or Email:* Jeff.Sheldrake@gov.bc.ca

CLIENT'S CERTIFICATION

I certify that I have read and concur with the content of this permit application, any amendments submitted to the Branch, and any other conditions the Minister may impose, as empowered by said *Act*.

Client Certification

Date:	*Client Name:*	*Client Affiliation:*	*Client Signature:*
December 8, 2021	**Jeff Sheldrake, Assistant Deputy Minister, Coast Area**	**Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD)**	

CERTIFICATION AND CONSENT

CLIENT'S CERTIFICATION

I certify that I have read and concur with the content of this permit application.

Client Certification.

Client Endorsement

For applications where there are no recorded archaeological sites, or where assessment is not required by another agency or under a Heritage Conservation Act Ministerial Order:

I acknowledge I have not been ordered to conduct a heritage inspection under S.12.3 of the Heritage Conservation Act and that I have commissioned an archaeological impact assessment on my own accord to facilitate my proposal to undertake the developments described herein.

Name: **Jeff Sheldrake, Assistant Deputy Minister, Coast Area**	*Company:* **Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD)**
Address: 4th Floor - 2975 Jutland Road, Victoria, BC V8T 5J9	
Phone: (778) 974-5826	*Fax or Email:* Jeff.Sheldrake@gov.bc.ca
Date: December 7, 2021	*Client Signature:* 

BRITISH COLUMBIA

Additional Client Certification for Permits Issued under Section 12.2 of the Heritage Conservation Act

Select as appropriate:

☒ An application for a Heritage Investigation Permit **21A0694** has been submitted to the Branch by: **Sarah Fraser, A/Associate Deputy Minister, Ministry of Forests, Land, Natural Resource Operations and Rural Development (FLNRORD).** It is currently described as: *Archaeological investigation of recovery activities undertaken in response to 2021's catastrophic rain resulting in widespread flooding and landslide events in British Columbia by the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD), the Ministry of Transportation and Infrastructure (MOTI) and other Provincial and/or Local Government proponents responsible to restore infrastructure in the affected areas*

Financial responsibility for assessments is assumed by the following proponent:

Name: **Gerry MacDougall** **A/Assistant Deputy Minister, South Area**	*Company:* **Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD)**
Address: 441 Columbia Street, Kamloops, BC V2C 2T3	
Phone: 250-267-8999	*Fax or Email:* Gerry.MacDougall@gov.bc.ca

CLIENT'S CERTIFICATION

I certify that I have read and concur with the content of this permit application, any amendments submitted to the Branch, and any other conditions the Minister may impose, as empowered by said *Act*.

Client Certification

Date:	*Client Name:*	*Client Affiliation:*	*Client Signature:*
December 10, 2021	**Gerry MacDougall A/Assistant Deputy Minister, South Area**	**Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD)**	

CERTIFICATION AND CONSENT

CLIENT'S CERTIFICATION

I certify that I have read and concur with the content of this permit application.

Client Certification.

Client Endorsement

For applications where there are no recorded archaeological sites, or where assessment is not required by another agency or under a Heritage Conservation Act Ministerial Order:

I acknowledge I have not been ordered to conduct a heritage inspection under S.12.3 of the Heritage Conservation Act and that I have commissioned an archaeological impact assessment on my own accord to facilitate my proposal to undertake the developments described herein.

Name: **Gerry MacDougall** **A/Assistant Deputy Minister, South Area**	*Company:* **Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD)**
Address: 441 Columbia Street, Kamloops, BC V2C 2T3	
Phone: 250-267-8999	*Fax or Email:* Gerry.MacDougall@gov.bc.ca
Date: December 10, 2021	*Client Signature:* 

BRITISH COLUMBIA

Additional Client Certification for Permits Issued under Section 12.2 of the Heritage Conservation Act

Select as appropriate:

☒ An application for a Heritage Investigation Permit **21A0694** has been submitted to the Branch by: **Sarah Fraser, A/Associate Deputy Minister, Ministry of Forests, Land, Natural Resource Operations and Rural Development (FLNRORD).** It is currently described as: *Archaeological investigation of recovery activities undertaken in response to 2021's catastrophic rain resulting in widespread flooding and landslide events in British Columbia by the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD), the Ministry of Transportation and Infrastructure (MOTI) and other Provincial and/or Local Government proponents responsible to restore infrastructure in the affected areas*

Financial responsibility for assessments is assumed by the following proponent:

Name: **Brent Persello, Environmental Services Manager**	*Company:* **Ministry of Transportation and Infrastructure (MoTI)**
Address: 477 Columbia Street, Kamloops, BC V2C 2T3	
Phone: 778-362-4522	*Fax or Email:* Brent.Persello@gov.bc.ca

CLIENT'S CERTIFICATION

I certify that I have read and concur with the content of this permit application, any amendments submitted to the Branch, and any other conditions the Minister may impose, as empowered by said *Act*.

Client Certification

Date:	*Client Name:*	*Client Affiliation:*	*Client Signature:*
December 8, 2021	**Brent Persello, Environmental Services Manager**	**Ministry of Transportation and Infrastructure (MoTI)**	

CERTIFICATION AND CONSENT

CLIENT'S CERTIFICATION

I certify that I have read and concur with the content of this permit application.

Client Certification.

Client Endorsement

For applications where there are no recorded archaeological sites, or where assessment is not required by another agency or under a Heritage Conservation Act Ministerial Order:

I acknowledge I have not been ordered to conduct a heritage inspection under S.12.3 of the Heritage Conservation Act and that I have commissioned an archaeological impact assessment on my own accord to facilitate my proposal to undertake the developments described herein.

Name: **Brent Persello, Environmental Services Manager**	*Company:* **Ministry of Transportation and Infrastructure (MoTI)**
Address: 477 Columbia Street, Kamloops, BC V2C 2T3	
Phone: 778-362-4522	*Fax or Email:* Brent.Persello@gov.bc.ca
Date: December 8, 2021	*Client Signature:*

May 13, 2024

Permit No. 2021-0453
Application No. 11200-30/21A0694

Sarah Fraser
Ministry of Forests, Lands, Natural Resource Operations and Rural Development
4th Floor - 545 Superior Street
Victoria, BC V8V 1T7
Email: FloodRecoveryHCA@gov.bc.ca

Re: Amendment 003 to Investigation Permit 2021-0453 - Granted

Dear Sarah Fraser:

Further to your request of April 17, 2024, the terms of the enclosed permit have been revised to **extend the expiry date to November 30, 2024**. Please note that as this amendment is administrative in nature, it has not been sent out for comment, but issued directly. Please keep a copy of the amended permit for your records; the original will be retained in the Archaeology Branch permit file.

The results of your investigations are to be presented in a permit report, submitted in both double-sided hard copy and PDF formats, by **November 30, 2024**. Individuals and organizations with knowledge of location, distribution, and significance of archaeological resources in the study area should be contacted where appropriate and documented in the permit report. Please ensure that site inventory forms are submitted separately, and that detailed site access information is not included in the report text. If site forms are included in the report, they will be removed by Branch staff.

Please note that Branch acceptance of permit reports only acknowledges the fulfillment of permit terms and conditions. Such acceptance does not bring with it an obligation by the Branch to accept report recommendations as they relate to impact assessments or impact management requirements.

Should you have any questions regarding this permit, please contact your Permitting Archaeologist, **Kira Kristensen**, who can be reached by calling **(236) 478-3331** or emailing FloodRecoveryHCA@gov.bc.ca.

Please note that the permit number listed above must be referenced in the subject line of all permit-related emails sent to the Archaeology Branch.

Sincerely,

Joel Kinzie
Manager – Archaeological Operations (Disaster Response and Recovery)

JK/gg/Encl.

pc: See attached Amendment Distribution List

Permit Number: 2021-0453
Amendment **003** Distribution List

✓	DISTRIBUTED TO	ATTENTION	CONTACTED	FILE #
	Sarah Fraser	Permit Holder	FloodRecoveryHCA@gov.bc.ca	
P	Adams Lake Indian Band	Brent Davidson	NATIONS CONNECT PORTAL	2021-0453 ALIB snapshot
	Ahousaht First Nation	John Rampanen, Tyson Atleo	info@ahousaht.ca; Tyson.Atleo@gmail.com	
	Aitchelitz Band	c/o Sto:lo Nation	referrals@peopleoftheriver.com	
	Alexander Mackenzie Grease Trail	Desi Cheverie, Elise McLellan	Desi.Cheverie@gov.bc.ca; Elise.McLellan@gov.bc.ca;	
	Ashcroft Indian Band	Ashcroft Indian Band	jodene@ashcroftband.ca; gblain43715@yahoo.ca; april@ashcroftband.ca	
P	Bonaparte First Nation	Amanda, Chief and Council Frank Antoine	BONAPARTE CONNECT PORTAL; kukpi7@bonaparte.band	
	Boothroyd Indian Band	c/o Nlaka'pamux NTC - Tawnya Collins	nntc.referrals@nntc.ca; nntc.spoc@gov.bc.ca	
	Boston Bar First Nation	Darren Florence	bbarbandd@uniserve.com; bbfnreferrals@gmail.com;	
P	Canim Lake Band	Melvin Paul	NStQ PORTAL	
	Cayoose Creek Band	Chief Bonnie Adolph and Council	chief@cayoosecreek.ca; daryn.scotchman@splitrockenvironmental.ca; john.redan@splitrockenvironmental.	
	Chawathil First Nation	c/o Sandy McDonald @ Sto:Lo	referrals@peopleoftheriver.com	
	Cheam First Nation	c/o Sandy McDonald @ Sto:lo Nation	referrals@peopleoftheriver.com	
	Coldwater Indian Band	Coldwater Indian Band	lspahan@coldwaterband.org; referrals@scwexmxtribal.org	
	Cook's Ferry Indian Band	Scott MacKay, Brenda Walkem, cc Chief Christine Walkem	lands@cooksferry.ca; Landscoordinator@cooksferry.ca; Christine.walkem@cooksferry.ca	
	Cowichan Tribes	Tracy Fleming, Natalie Anderson	referral.coordinator@cowichan; tracy.fleming@cowichan; natalie.anderson@cowichan; johnny.crocker@cow	
	Da'naxda'xw First Nation	Art Wilson c/o Nanwakolas	referrals@nanwakolas.com; tribaladmin@danaxdaxw.com	
P	Ditidaht First Nation	Paul Seieber	NATIONS CONNECT PORTAL	
	Douglas First Nation	Chief Don Harris	don.harris@xaxtsa.ca;	

	Ehattesaht Band	Darlene Smith,	admin@ehatis.ca; darlene.smith@ehatis.ca;	
	Esh-kn-am Cultural Resources Management Services	Esh-kn-am Cultural Resources Management Services	reception@nooaitchband.ca; referrals@scwexmxtribal.org; natasha.fountain@nooaitchband.ca	
P	Esketemc Land Settlement		ESKETEMC PORTAL	
	Esquimalt Nation	Katie Hooper, Rob Thomas	katie@esquimaltnation.ca; referrals@esquimaltnation.ca; rob@esquimaltnation.ca	
SER	Gitanyow Hereditary Chiefs' Office	Tara Marsden	Tara.Marsden@gitanyowchiefs.com; joel.starlund@gitanyowchiefs.com	
SER	Gitga'at First Nation	Ty Sorenson	referrals@gitgaat.ca; chrispicard@gitgaat.ca; simonereece@gitgaat.ca	
	Gitwangak / Lower Skeena Watershed	Arcadia Bright		
P	Gitxaala Nation	Craig Bolton, Linda Innes	NationsConnect Portal;	
SER	Gwa'sala-'Nakwaxda'xw Nation	Mark Kenny	gnnreferrals@gmail.com; lro@gwanaknations.ca;	
	Gwawaenuk Tribe	Cindy Gullstrom, cc Hereditary Chief Victoria (Vicki) Bunnie	gwafinance@telus.net;GwawaenukTribe2023@gmail.com;lands-marinemanager@gwawaenuktribe.ca	
SER	Haisla Nation Council	Crystal Smith	CaWilson@haisla.ca; dugrant@haisla.ca; KGardiner@haisla.ca; traceyross@haisla.ca	
	Halalt First Nation	Referral Staff	referrals@halalt.org;	
SER	Heiltsuk Nation	Marilyn Slett	Matt.Garmon@heiltsuk.ca; William.Housty@heiltsuk.ca; marilyn.slett@heiltsuk.ca;referrals@heiltsuk.ca	
	Hesquiaht First Nation	Brevin Charleson	Norma@Hesquiaht.ca; brevc@hotmail.com	
P	High Bar First Nation	Stewart Fletcher	HIGH BAR CONNECT PORTAL	
	Hupacasath First Nation	Brandy Lauder	Brandy@hupacasath.ca; Vanessa@hupacasath.ca	
	Huu-ay-aht First Nation	Rita Johnson	rita.j@huuayaht.org; executivedirector@huuayaht.org	
	In-SHUCK-ch Nation	CEO - Allen Gabriel		
	Iskut First Nations	c/o Tahltan Central Council	tlreferrals@gmail.com;	
	Ka:'yu:'k't'h'/Chek'tles7et'h' First Nation	Cynthia Blackstone	cynthiab@kcfirstnations.com; moniquedg@kcfirstnations.com; jeffn@kcfirstnations.com;timothys@kcfirst	

	Kanaka Bar Indian Band	Patrick Michell	KanakaChief@kanakabarband.ca;	
	Katzie First Nation	Kimberly Armour	Kimberly@katzie.ca; landopsreferrals@katzie.ca	
	Kelly Lake Cree Nation	Laurian Gladue	referrals@kellylakecreenation.com;	
SER	Kitasoo/Xai'xais Band	Doug Neasloss, Rosie Child and Evan Loveless	evanloveless@kxsa.ca; engagement@kxsa.ca; director@kxsa.ca	
SER	Kitselas First Nation	Jane Hauser	cedarbox@kitselas.com; PAO@kitselas.com;	
P SER	Kitsumkalum Band Council	Alyson Watt	NATIONS CONNECT PORTAL	
	Klahoose First Nation	Kathy Francis, cc Chief and Council	kathyfrancis@klahoose.org;stevenbrown@klahoose.org;emilywhite@klahoose.org;johnmarlow@klahoose.org	
	K'omoks First Nation	Art Wilson c/o Nanwakolas	referrals@nanwakolas.com	
	Ktunaxa Nation Council	Nicole Kappell, John Nicholas	archaeology@ktunaxa.org	
	Kwakiutl Band Council	Referral Staff	lands-resources@kwakiutl.bc.ca;lands-galgalis@kwakiutl.bc.ca;sga@kwakiutl.bc.ca	
	Kwakiutl Notification Area	Sherri Labour, Georgia Greetham	lands-resources@kwakiutl.bc.ca;manager@kwakiutl.bc.ca;	
	Kwantlen First Nation	Tanner Timothy	heritage@kwantlenlands.ca	
	Kwaw-kwaw-apilt First Nation	c/o Sto:lo Nation	referrals@peopleoftheriver.com	
	Kwiakah First Nation	Frank Voelker	frankvoelker@kwiakah.com	
	Kwikwasut'inuxw Haxwa'mis First Nations	Kate Wallace	landsmanager@khfn.ca; jamie@khfn.ca; herb@khfn.ca	
	Kwikwetlem First Nation	Referrals, Lands and Resources Department	referrals@kwikwetlem.com;	
	Lax Kw'alaams Band Council	Hudson Kunicky, Mayor Garry Reece	referral.intake@laxbdl.com; garry_reece@laxband.com; cultural_heritage@laxband.com;cao@laxband.com	
	Leq'a:mel First Nation	Justin Laslo, Referrals Officer	referrals_engagement@leqamel.ca	
	Lheidli-T'enneh Nation	Gbenga Ayansola	naturalresources@lheidli.ca; executivedirector@lheidli.ca;	
	Lhoosk'uz Dene Nation	Jeana Moore	neba_nduwhulh'ih@lhooskuz.com	
P	Lhtako Dene Nation	Bruce and Tracey McDonald, Jessica Mooney	NATIONS CONNECT	
	Lillooet Tribal Council	Chief Bonnie Adolph and Council	info@lillooettribalcouncil.ca; chief@cayoosecreek.ca	

P	Lil'wat Nation	Lisa Pedrini	LIL'WAT CKK PORTAL	12172021-001
	Lower Nicola Indian Band	Chief and Council	fileclerk@lnib.net; Stuart.Jackson@lnib.net; alex.laforce@lnib.net	Lisa Flower req more info
P	Lower Similkameen Indian Band	Alex Terbasket, John Terbasket	NATIONS CONNECT PORTAL	
	Lyackson First Nation	Lyackson Referrals	referrals@lyackson.bc.ca	
	Lytton First Nation	c/o Nlaka'pamux NTC - Referrals Coordinator	nntc.referrals@nntc.ca;	
P	Maa-nulth First Nations		Maa-nulth Connect Portal	
	Malahat First Nation	Chief and Council	referrals@malahatnation.com	
	Mamalilikulla First Nation	Art Wilson, cc Barb Drennan	referrals@nanwakolas.com; barb@mamalilikulla.ca	
	Matsqui First Nation	Cynthia Collins	cynthia.collins@matsqui.com	
SER	Metlakatla Stewardship Society	Jane Calvert, Steve Lehnert, Steve Rogers	projectapplications@metlakatla.ca;EAmanager@metlakatla.ca;slehnert@metlakatla.	
	Mowachaht/Muchalaht First Nations	Referrals Staff	gis@yuquot.ca; lands@yuquot.ca; azar.kamran@yuquot.ca; researcher@yuquot.ca; mmfn_archive@yuquot.ca	
	Musqueam Indian Band	Aeli Black, Kody Huard	ablack@musqueam.bc.ca; khuard@musqueam.bc.ca; esdreferrals@musqueam.bc.ca; referrals@musqueam.bc.ca	
	Namgis First Nation	Mike DesRochers	referrals@namgis.bc.ca;Geza.Vamos@namgis.bc.ca	
SEA	Nanwakolas Council	Art Wilson	referrals@nanwakolas.com;	
P	Nazko First Nation	Terrence Paul	Nazko Connect Portal	
	Neskonlith Indian Band	Referrals Staff	referrals@neskonlith.net	
	Nicomen Indian Band	Referral Submissions	chief@nicomenband.com; bandmanager@nicomenband.com	
	Nisga'a Lisims Government	Andrew D. Robinson, Roberta Clayton, David Cassidy, Mansell Griffin, Tracey McKay	andrewr@nisgaanation.ca;RobertaC@nisgaanation.ca; davidc@nisgaanation.ca;mansellg@nisgaanation.	
	Nlaka'pamux Nation Tribal Council NNTC	NNTC Referrals	nntc.referrals@nntc.ca	
	Nooaitch Indian Band	Chief Marcel Shackelly, David Lawrence	reception@nooaitchband.ca; referrals@scwexmxtribal.org; natasha.fountain@nooaitchband.ca	
P	Northern Shuswap Tribal Council	Jenny Allen	NStQ PORTAL;	

	N'Quatqua First Nations	Chief and Council	Micah.Thevarge@nquatqua.ca; chantel.thevarge@nquatqua.ca; referrals@nquatqua.ca	
	Nuchatlaht Tribe	Anabel Jarry	administrator@nuchatlaht.com; Judae.smith@nuchatlaht.com	
SER	Nuxalk Nation	Alec Willie, Ian Pootlass	lands@nuxalknation.ca; referrals@nuxalknation.ca; stewardship.director@nuxalknation.ca	
P	Okanagan Indian Band	Chief Byron Louis; Colleen Marchand ; juile.richard@okanagan.org referrals mgmt clerk	NATIONS CONNECT PORTAL	
	Okanagan Nation Alliance	Referrals Staff	referrals@syilx.org	
	Oregon Jack Creek Band	c/o Nlaka'pamux NTC - Referrals Coordinator	nntc.referrals@nntc.ca;	
	Osoyoos Indian Band	Amanda Anderson, Teresa Anderson	referrals@oib.ca; aanderson@oib.ca	
	Pacheedaht First Nation	Chief Jeff Jones, Kristine Pearson	referrals@pacheedaht.ca; treaty@pacheedaht.ca; jeffj@pacheedaht.ca	
	Pauquachin First Nation	Darlene Henry	reception@pauquachin.com; Darlene.henry@Pauquachin.com;	
	Penelakut Tribe	Robert Sam, Denise James	bandofficereception@penelakut.ca; robert@penelakut.ca; denisej@penelakut.ca	
P	Penticton Indian Band	Heather McDougall	NATIONS CONNECT PORTAL	
	Peters First Nation	Chief Norma Webb	PFNLands@petersfn.ca;	
	Popkum First Nation	Nisha Sikka, cc Chief James Murphy	popkum@live.ca; nsikka@firstpeopleslaw.com	
	Qualicum First Nation	Chief Michael Recalma	receptionist.qualicum@shaw.ca; recalmag.qualicum@shaw.ca	
	Quatsino First Nation	April Webber, James Redford, cc Charles Sheard	referrals@quatsinofn.ca; qfnreferrals@quatsinofn.ca; lands@quatsinofn.ca; forestry@quatsinofn.ca	
	Saik'uz First Nation	Kasandra Turbide	land.manager@saikuz.com; referrals@saikuz.com	
	Samahquam Nation	Sheldon Dowswell	referrals@samahquam.com	
	Sc'ianew First Nation	Bernice Millette, cc Treaty	bbfnregistry@live.com; info@temexw.org	
	Scowlitz First Nation	c/o People of the River Referrals Office	referrals@peopleoftheriver.com	
	Scw'exmx Tribal Council	Jeanette McCauley	referrals@scwexmxtribal.org; reception@nooaitchband.ca	

	Seabird Island Band	c/o Sto:lo Nation	referrals@peopleoftheriver.com	
	Sechelt/Shishalh Nation		lilxmit@shishalh.com;	
	Semiahmoo First Nation	Don Welsh, Joanne Charles	dwelsh@semiahmoofirstnation.org;mail@semiahmoofirstnation.org	
	Shackan Indian Band	Chief Arnold Lampreau	sibchief@shackan.ca; referrals@scwexmxtribal.org	
P	Shuswap Indian Band	Dwayne Spence	NATIONS CONNECT PORTAL	
	Shxwh:y Village	c/o Sto:lo Nation	referrals@peopleoftheriver.com	
	Shxw'ow'hamel First Nation	Referrals Administrator	referrals@peopleoftheriver.com	
P	Simpcw First Nation	Kerri Jo Fortier NRD.Manager@simpcw.com	NATIONS CONNECT PORTAL	
	Siska Indian Band	Chief Fred Sampson and Council	frontdesk@siskaband.ca;	
	Skatin Nations Council	Gabriel Williams, Xavier Williams, cc Rex Grant	tselxasqet@skatin.ca; Xavier@Skatin.ca; Rex@TyheeFinancialServices.com	
	Skawahlook First Nation	c/o Sandy McDonald @ Sto:lo Nation	referrals@peopleoftheriver.com	
P	Skeetchestn Indian Band	Mike Anderson; mike.anderson@sncorp.ca	NATIONS CONNECT PORTAL	
	Skin Tyee Nation	Rosemarie Skin	chief@skintyeefn.ca;gm@skintyeefn.ca; councillor1@skintyeefn.ca; councillor2@skintyeefn.ca	
	Skowkale First Nation	c/o Sto:lo Nation	referrals@peopleoftheriver.com	
	Skuppah Indian Band	c/o Nlaka'pamux NTC - Referrals Coordinator	nntc.referrals@nntc.ca;	
	Skwah First Nation	c/o Sto:lo	Referrals@Peopleoftheriver.com	
	Skw'lax te Secwepemcúlecw	Aubrey Cartier	nmarkey@lslb.ca	
	Snaw-Naw-As First Nation	Katie Bob-Sampson, Tom Bob, cc Treaty	katiesampson_ira@nanoose.org; tbob@nanoose.org; info@temexw.org	
	Snuneymuxw First Nation	Desiree Thomas, Chief Mike Wyse, Tara White, John White	landsclerk@snuneymuxw.ca; MichaelW@snuneymuxw.ca; taraw@snuneymuxw.ca; johnlw@snuneymuxw.ca	
	Songhees First Nation	Chief Ron Sam, Charmaine Coughlin; charmaine.coughlin@songheesnation.com	archaeology@songheesnation.com; jeannie.pelkey@songheesnation.com; ron.sam@songheesnation.com	
	Soowahlie First Nation	c/o Sandy McDonald @ Sto:lo Nation	referrals@peopleoftheriver.com	
P	Splatsin First Nation		NATIONS CONNECT PORTAL	
	Spuzzum First Nation		sdmb@spuzzumnation.com;	

	Squamish Nation	Nick Weber	archpermit@squamish.net;	
	Squiala First Nation	c/o Sto:lo Nation	referrals@peopleoftheriver.com	
	St'at'imc Chiefs Council	Chair and Council	referrals@statimcgs.org	
P	Stk'emlupsemc te Secwepemc Nation	Travis Marr	NATIONS CONNECT; travis@stkemlupsemc.ca;	
	Sto:lo Nation People of the River Referrals Office	Referrals Officer	referrals@peopleoftheriver.com	
	Sts'ailes Band	Morgan Ritchie, Boyd Peters, Fran Douglas, Jerram Ritchie, Stephanie Riedl, Shelly Felix	Morgan.Ritchie@stsailes.com; Boyd.Peters@stsailes.com; Fran.Douglas@stsailes.com; jerram.ritchie@sts	
P	Stswecem'c Xgat'tem First Nation	Harold Harry	NStQ PORTAL	
	Stz'uminus First Nation	Tina-Marie Heinrich, Ray Gauthier	referrals@coastsalishdevcorp.com; ray.gauthier@coastsalishdevcorp.com	
	Sumas First Nation	c/o Sto:lo Nation	referrals@peopleoftheriver.com	
	Tahltan Band	c/o Tahltan Central Government	lands@tahltan.org;tlreferrals@gmail.com;nmaclean@lgl.com;landsdirector@tahltan.org;sercoordinator@ta	
	Tahltan Central Government	Tahltan Central Government / attention: Blaine Lindstrom Referrals Coordinator	lands@tahltan.org;tlreferrals@gmail.com;nmaclean@lgl.com;landsdirector@tahltan.org;archaeology@tahlt	
	Te'mexw Treaty Association			
	T'it'q'et Administration (Lillooet Band)	Chief and Council ; Jasmine O'Donaghey Referral Clerk	NaturalResources@pegpiglha.org; communitychief@titqet.org; Referrals@pegpiglha.org	
P	Tk'emlups te Secwepemc	Leslie LeBourdais, Karly Gottfriedson	NATIONS CONNECT PORTAL;	
P	Tla'amin First Nation	Denise Smith, Richard Gage	Tla'amin Connect	
	Tla-o-qui-aht First Nation	Chief and Council	lands@tla-o-qui-aht.org; tribaladmin@tla-o-qui-aht.org; tribalparks@tla-o-qui-aht.org	
	Tlatlasikwala First Nation	Dave Steele	gm@gwanakresources.ca; info@tlatlasikwala.com; referrals@tlatlasikwala.com;	
	Tlowitsis First Nation	Art Wilson c/o Nanwakolas	referrals@nanwakolas.com	
	Toquaht Nation	Ryan Anaka	davidj@toquaht.ca; kirstenj@toquaht.ca	
	Tsal'alh First Nation/Seton Lake Band	Chief Randy James and Council	rjames57@yahoo.com; idamary_tsalalh@yahoo.ca;adm.tsalalh13@gmail.com;	

	Tsartlip First Nation	David Elliot, William Morris, Victor Rumbolt	ReferralsWorker@tsartlip.com; stewardship@tsartlip.com; admin@tsartlip.com; Engagement@tsartlip.com	
	Tsawataineuk Nation	Referrals Office, Administrative Office	dfnreferrals@kingcome.ca; dfn.administrator@kingcome.ca;	
P	Tsawout First Nation		LOUIS Toolkit Portal; referrals@tsawout.ca	
	Tsawwassen First Nation	Treaty Rights and Title	referrals@tsawwassenfirstnation.com;twilliams@tsawwassenfirstnation.com	
	Ts'elxweyeqw Tribe	David Jimmie	referrals@peopleoftheriver.com	
	Tseshaht First Nation	Darrell Ross Sr., Ken Watts, Len Watts	dross@tseshaht.com; kwatts@tseshaht.com;	
	Tsetsaut Skii km Lax Ha Nation	Darlene Simpson	simpson@tsetsaut.ca; darlene-simpson@hotmail.com	
	Tseycum First Nation	Tanya Jimmy, James Jimmy	chief@tseycum.ca;	
P	Tsilhqot'in National Government (TNG)	Sarah Gash	TNG PORTAL	Portal ID 20432
	Tsim An Makhl (Gitxsan)	Chief Yal, Aubrey Jackson	shannonhenn@hotmail.com	
	Ts'kw'aylaxw First Nation	Chief Justin Kane and Council	Chief.J.Kane@tskwaylaxw.com; reception@tskwaylaxw.com; bandadmin@tskwaylaxw.com	
	Tsleil-Waututh Nation	Chief and Council	archaeology@twnation.ca	
	T'Sou-ke Nation	Elizabeth Hermsen, Fwd Te'mexw Treaty Association	administrator@tsoukenation.com; landsmanager@tsoukenation.com; info@temexw.org	
P	Ts'uubaa-asatx First Nation	Carole Livingstone, Aaron Hamilton	NATIONS CONNECT;	
	Tzeachten First Nation	c/o Sto:lo Nation	referrals@peopleoftheriver.com	
	Uchucklesaht Tribe Government	Ryan Anaka	moses.towell@uchucklesaht.ca; Charlie.Cootes@uchucklesaht.ca; ryan.anaka@uchucklesaht.ca	
P	Ulkatcho First Nation	Marie-Catherine Fournier	ULKATCHO CONNECT PORTAL	
	Union Bar First Nation	Chief Andrew Alex	chiefandy7632@gmail.com; Tammy@ubfn.ca; Joshua@ubfn.ca	
P	Upper Nicola Band	Gloria Sheena,	NATIONS CONNECT PORTAL	UNB snapshot 2021-0453
	Upper Similkameen Indian Band	Koby West, Chief Bonnie Jacobsen	referrals@usib.ca; bonnie.jacobsen@usib.ca	
	We Wai Kai First Nation	Art Wilson c/o Nanwakolas	referrals@nanwakolas.com;	
	Wei Wai Kum First Nation	Art Wilson c/o Nanwakolas	referrals@nanwakolas.com	

P	Westbank First Nation	Chief Robert Louie and Council	WESTBANK CONNECT	
	Wet'suwet'en First Nation	Virginia Spence, cc Chief Maureen Luggi	wfnreferralsupport@merakiresources.com; nr@wetsuweten.net; chief@wetsuw	
P	Whispering Pines/Clinton Indian Band	Referral Worker	NATIONS CONNECT	
P	Williams Lake First Nation	John Walker	NStQ PORTAL	
SER	Wuikinuxv Nation	Calen May-Tobin, Andra Forney	referrals@wuikinuxv.net; lands_manager@wuikinuxv.net; stewardship_director@wuikinuxv.net	
P	Xat'sull First Nation	Darrin Sargent	NStQ PORTAL	
	Xaxli'p First Nation	Chief Darrell Bob Sr and Council	forestryassistant@xaxlip.ca; ecdev@xaxlip.ca;	
M	Xsana Loop (Gitxsan)	Chief Gyologyet, Fedelia O'Brien	BY MAIL;	
	Xsansisnak (Gitxsan)	Larry Wright	lhwright1457@gmail.com	
	Xsigalliixawit (Gitxsan)	Chief Wiigoobl, Don Wahlstrom	dbwahlstrom@hotmail.com;	
M	Xsihl Guugan (Gitxsan)	Chief Gyologyet, Fedelia O'Brien	BY MAIL;	
P	Xwemalhkwu First Nation	Chief Darren Blaney	HOMALCO CONNECT PORTAL	
	Xwisten/Bridge River Indian Band	Chief Ina Williams and Council, Susan Cook, cc Michael McGee, cc Gary Forsyth, cc Travis Peters	council@Xwisten.ca;landsreferral@Xwisten.ca;ecdev@;administrator@; lands-coord@; landsmanager@	
	Yakweakwioose First Nation	c/o Sto:lo Nation	referrals@peopleoftheriver.com	
	Yale First Nation	c/o Sto:lo Nation	referrals@peopleoftheriver.com	
	Yunesit'in Government	Luke Doxtator, Trina Setah, Rhoda Petal	Luke@tsilhqotin.ca; landmanagement@yunesitin.ca; rpetal@yunesitin.ca	
	Yuulu?il?at?	Ryan Anaka, Zoltan Schafer, cc Suzanne Williams	zoltan.schafer@ufn.ca;suzanne.williams@ufn.ca;jonquil.crosby@ufn.ca;carey.cunneyworth@ufn.ca	

Permit No. **2021-0453**

BRITISH COLUMBIA
The Best Place on Earth

HERITAGE CONSERVATION ACT

HERITAGE INVESTIGATION PERMIT

AMENDMENT (003)

THIS IS TO CERTIFY that **Sarah Fraser** of **Ministry of Forests, Lands, Natural Resource Operations and Rural Development** is hereby authorized to conduct an investigation as described below, subject to the terms and conditions on the back hereof.

Type of and location:

Archaeological investigation of recovery activities undertaken in response to 2021's catastrophic rain resulting in widespread flooding and landslide events in British Columbia by the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD), the Ministry of Transportation and Infrastructure (MOTI) and other Provincial and/or Local Government proponents responsible to restore infrastructure in the affected areas.

All work is to conform with the "Application for Permit" dated November 18, 2021, and the amendment requests dated February 9, 2023, June 22, 2023, and April 17, 2024.

Disposition of materials collected: **Princeton and District Museum and Archives, Royal British Columbia Museum**

Issued **December 6, 2021**
Amended (001) **March 13, 2023**
Amended (002) **October 12, 2023**
Amended (003) **May 13, 2024**
Expires **November 30, 2024**

Minister of Forests

Per _____
(See back for *Conditions*)

GENERAL TERMS AND CONDITIONS OF PERMIT

1. Permits shall be valid for the term stipulated on the front of the permit unless otherwise suspended or cancelled. Extensions to the term of the permit, or other amendments, will be considered upon submission of a request to the Archaeology Branch at least 45 days prior to the expiry date of the permit.
2. For projects other than oil and gas projects in northeastern BC, the permit-holder shall provide the Archaeology Branch with one (1) bound copy and one (1) electronic copy in PDF format of a written report, in accordance with the standards required by the Minister, outlining the work carried out under the terms of the permit. For oil and gas projects in northeastern BC, the permit-holder shall provide the Oil and Gas Commission with one (1) electronic copy in PDF format for review and acceptance prior to submitting one (1) bound copy and one (1) electronic copy in PDF format to the Archaeology Branch.
3. The title page of all reports must indicate the name(s) of the copyright owner(s) and, where agreed to, a Grant of License statement completed and signed by the copyright owner(s).
4. A person appointed by the branch may at any time inspect any aspect of a project conducted under the terms of this permit. To further their inspection, the appointee may request field data, or conduct excavations within the study area. Notwithstanding the expiration or earlier termination of the term of the permit this provision will remain and continue in full force and effect.
5. Upon completion of any inspection or investigation involving excavations, the permit-holder shall make reasonable efforts to ensure all sites are restored as nearly as possible to their former condition.
6. The permit-holder shall arrange for a secure repository to curate any materials recovered under authority of the permit.
7. Heritage objects and associated materials recovered under authority of the permit may not be sold or exchanged for financial gain. Any other transfer of heritage objects, materials and records, or changes to the conditions identified under the "Disposition of materials collected..." section of the permit, may only be carried out with prior consent of the Minister.
8. The permit-holder shall conform to all requirements that may be imposed by the institution or organization named in the "Disposition of materials collected..." section of the permit.
9. Notwithstanding expiration or earlier termination of the term of the permit, provisions with respect to the "Disposition of materials collected ..." section shall remain and continue in full force and effect.
10. The permit holder shall utilize any site recording forms, formats or systems required by the minister. To fulfill this condition, the site form, mapping, and related documentation must comply with Archaeology Branch directives for site record submission. Failure to submit satisfactory site records will be considered an outstanding obligation, thereby affecting the archaeologists' ability to hold additional permits or obtain amendments.
11. A permit issued under section 14(2) does not authorize entry onto land or into a building without the permission of the owner or occupier.
12. For heritage inspection permits, the permit-holder shall submit spatial information (as a shape file in accordance with the standards required by the Minister) of all study areas that were the subject of in-field inspections.
13. Where known, First Nation file numbers will be reference in permit-related correspondence.

14. Any other conditions that may be specified in the permit.

15. The permit holder will provide electronic copies of any reports produced under this permit to those First Nations with an interest in the study area, unless the parties have agreed to alternate arrangements.

    The permit holder shall conduct the inspection as described in the permit application, unless otherwise specified in the permit.

OTHER CONDITIONS

16. **N/A**

APPENDIX D – BID EVALUATION

ID: 240004 Hatzic Emergency Works Program

1 Introduction

Proponents spend a significant amount of time preparing and supporting the responses they submit to provide professional and technical services to the Government of British Columbia. The Province benefits from this investment as it contributes both quality and choice to government's plans. In return for this effort, Proponents are entitled to a full and fair evaluation. Since evaluation is inherently judgement, significant care is required to

1.1 Response Evaluation Process and Rules

The evaluation will be conducted by a team of evaluators that will represent the Province.
These rules will guide the evaluation:

1. A representative of the PSB shall be responsible for the overall conduct of the evaluation and may establish such rules or procedures as it may reasonably determine are required. An evaluation chair person
2. The evaluators shall be the same people from the beginning to the end of the evaluation. Further, each evaluator will remain consistent in the section(s) they evaluate from each response. For instance, if three
3. Evaluators shall not discuss any aspect of the evaluation or share any information submitted, including responses and other documents, with anyone other than other members of the evaluation team.
4. ENV will be the custodian of all documents received by the Province. Responses and related documents
5. Prior to detailed evaluation of the responses, one or more members of the evaluation team will review the submissions to ensure that all mandatory criteria have been met. If all mandatory criteria are not met,
6. For each response that meets the mandatory criteria, the evaluators will review that submission without
7. Drawing solely upon the information specified within the RFP, and in a manner free from bias and conflict, each evaluator will assign a score to each criterion and that score will be discussed with evaluators.
8. All efforts will be made to achieve consensus. In the event that consensus cannot be reached, the final score will be the whole number from the evaluation scoring system closest to the average of the evaluators'
9. Any comments pertinent to the assessment of the criteria will be entered into the workbook for review
10. All questions about the evaluation made, during or following the evaluation, by persons who are not part
11. Questions for Respondents arising as part of the evaluation process will be documented. The evaluation chair will handle all communication between Respondents and the evaluation team.
12. All information related to this evaluation must be retained in a secure environment at all times.
13. All Respondents will be offered a debriefing session at the conclusion of the process that will be attended

Scoring Methodology

This RFP is structured to solicit a Proposal from Respondents that will provide evaluators sufficient information to assess a firms or individuals experience against the criteria that was defined in the RFP

Due to the subjective nature of this assessment, it is essential that evaluators enter into the appropriate place in this evaluation workbook any comments, which qualify the score awarded.

Each requirement has been assigned a relative weight prior to the evaluation commencing. This weight if applicable is displayed in column D in the Desirable Requirements worksheet. Evaluators will make an assessment of the Proposals ability to satisfy a requirement and will assign a score by consensus according to the following scales :

This Table 1 will be used in the absense of guidance in the respective workbook.

Table 1: Guideline for Desirable Requirements	Quality	Score
Proposal offers the highest level of exceptional features and service levels with no added risk. Including components that will be of benefit to the Province.	Exceptional	**5**
Proposal meets all desirable requirements specified in the CFR with low risk for implementation, including components that will be of benefit to the Province	meets requirements	**4**
Proposal arguably meets the desirable requirements specified in the CFR	Average	**3**
Proposal has minor deficiencies from the requirements specified. i.e., the service levels are minimally degraded, some but not all elements of a component are provided.	Some risk	**2**
Major elements of one or more or key components are missing. Proposal has major deficiencies from the requirements and would lead to loss of features or service levels.	Below Requirements	**1**
No Proposal or a Proposal that is not relevant to the requirement.	No Proposal	**0**

Pass
Fail
Pass/Fail

Mandatory Requirements		Milestone Delta Aggregates Joint		QM Environmental	
Criteria		Met? (Y/N)	Comments	Met? (Y/N)	Comments
The Proposal is in English		Y		Y	
The Proposal was received at the closing time and Location before the Closing date and time.		Y		Y	
The Proposal was received in accordance with the requirements of the "delivery of submissions" section on the cover page.		Y		Y	
Proposals must include a Submission Declaration signed by an authorized representative of the Proponent, as required by section 2.2 of this RFP.		Y		Y	
An Appendix B Proposal Response form or a form substantially the same was received and completed		Y		Y	
The Proponent is a Qualified Supplier				Y	
The Proposal includes a a scanned copy of a Bid Bond in the amount of 10% of the Total Price.				Y	
The Proposal includes a letter(s) of surety confirming the Proponents ability to acquire a: --Performance Bond (50% of the Total Price) and --Labour and Materials Payment Bond (50% of the Total Price)		Y		Y	
If all Y then proceed to Desirable Requirements.		notes: Joint Venture Name is not on our Qualified Supplier list. Qualified Vendor name we have is Milestone Environmental Contracting Inc		notes:	
If there are any N's, document the deficiencies and do not evaluate further.					
Notes:					

Desirable Requirements				**Milestone Delta Aggregates Joint Venture**			**QM Environmental**	
	Proposal should address	**Section weight**	**Rel. weight**			**0.0**		**0.2**
4.1 Preliminary Construction Schedule		**P/F**		**Pass/Fail**	**Pass/Fail**	**Notes**	**Pass/Fail**	**Notes**
This section will be assessed on a pass/fail basis. Contruction Window: August 15 to September 15, 2024	In Table 1 – Schedule Milestones below (or alternate schedule format generated with project scheduling software), clearly identify the major task items (e.g., mobilizations(s), access development/remediation, excavation, stockpile preparation/remediation, as applicable). Include start and finish dates for each task, as applicable. Include the anticipated duration required at each provided task. The schedule shall clearly identify the sequencing of construction relative to each task. The scheduling should include some ability to accommodate unforeseen delays.			Pass/Fail	Pass/Fail		Pass/Fail	Pass
4.2 Work Methodology		**15**		**0.0**	**0.0**	**Below Minimum**	**0.0**	**Below Minimum**
Describe the methodology to be employed for Work and the Proponent's proposed work plan. The methodology description shall provide a high-level overview of the approach to the Work and shall describe a strategy for meeting project objectives. The methodology should provide a comprehensive listing of all construction activities associated with completing the work as described in the RFP.	Elements of the methodology should include and are not limited to: •Construction laydown and staging plans, •Seasonal constraints, •Dealing with flood events or seasonal fluctuations in flow, •Access to the creek for removal and disposal of sediment material including any necessary hauling permits or restrictions, •Temporary works to be employed to complete the Work, •Environmental, terrestrial and habitat considerations and mitigation measures; and •Restoration and cleanup.		3					

Desirable Requirements				Milestone Delta Aggregates Joint Venture			QM Environmental	
4.3 Key Personnel Experience		**15**		**0.0**	**0.0**	**Below Minimum**	**0.0**	**Below Minimum**
1.State the name of the proposed Key Personnel								
2.Provide three reference projects that can attest to the performance of the proposed Key Personnel a.Name of Owner b.Project Name and Location c.Project Description and Scope of Work d.Duration of Contract/Project e.Value of Project ($) f.Responsibility of Superintendent g.Owner Reference (Organization, Name, Telephone Number, Email Address)			3					
•Verify site health and safety plan implemented, •Ensure schedule is maintained, •Allocate equipment and labour force, •Monitor productivity of the work and productions rates, •Maintain accurate records of work force, field orders, changes, field reports, •Reporting on construction activities, progress, documentation, •Coordinate with Ministry Representative, Environmental Monitor, Stakeholders, •Monitor, adjust and/or modify work program to meet requirements.	Evidence of tasks is present in examples or descriptions: 1.Gravel bar sediment removal by dry bar and top bar excavation methods in a river and/or marine environment; 2.Working in environmentally sensitive salmon spawning water habitat environments; 3.Working adjacent to fast moving water and fluctuating water and water level conditions; and 4.Close working relationship and cooperation with Environmental Monitor		5					
3.Include the resume for the proposed Key Personnel. Any supporting documents may be appended to the response.	Resume supports information (for clarity, the resume should simply not detract from what the reference descriptions demonstrate).		2					
4. Include Key Personnel experience with First Nations Engagement	Addresses Key Personnel FN experience		2					

Desirable Requirements				Milestone Delta Aggregates Joint Venture			QM Environmental	
4.5 Corporate Work Experience		**15**		**0.0**	**0.0**	**Below Minimum**	**0.0**	**Below Minimum**
1.Provide three examples of past work that supports the Proponent's experience with respect to the scope of Work described in this RFP and in particular the Work described above. Include: a.Name of Owner b.Project Name and Location c.Description of Project / Scope of Work d.Duration of Contract/Project e.Value of Project ($) f.Owner Reference (Organization, Name, Telephone Number, Email Address)	The Proponent should have demonstrable corporate experience in the execution of projects that are the same or similar to the Work set forth this RFP. Without limitation, it might include: •Coordination with Municipal, Provincial, Federal, and Indigenous Authorities; •Working in environmentally sensitive salmon spawning stream habitats with restrictive construction scheduling windows and difficult access requirements; •Working adjacent to flowing water and fluctuating water level conditions including experience with care and control of flowing water within a construction footprint; •Close working relationship and cooperation with an Environmental Monitor; and •Gravel bar sediment removal by dry bar and top bar excavation methods in a river and/or marine environment.		3					
4.5b First Nations Engagement Plan Approach		**5**		**0.0**	**0.0**		**0.0**	
1. The Province's expectation is that the Contractor will constructively engage with First Nations in the performance of the Work.	The Proponent should outline their plan for inclusion and involvement with the First Nations for this project.		1					
5.1 Total Contract Price		**50**		**50.0**	**0.0**		**0.2**	
5.2 a) Schedule of Quantities and Pricing - Lagace Creek S-CR-14								
General Requirements	Qty							
Mobilization and Demobilization	1	L.S.		$1.00	$93,358.30		$42,000.00	
Traffic Accommodations along Dale Rd	1	L.S.		$1.00	$21,813.74		$35,000.00	
Incidental and Miscellaneous						$115,172.04		$77,000.00
Tree Trimming, Pruning, Clearing, Grubbing, and Disposal	3500	m2		$1.00	$18.57		$8.00	
Supply & Installation of Chain Link Fence and Rolling Gate per Drawing C-3504	1	L.S.		$1.00	$47,935.30		$11,000.00	
Installation of Temporary Access Approach per Drawing C-3102	1	L.S.			$122,000.00		$1,800.00	
Supply and Installation of Tree Row per Drawing C-3102	12	each		$1.00	$4,276.90		$600.00	
Environmental						$286,253.10		$48,000.00
Preparation and Approval of CEMP	1	L.S.		$1.00	$6,391.37		$8,000.00	
Environmental Monitoring and Reporting	1	L.S.		$1.00	$295,000.00		$31,000.00	
Earthworks						$301,391.37		$39,000.00
Restoration of Sand Recovery Station (SRS) per Drawing on C-3501	11	Each		$1.00	$8,360.00		$2,000.00	
Supply and Installation of New Sand Recovery Station per Detail C-3502	3	Each			$53,450.00		$13,000.00	
Supply and Installation of Coconut Matting and Riparian Area Mix per Drawing C-3102	900	m2			$58.95		$8.00	
Excavation and Off-site Disposal of Sediment	8,250	m3			$67.50		$84.00	
Excavation and Off-site Disposal of Contaminated Sediment	500	m3		$1.00	$822.23		$473.00	
Bioengineering						$1,273,355.00		$997,700.00
Supply and Installation of Dense Live Staking per Detail 1 on C-3505	720	m^2			$230.41		$186.00	
Supply and Installation of Live Stake Cluster per Detail 2 on C-3503	200	m^2		$1.00	$194.50	$204,795.20	$410.00	$215,920.00
Total Project Price Lagace Creek S-CR-14				$4,228.00	$2,180,966.71	subtotal on submission is 2,180,971.71	$1,377,620.00	

Desirable Requirements				Milestone Delta Aggregates Joint Venture			QM Environmental	
5.2 b) Schedule of Quantities and Pricing - Lagace Creek S-CR-17								
General Requirements	Qty							
Mobilization and Demobilization	1	L.S.		$1.00	$85,000.00		$7,000.00	
Traffic Accommodations along Dale Rd	1	L.S.		$1.00	$24,000.00		$13,000.00	
Environmental						$109,000.00		$20,000.00
Preparation and Approval of CEMP	1	L.S.		$1.00	$5,625.00		$2,000.00	
Environmental Monitoring and Reporting	1	L.S.		$1.00	$62,305.00		$10,000.00	
Earthworks						$67,930.00		$12,000.00
Excavation and Off-site Disposal of Sediment per Drawing C-3105	300	m^3		$1.00	$432.98		$186.00	
						$129,894.00		$55,800.00
Total Project Price Lagace Creek S-CR-17				$304.00	$306,824.00	Proponent had subtotal of $483,754 (error) as they included line items as well as subtotals in total). They also didn't fill in Bid Summary (last page)	$87,800.00	
TOTAL OF BOTH PROJECTS (not incl taxes)					**$2,487,790.71**		**$1,465,420.00**	

APPENDIX E – CONTRACT DOCUMENTS

Natural Resource Ministries

Major Works Contract

Contract/File No: **MWK25EPFLOOD0001** Project Name: **Hatzic Emergency Works Program – Lagace Creek – Sites S-CR-14/17**	THIS AGREEMENT DATED FOR REFERENCE THE **23rd** DAY OF **August, 2024** (the "**Contract Date**").

BETWEEN:

HIS MAJESTY THE KING IN RIGHT OF THE PROVINCE OF BRITISH COLUMBIA,
as represented by the MINISTER OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

Ministry Office Name: Flood Management Debris Secretariat
PO Box 9377 Provincial Government, Victoria BC V8W 9M1

(the "Province")

AND:

QM LP, dba QM Environmental

Phone Number: 250-893-8671 or 1-800-251-7773
Business E-mail Address: 200-5035 South Service Road, Burlington, ON L7L 6M9

Contractor Representative: Nicholas Doucette
Business Number: 77885 6922
WorkSafe BC and/or Personal Optional Protection Number: 968503

(the “Contractor”)

WHEREAS:

A. The Province requires the Work as set out in Schedule "C" – Project Specifications, to be carried out for its benefit.

B. The Contractor is in the business of carrying out the kind of work required by the Province.

C. The Province and the Contractor have agreed that the Work shall be carried out in accordance with certain contract documents as hereinafter set out.

Accordingly, the Parties agree as follows:

ARTICLE 1 DEFINITIONS

1.01 In this document, the following words shall have the following meanings:

(a) "**Acceptance Date**" has the meaning set out in Section 19.01;

(b) "**Agreement**" means the agreement between the Parties as set out in the Contract Documents;

(c) "**Amending Document**" has the meaning set out in Section 2.02;

(d) "**Builders' Lien Act**" means the *Builders' Lien Act* (British Columbia);

(e) "**Builders' Lien Holdback**" has the meaning set out in Section 15.09;

(f) "**Business Day**" means a day that is not a Saturday, Sunday or any other day which is a statutory holiday in the place where an action is to be performed or a payment is to be made;

(g) "**Changed Conditions**" has the meaning set out in Section 14.01;

(h) "**Changes in the Work**" has the meaning set out in Section 13.01;

(i) "**Condition Date**" has the meaning set out in Section 5.05;

(j) "**Condition Precedent**" has the meaning set out in Section 5.02;

(k) "**Construction Schedule**" has the meaning set out in Section 1.07(a) of Schedule "D" – Special Provisions;

(l) "**Contract Documents**" means those documents described in Section 2.01;

(m) "**Contract Price**" has the meaning set out in Section 3.01;

(n) "**Contract Security**" has the meaning set out in Section 4.02;

(o) "**Contractor**" has the meaning set out in the Recitals;

(p) "**Contractor's Authorized Representative**" has the meaning set out on the front page of this Agreement;

(q) "**Contractor's Permits**" has the meaning set out in Section 5.07(b);

(r) "**Cultural Monitor**" means a person or entity contracted by the Province to act as a cultural advisor for the Project;

(s) "**Deficiencies**" mean the minor defects in the Work, minor portions of incomplete work and minor items required, but not yet supplied, at the time of Substantial Performance; none of which substantially prevent or impair the proper operation or occupancy of the Work;

(t) "**Deficiency Holdback**" has the meaning set out in Section **Error! Reference source not f ound.**;

(u) "**Effective Date**" has the meaning set out in Section 5.02;

(v) "**Environmental Monitor**" means a person or entity contracted by the Contractor to act as an environmental advisor for the Project;

(w) "**Event of Default**" means any of the following:

i) failure to perform any of the Contractor's obligations under this Agreement, including without limitation any of the following:

A. the requirement to carry and maintain the insurance policies as specified in Schedule "B" – Project Insurance Requirements,

B. failure to provide any update of the Construction Schedule as and when required by the Contract Documents, and

C. failure to progress the Work in accordance with such Construction Schedule as is approved by the Ministry Representative from time to time, or

ii) any representation or warranty made by the Contractor in this Agreement (including as part of any competitive process resulting in this Agreement being entered into) is untrue or incorrect, or

iii) an Insolvency Event;

(x) "**Force Majeure Event**" has the meaning set out in Section 23.03;

(y) "**Good Industry Practice**" means the standards, practices, methods and procedures to a good professional and commercial standard, conforming to Laws and exercising that degree of skill, care, diligence, prudence and foresight which would reasonably and ordinarily be expected from a qualified, skilled and experienced contractor engaged in a similar type of undertaking as the Work under the same or similar circumstances in the vicinity of the Place of Work;

(z) "**Governmental Authority**" means any federal, provincial, territorial, regional, municipal or local authority, quasi-governmental authority, court, government, regulatory organization or self-regulatory organization, commission, board, tribunal, organization, or any regulatory, administrative or other agency, or any political or other subdivision, department or branch of any of the foregoing, having jurisdiction in any way over or in respect of any aspect of the performance of the Agreement or the Work;

(aa) "**Insolvency Event**" means any of the following:

i) an order is made, a resolution is passed or a petition is filed, for the Contractor's liquidation or winding up,

ii) the Contractor commits an act of bankruptcy, makes an assignment for the benefit of its creditors or otherwise acknowledge its insolvency,

iii) a bankruptcy petition is filed or presented against the Contractor or a proposal under the *Bankruptcy and Insolvency Act* (Canada) is made by the Contractor,

iv) a compromise or arrangement is proposed in respect of the Contractor under the *Companies' Creditors Arrangement Act* (Canada),

v) a receiver or receiver-manager is appointed for any of the Contractor's property, or

vi) the Contractor ceases, in our reasonable opinion, to carry on business as a going concern.

(bb) "**Inspector**" means a person or persons appointed by the Ministry Representative whose duties include inspection of the Work done and materials furnished. An Inspector is not authorized, in carrying out his/her duties, to commit the Province to a financial expenditure;

(cc) "**L&M Bond**" has the meaning set out in Section 4.02;

(dd) "**Laws**" means all laws, including common law, federal, provincial, and municipal statutes, bylaws, and other local laws, orders, rules, regulations, codes, approvals and policies of any Governmental Authority, including those related to occupational health and safety, fire, employment insurance, workers' compensation, the transportation and handling of hazardous substances, the transportation and handling of dangerous goods, environmental protection, standards, building codes and other governmental requirements, work practices and procedures, that are applicable to the discharge of obligations set out in the Contract Documents or to the Work;

(ee) "**Loss**" has the meaning set out in Section 8.01;

(ff) "**Maximum Amount**" has the meaning set out in Section 3.02;

(gg) "**Ministry Representative**" means a person appointed pursuant to Article 6, who may be a third party contractor appointed by the Province;

(hh) "**Notice**" means notice provided by one party to another in accordance with Section 27.05;

(ii) "**Other Contractor**" means a person, firm or corporation having a separate contract directly or indirectly with the Province for work other than that required by the Contract Documents;

(jj) "**Party**" means either the Contractor or the Province, and "**Parties**" means both of them;

(kk) "**Performance Bond**" has the meaning set out in Section 4.02;

(ll) "**Permits**" has the meaning set out in Section 5.07;

(mm) "**Place of Work**" is the designated sites or locations where the Work will be performed, as identified in the drawings attached as Schedule "G" – Project Drawings;

(nn) "**Plans and Specifications**" means the plans (including notes and schedules), profiles, drawings and specifications in this Agreement and the schedules thereto, including the requirements set out in Schedule "D" – Special Provisions, prepared and designed to be used for the Agreement and includes any general conditions or requirements contained therein;

(oo) "**Plant Warranty Period**" has the meaning set out in Section 19.01;

(pp) "**Project**" means the development and implementation of emergency work and solutions for the Hatzic Emergency Works Program – Lagace Creek – Sites S-CR-14/17.

(qq) "**Province**" has the meaning set out in the Recitals;

(rr) "**Province's Permits**" has the meaning set out in Section 5.02;

(ss) "**Quotation**" has the meaning set out in Section 13.03(a);

(tt) "**Reinstatement Order**" has the meaning set out in Section 24.02;

(uu) "**RFP**" means the Request for Proposals for the Project, Opportunity ID number 250001;

(vv) "**Subcontractor**" means a person, firm or corporation having a direct contract with the Contractor to perform a part or parts of the Work, or to supply products worked to a special design according to the Contract Documents, but does not include one who merely supplies products not so worked;

(ww) "**Substantial Performance**" means the Work is substantially complete and is being used for the purpose intended or is ready for use without any deficiencies affecting the safety of those using or likely to use the Work;

(xx) "**Superintendent**" means the employee of the Contractor who is designated by the Contractor to act pursuant to Section 6.06;

(yy) "**Suspension**" has the meaning set out in Section 24.01;

(zz) "**Suspension Costs**" has the meaning set out in Section 24.03;

(aaa) "**Suspension Period**" has the meaning set out in Section 24.01;

(bbb) "**Total Performance**" has the meaning set out in Section 17.01;

(ccc)"**Unit Price**" has the meaning set out in Section 3.01(a);

(ddd) "**Warranty**" has the meaning set out in Section 19.01;

(eee) "**Warranty Period**" has the meaning set out in Section 19.01; and

(fff) "**Work**" means all activities carried out under this Agreement, and the results of those activities.

1.02 If any of the words in Section 1.01 are used in any other Contract Document, they shall have the same meaning as in this document unless the context dictates otherwise.

1.03 Words or abbreviations which have well known technical or trade meanings are used in the Contract Documents in accordance with such recognized meanings.

1.04 References to the masculine or the singular shall be considered to include the feminine and the plural as the context requires.

1.05 The headings of the clauses of this Agreement have been inserted for reference only and do not define, limit, alter or enlarge the meaning of any provision of this Agreement.

ARTICLE 2 CONTRACT DOCUMENTS AND AMENDMENTS

Contract Documents

2.01 The Agreement between the Parties shall be contained in this document and any schedules attached (the "Contract Documents") and no others:

(a) this document and any schedules attached; and

(b) any Amending Documents.

The attached schedules are applicable to and form part of this Agreement:

Schedule A	Schedule of Approximate Quantities and Unit Price Table
Schedule B	Project Insurance Requirements
Schedule C	Project Specifications
Schedule D	Special Provisions
Schedule E	Safety Conditions
Schedule F	Prime Contractor Agreement
Schedule G	Project Drawings
Schedule H	Approved Subcontractors
Schedule I	Preliminary Construction Schedule
Schedule J	Supplementary Conditions to the Agreement
Schedule K	Tax Verification
Schedule L	Reserved

Amending Documents

2.02 No modification to this Agreement shall be effective unless it is in writing and signed by, or on behalf of, the Parties and is in the form of a Contract Modification Agreement (NRS600), or in such other standard form of a similar nature for which the Province may provide from time to time (an "**Amending Document**").

Conflicts

2.03 The Contract Documents will be read as complementary. In the event of any inconsistency or conflicts between provisions of the Contract Documents, the following shall apply:

(a) the order of priority between the Contract Documents, from highest to lowest with the Agreement having the highest priority, is as follows:

i. Schedule J – Supplementary Conditions to the Agreement, if applicable
ii. The main body of this Agreement
iii. Schedule D – Special Provisions
iv. Schedule C – Project Specifications
v. Schedule G – Project Drawings
vi. Schedule H – Approved Subcontractors
vii. Schedule B – Project Insurance Requirements
viii. All other Schedules to the Agreement.

(b) figured dimensions shown on a drawing shall govern even though they may differ from dimensions scaled on the same drawing;

(c) drawings of smaller scale shall govern over those of larger scale (i.e., 1:100 governs over scale of 1:1000);

(d) Schedule C – Project Specifications shall govern over notes and schedules shown on plans and drawings;

(e) material and finishing schedules shall govern over other drawings; and

(f) Schedule D - Special Provisions or general requirements shall govern over Schedule C – Project Specifications.

Additional Copies of Contract Documents

2.04 The Contractor shall be provided with sufficient copies of the Contract Documents or parts thereof as are necessary for the performance of the Work.

ARTICLE 3 CONTRACT PRICE The price for the Work (the "**Contract Price**") will be the sum of:

(a) the product of the actual quantities and the corresponding unit prices for the items set out in Schedule "A" – Schedule of Approximate Quantities and Unit Price Table (each a "**Unit Price**"); plus

(b) all lump sums, if any, listed in Schedule "A" – Schedule of Approximate Quantities and Unit Price Table, for items incorporated into or related to the Work; plus

(c) any force account payments owing in accordance with the provisions of the Contract Documents; plus

(d) any payment adjustments, including any payments on account of Changes in the Work (as defined herein) approved in accordance with the provisions of the Contract Documents, whether or not made from any provisional sum set out in Schedule "A" – Schedule of Approximate Quantities and Unit Price Table.

All prices (including all Unit Prices) as listed in the Contract Documents are fixed and subject to change only as expressly provided in the Contract Documents.

3.02 The Contract Price is guaranteed by the Contractor to not exceed **$1,465,420.00 (**the "**Maximum Amount**"), subject to adjustment as provided in Article 13. Any amount in excess of the Maximum Amount will be paid by the Contractor without reimbursement by the Province.

3.03 Unless provided otherwise, the Contract Price will represent the entire cost (excluding only Goods and Services Tax (GST) and any Provincial Sales Tax (PST) that the Contractor is required to charge the Province as a taxable transaction) to the Province of the complete Work. The Unit Prices, lump sum prices, or other forms of pricing will be deemed to include sufficient amounts to cover:

(a) all labour, supervision, materials, equipment, transportation and delivery, overhead, profit, taxes (including taxes paid or payable by the Contractor to a supplier during the performance of the Work) and other things required to completely incorporate the item into the Work;

(b) all assessments payable with respect to labour as required by any statutory scheme such as Workers' Compensation, unemployment insurance, holiday pay, insurance, CPP and all employee benefits;

(c) all overhead costs, including head office and on-site overhead costs, insurance, the Contract Security, financing, and all other costs and expenses whatsoever incurred by the Contractor in performing the Work and completing its obligations; and

(d) all amounts for the Contractor's profit.

3.04 The Province may set-off, as against any amounts due to the Contractor, any amount owing from the Contractor to the Province.

ARTICLE 4 CONTRACT SECURITY

4.01 To secure fulfillment of the Contractor's obligations in the Agreement, the Contractor shall provide to the Province, on or before the Effective Date, the Contract Security as hereinafter set out.

4.02 The Contractor shall provide security in the form of a performance bond ("**Performance Bond**") and a labour and material payment bond ("**L&M Bond**", and together with the Performance Bond, the "**Contract Security**").

4.03 Each bond constituting the Contract Security shall be:

(a) in an amount equal to at least 50% of the estimated total Contract Price

(b) issued by a duly licensed surety company authorized to transact a business of suretyship in Canada and shall otherwise be in a type acceptable to the Province; and

(c) in a form acceptable to the Province.

4.04 A copy of the L&M Bond shall be posted at the Place of Work.

4.05 The Contract Security shall be in effect until the end of the Warranty Period.

4.06 The Province may make a demand under the Performance Bond at any time up to the total aggregate amount available for demand under the Performance Bond if, in the Province's sole and absolute judgment, the Contractor has failed to observe or perform any of the terms, conditions or provisions of this Agreement, in which case the Province will not be required to provide any prior Notice to the Contractor of its intention to make a demand under the Performance Bond.

ARTICLE 5 CONDITION PRECEDENT, COMMENCEMENT AND COMPLETION

5.01 This Agreement is effective as between the Province and the Contractor as of and from the Contract Date.

5.02 The "**Effective Date**" means the date designated by the Province, by written Notice to the Contractor, on which the Province shall have obtained all permits and approvals as outlined and required of the Province in Section 1.18 of Schedule "D" – Special Provisions, if applicable (collectively, the "**Province's Permits**") allowing the Work to be performed at the Place of Work (the "**Condition Precedent**").

5.03 Except as may be expressly agreed in writing by the Province and the Contractor, the Contractor will not commence performance of any Work prior to the Effective Date.

5.04 The Condition Precedent is for the sole benefit of the Province and may only be waived by the Province in its sole discretion. T

5.05 If the Effective Date has not occurred by **August 29, 2024** (the "**Condition Date**"), then this Agreement will be deemed null and void *ab initio* unless, prior to the Condition Date, the Parties mutually agree in writing to extend the Condition Date.

5.06 If at any time prior to the Condition Date the Province determines, in its sole discretion, that the Condition Precedent will not be satisfied prior to the Condition Date, as may be amended pursuant to Section 5.05, then the Province may give written Notice to that effect to the Contractor, in which event this Agreement will immediately be deemed null and void *ab initio*.

5.07 Prior to commencement of the Work, the Contractor shall have:

(a) received the Notice set out in Section 5.02;

(b) obtained all permits and approvals as outlined and required of the Contractor under Schedule "D" – Special Provisions, if applicable (collectively, the "**Contractor's Permits**", and together with the Province's Permits, the "**Permits**");

(c) provided the Province with copies of the Contract Security in accordance with Section 4.01;

(d) provided the Province with evidence of the insurance coverage set out in Schedule "B" – Project Insurance Requirements in accordance with Section 8.03; and

(e) complied with all pre-construction requirements set out in this Agreement.

5.08 The Contractor shall attain Substantial Performance of the Work, as certified by the Ministry Representative, no later than the date for Substantial Performance set out in the Preliminary Construction Schedule or the then current Construction Schedule, as applicable.

5.09 The Contractor shall attain Total Performance of the Work, as certified by the Ministry Representative, no later than the date for Total Performance set out in the Preliminary Construction Schedule or the then current Construction Schedule, as applicable.

ARTICLE 6 PARTY REPRESENTATIVES

Ministry Representative

6.01 The Province shall engage Associated Engineering (B.C.) Ltd., as represented by Paul Hague (email: haguep@ae.ca and phone: 250-545-3672), as the Ministry's Representative for this Agreement (the "**Ministry Representative**"). The Ministry Representative shall provide administration of the Agreement as described in the Contract Documents, and shall be the sole judge of the Work as to quantity, quality, suitability and progress and, unless either Party elects to dispute such determination in accordance with Article 25, the Ministry Representative's decision shall be final.

6.02 The Ministry Representative shall have the right to inspect the Work, the manner of construction and the materials furnished in respect thereof.

6.03 The Province may substitute a Ministry Representative at any time, in its sole discretion, and shall so notify the Contractor of the change.

6.04 The Ministry Representative may require the Contractor to do anything necessary to satisfy the Ministry Representative that the Work is being constructed in accordance with the Contract Documents.

Contractor Representative

6.05 The Contractor shall designate a Superintendent, who shall have full authority to act on behalf of the Contractor in connection with the Work and the Agreement and who shall be available at all times to the Ministry Representative.

6.06 Upon contract award, the Contractor shall notify the Ministry Representative of the name, address and telephone number of the Superintendent designated pursuant to Section 6.05.

6.07 Subject to Section 6.08, the Contractor shall not substitute a Superintendent without the written consent of the Ministry Representative.

6.08 If, in the reasonable opinion of the Ministry Representative, the Superintendent appointed by the Contractor is not suitably experienced or is unable to properly supervise the Work, then the Contractor shall, upon receipt of written Notice from the Ministry Representative, replace that Superintendent forthwith.

ARTICLE 7 CONSTRUCTION SCHEDULE AND EQUIPMENT LIST

7.01 The Contractor shall carry out the Work according to:

(a) the Preliminary Construction Schedule or the then current Construction Schedule, as applicable, which shall indicate the timing of the major activities of the Work designed to ensure conformance with the commencement and completion requirements set out in Article 5; and

(b) If required, the list of the construction machinery and equipment to be used in the Work.

7.02 Where, in the opinion of the Ministry Representative, the rate of progress of the Work is insufficient to enable the Work to be completed in the manner and by the dates specified under

the Agreement, then the Ministry Representative may deliver written Notice to the Contractor directing the Contractor to accelerate the performance of the Work. Upon receipt of such Notice, the Contractor shall, at its sole cost and expense, promptly:

(a) submit to the Ministry Representative a plan to bring the Work back into conformity with the then current Construction Schedule that is acceptable to the Ministry Representative, acting reasonably; and

(b) comply with such plan at the Contractor's sole cost and expense.

Failure of the Contractor to comply with the requirements of this Section 7.02 will be deemed to be an Event of Default to which the provisions of Article 24 shall apply.

7.03 The Ministry Representative may, at any time, deliver written Notice to the Contractor requesting the Contractor to accelerate the performance of the Work at the Province's convenience. Upon receipt of such Notice, the Contractor shall promptly

(a) submit to the Ministry Representative a plan to accelerate the performance of the Work that is acceptable to the Ministry Representative; and

(b) perform such acceleration as a Change in the Work.

ARTICLE 8 INDEMNIFICATION AND INSURANCE

8.01 The Contractor shall indemnify and save harmless the Province, its employees and agents from any loss, claim, (including any claim of infringement of third party intellectual property rights), damage award, action, cause of action, cost or expense that the Province or any of its employees or agents may sustain, incur, suffer or be put to at any time, either before or after this Agreement ends, (each a "**Loss**") to the extent the Loss is directly or indirectly caused or contributed to by:

(a) any act or omission of the Contractor's or its Subcontractors' agents, employees, officers, directors or Subcontractors in connection with this Agreement, or

(b) any representation or warranty of the Contractor being or becoming untrue or incorrect.

8.02 Neither Party shall be liable under this Agreement, whether in contract, tort (including negligence), under any statute or otherwise for any punitive, special, contingent, exemplary, indirect or consequential damages, or pure economic loss or damage of whatever nature, including business interruption, loss of use, profit, revenue, earnings, expected savings or other commercial economic losses of any kind, whether or not such losses or damages were foreseeable and whether or not the Parties were advised of the possibility of them.

8.03 The Contractor shall, at the Contractor's own expense, carry and maintain insurance coverage as specified in Schedule "B" – Project Insurance Requirements or as specified in writing by the Province, as those terms may be modified from time to time in accordance with our directions.

ARTICLE 9 PROTECTION OF WORK AND PROPERTY

9.01 The Contractor shall protect the Work, the Province's property and property adjacent to the Place of Work, from damage and shall be responsible for damage which may arise as the result of the Contractor's operations under the Agreement, except damage which occurs as a result of:

(a) errors in the Contract Documents; or

(b) acts or omissions of the Province, the Inspector, Other Contractors, their agents and employees.

Fire Protection

9.02 The Contractor shall take every precaution to prevent unintentional fire from occurring on or about the Place of Work. If the Contractor lights, fuels or uses an open fire, it must comply with the provisions required for the relevant open fire category in accordance with the Wildfire Regulation made under the *Wildfire Act* (British Columbia), and the Open Burning Smoke Control Regulation made under the *Environmental Management Act* (British Columbia).

Archaeological Finds

9.03 The Contractor will, and will cause Subcontractors to, take every precaution to prevent unintentional damage to or destruction of any archaeological materials which may exist at or be discovered at the Place of Work. In the case of discovery by the Contractor, the Contractor shall ensure the appropriate authorities are notified and comply with Section 1.20(b) of Schedule "D" – Special Provisions and Laws, including the *Heritage Conservation Act* (British Columbia).

ARTICLE 10 SUBCONTRACTING

10.01 The Contractor agrees to employ only those Subcontractors designated by the Contractor in writing, as set out in Schedule "H" – Approved Subcontractors, subject to Section 10.02, unless the Province directs or agrees otherwise.

10.02 The Province may, for reasonable cause, object to the use of a designated Subcontractor and require the Contractor to employ another qualified Subcontractor.

10.03 The Contractor agrees to preserve and protect the rights and obligations of the Parties in the Agreement with respect to work to be performed by Subcontractors.

10.04 The Contractor agrees to incorporate into each agreement with Subcontractors:

(a) the applicable terms and conditions of the Contract Documents, and

(b) the right to assign to the Province, in the manner and to the extent provided in this Agreement, all of the rights of the Contractor under such agreement.

10.05 The appointment of any Subcontractors does not relieve the Contractor of its responsibility under the Agreement or for the quality of work, materials and services provided by it.

10.06 Nothing contained in the Contract Documents shall create a contractual relationship between a Subcontractor and the Province.

ARTICLE 11 COOPERATION WITH OTHER CONTRACTORS

11

11.01 The Province reserves the right to award separate contracts in connection with other portions of the Work to Other Contractors and to perform work with own forces.

11.02 Where, in the reasonable opinion of the Ministry Representative, it is necessary that an Other Contractor be sent into or adjacent to the Place of Work, the Contractor shall cooperate with the Other Contractor.

11.03 The Contractor, forthwith upon becoming aware of any apparent deficiencies in the Other Contractor's work which would affect the Work, shall report such deficiencies in writing to the Ministry Representative.

11.04 Except with respect to deficiencies which the Contractor was not reasonably aware of, failure by the Contractor to report as required in Section 11.03 shall invalidate any claims against the Province by reason of the deficiencies.

ARTICLE 12 COMPLIANCE WITH THE LAW

12.01 Except as expressly set out otherwise in the Contract Documents, the Contractor will:

(a) have complete control of the Work and will effectively direct and supervise the Work so that it conforms to the Contract Documents; and

(b) be solely responsible for construction means, methods, techniques, sequences and procedures and for coordinating the various parts of the Work.

12.02 This Agreement shall be governed by, and is to be interpreted and construed in accordance with, the Laws of the Province of British Columbia and the federal Laws of Canada applicable in British Columbia.

12.03 The Contractor shall perform the Work in accordance with:

(a) the Contract Documents;

(b) all Laws, including the Permits; and

(c) Good Industry Practice.

If more than one standard, code (including building codes), other governmental requirements, work practices and procedures or specifications applies to the performance of the Work, then the strictest of such will apply.

12.04 The Contractor is deemed to have examined the Place of Work and the local conditions related to the Work prior to entering into the Agreement and to have been knowledgeable of the Place of Work and of all such conditions as would be apparent to a qualified and experienced contractor upon review of the Contract Documents and inspection of the Place of Work, including, as applicable, geotechnical and subsurface conditions, drainage, access, local weather, availability and cost of labour, equipment and materials and any other relevant matters.

12.05 The Contractor will review the Contract Documents and promptly report to the Ministry Representative any discovered error, inconsistency or omission. If the Contractor discovers any error, inconsistency or omission in the Contract Documents, then the Contractor will not proceed with the Work affected by such error, inconsistency or omission without first receiving directions or clarifications from the Ministry Representative. If the Contractor proceeds with such affected Work after becoming aware of an error, inconsistency or omission, or, in any event, after the time when a qualified and experienced contractor should reasonably have become aware of the error, inconsistency or omission, without first receiving directions or clarifications from the Ministry Representative, then the Contractor will, at the Contractor's sole cost and expense, remove, replace or make good any Work which fails to meet the requirements of the Contract Documents. Subject to the above provisions of this Section 12.05, in conducting such review, the Contractor will not be responsible or liable to the Province to discover all errors, inconsistencies or omissions in the Contract Documents.

12.06 The Contractor will comply with the Province's Permits, and obtain all Contractor's Permits.

Compliance with the *Workers' Compensation Act*

12.07 The Contractor shall:

(a) be solely responsible for construction safety at the Place of Work;

(b) at its own expense, provide the necessary WorkSafe BC compensation coverage for itself, all workers and any shareholders, directors, partners or other individuals employed or engaged in the performance of the Work and shall ensure all Subcontractors obtain WorkSafe BC coverage;

(c) if the Contractor or its Subcontractors do not have the benefit of mandatory workers compensation coverage under the *Workers Compensation Act* (British Columbia), then the Contractor shall ensure that it and its Subcontractors apply for and maintain Personal Optional Protection under the *Workers Compensation Act* (British Columbia);

(d) comply with, and ensure all Subcontractors comply with, all applicable occupational health and safety Laws in relation to the performance of the Contractor's obligations under this Agreement, including the *Workers' Compensation Act* (British Columbia) or similar Laws in other jurisdictions;

(e) be responsible for and pay for all fines, assessments, penalties and levies made or imposed under the *Workers' Compensation Act* (British Columbia) and regulations relating in any way to the Work; and

(f) upon request, provide the Province with proof of such compliance.

12.08 For the purposes of the *Workers' Compensation Act* (British Columbia), the Contractor shall be considered the "Prime Contractor" for the Work, as described in Schedule "E" – Safety Conditions, and as such shall enter into a Prime Contractor Agreement in the form attached hereto as Schedule "F" – Prime Contractor Agreement, and carry out the duties as described therein.

Compliance of Plans and Specifications with Law

12.09 The Contractor is not responsible for verifying that the Plans and Specifications comply with any law. If the Plans and Specifications do not comply with law, either at the time this Agreement is executed or as a result of a subsequent modification in law, the Contractor shall advise the Ministry Representative in writing and, the Province may modify the Plans and Specifications to comply. The Contractor will complete the Work on the basis of the modified Plans and Specifications and the Contract Price may be modified in accordance with this Agreement.

ARTICLE 13 CHANGES IN THE WORK

13

13.01 "**Changes in the Work**" means additions, deletions or other revisions to the Work, within the intent of the Agreement, but are not Changed Conditions (see Section 14.01).

13.02 The Ministry Representative may, at any time before verifying Total Performance of the Work, do any of the following:

(a) order additional work or material; or

(b) order work or material to be deleted or changed;

from that provided for in the Plans and Specifications if the additional work or material, deletion or change is consistent with the general intent of the Agreement.

13.03 For Changes in the Work ordered by the Ministry Representative or if the Contractor receives a direction, instruction or decision that the Contractor concludes is a Change for which the Contractor intends to claim:

(a) the Contractor shall, within ten (10) Business Days of (i) receipt of a Change in the Work ordered by the Ministry Representative; or (ii) the Contractor's receipt of a direction, instruction or decision that the Contractor concludes is a Change, prepare and present to the Ministry Representative the Contractor's claim for a resulting change in the deadlines set out in either or both of Section 5.08 and Section 5.09 and/or in the Contract Price, which claim for a change in the Contract Price shall, if applicable, be accompanied by a written price quotation based on one or more of the following methods;

a. by estimate and acceptance in a lump sum;

b. by unit prices set out in this Agreement or subsequently agreed upon;

c. by actual cost of labour and materials and a fixed fee or percentage fee of 15 percent based on the value of the change order;

d. by cost for all found equipment in accordance with rates established in the current edition of the 'Province of British Columbia, Equipment Rental Rate Guide',

(a "**Quotation**");

(b) the Ministry Representative shall consider the claim and the Quotation with a view to becoming satisfied that the claim and Quotation are appropriate; and

(c) upon becoming satisfied as to the appropriateness of the claim and the Quotation, the Ministry Representative shall refer the matter to the Province for final approval.

13.04 The Contractor shall perform the Changes in the Work that are ordered by the Ministry Representative as if they had appeared in and been part of the Plans and Specifications.

13.05 The Contractor shall keep accurate and complete records of quantities or costs and shall present an account of the cost of the Change(s) in the Work, together with vouchers where applicable, at intervals requested by the Ministry Representative.

13.06 Changes in the Work shall not proceed without a written signed Amending Document by the Province and the Contractor.

13.07 If the Contractor fails to prepare and present to the Ministry Representative the Contractor's claim for a change in the deadlines set out in either or both of Section 5.08 and Section 5.09 and/or in the Contract Price, and if applicable, a Quotation in accordance with Section 13.03, then the Contractor will not be entitled to make such claim.

13.08 Payment for Changes in the Work shall be made in accordance with Article 15.

13.09 If there are Changes in the Work done by the Contractor pursuant to this Agreement, the Contractor shall ensure the surety companies named in the Performance Bond and the L&M Bond are advised and consent to the Changes in the Work, and the value of the Contract Security shall be adjusted commensurately with any change in the Contract Price.

ARTICLE 14 CHANGED CONDITIONS

14

14.01 "**Changed Conditions**" means physical conditions at the Place of Work which were not foreseen by the Contractor and which would not have been reasonably foreseen by a reasonable contractor who, in accordance with Section 12.04, prior to submitting its response to RFP-250001, conducted a thorough investigation of the work to be done to complete the Work, including thoroughly inspecting the Place of Work and reviewing all information available from the Province to persons wishing to submit a response to the RFP, but does not include any weather or natural event.

14.02 When the Contractor observes a Changed Condition, the Contractor shall advise the Ministry Representative or Inspector prior to proceeding with the portion of the Work affected by the Changed Conditions. Should the Ministry Representative determine that conditions do differ materially, the Ministry Representative will issue appropriate instructions.

14.03 The Ministry Representative and the Contractor shall agree on the net effect on the quantities and time for performance of the Work, and the total adjustment, if any, to the Contract Price and/or the deadlines set out in either or both of Section 5.08 and Section 5.09 resulting from the Changed Condition, prior to certification of Total Performance of the Work, which shall be based on one or more of the following methods:

(a) by estimate and acceptance in a lump sum;

(b) by unit prices set out in this Agreement or subsequently agreed upon;

(c) by actual cost of labour and materials and a fixed fee or percentage fee of 15 percent based on the value of the change order; or

(d) by cost for all found equipment in accordance with rates established in the current edition of the 'Province of British Columbia, Equipment Rental Rate Guide'.

ARTICLE 15 PAYMENT

15.01 Applications for payment on account may be made monthly as the Work progresses, in a form acceptable to the Ministry Representative.

15.02 The Province will pay any applicable taxes payable under law or agreement with the relevant taxation authorities. Invoices must show the calculation of any applicable taxes (excluding taxes paid directly by the Contractor to a supplier and which are inclusive in the bid price) payable by the Province in relation to the Work as a separate line item.

15.03 Applications for payment shall be dated the last day of the agreed payment period and the amount claimed shall include:

(a) in respect of each unit price item in Schedule "A" – Schedule of Approximate Quantities and Unit Price Table, the applicable quantity of Work done by the Contractor, as estimated from progress measurements prepared by the Contractor and certified by the Ministry Representative; and

(b) the percentage of completion of Work in respect of any lump sum items incorporated into or related to the Work.

Terms of Payment

15.04 The Ministry Representative shall, no later than ten (10) days after the receipt of an application for payment from the Contractor submitted in accordance with Section 15.01, certify or reject the application for payment in the amount applied for or in such other amount the Ministry Representative determines is properly due. If the Ministry Representative amends or rejects the application, the Ministry Representative shall promptly advise the Contractor in writing giving reasons for amendment or rejection.

15.05 The Province will make progress payments pursuant to Section 15.03 and subject to the holdback provisions of Section 15.09, in accordance with the Province's payment practices and the *Financial Administration Act* (British Columbia).

15.06 Regulations pursuant to the *Financial Administration Act* (British Columbia) do not permit interest payments unless the account is overdue by at least sixty-one (61) days. The overdue period is calculated from the date the Ministry Representative authorizes payment, or the date the invoice is received, whichever is the latter, to the date the cheque is printed by the Ministry of Finance.

Appropriation

15.07 Despite any other provision of this Agreement, the obligation for payment of money by the Province to the Contractor, pursuant to this Agreement, is subject to:

(a) the Legislative Assembly of the Province of British Columbia having provided sufficient funds to enable the Province, in any fiscal year or part thereof, to make payment pursuant to this Agreement when it is due; and,

(b) the Province of British Columbia's Treasury Board not having controlled or limited expenditure of any funds referred to in subparagraph (a).

15.08 No payment by the Province under this Agreement, or partial or entire use or occupancy of the Work by the Province, shall constitute an acceptance of work or products which are not in accordance with the Contract Documents, or a release of the Contractor from any responsibility under this Agreement.

Builders' Lien Holdback

15.09 Progress payments approved under Section 15.04 shall be subject to a holdback of ten percent (10%) of the value of the Work performed and the materials supplied under the terms of the Agreement in accordance with the Builders' Lien Act (the "**Builders' Lien Holdback**"). No interest or other charges shall accrue on any amounts retained pursuant to this Section 15.09.

Discharge of Liens

15.10 Provided that the Province has made payment of undisputed amounts pursuant to this Agreement, the Contractor will not allow any lien, claim of lien or other encumbrance to be filed

or claimed against the Work, the Place of Work, or any other property of the Province. The Contractor will, at its sole risk and expense, do everything necessary, including through the institution, prosecution or defence of legal proceedings, to promptly discharge from title to the Place of Work or any other property of the Province, any builders' liens or certificates of pending litigation. In the event a builders' lien or certificate of pending litigation is filed against title to the Work or the Place of Work, the Province may, on five (5) days' written Notice, make an application to court pursuant to the provisions of the Builders' Lien Act, to obtain a court order whereby the Builders' Lien Holdback can be paid into court and the lien or certificate of pending litigation can be discharged. The Contractor will reimburse the Province for any legal and other costs actually incurred by the Province relating to such application to court immediately upon receipt of an invoice from the Province for such costs.

ARTICLE 16 SUBSTANTIAL PERFORMANCE

16.01 When the Contractor considers that it has achieved Substantial Performance of the Work, the Contractor will deliver to the Ministry Representative, for the Ministry Representative's review and certification, a written application to establish Substantial Performance of the Work. The Contractor's application for Substantial Performance of the Work shall include the following supporting material:

(a) a clearance letter from WorkSafe BC indicating all current assessments due from the Contractor have been paid;

(b) an NRS263 Statutory Declaration (supplied by the Province) attesting that all monies owing to the Contractor's workers, Subcontractors, material and equipment suppliers and government agencies have been paid; and

(c) written confirmation and acceptance of measurement quantities, if requested by the Ministry Representative.

16.02 The Ministry Representative will review the Work to verify the validity of the application for Substantial Performance of the Work in accordance with the Builders' Lien Act, and will promptly, and in any event, no later than ten (10) Business Days after receipt of the Contractor's application:

(a) advise the Contractor in writing that the Work is not substantially performed and give reasons why; or

(b) verify Substantial Performance of the Work, state the date of Substantial Performance of the Work in a certificate of Substantial Performance of the Work, and issue a copy of the certificate of Substantial Performance of the Work to the Province and the Contractor.

16.03 The certificate of Substantial Performance of the Work shall describe the parts of the Work not completed to the satisfaction of the Ministry Representative and all things that must be done before the Ministry Representative will verify Total Performance of the Work.

16.04 Upon receipt of the certificate of Substantial Performance of the Work, the Contractor shall submit an application for payment of the Builders' Lien Holdback in accordance with Article 15. The Builders' Lien Holdback shall become due and payable to the Contractor no later than ten (10) days after the expiration of the holdback period stipulated in the Builders' Lien Act.

16.05 If because of climatic or other conditions reasonably beyond the control of the Contractor there are items of the Work that cannot be performed, payment in full for work which has been performed as certified by the Ministry Representative shall not be withheld or delayed by the Province on account thereof, but the Province may withhold until the remaining work is finished, such monies as the Ministry Representative determines are sufficient and reasonable to cover the cost of performing such remaining work and to adequately protect the Province from claims.

Deficiency Holdback

16.06 Concurrently with the issuance of the certificate set out in Section 16.02(b), the Contractor and the Ministry Representative will create a "deficiency list" describing all items of the Work which are incomplete, outstanding, deficient or defective, and which remain to be completed or rectified, and reasonable dates for finishing such Work, which shall be no later than the date for Total Performance of the Work. The Province may retain out of any amount due and owing to the Contractor an amount equal to two (2) times the value the Ministry Representative, acting reasonably, estimates as the cost to complete or correct such "deficiency list" items (the "**Deficiency Holdback**"). The Deficiency Holdback shall be applied against all subsequent progress payments, until such time as such "deficiency list" items have been completed or corrected. No interest or other charges shall accrue on any amounts retained pursuant to this Section 16.06.

ARTICLE 17 TOTAL PERFORMANCE

17.01 When the Contractor considers that the Work has been completed in accordance with the Contract Documents and that the Work has satisfactorily passed all final tests prescribed by the Project Specifications ("**Total Performance**"), the Contractor will deliver to the Ministry Representative, for the Ministry Representative's review and certification, a written application to establish Total Performance of the Work. The Contractor's application for Total Performance of the Work shall include the following supporting material:

(a) a clearance letter from WorkSafe BC indicating all current assessments due from the Contractor have been paid;

(b) an NRS263 Statutory Declaration (supplied by the Province) attesting that all monies owing to the Contractor's workers, Subcontractors, material and equipment suppliers and government agencies have been paid; and

(c) written confirmation and acceptance of measurement quantities, if requested by the Ministry Representative.

17.02 The Ministry Representative will review the Work to verify the validity of the application for Total Performance of the Work, and will promptly, and in any event, no later than ten (10) Business Days after receipt of the Contractor's application:

(a) advise the Contractor in writing that the Work is not totally performed and give reasons why; or

(b) verify Total Performance of the Work, provide written Notice to the Province and the Contractor stating the date of Total Performance of the Work, and certify for payment the remaining monies due to the Contractor under the Agreement.

ARTICLE 18 TAXES AND DUTIES

18.01 The Contractor shall provide the Province with a Valid tax Verification Letter concurrently with the execution of this Agreement. Upon request by the Province, the Contractor shall provide the Province with an updated and valid Tax Verification Letter.

18.02 Except for those taxes chargeable to the Province in accordance with Section 18.03, the Contractor shall pay any applicable taxes, customs duties and excise taxes in respect of the Agreement.

18.03 A Contractor who has neither residence nor place of business in the Province of British Columbia shall, upon request, provide the Province with proof of registration with the provincial sales tax authorities.

ARTICLE 19 WARRANTY

19.01 The Contractor warrants that the Work shall be performed in accordance with Good Industry Practice, the requirements of this Agreement and Laws, and shall be free of any defects in materials and workmanship (the “Warranty”). Where the Work includes the supply and planting

of vegetation or bioengineering, the Contractor shall make a written request to the Ministry Representative identifying the vegetation or bioengineering planting zones or areas that have been completed in accordance with the Specifications and are ready for inspection, and the Ministry Representative shall, within ten (10) days, review such request and either provide an acceptance letter or a rejection letter with respect to such vegetation or bioengineering within ten (10) Business Days, provided that, where the Ministry Representative fails to respond to such request within such ten (10) Business Days, the Ministry Representative be will be deemed to have provided an acceptance letter on the tenth day from delivery by the Contractor with respect to such vegetation or bioengineering. The period of the Warranty with respect to such vegetation or bioengineering (the "Plant Warranty Period") shall begin on the date on which the Ministry has, or if applicable, is deemed to have, delivered an acceptance letter to the Contractor with respect to such vegetation or bioengineering (the "Acceptance Date") and shall end on the date that is two (2) years from the Acceptance Date. The period of the warranty with respect to the remainder of the Work (the "Warranty Period") shall begin on the date on which Total Performance of the Work has been obtained and end on the date that is one (1) year from such date.

19.02 The Province, or any party it designates as its representative, shall promptly give the Contractor written Notice of observed defects and deficiencies in the Work which occur during the Plant Warranty Period or the Warranty Period, as applicable.

19.03 Notwithstanding any other provision of this Agreement, or the expiration or sooner termination of this Agreement, the Contractor agrees to promptly, at the Contractor's sole cost and expense, correct all defects or deficiencies prior to Total Performance of the Work and during the period of the Plant Warranty Period or the Warranty Period, as applicable.

19.04 The Contractor shall correct or pay for damage resulting from corrections made under the requirements of Section 19.01.

ARTICLE 20 PROVINCIAL PROPERTY

20.01 Any materials, equipment or property supplied by or on behalf of the Province to the Contractor as a result of this Agreement shall be the exclusive property of the Province.

20.02 The Contractor shall deliver the property to the Province immediately following the expiration or sooner termination of this Agreement. The Ministry Representative may, before the expiration or sooner termination of this Agreement, give written Notice to the Contractor requesting the Contractor to return to the Province any part of the property, in which event the Contractor shall comply with the request.

20.03 The Contractor is liable to the Province for any loss or damage to materials, equipment or property that is supplied or placed in the care, custody and control of the Contractor by the Province, for use in connection with the Agreement, excepting always loss or damage attributable to reasonable wear and tear.

ARTICLE 21 CLEANUP

21.01 The Contractor and its Subcontractors shall maintain the Place of Work in a tidy condition and free from accumulation of waste products and debris, other than that caused by the Province, Other Contractors or their employees.

21.02 Upon attaining Substantial Performance of the Work, the Contractor shall remove the Contractor's surplus products, tools, construction machinery and equipment not required for the performance of the remaining work. The Contractor shall also remove waste products and debris other than that caused by the Province, Other Contractors or their employees, and leave the Place of Work clean and suitable for occupancy or use by the Province, unless otherwise specified.

21.03 Total Performance of the Work shall not be attained until the Contractor has removed its surplus products, tools, construction machinery and equipment. The Contractor shall also have removed

waste products and debris, other than that caused by the Province, Other Contractors or their employees.

ARTICLE 22 LAYOUT

22.01 The Contractor shall, at the Contractor's own expense:

(a) layout the Work and, if requested by the Province, give the Ministry Representative or the Inspector such facilities and assistance in establishing lines, grades and points, and measure up the Work, as the Ministry Representative or the Inspector directs; and

(b) do whatever is necessary to ensure that all marks and stakes placed on the Work or Place of Work by or under the authority of the Ministry Representative or the Inspector, are protected and are not removed, defaced, altered or destroyed.

22.02 Before the commencement of the Work, the Contractor shall satisfy itself as to the meaning and correctness of all marks and stakes, as no claim will be accepted thereafter. If the Contractor determines or has reason to suspect any errors in the marks and stakes, it shall stop work and advise the Ministry Representative or the Inspector, who shall investigate and provide additional instructions for rectification, if necessary. No claim for delay or additional costs shall be permitted under this Section.

ARTICLE 23 DELAYS

23.01 If:

(a) the Contractor is delayed in the performance of the Work by act or omission of the Province, Inspector, Other Contractor, or anyone employed or engaged by them directly or indirectly, contrary to the provisions of the Contract Documents;

(b) a Province's Permit is revoked or materially amended and such revocation or material amendment is not the result of an act of fault by the Contractor (or anyone employed or engaged directly or indirectly by the Contractor); or

(c) the Contractor is delayed in the performance of the Work by a stop work order issued by a court or other Governmental Authority, and if the stop work order is issued because of an act of fault by the Province, (or any person employed or engaged directly or indirectly by the Province) and not an act of fault by the Contractor (or anyone employed or engaged directly or indirectly by the Contractor),

then the completion deadlines set out in either or both of Section 5.08 and Section 5.09 shall be extended for such reasonable time as is caused by the delay, including the impact, if any, of the delay on the requirements under the Province's Permits. The Contractor shall be reimbursed for reasonable, direct, and substantiated costs incurred by the Contractor as the result of such delay.

23.02 If the Contractor is delayed in the performance of the Work by its own acts or omissions, or those of its employees, agents or subcontractors, then the Contractor will not be entitled to any extension of time or reimbursement as a result of such delay.

23.03 If the Contractor is delayed in the performance of the Work by labour disputes, strikes, lock-outs (including lock-outs decreed or recommended for its members by a recognized contractors' association, of which the Contractor is a member or to which the Contractor is otherwise bound), fire, unusual delay by common carriers or unavoidable casualties, health restrictions imposed by a provincial health authority due to a health crisis, epidemic or pandemic, or, without limit to any of the foregoing, by a cause beyond the Contractor's control (a "**Force Majeure Event**"), such that if the Contractor is delayed in the performance of any of its obligations, provided that the Contractor gives written prompt Notice of the Force Majeure Event to the Province and complies with Section 23.05, then the completion deadlines set out in either or both of Section 5.08 and Section 5.09 shall be extended for such reasonable time as is caused by the delay, including the

impact, if any, of the delay on the requirements under the Province's Permits. The Contractor shall not be entitled to payment for costs incurred as a result of such delays.

23.04 No extension to the completion date for the Work shall be made for delay unless written Notice of claim is given to the Ministry Representative not later than three (3) days after the commencement of delay, providing, however, that in the case of a continuing cause of delay only one Notice of claim shall be necessary.

23.05 In all cases where the Contractor is entitled to receive from the Province any additional compensation, damages, or extensions of time, the Contractor will use both all commercially reasonable efforts and all due diligence to mitigate and reduce the amount required under the Agreement to be paid by the Province to the Contractor or the amount of the extension of the time for the performance of the Work. This obligation will be taken into account in the determination of the Contractor's entitlement to an extension of time for the performance of the Work and reimbursement of costs or both.

23.06 Notwithstanding the preceding provisions of this Section 23, with respect to concurrent delays:

(a) if two or more events occur concurrently that each entitle the Contractor to an extension of the time for the performance of the Work, then for the period of any concurrency the Contractor will be entitled to claim an extension with respect to only one of the concurrent events;

(b) if an event as described in Section 23.01 occurs concurrently with an event as described in Section 23.03, then during the period of any concurrency the Contractor will be entitled to claim only an extension of time with respect to the event described in Section 23.01;

(c) if an event as described in Section 23.01 occurs concurrently with an event as described in Section 23.02, then during the period of any concurrency the Contractor will not be entitled to claim, nor will the Contractor make any claim for, any extension of time or reimbursement of costs with respect to the event described in Section 23.01; and

(d) if an event as described in Section 23.02 occurs concurrently with an event as described in Section 23.03, then during the period of any concurrency the Contractor will not be entitled to claim, nor will the Contractor make any claim for, any extension of time or reimbursement of costs with respect to the event described in Section 23.03.

ARTICLE 24 PROVINCE'S RIGHT TO SUSPEND THE WORK, PERFORM THE WORK OR STOP THE WORK OR TERMINATE CONTRACT

24.01 If the Province's Permit is revoked or materially amended, or if, for reasons outside of the control of the Contractor or those for whom it is responsible, the Contractor is unable to continue its performance of the Work in compliance with the Province's Permit, then the Province may suspend the Work (a "Suspension") by notifying the Contractor in writing (such period of suspension hereinafter a "Suspension Period").

24.02 During the Suspension Period, the Contractor shall properly protect and secure the Work. The Contractor shall resume the Work on a date as may be specified by the Province in a written notice to the Contractor (the "Reinstatement Order").

24.03 Pursuant to Section 13.05, the Contractor shall provide the Province with a Quotation for the reasonable, direct and substantiated costs of preserving all Work performed up to the date on which the Contractor receives a written Notice of such Suspension and any necessary demobilization costs (the "Suspension Costs). In no event shall the Contractor be entitled to any increase to the Price for Consequential Damages caused by such Suspension or Reinstatement Order.

24.04 The Province shall reimburse the Contractor for the Suspension Costs within thirty (30) days of the Province providing the Contractor with written acceptance of the Quotation.

24.05 If the Contractor should neglect to prosecute the Work or on the happening of an Event of Default, or at any time thereafter, the Ministry Representative or Inspector may notify the Contractor in writing that the Contractor is in default and instruct the Contractor to correct the default in the five (5) days immediately following the receipt of such Notice.

24.06 If the Contractor receives such Notice pursuant to Section 24.05, the Contractor, subject to Section 24.07, shall correct the default within such five (5) day period noted in Section 24.05.

24.07 If the correction of the default cannot be completed in the five (5) days specified, the Contractor shall be in compliance with the Province's instructions if the Contractor:

(a) commences the correction of the default within the specified time; and

(b) provides the Province with an acceptable schedule for such correction; and

(c) completes the correction in accordance with such schedule.

24.08 If the Contractor fails to correct the default in the time specified or subsequently agreed upon, the Province, without prejudice to any other right or remedy it may have, may, in its sole discretion do one or more of the following:

(a) correct such default and deduct the actual cost thereof from any payment then or thereafter due the Contractor;

(b) terminate the Contractor's right to continue with the Work in whole or part.

(c) waive the default in a Notice and on such conditions as the Ministry Representative may determine; or

(d) terminate this Agreement with immediate effect or on a future date specified by the Province.

24.09 If the Province terminates the Contractor's right to continue with the Work under the conditions set out in Section 24.08(b) or (d), the Province shall be entitled to do any one or more of the following:

(a) take possession of the Work and products and utilize all construction machinery and equipment, subject to the rights of third Parties, and finish the Work by whatever method it may consider expedient but without undue delay or expense, in which event the Province may require the Contractor to: (i) assign to the Province, in the manner and to the extent directed, all of the rights of the Contractor under purchase orders and subcontracts with first-tier Subcontractors, if any; and/or (ii) terminate purchase orders and agreements with first-tier Subcontractors, if any, to the extent that they are not assigned to the Province;

(b) withhold further payments to the Contractor until the Work is finished; and

(c) upon Total Performance of the Work, charge the Contractor the full cost of finishing the Work (as certified by the Ministry Representative), which cost shall include compensation for any additional services of the Ministry Representative required to complete the Work.

24.10 No failure or delay on the Province's part to exercise its rights in relation to an Event of Default will constitute a waiver of such rights.

24.11 If the Contractor becomes aware that an Event of Default has occurred or anticipates that an Event of Default is likely to occur, the Contractor must promptly notify the Province of the particulars of the Event of Default or anticipated Event of Default. A Notice under this section as to the occurrence of an Event of Default must also specify the steps the Contractor proposes to take to address, or prevent recurrence of, the Event of Default. A Notice under this section as to an anticipated Event of Default must specify the steps the Contractor proposes to take to prevent the occurrence of the anticipated Event of Default.

24.12 The Contractor's obligations under the Agreement as to quality, correction and warranty of the work performed by the Contractor up to the time of termination shall continue in force after such termination.

24.13 The rights, powers, and remedies conferred upon the Province under this Article are not intended to be exclusive and each such right, power, and remedy referred to therein shall be cumulative and in addition to and not in substitution for every other right, power or remedy existing or available to the Province under the Agreement, at law or in equity, and the exercise by the Province of any right, power, or remedy shall not preclude the simultaneous or later exercise by the Province of any other right, power or remedy.

24.14 Notwithstanding any other provision of the Agreement, the Province may at any time and for any reason, upon giving thirty (30) days prior Notice to the contractor, terminate the Agreement.

24.15 Subsequent to receipt of Notice from the Province pursuant to Section 24.14, the Contractor shall only proceed with those portions of the Work specifically authorized in a Notice by the Ministry Representative to be completed prior to termination.

24.16 Upon termination of the Agreement in accordance with this Agreement, the Province shall have no further obligation to the Contractor save and except to pay to the Contractor:

(a) The amount the Contractor is entitled to for Work completed to the Province's satisfaction prior to the date of termination after any deductions made in accordance with this Agreement; and

(b) Other expenses actually incurred by the Contractor, such as demobilization and compensation for unrecovered actual fixed expenses which are, in the sole opinion of the Province, reasonable in the circumstances.

ARTICLE 25 DISPUTE RESOLUTION

25.01 If a dispute occurs between the Parties concerning any matter under this Agreement, the disputing Party shall promptly advise the other Party and the Parties together shall use all reasonable efforts to resolve the dispute informally.

25.02 If the Parties are unable to resolve the dispute informally, either Party may then give Notice, of the dispute to the Ministry Representative within fourteen (14) days of the failure of the informal resolution, which particulars shall include the following:

(a) a detailed description of the nature of the complaint;

(b) a list of the relevant provisions of the Contract Documents; and

(c) a valuation of the matters in dispute.

25.03 Where the Contractor submitted the Notice described in Section 25.02, the Province shall, within thirty (30) days of receipt by the Ministry Representative of the written particulars, give to the Contractor a decision, in writing, of one of the following:

(a) that the Province accepts the position of the Contractor; or

(b) that the Province rejects the position of the Contractor.

25.04 If the Province accepts the position of the Contractor, the Parties shall enter into an Amending Document to reflect the agreement.

25.05 If the Province rejects the position of the Contractor, the Parties shall, if they both agree, have the matter resolved by arbitration, in accordance with the *Commercial Arbitration Act* (British Columbia).

25.06 If the matter in dispute is not resolved promptly pursuant to Section 25.01, the Ministry Representative may give to the Contractor such instructions as in the Ministry Representative's opinion are necessary to provide for the proper performance of the Work and to prevent delays.

25.07 If the Contractor receives instructions pursuant to Section 25.06, the Contractor shall act immediately to carry out the work pursuant to the instructions, but any work performed by the Contractor in this respect shall be without prejudice to any claim the Contractor may have concerning the dispute.

25.08 Nothing in this Article shall preclude either Party from having a dispute resolved by a court of competent jurisdiction.

ARTICLE 26 DAMAGES AND MUTUAL RESPONSIBILITY

26.01 If either Party to this Agreement should suffer any Loss due to a material breach of the obligations of the other Party, then that Party shall be reimbursed by the other Party for such damage.

26.02 Claims for damage under Section 26.01 shall be made in writing to the Party liable within reasonable time after the first observance of such damage and if undisputed shall be confirmed by an Amending Document. Disputed claims shall be resolved as set out in Article 25.

26.03 If the Contractor has caused damage to the work of an Other Contractor at the Place of Work, the Contractor agrees, upon receipt of written Notice, to settle with the Other Contractor by negotiation or arbitration. If the Other Contractor makes a claim against the Province on account of damage alleged to have been so sustained, the Province shall notify the Contractor and may require the Contractor to defend the action at the Contractor's expense. The Contractor shall satisfy a final order or judgment against the Province and pay the costs incurred by the Province arising from such action.

26.04 If the Contractor becomes liable to pay or satisfy a final order, judgment, or award against the Province, then the Contractor, upon undertaking to indemnify the Province against any and all liability for costs, shall have the right to appeal in the name of the Province such final order or judgment to any and all courts of competent jurisdiction, subject to the *Attorney General Act* (British Columbia).

ARTICLE 27 MISCELLANEOUS

Confidentiality

27.01 The Contractor will treat as confidential and will not, without the prior written consent of the Province, disclose or permit to be disclosed or used, either before or after the expiration or sooner termination of this Agreement, any information supplied to, obtained by, or which comes to the knowledge of, the Contractor or any of its Subcontractors (whether verbally, electronically or otherwise) as a result of this Agreement except if the disclosure is necessary to enable the Contractor to fulfill its obligations under this Agreement or to comply with Laws or if it is information that is generally known to the public other than as a result of a breach of this Agreement.

Records to be Kept by Contractor

27.02 The Contractor shall:

(a) maintain full records of his estimated and actual cost of the Work together with all tender calls, quotations, contracts, material cost distribution worksheets, equipment records (including, without limitation, hours of use and distribution), correspondence, invoices, receipts and vouchers relating thereto;

(b) when requested, make all records and material referred to in subsection (a), available for audit and inspection by the Ministry Representative, or by other persons acting on the Province's behalf;

(c) allow any of the persons referred to in subsection (b) to make copies of and to take extracts from any of the records and material referred to in subsection (a); and

(d) furnish any person referred to in subsection (b) with any information they may require from time to time in connection with such records and material.

The records maintained by the Contractor pursuant to this Section shall be kept intact by the Contractor until the expiration of seven (7) years after the date of Substantial Performance, if given, or Total Performance otherwise, or until the expiration of such other period of time as the Province may direct.

The Contractor shall permit the Province, at all reasonable times, to inspect and copy any findings, data, specifications, drawings, working papers, reports, documents and material whether complete or otherwise that have been produced, received or acquired by, or provided by or on behalf of the Province to the Contractor, as a result of this Agreement.

Samples and Testing

27.03 The Ministry Representative or the Inspector may, at the expense of the Province, take samples, and test and inspect materials that are incorporated or are intended to be incorporated into the Work. The Contractor shall cooperate with the Ministry Representative or the Inspector in providing every necessary facility for sampling, testing and inspecting.

The Contractor shall furnish to the Ministry Representative, if requested, a complete written statement of the origin, composition and manufacture of any materials supplied by the Contractor that are incorporated or are intended to be incorporated in the Work.

Defective Work

27.04 Defective work, whether the result of poor workmanship, use of defective products or damage through carelessness or other act or omission of the Contractor, and whether incorporated in the Work or not, which has been rejected by the Ministry Representative or Inspector as failing to conform to the Plans and Specifications shall be removed promptly from the Place of Work by the Contractor and replaced or re-executed promptly in accordance with the Plans and Specifications at the Contractor's expense.

The Contractor shall make good promptly Other Contractors' work destroyed or damaged by such removals or replacements, at the Contractor's expense.

If, in the opinion of the Ministry Representative, it is not expedient to correct defective work or work not performed in accordance with the Plans and Specifications, the Province may deduct from monies otherwise due to the Contractor, the difference in value between the work as performed and that called for by the Plans and Specifications, the amount of which will be determined in the first instance by the Ministry Representative.

Notice

27.05 Any Notice or document required to be given under this Agreement shall be conclusively deemed to be validly given or delivered to and received by the Parties at the Place of Work or at the address or email address specified on the first page of this Agreement (or at such other address as either Party may from time to time designate by written Notice to the other):

(a) if hand delivered to the Party or the specified Party representative, on the date of that personal delivery; or

(b) if pre-paid post and if mailed during any period when normal postal services prevail, on the fifth Business Day after its mailing; or

(c) if delivered by courier service, on the fifth Business Day after collection by the courier service; or

(d) if sent by electronic transmission, on the day of transmittal unless transmitted after the normal business hours of the addressee or on a day that is not a business day, in which case it will be deemed to be received on the next following Business Day.

Agreement Execution

27.06 This Agreement may be entered into by a separate copy of this Agreement being executed by, or on behalf of, each Party and that executed copy being delivered to the other Party by a method provided for in Section 27.05 or any other method agreed to by the Parties.

Survival of Terms

27.07 All terms of this Agreement in favour of the Province and all rights and remedies of the Province, either at law or in equity, survive the expiration or sooner termination of this Agreement subject to any applicable limitation period prescribed by law.

Successors and Assigns

27.08 This Agreement enures to the benefit of and binds the Province and its assigns and the Contractor and its successors and permitted assigns.

The Contractor must not assign its rights or obligations under this Agreement, either in whole or in part, without the prior written consent of the Province. Upon providing written notice to the Contractor, the Province may assign to any person any of the Province's rights under this Agreement and may assign to any "government corporation", as defined in the *Financial Administration Act*, any of the Province's obligations under this Agreement.

Use of the Work

27.09 The Contractor shall confine construction machinery and equipment, storage of products and the operations of employees to limits indicated by Laws, ordinances, Permits or the Contract Documents and shall not unreasonably encumber the Place of Work with products.

The Contractor shall not load, or permit to be loaded, any part of the Work with a weight or force that will endanger the safety of the workers or the Work.

The Contractor shall not erect or permit the erection of any sign or advertising on the Work or the Place of Work without the prior written consent of the Province.

Contractor Status

27.10 In relation to the performance of the Contractor's obligations under this Agreement, the Contractor is an independent contractor and not the Province's:

(a) employee or partner; or

(b) agent except as may be expressly provided for in this Agreement.

The Contractor must not act or purport to act contrary to this section.

The Contractor will not purport to commit the Province to the payment of any money to any person.

All personnel hired or used by the Contractor to perform the Work are at all times the employees of the Contractor and not of the Province. The Contractor is solely responsible for arranging reliefs and substitutions, pay, supervision, discipline, unemployment insurance, leave and all other matters arising out of the relationship of employer and employee.

Unsuitable Workers

27.11 The Contractor must provide a sufficient number of persons to perform the Work and shall ensure all persons are fully instructed and supervised, legally entitled to work in Canada, competent, English literate, efficient, qualified by education, adequately trained, and experienced to carry out the tasks to which each is assigned.

27.12 The Contractor shall, upon request of the Ministry Representative, remove any person employed by the Contractor for purposes of this Agreement who, in the opinion of the Province, is incompetent or has exhibited improper conduct and the Contractor shall not permit a person who has been removed to return to the Place of Work.

Terms of the RFP

27.13 The Contractor represents to the Province that the Contractor has complied with any investigative requirements in the RFP and has fully advised Subcontractors of the results of investigation where appropriate.

Non-Waiver

27.14 A waiver of any term or breach of this Agreement is effective only if it is in writing and signed by, or on behalf of, the waiving Party and is not a waiver of any other term or breach.

Time of Essence

27.15 Time shall be of the essence in this Agreement, and, without limitation, will remain of the essence after any modification or extension of this Agreement, whether or not expressly restated in the document effecting the modification or extension.

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Representations and Warranties

27.16 As at the Contract Date, the Contractor represents and warrants, except to the extent it has previously disclosed otherwise in writing to the Province:

(a) all information, statements, documents and reports furnished or submitted by it to the Province in connection with this Agreement (including as part of any competitive process resulting in this Agreement being entered into) are in all material respects true and correct; and

(b) if the Contractor is not an individual:

i) it has the power and capacity to enter into this Agreement and to observe, perform and comply with the terms of this Agreement and all necessary corporate or other proceedings have been taken and done to authorize the execution and delivery of this Agreement by, or on its behalf, and

ii) this Agreement has been legally and properly executed by the Contractor, or on its behalf, and is legally binding upon and enforceable against the Contractor in accordance with its terms.

The Parties hereto have duly executed this Major Works Contract.

SIGNED AND DELIVERED on behalf of the Province by an authorized representative of the Province	**SIGNED AND DELIVERED** by or on behalf of the Contractor (or by an authorized signatory of the Contractor if a corporation)
(Authorized Ministry Expense Authority)	(Contractor or Authorized Signatory)
Printed Name Amy Avila Acting Assistant Deputy Minister	Printed Name Nicholas Doucette VP, Special Projects and New Markets
Dated this 27 day of August, 2024	Dated this 25 day of August, 2024

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f. Business Day
g. Changed Conditions
h. Changes in the Work
i. Condition Date
j. Condition Precedent
k. Construction Schedule
l. Contract Documents
m. Contract Price
n. Contract Security
o. Contractor
p. Contractor's Authorized Representative
q. Contractor's Permits
r. Cultural Monitor
s. Deficiencies
t. Deficiency Holdback
u. Effective Date
v. Environmental Monitor
w. Event of Default
x. Force Majeure Event
y. Good Industry Practice
z. Governmental Authority
aa. Insolvency Event
bb. Inspector
cc. L&M Bond
dd. Laws
ee. Loss
ff. Maximum Amount
gg. Ministry Representative
hh. Notice
ii. Other Contractor
jj. Party and Parties
kk. Performance Bond
ll. Permits
mm. Place of Work
nn. Plans and Specifications
oo. Plant Warranty Period
pp. Project
qq. Province
rr. Province's Permits
ss. Quotation
tt. Reinstatement Order
uu. RFP

vv. Subcontractor
ww. Substantial Performance
xx. Superintendent
yy. Suspension
zz. Suspension Costs
aaa. Suspension Period
bbb. Total Performance
ccc. Unit Price
ddd. Warranty
eee. Warranty Period
fff. Work

ARTICLE 2 CONTRACT DOCUMENTS AND AMENDMENTS

ARTICLE 3 CONTRACT PRICE

ARTICLE 4 CONTRACT SECURITY

ARTICLE 5 CONDITION PRECEDENT, COMMENCEMENT AND COMPLETION

ARTICLE 6 PARTY REPRESENTATIVES

ARTICLE 7 CONSTRUCTION SCHEDULE AND EQUIPMENT LIST

ARTICLE 8 INDEMNIFICATION AND INSURANCE

ARTICLE 9 PROTECTION OF WORK AND PROPERTY

ARTICLE 10 SUBCONTRACTING

ARTICLE 11 COOPERATION WITH OTHER CONTRACTORS

ARTICLE 12 COMPLIANCE WITH THE LAW

ARTICLE 13 CHANGES IN THE WORK

ARTICLE 14 CHANGED CONDITIONS

ARTICLE 15 PAYMENT

ARTICLE 16 SUBSTANTIAL PERFORMANCE

ARTICLE 17 TOTAL PERFORMANCE

ARTICLE 18 TAXES AND DUTIES

ARTICLE 19 WARRANTY

ARTICLE 20 PROVINCIAL PROPERTY

ARTICLE 21 CLEANUP

ARTICLE 22 LAYOUT

ARTICLE 23 DELAYS

ARTICLE 24 PROVINCE'S RIGHT TO PERFORM WORK OR STOP THE WORK OR TERMINATE CONTRACT

ARTICLE 25 DISPUTE RESOLUTION

ARTICLE 26 DAMAGES AND MUTUAL RESPONSIBILITY

1. MAXIMUM AMOUNT PAYABLE:

Maximum Amount: Despite section 2 of this Schedule, **$1,465,420.00** is the maximum amount which the Province is obliged to pay to the Contractor for fees and expenses under this Agreement (exclusive of any applicable taxes described in Section 18.02 of this Agreement).

2. FEES:

The Contractor's fees are based on the quoted unit price in the Unit Price Table below. The unit price accounts for all items outlined in Schedule C and D of this Agreement.

Schedule of Quantities and Unit Prices

Lagace Creek -S-CR-14					
Item	**Description of Work**	**Unit**	**Quantity**	**Unit Price**	**Extension**
1.0	**General Requirements**				
1.01	Mobilization and Demobilization	L.S.	1	$42,000	$42,000
1.02	Traffic Accommodations along Dale Road	L.S.	1	$35,000	$35,000
	Total 1.0 – GENERAL REQUIREMENTS				$77,000.00
2.0	**Incidental and Miscellaneous**				
2.01	Tree Trimming, Pruning, Clearing, Grubbing, and Disposal	m^2	3,500	$8	$28,000
2.02	Supply and Installation of Chain Link Fence and Rolling Gate per Drawing C-3504	L.S.	1	$11,000	$11,000
2.03	Installation of Temporary Access Approach per Drawing C-3102	L.S.	1	$1,800	$1,800
2.04	Supply and Installation of Tree Row per Drawing C-3102	Each	12	$600	$7,200
	TOTAL 2.0 – INCIDENTAL AND MISCELLANEOUS				$48,000.00

Schedule Continued on next page

3.0	**Environmental**				
3.01	Preparation and Approval of CEMP	L.S.	1	$8,000	$8,000
3.02	Environmental Monitoring and Reporting	L.S.	1	$31,000	$31,000
	TOTAL 3.0 – ENVIRONMENTAL				$39,000.00
4.0	**Earthworks**				
4.01	Restoration of Sand Recovery Station (SRS) per Drawing on C-3501	Each	11	$2,000	$22,000
4.02	Supply and Installation of New Sand Recovery Station per Detail C-3502	Each	3	$13,000	$39,000
4.03	Supply and Installation of Coconut Matting and Riparian Area Mix per Drawing C-3102	m^2	900	$8	$7,200
4.04	Excavation and Off-site Disposal of Sediment	m^3	8,250	$84	$693,000
4.05	Excavation and Off-site Disposal of Contaminated Sediment	m^3	500	$473	$236,500
	TOTAL 4.0 - EARTHWORKS				$997,700.00
5.0	**Bioengineering**				
5.01	Supply and Installation of Dense Live Staking per Detail 1 on C-3505	m^2	720	$186	$133,920
5.02	Supply and Installation of Live Stake Cluster per Detail 2 on C-3503	m^2	200	$410	$82,000
	TOTAL 5.0 – BIOENGINEERING				$215,920.00
				SUB TOTAL (EXCLUDING GST)	$1,377,620.00
				GST @ 5%	$68,881.00
				TOTAL CONTRACT PRICE INCLUDING GST	$1,446,501.00

Schedule Continued on next page

Lagace Creek – S-CR-17					
Item	**Description of Work**	**Unit**	**Quantity**	**Unit Price**	**Extension**
1.0	**General Requirements**				
1.01	Mobilization and Demobilization	L.S.	1	$7,000	$7,000
1.02	Traffic Accommodations along Sylvester Road	L.S.	1	$13,000	$13,000
	Total 1.0 – GENERAL REQUIREMENTS				$20,000.00
2.0	**Environmental**				
2.01	Preparation and Approval of CEMP	L.S.	1	$2,000	$2,000
2.02	Environmental Monitoring and Reporting	L.S.	1	$10,000	$10,000
	TOTAL 2.0 - ENVIRONMENTAL				$12,000.00
3.0	**Earthworks**				
3.01	Excavation and Off-site Disposal of Sediment per Drawing C-3105	m^3	300	$186	$55,800
	TOTAL 3.0 - EARTHWORKS				$55,800.00
				SUB TOTAL (EXCLUDING GST)	$87,800.00
				GST @ 5%	$4,390.00
				TOTAL CONTRACT PRICE INCLUDING GST	$92,190.00

Schedule Continued on next page

BID SUMMARY	
Lagace Creek – S-CR-14	
TOTAL 1.0 – General Requirements	$77,000.00
TOTAL 2.0 – Incidental and Miscellaneous	$48,000.00
TOTAL 3.0 - Environmental	$39,000.00
TOTAL 4.0 - Earthworks	$997,700.00
TOTAL 5.0 – Bioengineering	$215,920.00
TOTAL – Lagace Creek – S-CR-14	$1,377,620.00
Lagace Creek – S-CR-17	
Total 1.0 – General Requirements	$20,000.00
TOTAL 2.0 – Environmental	$12,000.00
TOTAL 3.0 - Earthworks	$55,800.00
TOTAL - Lagace Creek – S-CR-17	$87,800.00
SUBTOTAL (excluding GST) for both – Lagace Creek S-CR-14 and Lagace Creek S-CR-17	$1,465,420.00
GST @5% - for both Lagace Creek S-CR-14 and Lagace Creek S-CR-17	$73,271.00
TOTAL CONTRACT PRICE (including GST) for Lagace Creek S-CR-14 and Lagace Creek S-CR-17	$1,538,691.00

1. The Contractor shall, without limiting its obligations or liabilities or restricting the generality of the indemnification provisions contained in the Agreement, at its own expense, provide and maintain, the following insurance(s) coverage as fully specified in Paragraph 14 of this Schedule "B" – Project Insurance Requirements, and any additional insurance which it is required by law to carry or which it considers necessary to cover risks not otherwise covered by insurance specified in this Schedule in its sole discretion.

2. Unless otherwise specified, the duration of each coverage and insurance policy shall be from the Effective Date and shall remain in full force and effect until all conditions of the Agreement have been fully complied with and until acceptance by the Ministry of all Works and appurtenances pertaining to the Agreement.

3. Insurance shall be placed with Insurers licensed to underwrite such insurance in Canada and in forms and amounts acceptable to the Province. All such insurance shall be at no expense to the Province. If the Province requires additional Insurance Coverage to be obtained by the Contractor, the additional expense of such additional insurance shall be borne by the Province.

4. All insurance shall be primary and not require the sharing of any loss by any insurer of the Province.

5. The Contractor hereby waives all rights of recourse against the Province with regard to damage to the Contractor's property.

6. Notwithstanding Paragraph 7 of this Schedule "B" – Project Insurance Requirements, the Contractor shall, prior to the Effective Date and before any payments are made under the Agreement, file with the Ministry Representative evidence of insurance coverage in the form of a completed Province of British Columbia Certificate of Insurance (Form FIN 173). When requested by the Province, the Contractor shall provide certified copies of required insurance policies.

7. ICBC's Confirmation of Automobile Insurance Coverage (Form APV 47) or Confirmation of Unlicensed Vehicle Coverage (Form APV 45) shall be used when applicable as evidence of Automobile Liability Insurance for vehicles or off-road vehicles used during the performance of the work.

8. The insurance policies, except for ICBC Automobile Liability Insurance, shall provide that the insurance shall not be cancelled or materially changed so as to affect the coverage provided

under the Agreement, without the Insurer giving at least thirty (30) days prior written Notice to the Province.

9. Failure to provide the required insurance documentation shall result in termination of the Agreement.

10. If the insurance policies expire prior to the end of the Agreement Term, the Contractor shall provide the ministry evidence of renewal or new policy meeting the requirements of the expired insurance in the form of a completed Province of British Columbia Certificate of Insurance and ICBC's Form APV 47 or APV 45, if applicable, at least ten (10) days prior to the expiry date of the policies listed in this Schedule.

11. The payment of any deductible shall be the responsibility of the Contractor, except for flood and earthquake which will be the responsibility of the Province.

12. The Contractor shall ensure that all its Subcontractors performing Work under the Agreement carry insurance in the form and limits specified in Paragraph 14.

13. Unless stated otherwise under any subsection of Paragraph 14, where the Province is to be added as an Additional Insured or otherwise to be identified on the policy, it shall be written as follows: "His Majesty the King in right of the Province of British Columbia as represented by the Minister of Environment and Climate Change Strategy and any of its employees, servants or agents".

14. The following forms of insurance and specified minimum limits are required.

    a) Commercial General Liability Insurance

    Such policy of insurance shall have coverage in an amount not less than $2 million inclusive per occurrence against bodily injury, personal injury, and damage to property including loss of use thereof arising out of or resulting from the Work and including liability assumed under the Agreement.

    Such policy of insurance shall include, but not be limited to:

    i) Products and Completed Operations Liability;

    ii) Owner's and Contractor's Protective Liability;

    iii) Contingent Employer's Liability:

    iv) Blanket Written Contractual Liability;

    v) Personal Injury Liability;

    vi) Non-Owned Automobile Liability;

    vii) Cross Liability;

    viii) Employees as Additional Insureds;

    ix) Broad Form Property Damage;

    x) A Sudden and Accidental Pollution endorsement on the Commercial General Liability insurance policy with a limit of liability not less than the amount indicated below per occurrence insuring against bodily injury, property damage and cleanup expenses arising from new pollution conditions arising from the

Contractor's performance of the Agreement, or if such endorsement is unavailable on the Commercial General Liability insurance policy, a Sudden and Accidental Pollution insurance policy insuring against same and with same limits of liability indicated below, and this insurance shall include the Province as an "Additional Insured":

☐ $250,000

☐ $500,000

☒ $1 million

☐ Not applicable

Where such further risk exists, such policy shall include, but not be limited to:

xi) Shoring, blasting, excavating, underpinning, demolition, hot roof application, crane operations and removal, piledriving and caisson work, work below ground surface, tunnelling and grading;

xii) Elevator and Hoist Liability;

xiii) Operation of Attached Machinery; and

xiv) Forest Fire Fighting Expense Coverage in the amount of:

☒ $1 million

☐ $500,000

☐ Not applicable

xv) Construction activities occurring at airport facilities. Alternatively, coverage may have to be provided under an aviation liability policy.

☐ Applicable

☒ Not applicable

Where the Contractor's performance of the Work is associated with hazardous materials clean-up, removal and/or containment, transit and disposal, such policy shall include:

xvi) Contractor's Pollution Liability insurance policy with a limit of liability not less than $2 million inclusive per occurrence insuring against bodily injury and property damage. This insurance must include the Province as an "Additional Insured" for its vicarious liability as landowner, project owner, or party to this Agreement. Such insurance shall not be impaired by any time element limitations, biological contaminants (without limitation, mould and bacteria), asbestos, or lead based paint exclusions. Any "insured vs. insured" exclusion shall not prejudice coverage for the Province and shall not affect the Province's ability to bring suit against the Contractor as a third party. Such insurance must include, as a protected entity, the Province and each contractor, Subcontractor, architect, engineer, consultant and anyone employed by them to perform a part or parts of the Work, but excluding suppliers whose only function is to supply and/or transport products to the work site. The Province is to be added as an "Additional Insured" under this policy. Such policy shall preclude subrogation claims by the insurer against anyone insured by the policy, and provide Products and Completed operations coverage, as applicable, in force for the duration of the Warranty Period specified in the Contract.

b. Automobile Liability

Third Party Automobile Liability on all vehicles or off-road vehicles owned, leased, rented or used in the performance of this Agreement, in an amount not less than $2 million inclusive per occurrence must be provided for any such vehicle.

☒ Applicable

☐ Not applicable

c. Aviation Liability

Where any aircraft (including helicopters) are operated or used in the performance of the Work, the Contractor will obtain and maintain, or will cause to be obtained and maintained and will provide evidence to the Province of all Subcontractor's compliance with this requirement, Aviation Liability Insurance insuring against bodily injury, property damage, and passenger liability, in an amount not less than the limits of liability imposed by any Canadian Aviation Regulation and in any event not less than a per occurrence combined single limit of:

☐ $3 million for aircraft up to 5 passenger seats, or

☐ $3 million plus $1 million for each additional passenger seat for aircraft up to 10 passenger seats, or

☐ $10 million for aircraft over 10 passenger seats;

☒ Not applicable

Such insurance shall include a cross liability clause.

The Province is to be added as an "Additional Insured" under this policy.

d. Watercraft Liability

Where any watercraft are operated or used (including rented watercraft) in the performance of this Agreement, the Contractor will obtain and maintain, or will cause to be obtained and maintained and will provide evidence to the Province of a Subcontractor's compliance with this requirement, Watercraft liability insurance in an amount not less than the limits of liability imposed by the Marine Liability Act and in any event not less than $2 million inclusive per occurrence.

Such policy shall include:

i) A cross liability clause

ii) A Sudden and Accidental Pollution endorsement on the Watercraft liability insurance policy with a limit of liability not less than the amount indicated below per occurrence insuring against bodily injury, property damage and cleanup expenses arising from new pollution conditions arising from the Contractor's performance of the Agreement, or if such endorsement is unavailable on the Watercraft Liability insurance policy, a Sudden and Accidental Pollution insurance policy insuring against same and with same limits of liability indicated below, and this policy shall include the Province as an “Additional Insured”:

☐ $250,000

☐ $500,000

☐ $1 million

☒ Not Applicable

Where applicable, such policy will also include coverage for marine towing operations.

e. Builder's All-risk

Property insurance in the form of an "all-risks" builder's risk policy including but not limited to coverage for structural collapse, flood and earthquake. Such policy must insure the Work to the total of the full value of the Contract Price, including the value of any labour and materials and/or

structures and/or property and/or equipment destined for or entering into or forming part of the Work and must extend to cover property at any other location, awaiting and/or during construction or erection, while in transit and during installation and testing occurring anywhere within Canada or the continental United States of America.

Such insurance must:

i) preclude subrogation claims by the insurer against anyone insured by the policy except where a loss is deemed to have been caused by or resulting from any error in design or any other professional error or omission;

ii) include as a protected entity the Province and each of the Contractor, the Sub-contractors, Architect or Engineer and all others having an insurable interest in the Work;

iii) identify the Province as "His Majesty the King in right of the Province of British Columbia as represented by the Minister of Environment and Climate Change Strategy";

iv) permit that use and occupancy of the Work or any part thereof prior to Substantial Performance will not be cause for any termination of coverage; and

v) automatically include any changes in design or method of construction.

vi) The deductibles for such policy shall be on a per occurrence basis, with the following values:

(1) Flood - $25,000.00 maximum;

(2) Earthquake – up to 10% of the actual value at the time of loss;

(3) All other losses up to $5,000.00 or one percent (1%) of the Contract Price, whichever is greater.

The Contractor shall, at its own expense, take special precaution to prevent fires occurring in or about the Work and shall observe and comply with all insurance policy warranties and all laws and regulations in force respecting fires.

Where, due to the nature of the work the full insurable value of the work is substantially less than the full value of the Contract Price, the Province shall, at its sole discretion, reduce the amount of insurance required or waive the Builder' s All-risk insurance requirement.

☒ Applicable

☐ Not Applicable

f. Contractor's Construction Equipment

Contractor's Construction Equipment insurance covering construction machinery and equipment used by the Contractor in its performance of the Work, in such forms and amounts as will enable prompt replacement and repair of such construction equipment.

☒ Applicable

☐ Not Applicable

Part 1. WORK:

Outputs

1. The Contractor must provide the following as part of the Work:
    a. Mobilization to the Place of Work
    b. Layout of the Work
    c. Baseline construction schedule
    d. Weekly construction updates
    e. Construction environmental management plan (“CEMP")
    f. Environmental monitoring and reporting
    g. Traffic accommodation
    h. Tree trimming, pruning, clearing, grubbing, and disposal
    i. Restoration of sand recovery stations
    j. Supply and installation of new sand recovery station
    k. Excavation, hauling, and off-site disposal of sediment.
    l. Excavation, hauling, and off-site disposal of contaminated sediment.
    m. Supply and placement of coconut matting and riparian area mix
    n. Supply and installation of dense live stakes
    o. Supply and installation of live stake clusters
    p. Supply and installation of chain link fencing and rolling gate
    q. Installation of temporary access approach
    r. Supply and installation of tree row
    s. Marked-up drawings
    t. Request for certificate of completion
    u. Cleaning up of the Place of Work
    v. Demobilization from the Place of Work
2. The Contractor must ensure the Work occurs in compliance with the following regulations and guidelines:
    a. *Fisheries Act* (British Columbia)
    b. *Migratory Birds Convention Act* (British Columbia)
    c. *Species at Risk Act* (British Columbia)
    d. *Canadian Navigable Waters Act* (British Columbia)
    e. *Water Sustainability Act* (British Columbia)
    f. *Wildlife Act* (British Columbia)

g. *Weed Control Act* (British Columbia)

h. *Dike Maintenance Act* (British Columbia)

i. Streamside Protection Bylaw, 2005

j. Tree Protection Bylaw, 2010

k. Erosion and Sediment Control Bylaw, 2010

l. BC Hydro Right-of-Way

m. FortisBC Right-of-Way

n. *Agricultural Land Commission Act*

3. The Contractor must ensure that the Work is carried out in compliance with the CEMP and instructions received from the Environmental Monitor and the Cultural Monitor. Should the Environmental Monitor or Cultural Monitor instruct the Contractor to cease work, the Contractor must ensure that such instructions are followed by all Parties engaged in completing the Work, including but not limited to the Contractor's employees, staff, agents, and Subcontractors.

Inputs

1. The Contractor must hire individuals for the following positions in order to carry out the Work:
    a. Superintendent
    b. Environmental Monitor
    c. Surveyor
2. The Contractor must ensure the Superintendent carries out the following roles and responsibilities:
    a. Verify the site health and safety plan is implemented;
    b. Ensure the schedule is maintained;
    c. Allocate equipment and labour force;
    d. Monitor productivity of the work and production rates;
    e. Maintain accurate records of work force, field orders, changes, and field reports;
    f. Reporting on construction activities, progress, and documentation;
    g. Coordinate with the Ministry Representative, Environmental Monitor, and stakeholders; and
    h. Monitor, adjust, and modify work program to meet requirements.
3. The Contractor must ensure the Environmental Monitor carries out their responsibilities and obligations in accordance with the CEMP, prepared by the Ministry Representative, attached as Appendix 4 to Schedule D.
4. The Contractor must secure and provide all of the required labour, materials, and equipment to complete the Work outlined in this Schedule C, including but not limited to:
    a. Any labourers or operators of heavy machinery;
    b. Any material required to construct and maintain roads and culverts used to access and excavate at the sand recovery stations; and
    c. All equipment including trucks, excavators, and any other equipment the Contractor believes will be reasonably necessary to carry out the Work.
5. Prior to commencing any excavation work, the Contractor shall establish location and state of use of buried utilities. It is the responsibility of the Contractor to follow all WorkSafe BC requirements and guidelines.
6. The Contractor shall take all necessary precautions to protect and preserve existing survey control or legal survey markers on and adjacent to the site. Costs to re-establish these existing control points or legal survey markers shall be paid for by the Contractor.

Reporting requirements

Reports must be delivered in accordance with the reporting requirements as outlined in the Specifications attached to the RFP package as Schedule D.

ADDENDUM 1 for RFP 250001 –

HATZIC EMERGENCY WORKS PROGRAM LAGACE CREEK – SITES S-CR-14/17
August 8, 2024

The following changes, additions, and/or deletions are hereby made a part of the Contract Documents for Hatzic Emergency Works Program – Lagace Creek – Sites S-CR-14/17 as fully and completely as if the same were fully set forth therein:

CLARIFICATIONS
Regarding quantities, layout and means/methods – the Works are intended to be field fit, and the drawings are intended to provide direction.

All clearing and grubbing materials shall be removed from the subject properties and disposed of appropriately.
The level of Environmental Monitoring is at the discretion of the Contractor but must adhere to the EMP and the future CEMP and all permit conditions. These items shall be addressed under proposal response form items 3.01 and 3.02 - Lagace Creek S-CR-14 table.

QUESTIONS

Question 1 – Where is the fence to be located?
(Context: Standing east of Dale Road bridge looking at parcel 011-062-355 discussing site access and privacy)
Answer – It shall be located along the property line parallel to Dale Road, not along the creek (refer to drawing 2632-03-C-3102). Assume the fence to be 12 m long.

Question 2 – How is knotweed to be addressed?
Answer – Knotweed is to be addressed per the EMP (Environmental Management Plan) and in consideration of best management practices. Where sediment is being excavated from the creek bank and the construction of sand stations, the material will be disposed of and tracked per item 4.05 - Lagace Creek S-CR-14 table in the proposal response form. Soil within 20 m circumference and 2 m depth of surface knotweed is considered contaminated (i.e., may contain seeds, root material) and should not be used for site reclamation. Where knotweed is being pruned and trimmed back, those plants need to have the appropriate herbicide injected into the stalk. This cost shall be associated with the restoration of the sand stations as per line item 4.01 - Lagace Creek S-CR-14 table. The CEMP (Contractors Environmental Management Plan) shall address knotweed management. Where knotweed is encountered in relation to trimming, pruning, clearing, grubbing and disposal, those costs should be included in item 2.01 - Lagace Creek S-CR-14 table.

Question 3 – Who is responsible for survey?
Answer – Contractor is responsible for survey.

Question 4 – How will fish be accommodated?
(Context: Standing adjacent on the banks of Lagace Creek, discussing fish passage and environmental procedures. Drawing people's attention to note: 9 on drawing 2632-03-C-3101)
Answer – Per the EMP, this work site includes non-spawning grounds and fish passage shall be maintained for the duration of the Works as noted on the drawings. Assume full by-pass around the instream work area will be required. Contractor's Environmental Monitor will be responsible for obtaining emergency fish salvage permits.

Question 5 – How long is the contractor responsible for the work? (Context: discussing knotweed and maintenance requirements.)
Answer – The contractor is responsible for the Works as per the warranty period noted in the Major Works Contract (MWC). In addition, the contractor is responsible for maintenance as per the technical specifications.

Question 6 regarding the landowner contacts as per the RFP:
Answer - Should any Proponent wish to engage directly with impacted landowners, please email the Official Contact to attain contact information.

Question 7 – Is there a specifications document for this project. I do not see specs on the drawings for materials, or clear information regarding planting maintenance period.
Answer – Refer to Major Works Contract, Schedule "D" - Special Provisions, Appendix 1: 2020 British Columbia Ministry of Transportation and Infrastructure Standard Specifications for Highway Construction and specifications noted on drawings

SECTION 1 GENERAL

1.01 Location of the Place of Work

The Place of Work is located at 2 sites and are approximately 9 km and 14 km respectively to the north-east of Mission, BC within the Hatzic Lake watershed. These sites are described below:

Site ID: S-CR-14

Location: 49.191343°, -122.250592°

Site Description: 10491 Farms Rd, Hatzic, BC

Local Government Agency: Fraser Valley Regional District (FVRD)

Waterbody: Lagace Creek

Site ID: S-CR-17

Location: 49.235909°, -122.218453°

Site Description: Lagace Creek between Pattison Creek and Allan Lake, Hatzic, BC

Local Government Agency: Fraser Valley Regional District (FVRD)

Waterbody: Lagace Creek

1.02 Scope of Work

The Work consists of, but is not necessarily limited to, the following:

(a) Mobilization to the Place of Work
(b) Layout of the Works
(c) Baseline Construction Schedule
(d) Weekly construction updates
(e) Construction Environmental Management Plan (CEMP)
(f) Environmental Monitoring and Reporting
(g) Traffic accommodation
(h) Tree trimming, pruning, clearing, grubbing, and disposal
(i) Restoration of Sand Recovery Stations
(j) Supply and Installation of new Sand Recovery Station
(k) Excavation, hauling, and off-site disposal of sediment.

(l) Excavation, hauling, and off-site disposal of contaminated sediment.

(m) Supply and placement of coconut matting and riparian area mix

(n) Supply and Installation of dense live stakes

(o) Supply and Installation of live stake clusters

(p) Supply and Installation of chain link fencing and rolling gate

(q) Installation of temporary access approach

(r) Supply and Installation of tree row

(s) Marked-up Drawings

(t) Request for Certificate of Completion

(u) Cleaning up of the Place of Work

(v) Demobilization from the Place of Work

1.03 Interpretation

Abbreviations are defined in the Glossary of Terms of the 2020 Standard Specifications for Highway Construction attached as Appendix 1 to this Schedule D.

Capitalized terms used herein but not otherwise defined shall have the meaning given thereto in the main body of the Agreement or the 2020 British Columbia Ministry of Transportation and Infrastructure Standard Specifications for Highway Construction and the attached Special Provisions Appendix for *Amendments to the 2020 Standard Specifications* (the "**Standard Specifications**"), as applicable.

Ministry names may change and any changes from names used in this Agreement shall be resolved in accordance with SS 000.01.

Current names of all Ministries may be found at the following link:

https://www2.gov.bc.ca/gov/content/governments/organizational-structure/ministries-organizations/ministries

1.04 Applicable Specifications

(a) Standard Specifications

All references herein to "SS" shall be references to the applicable sections within the Standard Specifications (as defined in Section 1.03).

1.05 Availability of Relevant Publications

If a relevant publication is not available from the source indicated below, please contact the Ministry Representative.

(a) Archaeological Documents

The Place of Work is in an area of high archaeological potential, however no archaeological sites have been identified to date.

(b) Equipment Rental Rate Guide:

The Equipment Rental Rate Guide is available from:

B.C. Road Builders and Heavy Construction Association
Suite #307 - 8678 Greenall Avenue
Burnaby, British Columbia
V5J 3M6
Phone Number: (604) 436-0220 Fax Number: (604) 436-2627

https://www.roadbuilders.bc.ca/blue-book/

(c) Other Documents:

All other General Reference Documents and other relevant publications can be obtained through King's Printer at:

King's Printer
Government Publication Services
Box 9452, Stn Prov Govt
Victoria BC V8W 9V7

Phone toll free at: 1-800 663-6105

https://www.publications.gov.bc.ca/

1.06 Insurance

The Contractor shall comply with the insurance requirements as described in the Contract Documents.

1.07 Construction Schedule

Further to Article 7 of the Agreement, the Construction Schedule (as defined in Subsection (a) below) shall comply with the following requirements:

(a) General

The Parties have agreed on the preliminary construction schedule attached to the main body of the Agreement as Schedule "I" – Preliminary Construction Schedule (the "**Preliminary Construction Schedule**"). The Contractor will, from time to time, update and deliver to the Ministry Representative a revised construction schedule satisfactory to the Ministry Representative, acting reasonably, that is based on the Preliminary Construction Schedule, is updated in a manner consistent with the format and level of detail of the Preliminary Construction Schedule. Upon acceptance by the Ministry Representative, acting reasonably, such updated schedule will become the applicable Construction Schedule (the "**Construction Schedule**").

The Construction Schedule shall:

(i) Be consistent in all respects with the requirements of the Agreement, show the order of the Work, be practical and consistent and make adequate provision for adverse weather which may be expected from records for the area.

(ii) Identify the sequencing of activities and time required for undertaking the Work.

(iii) Provide for orderly, timely and effective progress of the Work and contain sufficient detail to enable both the Contractor and the Ministry Representative to plan, coordinate, analyze, document and control their respective contract responsibilities.

(iv) Identify the critical path(s). The start date and finish date of each item on a critical path shall be identified in each submission.

(v) Identify, include provision for and accommodate utility relocations, availability of right-of-way, environmental restrictions, and any permitting required that is applicable to the Work.

(vi) Provide a comparison between actual start/finish times and originally scheduled start/finish times for each operation.

(vii) Identify any significant Hold Points and Witness Points, as defined in SS 145.12, or as otherwise specified by the Ministry Representative.

(b) Construction Schedule Format

The Construction Schedule and any updates thereto shall be submitted in any one of the following formats:

- A network diagram which shall as a minimum include all the operations and their subsections as listed in the table below, logically linking them to show the manner in which the Work will be constructed; or
- A bar chart derived from the network diagram, listing all of the same operations and their subsections, showing graphically the length of time needed for each; or

(c) Scheduling Constraints

The Construction Schedule shall identify and accommodate any scheduling constraints identified within the Contract, including the conditions of the Permits, as may be amended from time to time.

(d) Scheduling Minimum Requirements

The table below describes the minimum amount of information that shall be shown on a Construction Schedule.

Table 1: Minimum Construction Schedule Breakdown

Operation	Subsections
Mobilization	By date
Quality Management Plan	By submittal date
Access and Restoration	By station range
Construction Survey	By station range
Construction Environmental Management	By submittal date
Sediment Removal	By station range of individual excavations and associated embankments or disposal sites
Clean Up and Site Restoration	By station range
Post-Construction Submittals	By submittal date

(e) Preliminary and Baseline Schedule

Within three (3) days after the Contractor has been advised that it is the successful proponent in respect of the RFx, the Ministry Representative and the Contractor shall meet to review the Preliminary Construction Schedule. The Ministry Representative will review the Preliminary Construction Schedule for compliance with all time limitations and other constraints.

Within three (3) days, after the review meeting, the Contractor shall submit a revised and expanded Preliminary Construction Schedule with required revisions. Upon acceptance by the Ministry Representative, acting reasonably, such revised and expanded schedule will become the Construction Schedule.

Review of this and subsequent Construction Schedules by the Ministry Representative will not relieve the Contractor of the responsibility for timely and efficient execution of the Contract.

(f) Weekly Construction Schedules

The Contractor shall provide an updated Construction Schedule to the satisfaction of the Ministry Representative, acting reasonably, on a weekly basis. The Ministry Representative will review the Construction Schedule for compliance with all time limitations and other constraints. Upon acceptance by the Ministry Representative, acting reasonably, such updated schedule will become the applicable Construction Schedule.

The Weekly updates shall include:

- Progress to date, showing the actual start and finish times of activities,
- Comparison to the Preliminary Construction Schedule,
- Forecast to Work completion and identification of schedule revisions and operation revisions, so that the weekly Construction Schedule is compliant with all Agreement time limitations, milestones and other constraints,

- A description of any past, current or expected changes or delaying factors and their effect on the Construction Schedule.

(g) Payment

All Contractor activities required to provide Construction Schedules are at the Contractor's expense.

If the Contractor fails to submit a Construction Schedule compliant with the terms of the Contract Documents, the Ministry Representative may withhold the payment until an updated Construction Schedule meeting the requirements of the Agreement is provided.

1.08 Mobilization

(a) General

The category of Mobilization and Demobilization shall include all costs for mobilization and demobilization of the Contractor's equipment, site facilities, bonding and insurance, and services from the Place of Work.

(b) Payment

Contrary to SS145.08, payment for Mobilization and Demobilization will be as follows:

(i) 50% of the lump sum when the Contractor has mobilized to the Place of Work; and

(ii) 50% of the lump sum when the Contractor has completed all Work, has left the Place of Work in a condition acceptable to the Ministry Representative, and demobilized from the Place of Work.

(iii) The lump sum bid under this item shall not exceed 5% of the total tender.

1.09 Hours of Work

(a) Working Restrictions

The Contractor shall confine the Work to the following time periods, unless otherwise approved in writing by the Ministry Representative

(i) Between 7:30am and 6:30pm from Monday through Saturday

(ii) No work is to occur on Sunday or Statutory Holidays.

(b) Variances to Hours of Work

No Work will be carried out at times outside of these hours of work without the prior written approval of the Ministry Representative.

1.10 Availability of Site or Right-of-Way

The Place of Work is available for immediate commencement of construction.

1.11 Access to Site

The Province shall be responsible for the procurement and provision to the Contractor all documentation required to carry out construction on private property impacted by the Work.

The Contractor shall abide by all requirements set out in the access agreement(s) throughout the construction of the Work and the Warranty Period and to the satisfaction of the Province and landowner until such time that ownership of the Work is transferred to the Province or landowner.

The Contractor shall be responsible for the construction and removal of access roads.

1.12 Site Safety and Prime Contractor

(a) General:

Requirements and responsibilities for construction site safety are set out in SS 135 - Construction Site Safety.

Within the Place of Work, the Contractor shall be responsible for and shall fulfill all of its obligations as an "employer" under the *Workers Compensation Act* and the *Occupational Health and Safety Regulation* and may, where designated as the "Prime Contractor" by the Province, have additional responsibilities for an "Area of Responsibility" as detailed in SS 135 and these Special Provisions.

The distinction between the geographic areas of the "Place of Work" (where the Contractor is contracted to the Province to construct the Work) and the "Area of Responsibility" (where the Contractor or another party has responsibilities for occupational health and safety issues between multiple employers) is important.

Further to SS 135 and SS 145.30, the Contractor shall not commence Work until the Ministry Representative has accepted the Contractor's Occupational Health and Safety Program and AoR Specific Safety Plan.

(b) Area(s) of Responsibility:

The Area(s) of Responsibility encompassing the Place of Work are as described in the following paragraph and may, if approved by the Province and with proper Notice to the Workers Compensation Board (WorkSafeBC) by the Prime Contractor for each affected Area of Responsibility, include other such areas as required by the specific methodology and equipment used during the course of the Work.

The Area of Responsibility is the Place of Work.

1.13 Obscure Hazards

The Contractor shall continually assess, investigate and evaluate the Work and the Place of Work for potential hazards.

1.14 Work by Others in the Place of Work

No other parties are currently anticipated to be working on or near the Place of Work, other than as outlined in 1.14(a) and 1.15, if applicable.

(a) First Nations Band Members:

There may be First Nations members on the Place of Work throughout the duration of the Work, monitoring for the presence of heritage resources and any impacts, as described in Section 1.19 of this Schedule "D" – Special Provisions.

1.15 List of Subcontractors and Suppliers

The Contractor shall complete Schedule H: Approved Subcontractors, submit this form to the Ministry Representative at the pre-construction meeting, and provide updates of any subsequent changes.

1.16 Quality Management

Further to SS 101.02, Contractor reviews of Quality Management activities delegated to third parties shall be performed monthly and be in sufficient detail to provide assurance to the Contractor and the Province that all quality management functions are being performed in accordance with the Contract.

(a) QC Plan Contract-Specific Work Submission Requirements

In accordance with SS 101.02.03(b), the Province may accept a partial QC Plan submission.

(b) Hold Points and Witness Points

(i) General

Hold Points and Witness Points (as defined in SS145.12) are required at critical times for the Ministry Representative and/or the Engineer(s) of Record (EOR) to review crucial work processes.

(ii) Hold Points

Hold Points may be specified throughout these Special Provisions, the Appendices, the Drawings, and in the Standard Specifications.

The Contractor shall provide the Ministry Representative seven (7) days' prior written Notice in advance of a Hold Point to allow the Ministry Representative to provide adequate written Notice to the EOR.

Additional Hold Points may be added by the Ministry Representative at any time, by written Notice to the Contractor.

(iii) Witness Points

Witness Points may be specified throughout this Schedule "D" – Special Provisions, the Drawings, and in the referenced provisions of the Standard Specifications.

The Ministry Representative will provide the Contractor with written Notice of any additional Witness Points as the Work progresses. The Contractor shall provide the Ministry Representative with one (1) clear day Notice of the commencement of the work requiring witnessing.

(c) Minimum Testing and Inspection Frequencies

Minimum QC testing and inspection frequencies shall meet or exceed those indicated in Table 2 below, elsewhere in this Schedule "D" – Special Provisions, and/or in the Standard Specifications.

(d) Quality Management Reporting

The Contractor shall, in addition to the requirements of SS 101, submit a summary of all Quality Control activities, including material testing and inspections.

(e) Payment

Contrary to SS101.07, all costs associated with Quality Management are considered incidental to the contract and are the responsibility of the Contractor.

1.17 Materials Supplied by the Province

The Province will not supply any material for this Agreement.

1.18 Protection of the Environment

(a) General

Protection of the environment shall be carried out according to SS 165, and SS 165 shall apply to the Work in its entirety unless otherwise specified in these Special Provisions.

(b) Regulatory Approvals

The Province has secured the following permits for the Work:

- Heritage Investigation Permit (Permit Number 2021-0453)
- Fisheries and Oceans Canada Emergency Authorization (PATH No.: 22-HPAC-01308)

The following permits and approvals will be obtained by the Province:

- Ministry of Forests Section 11 Water Sustainability Act Change Approval (Site 14: WSA 2011310, Site 17: WSA 2011242)

The Contractor shall apply for the following permits:

- Wildlife Salvage Permit
- Fish Salvage Permit

The Contractor must provide three days' prior written Notice to the Ministry Representative before any salvaging activities occur.

(c) Fishery Timing Window

Subject to Laws, the Fishery Timing Window for designated streams on the Work is expected to last from August 1, 2024 to September 15, 2024.

Any activity within the wetted perimeters of the creek at the Place of Work shall be carried out only within the Fishery Timing Window, except where the Contractor has applied to the Province for a variance and received written notification from the Ministry Representative, or their agent, of any relaxation to this requirement and to the extent permitted by the Ministry of Environment and/or Fisheries and Oceans Canada.

(d) Breeding Bird Nesting

Further to SS 200.01.02 the Contractor shall avoid undertaking any clearing and grubbing operations for the Place of Work during the regional breeding bird nesting period which is defined by Environment and Climate Change Canada to be March 15 to August 30 to minimize the risk of any contravention of the Migratory Birds Convention Act provisions. Additional information can be found at:

https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/general-nesting-periods.html.

If clearing and/or grubbing operations are proposed to occur during the defined nesting period, the Contractor's Environmental Monitor shall conduct an intensive survey of the Place of Work where vegetation is to be removed following the Breeding Bird Nest Survey Protocol included as Appendix - Protection of the Environment - Breeding Bird Nest Survey Protocol. Any required surveys shall be the sole the responsibility of the Contractor and will be performed and documented to the satisfaction of the Ministry Representative. All costs associated with these nest surveys shall be considered incidental to the Work and no additional payment will be made to the Contractor. In the event any active nests are identified, no activities shall take place within (50 m) of such nests, and the Contractor shall ensure that the Contractor's Environmental Monitor develops and implements a nest management plan including appropriate mitigation measures for the duration of the nest occupancy, which plan shall be reviewed by the Ministry Representative and approved or rejected by the Ministry Representative within three days of its receipt.

(e) Special Erosion Protection Areas

The following areas of the Place of Work, which may be characterized by poor drainage, standing water, and/or drainage flowing directly into fish-bearing streams or sensitive watercourses, are designated as Special Erosion Protection Areas:

- Any work in stream that is above the high-water mark and below the top of banks.

Subject to Subsection (d), clearing, grubbing, drainage and grading work in the above areas should be conducted during dry conditions. It is anticipated that in any other period the Contractor will be required to undertake extensive and onerous precautions to satisfy the requirements herein with respect to the commencement and continuance of the Work in accordance with an accepted and still-valid Erosion and Sediment Control Plan.

Pursuant to SS 165.04.01, separate Erosion and Sediment Control Plans for Work in the Special Erosion Protection Areas will be required and will be subject to review on a weekly basis by the Ministry Representative and the Contractor. Where required by the Province, the Contractor shall submit an updated Erosion and Sediment Control Plan to the Ministry Representative for acceptance.

(f) Contractor's Environmental Monitor

The Contractor shall retain an Environmental Monitor. This person shall be an appropriately Qualified Professional as set out in SS 165.02. The Environmental Monitor shall also abide by the Environmental Management Plan, prepared by the Ministry Representative and attached as Appendix 4 to this Schedule "D" – Special Provisions.

(g) Construction Environmental Management Plan

Further to SS 165.02.02:

- The Contractor shall provide, in form and substance acceptable to the Ministry Representative, one hard copy and one digital PDF copy of a Construction Environmental Management Plan (CEMP) which has been produced by the Contractor's Environmental Monitor and signed by the Contractor and the Environmental Monitor, and any subsequent updates to the plan. Any updates or amendments to the plan shall be numbered sequentially for clarity.

- The Contractor shall ensure the CEMP references and incorporates the Environmental Management Plan, and identifies those Work activities where the Environmental Monitor will be carrying out its obligations at the Place of Work.

(h) Environmental Procedures

Site-specific Environmental Procedures, as provided to the Contractor by the Ministry Representative, may be required; once provided such procedures will be adhered to by the Contractor.

(i) Idle Reduction

The Province is taking initiatives to reduce greenhouse gas emissions from the Work and has identified reduced idling of construction vehicles and equipment as a reduction strategy. Further to SS 165.02.02, and SS 165.16.02, the Contractor's Construction Environmental Management Plan shall include procedures outlining how drivers and equipment operators will be engaged in idle reduction practices (the "**Idle Reduction Plan**").

The Contractor is encouraged to develop innovative and practical methods to influence workers to participate in this program. The following are sample idle reduction strategies grouped within four areas of opportunity which may be applicable to the Work and that can be used as a basis for the Contractor to develop the Idle Reduction Plan:

(i) Location of staging areas to minimize impact of emissions:

- Locate combustion engines away from sensitive receptors such as fresh air intakes, air conditioners, and windows.

- Establish a staging zone for trucks that are waiting to load or unload material in the area of the Place of Work, away from sensitive receptors.

(ii) Idling time restrictions:

During periods of inactivity and while stopped within a queue formed under the direction of a traffic control person or device, idling of Contractor and Subcontractor off-road equipment shall be minimized and are not to exceed the following:

- Motor vehicles and light diesel trucks - 1 minute;

- Heavy duty diesel vehicles - 5 minutes;

- Diesel vehicles involved in construction site passenger transportation – 10 minutes; and

- Construction Equipment - exempt when actually employed at the Place of Work for performance of the Work.

Idling for more than the above times is permitted only under the following circumstances:

- When the vehicle or equipment is forced to remain motionless because of other traffic conditions or mechanical difficulties over which the operator has no control;

- To bring the vehicle or equipment to the manufacturer's recommended operating temperature;

- When the outdoor temperature is below 0°C or above +30°C and the operator or passengers are inside the vehicle, and there are no auxiliary power sources available to provide temperature control;
- When it is necessary to operate auxiliary equipment that is located in or on the vehicle or equipment to accomplish the intended use of the vehicle or equipment (for example, cranes and cement mixers);
- When the vehicle is detaching or exchanging a trailer;
- When the vehicle or equipment is being repaired or engaged in repairing another vehicle, if idling is necessary for such repair;
- When the vehicle or equipment is queued for inspection, if idling is necessary for such inspection;
- For designated emergency vehicles or any vehicle or equipment assisting in police, fire or ambulance services; and/or
- When defrosting or defogging windows. Idling shall end when fog, frost, or ice conditions have been eliminated.

(iii) Outreach and Communications:

- The Contractor shall implement a system of education and training as part of site orientation for all on-site staff and Subcontractors.
- The Contractor shall reinforce the idle reduction initiative via signage and during toolbox, health and safety, and Province meetings.

(iv) Idle Reduction Technologies:

The Contractor is encouraged to utilize idle reduction technologies where appropriate and applicable. Some examples are available at:

https://www.epa.gov/verified-diesel-tech/learn-about-idling-reduction-technologies-irts-trucks-and-school-buses

1.19 First Nations Monitoring and Resources

(a) First Nations Monitoring

There may be First Nations members at the Place of Work throughout the duration of the Work, including for monitoring for the presence of heritage resources and any impacts.

The First Nations shall be providing the following:

(i) Monitor(s) at the Place of Work to monitor natural ground altering activities and in-stream works. The Contractor shall not conduct ground disturbance activities or in-stream works without the presence of the Cultural Monitor(s) (as defined in 1.20 subsection (c)), unless approved by the Ministry Representative.

Table 2: First Nations Contacts

Contact	Tina Pederson, Leqamel First Nation
Address	43101 Leq'a:mel way, Deroche
Telephone	604-826-7979
Email	tina@leqamel.ca

1.20 Archaeological Sites

(a) General

No archaeological sites have been identified to date. An archaeological assessment will be conducted under the Province's emergency works Heritage Conservation Permit 2021-0453 by a consultant engaged by the Ministry Representative. A cultural heritage desktop review will be conducted to identify previously recorded sites and areas. An archaeological preliminary field reconnaissance will be conducted prior to ground disturbance to identify cultural heritage sites (on the surface) or areas of subsurface archaeological potential. The archaeological assessment will identify locations where ground disturbance will require archaeological monitoring.

Prior to commencement of the Work, the Contractor shall arrange a documented meeting with the Ministry Representative, Province-appointed archaeologist for the Work (the "**Archaeologist**") and the Cultural Monitors (as defined in Subsection (c)) to ensure a clear understanding of the roles and responsibilities of each party with regard to land altering activities.

(b) Chance Finds

In the event that any archaeological materials are uncovered during performance of the Work (a "**Chance Find**"), the Contractor shall follow the procedures outlined in SS 165.20 Archaeological and Paleontological Discoveries, Appendix 2 – Archaeological Chance Find Procedure.

The Contractor shall ensure that all workers and Subcontractors are fully aware of the requirements and processes detailed in SS 165.20 Archaeological and Paleontological Discoveries, Appendix 2 – Archaeological Chance Find Procedure.

Further to SS 165.20, in the event of a discovery, the Contractor shall immediately flag off a 30 m radius around the discovery site(s) and relocate any impacted equipment to resume Work outside of the discovery site. The Ministry Representative may increase or decrease this radius in collaboration with the Archaeologist**.**

There shall be no additional cost to the Province for the flagging of the area or relocation of equipment to the alternate location, but the impacts of any additional mitigation measures required by the Ministry Representative shall be borne by the Province**.**

The Contractor shall work in strict accordance with SS 165.20 Archaeological and Paleontological Discoveries. Any delays or costs caused by the Contractor's failure to comply with Section 9.03 of the Agreement, this Section 1.20(b), or by the Contractor's negligence shall be the Contractor's responsibility.

(c) Cultural Monitoring of the Place of Work

Prior to the commencement of the Work, the Ministry Representative will use commercially reasonable efforts to retain one or more cultural monitors, for those First Nations groups described in Section 1.19 ("**Cultural Monitor**"). Cultural Monitors will be observing all land altering activities that take place within the Place of Work, including within identified archaeological site boundaries and throughout the performance of the Work. Cultural Monitors will be observing for Chance Finds and for evidence of cultural artefacts. The Contractor shall develop safe work procedures for working in the proximity of equipment and train the monitors and equipment operators in the implementation of such procedures.

Cultural monitoring may result in decreased productivity for associated Work. Such impacts are incidental to the Work and there will be no additional payment for any impacts caused by the cultural monitoring.

1.21 Signs

The Contractor shall supply all signs, including C-018-1A, and appropriate Idle Reduction Sign, with the exception of the C-035 project signs.

Maintenance of these signs during the term of the Agreement shall be incidental to the Work, and shall not entitle the Contractor to additional payment.

1.22 Marked-Up Drawings

(a) General

As construction progresses, "as-built" information shall be recorded by the Contractor in a timely manner and be subject to a weekly review by the Ministry Representative.

Upon the completion of the Work, the Contractor shall provide the Ministry Representative with one marked-up set of contract drawings to be used by the Province for the production of record drawings (the "**Contract Drawings**").

These drawings shall be PDF/CAD-produced, shall show in a neat and accurate manner all changes, additions, and deletions to the original Drawings to show the "as-built" installation.

For the purpose of this Section 1.22, a change is defined as any installation that has been constructed outside of the Contract allowable tolerances. If no Contract allowable tolerances are provided the tolerances shall be 150 mm Horizontal and 50 mm Vertical or as otherwise specified by the Ministry Representative. This definition is only for the purpose of this Section 1.22 and is only intended to define the parameters for the "as-built" details.

All "as-built" mark-ups shall be submitted to the Ministry Representative on or before completion of the Work. Pursuant to Article 16 and Article 17 of the Agreement, neither Certificate of Substantial Performance nor the final progress payment will be released if these "as-built" plans, in compliance with the Contract Documents and to the satisfaction of the Ministry Representative, have not been received.

(b) Mark-up Instructions

(i) Copies of the most current Drawings are to be used and marked-up as required to reflect the actual constructed roadway template and amenities at completion of the Work;

(ii) The Drawing numbers shall remain the same as the originals;

(iii) The marked-up Drawings shall be stand-alone documents and contain the original information plus all of the information with regard to changes, additions and deletions;

(iv) All underground utilities removed during construction shall be marked as "removed". All underground utilities abandoned shall be marked as "abandoned";

(v) All items on the Drawings shown to be relocated, either by the Contractor or others, shall be shown as "relocated" and the new locations shall be shown on the marked-up Drawings as an addition as described below;

(vi) The original Design information that has been changed shall be replaced by the information that represents the "as-built" works;

(vii) Each item that has been deleted from the Drawing shall also be crossed out and labelled on the Drawing as "Deleted"; and

(viii) Each item on the Drawing that has been changed, added or deleted from the Design shall have the revisions clearly marked and a description of the revision written adjacent to it. Alternatively, a sequential number may be inserted at each revision, with a table of descriptions added elsewhere on the Drawing sheet.

(c) Contractor as Engineer of Record

For any portion of the Work which the Contractor is responsible to design (such as proprietary structures or elements of a Value Engineering Proposal), the Contractor's Engineer of Record shall produce record drawings in accordance with the Province's Technical Circulars T-06/09 Engineer of Record and Field Review Guidelines and T-07/09 Record Drawings, including any updates to either, and provide signed and sealed copies to the Ministry Representative.

These Technical Circulars are available from the Ministry Representative or on-line at the Province's web page:

INDEX: https://www2.gov.bc.ca/gov/content/transportation/transportation-infrastructure/engineering-standards-guidelines/technical-circulars

T-06/09: https://www2.gov.bc.ca/assets/gov/driving-and-transportation/transportation-infrastructure/engineering-standards-and-guidelines/technical-circulars/2009/t06-09.pdf

T-07/09: https://www2.gov.bc.ca/assets/gov/driving-and-transportation/transportation-infrastructure/engineering-standards-and-guidelines/technical-circulars/2009/t07-09b.pdf

(d) Quality Control

In the event that the Ministry Representative determines that the "as-built" information is not being adequately assembled, deductions from any monthly payment due the Contractor may be.

(e) Payment

No separate payment will be made for this Work and the cost thereof will be considered incidental to the various items of Work to be performed.

1.23 Contractor Survey Layout

The Contractor shall perform survey, layout, measurement, and associated tasks in accordance with SS 145.

1.24 Provision of Electronic Information

At the Contractor's request the Province will provide the Contractor with electronic copies of the Drawings, design digital terrain model, or other such information.

Such information is provided "as is" without warranty of any kind, whether expressed or implied. All implied warranties, including, without limitation, implied warranties of accuracy, completeness, merchantability, fitness for a particular purpose, and non-infringement, are hereby expressly disclaimed by the Province in respect of all such information.

Under no circumstances will the Province be liable to any person or business entity for any direct, indirect, special, incidental, consequential, or other damages based on any use of this information or any information referenced therein, including, without limitation, any lost profits, business interruption, or loss of programs or information, even if the Province has been specifically advised of the possibility of such damages.

1.25 Equipment Rental Rate Premium

In addition to the "Equipment Rental Rates", the rate premiums specified in Table 4 shall apply to any Work done by force account rates under this Agreement:

Table 3: Applicable Force Account Rate Premiums

Description	**Area of the Province**	***Applicability – Equipment Rental Rate Guide Section (the Blue Book)***	**Premium**
Fuel cost adjustment	All Districts	Applicable to licensed on-road vehicles, and heavy off-road equipment in accordance with https://www2.gov.bc.ca/gov/content/industry/construction-industry/transportation-infrastructure/hired-equipment-program/fuel-price-adjustment	Revised frequently. See https://www2.gov.bc.ca/gov/content/industry/construction-industry/transportation-infrastructure/hired-equipment-program/fuel-price-adjustment for the applicable rate at the time the work is being performed
Pick-ups, light plants, service vehicles and other similar equipment are excluded from the equipment rental rate premium.			

Information on the Province's Hired Equipment List registration process can be found at:

https://www2.gov.bc.ca/gov/content/industry/construction-industry/transportation-infrastructure/hired-equipment-program.

1.26 Motor Vehicle Act Hours of Service

Solely for the purposes of the Motor Vehicle Act Regulations – Division 37, Part 3 Hours of Service, Section 37.11(h) the "site of the work" referenced therein shall include the Place of Work and, subject to the approval in writing of the Ministry Representative, any of the following areas as the Contractor may explicitly request in writing as desired "Extensions to the Place of Work";

(i) any Contractor-provided pits, quarries, crusher or asphalt plant sites, and

(ii) such highway rights-of-way for the entire distance from a Limit of Construction to the property boundary of a Ministry- or Contactor-provided pit, quarry, crusher or asphalt plant site, up to a maximum cumulative length of thirty (30) km.

The above referenced Motor Vehicle Act Regulations may be found at the following link:

http://www.bclaws.ca/Recon/document/ID/freeside/26_58_12#section37.11

The following routes have been reviewed for potential acceptability for inclusion as "Extensions to the Place of Work for Section 37.11(h):

- Not applicable

1.27 Site Modifications

Where the Ministry Representative determines that site modifications are required, the Ministry Representative may notify the Contractor, and such site modifications shall be treated as a Change in the Work and resolved in accordance with Article 13 of the Agreement.

1.28 Conditional Items

Time required to accommodate construction of all Conditional Item Work is to be accommodated by the Contractor within the Construction Schedule.

SECTION 2 MEASUREMENT AND PAYMENT

2.01 General Requirements

(a) Mobilization and Demobilization

(i) Payment

Payment to the Contractor for this category shall be made by the conditions outlined in section 1.08 of these Special Provisions.

(b) Traffic Accommodations along Dale Road

(i) As per SS 194 Traffic Management for Work Zones.

(c) Traffic Accommodations along Sylvester Road

(i) As per SS 194 Traffic Management for Work Zones.

(d) Bonding and Insurance

(i) General

Bonding and Insurance as such term is used herein includes all costs for bonding and insurance as required pursuant to the terms of the Agreement.

2.02 Incidental and Miscellaneous

(a) Tree Trimming, Pruning, Clearing, Grubbing, and Disposal

(i) General

The category of Tree Trimming, Pruning, Clearing, Grubbing, and shall include all costs associated with tree trimming, pruning, clearing, grubbing, removal and disposal, including but not limited to, planning and preparedness documentation, hand or machine cutting of the trees, harvesting, hauling and disposing off site, removal of debris and slash and disposal off site, grubbing of stumps and roots, including but not limited to excavating, loading, hauling to disposal area off site, equipment, personnel, and other necessary controls and measures.

The Contractor shall provide disposal sites in accordance with SS 165.07.01 and SS 145.27.02.

Contrary to SS200.03, grubbing consists of excavation and removal of stumps and roots, buried logs, logging slash (downed logs, tree branches and tops, and uprooted stumps, trees, and shrubs), and other debris left on the ground from clearing operations.

(ii) Payment contrary to SS200.91 and SS200.93.

Payment to the Contractor for this category shall be made at the unit price per square metre, as outlined in the attached Schedule "A" – Schedule of Approximate Quantities and Unit Price Table.

(b) Supply and Installation of Chain Link Fence and Roling Gate

(i) Payment in accordance with SS 741.91. Contrary to SS 741.92, payment for gate will not be made as a separate bid item and will be included as one bid item with the chain link fence. Gate to be included in linear metre of fence.

(c) Installation of Temporary Access Approach per Drawing C-3102

(i) General

The category of Installation of Temporary Access Approach shall include supply and installation of gravel and culvert to assist in access to site and all work incidental thereto. Once work is completed the gravel and culvert shall be removed.

(ii) Payment

Payment to the Contractor for this category shall be made at the lump sum price, as outlined in the attached Schedule "A" – Schedule of Approximate Quantities and Unit Price Table.

(d) Supply and Installation of Tree Row per Drawing C-3102

(i) General

The category of Supply and Installation of Tree Row shall include supply and installation of Big Leaf Maple trees (5-7 years old) and post installation watering, and all work incidental thereto.

(ii) Payment

Payment to the Contractor for this category shall be made at the unit price per each Tree Row installed, as outlined in the attached Schedule "A" – Schedule of Approximate Quantities and Unit Price Table.

2.03 Environmental

(a) Preparation and Approval of CEMP

(i) General

The category of Preparation and Approval of CEMP shall include the development of a CEMP and implementation of all controls necessary for the duration of the project. Detailed requirements are outlined in the SS 165.

(ii) Payment

Payment to the Contractor for this category shall be made at the lump sum price, as outlined in the attached Schedule "A" – Schedule of Approximate Quantities and Unit Price Table.

(b) Environmental Monitoring and Reporting

(i) General

The category of Environmental Monitoring and Reporting shall include Environmental Monitoring and Reporting necessary for the duration of the project.

(ii) Payment

Contrary to SS 165.03.06, the lump sum associated with Environmental Monitoring and Reporting will be made as follow:

50% of the lump sum when the when the Contractor mobilizes to the Place of Work; and (ii) 50% of the lump sum after the Contractor performs site clean-up and demobilizes from the Place of Work.

2.04 Earthworks

(a) Restoration of Sand Recovery Station (SRS)

(i) General

The category of Restoration of Sand Recovery Stations (SRS) shall include all cost with locating and recovering existing sand recovery stations, including but not limited to, locating and staking edges of the lock block structure, trimming/pruning any vegetation required to do the work (including access to said SRS), and excavating any sediment at the SRS to gain access to the Lagace creek.

(ii) Payment

Payment to the Contractor for this category shall be made at the unit price per existing Sand Recovery Station (SRS), as outlined in the attached Schedule "A" - Schedule for Approximate Quantities and Unit Price Table.

(b) Supply and Installation of New Sand Recovery Station

(i) General

The category of Supply and Installation of New Sand Recovery Station shall include all cost with excavation, slope trimming, embankment compaction, supply and installation of lock blocks, geotextile, and fill material, and all works incidental to work required to construct the SRS.

(ii) Payment

Payment to the Contractor for this category shall be made at the unit price for each new SRS, as outlined in the attached Schedule “A” – Schedule for Approximate Quantities and Unit Price Table.

(c) Supply and Installation of Coconut Matting and Riparian Area Mix

(i) General

The category of Supply and Installation of Coconut Matting and Riparian Area Mix shall include all costs associated with Supply and Installation of coconut matting and riparian area mix, including but not limited to, supplying, including coconut matting and riparian area mix, hauling, placing, equipment, personnel, and other necessary controls and measures.

(ii) Payment

Payment to the Contractor for this category shall be made at the unit price per square metre, as outlined in the attached Schedule "A" – Schedule of Approximate Quantities and Unit Price Table.

(d) Excavation and Off-site Disposal of Sediment

(i) General

The category of Excavation and Off-site Disposal of Sediment shall include all costs associated with Excavation and Off-site Disposal of Sediment including, but not limited to, excavation,

slope trimming, compacting into embankment, hauling and disposal of channel material and debris off site, equipment, personnel, and other necessary controls and measures.

The Contractor shall provide disposal sites in accordance with SS 165.07.01 and SS 145.27.02.

(ii) Payment

Payment to the Contractor for this category shall be made at the unit price per cubic metre, as outlined in the attached Schedule “A” – Schedule of Approximate Quantities and Unit Price Table.

(e) Excavation and Off-site Disposal of Contaminated Sediment

(i) General

The category of Excavation and Off-site Disposal of Contaminated Sediment shall include all costs associated with Excavation and Off-site Disposal of Contaminated Sediment including, but not limited to, excavation, slope trimming, compacting into embankment, hauling and disposal of channel material and debris off site, equipment, personnel, and other necessary controls and measures.

The Contractor shall provide disposal sites in accordance with SS 165.07.01 and SS 145.27.02.

(ii) Payment

Payment to the Contractor for this category shall be made at the unit price per cubic metre, as outlined in the attached Schedule “A” – Schedule of Approximate Quantities and Unit Price Table.

2.05 Bioengineering

(a) Supply and Installation of Dense Live Staking

(i) General

The category of Supply and Installation of Dense Live Staking shall include all costs associated with, supply, storage, and installation of live willows stakes, and all work incidental thereto. Post installation watering is also included.

(ii) Payment

Payment to the Contractor for this category shall be made at the unit area, as outlined in the attached Schedule "A" – Schedule of Approximate Quantities and Unit Price Table.

(b) Supply and Installation of Live Stake Cluster

(i) General

The category of Supply and Installation of Live Stake Cluster shall include all costs associated with supply, storage, and installation of live willow or red osier dogwood stakes, supply and installation of coconut matting, and filter fabric, and supply of soil material, and all work incidental thereto.

(ii) Payment

Payment to the Contractor for this category shall be made at the unit area, as outlined in the attached Schedule "A" – Schedule of Approximate Quantities and Unit Price Table.

Schedule D: APPENDIX/APPENDICES

Appendix 1 – 2020 Standard Specifications for Highway Construction

- 2020 Standard Specifications for Highway Construction Volume 1 (20MB PDF)
  November 1, 2020
- 2020 Standard Specifications for Highway Construction Volume 2 (45MB PDF)
  November 1, 2020

Appendix 2 – Archaeological Chance Find Procedure

PROVINCE OF BC

BRITISH COLUMBIA

ARCHAEOLOGICAL CHANCE FIND PROCEDURES

Overview

Archaeological sites are protected by the *Heritage Conservation Act* (HCA). In the event that any item of archaeological, heritage, historical, cultural or scientific interest is found on the project site, the following Chance Find Procedure shall apply:

1 Stop Work

- Upon find by cultural monitor or observation from operator suspects a cultural find, all operations must immediately stop work within 30m of find.

2 Notify Cultural Monitor

- Upon ceasing operations, notify the Cultural Monitor and Site Supervisor of the suspected find.
- The find location will be recorded, and the find will be left in place.



3 Archaeology Assessment

- If the find is suspected to be archaeological in nature, the project archaeologist will be contacted.
- If the significance of the find is judged to be sufficient to warrant further action, then the project archaeologist in consultation with the Archaeology Branch and representatives of local First Nation communities will determine the appropriate course of action.
- In the case of human remains, if the remains are deemed to be archaeological in nature, then the Archaeology Branch and local First Nations will be consulted to determine an appropriate course of action and the RCMP and/or coroner will be notified of the find.
- If human remains are encountered and deemed not to be archaeological in nature, the RCMP and/or coroner will be contacted immediately.

4 Resuming Works

- Work shall not resume within 30m of the discovery site until an appropriate directive has been received from the Archaeology Branch.

If you see any archaeological, heritage, historical, cultural, or scientific interest items in your work area, stop works immediately and report find to the Cultural Monitor and your Site Supervisor.

BRITISH COLUMBIA | Ministry of Transportation and Infrastructure

Protection of the Environment- Breeding Bird Nest Survey Protocol September 10,2020

1. Survey Requirements for Areas to be Cleared and Grubbed

Both vegetated habitats and non-vegetated habitats (i.e. rock outcrops) have the potential to support nesting birds, although bird abundance is generally greater in heavily vegetated areas. In addition, many man-made structures such as retention ponds, bridges, utility towers and larger culverts have the potential to support bird nesting activity.

2. Survey Timing

Bird nest surveys should be conducted during the appropriate seasonal timing window. In general this window occurs between March 15th and August 15th, however, the Contractor's Appropriately Qualified Professional (AQP) may use the guidance of the General Nesting Periods of Migratory Birds in Canada (https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/general-nesting-periods.) to refine the window.

Bird nest surveys should be carried out within the first 3 to 4 hours after sunrise. Surveys should not be undertaken during periods of inclement weather (e.g. heavy rain, light rain, or snow[1]), under windy conditions (i.e., >2 on the Beaufort scale), or when air temperatures are below certain thresholds[2]

**Note: Non-passerine species such as raptors or owls may have different seasonal nesting windows and are active at different times of the day. If environmental assessments have identified the potential for non-passerine bird species to be present, alternate survey timing may be required.*

3. Team Member Qualifications

All nest surveys must be conducted by, or be completed under the direction of, an Appropriately Qualified Professional (AQP) who will be responsible for sign-off on all surveys. All survey team members must have sufficient experience with bird biology and identification (by sight and sound).

4. Survey Effort

Survey duration must be a minimum of 1 hour per hectare and may be longer if searches are occurring in complex habitats. The AQP will be responsible for determining the effort required.

Survey team members will walk parallel transects and systematically cover the area to be cleared to search for bird nests and nesting activity. Where appropriate, surveyors should also use additional survey techniques to increase the likelihood of finding nests such as behavioural cues and bird song identification.

Surveys should be conducted both within the clearing and grubbing limits and, where feasible and appropriate, up to 30 meters beyond these limits to record birds nesting nearby that may be impacted by the work activity.

5. Determining Nest Activity

Each nest observed during the survey must be mapped and designated as either **active** or **inactive**. If the contents of the nest are easily observed from a distance, indicators such as new nesting material and/or eggs can be used to determine activity. Other means of determining nest activity can include observations of adult birds exhibiting nesting or territorial behaviour

Observed nests that are in good condition but do not appear to be occupied at the time of the survey, must still be considered "active" until additional observation periods have been undertaken. A minimum 1-hour observation period (during the time when nest activity is most likely) should be conducted on two consecutive days to determine nest status. To avoid unnecessary disturbance, a nest should be observed from a distance if it is considered active.

6. Active Nest Buffers

A No Work Zone buffer must be applied to any active nests identified. The Contractor's AQP is responsible for developing and implementing a nest management plan including an appropriate buffer width, buffer marking, and mitigation measures for the duration of the nest occupancy. Buffer zones may be determined based on factors such as surrounding vegetative cover, topography, species sensitivity to disturbance, existing disturbance in the area, or proposed construction activities in the vicinity of the nest.

7. Survey Cycles

a. New Surveys

Unless otherwise approved by the Ministry Representative, areas to be cleared must be surveyed a minimum of 3 times over a 5-day period with no more than 1 survey in any given day. Consecutive days are preferred. Vegetation clearing must begin within 48 hours of the end of the survey cycle. Clearing and grubbing can be undertaken for up to 10 days after the end of the survey cycle, if the AQP determines that ongoing construction activities will preclude additional nesting activity.

b. Survey Extensions

If vegetation clearing does not begin within 48 hours of the end of the survey cycle or cannot be completed within the 10-day clearing window, then additional survey work will be required.

i) If vegetation clearing is delayed for 2-5 days following the last survey, 1 replicate survey (1 nest survey in 1 day) will be required within this 2-5-day period.

ii) If vegetation clearing is delayed for 6-9 days following the last survey, 2 replicate surveys (2 nest surveys over 2 consecutive days) will be required within this 6-9-day period.

If the above procedures are not implemented (i.e. the survey is not extended), a new survey cycle must be initiated before vegetation clearing can commence.

c. Reassessment of Active Nests

A minimum of 14 days after a nest is designated as active, the nest can be reassessed.

Reassessment will consist of a minimum 1-hour nest observation period on 2 separate days, with the timing for these reassessments based on the likelihood of observing birds at the nest. Potential disturbance of birds must be minimized during the observation period. If watches have been conducted and no bird presence and/or breeding activity is noted, nest status can change from active to inactive. As a final verification of inactivity, the nest may be approached and inspected. The No Work Zone buffer can also be removed.

For any nest found to be active during clearing or construction works, the AQP will determine the appropriate buffer and initiate the active nest procedure outlined above.

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[1], http://www.spc.noaa.gov/faq/tornado/beaufort.html

[2] Standards for Components of British Columbia's Biodiversity No 15. Inventory Methods for Forest and Grassland Songbirds. Version 2.0.

Appendix 4 – Environmental Monitoring Plan

See following page for Environmental Monitoring Plan

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

REPORT

Ministry of Environment and Climate Change Strategy

Lower Lagace Creek (SCR 14) Sediment Removal and Bank Stabilization Environmental Management Plan



JULY 2024
REVISED

carbon neutral since 2009

CANADA BEST MANAGED COMPANIES Platinum member

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1 INTRODUCTION

The Ministry of Environment and Climate Change Strategy (ENV) retained Associated Engineering (B.C.) Ltd. (AE) to design emergency flood restoration works in lower Lagace Creek (Site 14) in Hatzic, BC (Figure 1-1) (the Project). The atmospheric river event of November 2021 resulted in significant flooding and widespread sediment deposition throughout Lagace Creek, including the lower reach where Lagace Creek flows into Hatzic Slough. Sediment from the steeper, upstream portions of the Hatzic Lake watershed was transported to and deposited throughout the downstream reaches of Lagace Creek (AE 2022).

The Project objective is to restore these sites to their pre-atmospheric river event condition by removing sediment and stabilizing the channel banks based on the current codes and standards. Approximately 8,250 m^3 of sediment is proposed for removal from lower Lagace Creek. Excess sediment is a contributing factor to the ongoing flood risk, including the potential risk of damage to watercourses, public and private infrastructure, and public safety during major storm events.

AE engaged Associated Environmental Consultants Inc. (Associated), a subsidiary of the Associated group of companies, to provide this environmental management plan (EMP). The EMP describes the Project works and mitigation measures recommended to reduce or eliminate the potential adverse environmental effects of the works. This EMP is intended to support the contractor in developing their construction environmental management plan (CEMP) and the EMP will accompany the application for change approval for the works under Section 11 of the *Water Sustainability Act*.

1.1 Project Background

In April 2022, AE conducted a high-level, qualitative site assessment along lower Lagace Creek, which consisted of a risk assessment and the development of recommendations for mitigation works (Appendix A). The November 2021 atmospheric river event resulted in significant flooding and widespread sediment deposition throughout these areas. The event mobilized sediment and debris from the steep, upstream parts of the watershed and transported it to the flatter, lower parts of the catchment. Based on a review of previous assessments of Lagace Creek, there is a history of deposition and bank erosion along the watercourse (NHC 2005; AE 2022) caused by fall and winter storms that generate high water flow. Lower Lagace Creek (from Hatzic Lake upstream to the Dale Road crossing) has been heavily aggraded over the past few years. Landowners have reported frequent flooding of the area not only during high-flow events but also during successive lower flows. Sediment deposition appears to be a regular occurrence during high-flow events, as noted in the NHC report. This aggradation affects channel capacity and water levels in the creek.

AE noted the following during their assessment of lower Lagace Creek:

- Some sediment deposition was observed along the bed of the creek.
- Localized stream bank erosion was observed upstream and downstream of the Youngston Road bridge, likely resulting from higher flow volume, velocity, and sediment deposition due to the November 2021 atmospheric river event.
- Roadway ditches along Youngston Road were filled with debris and sediment, which also affected the overall conveyance capacity of the ditch.

1.2 Proposed Flood Restoration Works

Flood restoration works along lower Lagace Creek will include removing sediment from the channel and installing bioengineering measures at identified failure locations. The Project limits have been defined in the conceptual design drawings, and the extent of the proposed flood restoration works will be directed by the engineer on site.

Sediment that accumulated during the atmospheric river event will be removed from the channel from 14 discrete locations. Eleven of the locations will be at sand recovery stations that were originally constructed for a sand removal project in 2015 (Letts 2015). Three new sand recovery stations are proposed to be constructed at the upstream end of the Project area, near Dale Road. An estimated 8,250 m^3 of sediment will be removed, comprising a total area of 5,100 m^2. The sediment removal volume at each station ranges from 250 m^3 to 950 m^3. The stations will be accessed via existing roads; however, some resurfacing and/or gravel placement may be required. Since 2015, extensive vegetation has grown on and around these stations; some minor vegetation pruning and trimming is anticipated to facilitate access to the stations and re-expose them. Approximately 3,000 m^2 of vegetation clearing is required for construction of the new sand recovery stations.

In general, construction of a new sand recovery station will comprises the following steps:

- Isolate the workspace in the creek and on land.
- Clear and grub vegetation, removing knotweed where present, and removing trees as required to facilitate the work.
- Remove overburden and excavate the new sand station locations.
- Construct the station base using a combination of granular fill, concrete lock blocks, and Combigrid® geotextile material. structure base (granular material wrapped in geotextile).
- Grade and backfill slopes with native material as required to achieve the desired slopes.
- Seed the area with riparian area mix, place coconut matting and install live stake clusters.
- Excavate sediment from the creek.
- Plant new bigleaf maple trees along access road.

Dense planting of live willow stakes is proposed as a bioengineering measure to protect three sites in lower Lagace Creek from erosion, covering a total length of 370 m and a total area of 720 m^2 (Appendix B). Potential access routes to these sites have been identified on the concept design drawings but will be field fitted to minimize vegetation clearing and will be based on landowner requirements where necessary (Appendix B). Landowners have been engaged to discuss establishing potential access locations.

1.3 Construction Schedule

Flood restoration works are anticipated to occur during the least-risk fisheries window for lower Lagace Creek, between August 1 and September 15, 2024. Instream isolation will be installed within this window, and upstream fish passage will be maintained where required. Sediment removal activities are anticipated to take up to 21 days and include mobilization, demobilization, and restoration of the access routes. For the proposed bioengineering, willow cuttings must be harvested and planted during the dormant season (i.e., September to May). Therefore, bioengineering installation is expected to occur outside the regional least-risk fisheries window.

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LEGEND
Site 14

AE PROJECT NO.	2022-2632
SCALE	1:8,000
COORD. SYSTEM	NAD 1983 UTM ZONE 10N
DATE	2024-04-26
REV	00
DRAWN BY	SC
CHECKED BY	NS

FIGURE 1-1
PROJECT LOCATION

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
SCR14 LAGACE CREEK

1.4 Regulatory Context

The following federal and provincial legislation applies to the Project.

1.4.1 *Water Sustainability Act*

The provincial *Water Sustainability Act* (SBC 2014, c. 15) and the associated *Water Sustainability Regulation* (BC Reg. 36/2016) protect the quality of water, fish and wildlife habitat, and the rights of licensed water users. Under Section 11 of the Act, any activities that result in changes in or about a stream require submission of a notification or an application for change approval. The holders of water licences on lower Lagace Creek who may be affected by proposed works must be advised prior to construction, and an alternative supply of fresh water must be provided during periods when water quality or availability will be adversely impacted.

Sediment removal and erosion protection works in lower Lagace Creek will result in changes in or about a stream, as instream activities will occur below the high-water mark. Associated will apply for a change approval to the Ministry of Water, Lands and Resource Stewardship. One water licence holder in the Project area may be affected by flood restoration activities.

1.4.2 *Fisheries Act*

The *Fisheries Act* (RSBC 1985, c. F-14) is the main federal legislation for managing Canadian fisheries through the conservation and protection of fish and fish habitat. The Act defines fish habitat as "spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly to carry out their life processes." Subsection 35 (1) states that "no person shall carry on any work, undertaking or activity that results in the harmful alteration, disruption or destruction of fish habitat." Subsection 36 (3) stipulates that "no person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish." A deleterious substance under the Act is "any substance that, if added to any water, would degrade or alter or form part of a process of degradation or alteration of the quality of water so that it is rendered or is likely to be rendered deleterious to fish or fish habitat." This definition includes suspended sediment.

Project works will begin during the least-risk fisheries window of August 1 to September 15. Lower Lagace Creek is fish bearing, as confirmed during site assessments in October 2023. Fish salvage will occur in isolated work areas in lower Lagace Creek before instream works begin. All work will be completed in the dry, or while a clean flow of water is maintained, to prevent downstream impacts to fish or fish habitat during construction. Impacts to fish and fish habitat are anticipated to be fully mitigated to prevent permanent harmful alteration, disruption, or destruction; however, an emergency authorization under the *Fisheries Act* was obtained from Fisheries and Oceans Canada for these works (Appendix C).

1.4.3 *Species at Risk Act*

The federal *Species at Risk Act* (SC 2002, c. 29) provides legal protection for wildlife designated in Schedule 1 of the Act and their habitats. The purpose of the Act is to prevent Canadian indigenous species, subspecies, and distinct populations from becoming extirpated or extinct, to provide for the recovery of endangered or threatened species, and to encourage the management of other species to prevent them from becoming at risk. The Act applies to species that are federally managed (i.e., those that occur on federal lands, aquatic species, or migratory birds) and makes it an offence under Sections 32 and 33 to kill, harm, harass, capture, or take an individual of a listed species that is extirpated, endangered, or threatened; possess, collect, buy, sell, or trade an individual of a listed species that is

extirpated, endangered or threatened, or its part or derivative; and damage or destroy the residence of one or more individuals of a listed endangered or threatened species or of a listed extirpated species if a recovery strategy has recommended its reintroduction. The Act protects the species, their residences, and critical habitat. Western toads (*Anaxyrus boreas*) and northern red-legged frogs (*Rana aurora*) are known to occur in the upstream reaches of Lagace Creek and may be present in lower Lagace Creek. Other species with the potential to occur in the Project area listed in Schedule 1 of the *Act* are discussed in Section 2.5.1.

1.4.4 *Migratory Birds Convention Act, 1994*

The federal *Migratory Birds Convention Act*, *1994* (SC 1994, c. 22), protects various species of migratory birds, migratory insectivorous birds, and migratory non-game birds, including herons. The Act provides protection for migratory breeding birds and their nests by requiring that works be conducted in a manner that prevents destruction and/or disturbance to bird nests. Amendments to the *Migratory Birds Regulations*, *2022* now provide enhanced nest protection for species in Schedule 1 of the Regulations.

The Act largely pertains to the site preparation and construction phases of the Project, when removal and disturbance of vegetation may affect habitat use by migratory birds during migratory stopover, staging, breeding, and summer foraging behaviours. The regional migratory breeding window for Hatzic is from mid-March to mid-August (ECCC 2023a). Further, if a nest of a species listed in Schedule 1 of the *Migratory Birds Regulations*, *2022* is detected in the Project footprint, designated wait times for the declaration of an abandoned nest will come into effect.

1.4.5 *Weed Control Act*

The provincial *Weed Control Act* (RSBC 1996, c. 487) designates provincially and regionally noxious weeds (listed in Schedule A of the Act) and the associated regulations governing those plants. The Act provides guidance for noxious weed prevention and management, stating that it is an occupier's (e.g., landowner) responsibility to manage and prevent the spread of noxious weeds. Noxious weeds are typically non-native plants that have been introduced to BC without the insect predators and plant pathogens that help keep them in check in their native habitats. For this reason, and because of their aggressive growth, these alien plants can be highly destructive, competitive, and difficult to control. The mitigation measures described in Section 4.6 should be followed to minimize the spread of weeds in the Project area.

2 EXISTING ENVIRONMENTAL CONDITIONS

2.1 Methods

This EMP was prepared based on a desktop background review and site visits conducted in October 2023 and March 2024 by Associated. Field methods for the instream habitat surveys were adapted from the Resource Information Standards Committee's Fish and Fish Habitat Inventory Standards and Procedures (RISC 2001) and the Fish Habitat Assessment Procedures (Johnston and Slaney 1996) and were tailored to the Project. Observations included average wetted and bankfull channel width and depth, gradient, channel morphology, substrate composition, large woody debris, cover and salmonid spawning, rearing, and overwintering habitat quality. Additionally, riparian habitat quality was assessed on the left and right banks, and included documentation of forest type, stage, and dominant species.

The terrestrial assessment consisted of a visual encounter survey to opportunistically search for vegetation and wildlife species of interest and their habitat features (FLNRO 2016, RIC 1998). The survey was conducted by walking

the length of the Project limits, including up to 20 m from the creek centreline, to characterize wildlife habitat (including suitability for species at risk), identify significant wildlife features (e.g., dens, nests, cavities), and document rare and invasive plant species.

Representative photographs were taken of aquatic and terrestrial habitat and anthropogenic features in the Project area and are provided in Appendix D.

2.2 Climate

The Project is located in the Coastal Western Hemlock dry maritime (CWHdm) biogeoclimatic subzone, at an elevation of approximately 200 m above mean sea level. The CWH is one of Canada's wettest biogeoclimatic zones and has the most productive forest areas. The weather includes moist Pacific winds, extensive cloud cover and mist, and frequent drizzle. The climate is generally moderate (cool mesothermal), with cool summers and mild winters. The mean annual temperature in the CWH zone is 5.5°C, and the mean precipitation is 2,200 mm (Pojar et al. 1991).

2.3 Fish and Fish Habitat

Lagace Creek is a third-order stream (ENV 2023a) with its headwaters located in a mountainous region approximately 5 km east of the Project. Lagace Creek flows into Hatzic Slough and ultimately into Hatzic Lake, which continues into the Fraser River. Lagace Creek is fish bearing and the following species have been documented: rainbow trout (*Oncorhynchus mykiss*), cutthroat trout (*O. clarkii clarkii*), chum salmon (*O. keta*), coho salmon (*O. kisutch*), sockeye salmon (*O. nerka*), lamprey (*Entosphenus*), threespine stickleback (*Gasterosteus aculeatus*), and prickly sculpin (*Cottus asper*) (ENV 2023a, ENV 2023b). Fish and fish carcasses were observed throughout the creek in the Project area.

Lower Lagace Creek is bordered by residential homes and agricultural land to the east and west in the Project area. Sedimentation appears to be an ongoing issue, evidenced by the amount of sediment and silt found in lower Lagace Creek. Sandy bars and troughs were found along the length of the creek, and undercut banks, irregular instream islands, and small amounts of large woody debris were also noted throughout.

Lower Lagace Creek has an average wetted width of 19 m, and the depth ranges from 0.3 to 0.6 m during low-flow stages. The channel has an irregular meandering pattern, straightening upstream, north of Dale Road (Figure 2-1). The creek in this reach displays a glide morphology, typical of low-gradient (0.5%), valley-bottom streams. Undercut banks provide deeper pockets of water with a higher flow, providing refuge for migrating salmonids. The channel substrate largely consists of sand and silt, which can be easily shifted and shaped according to flow pathways and rates in the slough, resulting in a convex channel bed morphology. Water along the centreline is shallow and becomes deeper along the banks. Pool habitat is limited in this reach; only four or five pools were noted along this section, some created by water scouring around pieces of large woody debris, as well as from undercut banks, and at the outlet of drainage channels. Large woody debris (i.e., pieces of wood ≥10 cm in diameter and at least 2 m in length) was extremely sparse.

The riparian vegetation along lower Lagace Creek in the Project area predominantly consists of shrubs and contains few trees, providing limited input of large woody debris, overhanging vegetation, and nutrients from litterfall into the stream. Further, the stream banks have been modified as a result of agricultural and residential development. On some properties, vegetation along the banks had been cleared all the way to the water's edge, while at other properties, the banks have been modified to create shallow pools or construct docks. Small, motorized boats were observed tied up along the banks. A low retaining wall had been built along the length of one property, just above the water's edge.

The lower reach of Lagace Creek has a gradient of 0.5%, and its flow rate is generally slower than that upstream of Dale Road. Lower Lagace Creek has several tributaries, or off-channels, including several inputs that appear to be drainage ditches for nearby farms. Beaver (*Castor canadensis*) activity was noted just above the Farms Road bridge, where a beaver dam had created a channel on the left bank (looking downstream) and a large off-channel habitat.

Adult salmonids are reported to migrate through this area in large numbers, supported by documented fish presence and spawning activity upstream (Associated 2023). The lack of pool habitat and overhead cover would make the area a poor choice for overwintering, and the almost complete lack of spawning substrate, such as clean gravels and smaller cobbles, would preclude spawning in this area. Further, lower Lagace Creek provides limited rearing habitat for juvenile salmonids in the form of protected, slow-moving off-channel habitat.

2.4 Vegetation and Broad Ecosystems

The riparian area in the Project area comprises a narrow corridor of riparian shrub vegetation, with occasional small forest stands, largely surrounded by agricultural land (Figure 2-1). Riparian shrub vegetation is dominated by red-osier dogwood (*Cornus sericea*), Pacific ninebark (*Physocarpus capitatus*), salmonberry (*Rubus spectabilis*), and willow (*Salix*). Forest stands are dominated by red alder (*Alnus rubra*) and black cottonwood (*Populus trichocarpa*), with occasional Douglas-fir (*Pseudotsuga menziesii*), shore pine (*Pinus contorta* var. *contorta*), and western redcedar (*Thuja plicata*) trees. Occasional open areas dominated by grasses were also present along the creek in the Project area.

Approximately 600 m downstream from the Dale Road bridge, some typical wetland vegetation, such as cattail (*Typha*) and sedge (*Carex*), is present in a large off-channel reach that appears to be disconnected from the main creek channel at the upstream end and connected by a narrow channel at the downstream end (Figure 2-1). This off-channel habitat measures approximately 8 m wide by 50 m long.

2.4.1 Rare Plants and Ecosystems at Risk

No documented rare plants or known ecosystems at risk occur within 2 km of the Project area (CDC 2023a), and none were observed during the site visits.

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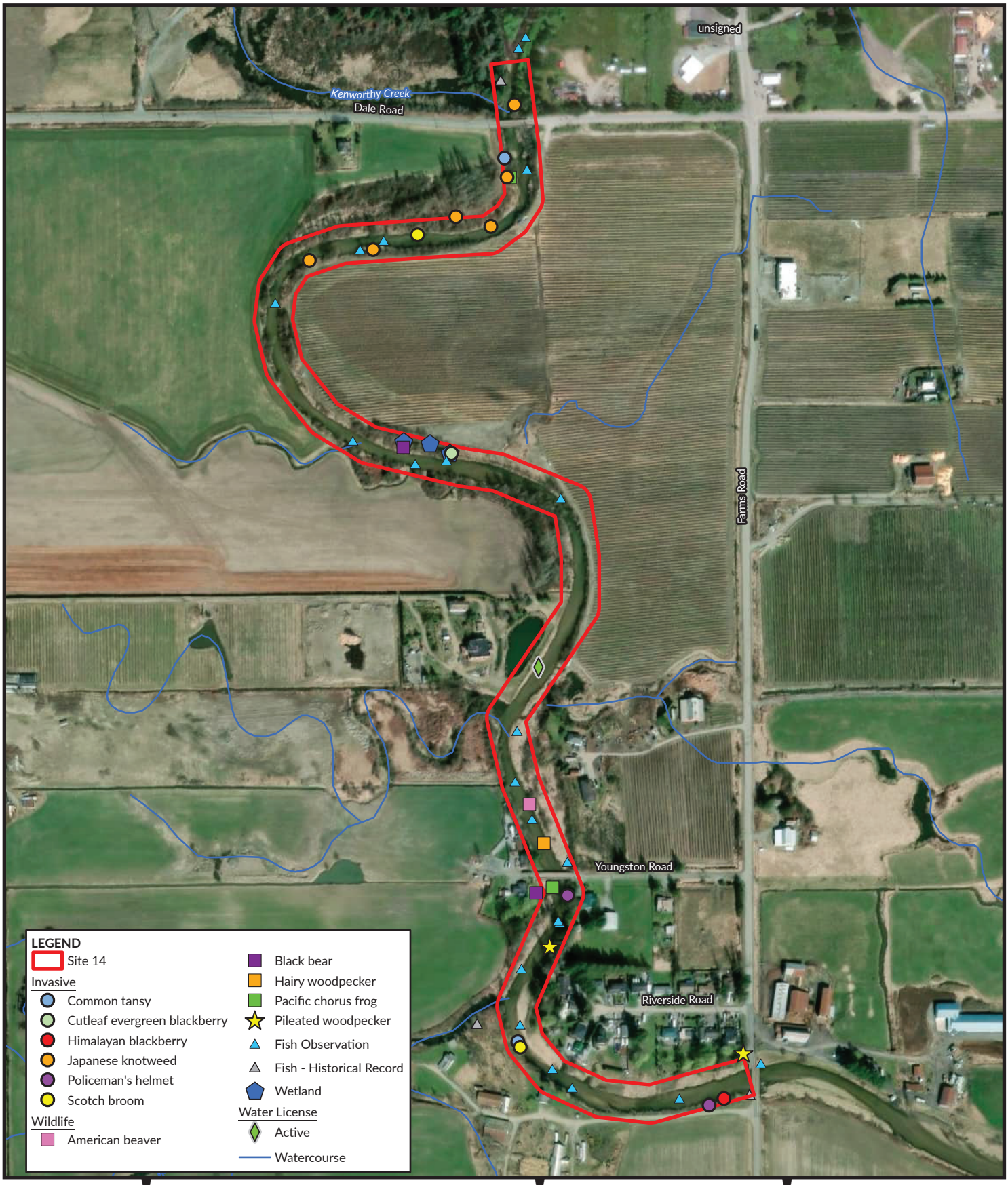

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IMAGERY: ESRI, DIGITALGLOBE, GEOEYE, I-CUBED, USDA FSA, USGS, AEX, GETMAPPING, ROAD AND HYDROGRAPHY: GOVERNMENT OF CANADA, 2019; WATER LICENSE: GOVERNMENT OF BRITISH COLUMBIA, 2023.

Associated Environmental

Ministry of Environment and Climate Change Strategy

0 50 100 150 200 250 m

AE PROJECT NO.	2022-2632
SCALE	1:5,419
COORD. SYSTEM	NAD 1983 UTM ZONE 10N
DATE	2024-04-26
REV	00
DRAWN BY	SC
CHECKED BY	NS

FIGURE 2-1
EXISTING CONDITIONS

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
SCR14 LAGACE CREEK

2.4.2 Invasive Species

Six invasive plant species were documented in the Project area, including several large patches of the highly invasive Japanese knotweed (*Reynoutria japonica* var. *japonica*) along the creek banks and up to the edge of the channel in many places. Japanese knotweed is designated as a noxious weed by the provincial *Weed Control Regulation* (BC Reg. 66/85) (Figure 2-1). Himalayan blackberry (*Rubus armeniacus*) was abundant throughout the corridor and formed dense thickets in some areas. Table 2-1 shows a complete list of the invasive plant species documented during the field visits.

Table 2-1 Invasive Plant Species Observed in the Lower Lagace Creek Project Area

Common Name	Scientific Name	Provincial Management Objective[1]	Noxious Weed[2]
Common tansy	*Tanacetum vulgare*	Regional containment/control	Regionally noxious (not applicable in Project area)[3]
Cutleaf evergreen blackberry	*Rubus laciniatus*	N/A	N/A
Himalayan blackberry	*Rubus armeniacus*	Regional containment/control	N/A
Japanese knotweed	*Reynoutria japonica* var. *japonica*	Regional containment/control	Provincially noxious
Policeman's helmet	*Impatiens glandulifera*	Regional containment/control	N/A
Scotch broom	*Cytisus scoparius*	Regional containment/control	N/A
Yellow floating heart[4]	*Nymphoides peltata*	Regional containment/control	N/A

[1] Provincial priority invasive species management category (BC GOV 2023). [2] Designation under the provincial *Weed Control Regulation* (BC Reg. 66/85). [3] Schedule A, Part II, of the *Weed Control Regulation* designates some plant species as noxious weeds only in specific regions; common tansy is a noxious weed in Bulkley-Nechako, Central Kootenay, Columbia-Shuswap, East Kootenay, and North Okanagan, but not in the Fraser Valley region. [4] Suspected, based on its reported presence in Hatzic Lake (personal communication, Becky Brown, 2023). N/A – not applicable

2.5 Wildlife and Wildlife Habitat

The habitat along lower Lagace Creek comprises a complex of forest stands, riparian vegetation, and agricultural land, and has the potential to support a diversity of wildlife. The riparian corridor consisting of young deciduous forest provides extensive foraging and nesting opportunities for passerine birds. Bird species detected during the field visit included American crow (*Corvus brachyrhynchos*), black-capped chickadee (*Poecile atricapillus*), European starling (*Sturnus vulgaris*), pine siskin (*Spinus pinus*), red-winged blackbird (*Agelaius phoeniceus*), and Steller's jay (*Cyanocitta stelleri*). Great blue herons (*Ardea herodias* ssp. *fannini*), northern flicker (*Colaptes auratus*), belted kingfisher (*Megaceryle alcyon*), and hairy woodpecker (*Dryobates villosus*) were also observed flying over or foraging in the Project area. No bird nests or nesting activity we re detected during the site visits.

Deer and other mammals likely use the narrow riparian areas for foraging and as a travel corridor. Beaver activity was noted in several places along the creek, and an intact beaver dam with an associated pond are present in lower Lagace Creek, approximately 150 m north of Dale Road. A local resident noted another potential beaver den further downstream, approximately 70 m north of Youngston Road. American black bear (*Ursus americanus*) scat and marked trees were also detected in several locations in the Project area.

Two snags (i.e., standing, dead, or dying trees, often missing the top or most of the smaller branches) with signs of woodpecker foraging were noted in the Project area. Calls of pileated woodpecker (*Dryocopus pileatus*) were detected from several locations near the southern end of the Project extents, and pileated woodpeckers were visually observed foraging in trees at two locations near the intersection of Farms Road and Riverside Road. Cavities with the size, shape, and placement typical of pileated woodpecker nests were not detected; however, the presence of pileated woodpeckers indicates that there is a potential for nest cavities in the Project area.

Two raptors were observed flying and/or calling from within the Project area: one northern harrier (*Circus hudsonius*), and one suspected American kestrel (*Falco sparverius*). No raptor nests or nesting activity were detected during the site visits.

Pacific chorus frogs (*Pseudacris regilla*) were heard calling from vegetated areas near Dale Road. Off-channel habitats and slow-moving tributaries in the Project area provide highly suitable breeding habitat for amphibians.

2.5.1 Species at Risk

Based on a search of the BC Conservation Data Centre online database, critical habitat and marked known occurrences of species at risk were identified within 2 km of the Project area (CDC 2023a) (Figure 2-2, Table 2-2).

Table 2-2 Wildlife Species at Risk With Critical Habitat or Marked Known Occurrences Within 2 km of the Study Area

Common Name	Scientific Name	BC List[1]	SARA Status[2]	Presence in Study Area and Potential Interaction with Project
Oregon forestsnail	*Allogona townsendiana*	Red	Endangered	There are several occurrence records for this species near the Project area, including further upstream on Lagace Creek, where two snails were found in 2006, as well a mapped critical habitat. This site borders agricultural land and may have been mowed. This species is most commonly associated with deciduous forest canopy dominated by bigleaf maple (*Acer macrophyllum*), with stinging nettle (*Urtica dioica*) in the understorey. Suitable habitat for this species was not detected in the Project area.
Northern red-legged frog	*Rana aurora*	Blue	Special concern	There is one record of this species in a small tributary that flows parallel to Lagace Creek, approximately 1.2 km east-northeast of the Project area. Associated also detected adult red-legged frogs further upstream in

Common Name	Scientific Name	BC List[1]	SARA Status[2]	Presence in Study Area and Potential Interaction with Project
				Lagace Creek, approximately 4 km northeast of the Project area. This species breeds in lotic habitat with little to no flow. Suitable habitat for this species exists in the Project area.
Pacific water shrew	*Sorex bendirii*	Red	Endangered	There is an occurrence record for this species in a wetland on Farms Road, approximately 100 m south of Lagace Creek, in 2016. Suitable habitat for this species is found in riparian habitats associated with streams, creeks, and wetlands in mature coniferous or deciduous forests. While the high flows in the mainstem of Lagace Creek likely renders it unsuitable for Pacific water shrew, the adjacent riparian and off-channel habitat are highly suitable for this species.
Barn owl	*Tyto alba*	Blue	Threatened	Critical habitat for this species has been mapped in the agricultural lowland along Hatzic Slough, in an area that overlaps the southern end of the Project area. This species typically nests in buildings (e.g., barns and silos) and forages over fields of dense grass. Suitable habitat for barn owl exists near Lagace Creek but is unlikely to be affected by in-channel works.
Spotted owl, *caurina* subspecies	*Strix occidentalis* ssp. *caurina*	Red	Endangered	Proposed critical habitat for this species exists approximately 1.7 km east of the Project area, on the forested mountain slopes. This area is considered potential future critical habitat, defined as “habitat that either already possesses, or is expected to develop (within a 50-year period), the features required by the owls to successfully nest, roost, forage and move safely” (ECCC 2023b). Suitable habitat for this species is old-growth or old-growth–like forests with multilayered canopies, and where there are large-diameter trees (e.g., >20 cm diameter) with existing cavities for nesting. Forests where small mammal prey animals are abundant are

Common Name	Scientific Name	BC List[1]	SARA Status[2]	Presence in Study Area and Potential Interaction with Project
				likely to be preferred as nesting sites (CDC 2023b). Suitable habitat for spotted owl does not exist in the Project area.
Marbled murrelet	*Brachyramphus marmoratus*	Blue	Threatened	Critical habitat for this species has been mapped in forest habitat approximately 1.9 km northeast and 1.9 km east of the Project area. Suitable habitat for this species comprises mature and/or old-growth coniferous forest near the coast. The riparian forest habitat in the Project area does not provide the necessary biophysical attributes for this species.
Great blue heron, *fannini* subspecies	*Ardea herodias* ssp. *fannini*	Blue	Special concern	Great blue herons forage for fish in various aquatic habitats, including wetlands and riparian areas, that are generally less than 0.5 m deep. Herons typically forage within 5 km of nest sites, although they can travel as far as 33 km to forage (CDC 2023b). Great blue herons were observed in three locations in the Project area, indicating that herons use the creek for foraging. No great blue heron nests were detected during the site visits.
Western screech owl, *kennicottii* subspecies	*Megascops kennicottii kennicottii*	Blue	Threatened	This is a wide-ranging raptor species associated with mature to old-growth mixedwood forests. Forested habitat can be contiguous or interspersed within a matrix consisting of farmland, grassland, and creek and river riparian zones. Suitable habitat for this species exists in the Project area.

[1] Provincial status codes: Yellow indicates the species is secure or apparently secure, blue indicates the species is of special concern, and red indicates the species is extirpated, endangered, or threatened.
[2] *Species At Risk Act*, Schedule 1 status codes: Endangered indicates the species is facing imminent extirpation or extinction, threatened indicates the species is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction, and special concern indicates the species may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.

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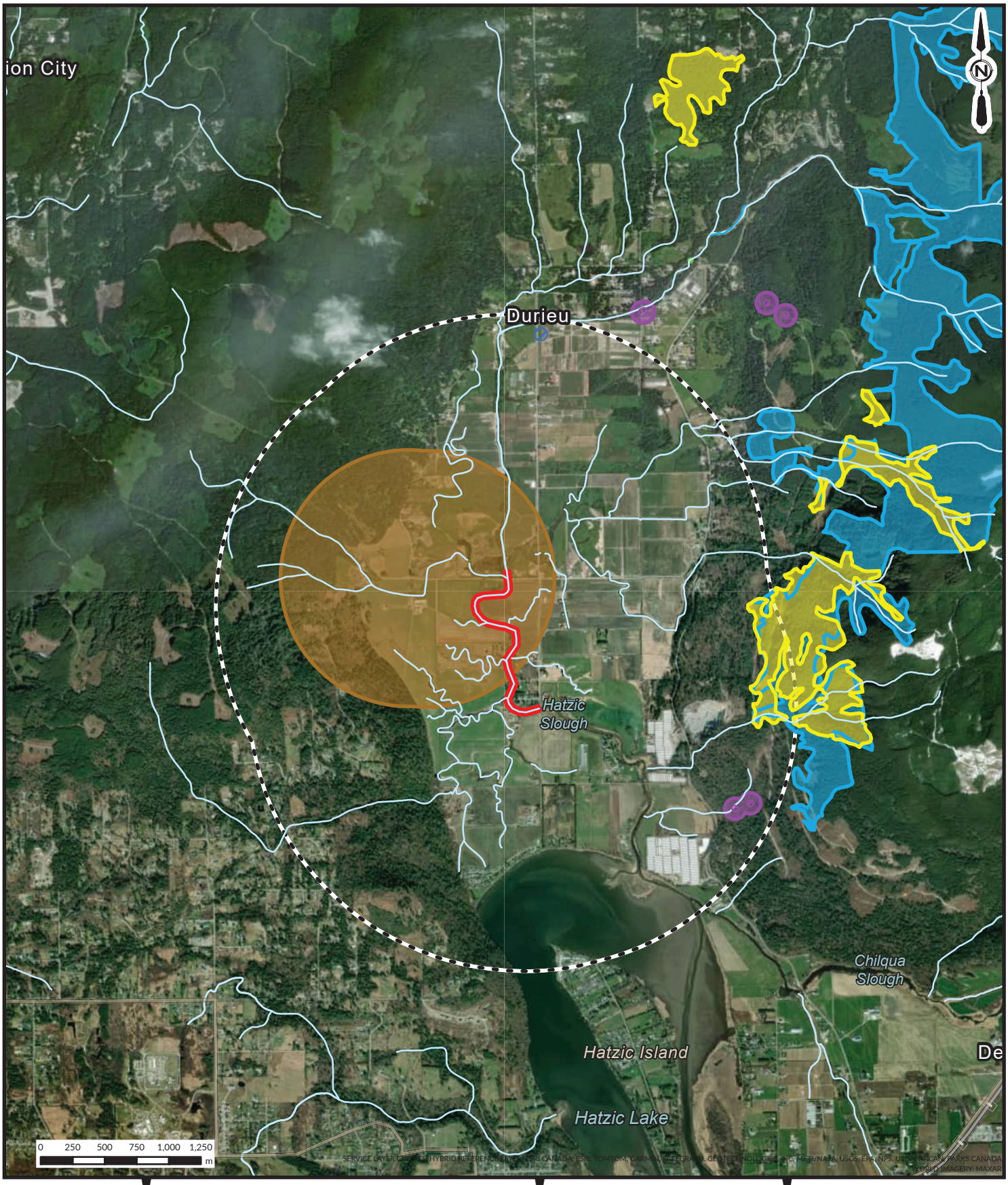

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Associated Environmental

Ministry of Environment and Climate Change Strategy

LEGEND

- Site 14
- 2km Buffer

Marked Known Occurences
- Oregon Forestsnail
- Pacific Water Shrew

Critical Habitat
- Barn Owl
- Marbled Murrelet
- Oregon Forestsnail
- Spotted Owl caurina subspecies

AE PROJECT NO.	2022-2632
SCALE	1:40,000
COORD. SYSTEM	NAD 1983 UTM ZONE 10N
DATE	2024-04-29
REV	00
DRAWN BY	SC
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FIGURE 2-2
CRITICAL HABITAT AND SPECIES AT RISK

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
SCR14 LAGACE CREEK

2.6 Surface Water Licences

Based on a search of iMap (CDC 2023a), there is one surface water licence with a point of diversion on lower Lagace Creek where it flows into Hatzic Slough within the Project extents (Figure 2-1, Table 2-3).

Table 2-3 Surface Water Licence Along Lower Lagace Creek

Licence Number	Status	Use Type	Source
C114253	Current	Greenhouse and nursery	Hatzic Slough

2.7 Valued Components in the Project Area

Based on the existing conditions, the following valued components are present in the Project area and are likely to be affected by the proposed flood restoration works:

- Fish and fish habitat;
- Riparian vegetation; and
- Wildlife (including species at risk).

3 POTENTIAL ENVIRONMENTAL EFFECTS

Elements of the Project with the potential to affect the environment include clearing vegetation to provide access for machinery, temporarily diverting the flow of water, removing sediment and debris from the stream channel, and stabilizing the banks and slopes. The potential environmental effects of these works include:

- Direct loss of or disturbance to fish and/or wildlife and/or their habitat;
- Direct loss of natural riparian vegetation through:
  - Physical disturbance
  - Introduction or spread of invasive weeds
- Introduction of deleterious substances into lower Lagace Creek; and
- Noise disturbance to wildlife and/or physical disturbance of aquatic and terrestrial habitat.

3.1 Temporary Disturbance and/or Loss of Fish and Fish Habitat

Instream works on lower Lagace Creek are scheduled to occur during the regional least-risk fish window for the species occurring in the creek (i.e., August 1 to September 15). Instream works may temporarily disturb fish habitat in lower Lagace Creek during the flood restoration activities; however, this effect can be mitigated if work areas are isolated, and flow and fish access are maintained around the isolated area. Mitigation measures, including instream isolation (e.g., silt curtain), will be installed during the least-risk window. Fish will be salvaged in isolated work zones in lower Lagace Creek before sediment is removed and will be moved upstream or downstream. To mitigate downstream impacts to Hatzic Slough from siltation or pollution, standard best management practices for equipment and spill prevention will be applied and erosion and sediment control measures will be implemented.

Removing excess sediment and debris from 14 discrete locations in lower Lagace Creek has the potential to alter or eliminate rearing or potential overwintering habitat in this stretch of the creek. However, this effect would likely only be short term, and higher-value habitat exists further upstream along the channel. Further, removing the sediment is

intended to restore the creek to its pre-atmospheric river event condition and improve flow in the channel. Approximately 3,000 m^2 of vegetation clearing is anticipated to facilitate access to, and construction of, the new sand recovery stations. The bank will be re-seed and planted with live stake clusters. Only minor trimming and pruning of vegetation is anticipated to expose the existing stations. Planting live willow stakes to protect the banks from erosion at four locations in lower Lagace Creek will further improve streamside cover along the channel.

No permanent disturbance or loss of fish or fish habitat is anticipated as a result of the works in lower Lagace Creek. Sediment and erosion control measures and spill prevention and response plans will be implemented to prevent deleterious substances from entering Hatzic Slough.

3.2 Temporary Disturbance and/or Loss of Vegetation, Wildlife, and Wildlife Habitat

Loss of riparian vegetation and disturbance to wildlife and wildlife habitat are primarily associated with site access. Access is primarily via existing roads, with only minor vegetation trimming and pruning, however, approximately 3,000 m^2 of vegetation clearing is anticipated for construction of the three new sand recovery stations. Access routes will be field fitted to avoid mature trees and snags (i.e., standing, dead, or dying trees) with large cavities, where possible. Clearing will occur under the direction of a qualified environmental professional (QEP) engaged by the contractor to ensure that sensitive habitat is avoided as much as possible, or where it can't be avoided, that appropriate mitigations are implemented, including salvage and relocation of individuals. Currently, works are scheduled to be conducted between August 1 and September 15, which overlaps with the end of the regional migratory breeding bird window of mid-March to mid-August. Therefore, a QEP may need to conduct pre-clearing nest surveys.

Machine access to the sand recovery stations has the potential to disturb amphibians that may be sheltering and/or foraging in upland areas near the creek (CDC 2023b). Removing sediment from within lower Lagace Creek has the potential to disturb breeding or juvenile amphibians in pools or along the edges of the creek, in areas of low water flow velocity. Before construction begins, a QEP should conduct surveys for amphibian species at risk where suitable habitat exists. If amphibians are found, they should be salvaged and relocated to suitable nearby habitat before upland or instream habitat areas are disturbed. Replacing large woody debris along lower Lagace Creek after sediment is removed and restoring the banks using bioengineering techniques will re-establish cover along this potential movement corridor.

Several signs of woodpecker feeding were detected in the lower Lagace Creek Project area. Cavities with the size, shape, and placement typical of pileated woodpecker nests were not detected; however, the presence of pileated woodpeckers in the Project area indicates that nest cavities may exist within the Project extents. Pileated woodpeckers are listed in Schedule 1 of the *Migratory Birds Regulations, 2022*, and cavity nests of this species are afforded enhanced nest protection, which includes designated wait times before a nest is declared abandoned and may be removed. Tree clearing may be required in the vicinity of Dale Road, for the construction of the three new sand recovery stations, and the area should be surveyed for pileated woodpecker nest cavities, by a QEP, prior to the start of construction. If a pileated woodpecker nest cavity is detected, access routes and laydown areas should be sited to avoid the nest tree. Further, if construction work is anticipated within 30 m of a pileated woodpecker nest, additional monitoring may be required before construction begins to determine whether the nest is occupied and to develop a plan to avoid disturbing nesting birds.

Flood restoration works have the potential to spread invasive plant species within the Project area. Invasive plant species were documented throughout the stream channel of lower Lagace Creek, including numerous patches of

Japanese knotweed, which is designated as a noxious weed in Schedule A of the provincial *Weed Control Regulation*. In addition, yellow floating heart (*Nymphoides peltata*) has been reported in Hatzic Lake and is presumed to occur in the Project area. Site-specific measures will be required during construction to mitigate further spread of Japanese knotweed, yellow floating heart, and other invasive plants.

Approximately 3,000 m^2 of vegetation will be removed to facilitate construction of the new sand recovery stations. The bank will be restored with a combination of riparian seed mix, live stake clusters, and planting of 12 new bigleaf maple trees along the access road.

4 MITIGATION MEASURES

All works will follow the measures provided in the *Water Sustainability Act* Section 11 change approval, emergency *Fisheries Act* authorization, and standard best management practices. This EMP provides further mitigation measures to protect valued components in the Project area during and after works. The contractor is responsible for implementing the mitigation measures, and the QEP is responsible for monitoring and reporting on the implementation of the mitigation measures and providing guidance to the contractor as required.

4.1 Environmental Monitoring

The contractor will retain an independent environmental monitor (EM) who will be on site full time, including before and during vegetation clearing, site isolation, fish and amphibian salvage, dewatering (if required), and diversion and reinstatement of flow, as well as during all in-water works, during or immediately after rain events, or any other works in environmentally sensitive areas that may be adversely affected. The EM will be a QEP and will:

- Prepare a site-specific CEMP before construction begins for review and approval by the ENV representative.
- Stop construction if activities contravene the mitigation measures recommended in this EMP or the permit conditions, if activities have the potential to harm the natural environment or if weather conditions are no longer conducive to instream works. Stop work orders must be accompanied by clear directives and restarting expectations. Only the EM has the authority to approve the resumption of works after a stoppage, once they confirm the environmental risk has been managed.
- Implement the protection measures detailed in this EMP and the CEMP.
- Obtain a fish collection permit (Fisheries and Oceans Canada) and a scientific fish collection permit (Ministry of Water, Land and Resource Services), and salvage fish as required, before instream works begin, or support Leq'á:mel First Nation in salvage efforts.
- Obtain a general wildlife permit (Ministry of Forests) and salvage wildlife (e.g., western toad, northern red-legged frog), as required, before clearing activities begin.
- Prepare all permit reporting as required and submit it to agencies after salvage.
- Visit the site during instream work and any work in sensitive areas and attend all key meetings at which environmental protection measures are discussed.
- Monitor turbidity in lower Lagace Creek upstream and downstream of the work areas routinely during sediment removal and ensure that turbidity levels adhere to the guidelines outlined in the BC Approved Water Quality Guidelines for aquatic life (ENV 2023c).
- Prepare and submit daily monitoring reports detailing the works on site and the mitigation measures in place and report any incidents or contraventions.

- Provide any necessary recommendations that will improve the effectiveness of the environmental mitigation measures.
- Document any environmental incidents or accidents that occur and provide guidance in addressing such incidents.
- Prepare necessary site-specific restoration plans that should be implemented after construction in accordance with environmental permits and this EMP.
- Oversee site-specific mitigation and protection measures as outlined in the sections below, including:
  - Field-fitting access routes to avoid large-diameter trees (i.e., >20 cm diameter), dead standing snags, and trees with cavities
  - Conducting pre-clearing nest surveys and salvaging wildlife and fish where required
- Oversee management and disposal of noxious weeds (i.e., Japanese knotweed) and provincial priority invasive species.
- Prepare a final completion report for the Project within 20 days of completing construction to summarize the information collected during monitoring, any actions taken on the part of the contractor, and any potential future environmental impacts that could occur on site.

4.2 Timing of Works

Instream works on lower Lagace Creek are scheduled to occur within the regional least-risk fisheries window of August 1 to September 15. The contractor will isolate instream work areas before sediment is removed (e.g., installing a silt curtain), maintaining clean downstream flow. A QEP will be present during all in-water works and must be prepared to monitor sediment removal full time in case breaches in the silt curtain occur. Vegetation clearing may overlap with the end of the regional breeding bird window in early August; pre-clearing nest surveys by a QEP may be required. Willow cuttings are harvested and planted during the dormant season (i.e., September to May), therefore, bioengineering installation will occur outside the regional least-risk fisheries window. Installation of the live stakes is to occur by hand and will start at the toe of slope above the wetted width. All activity including foot traffic will be restricted to above the water's edge and appropriate site isolation will be installed along the banks to prevent the migration of sediment.

4.3 Protection of Aquatic Habitat

The following general mitigation measures are intended to avoid or minimize impacts on instream habitat during construction:

- Complete work in the dry, during periods of low water, or isolate the work area.
- Isolate the instream work zones to mitigate sediment migration, either by diverting flow around the isolated areas via pumps or temporary diversion channels, or by installing silt curtains, and maintain upstream fish passage, as required, as sediment is removed.
- Install instream isolation during the regional least-risk fisheries window of August 1 to September 15, and ensure instream isolation is maintained until the works are complete. If instream works are anticipated to extend beyond the least-risk window, ensure that the work area is completely isolated, and that upstream fish passage is unimpeded.
- Use fish-friendly screens on all pumps (DFO 2020).

- Monitor downstream turbidity during construction and compare the results to background measurements collected upstream of the sites.
- Correct any failure of sediment and erosion control measures immediately to contain turbid water in the Project footprint, and document the incident.
- Reinstate isolation and salvage fish in the work areas again after heavy rainfalls resulting in high flow.
- Reintroduce water to isolated areas gradually after completing the instream works to prevent a large pulse of sediment from being released downstream.

4.4 Protection of Vegetation

The following general mitigation works are intended to avoid or minimize impacts during vegetation clearing and bank restoration works:

- Minimize vegetation removal, especially large-diameter trees (i.e., >20 cm diameter) and dead standing snags.
- Field-fit access routes to avoid large-diameter trees, dead standing snags, and trees/snags with cavities.
- Choose access points that cause the least damage to terrestrial habitat.
- Specify that barriers be established along the construction limits to prevent accidental intrusion and encroachment on the adjacent forest habitat.
- Restore cleared and disturbed areas by reseeding or planting once construction is complete, and use native species in the restoration plan.
- Install live cuttings of native species for bioengineering during the dormant season (i.e., September to May) and adhere to guidance noted in the engineered design drawings (Appendix B). Before planting cuttings, soak them for at least 24 hours but no longer than 14 days. Implement a watering program for the first growing season after planting.

4.5 Protection of Wildlife

The following general mitigation measures are intended to avoid or minimize impacts on wildlife:

- Site access routes to avoid sensitive habitat and wildlife features (e.g., amphibian habitat, tree cavities).
- Salvage for all species at risk (e.g., western toad, northern red-legged frog) before construction begins, where suitable habitat exists in the Project footprint.
- Install appropriate wildlife isolation fencing to prevent salvaged wildlife from returning to the construction area.
- Follow the Best Management Practices for Raptor Conservation during Urban and Rural Land Development in British Columbia (FLNRO 2013).
- Retain large-diameter trees (i.e., >20 cm diameter) and dead standing snags, where possible.
- Survey for pileated woodpecker nest cavities and protected raptor nests within the proposed clearing footprints before works occur.
- Schedule construction timing to avoid clearing and grubbing within the peak migratory bird nesting window of March 12 to August 17 (ECCC 2023a). Specify that a nest survey be conducted in advance by a QEP to confirm that there will be no disturbance to occupied bird nests and/or eggs if clearing during the nesting period is unavoidable.

- Educate the contractor and crew of the species at risk that have the potential to occur in the area (i.e., western toad, northern red-legged frog). If any species at risk are encountered, halt works, contact the EM, and salvage or mitigate as appropriate.
- Specify that construction avoid typical high-activity periods for wildlife, such as dawn or dusk, whenever possible.
- Specify that standard best management construction practices be implemented to minimize construction noise.
- Implement a waste management system to avoid attracting wildlife, including appropriate containment or removal off site.
- Salvage and stockpile coarse woody debris and replace it after works are complete to re-establish instream cover and habitat complexity along the channel.
- Replant all exposed and disturbed areas on the creek banks using appropriate native vegetation, under the direction of a QEP, to re-establish cover for wildlife.
- Revegetate all cleared areas immediately after construction, under the direction of a QEP.

4.6 Weed Management

The *Weed Control Act* (RSBC 1996, c. 487) states that any noxious weed species must be controlled by the owner of the land on which the weeds occur. The following measures are intended to reduce the potential for introduction, transfer, or establishment of invasive plants and noxious weeds:

- Identify areas of invasive plants (e.g., Japanese knotweed, Himalayan blackberry, common tansy) within the Project area, remove the plants with their root structures, and dispose of them off site (i.e., to an appropriate location and method to prevent their proliferation in adjacent areas).
- Handle noxious weeds (i.e., Japanese knotweed) according to their management provisions and under the guidance of the EM (BC GOV 2023). Soils near noxious weed sites will potentially be contaminated (i.e., may contain seeds, root material) and should not be used for site reclamation to prevent further spread. Restore these areas quickly to prevent re-establishment.
- Treat yellow floating heart with an aquatic herbicide before removing sediment, if it is confirmed in the Project area. Develop a treatment plan in collaboration with the Ministry of Forests, via the Inter-Ministry Invasive Species Working Group, and obtain a pesticide use permit.
- Ensure all vehicles accessing the sites are clean and free of weeds and any associated seeds before entering or leaving the worksites. Implement a program on site to ensure all vehicles and machines are inspected before they enter or leave the worksites, including a designated cleaning station.
- Design and implement a restoration plan to re-establish disturbed areas after construction.
- Dispose of sediment at an approved facility.

4.7 Erosion and Sediment Control

The following erosion and sediment control measures are intended to avoid or minimize impacts during construction:

- Install appropriate site isolation, including silt curtain and/or fencing, before instream works begin, as required.
- Tie the ends of the silt curtain or silt fence into the shoreline or bank, as required, to prevent the escape of sediment-laden water.

- Restrict isolation to the area required for instream work.
- Install erosion and sediment control measures on all disturbed areas, including banks and access routes.
- Inspect erosion and sediment control structures regularly and after major rainfalls to ensure continued effectiveness, and to identify where replacement or maintenance are required and where trapped sediment needs to be removed. Maintain or repair erosion control structures as soon as practicable.
- Operate all machinery from outside the wetted channel or in isolation of flowing water.
- Monitor downstream turbidity and background/upstream turbidity routinely during instream works, and during and after significant rain events (i.e., >25 mm within 24 hours).

4.8 Fuel Storage and Spill Contingency Plan

Storage Facilities

- Contain and store all construction materials, equipment, and liquids at least 30 m away from the watercourse and all tributaries.

Orientation and Training

- Train all construction personnel to use spill prevention and control equipment before construction begins.
- Explain the spill reporting procedures to all personnel. Provide all personnel with the spill response and reporting guidelines in an easy-to-follow, written format.

Environmental Best Management Practices

- Ensure that a fully stocked and appropriately sized spill kit is stored nearby and ready for use.
- Refuel at least 30 m from the top of any watercourse, or at such a distance that petroleum products will not be released into surface drainage.
- Prevent fuel overflow or spillage. Ensure that fuel tanks have connections that shut off automatically when the container is full.
- Collect condensation siphoned from fuel tanks in a separate tank for disposal in a licensed facility.
- Ensure all equipment used on site is in sound mechanical condition. Do not use equipment with fuel leaks or deteriorated hydraulic hoses. Other precautions to be followed are:
    - Inspect equipment daily and keep it clean and free of oil, grease, coolant, and other contaminants.
    - Install drip trays on stationary equipment working on site to contain leakage of fuel, lubricant, or any other fluid.
    - Use biodegradable hydraulic fluids at all times when working in the watercourse channel.
    - Ensure all machinery complies with applicable provincial and federal regulations for operations and exhaust emissions. Exhaust systems must work well enough to control noise to normal operating levels.

Spill Response

- Ensure safety:
    - Ensure personal, public, and environmental safety.
    - Wear appropriate protective gear.
    - Identify the product spilled before cleanup.

    - Warn people in the vicinity.
    - Ensure no ignition sources are present if the spill is flammable.
- Stop the flow:
    - Act quickly to reduce the risk to the environment.
    - Close valves, shut off pumps, or plug leaks.
    - Stop the flow at its source.
- Secure the area:
    - Limit access to the area.
    - Prevent unauthorized entry onto the site.
- Contain the spill:
    - Prevent the spill from entering any drainage structures (e.g., ditches) or watercourses.
    - Use spill-absorbent material to contain the spill.
    - Minimize environmental contamination.
- Notify/report spills (Section 4.9).

The contractor must notify the EM and the project manager of all spills and the cleanup status. The contractor will confirm that spill kits and other spill containment materials are replenished and readily available for use in the future.

4.9 Environmental Incident Reporting

An environmental incident is one that has adversely impacted the environment, including:

- Adverse impacts on the quality of air, land, water, wildlife, fish, habitat, aquatic species, or species at risk;
- Unauthorized release or discharge to the environment;
- Exceedance of compliance requirement limits as documented in a regulatory instrument (e.g., permit, order, licence, authorization, agreements);
- Violation of legislation, related policies, or regulations; and
- Alteration of, or damage to, existing infrastructure.

The reporting of spills is mandated by the *Spill Reporting Regulation* (BC Reg. 187/2017) of the *Environmental Management Act* (SBC 2003, c. 53).

Generally, on-site personnel will notify the contractor of any event that could potentially result in an adverse effect to safety or the environment (e.g., wildlife incident, accident on site, fuel or oil spill, concrete spill, machinery failure, or introduction of a deleterious substance into a waterbody). The contractor will then determine, in consultation with the EM, the correct and required course of action. The agreed-on action will be implemented immediately, and the contractor will report the event to the project manager.

The EM will complete an environmental incident report for all environmental incidents, including spills. The incident report will include:

- Name and telephone number of the person who reported the incident;
- Name and telephone number of the person who caused the incident;
- Location, cause, and a description of the surrounding area;

- Type (including safety data sheet number) and quantity of any spilled material;
- Details of the incident response, including the location of the disposal site of waste material;
- Names of all people on the scene, including Ministry representatives;
- Names of people and agencies notified after the incident;
- Sequence of events, including notifications and timing; and
- Comments on the handling of the incident.

The *Spill Reporting Regulation* requires all persons who manage hazardous materials to report spills of any size into water immediately and to report only significant spills on land to the Provincial Emergency Program (PEP) at 1-800-663-3456. The types of materials likely to be present at the Project site and the amount of spill above which the PEP must be immediately advised include:

- Fuels, engine oils, and hydraulic oils: 100 L;
- Petroleum oils and emulsions: 100 L;
- Antifreeze: 5 L; and
- Propane: 10 kg.

Under the *Environmental Management Act*, the person who had possession, charge, or control of the substance immediately before its spill must immediately report the spill to the PEP. A report to the PEP must include, where applicable:

- Name and telephone number of the person who reported the spill;
- Name and telephone number of the person who caused the spill;
- Location and time of the spill;
- Type and quantity of the substance spilled;
- Cause and effect of the spill;
- Details of action taken or proposed;
- Description of the spill location and the area surrounding the spill;
- Details of further action contemplated or required;
- Names of any agencies on the scene; and
- Names of other persons or agencies advised concerning the spill.

4.10 Project Area Restoration

The contractor must remove all construction materials from the Project site after the Project is complete. The Project site must be left in a condition acceptable to the EM and the ENV representative. If trees were removed, the EM will recommend planting to replace lost vegetation appropriate to the site conditions, detailed in a site-specific restoration plan. Access points will be regraded and seeded or planted with native species, as necessary.

After sediment removal is complete and bioengineering plantings installed, the EM will prepare a final report summarizing the information collected during monitoring, any actions taken on the part of the contractor, and any potential future environmental impacts that could occur on site. The Project completion report will include the final instream and riparian footprint areas.

As the Project proponent, ENV will monitor post-construction effectiveness after restoration is complete according to the terms of the *Water Sustainability Act* change approval and Fisheries and Oceans Canada authorization.

5 ENGAGEMENT

5.1 First Nations

Representatives from Leq'á:mel, Sumas, and Matsqui First Nations are members of the Hatzic Valley Emergency Works Task Force, which is a decision-making body that guides the activities related to ENV's flood response through the Flood Debris Management Secretariat. Meeting minutes are available on request. To date, no environmental issues of concern specific to this site have been raised.

5.2 Landowners

Private landowners with parcels along the channel where instream works are proposed and where access through property is required have been notified of ENV's emergency works program, and preliminary engagement is underway (Table 5-1). Zenith Appraisal & Land Consulting Ltd. is working with the affected landowners, on behalf of ENV, to finalize access agreements. The BC Ministry of Transportation and Infrastructure has also been engaged, as some of the proposed works will occur within the road right-of-way.

Table 5-1 Properties Overlapping the Footprint of Flood Restoration Works

PID	Property Address	Property Owner
008-042-217	10491 Farms Rd., Mission V2V 4J1	Achhatter S. Jhulley Baljit K. Jhulley
009-506-683	35210 Youngston Rd., Mission V2V 4J1	Carl David Penner
010-941-606	Patterson Rd., Mission V2V 4J1	Robert John Dale
010-941-614	Patterson Rd., Mission V2V 4J1	Robert John Dale
010-941-622	Patterson Rd., Mission V2V 4J1	Robert John Dale
010-941-673	35118 Dale Rd., Mission V2V 0B7	Robert John Dale
011-054-778	10285 Farms Rd., Mission V2V 4J1	Stephen John Anderson
011-062-355	35225 Dale Rd., Mission BC, V2V 0B7	Sheri Robina Hancock Douglas Todd Hancock

6 SUMMARY

Table 6-1 summarizes the proposed flood restoration works, including the scope of activities and the construction schedule.

Table 6-1 Summary of Instream Impacts Associated With Proposed Flood Restoration Works at Lower Lagace Creek in Hatzic Valley

Stream	Description of Works Impacting the Stream (With Rationale)	Area of Impact (Dimensions)			No. of Days Required to Complete Work	Timing of Works	Potential Aquatic and Riparian Benefits and/or Impacts			Proposed Avoidance/Mitigation Measures
		Average Assumed Depth (m)	Area	Length Along Creek (m)			Aquatic Ecosystem	Water Quality	Water Quantity	
Lower Lagace Creek	Construction of 3 new sand recovery stations. Sediment removal from 14 discrete locations to increase hydraulic capacity in the creek Erosion protection: Bioengineering at three discrete locations	- Varies; maximum depth 2.8 m –	10,500 m^2 (volume of 8,250 m^3) 720 m^2	360 370	21 ~60	August 1–September 15, 2024 October or November 2024	Instream habitat will be disturbed temporarily during construction.	None; appropriate erosion and sediment control measures will be implemented.	None; water flow will be maintained either via bypass pump or silt curtain.	• Conduct works in the dry, or isolate instream work zones. • Restore or improve channel functionality. • Stabilize banks with bioengineering. • Minimize clearing associated with access routes and revegetate immediately after construction.

CLOSURE

This report was prepared for the Ministry of Environment and Climate Change Strategy to assess the potential impacts to the environment from the proposed Project design and to recommend mitigation measures to reduce or eliminate the potential impacts of the works on the aquatic and terrestrial environments. The contractor is responsible for implementing the mitigation measures provided in this environmental management plan, under the guidance of an independent environmental monitor. Please contact the undersigned if you have any questions or concerns about the information provided.

The services provided by Associated Environmental Consultants Inc. in the preparation of this report were conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practising under similar conditions. No other warranty expressed or implied is made.

Respectfully submitted,

Associated Environmental Consultants Inc.

Submitted digitally.

Naomi Sands, R.P.Bio.
Environmental Scientist

Dave Muhlert, R.B.Tech.
Environmental Technologist

Reviewed by:

Jennifer Privé, R.P.Bio.
Manager, Environmental Sciences

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APPENDIX A – PRELIMINARY RISK ASSESSMENT LETTERS

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#500 - 2889 East 12th Avenue
Vancouver, BC, Canada, V5M 4T5

TEL: 604.293.1411
FAX: 604.291.6163
www.ae.ca

June 24, 2022
File: 2022-2462-00

Fred Bjork, P.Eng.
Price Waterhouse Coopers
Submitted via email: fred.bjork@pwc.com

Re: PRELIMINARY SITE ASSESSMENT OF POTENTIAL AREAS OF IMMEDIATE CONCERN
PWC SITE ID: S-CR-14 - 10491 FARMS RD, HATZIC, BC

Dear Mr. Bjork:

The purpose of this high level and preliminary assessment of identified potential Areas of Immediate Concern is to allow the Province of BC to review and consider risks, potential consequences, and to prioritize urgent mitigation measures, including removal of sediments introduced by the 2021 Atmospheric River event (and other potential mitigation measures). The objective is to avoid hydraulic restrictions in the waterways and associated flooding due to the upcoming 2022 spring freshet, which may cause additional damage to riverbeds, banks, and infrastructure, and pose a significant threat to the safety of people, properties, infrastructure, and the environment.

1 SITE INFORMATION

Site ID: S-CR-14
Site Location: 49.191343, -122.250592
Site Description: 10491 Farms Rd, Hatzic, BC
Local Government Agency: Fraser Valley River District (FVRD)
Waterbody: Lagace Creek

The site location is shown in **Figure 1** and **Figure 2** located at the end of the letter.

2 SITE HAZARD

2.1 HAZARD ASSESSMENT METHODOLOGY

The assessment, as summarised in this letter for the noted Area of Immediate Concern, follows the following general methodology and approach:

1. High level senior engineering level experience and judgement, review of available relevant reference information, site visits and visual inspections, and communication with relevant stakeholders;
2. Risk assessment; and
3. Identification and advice on prioritized and appropriate mitigation measures (if any), their required timing, and further work required to validate such advice.

A Carbon Neutral Company

CANADA BEST MANAGED COMPANIES Platinum member

Associated Engineering (AE) completed the assessment of the above-noted site, based on a site visit completed on April 5, 2022 and a review of the background data noted in **Section 3**.

2.2 HAZARD ASSESSMENT SUMMARY

The November 2021 Atmospheric River resulted in significant flooding and widespread sediment deposition throughout Lagace Creek. Sediment from the steeper upstream portions of the Hatzic Lake watershed were transported to and deposited throughout downstream reaches of Lagace Creek.

According to Northwest Hydraulic Consultants (NHC) *Flood Damage Recovery Plan. Lagace Creek, Hatzic Valley* (2005, June) report, it appears that the Lagace Creek Reach 1 (upstream of Hatzic Lake to the Dale Road Crossing) has been heavily aggraded in the past few years. Frequent flooding of the area has been reported by landowners not only during high-flow events but also during successively lower flows. Sediment deposition appears to be a regular occurrence during high-flow events as noted in the NHC report. This aggradation has an impact to the channel capacity and water levels of the creek.

Based on a review of previous assessments of Lagace Creek and available historical imagery, it appears that there is a history of deposition and bank erosion along this creek. High flows are generated during fall and winter storms, such as an atmospheric river, rather than a freshet (snowmelt) event.

During our site assessment of 10491 Farms Road, we noted the following:

1. Some sediment deposition was observed at the bottom of the Lagace Creek; however, due to the high water levels of Lagace Creek, the extent of the deposition was not discernable during our site visit;
2. Localized stream bank erosion was observed upstream and downstream of the Youngston Road bridge. Bank erosion is likely due to higher flow volume, velocities and sediment deposition from the November 2021 event;
3. At the time of this assessment, water levels in Lagace Creek were observed to be backing up into the Youngston Road ditches limiting the conveyance capacity of the ditch. This creates an increased risk of flooding of adjacent areas; and
4. Roadway ditches along Youngston Road are currently filled with debris and sediment also impacting the overall conveyance capacity of the ditch.

In our opinion, the available hydraulic capacity of the creek is not adequate for typical spring and summer flows. Due to the heavily aggraded Creek bottom and increased water levels in the creek, the risk of damage to the Youngston Road bridge and existing properties is considered high. Site improvement should be completed immediately to reduce the risk to nearby properties.

3 PRELIMINARY RISK EVALUATION

The Preliminary Risk Evaluation for the site is shown in Table 3-1. The risk key is included in Enclosure A for ease of reference.

Table 3-1:
Preliminary Risk Evaluation

Category	Preliminary Risk Evaluation	Anticipated Consequence
Public Health and Safety	High	Road and land conditions that make travelling and accessing property dangerous. Flooding of houses.
River Capacity	High	River capacity has been significantly reduced due to sediment deposition.
Environmental	High	Increased frequency and duration of flooding of agricultural areas is expected to result in financial losses to farmers.
Infrastructure	High	Residential and agricultural structures at increased risk of flooding.

Based on the preliminary risk evaluation noted above, we assess the risk to be **High**. On this basis, we confirm that the site remains an Area of Immediate Concern.

The Preliminary Risk Evaluation is based on the following currently available information:

1. Background Reports:
    a. Northwest Hydraulic Consultants (NHC). (2005, June). *Flood Damage Recovery Plan. Lagace Creek, Hatzic Valley.*
    b. Associated Engineering. (1992, August). *Hatzic Prairie Drainage Study Volume 1.*
    c. Stirling Geoscience Ltd. (2021, December 16). *Hatzic Prairie Creek Assessment and Preliminary High-Level Mitigation Cost Estimate, Hatzic Prairie, BC. - DRAFT*
2. Site Assessment completed on April 5, 2022;
3. Phone Conversation with Jamie Stirling, P.Eng. on April 6, 2022;
4. Google Satellite Imagery;
5. Discussions with FVRD staff; and
6. Debris assessment mapping and GIS base data (hydrology, provided by Emergency Management BC)

4 SITE OPINION AND ADVICE

Based on the hazard and risk assessment, it is our opinion that Site S-CR-14 is an Area of Immediate Concern (AIC), requiring further assessment, emergency work, and potential mitigation measures to be implemented as soon as possible:

Emergency Works (ASAP):

1. Remove sediment deposition on Lagace Creek upstream and downstream of the Youngston Road Bridge to increase channel capacity. Extend of sediment removal to be confirmed through additional field investigation.
2. Remove debris from ditches.

Long-Term Holistic Solutions (to current Codes and Standards):

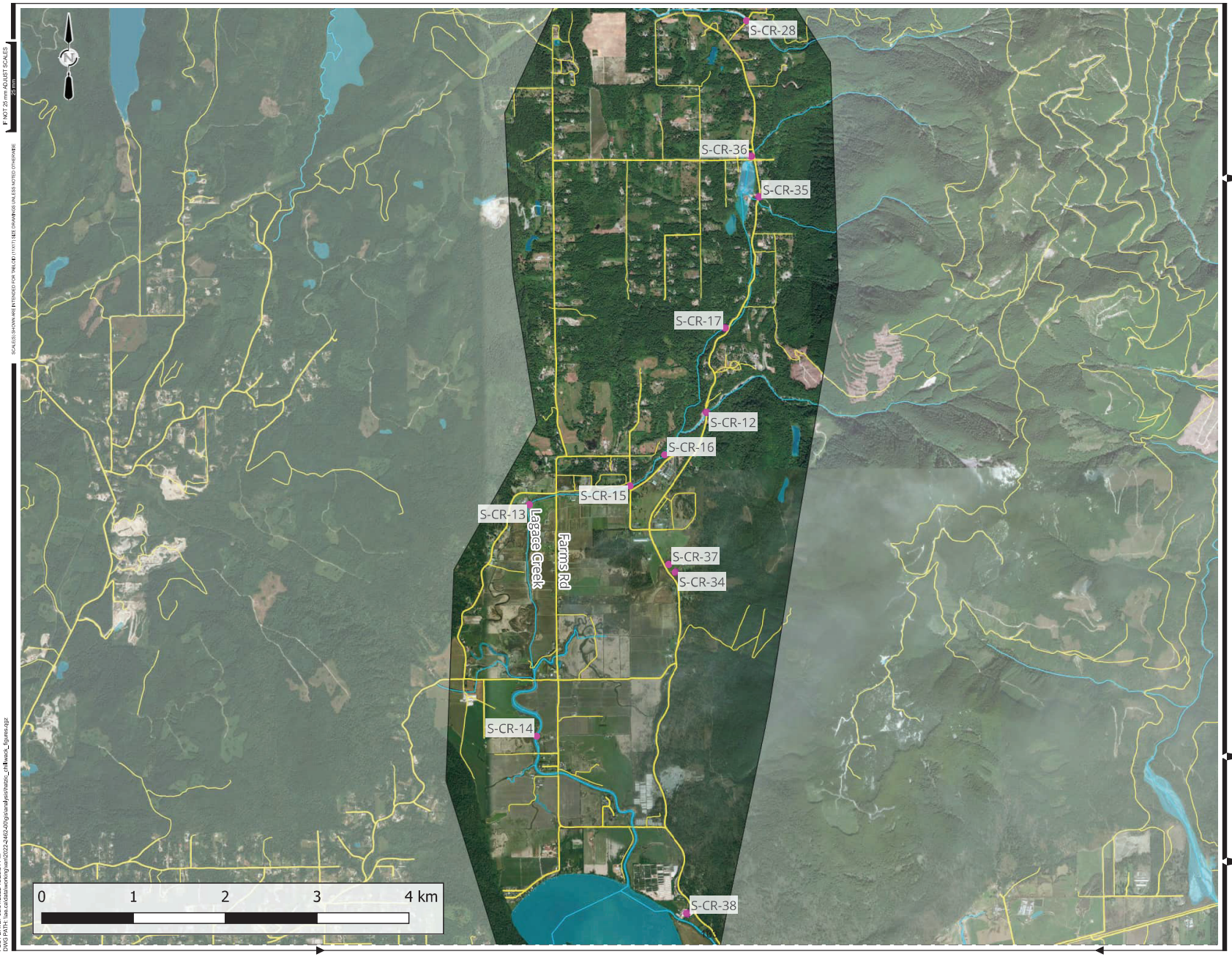
1. Complete a hydraulic capacity assessment of the creek channel.
2. Restore the channel's hydraulic capacity by:
   a. Coordinating with FVRD and environmental regulators;
   b. Sediment removal, as required, based on the results of hydraulic capacity assessment;
   c. Bank restoration; and
   d. Installation of riprap on channel banks. Locations and extents to be determined as part of the hydraulic capacity assessment.

5 CLOSURE

Please contact Andrew Wiens at 403-863-4009 if there are additional questions or concerns.

Yours truly,

Prepared by:	Reviewed by:
Lisbeth Medina, P.Eng. (Alberta) Water Resources Engineer LM/AW/fd/kc	Andrew Wiens, P.Eng. (BC) Senior Water Resources Engineer



Associated Engineering

BEST MANAGED COMPANIES
Platinum member

Legend

- Roads
- Watercourse
- Waterbodies
- Problem Location (Site)

NOTE: AERIAL IMAGERY PROVIDED BY BING AERIAL MAY NOT REFLECT CURRENT CONDITIONS DUE TO FLOOD EVENTS SINCE THE DATE OF COLLECTION

PROJECT LOCATION



pwc

FIGURE 1

PRICEWATERHOUSE COOPERS
BC MINISTRY OF ENVIRONMENT

WATERWAY SEDIMENT ASSESSMENT
PWC HATZIC PRARIE SITE OVERVIEW

AE PROJECT No.	20222462-00
SCALE	AS SHOWN
APPROVED	A. WIENS
DATE	20220531
REV	A
DESCRIPTION	ISSUED FOR FINAL

IF NOT 25 mm ADJUST SCALES
25 mm

SCALES SHOWN ARE INTENDED FOR 11"x17" SIZE DRAWINGS UNLESS NOTED OTHERWISE

PLOT DATE: 05/31/2022 12:25:34 PM
DWG PATH: \\ae.ca\data\work\projects\2022-2462-00\gis\analysis\hatzic_chilliwack_figures.aprx



Associated Engineering

BEST MANAGED COMPANIES
Platinum member

Legend

- Roads
- Watercourses
- Waterbodies
- Problem Location (Site)

NOTE: AERIAL IMAGERY PROVIDED BY BING AERIAL MAY NOT REFLECT CURRENT CONDITIONS DUE TO FLOOD EVENTS SINCE THE DATE OF COLLECTION

PROJECT LOCATION



pwc

FIGURE 2

PRICEWATERHOUSE COOPERS
BC MINISTRY OF ENVIRONMENT

WATERWAY SEDIMENT ASSESSMENT
PWC SITE: S-CR-14
FARMS RD NEAR YOUNGSTON RD

AE PROJECT No.	20222462-00
SCALE	AS SHOWN
APPROVED	A. WIENS
DATE	20220427
REV	A
DESCRIPTION	ISSUED FOR FINAL

IF NOT 25 mm ADJUST SCALES
SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE
PLOT DATE: 04/28/2022 13:54:45 PM
DWG PATH: \\ae.ca\data\working\per\2022-2462-00\gis\analyses\hatzic_chilliwack_figures.qgz

Enclosure A – Risk Matrix

Risk Evaluation and Response						
	Consequence Rating	**Very Low**	**Low**	**Medium**	**High**	**Very High**
Indices	**Public Health and Safety**	Minor disruption to few.	Minor, short term disruption to local community or moderate disruption to few.	Moderate disruption to local community, or substantial disruption to few.	Moderate, long term disruption to local community.	Substantial, long term disruption to region.
	River Capacity	Flow contained within the channel	Flow temporarily floods adjacent land	Flow floods adjacent lands resulting in prolonged flooding	Partial avulsion of flow resulting in flooding, erosion and scour damage to adjacent land and infrastructure	Full avulsion of flow resulting in flooding, erosion and scour damage to adjacent land and infrastructure
	Environmental	No noticeable loss or deterioration of habitat, species, unique landscapes, or culturally valued sites.	Small, short term loss or deterioration of important, unique, rare, or endangered habitat, species, landscapes, or culturally valued sites. Moderate, recoverable loss or damage of less valued habitat, species, landscapes, or sites.	Moderate temporary or small permanent loss or deterioration of important, unique, rare, or endangered habitat, species, landscapes, or culturally valued sites. Moderate loss or damage of less valued habitat, species, landscapes, or sites.	Moderate permanent loss or deterioration of important, unique, rare, or endangered habitat, species, landscapes, or culturally valued sites.	Major permanent loss or deterioration of important, unique, rare, or endangered habitat, species, landscapes, or culturally valued sites.
	Infrastructure	No infrastructure impacted	Impacts to infrastructure (minor erosion or scour, some debris accumulation, partial infilling, etc.) are not expected to have an impact of the operation of the infrastructure.	Impacts to infrastructure (erosion or scour, debris accumulation, infilling, etc.) leave infrastructure vulnerable	Impacts to infrastructure (erosion or scour, debris accumulation, infilling, etc.) should be repaired post-freshet	Impacts to infrastructure (erosion or scour, debris accumulation, infilling, etc.) will likely result in failure or irreparable damage to the infrastructure - repairs should commence pre-freshet
Likelihood	**Annual Exceedance Probability**	**Very Low**	**Low**	**Medium**	**High**	**Very High**
Very Likely	>0.2	**M**	**H**	**H**	**VH**	**VH**
Likely	0.2-0.1	**L**	**M**	**H**	**H**	**VH**
Moderate	0.1-0.02	**L**	**L**	**M**	**H**	**H**
Unlikely	0.02-0.005	**VL**	**L**	**L**	**M**	**H**
Very unlikely	<0.005	**VL**	**VL**	**L**	**L**	**M**

Risk Key			
	VH	Very High	Risk is unacceptable short-term (before next flood season); Risk reduction required
	H	High	Risk is unacceptable medium-term; Risk reduction plan must be developed and implemented in a reasonable time frame
	M	Medium	Risk may be tolerable; more detailed review required
	L	Low	Risk is tolerable; monitor
	VL	Very Low	Risk is broadly acceptable; no further review needed

APPENDIX B – DESIGN DRAWINGS

IF NOT 50 mm ADJUST SCALES
50 mm

SCALE(S) SHOWN ARE INTENDED FOR ANSI D (22X34) SIZE DRAWINGS, TABLOID (11X17) SIZE DRAWINGS ARE 1/2 OF SCALE (S) SHOWN UNLESS NOTED OTHERWISE

ROAD

EXISTING	DESIGN	
	100+000	CONTROL LINE
		GRAVEL ROAD
		EDGE OF PAVEMENT
		CURB (ACTUAL WIDTH)
		SIDEWALK (ACTUAL WIDTH)
		CURB DEPRESSION
		GUIDE RAIL

PROFILE VIEW

EXISTING	DESIGN	
		GROUND
		WATER MAIN
		SANITARY SEWER
		STORM SEWER

SURVEY

EXISTING	DESIGN	
HUB		SURVEY HUB
MON		MONUMENT
IP		IRON PIN
IPF		IRON PIN (FOUND)
LP		LEAD PLUG
U		UNIDENTIFIED MANHOLE
MW		MONITORING WELL
PZ		PIEZOMETER
OW		OBSERVATION WELL

CONTOUR

EXISTING	DESIGN	
		MAJOR
		MINOR

PROPERTY

EXISTING	DESIGN	
		PARCEL / LOT LINE
		EASEMENT
		STATUTORY ROW
		ROAD ROW

GAS / OIL

EXISTING	DESIGN	
G	G	GAS
OIL	OIL	OIL
		VAULT BOX
		VALVE BOX
		MANHOLE
		METER

WATER

EXISTING	DESIGN	
W	W	WATER MAIN
F	F	FIRE SUPPRESSION
IR	IR	IRRIGATION
RW	RW	RAW WATER
PW	PW	POTABLE WATER
		VAULT BOX
FH	FH	FIRE HYDRANT
W	W	MANHOLE
		METER CHAMBER
		CROSS FLANGE
		TEE FLANGE
		END CAP / PLUG
		GATE VALVE
		THRUST BLOCK
		45 DEGREE ELBOW
		90 DEGREE ELBOW
		WYE
ESM	ESM	ENCASEMENT
		WATER LEVEL
		COUPLING
		REDUCER
		WELL
CS	CS	CURB STOP / CURB BOX

SANITARY SEWER

EXISTING	DESIGN	
SS	SS	SANITARY SEWER
FM	FM	SANITARY FORCEMAIN
COMB	COMB	SANITARY COMBINED SEWER
S	S	MANHOLE
CB	CB	COMBINED MANHOLE
VC	VC	VALVE CHAMBER
CO	CO	CLEANOUT
		VALVE BOX
		FLOW DIRECTION
LS	LS	LIFT / PUMP STATION

COMMUNICATIONS / TELEPHONE

EXISTING	DESIGN	
CATV	CATV	CABLE
FO	FO	FIBRE OPTIC CABLE
T	T	TELEPHONE / LINE
UT	UT	UNDERGROUND TELEPHONE
		COMMUNICATIONS VAULT BOX
T	T	TELEPHONE MANHOLE
		TELEPHONE VAULT BOX
C	C	COMMUNICATIONS MANHOLE
T	T	TELEPHONE PEDESTAL

STORM DRAINAGE

EXISTING	DESIGN	
CP	CP	CULVERT (Ø AND TYPE)
D	D	STORM SEWER
CB	CB	CATCH BASIN
DCB	DCB	DOUBLE CATCH BASIN
DCB	DCB	DITCH INLET CATCH BASIN
CB	CB	CATCH BASIN / MANHOLE
LB	LB	LAWN BASIN
D	D	MANHOLE
STC	STC	STORMCEPTOR
OI	OI	OIL INTERCEPTOR
		VALVE BOX
CI	CI	CULVERT INLET
CO	CO	CULVERT OUTLET
		HEADWALL
		DITCH FLOW

ELECTRICAL / POWER

EXISTING	DESIGN	
P	P	POWER / COMM / CONDUIT
OP	OP	OVERHEAD POWER
UP	UP	UNDERGROUND POWER
		VAULT / HYDRO BOX
PB	PB	PULL BOX
J	J	JUNCTION BOX
TM	TM	TRANSFORMER VAULT MANHOLE
TP	TP	TRANSFORMER PAD
M	M	METER
E	E	MANHOLE
		LIGHT / LAMP STANDARD
		HYDRO / UTILITY POLE
		GUY WIRE
SIG	SIG	SIGNAL
SIG	SIG	SIGNAL WITH OVERHEAD ARM

MISCELLANEOUS

EXISTING	DESIGN	
X	X	FENCE
O	O	SILT FENCE
ABN		ABANDONED PIPE
		BOTTOM OF BANK
		TOP OF BANK
EW		EDGE OF WATER
		BUILDING
		200 YEAR FLOOD EXTENTS
		PROJECT EXTENTS
		PROJECT FOOTPRINT
		PROPOSED SAND RECOVERY STATION
		DENSE LIVE STAKING
		COCONUT MATTING

MISCELLANEOUS

EXISTING	DESIGN	
MAXIMUS CREEK		CREEK (OVER 3 m WIDE) (WIDTH OF CREEK SHOWN TO SCALE)
TP	TP	TEST PIT
BH	BH	BORE HOLE
FP	FP	FLAG POLE
PM	PM	PARKING METER
MB	MB	MAILBOX
		BOULDER
		RAILWAY SIGNAL LIGHT
BO	BO	POST/BOLLARD (ANNOTATE AS REQUIRED)
		NO POST BARRIER / JERSEY BARRIER (SCALE AS REQUIRED)
		SIGN
		GATE
		BUSH
		TREE (DECIDUOUS) (SCALE AS REQUIRED)
		TREE (CONIFEROUS) (SCALE AS REQUIRED)
EL1000	100.000	SPOT ELEVATION
% 2 1	% 2 1	SLOPE
413.5 413.4		GRID, CO-ORDINATE REGISTRATION

HATCH PATTERNS

- EXISTING SAND RECOVERY STATION
- PROPOSED SAND RECOVERY STATION
- EXISTING RIPRAP
- LIVE STAKE CLUSTERS
- SOIL
- SEDIMENT REMOVAL
- PERMANENT GRAVEL
- TEMPORARY GRAVEL
- COCONUT MATTING AND HYDRAULIC SEEDING

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BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: NTS

BRITISH COLUMBIA

GENERAL LEGEND

DRAWING	REVISION	SHEET
2632-03-G-3002	1	2

IF NOT 50 mm ADJUST SCALES
50 mm

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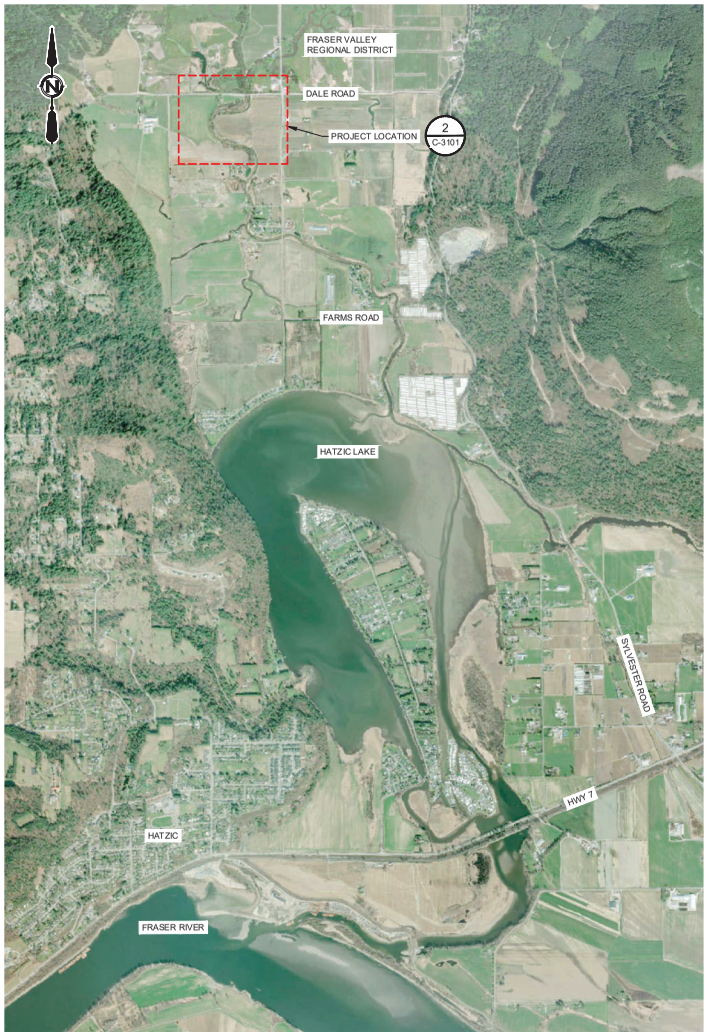
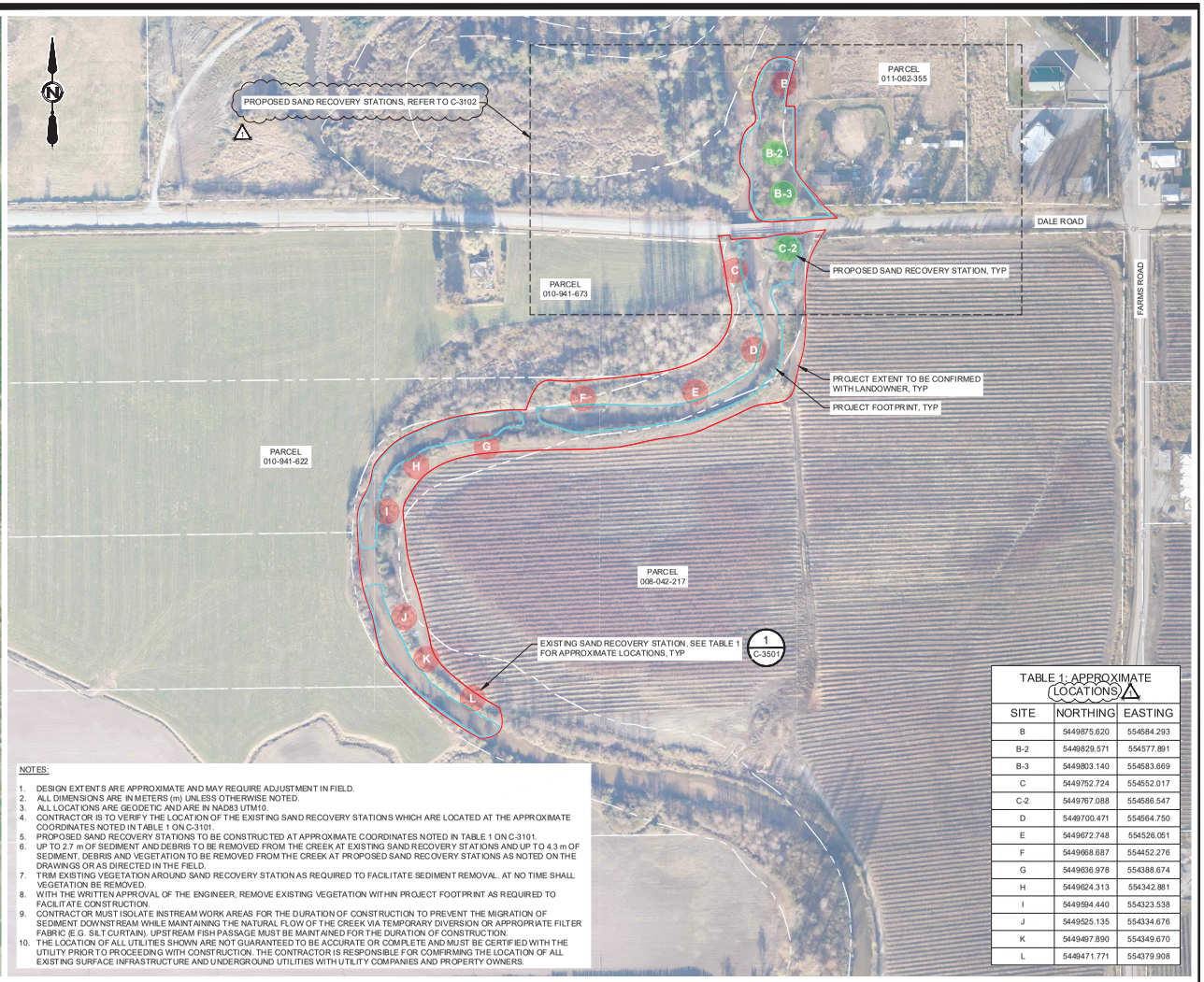


1 C-3101 PLAN NTS
REGIONAL AREA



NOTES:

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2. ALL DIMENSIONS ARE IN METERS (m) UNLESS OTHERWISE NOTED.
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4. CONTRACTOR IS TO VERIFY THE LOCATION OF THE EXISTING SAND RECOVERY STATIONS WHICH ARE LOCATED AT THE APPROXIMATE COORDINATES NOTED IN TABLE 1 ON C-3101.
5. PROPOSED SAND RECOVERY STATIONS TO BE CONSTRUCTED AT APPROXIMATE COORDINATES NOTED IN TABLE 1 ON C-3101.
6. UP TO 2.7 m OF SEDIMENT AND DEBRIS TO BE REMOVED FROM THE CREEK AT EXISTING SAND RECOVERY STATIONS AND UP TO 4.3 m OF SEDIMENT, DEBRIS AND VEGETATION TO BE REMOVED FROM THE CREEK AT PROPOSED SAND RECOVERY STATIONS AS NOTED ON THE DRAWINGS OR AS DIRECTED IN THE FIELD.
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8. WITH THE WRITTEN APPROVAL OF THE ENGINEER, REMOVE EXISTING VEGETATION WITHIN PROJECT FOOTPRINT AS REQUIRED TO FACILITATE CONSTRUCTION.
9. CONTRACTOR MUST ISOLATE INSTREAM WORK AREAS FOR THE DURATION OF CONSTRUCTION TO PREVENT THE MIGRATION OF SEDIMENT DOWNSTREAM WHILE MAINTAINING THE NATURAL FLOW OF THE CREEK VIA TEMPORARY DIVERSION OR APPROPRIATE FILTER FABRIC (E.G. SILT CURTAIN). UPSTREAM FISH PASSAGE MUST BE MAINTAINED FOR THE DURATION OF CONSTRUCTION.
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TABLE 1: APPROXIMATE LOCATIONS

SITE	NORTHING	EASTING
B	5449875.620	554584.293
B-2	5449829.571	554577.891
B-3	5449803.140	554583.669
C	5449752.724	554552.017
C-2	5449767.088	554586.547
D	5449700.471	554564.750
E	5449672.748	554526.051
F	5449668.687	554452.276
G	5449636.978	554388.674
H	5449624.313	554342.881
I	5449594.440	554323.538
J	5449525.135	554334.676
K	5449497.890	554349.670
L	5449471.771	554379.908

1 C-3101 PLAN 1:1500
PROJECT LOCATION

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BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: AS SHOWN

BRITISH COLUMBIA

CIVIL
PLAN
S-CR-14 SEDIMENT REMOVAL

DRAWING	REVISION	SHEET
2632-03-C-3101	1	3

IF NOT 50 mm ADJUST SCALES
50 mm

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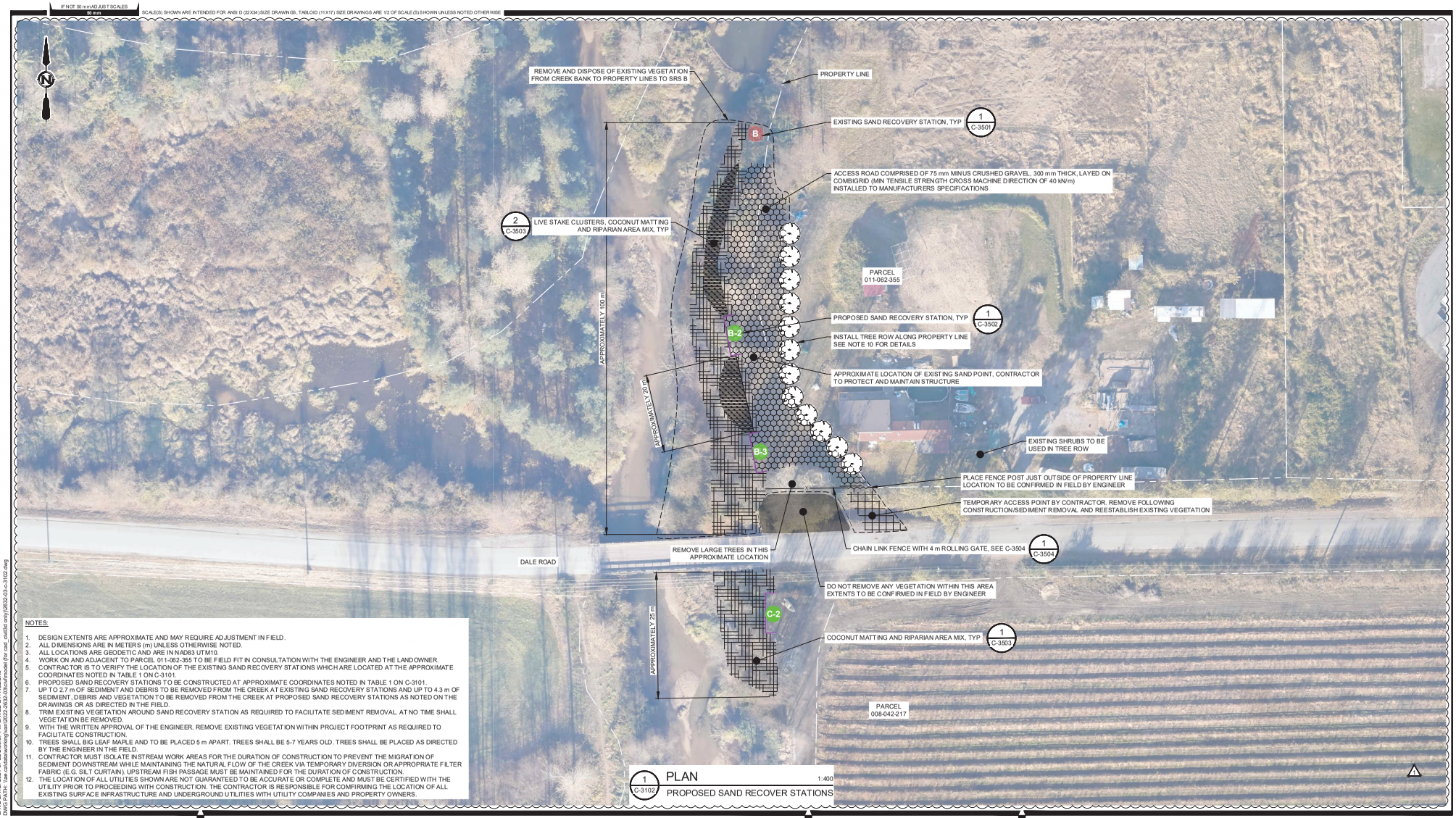

1 C-3102 PLAN 1:400
PROPOSED SAND RECOVER STATIONS

NOTES:

1. DESIGN EXTENTS ARE APPROXIMATE AND MAY REQUIRE ADJUSTMENT IN FIELD.
2. ALL DIMENSIONS ARE IN METERS (m) UNLESS OTHERWISE NOTED.
3. ALL LOCATIONS ARE GEODETIC AND ARE IN NAD83 UTM10.
4. WORK ON AND ADJACENT TO PARCEL 011-062-355 TO BE FIELD FIT IN CONSULTATION WITH THE ENGINEER AND THE LANDOWNER.
5. CONTRACTOR IS TO VERIFY THE LOCATION OF THE EXISTING SAND RECOVERY STATIONS WHICH ARE LOCATED AT THE APPROXIMATE COORDINATES NOTED IN TABLE 1 ON C-3101.
6. PROPOSED SAND RECOVERY STATIONS TO BE CONSTRUCTED AT APPROXIMATE COORDINATES NOTED IN TABLE 1 ON C-3101.
7. UP TO 2.7 m OF SEDIMENT AND DEBRIS TO BE REMOVED FROM THE CREEK AT EXISTING SAND RECOVERY STATIONS AND UP TO 4.3 m OF SEDIMENT, DEBRIS AND VEGETATION TO BE REMOVED FROM THE CREEK AT PROPOSED SAND RECOVERY STATIONS AS NOTED ON THE DRAWINGS OR AS DIRECTED IN THE FIELD.
8. TRIM EXISTING VEGETATION AROUND SAND RECOVERY STATION AS REQUIRED TO FACILITATE SEDIMENT REMOVAL. AT NO TIME SHALL VEGETATION BE REMOVED.
9. WITH THE WRITTEN APPROVAL OF THE ENGINEER, REMOVE EXISTING VEGETATION WITHIN PROJECT FOOTPRINT AS REQUIRED TO FACILITATE CONSTRUCTION.
10. TREES SHALL BIG LEAF MAPLE AND TO BE PLACED 5 m APART. TREES SHALL BE 5-7 YEARS OLD. TREES SHALL BE PLACED AS DIRECTED BY THE ENGINEER IN THE FIELD.
11. CONTRACTOR MUST ISOLATE INSTREAM WORK AREAS FOR THE DURATION OF CONSTRUCTION TO PREVENT THE MIGRATION OF SEDIMENT DOWNSTREAM WHILE MAINTAINING THE NATURAL FLOW OF THE CREEK VIA TEMPORARY DIVERSION OR APPROPRIATE FILTER FABRIC (E.G. SILT CURTAIN). UPSTREAM FISH PASSAGE MUST BE MAINTAINED FOR THE DURATION OF CONSTRUCTION.
12. THE LOCATION OF ALL UTILITIES SHOWN ARE NOT GUARANTEED TO BE ACCURATE OR COMPLETE AND MUST BE CERTIFIED WITH THE UTILITY PRIOR TO PROCEEDING WITH CONSTRUCTION. THE CONTRACTOR IS RESPONSIBLE FOR COMFIRMING THE LOCATION OF ALL EXISTING SURFACE INFRASTRUCTURE AND UNDERGROUND UTILITIES WITH UTILITY COMPANIES AND PROPERTY OWNERS.

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HATZIC EMERGENCY WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: AS SHOWN

BRITISH COLUMBIA

CIVIL
PLAN
S-CR-14 PROPOSED SAND RECOVERY STATIONS

DRAWING	REVISION	SHEET
2632-03-C-3102	1	4

IF NOT 50 mm ADJUST SCALES
50 mm

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TABLE 2: DEPTH RANGE

#		MIN.	MAX.
1		-2.8 m	-2.1 m
2		-2.1 m	-2.0 m
3		-2.0 m	-1.9 m
4		-1.9 m	-1.6 m
5		-1.6 m	-1.2 m
6		-1.2 m	-0.8 m
7		-0.8 m	-0.4 m
8		-0.4 m	-0.2 m
9		-0.2 m	0.8 m

TABLE 3: APPROXIMATE VOLUME REMOVAL

SITE	CUBIC METERS
B	250
B-2 AND B-3	950
C AND C-2	650
D	450
E	450
F	500
G	450
H	500
I	400
J	600
K	700
L	400
TOTAL	8250

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LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: AS SHOWN

BRITISH COLUMBIA

CIVIL
PLAN
S-CR-14 SEDIMENT REMOVAL EXTENTS

DRAWING	REVISION	SHEET
2632-03-C-3103	1	5

IF NOT 50 mm ADJUST SCALES
50 mm

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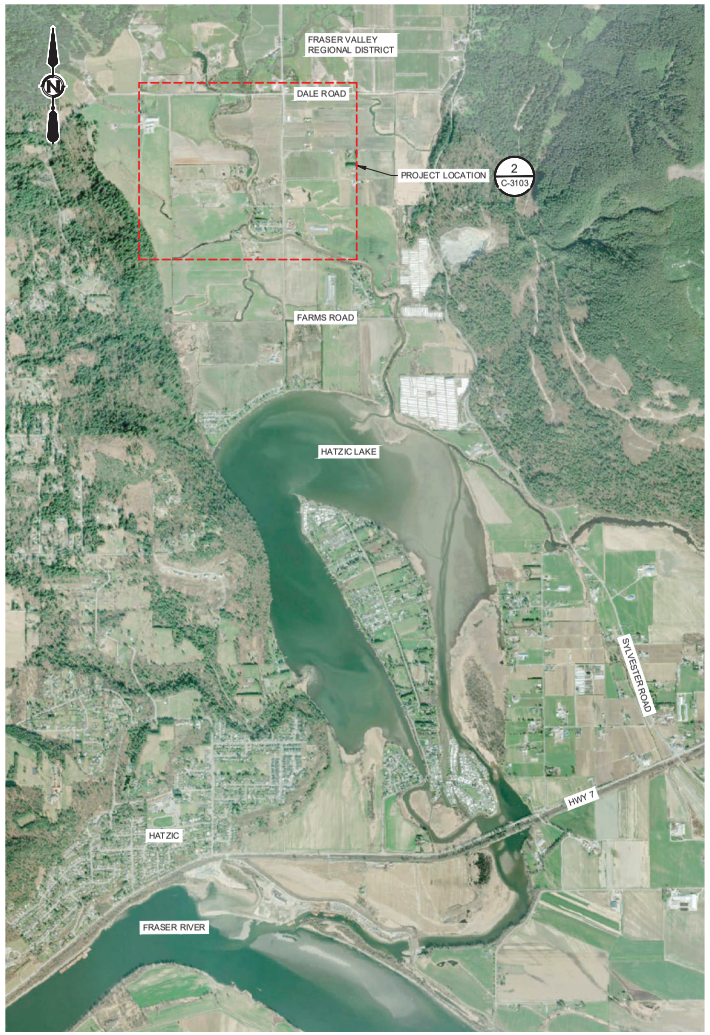
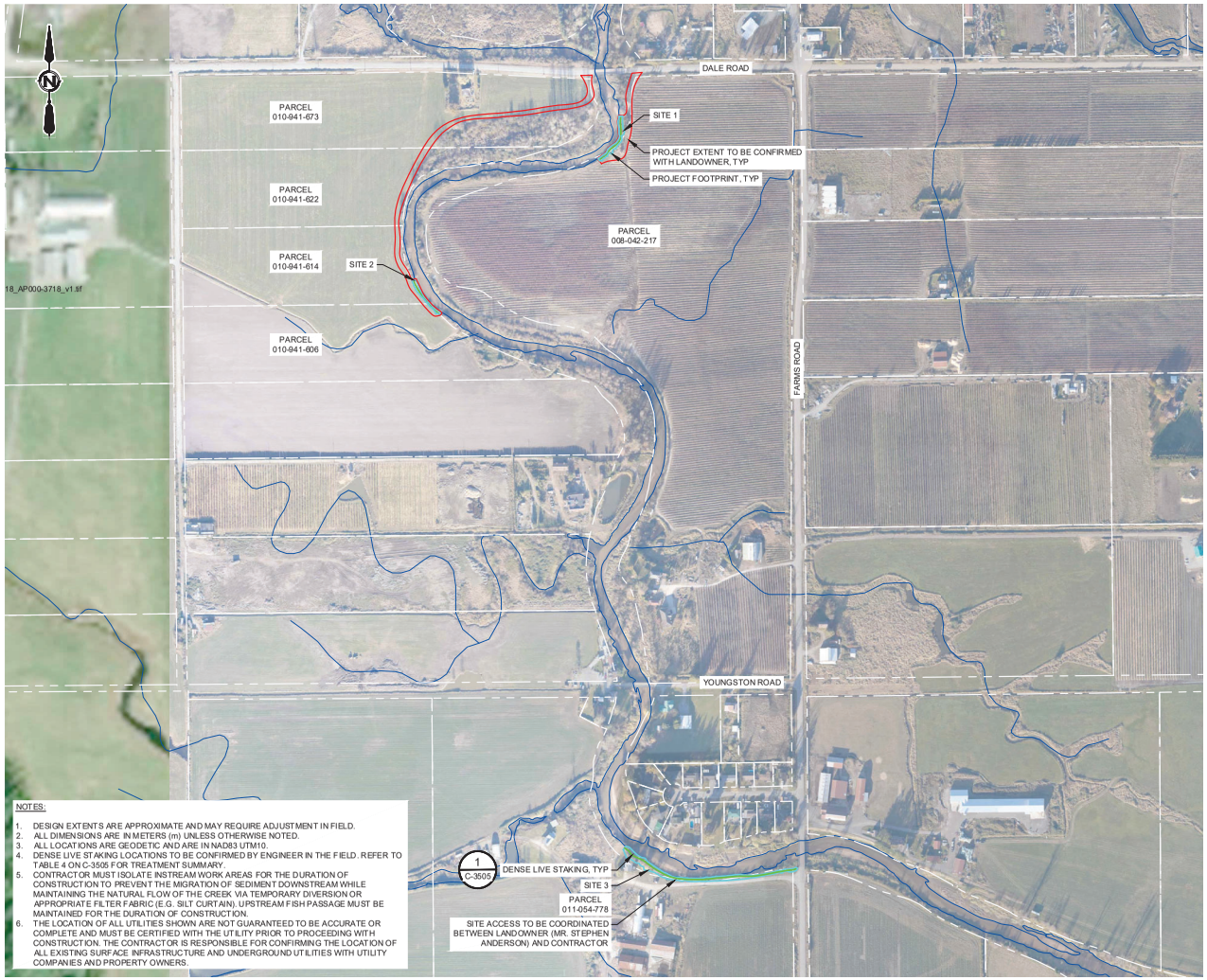


1 C-3103 PLAN NTS
REGIONAL AREA



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4. DENSE LIVE STAKING LOCATIONS TO BE CONFIRMED BY ENGINEER IN THE FIELD. REFER TO TABLE 4 ON C-3505 FOR TREATMENT SUMMARY.
5. CONTRACTOR MUST ISOLATE INSTREAM WORK AREAS FOR THE DURATION OF CONSTRUCTION TO PREVENT THE MIGRATION OF SEDIMENT DOWNSTREAM WHILE MAINTAINING THE NATURAL FLOW OF THE CREEK VIA TEMPORARY DIVERSION OR APPROPRIATE FILTER FABRIC (E.G. SILT CURTAIN). UPSTREAM FISH PASSAGE MUST BE MAINTAINED FOR THE DURATION OF CONSTRUCTION.
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2 C-3103 PLAN 1:3000
PROJECT LOCATION

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LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: AS SHOWN

BRITISH COLUMBIA

CIVIL
PLAN
S-CR-14 EROSION PROTECTION

DRAWING	REVISION	SHEET
2632-03-C-3104	1	6

IF NOT 50 mm ADJUST SCALES
50 mm
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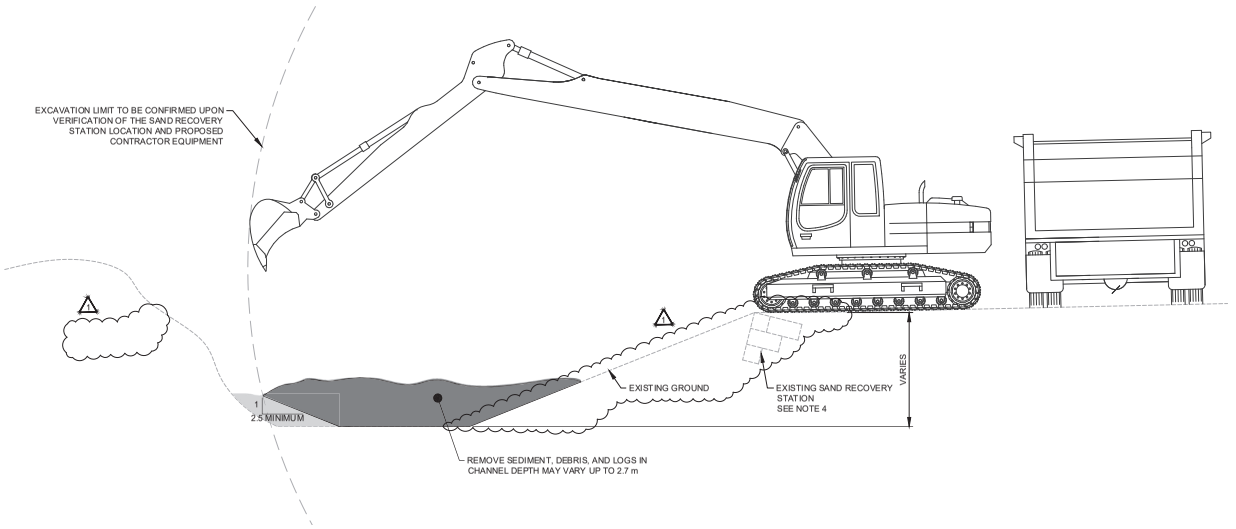

1 TYPICAL DETAIL NTS
EXISTING SAND RECOVERY STATION EXCAVATION

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LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

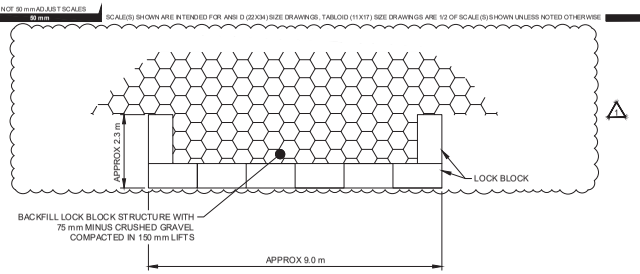
SCALE: AS SHOWN

BRITISH COLUMBIA

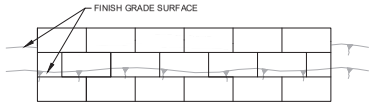
CIVIL
DETAIL 1 OF 6
EXISTING SAND RECOVERY STATION

DRAWING	REVISION	SHEET
2632-03-C-3501	1	9

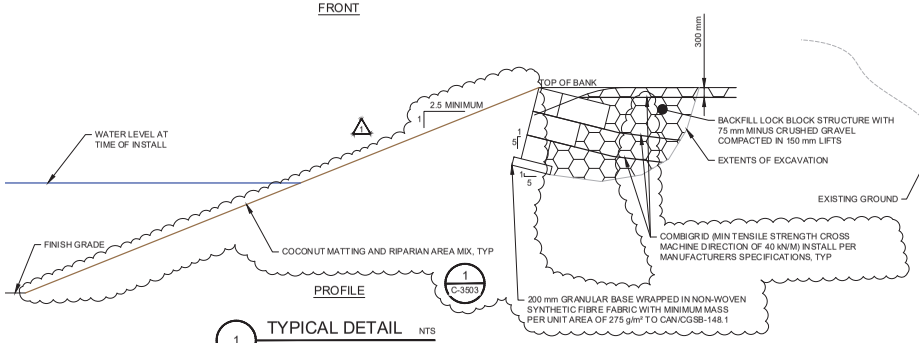
IF NOT 50 mm ADJUST SCALES
50 mm
SCALE(S) SHOWN ARE INTENDED FOR ANSI D (22X34) SIZE DRAWINGS, TABLOID (11X17) SIZE DRAWINGS ARE 1/2 OF SCALE (S) SHOWN UNLESS NOTED OTHERWISE



PLAN

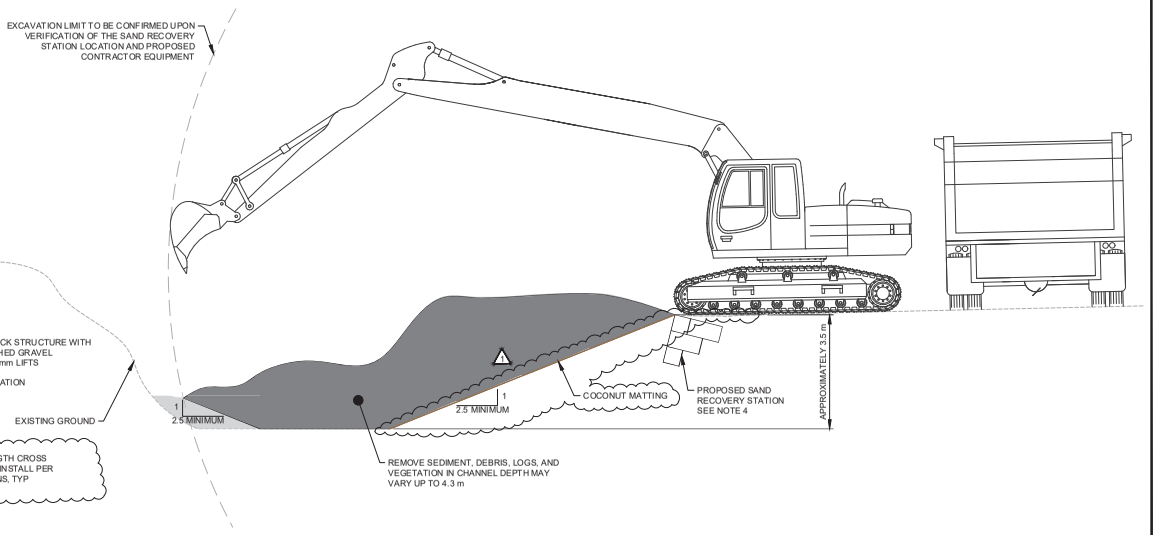


FRONT



PROFILE

1 TYPICAL DETAIL NTS
LOCK BLOCK STRUCTURE



2 TYPICAL DETAIL NTS
PROPOSED SAND RECOVERY STATION EXCAVATION

NOTES:

1. DESIGN EXTENTS ARE APPROXIMATE AND MAY REQUIRE ADJUSTMENT IN FIELD.
2. ALL DIMENSIONS ARE IN METERS (m) UNLESS OTHERWISE NOTED.
3. ALL LOCATIONS ARE GEODETIC AND ARE IN NAD83 UTM10.
4. CONTRACTOR IS TO VERIFY THE LOCATION OF THE EXISTING SAND RECOVERY STATIONS WHICH ARE LOCATED AT THE APPROXIMATE COORDINATES NOTED IN TABLE 1 ON C-3101.
5. PROPOSED SAND RECOVERY STATIONS TO BE CONSTRUCTED AT APPROXIMATE COORDINATES NOTED IN TABLE 1 ON C-3101.
6. UP TO 2.7 m OF SEDIMENT AND DEBRIS TO BE REMOVED FROM THE CREEK AT EXISTING SAND RECOVERY STATIONS AND UP TO 4.3 m OF SEDIMENT, DEBRIS AND VEGETATION TO BE REMOVED FROM THE CREEK AT PROPOSED SAND RECOVERY STATIONS AS NOTED ON THE DRAWINGS OR AS DIRECTED IN THE FIELD.
7. TRIM EXISTING VEGETATION AROUND SAND RECOVERY STATION AS REQUIRED TO FACILITATE SEDIMENT REMOVAL. AT NO TIME SHALL VEGETATION BE REMOVED.
8. WITH THE WRITTEN APPROVAL OF THE ENGINEER, REMOVE EXISTING VEGETATION WITHIN PROJECT FOOTPRINT AS REQUIRED TO FACILITATE CONSTRUCTION.
9. CONTRACTOR MUST ISOLATE INSTREAM WORK AREAS FOR THE DURATION OF CONSTRUCTION TO PREVENT THE MIGRATION OF SEDIMENT DOWNSTREAM WHILE MAINTAINING THE NATURAL FLOW OF THE CREEK VIA TEMPORARY DIVERSION OR APPROPRIATE FILTER FABRIC (E.G. SILT CURTAIN). UPSTREAM FISH PASSAGE MUST BE MAINTAINED FOR THE DURATION OF CONSTRUCTION.
10. THE LOCATION OF ALL UTILITIES SHOWN ARE NOT GUARANTEED TO BE ACCURATE OR COMPLETE AND MUST BE CERTIFIED WITH THE UTILITY PRIOR TO PROCEEDING WITH CONSTRUCTION. THE CONTRACTOR IS RESPONSIBLE FOR COMFIRMING THE LOCATION OF ALL EXISTING SURFACE INFRASTRUCTURE AND UNDERGROUND UTILITIES WITH UTILITY COMPANIES AND PROPERTY OWNERS.

PLOT DATE: 2024-07-24 12:26:47 PM
SAVE DATE: 2024-07-22 1:45:14 PM SAVED BY: ROZONJ
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PERMIT NUMBER: 1000163
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REV	DATE	DESIGN	DRAWN	DESCRIPTION
1	2024JUL22	R. KARGAARD	J. ROZON	ISSUED FOR RFP AND PERMITTING
0	2024JUN14	R. KARSGAARD	J. ROZON	ISSUED FOR RFP

BC MINISTRY OF ENVIRONMENT
AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY
WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: AS SHOWN

BRITISH COLUMBIA

CIVIL
DETAIL 2 OF 6
PROPOSED SAND RECOVERY STATION

DRAWING	REVISION	SHEET
2632-03-C-3502	1	10

IF NOT 50 mm ADJUST SCALES
50 mm
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VEGETATED RIPRAP SPECIFICATIONS:

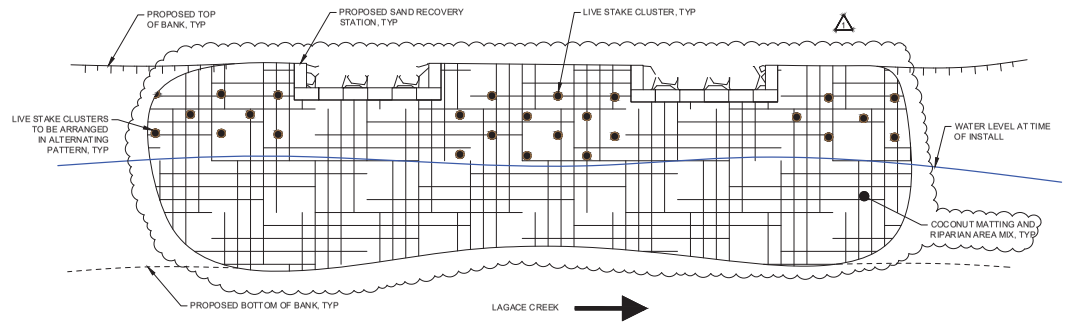
1. HARVESTING:
 1.1. THE HARVESTING OF LIVE STAKES IS TO BE CONDUCTED BY A LOCAL NURSERY OR QUALIFIED PROFESSIONAL EXPERIENCED WITH LIVE STAKING WITHIN 48 HOURS OF INSTALLATION. IF THIS TIME PERIOD IS NOT POSSIBLE, STAKES NEED TO BE PROPERLY STORED IN A COOL DARK LOCATION THAT IS CONSISTENTLY LESS THAN 5 DEGREES CELSIUS.
 1.2. HARVESTING SUITABLE NATIVE WILLOW AND RED OSIER-DOGWOOD SPECIES FROM WITHIN 100 KM OF THE PROPERTY AND WITHIN 300 M IN ELEVATION.
 1.3. SELECT NATIVE PLANTS GROWING IN SIMILAR CONDITIONS TO WHERE THEY WILL BE PLANTED: CONSIDER SUN EXPOSURE, DISTANCE TO WATER, AVAILABILITY OF SOIL NUTRIENTS
 1.4. DO NOT HARVEST FROM SENSITIVE AREAS, SUCH AS RIPARIAN AREAS WITH LIMITED VEGETATION OR PROTECTED AREAS.
 1.5. HARVESTING STRAIGHT CUTTINGS DURING THE DORMANT SEASON OCTOBER TO APRIL, AFTER LEAF DROP OR BEFORE LEAF OUT.
 1.6. SELECTING STRAIGHT STEMS 25 TO 75 MM IN DIAMETER AND 1.5 - 2M IN LENGTH.
 1.7. REMOVING SIDE BRANCHES BY CLIPPING THEM CLOSE TO THE MAIN STEM. USE AN AXE TO SHARPEN BOTTOM END OF THE STAKE ENSURING THAT BUD SCARS FACE UPWARD. AFTER INSTALL, CUT THE TOP END OF THE STEM HORIZONTALLY TO CREATE A FLAT SURFACE TO FACILITATE TAPPING IN STAKES, WHERE NEEDED.
 1.8. STORING LIVE STAKES IN CLEAN COOL WATER (IN A DRY DARK CELLAR OR A DRY COLD ROOM) FOR AT LEAST 24 HOURS UNTIL PLANTED FOR AT MOST 10 DAYS. IF YOU CANNOT PLANT THE CUTTINGS WITHIN 10 DAYS OF HARVESTING, CUTTINGS CAN BE STORED UNTIL YOU ARE READY TO PLANT THEM IN THE SHOULDER SEASONS (APRIL/MAY OR OCTOBER/NOVEMBER) FOR UP TO 8 WEEKS).

2. LIVE CLUSTER PREPARATION AND STAKING DURING CONSTRUCTION
 2.1. TO CREATE SOIL POCKETS FOR THE LIVE STAKE CLUSTERS DURING THE PREFERRED SHOULDER SEASON, SITE PREPARATION REQUIREMENTS INCLUDE:
  2.1.1. REMOVING ANY DEBRIS, ROCKS, OR OTHER OBSTRUCTIONS FROM THE PLANTING AREA ALONG THE RIPRAP SLOPE TO CREATE AN EASY PLANTING SURFACE.
  2.1.2. EXCAVATING THE SOIL FOR THE POCKET AREA TO A DEPTH OF 0.5 M DEPTH INTO NATIVE SOIL, TO ALLOW FOR ADEQUATE ROOT PENETRATION AND WATER ABSORPTION.
  2.1.3. STAGGERING THE PLACEMENT OF LIVE STAKE CLUSTERS SITES, AND SPACE STAKES 0.1 M APART, AS SHOWN IN TYPICAL DETAIL 2 ON C-3503, FOR AN ESTIMATED TOTAL OF 25 CLUSTERS.
  2.1.4. ENSURING THAT THE BASE OF THE SOIL POCKET EXCAVATION IS BETWEEN 0.5 m BELOW THE TOP OF BANK AND THE LOW WATER LEVEL AT TIME OF INSTALLATION, AS PER TYPICAL DETAIL 2 ON C-3503.
  2.1.5. ADDING TOPSOIL TO THE SOIL POCKET TO IMPROVE SOIL QUALITY AND FERTILITY. IMPORTING WEED-FREE TOPSOIL.
  2.1.6. STAKE CLUSTERS SHOULD BE PLACED APPROXIMATELY 0.25 m ABOVE THE TOE OF THE LOW WATER LEVEL AT TIME OF PLANTING.
  2.1.7. CUT COCONUT MATTING TO A LENGTH THAT WILL ENTIRELY WRAP AROUND THE SOIL POCKET ONCE BUILT (0.3 M DIAMETER), APPROXIMATELY 1 TO 2 M.
  2.1.8. ONCE RIPRAP IS INSTALLED TO THE CORRECT ELEVATION, CUT COCONUT MATTING IS TO BE LAID FLAT ON THE RIPRAP BELOW THE PREPARED SOIL POCKET EXCAVATION AREA.
  2.1.9. FOLLOWING TYPICAL DETAIL 2 ON C-3503, SOIL WILL BE PLACED ON THE COCONUT MATTING TO A DIAMETER OF 30 CM UP TO THE DEPTH OF THE RIPRAP. THE COCONUT MATTING ENDS ARE TO BE LEFT FREE TO BE WRAPPED AROUND THE SOIL POCKET.
  2.1.10. PLACE FOUR STAKES IN THE SOIL, AT 10 CM DISTANCE APART, THEN WRAP COCONUT MATTING AROUND THE SOIL AND STAKES MAKING A CIRCULAR CLUSTER THAT IS 30 CM IN DIAMETER. THEN CONTINUE PLACING RIPRAP.

3. INSTALLATION
 3.1. SUCCESSFUL INSTALLATION OF LIVE STAKING REQUIRES THAT:
 3.2. THE INSTALLATION OF LIVE STAKES IS COMPLETED WHILE THEY ARE DORMANT IN EARLY FALL TO MID-SPRING (OCTOBER TO MAY BEFORE LEAF-OUT OR AFTER LEAF DROP), IN UNFROZEN GROUND.
 3.3. LIVE STAKES SHOULD BE SOAKED FOR A MINIMUM OF 24 HOURS AND NO LONGER THAN 14 DAYS PRIOR TO PLANTING. CUTTINGS MAY BE SOAKED IN CONTAINERS. WHEN SOAKING, 100 PERCENT OF THE LENGTH OF THE CUTTING SHOULD BE IN CONTACT WITH WATER (ADDING WEIGHT MAY BE NECESSARY IF SOAKING IN HORIZONTAL POSITION). DO NOT STORE CUTTINGS ONSITE IN DRY AND/OR IN DIRECT SUNLIGHT CONDITIONS.
 3.4. AVOIDING THE SPLINTERING OR CRUSHING THE TOP OF CUTTINGS.
 3.5. A MINIMUM OF 80% BURIAL (CONTACT WITH SOIL) WITH AT LEAST 200 MM OF THE LIVE STAKE ABOVE THE RIPRAP.
 3.6. THAT FOUR LEAF BUDS SHOULD REMAIN ABOVE GROUND AND SHOULD BE FACING IN AN UPRIGHT DIRECTION.
 3.7. THAT IF CUTTINGS ARE DAMAGED DURING INSTALLATION, ONE IS TO REMOVE THE DAMAGED PORTION BY PROVIDING A CLEAN CUT BELOW THE DAMAGED SECTION.
 3.8. TAMPING SOIL AROUND LIVE STAKE AND ADDING SOIL, AS REQUIRED. WATER PRIOR TO AND AFTER INSTALLATION.

4. MAINTENANCE
 4.1. ALTHOUGH IT IS WEATHER AND STAKE ESTABLISHMENT DEPENDANT, MAINTENANCE OF THE LIVE STAKE CLUSTERS IS REQUIRED. A QUALIFIED ENVIRONMENTAL PROFESSIONAL (QEP) WILL BE CONSULTED WITH REGARDS TO A MAINTENANCE SCHEDULE. GENERALLY, MAINTENANCE OF THE LIVE STAKE CLUSTERS REQUIRES THAT PLANTINGS BE WATERED FROM APRIL 2024 THROUGH 2025 AT THE FOLLOWING FREQUENCY:
 4.2. TWICE PER MONTH APRIL TO MAY,
 4.3. ONCE PER WEEK FROM JUNE THROUGH THE END OF JULY,
 4.4. TWICE PER WEEK FROM AUGUST TO THE END OF SEPTEMBER, AND
 4.5. ONCE PER WEEK FROM EARLY OCT UNTIL PRECIPITATION EVENTS OCCUR (RAIN OR SNOW).

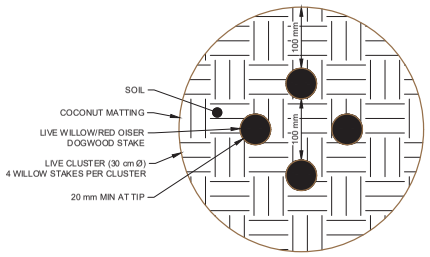
NOTE:
DEPENDING ON PRECIPITATION LEVELS FOR THE FIRST TWO GROWING SEASONS, WATERING MAY NEED TO OCCUR FOR THREE GROWING SEASONS. IN ADDITION TO REGULAR WATERING, REMOVAL OF INVASIVE WEEDS MAY BE REQUIRED.



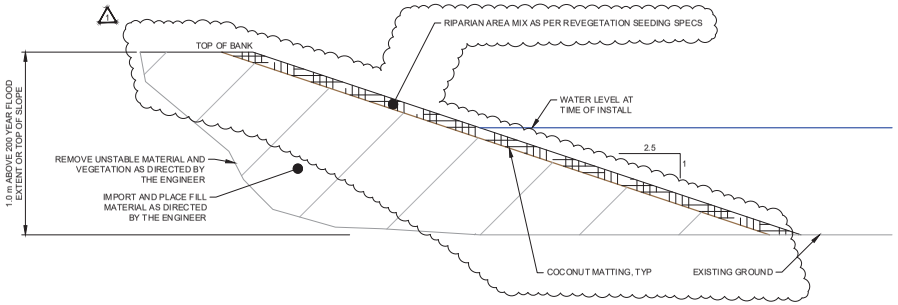
PLAN

NOTE:
CLUSTER NUMBERS MAY CHANGE DUE TO CHANGING SITE CONDITIONS. THE TARGET IS ONE CLUSTER PER 3 m², 0.5 m BELOW TOP OF BANK, AND 0.25 m ABOVE WATER LEVEL AT TIME OF INSTALL.

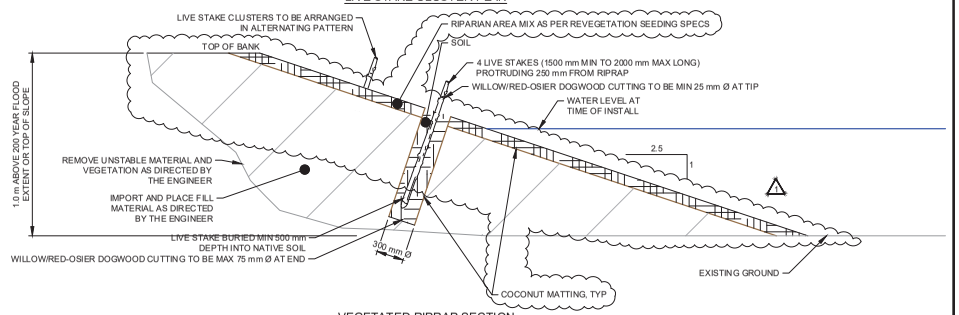
DISCLAIMER:
BIOENGINEERING IS A NATURE-BASED SOLUTION THAT IS DEPENDANT UPON THE VIABILITY OF THE PRESCRIBED MATERIALS, THE EXPERIENCE OF INSTALLERS, AND POST-INSTALLATION WATERING OR WEEDING. SAID VIABILITY IS CONTINGENT ON MANY FACTORS OUTSIDE OF THE DESIGNER'S CONTROL SUCH AS CLIMACTIC CONDITIONS, ENVIRONMENTAL FACTORS, AND HUMAN INTERACTIONS. THE NOTED DESIGN MEETS THE PROJECT DESIGN INTENT; HOWEVER, NO GUARANTEES ARE INFERRED OR IMPLIED.



LIVE STAKE CLUSTER PLAN



1 TYPICAL DETAIL NTS
100 kg CLASS RIPRAP



VEGETATED RIPRAP SECTION

2 TYPICAL DETAIL NTS
VEGETATED RIPRAP

PLOT DATE: 2024-07-24 12:26:57 PM
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FOR CIVIL FOR BIOENGINEERING

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1	2024JUL22	R. KARGAARD	J. ROZON	ISSUED FOR RFP AND PERMITTING
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BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: AS SHOWN

BRITISH COLUMBIA

CIVIL
DETAIL 3 OF 6
BANK PROTECTION

DRAWING	REVISION	SHEET
2632-03-C-3503	1	11

IF NOT 50 mm ADJUST SCALES
50 mm

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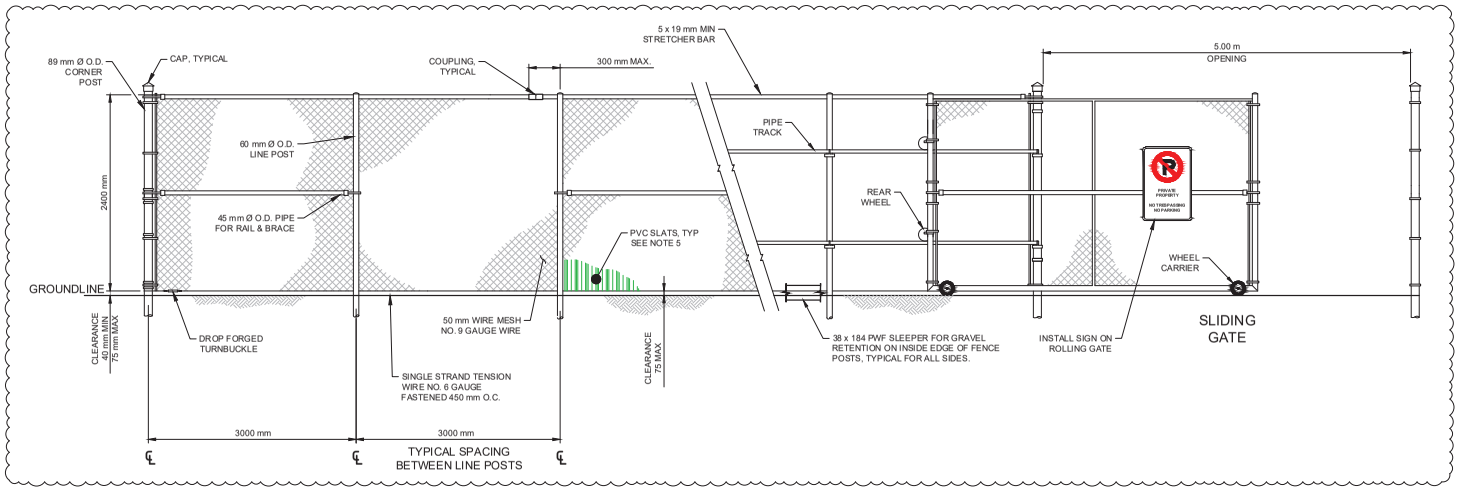
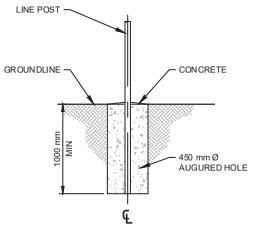
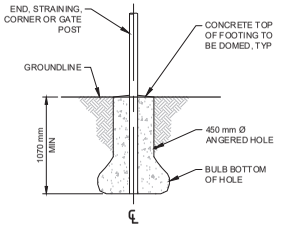


1 C-3102 **DETAIL** NTS
FENCE AND ROLLING GATE



2 **TYPICAL DETAIL** NTS
LINE POST SUPPORT IN EARTH



3 **TYPICAL DETAIL** NTS
CORNER, END AND GATE POST SUPPORT IN EARTH

NOTES:

1. DESIGN EXTENTS ARE APPROXIMATE AND MAY REQUIRE ADJUSTMENT IN FIELD.
2. ALL DIMENSIONS ARE IN METERS (m) UNLESS OTHERWISE NOTED.
3. ALL LOCATIONS ARE GEODETIC AND ARE IN NAD83 UTM10.
4. CONTRACTOR IS TO VERIFY THE PLACEMENT OF FENCE AND GATE WITH ENGINEER AND PROPERTY OWNER.
5. PVC SLATS SHALL BE PLACED WITHIN THE WIRE MESH. COLOUR TO BE GREEN THAT MATCHES THE SURROUNDING VEGETATION.
6. WITH THE WRITTEN APPROVAL OF THE ENGINEER, REMOVE EXISTING VEGETATION WITHIN PROJECT FOOTPRINT AS REQUIRED TO FACILITATE CONSTRUCTION.
7. THE LOCATION OF ALL UTILITIES SHOWN ARE NOT GUARANTEED TO BE ACCURATE OR COMPLETE AND MUST BE CERTIFIED WITH THE UTILITY PRIOR TO PROCEEDING WITH CONSTRUCTION. THE CONTRACTOR IS RESPONSIBLE FOR COMFIRMING THE LOCATION OF ALL EXISTING SURFACE INFRASTRUCTURE AND UNDERGROUND UTILITIES WITH UTILITY COMPANIES AND PROPERTY OWNERS.

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HATZIC EMERGENCY
WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: AS SHOWN

BRITISH COLUMBIA

CIVIL
DETAIL 4 OF 6
FENCE AND GATE INSTALLATION

DRAWING	REVISION	SHEET
2632-03-C-3504	1	12

IF NOT 50 mm ADJUST SCALES
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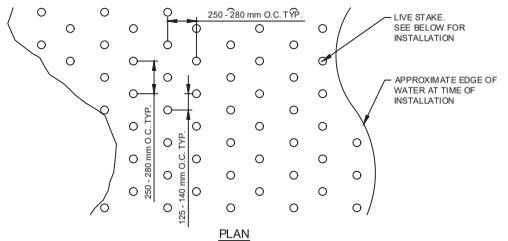
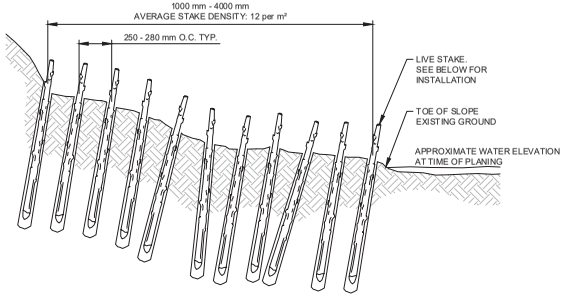
BIOENGINEERING SPECIFICATIONS:

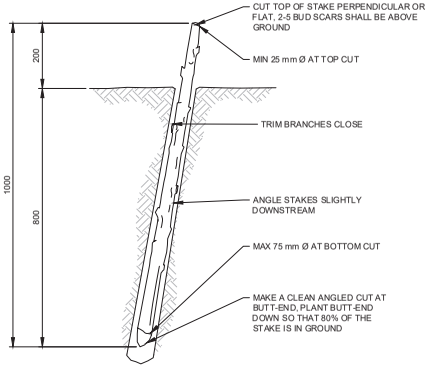
1. PLANT MATERIAL
   - 1.1. ONLY NATIVE SPECIES WILL BE INSTALLED. SOURCE NATIVE PLANT MATERIAL IN CLOSE PROXIMITY TO THE PROJECT SITE. PLANT MATERIAL WILL BE SOURCED FROM WITHIN 100 km OF LAGACE CREEK, SUBJECT TO APPROVAL OF THE OWNER.
   - 1.2. PLANTS SHALL BE GENERALLY TRUE TO TYPE AND STRUCTURALLY SOUND, HEALTHY AND VIGOROUS AND FREE OF DISEASE, INSECT INFESTATIONS, INSECT EGGS, WILDLIFE DAMAGE, SUNSCALD, FROST CRACKS AND MECHANICAL WOUNDS. STEMS SHALL BE COVERED IN SMOOTH BARK (I.E. NOT FURROWED). PRUNING CUTS SHALL SHOW VIGOROUS BARK ON ALL EDGES AND ALL PARTS SHALL BE MOIST AND SHOW LIVE, GREEN CAMBIUM TISSUE WHEN CUT.
   - 1.3. LIVE CUTTINGS FROM NATIVE STANDS:
     - 1.3.1. LOCATION OF CUTTINGS TO BE DOCUMENTED AND SUBMITTED TO THE OWNER PRIOR TO COLLECTION. TARGET HARVESTING FROM WITHIN LAGACE CREEK PROJECT FOOTPRINT (WITHIN THE DREDGING FOOTPRINT), IF THE TIMING WINDOW IS APPROPRIATE FOR HARVESTING, SEE NOTE 1.5.
     - 1.3.2. CUTTINGS WILL NOT BE TAKEN FROM WITHIN LAGACE CREEK CHANNEL MARGINS WHERE NO DREDGING IS OCCURRING.
     - 1.3.3. COLLECTION FOR LIVE STAKING WILL OCCUR UNDER SUPERVISION OF PERSONNEL WITH TRAINING AND EXPERIENCE IN LIVE STAKING.
   - 1.4. ACCEPTABLE SPECIES INCLUDE:
     - 1.4.1. NATIVE WILLOW SPECIES (SALIX SP)
   - 1.5. HARVESTING OF CUTTINGS
     - 1.5.1. HARVEST CUTTINGS ONLY DURING THE DORMANT SEASON (BETWEEN LEAF-OFF IN FALL AND PRIOR TO SPRING BUD BREAK). SELECT STEMS THAT ARE A MINIMUM OF 25 mm AT THE TOP AND A MAXIMUM OF 75 mm AT THE BOTTOM IN DIAMETER, KEEPING THEM FULL LENGTH UNTIL THE TIME OF INSTALLATION WHERE POSSIBLE. DURING HARVEST, SIDE BRANCHES SHOULD BE REMOVED BY CLIPPING THEM CLOSE TO THE MAIN STEM.
     - 1.5.2. STAKE LENGTHS SHOULD BE A MINIMUM OF 1.25 m AND A MAXIMUM OF 2.0 m.
     - 1.5.3. CUT STEMS TO LENGTH BASED ON THE DETAIL DRAWINGS AFTER INSTALLATION.
     - 1.5.4. WRAP CUTTINGS INTO MANAGEABLE BUNDLES USING NATURAL TWINE, AND BURLAP. FOR FUTURE REFERENCE, MARK EACH BUNDLE WITH FLAGGING TAPE, AND RECORD THE SPECIES AND HARVESTING DATE AND GENERAL LOCATION.
     - 1.5.5. HARVEST HEALTHY, STRAIGHT AND LIVE WOOD AT LEAST 1 YEAR OLD.
   - 1.6. PREPARATION:
     - 1.6.1. PRIOR TO INSTALLATION, SOAK CUTTINGS FOR A MINIMUM OF 24 HOURS AND NO LONGER THAN 14 DAYS. CUTTINGS MAY BE SOAKED IN CONTAINERS. POTABLE OR CREEK WATER IS ACCEPTABLE, AND NO ADDITIVES ARE REQUIRED. WATER TEMPERATURE SHOULD MIMIC THE CREEK TEMPERATURE FOR THE TARGETED TIME OF INSTALLATION.
     - 1.6.2. APPROXIMATELY 80 TO 100 PERCENT OF THE LENGTH OF THE CUTTING SHOULD BE IN CONTACT WITH WATER (WEIGHT ON TOP IF SOAKING IN A HORIZONTAL POSITION).
   - 1.7. STORAGE:
     - 1.7.1. IF CUTTINGS ARE NOT INSTALLED WITHIN 14 DAYS, PLACE WRAPPED BUNDLES IN COLD STORAGE (BETWEEN -5 AND -1°C) WITH A MINIMUM OF 80% RELATIVE HUMIDITY. CUTTINGS IN STORAGE >-1°C CAN ONLY BE STORED FOR 2-3 MONTHS. STORAGE FOR OVER 3 MONTHS REQUIRES COLDER TEMPERATURES, STORE STAKES AT THE ULTIMATE MAXIMUM OF 180 DAYS (6 MONTHS); HOWEVER, THE PREFERRED MAXIMUM IS 120 DAYS (4 MONTHS) IF STAKES ARE TO BE STORED FOR MORE THAN 4 MONTHS, HARVEST 1/3 MORE THAN THE PRESCRIPTION REQUIRES TO ACCOUNT FOR DIE-OFF IN STORAGE.
     - 1.7.2. WHEN TAKING STAKES OUT OF STORAGE, PRIOR TO PREPARATION, ENSURE THE STEMS ARE LIVE BY SCRAPING A SMALL SECTION OF THE BARK, GREEN SHOULD BE REVEALED UNDERNEATH.
     - 1.7.3. TRANSPORT TO SITE AND SUBSEQUENT STORAGE PRIOR TO INSTALLATION SHALL OCCUR IN A COOL ENVIRONMENT. STAKES MUST BE INSTALLED WITHIN 24 HOURS OF DELIVERY TO THE SITE. SHOULD INSTALLATION BE DELAYED BEYOND THIS PERIOD, THE STAKES ARE TO BE STORED IN A SHADED AREA WHILE IMMERSED IN WATER.
2. ENVIRONMENTAL MANAGEMENT
   - 2.1. ONLY USE ACCESS POINTS INTO THE CHANNEL AS IDENTIFIED ON DRAWING C-3104.
   - 2.2. FOLLOW ALL BEST MANAGEMENT PRACTICES, EROSION CONTROL MITIGATION MEASURES, SITE ISOLATION METHODS AND ANY OTHER APPLICABLE MEASURES IN THE CEMP AT ALL TIMES.
   - 2.3. WORK "IN THE DRY" AND MAINTAIN AN ISOLATED WORKSITE FROM WATER AND FISH AT ALL TIMES, IF THE WORKSITE BECOMES WETTED FROM SURFACE OR GROUNDWATER SEEPING INTO THE SITE, STOP WORKS AND RE-ISOLATE THE SITE. FISH MUST BE SALVAGED FROM ISOLATED WORK ZONES.
   - 2.4. DO NOT DISTURB, DAMAGE OR REMOVE ANY EXISTING NATIVE VEGETATION. IF VEGETATION IS PRESENT, WORK AROUND THE STEMS WITHOUT DAMAGING THEM.
3. INSTALLATION
   - 3.1. DENSE LIVE STAKING:
     - 3.1.1. LIVE CUTTINGS WILL BE INSTALLED IN THE DORMANT SEASON (WHEN THE LEAVES HAVE DROPPED OFF THE STEMS IN THE LATE FALL, OR BEFORE BUDS START TO GROWN AND OPEN IN THE EARLY SPRING).
     - 3.1.2. ONLY WILLOW CUTTINGS WILL BE USED.
     - 3.1.3. CUTTINGS UP TO 1.25 m LONG ARE INSTALLED APPROXIMATELY 1.0 m DEEP.
     - 3.1.4. CUTTINGS MUST NOT PROTRUDE FROM THE SURFACE MORE THAN 25 cm IN LENGTH.
     - 3.1.5. APPLY THIS TREATMENT ALONG THE TOE OF THE CREEK BANKS SLOPES, IN LOCATIONS SHOWN ON C-3104, WHERE THE CHANNEL MARGIN IS UNVEGETATED. WIDTH OF TREATMENT WILL BE SILECTED IN THE FIELD AND DEPENDS ON SITE CHARACTERISTICS. INSTALL STAKES FROM THE WATERS EDGE UP THE BANK TO A MAXIMUM OF 4 m (HORIZONTAL) WIDTH.
     - 3.1.6. DO NOT INSTALL CUTTINGS WHERE VEGETATION IS GROWING.
     - 3.1.7. MAKE CLEAN CUTS AND DO NOT DAMAGE STAKES OR SPLIT ENDS DURING INSTALLATION; USE A PLANTING BAR (1.5 m LONG STRAIGHT HEAVY IRON BAR WITH A POINTED END) AND CREATE THE PILOT HOLE TO A DEPTH OF 1.0 m. DO NOT USE LIVE STAKES TO CREATE THE PILOT HOLES AS THIS WILL DAMAGE THEIR BARK AND COMPROMISE THE VIABILITY OF THE STAKE. PILOT HOLES CAN ALSO BE CREATED WITH A HAND DRILL AUGER BUT LIVE STAKES MUST BE PLANTED TO A MINIMUM DEPTH OF 0.8 m.
     - 3.1.8. HAND INSTALLATION ONLY.
     - 3.1.9. LIGHTLY TAMP THE STAKE INTO THE HOLE WITH A RUBBER MALLET, TAKING CARE NOT TO SPLIT THE END, TRIM THE STAKE TO DESIRED LENGTH, AND TAMP THE SEDIMENT AROUND THE STAKE FOLLOWING INSTALLATION.
     - 3.1.10. THE INSTALLATION ANGLE OF THE CUTTING IN THE SEDIMENT MAY VARY. SLIGHT ANGLE DOWNSTREAM IS PREFERRED.
     - 3.1.11. KEEP ALL ACTIVITY AND FOOT TRAFFIC ABOVE WATER TO PREVENT EROSION AND SEDIMENTATION.
     - 3.1.12. WIDTH OF TOE STAKING SHALL VARY BASED ON SITE CONDITIONS DURING INSTALLATION.
     - 3.1.13. START TOE STAKING JUST ABOVE WATER AT TIME OF CONSTRUCTION (TO BE INSTALLED DURING LOW FLOW.)
     - 3.1.14. DO NOT DISTURB OR DAMAGE EXISTING NATIVE WOOD VEGETATION GROWING IN TREATMENT AREA.
     - 3.1.15. INSTALL LIVE STAKES IN AND AROUND EXISTING NATIVE WOODY VEGETATION, ADJUST TREATMENT SPECIFICATIONS IN THE FIELD AS NECESSARY TO AVOID WOODY VEGETATION.
4. WATERING
   - 4.1. WATER THE CUTTINGS IMMEDIATELY AFTER INSTALLATION.
   - 4.2. A WATERING PROGRAM WILL BE IMPLEMENTED THE FIRST GROWING SEASON AFTER PLANTING (WHEN SOIL TEMPERATURES ARE 5°C OR ABOVE) AS PER THE SCHEDULE IN 4.5, UNLESS IT HAS RAINED OVER 5 mm WITHIN 2-3 DAYS OF PLANNED WATERING.
   - 4.3. THE CONTRACTOR IS RESPONSIBLE FOR ACQUIRING THE WATER SOURCE AND THE WATERING PROGRAM, ALONG WITH ALL REQUIRED PERMITS AND LAND PERMISSIONS.
   - 4.4. WATERING DEPTH TARGET IS BETWEEN 250 mm MINIMUM AND 500 mm MAXIMUM, TO BE ADJUSTED DEPENDING ON SOIL MOISTURE CONDITIONS. SOIL SHOULD BE MOIST UP TO 1500 mm MINIMUM AFTER WATERING.
   - 4.5. WATERING SCHEDULE:
     - 4.5.1. WATER ONCE PER MONTH WHEN WEEKLY TEMPERATURES ARE, ON DAILY AVERAGE, BETWEEN 5-10°C AT SITE.
     - 4.5.2. WATER TWICE PER MONTH WHEN WEEKLY TEMPERATURES ARE, ON DAILY AVERAGE, BETWEEN 11-15°C AT SITE.
     - 4.5.3. WATER WEEKLY, WHEN WEEKLY TEMPERATURES ARE, ON DAILY AVERAGE, BETWEEN 16-25°C AT SITE.
     - 4.5.4. WATER BI-WEEKLY, WHEN WEEKLY TEMPERATURES ARE, ON DAILY AVERAGE, BETWEEN 26-35°C AT SITE.
     - 4.5.5. WATER THREE TIMES PER WEEK WHEN WEEKLY TEMPERATURES ARE, ON DAILY AVERAGE, 36°C AND ABOVE AT SITE.
   - 4.6. THE SELECTED WATERING METHODOLOGY MUST NOT CAUSE EROSION.
   - 4.7. THE SELECTED WATERING METHODOLOGY MUST NOT CAUSE HARM OR DISTURB NATIVE VEGETATION GROWING ONSITE.



PLAN



CROSS SECTION



CROSS SECTION

1 TYPICAL DETAIL NTS
DENSE LIVE STAKING

TABLE 4: DENSE LIVE STAKING TREATMENT SUMMARY			
LOCATION	APPROXIMATE AREA	APPROXIMATE LINEAR METERS	AVERAGE DENSITY
SITE 1	120 m²	80 m	12 PER m²
SITE 2	100 m²	50 m	
SITE 3	500 m²	240 m	

NOTE:
CONTRACTOR IS SOLELY RESPONSIBLE FOR CONFIRMING THE NUMBER OF STEMS REQUIRED

1

DISCLAIMER:
BIOENGINEERING IS A NATURE-BASED SOLUTION THAT IS DEPENDANT UPON THE VIABILITY OF THE PRESCRIBED MATERIALS, THE EXPERIENCE OF INSTALLERS, AND POST-INSTALLATION WATERING OR WEEDING. SAID VIABILITY IS CONTINGENT ON MANY FACTORS OUTSIDE OF THE DESIGNER'S CONTROL SUCH AS CLIMACTIC CONDITIONS, ENVIRONMENTAL FACTORS, AND HUMAN INTERACTIONS. THE NOTED DESIGN MEETS THE PROJECT DESIGN INTENT; HOWEVER, NO GUARANTEES ARE INFERRED OR IMPLIED.

PLOT DATE: 2024-07-24 12:28:21 PM
SAVE DATE: 2024-07-24 9:07:24 AM SAVED BY: ELLINGSONJ
DWG PATH: \\ae.ca\data\working\van\2022-2632 03\civil\mode\ [for cad_civil\24 only]\2632-03-c-3505.dwg

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ASSOCIATED ENGINEERING (B.C.) LTD.
PERMIT NUMBER: 1000163
Engineers & Geoscientists BC

REV	DATE	DESIGN	DRAWN	DESCRIPTION
1	2024JUL22	R. KARGAARD	J. ROZON	ISSUED FOR RFP AND PERMITTING
0	2024JUN14	R. KARSGAARD	J. ROZON	ISSUED FOR RFP

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: AS SHOWN

BRITISH COLUMBIA

CIVIL
DETAIL 5 OF 6
DENSE LIVE STAKING

DRAWING	REVISION	SHEET
2632-03-C-3505	1	13

APPENDIX C – EMERGENCY *FISHERIES ACT* AUTHORIZATION FROM FISHERIES AND OCEANS CANADA

Fisheries and Oceans Canada | Pêches et Océans Canada

Paragraphs 34.4(2)(b) and 35(2)(b) *Fisheries Act* Authorization
EMERGENCY AUTHORIZATION

November 2023 Amendment[1]

Authorization issued to
BC Ministry of Environment and Climate Change Strategy (MoECCS)

Attention to:
Thyren Jacobs
PO Box 9337 Stn Prov Govt
Victoria, B.C.
V8W 9M1 *(hereafter referred to as the "Proponent")*

Location of Proposed Project

Nearest community: Mission
District: Fraser Valley Regional District
Province: British Columbia
Name of watercourses and coordinates:

Priority sites:
1. CR-12 - Pattison Creek (near Sylvester Road): 49.224318°, -122.225164°
2. CR-28 - Carratt Creek (at Carratt Road bridge): 49.262427°, -122.217317°
3. CR-38 - Davies Creek: 49.175456°, -122.227440°

Remaining nine (lower priority) sites:
4. CR-13 - Legace Creek (near 11744 Stave Lake Road): 49.215732°, -122.251508°
5. CR-14 - Legace Creek (at 10491 Farms Road): 49.191343°, -122.250592°
6. CR-15 - Legace Creek (at Seux Road): 49.217294°, -122.236456°
7. CR-16 - Legace Creek (from confluence with Pattison Creek to Seux Road Bridge): 49.131411°, -122.135081°
8. CR-17 - Legace Creek (between Pattison Creek and Allan Lake)
   Site 1 - Failed Driveway: 49.235909°, -122.218453°
   Site 2 - Legace Creek Tributary: 49.240045°, -122.217729°
9. CR-34 - South Herford Creek: 49.208806°, -122.230723°
10. CR-35 - McNab Creek: 49.245478°, -122.216991°
11. CR-36 - Eng Creek: 49.249415°, -122.217877°
12. CR-37 - North Herford Creek: 49.209358°, -122.231182°

Valid Authorization Period

This Authorization remains in force from the **Date of Issuance** until **December 31, 2030**.

[1] This is the first amendment to *Fisheries Act* Authorization 22-HPAC-01308 originally issued on October 27, 2022. Amendments to this Authorization will be highlighted in footnotes.

Canada

Please note that this Authorization may contain more specific timing requirements and limitations. These are set out in the Conditions of Authorization section.

Description of Proposed Project

The proposed project of which the work, undertaking or activity authorized is a part of involves:

- Emergency works to remove accumulations of sediment, organic debris or anthropogenic debris ("debris") in locations where it poses a risk to downstream infrastructure (e.g., bridges or homes) under high flow conditions between 2022 and 2024[2], and/or
- Completing emergency works to stabilize bank slopes and implement erosion protection measures.

The project is described in the following documents, hereafter referred to collectively as the "Project Plan":

- Application Form and supporting documents for the Issuance of an Authorization under Paragraphs 34.4(2)(b) and 35(2)(b) of the *Fisheries Act* (Emergency Situation) received on October 13, 2022.
- *The Ministry of Environment and Climate Change Strategy: Pattison, Carratt and Davies Creeks – Sediment Removal and Bank Protection Environmental Management Plan* report produced by Associated Environmental Consultants Inc. dated October 2022.

Description of Authorized work(s), undertaking(s) or activity(ies) likely to result in the death of fish by means other than fishing and/or the harmful alteration, disruption or destruction of fish habitat:

- Site isolation using either pumps or temporary diversion channels;
- Removal of watercourse substrate (including sediment or debris) using excavators, large trucks, and hand tools;
- Relocation and/or removal of large woody debris from the watercourses using excavators, large trucks, and hand tools;
- Bank repairs and installation of erosion protection measures; and
- Removal of riparian vegetation for site access.

The authorized work(s), undertaking(s), or activity(ies) are likely to result in the following impacts to fish and fish habitat:

- Alteration and disruption of aquatic habitat including substrate removal and replacement likely to result in a reduction in habitat availability and complexity, and cause sedimentation.
- Site isolation leading to a temporary disruption to fish passage which may impact life history stages including spawning, migration, overwintering and rearing.

[2] November 2023 Amendment: Changed from "in the 2022 fall and 2023 spring periods" to "between 2022 and 2024".

- Alteration and disruption to stream bank habitat likely to result in a reduction in habitat function of both the aquatic and riparian habitat.
- Alteration, disruption and destruction of riparian habitat for site access.

Riparian and aquatic footprints of the above WUAs for Pattison, Carratt and Davies Creeks shall not exceed what is described in the Project Plan. For the nine lower-priority sites, riparian and aquatic footprints shall not exceed what is required to alleviate flood risk based on the Risk Assessment Methodology of the Project Plan.

Conditions of Authorization

The above-described work, undertaking or activity must be carried on in accordance with the following conditions.

1. **Conditions that relate to the period during which the work, undertaking or activity can be carried on**

   The work, undertaking or activity that is/are authorized to be carried on during the following period:

   FROM: Date or Issuance TO: December 31, 2024[3]

   If the Proponent cannot complete the work, undertaking or activity during this period, Fisheries and Oceans Canada (DFO) must be notified in advance of the expiration of the above time period. An application for amendment, suspension or cancellation of the authorization should be submitted to DFO.

   The periods during which other conditions of this authorization must be complied with are provided in their respective sections below.

2. **Conditions that relate to measures and standards to avoid and mitigate impacts to fish and fish habitat**

2.1 Works, undertakings, and activities shall be conducted in a manner that avoids the death of fish.

2.2 A Qualified Environmental Professional will be onsite during high-risk instream and riparian works (e.g., substrate removal, riparian vegetation removal) to oversee/direct avoidance and mitigation measures to reduce impacts to fish and fish habitat and avoid unauthorized death of fish by means other than fishing and harmful alteration, disruption and destruction of fish habitat.

2.2.1 Conduct full time observations for all fish species that may be present near and within the project footprint and modify or direct works to the extent possible to avoid or minimize potential injury and death of fish;

2.2.2 Prior to sediment removal and other instream disturbances, isolate work site(s) and salvage fish;

[3] November 2023 Amendment: Changed from December 31, 2023 to December, 31, 2024.

2.2.3 Fish salvage methodologies should consider the winter nocturnal activity of juvenile salmonids (e.g. Pacific salmon and trout species) that may spend the day concealed in the stream substrates. Where isolation occurs, conduct fish salvage between dusk and dawn (sunset/sunrise) when fish emerge to forage, to avoid and mitigate against the death of juvenile fish;

2.2.4 Relocate all salvaged fish species from the work area, or those holding below a work area, back to the same watercourse in a nearby area that is not impacted by construction or removal works or its zone of influence (i.e., areas of higher turbidity due to instream works);

2.2.5 Conduct full time monitoring for deleterious substance released during the removal of sediment and direct avoidance and mitigation measures to reduce impacts to fish and fish habitat and avoid unauthorized death of fish by means other than fishing and harmful alteration, disruption and destruction of fish habitat and to prevent their further movement into the watercourse; and

2.2.6 Monitor implementation of the conditions of this authorization.

2.3 Sediment and erosion control: Sediment and erosion control measures must be in place and shall be upgraded and maintained, such that release of sediment is avoided at the location of the authorized work, undertaking, or activity. Monitor the watercourse for signs of sedimentation resulting from the works, undertakings or activities and take corrective action if required.

2.3.1 Areas of streambank disturbed during the works shall be rehabilitated to a stable condition (e.g. re-sloped and contoured) and protected from erosion.

2.4 List of measures and standards to avoid and mitigate impacts to fish and fish habitat:

2.4.1 Every reasonable effort should be made to minimize the frequency and duration of instream works, including excavation. Work from established infrastructure, above the high water mark (i.e., top of bank), or at a minimum above the water line when possible. Restrict instream disturbance to the area(s) required to access and remove accumulations of sediment;

2.4.2 Fish passage is to be maintained around the isolated work zones through the implementation of a diversion channel where practicable. Sites with expected adult salmon presence with spawning and/or overwintering habitat upstream should be prioritized for a diversion channel. If a diversion channel is not practicable and fish are observed holding below the work zone, ongoing fish salvage is required to relocate fish around the work zone;

2.4.3 Large woody debris can only be removed from the floodplain if it poses imminent risk to downstream infrastructure and property. Where possible, stockpile the natural debris removed from the floodplain to an area that can be accessed for future restoration work. Reinstall root wads or large woody debris below the high water mark where practicable;

2.4.4 Do not stockpile materials such as rock, riprap, or dirt in areas where the material has the potential to enter fish-bearing waters;

2.4.5 Maintain all machinery on site in a clean condition and free of fluid leaks. All heavy equipment should use environmentally friendly oil ("enviro-oil");

2.4.6 Fuel should be stored a minimum of 30 m from any watercourse. Wash, refuel and service machinery and store fuel and other materials for the machinery in such a way as to prevent any deleterious substances from entering the watercourse;

2.4.7 Have spill containment and clean-up materials within operating machinery and vehicles and on site in case of leaking deleterious substances (e.g., fuel, oil, grease) from extracted anthropogenic debris. Report leaks or spills of deleterious substances that have caused, or are about to cause, the unauthorized death of fish by means other than fishing and/or the harmful alteration, disruption or destruction of fish habitat to DFO.PACViolations-infractionsPAC.MPO@dfo-mpo.gc.ca and to Observe, Record, Report at 1-800-465-4336 or DFO.ORR-ONS.MPO@dfo-mpo.gc.ca;

2.4.8 Dispose of all anthropogenic debris removed at an appropriate waste management facility as required; and

2.4.9 Works must be conducted in the dry. Follow DFO's interim Standard for In-Water Site Isolation: (https://www.dfo-mpo.gc.ca/pnw-ppe/codes/interim-provisoire/site-isolation-confinement-aire-travail-eng.html); DFO's interim Code of Practice for End-of-Pipe Fish Protection Screens for Small Water Intakes in Freshwater: (https://www.dfo-mpo.gc.ca/pnw-ppe/codes/screen-ecran-eng.html); and follow DFO's Code of Practice for Temporary Fords: (https://www.dfo-mpo.gc.ca/pnw-ppe/codes/temporary-fords-traversees-temporaires-eng.html)[4]. If works cannot be conducted in the dry due to high flow conditions, the work area must be decommissioned and fish passage reinitiated until conditions allow for site isolation.

2.5 Avoid removal of riparian vegetation, particularly mature trees, as much as possible. Where removal of riparian vegetation is not avoidable:

2.5.1 Prune or top the vegetation instead of grubbing/uprooting;

2.5.2 Construct access points and approaches perpendicular to the watercourse;

2.5.3 Rehabilitate areas of the streambank disturbed during the works to a stable condition (e.g., sloped and contoured and protected from erosion);

2.5.4 Re-vegetate disturbed areas with native trees, shrubs and grasses species suitable for the site; and

2.5.5 Where possible, incorporate bioengineering (i.e., pocket planting, live staking, root wad placement, etc.) within the bank restoration and erosion protection designs.

[4] November 2023 Amendment: Changed from "DFO's Interim Code of Practice for Temporary Cofferdams and Diversion Channels" to "DFO's interim Standard for In-Water Site Isolation". Also changed from "DFO's Interim Code of Practice for Temporary Stream Crossings" to "DFO's Code of Practice for Temporary Fords".

2.6 Avoid the installation of riprap bank slopes to the extent practicable.

2.7 Avoid works, undertakings or activities in Critical Habitat (as defined under the *Species at Risk Act*), or the handling or harm of species listed as Threatened or Endangered under the *Species at Risk Act*. If these aforementioned works, undertakings, or activities are required, works must stop and Proponent shall contact DFO for additional guidance and/or permitting.

2.8 Contingency measures shall be put in place if monitoring required in section 3 below indicates that the measures and standards to avoid and mitigate impacts to fish and fish habitat are not successful.

2.9 Dates by which these measures and standards shall be implemented: Measures and standards to avoid and mitigate impacts to fish and fish habitat shall be implemented prior to the initiation of works, undertakings or activities.

3. Conditions that relate to monitoring and reporting of measures and standards to avoid and mitigate impacts to fish and fish habitat.

3.1 Monitoring of avoidance and mitigation measures: The Proponent shall monitor the implementation of avoidance and mitigation measures referred to in section 2 of this authorization and report to DFO, within 30 days post-construction, and indicate whether the measures and standards to avoid and mitigate impacts to fish and fish habitat were conducted according to the conditions of this authorization. This shall be done by:

3.1.1 Demonstration of effective implementation and functioning: Providing dated photographs and inspection reports to demonstrate effective implementation and functioning of mitigation measures and standards described above to limit the impacts to fish and fish habitat to what is covered by this authorization; and

3.1.2 Contingency measures: Providing details of any contingency measures that were followed, to prevent impacts greater than those covered by this authorization in the event that mitigation measures did not function as described.

3.2 Other monitoring and reporting conditions:

3.2.1 Providing dated photographs of each debris removal, inspection reports and details outlining how each condition of this Authorization was met, and whether avoidance and mitigation measures were effective in reducing or limiting serious harm to fish to what is authorized herein;

3.2.2 Providing a geospatial polygon that accurately represents the completed HADD footprint(s). Geospatial polygon data should be collected using WGS 1984 to four (4) decimal places (e.g., 28.5234ºN, 80.6830ºW). Geospatial polygon data must be supplied in Shape File (.shp) format to ReferralsPacific@dfo-mpo.gc.ca with reference to DFO file: 22-HPAC-01308. In addition to the geospatial polygon, the following data must also be supplied in an Excel file (i.e., metadata):

- The date of sediment/debris removal, the type of debris removed (e.g., log jam, boulders etc.), the watercourse of removal, the coordinates of removal, if leaks or spills of deleterious substances were documented and mitigation measures to contain and clean leaks and spills;

- The type of HADD (e.g., riparian removal, aquatic footprint, etc.), the date of the HADD, and HADD area per habitat type (based on depth during high and low water seasons, high water mark); and

- Brand name and model of GPS unit, the coordinate system used, and guaranteed accuracy of GPS unit.

3.2.3 Providing a summary of observational mortality for the death of fish (e.g., eggs, alevins, fry) by means other than fishing related to the works, undertakings or activities.

3.2.4 Providing a summary of the fish salvaged. The information summarized shall include dates, the number of individuals salvaged, the location of salvage and relocation, and the nature of any effects to fish salvaged (capture, death, sub-lethal harm, etc.).

3.2.5 Providing details of any contingency measures that were followed, should prescribed mitigations not function as intended, to contain the impacts to fish and fish habitat to that which is authorized herein.

4. Conditions that relate to offsetting

4.1 Upon receipt and review of the monitoring results and supporting documentation outlined in section 3 above, DFO will determine whether offsetting is required.

4.2 If offsetting is required, the Proponent shall prepare a draft offsetting plan, consistent with the DFO's *Policy for Applying Measures to Offset Adverse Effects on Fish and Fish Habitat Under the Fisheries Act* and *Applicant's Guide Supporting the "Authorizations Concerning Fish and Fish Habitat Protection Regulations"* and provide it to DFO within 45 days of receipt that an Offsetting Plan is required.

4.3 If offsetting is required, the offsetting plan shall include the information identified in Schedule 1, Section 16 of the *Authorizations Concerning Fish and Fish Habitat Protection Regulations*, including an offsetting effectiveness monitoring plan.

4.4 Once acceptable to DFO, the offsetting plan shall be implemented with any additional requirements from DFO.

Authorization Limitations and Application Conditions

The Proponent is solely responsible for plans and specifications relating to this authorization and for all design, safety and workmanship aspects of all the works associated with this authorization.

The holder of this authorization is hereby authorized under the authority of Paragraphs 34.4(2)(b) and 35(2)(b) of the *Fisheries Act*. R.S.C., 1985, c.F-14, to carry on the work(s), undertaking(s) and/or activity(ies) that are likely to result in impacts to fish and fish habitat as described herein.

This authorization does not purport to release the applicant from any obligation to obtain permission from or to comply with the requirements of any other regulatory agencies.

This authorization does not permit the deposit of a deleterious substance in water frequented by fish. Subsection 36(3) of the *Fisheries Act* prohibits the deposit of any deleterious substances into waters frequented by fish unless authorized by regulations made by Governor in Council.

It is also your *Duty to Notify* DFO if you have caused, or are about to cause, the unauthorized death of fish by means other than fishing and/or the harmful alteration, disruption or destruction of fish habitat. Such notifications should be directed to DFO.PACViolations-InfractionsPAC.MPO@dfo-mpo.gc.ca **and** to Observe, Record, Report at 1-800-465-4336 or DFO.ORR-ONS.MPO@dfo-mpo.gc.ca.

The failure to comply with any condition of this authorization constitutes an offence under Paragraph 40(3)(a) of the *Fisheries Act*, and may result in charges being laid under said Act.

A copy of this authorization should be kept on site while the work is in progress and upon request be provided to relevant federal or provincial officials. The authorization holder is responsible for ensuring work crews are familiar with, and able to adhere to, the conditions.

This authorization cannot be transferred or assigned to another party. If the work(s), undertaking(s) or activity(ies) authorized to be conducted pursuant to this authorization are expected to be sold or transferred, or other circumstances arise that are expected to result in a new Proponent taking over the work(s), undertaking(s) or activity(ies), the Proponent named in this authorization shall advise DFO in advance.

Date of Issuance: November 23, 2023

Approved by: _____

Brenda Rotinsky
Watershed Operations Regulatory Manager
Fish and Fish Habitat Protection Program, Pacific Region
Fisheries and Oceans Canada

APPENDIX D – SITE PHOTOGRAPHS

Photo 1 Vegetation cleared to the water line behind a home. Note the sandy substrate in lower Lagace Creek



Photo 2 Left bank of lower Lagace Creek has been modified to create a lawn, beach area, and dock



Photo 3 Representative photo of large woody debris found along the banks of lower Lagace Creek



Photo 4 Example of undercut banks found throughout the site with lack of overhead cover



Photo 5 Representative photo of Lagace Creek showing laminar flow, no habitat complexity and no overhead cover



Photo 6 Vegetated islands mid-channel below Dale Road bridge



Photo 7 Beaver dam in lower Lagace Creek, north of Dale Road



Photo 8 Japanese knotweed *(Reynoutria japonica* var. *japonica*) along the bank of lower Lagace Creek



Photo 9 Typical riparian vegetation along lower Lagace Creek



Photo 10 Upstream view of lower Lagace Creek



Photo 11 Downstream view of lower Lagace Creek



Associated Environmental

REPORT

Ministry of Environment and Climate Change Strategy

Upper Lagace Creek (SCR 17) and Saporano Creek Bank Protection and Sediment Removal Environmental Management Plan



JULY 2024
REVISED

carbon neutral since 2009

CANADA BEST MANAGED COMPANIES Platinum member

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1 INTRODUCTION

The Ministry of Environment and Climate Change Strategy (ENV) retained Associated Engineering (B.C.) Ltd. (AE) to design emergency flood restoration works in upper Lagace Creek (Site 17) in Hatzic, BC (Figure 1-1) (the Project). The atmospheric river event (ARE) of November 2021 resulted in significant flooding and widespread sediment deposition throughout Lagace Creek. Sediment from the steeper, upstream portions of the Hatzic Lake watershed was transported to and deposited throughout the downstream reaches of Lagace Creek (Associated Engineering 2022).

The Project objective is to restore these sites to their pre-event condition by removing sediment and restoring the channel banks based on the current codes and standards. Approximately 300 m^3 of sediment are proposed for removal from upper Lagace Creek. Excess sediment is a contributing factor to the ongoing flood risk, including the potential risk of damage to watercourses, public and private infrastructure, and public safety during major storm events.

AE has engaged Associated Environmental Consultants Inc. (Associated), a subsidiary of the Associated group of companies, to provide this environmental management plan (EMP). The EMP describes the Project works and mitigation measures recommended to reduce or eliminate the potential adverse environmental effects of the works. This EMP is intended to support the contractor in the development of their Construction Environmental Plan (CEMP) and accompany the application for change approval under Section 11 of the *Water Sustainability Act* for the works.

1.1 Project Background

In April 2022, AE conducted a high-level, qualitative site assessment along upper Lagace Creek, which consisted of a risk assessment and the development of recommendations for mitigation works (Appendix A). The November 2021 ARE resulted in significant flooding and widespread sediment deposition throughout these areas. The event mobilized sediment and debris from the steep, upstream parts of the watershed and transported it to the flatter, lower parts of the catchment. Based on a review of previous assessments of Lagace Creek, it appears there is a history of deposition and bank erosion along the watercourse (Associated Engineering 2022, Appendix A). Fall and winter storms, such as AREs, generate high water flow. Events such as spring freshet do not appear to cause similar amounts of sediment deposition or types of damage in this section of the creek and its tributaries.

AE noted the following during the assessment of Lagace Creek from its origins at Allan Lake to the Lagace Creek / Pattison Creek confluence downstream:

- One private driveway bridge over Lagace Creek has failed due to inadequate hydraulic capacity of the culverts under the driveway. This driveway causes a damming effect during heavy rain events, causing water to back up on the upstream side of the bridge. This effect puts nearby structures at risk of flooding and has caused the embankment of the driveway to fail. The eroded material is deposited downstream during high-flow events, further reducing the hydraulic capacity of the creek and increasing flooding potential.
- Saporano Creek has deposited sediment on the east and west sides of Sylvester Road, and further downstream into Lagace Creek, restricting local channel and culvert capacity.
- Sediment deposition is visible at several various locations along Lagace Creek, particularly in the lower parts of this reach.

1.2 Proposed Flood Restoration Works

Flood restoration works along upper Lagace Creek will include sediment and debris removal from the main channel and along a tributary ditch on the east side of Sylvester Road to improve hydraulic capacity. The Project limits have been defined in the conceptual design drawings and the extents of proposed flood restoration works will be directed by the engineer on site. Potential access routes and laydown areas have been identified on the concept design drawings but where necessary will be field-fitted based on landowner requirements . Negotations with landowners for access agreements are in progress. One laydown area of approximately 275 m^2 is proposed within the riparian area of the creek. The conceptual design drawings for the proposed flood restoration works are provided in Appendix B.

The sediment that accumulated during the ARE will be removed from the channel at one location within the upper Lagace Creek creek, comprising a 45 m stretch approximately 500 m north of Lundgren Road, to restore the pre-flood channel capacity. The excavation depths will vary, to a maximum of 1.0 m, totalling an estimated 250 m^3 of sediment. An additional 50 m^3 of sediment will be removed from the tributary ditch along the east side of Sylvester Road (i.e., lower Saporano Creek). These volumes are approximate and are subject to change based on field direction during construction.

1.3 Construction Schedule

Flood restoration works are anticipated to begin during the least-risk fisheries window for upper Lagace, between August 1 and September 15, 2024, and instream isolation will be installed within this window, with upstream fish passage maintained where required. Construction is anticipated to take approximately 10 days, including mobilization, demobilization, and restoration of disturbed areas. The final construction schedule will be confirmed by the contractor; works will likely be completed sequentially, starting at downstream end and working upstream.

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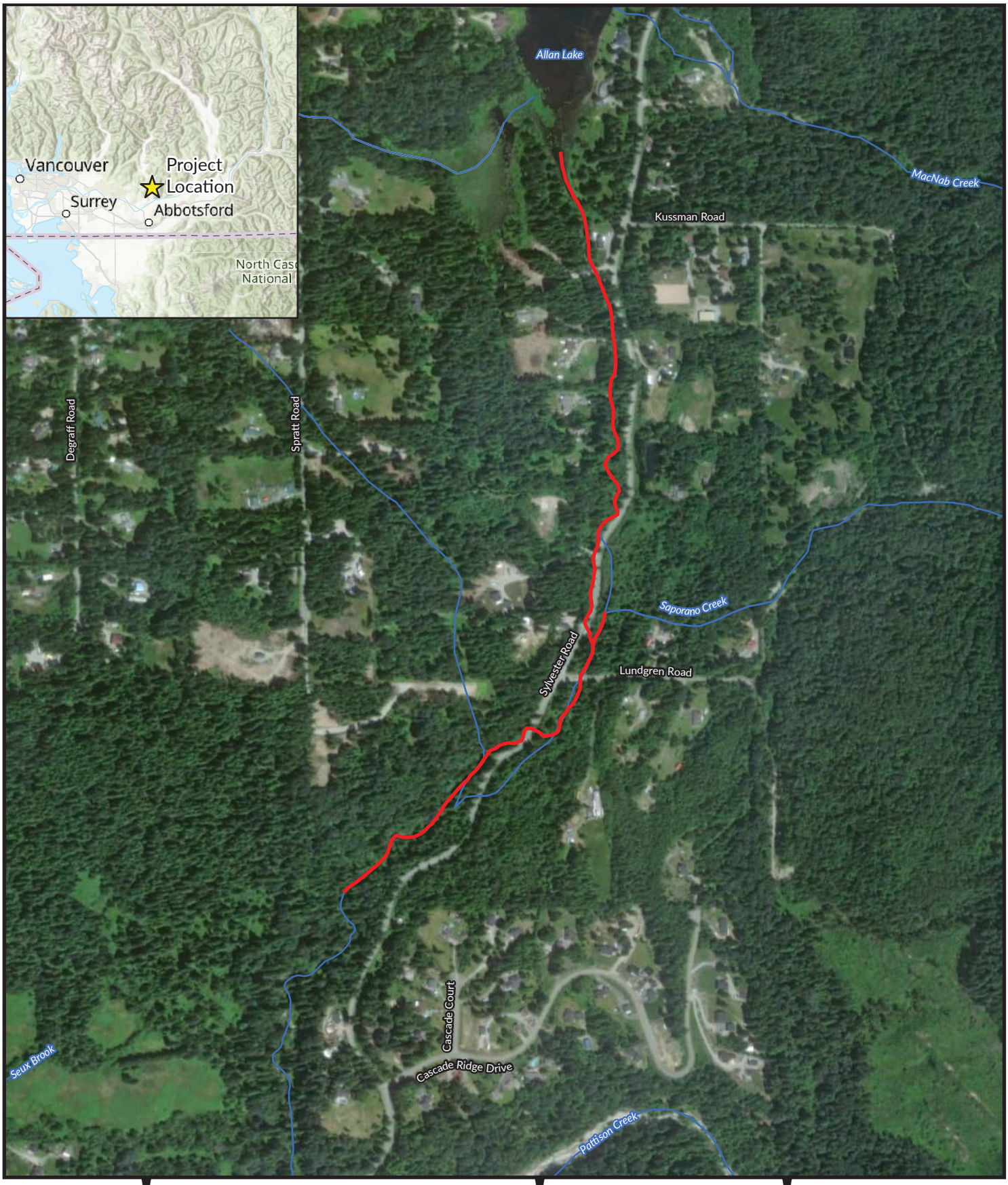

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Associated Environmental

Ministry of Environment and Climate Change Strategy

LEGEND

Project Location

Base Data

Watercourse

0 50 100 150 200 250 m

140

AE PROJECT NO.	2022-2632
SCALE	1:9,000
COORD. SYSTEM	NAD 1983 UTM ZONE 10N
DATE	2024-07-30
REV	01
DRAWN BY	SC
CHECKED BY	NS

FIGURE 1-1
PROJECT LOCATION

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
SCR17 LAGACE CREEK

1.4 Regulatory Context

The following federal and provincial legislation is relevant to the Project.

1.4.1 *Water Sustainability Act*

The provincial *Water Sustainability Act* (SBC 2014, c. 15) and the associated *Water Sustainability Regulation* (BC Reg. 36/2016) protect the quality of water, fish and wildlife habitat, and the rights of licensed water users. Under Section 11 of the Act, any activities that result in changes in or about a stream require submission of a notification or an application for change approval. The holders of water licenses on upper Lagace and Saporano Creeks, which may be affected by proposed works, must be advised as soon in advance of construction, and an alternate supply of fresh water provided during periods when water quality or availability will be adversely impacted, where required.

Sediment removal and erosion protection works in upper Lagace Creek will result in changes in or about a stream, with instream activities occurring below the high-water mark. Associated has submieted an application for a change approval to the Ministry of Water, Lands and Resource Stewardship. There are no water license holders within the proposed works area likely to be impacted by flood restoration activities.

1.4.2 *Fisheries Act*

The *Fisheries Act* (RSBC 1985, c. F-14) is the main federal legislation for Canadian fisheries management through the conservation and protection of fish and fish habitat. The Act defines fish habitat as “spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly to carry out their life processes.” Subsection 35 (1) states that “no person shall carry on any work, undertaking or activity that results in the harmful alteration, disruption or destruction of fish habitat.” Subsection 36 (3) stipulates that “no person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish.” A deleterious substance under the Act is “any substance that, if added to any water, would degrade or alter or form part of a process of degradation or alteration of the quality of water so that it is rendered or is likely to be rendered deleterious to fish or fish habitat.” This includes suspended sediment.

Project works will be started during the least-risk fisheries window of August 1 to September 15. Upper Lagace Creek has been confirmed to be fish bearing during site assessments in August 2023. A fish salvage will be conducted in work areas located in upper Lagace Creek before instream works begin. All instream works will be completed in the dry, or while a clean flow of water is maintained, to ensure no downstream impacts to fish or fish habitat occur during construction. Impacts to fish and fish habitat are anticipated to be fully mitigated to prevent permanent harmful alteration, disruption, or destruction; however, an emergency authorization under the *Fisheries Act* was obtained from Fisheries and Oceans Canada for these works (Appendix C).

1.4.3 *Species at Risk Act*

The federal *Species at Risk Act* (SC 2002, c. 29) provides legal protection for wildlife designated under Schedule 1 of the Act and their habitats. The purpose of the Act is to prevent Canadian indigenous species, subspecies, and distinct populations from becoming extirpated or extinct, to provide for the recovery of endangered or threatened species, and to encourage the management of other species to prevent them from becoming at risk. The Act applies to species that are federally managed (i.e., occur on federal lands, aquatic species or migratory birds) and makes it an offence under Sections 32 and 33 to kill, harm, harass, capture, or take an individual of a listed species that is extirpated, endangered, or threatened; possess, collect, buy, sell, or trade an individual of a listed species that is extirpated, endangered or threatened, or its part or derivative; and damage or destroy the residence of one or more individuals of

a listed endangered or threatened species or of a listed extirpated species if a recovery strategy has recommended its reintroduction. The Act protects species, their residences, and critical habitat. Western toads are known to breed in Allan Lake and may use upper Lagace Creek as overwintering habitat or migration corridors to upland forest habitat. Other species with the potential to occur in the Project area listed in Schedule 1 of the Act are discussed in Section 2.4.3.

1.4.4 *Migratory Birds Convention Act, 1994*

The federal *Migratory Birds Convention Act, 1994* (SC 1994, c. 22), protects various species of migratory birds, migratory insectivorous birds, and migratory non-game birds, including herons. The Act provides protection for migratory breeding birds and their nests by requiring that works be conducted in a manner that prevents destruction and/or disturbance to bird nests. Amendments to the *Migratory Bird Regulations, 2022* now provide enhanced nest protections for species in Schedule 1 of the Regulations.

The Act largely pertains to the site preparation and construction phases of the Project, when removal and disturbance of vegetation may affect habitat use by migratory birds during migratory stopover, staging, breeding, and summer foraging behaviours. The regional migratory breeding window for Hatzic is from late March to mid-August (ECCC 2023b). Further, if a nest of a species listed in Schedule 1 of the Regulations is detected in the Project footprint, designated wait times for the declaration of an abandoned nest will come into effect.

1.4.5 *Weed Control Act*

The provincial *Weed Control Act* (RSBC 1996, c. 487) designates provincially and regionally noxious weeds (listed in Schedule A of the Act) and the associated regulations governing those plants. The Act provides guidance for noxious weed prevention and management, stating that it is an occupier's (e.g., landowner) responsibility to manage and prevent the spread of noxious weeds. Noxious weeds are typically non-native plants that have been introduced to BC without the insect predators and plant pathogens that help keep them in check in their native habitats. For this reason, and because of their aggressive growth, these alien plants can be highly destructive, competitive, and difficult to control. The mitigation measures described in Section 4.6 should be followed to minimize the spread of weeds in the Project area.

2 EXISTING ENVIRONMENTAL CONDITIONS

2.1 Methods

This EMP is based on a desktop background review and site visits conducted in summer and early winter 2023 by Associated's Michaela Burke, R.B.Tech., and Dave Muhlert, R.B.Tech. Upper Lagace Creek was surveyed from August 8 to 10, 2023, and Saporano Creek was surveyed on December 1, 2023.

Field methods for the instream habitat surveys were adapted from Resource Information Standards Committee's Fish and Fish Habitat Inventory Standards and Procedures (RISC 2001) and the Fish Habitat Assessment Procedures (Johnston and Slaney 1996) and were tailored to the Project. Observations at each reach of Lagace and Saporano Creeks (from the confluence with Pattison Creek to Allan Lake for upper Lagace Creek, and from the confluence with Lagace Creek to 350 m upstream on Saporano Creek) included average wetted and bankfull channel width and depth, gradient, channel morphology, substrate composition, large woody debris, cover and salmonid spawning, rearing, and overwintering habitat quality. Additionally, riparian habitat quality was assessed by reviewing the left and right banks, and included documentation of forest type, stage, and dominant species.

The terrestrial assessment consisted of a visual encounter survey to opportunistically search for vegetation and wildlife species of interest and their habitat features (FLNRO 2016). The survey was conducted by walking the length of each Study Area (from the confluence with Pattison Creek to Allan Lake for upper Lagace Creek, and from the confluence with Lagace Creek to 350 m upstream on Saporano Creek), including up to 20 m from the creek centreline, to characterize wildlife habitat (including suitability for species at risk), identify significant wildlife features (e.g., dens, nests, cavities), and document rare or invasive plant species. The BC Ministry of Forests provided records of invasive plant locations near the sites (MOF 2023), which Associated subsequently verified in the field.

Representative photographs were taken of aquatic and terrestrial habitat and anthropogenic features in the Study Areas and are provided in Appendix D.

2.2 Fish and Fish Habitat

2.2.1 Lagace Creek

Lagace Creek is a third-order stream (ENV 2023a) and is a tributary of Hatzic Slough to the south. Allan Lake outflows into Lagace Creek; however, Allan Lake was dry with emergent vegetation at the time of the assessment. During the August 2023 site visit, flow in upper Lagace Creek appeared to originate from groundwater, approximately 450 m downstream of the lake. Water in the upstream portion was confined to isolated pools; water flow became consistent approximately 800 m downstream of Allan Lake. Water flow became more persistent in the creek further downstream, partly due to contribution from tributaries. Pattison Creek flows into Lagace Creek approximately 2.8 km downstream of the lake (Photo 1). Flow from this watershed eventually ends up in Hatzic Lake, ultimately flowing into the Fraser River (Figure 2-1).

Lagace Creek is fish bearing, and the following species have been documented in the creek: rainbow trout (*Oncorhynchus mykiss*), cutthroat trout (*O. clarkii clarkii*), chum salmon (*O. keta*), coho salmon (*O. kisutch*), sockeye salmon *(O. nerka*), lamprey (*Entosphenus* spp.), three-spine stickleback (*Gasterosteus aculeatus*), and prickly sculpin (*Cottus asper*) (ENV 2023a, 2023b). Salmonids were observed throughout the entire alignment, from the confluence to approximately 450 m downstream of Allan Lake, where the creek dried up. Fish were observed in isolated pools at the upstream end of this section.

Aggradation was evident throughout the creek, with a generally poorly defined thalweg and frequent flow splitting. Islands of accumulated material were found in the middle of the stream, and flow was relegated to the left and right banks, which likely exacerbates the bank erosion.

The bankfull width along the Study Area ranged from 18 m to less than 1 m; wetted width ranged from 17 m to 0 m (i.e., dry) (Photo 2, Photo 3). The upper 450 m of the channel was completely dry. The gradient throughout the 2.8 km Study Area ranged from 1 to 4 %, and riparian canopy cover ranged from 15 to 95% (Photo 4). Fish, likely 1- to 2-year-old cutthroat trout or coho, were observed throughout the wetted parts of the creek and in isolated pools as the stream connectivity lessened (Photo 5). If these pools continue to dry up, the fish may expire. Fish in these isolated pools are routinely at higher risk of predation as hiding places dry up.

Large woody debris, defined by Johnston and Slaney (1996) as pieces of wood ≥10 cm in diameter and at least 2.0 m in length, was abundant (Photo 4). The creek was overgrown with vegetation in many areas, and clusters of large woody debris occurred at regular intervals throughout, shaping the way sediment and cobbles were deposited and forming pools upstream or downstream of any log jams found. Riparian vegetation along Lagace Creek in the Study

Area comprises young forest, limiting large woody debris inputs to the creek. Riparian cover included coniferous and deciduous trees, shrubs, and ferns.

A concrete and rock weir (Photo 6) was constructed approximately 150 downstream of Allan Lake. The weir was covered with vegetation during the field visit on August 10, 2023, and the channel bed was dry from the weir to Allan Lake (Photo 7). Allan Lake itself was dry and full of emergent vegetation at the time of the survey (Photo 8). Based on field observations recorded on March 8, 2024, the weir is likely a partial fish passage barrier. The vertical drop at the weir structure was approximately 0.6 m, with a residual pool depth of 0.4 m below. Water flow did not pass over the weir but rather through three small (5 cm wide) slits, evenly distributed along the weir. At low flows this weir likely prevents any passage of fish; however, if flows overtopped the weir, there is potential for fish to access upstream. This is supported by the observation of cutthroat trout upstream of Allan Lake in Lagace Creek in 2003 (CDC 2023a).

Overall, upper Lagace Creek provides very good rearing habitat for juvenile salmonids and small-bodied fish species, as evidenced by the number of fish observed in the pools throughout the Study Area. Spawning gravels were observed in many areas throughout the stream, although they varied in quality and size, as a result of the copious amounts of cobble and boulder in the channel. Pools were often shallow in depth, at less than 0.4 m, possibly due to the extreme drought conditions occurring at the time of the survey. The bankfull depth measured seemed to indicate that the pools are deeper in the winter, and with the amount of overhanging vegetation and instream large woody debris, upper Lagace Creek may provide good to excellent overwintering habitat.

2.2.2 Saporano Creek

Saporano Creek (watershed code: 100-058500-84700-72100) is a first order stream that originates from alpine headwaters to the east. The stream enters Lagace Creek approximately 700 m downstream of Allan Lake (Figure 2-1). The lower reach of the stream is characterized by a riffle-pool morphology and an average gradient of 3.5%. The average channel width and wetted width were 4 m and 1.5 m during a low flow stage, respectively. The channel pattern is straight, and the substrate is comprised of cobble and boulder. Small woody debris and boulders provide the dominant form of instream cover for fish. The riparian vegetation is a mixed mature stage, comprised of deciduous and coniferous trees. The stream likely offers suitable rearing habitat for juvenile salmonids; however, the absence of suitable gravels suggests that spawning habitat is absent to limited.

There is a 1.6 m vertical drop at the downstream end of Saporano Creek, where it flows in a roadside ditch alongside Sylvester. There is a shallow (0.3 m) deep pool at the bottom of the vertical drop, which poses a barrier to fish passage upstream. Above this barrier, Saporano Creek was dry throughout the segment surveyed in December 2023. The bank around the vertical drop showed almost no signs of erosion, and the area is heavily vegetatated by shrubs and young trees. Based on these observations, it appears that Saporano Creek only flows downstream into the ditched segment on rare occasions, likely during high-volume storm events.

At confluence of Saporano Creek and Lagace Creek, the surface flow of Saporano dissipates subsurface through a mixture of unconsolidated gravel and cobble for a length of approximately 5 m before resurfacing. The unconsolidated substrate appears to have been deposited from a recent high flow event. Currently, at low flow stages, the absence of surface flow likely impedes the passage of fish into Saporano Creek.

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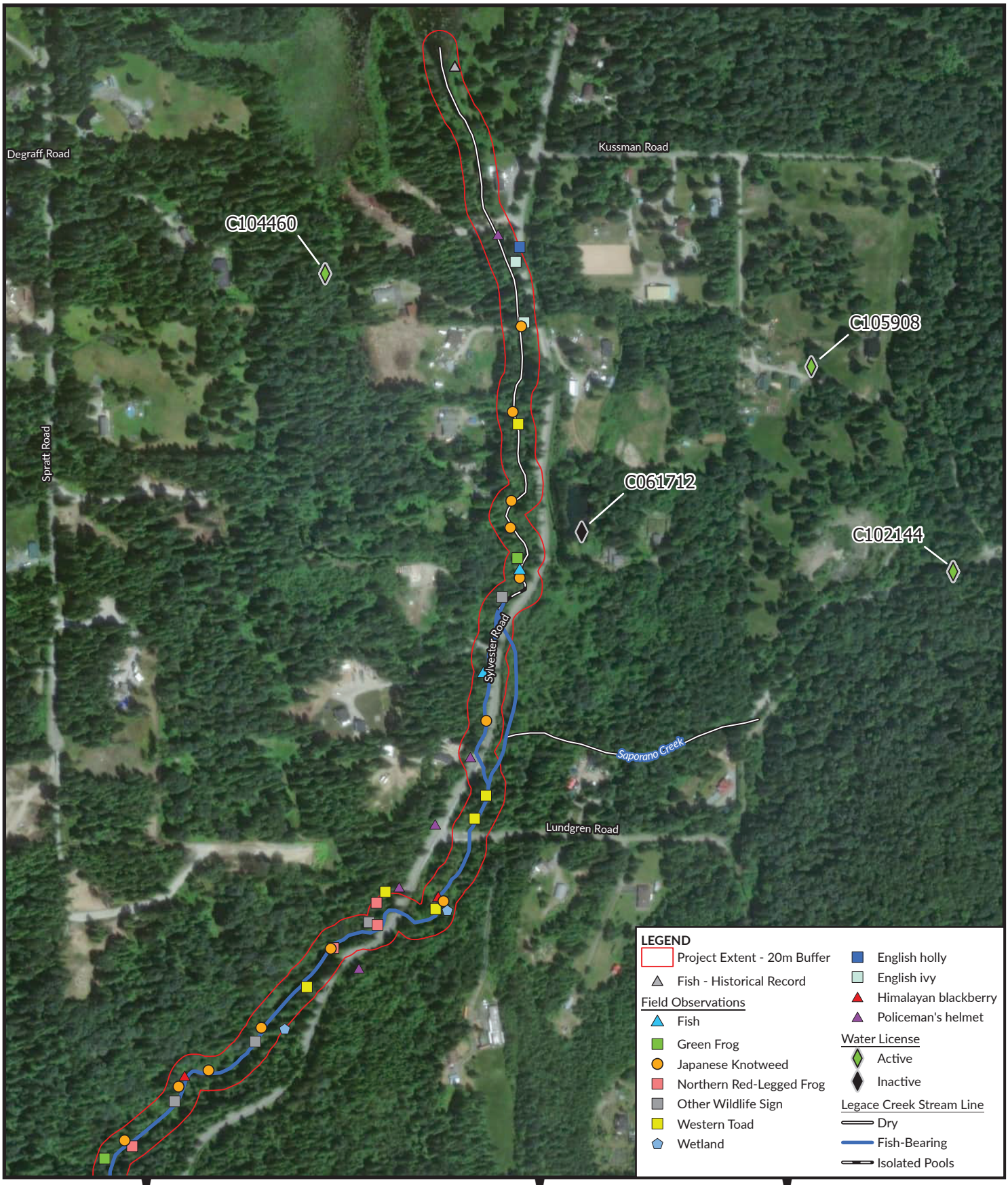

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Associated Environmental

Ministry of Environment and Climate Change Strategy

0 50 100 150 200 250 m

AE PROJECT NO.	2022-2632
SCALE	1:6,000
COORD. SYSTEM	NAD 1983 UTM ZONE 10N
DATE	2024-07-30
REV	04
DRAWN BY	HS
CHECKED BY	DM

FIGURE 2-1
EXISTING CONDITIONS

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
SCR17 LAGACE CREEK

2.3 Vegetation

2.3.1 Climate

The Study Area is located in the Coastal Western Hemlock dry maritime biogeoclimatic subzone (CWHdm), at an elevation of approximately 200 m above mean sea level. The CWH is one of Canada's wettest biogeoclimatic zones and has the most productive forest areas. The weather includes moist Pacific winds, extensive cloud cover and mist, and frequent drizzle. The climate is generally moderate (cool mesothermal), with cool summers and mild winters. The mean annual temperature in the CWH zone is 5.5°C, and the mean precipitation is 2,200 mm (Pojar *et al*. 1991).

2.3.2 Broad Ecosystems

Vegetation along the banks of upper Lagace Creek in the Study Area comprises young and mature forest areas dominated by red alder (*Alnus rubra*), bigleaf maple (*Acer macrophyllum*), western redcedar (*Thuja plicata*), and western hemlock (*Tsuga heterophylla*) (Photo 9). Below the top of bank, vegetation in the Study Area was dense and dominated by native shrubs such as vine maple (*Acer circinatum*), Pacific ninebark (*Physocarpus capitatus*), stink currant (*Ribes bracteosum*), and willow (*Salix* sp.) (Photo 10). In some areas, invasive Himalayan blackberry (*Rubus armeniacus*) formed dense thickets along the banks of the creek. Above the top of bank throughout the Study Area, the forest understorey was dominated by native shrubs, such as beaked hazelnut (*Corylus cornuta*), osoberry (*Oemleria cerasiformis*), salmonberry (*Rubus spectabilis*), vine maple, and thimbleberry (*Rubus parviflorus*) (Photo 11). The land outside the creek channel and riparian zone is primarily pasture land and agricultural fields where a variety of crops are grown.

Two potential wetland sites were observed adjacent to the main channel, based on the presence of a wet/muddy substrate and typical wetland vegetation, such as skunk cabbage (*Lysichiton americanus*) and sedge (*Carex* sp.) (Figure 2-1). The first site was approximately 1.5 km upstream from the confluence of Lagace Creek and Pattison Creek, and approximately 20 m upland from the main channel (Photo 12). This area was approximately 6 m wide and 15 m long and drains into the main channel of Lagace Creek. The second potential wetland area was approximately 300 m further upstream and approximately 10 m upstream from the main channel. This area was approximately 8 m by 15 m, with similar vegetation and substrate, and also appeared to drain into the main channel of Lagace Creek (Photo 13). During the field visit, both of these areas were mostly mud and had very little standing water.

2.3.3 Rare Plants and Ecosystems at Risk

No documented rare plants or known ecosystems at risk occur within 2 km of the upper Lagace Creek Study Area, and none were observed during the field visit (CDC 2023a).

2.3.4 Invasive Species

Nine invasive plant species were observed in the Lagace Creek Study Area, including numerous patches of the highly invasive Japanese knotweed (*Reynoutria japonica* var. *japonica*) in the main channel (Figure 2-1). Himalayan blackberry was abundant on the banks of upper Lagace Creek throughout the Study Area and formed dense thickets in some locations. Isolated patches of common foxglove (*Digitalis purpurea*) and policeman's helmet (*Impatiens glandulifera*) occurred within the stream channel. Yellow iris (*Iris pseudocora*) was present at the south end of Allan Lake, which was dry during the field visit. Several other invasive plant species were observed above the top of bank in the Study Area. A list of all invasive plant species documented during the field visit is provided in Table 2-1.

Table 2-1 Invasive Plant Species Observed Along Upper Lagace Creek

Common Name	Scientific Name	Status	Occurrences >1
English holly	*Ilex aquifolium*	Provincial priority[1]	
English ivy	*Hedera helix*	Provincial priority	✓
Cutleaf evergreen blackberry	*Rubus laciniatus*	No status	✓
Common foxglove	*Digitalis purpurea*	No status	✓
Creeping buttercup	*Ranunculus repens*	No status	
Himalayan blackberry	*Rubus armeniacus*	Provincial priority	✓
Japanese knotweed	*Reynoutria japonica* var. *japonica*	Provincial priority, noxious weed[2]	✓
Policeman's helmet	*Impatiens glandulifera*	Provincial priority	✓
Yellow iris	*Iris pseudacorus*	Provincial priority, noxious weed	

[1] Provincial priority means the species has been assigned a management objective by the BC Inter-Ministry Invasive Species Working Group (BC GOV 2023). [2] Noxious weed means the species is listed in Schedule A of the BC *Weed Control Regulation* (BC Reg. 66/85).

2.4 Wildlife and Wildlife Habitat

The habitat in the Study Area comprises a complex of forest, wetland, and agricultural land, and has the potential to support a diversity of wildlife. The young deciduous forest provides extensive foraging and nesting opportunities for passerines. Snags (i.e., a standing, dead or dying tree, often missing a top or most of the smaller branches) with signs of woodpecker feeding were observed throughout the Study Area; however, no potential nest cavities were detected. Many birds were observed calling and/or foraging in the Study Area, including black-capped chickadee (*Poecile atricapillus*), song sparrow (*Melospiza melodia*), spotted towhee (*Pipilo maculatus*), brown creeper (*Certhia americana*), American dipper (*Cinclus mexicanus*), Steller's jay (*Cyanocitta stelleri*), American robin (*Turdus migratorius*), gray catbird (*Dumetella carolinensis*), cedar waxwing (*Bombycilla cedrorum*), varied thrush (*Ixoreus naevius*), western tanager (*Piranga ludoviciana*), and downy woodpecker (*Dryobates pubescens*).

Some stick and cup nests were detected in the riparian vegetation on the banks of the creek, and all had the typical size, shape, and placement of passerine nests (Figure 2-1). However, none of the nests appeared to be recently maintained, most appearing abandoned or destroyed (Photo 14). Bird nesting activity was not detected during the site visit, and no raptor nests were detected.

Several mammals were observed in the Study Area, including coyote (*Canis latrans*), American mink (*Neovison vison*), and Douglas squirrel (*Tamiasciurus douglasii*). Mammal tracks, likely made by raccoons (*Procyon lotor*), were also observed (Photo 15) (Figure 2-1). In addition, bones were found in the creek that were consistent in size and shape with the sacrum and the femur of an American black bear (*Ursus americanus*) (Photo 16) (Figure 2-1).

Adult northern red-legged frog (*Rana aurora*) and juvenile western toads were observed in the main channel and in multiple upland locations adjacent to the creek, beginning approximately 1 km upstream from the confluence of Lagace Creek and Pattison Creek, to approximately 500 m downstream from Allan Lake (Figure 2-1) (Photo 17). In this area, red-legged frogs were also heard calling, and invasive green frogs (*Lithobates clamitans*) were observed in the main channel (Photos 18 and 19).

2.4.1 Species at Risk

Based on a search of the HabitatWizard portal (BC ENV 2023b) for publicly available observations of critical habitat and mapped known occurrences of species at risk within 2 km of upper Lagace Creek, species that occur or that have the potential to occur in the Study Area were identified (Table 2-2, Figure 2-2).

Table 2-2 Wildlife Species at Risk with the Potential to Occur in the Project Area

Common Name	Scientific Name	Provincial Status[1]	SARA List	Presence in Project Area and Potential Interaction with Project
				There are several occurrence records and mapped critical habitat for this species approximately 600 m south of the Project area, including areas adjacent to Lagace Creek, downstream of its confluence with Pattison Creek. These occurrences are approximately 2 km south of Saporano Creek. This species is most commonly associated with deciduous forest canopy dominated by bigleaf maple (*Acer macrophyllum*), with stinging nettle (*Urtica dioica*) in the understorey. Bigleaf maple trees and leaf litter, along with sporadic patches of stinging nettle, were observed in the upper Lagace Creek Study Area; therefore, this species has the potential to occur.
Oregon forestsnail	*Allogona townsendiana*	Red	Endangered	
Northern red-legged frog	*Rana aurora*	Blue	Special concern	There is a marked known occurrence of this species approximately 300 m downstream from the confluence of Lagace Creek and Pattison Creek. Associated detected multiple northern red-legged frogs in Lagace Creek during field visits in August 2023, approximately 200 m downstream from

Common Name	Scientific Name	Provincial Status[1]	SARA List	Presence in Project Area and Potential Interaction with Project
				the confluence of Lagace Creek and Saporano Creek. This species will breed in lotic habitat, with little to no flow, and may breed in upper Lagace Creek.
Western toad	*Anaxyrus boreas*	Yellow	Special concern	This species is known to breed in Allan Lake and disperses in the surrounding upland forest habitat. Suitable habitat for western toad occurs in the Lagace Creek Study Area. Associated detected juvenile western toads in the main channel of upper Lagace Creek and the associated upland riparian forest during the August 2023 field visit. Adult western toads are reported to breed in Allan Lake in spring, using connected channels as migration corridors (Aimee Mitchell, pers. comm. 2023). Once metamorphosed, juveniles typically congregate on the shore of the lake, staging for a mass emigration to the surrounding upland forest habitat in July or August (the exact timing varies each year and depends on seasonal factors and weather). Adults have also been observed overwintering in the drainage ditches surrounding the lake. Western toads could potentially be found in upper Lagace Creek at any time of year.
Pacific water shrew	*Sorex bendirii*	Red	Endangered	There is an occurrence record for this species from a wetland south of Lagace Creek, approximately 1.6 km downstream from the confluence of Lagace Creek and Pattison Creek (approximately 3 km southwest of Saporano Creek).

Common Name	Scientific Name	Provincial Status[1]	SARA List	Presence in Project Area and Potential Interaction with Project
				Suitable habitat for this species is found in riparian habitats associated with streams, creeks, and wetlands in mature coniferous or deciduous forests. Low flow and deep pools were present in Lagace Creek upstream of the confluence with Pattison Creek. Coarse woody debris that could be used by shrews for shelter or travel were present in the channels of upper Lagace Creek.
Marbled murrelet	*Brachyramphus marmoratus*	Blue	Threatened	Critical habitat for this species has been mapped in forest habitat approximately 200 m west of upper Lagace Creek, and approximately 500 m east of Allan Lake. Suitable habitat for this species comprises mature/old-growth coniferous forest near the coast. Areas of mature bigleaf maple, western redcedar (*Thuja plicata*), and western hemlock (*Tsuga heterophylla*) forest in the upper Lagace Creek Study Area may provide suitable nesting habitat for this species.
Spotted owl, *caurina* subspecies	*Strix occidentalis* ssp. *caurina*	Red	Endangered	Critical habitat for this species is mapped along the higher elevations parallel to upper Lagace Creek, approximately 700 m to the east. Suitable habitat for this species is old-growth or old-growth–like forests with multi-layered canopies, and where there are large-diameter trees with existing cavities for nesting. Forests in which abundant small mammals are available as prey are likely to be preferred as nesting sites.

Common Name	Scientific Name	Provincial Status[1]	SARA List	Presence in Project Area and Potential Interaction with Project
				Large-diameter trees with existing cavities were not detected in the Study Area, and most of the forest was second growth with a single-layered canopy. Therefore, suitable habitat for this species is likely not present in the upper Lagace Creek Study Area.

[1] Yellow indicates that a species is secure or apparently secure; blue indicates that a species is of special concern; and red indicates that a species is extirpated, endangered, or threatened.

2.5 Surface Water Licences

Based on a search of iMap (CDC 2023a), several surface water licences exist in the vicinity of upper Lagace Creek (Figure 2-1, Table 2-3). There are no water licenses along upper Lagace Creek, within the project extents.

Table 2-3 Surface Water Licences near Upper Lagace Creek

Licence Number	Status	Use Type	Creek Source
C06712	Cancelled	04A - Land Improve: General	Saporano Creek
C102144	Current	02I31 - Livestock & Animal: Stockwatering	Saporano Creek
	Current	01A - Domestic	Saporano Creek
	Current	03B - Irrigation: Private	Saporano Creek
	Current	01A - Domestic	Saporano Creek
	Current	03B - Irrigation: Private	Saporano Creek
	Current	02I31 - Livestock & Animal: Stockwatering	Saporano Creek
C104460	Current	01A - Domestic	Longspur Brook
	Current	01A - Domestic	Longspur Brook
	Current	01A - Domestic	Longspur Brook
	Current	01A - Domestic	Longspur Brook
C105908	Current	04A - Land Improve: General	Deer Creek
	Current	04A - Land Improve: General	Deer Creek

ALTHOUGH ASSOCIATED HAS TAKEN THE EFFORT AND DUE CARE TO ENSURE THE ACCURACY OF THE INFORMATION DISPLAYED AT THE DATE OF PRODUCTION, THE USER ACKNOWLEDGES THAT CHANGES OVER TIME AND THE CURRENCY OF THE DATASET(S) MAY IMPACT THE ACCURACY OF THE INFORMATION WITHOUT NOTICE. ASSOCIATED SHALL NOT BE HELD LIABLE TOWARDS THE RESULTS OBTAINED FROM THE USE OF THIS INFORMATION. SCALE(S) SHOWN ARE INTENDED FOR LETTER (8.5X11) SIZE ONLY.



\\AE-CALDATA\WORKING\VAN\2022-2632-06\GIS_ARC\2022-2632-060.APRX
IMAGERY: ESRI, DIGITALGLOBE, GEOEYE, I-CUBED, USDA FSA, USGS, AEX, GETMAPPING, ROAD AND HYDROGRAPHY: GOVERNMENT OF CANADA, 2019; SPECIES AT RISK AND CRITICAL HABITAT AREAS: GOVERNMENT OF BRITISH COLUMBIA, 2023.

Associated Environmental

Ministry of Environment and Climate Change Strategy

LEGEND

- Project Location
- Project Location - 2km Buffer

Critical Habitat Area
- Marbled Murrelet
- Oregon Forestsnail
- Spotted Owl (Caurina Subspecies)

Base Data
- Watercourse

AE PROJECT NO.	2022-2632
SCALE	1:35,000
COORD. SYSTEM	NAD 1983 UTM ZONE 10N
DATE	2024-07-30
REV	03
DRAWN BY	SC
CHECKED BY	NS

FIGURE 2-2
SPECIES AT RISK AND CRITICAL HABITAT

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
SCR17 LAGACE CREEK

2.6 Valued Components in the Project Area

Based on the findings of the background review, the following valued components are present in the Project area and are likely to be affected by the proposed flood restoration works:

- Fish and fish habitat;
- Riparian vegetation; and
- Wildlife (including species at risk).

3 POTENTIAL ENVIRONMENTAL EFFECTS

Elements of the Project with the potential to affect the environment include vegetation clearing to provide access for machinery, temporary stream diversion, removing sediment and debris from the stream channel, and stabilizing the banks and slopes. The potential environmental effects of these works include:

- Direct loss of or disturbance to fish and/or wildlife and/or their habitat;
- Direct loss of natural riparian vegetation through:
  - physical disturbance
  - introduction or spread of invasive weeds
- Introduction of deleterious substances into Lagace or Saporano Creeks; and
- Noise disturbance to wildlife and/or physical disturbance of aquatic and terrestrial habitat.

3.1 Temporary Disturbance and/or Loss of Fish and Fish Habitat

The instream works on upper Lagace Creek is scheduled to begin during the least risk fish window for instream works, August 1 to September 15. Instream works may temporarily disturb fish habitat in upper Lagace Creek throughout the flood restoration activities; however, this effect can be mitigated if flow and fish access are maintained around the isolated works area where required. Mitigation works such as isolation and stream bypassing will be installed during the least risk window. A fish salvage will be conducted in advance of instream works in upper Lagace Creek to capture any fish in the works area and move them upstream or downstream. Downstream impacts to Hatzic Slough from siltation or pollution will be mitigated by using standard best management practices for equipment and spills prevention and implementing erosion and sediment control measures.

Removing excess sediment and debris from one location in the upper Lagace Creek main channel has the potential to alter or eliminate valuable rearing or potential overwintering habitat in this stretch of the creek; however, this effect would likely only be short-term and suitable habitat exists along the channel both upstream and downstream of the sediment removal location. Further, sediment removal is intended to restore the creek to its pre-ARE condition and improve flow in the channel.

Minor sediment removal from the tributary ditch along the east side of Sylvester Road has the potential to temporarily affect fish rearing in this reach, however, upstream from this site, Saporano Creek is currently non-fish bearing. No permanent disturbance or loss of fish or fish habitat is anticipated as a result of the works in upper Lagace Creek and associated tributaries. Sediment and erosion control measures, as well as spill prevention and response plans, will be required in both creeks to prevent the entry of deleterious substances into fish habitat downstream.

3.2 Temporary Disturbance and/or Loss of Vegetation, Wildlife, and Wildlife Habitat

Loss of riparian vegetation and disturbance to wildlife and wildlife habitat are primarily associated with site access and laydown. An maximum of 275 m^2 of vegetation will need to be cleared for laydown with the riparian corridor along upper Lagace Creek. Access will be from Sylvester Road, to the extent practicable, and routes will be field fitted to avoid mature trees and snags (i.e., a standing, dead or dying tree) with large cavities to the extent possible. This will occur under the direction of a qualified environmental professional (QEP) engaged by the Contractor to ensure that sensitive habitat is avoided as much as possible or that appropriate mitigations are implemented, including salvage and relocation of individuals. Currently, works are scheduled to be conducted between August 1 and September 15, which overlaps with the end of the regional migratory breeding bird window of late March to mid-August. Pre-clearing nest surveys by a QEP may be required.

Clearing vegetation for site access and laydown has the potential to disturb adult western toads that may be sheltering in loose soils, in existing small mammal burrows, or under rocks or woody debris, or juvenile western toads that may be migrating from the creek to the forest. Clearing vegetation also has the potential to disturb northern red-legged frogs that may be foraging in upland areas near the creeks (CDC 2023b). Removing sediment from within the creek channels has the potential to disturb breeding or juvenile amphibians in pools and areas of low water flow velocity. Northern red-legged frogs lay eggs in the spring (i.e., March to July), and juveniles rear in slow-moving water until they are fully metamorphosed and emerge in late summer to early fall (CDC 2023b). Surveys for amphibian species at risk should be conducted by a QEP, where suitable habitat exists, before construction begins. If present, amphibians should be salvaged and relocated to suitable nearby habitat before upland or instream habitat areas are disturbed.

Several signs of woodpecker feeding were detected in the upper Lagace Creek Study Area, although no potential nest cavities made by pileated woodpeckers were detected. Pileated woodpeckers are listed on Schedule 1 of the *Migratory Birds Regulations, 2022*, and cavity nests of this species are afforded enhanced nest protection, which includes designated wait times before a nest is declared abandoned and the tree is removed. If a pileated woodpecker nest is detected, access routes and laydown areas should be sited to avoid the nest tree. Further, if construction work is anticipated within 30 m of a pileated woodpecker nest, additional monitoring may be required before construction begins to determine whether the nest is occupied and to develop a plan to avoid disturbing nesting birds.

Flood restoration works have the potential to spread invasive plant species within the Project area. Invasive plant species were documented throughout the stream channel of upper Lagace Creek, including numerous patches of Japanese knotweed and one occurrence of yellow iris, which are designated as noxious weeds in the provincial *Weed Control Act* (Figure 2-1). Site-specific measures will be required during construction to mitigate further spread of these and other invasive species.

Disturbed areas outside the channel will be seeded and/or planted with native vegetation once construction is complete. Generally, permanent environmental effects are not anticipated as a result of the flood restoration works.

4 MITIGATION MEASURES

All works will follow the measures provided in the *Water Sustainability Act* Section 11 Change Approval, Fisheries and Oceans Authorization, and standard best management practices. This EMP provides further mitigation measures to protect valued components in the Project area during and after works. The contractor is responsible for implementing the mitigation measures, and the QEP is responsible for monitoring and reporting on the implementation of the mitigation measures and providing guidance to the contractor as required.

4.1 Environmental Monitoring

An independent environmental monitor (EM) will be on site full time, including before and during vegetation clearing, site isolation, fish and amphibian salvage, dewatering, diversion, and reinstatement of flow, as well as during all in-water works, during or immediately after rain events or any other works in environmentally sensitive areas with the potential for adverse effects. The EM will be a QEP and will:

- Prepare a site-specific Construction Environmental Management Plan (CEMP) before construction begins for review and approval by the ENV representative.
- Stop construction if activities contravene mitigation recommendations in this EMP or the permit conditions, if activities have the potential to harm the natural environment, or if weather conditions are no longer conducive to instream works. Stop work orders must be accompanied by clear directives and restarting expectations. Only the EM has the authority to approve the resumption of works (after a stoppage) when they confirm the environmental risk has been managed.
- Implement the protection measures detailed in this EMP and the construction environmental management plan.
- Obtain a fish collection permit (Fisheries and Oceans Canada) and a scientific fish collection permit (Ministry of Water, Land and Resource Services), and salvage fish as required, before instream works begin;
- Obtain a general wildlife permit (Ministry of Forests) and salvage wildlife, as required, before clearing activities begin (e.g., western toad, northern red-legged frog, etc.).
- Prepare all permit reporting as required and submit to agencies after salvage.
- Visit the site during instream work and work in sensitive areas, and attend all key meetings at which environmental protection measures are will be discussed.
- Monitor turbidity in the creeks and/or downstream of the work areas routinely during construction as required (i.e., where there is water flow in the creek) and ensure it adheres to the guidelines outlined in BC Approved Water Quality Guidelines (2023), for aquatic life.
- Prepare and submit daily monitoring reports detailing the works occurring on site and the mitigation measures in place and report any incidents or contraventions.
- Provide any necessary recommendations that will improve the efficiency of the environmental mitigation measures.
- Document any environmental incidents or accidents that occur and provide guidance in addressing such incidents.
- Prepare necessary site-specific restoration plans for implementation after construction in accordance with environmental permits and this EMP.
- Oversee that channel restoration is implemented to re-establish cover along Saporano Creek (e.g., replacement of root wads), per the engineered design drawings.
- Oversee site-specific mitigation and protection measures as specified in the sections below, including:
  - field-fitting access routes to avoid large-diameter trees, dead standing snags, and trees with cavities
  - conducting pre-clearing surveys (nests) and salvages (wildlife and fish) where required
- Oversee management and disposal of provincial priority invasive species, if encountered in the Project area.
- Prepare a final completion report for the Project, within 20 days of the completion of construction, summarizing the information collected during monitoring, any actions taken on the part of the contractor, and any potential future environmental impacts that could occur on site.

4.2 Timing of Works

Instream works on Lagace Creek are scheduled to begin within the regional least-risk fisheries window of August 1 to September 15. The contractor will isolate instream work areas before sediment is removed, completing the rest of the work in isolation of flowing water and maintaining clean downstream flow. A QEP will be present during all in-water works and must be prepared to monitor dewatering works full time in case stranded fish or amphibians are present. Vegetation clearing may overlap with the end of the regional breeding bird window, in early August, and pre-clearing nest surveys by a QEP may be required. Exposed areas created by access clearing will be recontoured and seeded and/or planted with native species immediately after construction. All ground disturbance works are anticipated to be completed by October 31, thereby avoiding the amphibian overwintering period; however, if unforeseen delays result in sediment removal occurring past October 31, the Contractor's EM will survey excavation sites and assess the potential for amphibian overwintering. Suitable overwintering habitat must not be disturbed from October 31 to March 1.

4.3 Protection of Aquatic Habitat

The following general mitigation measures are intended to avoid or minimize impacts on instream habitat during construction:

- Complete work in the dry, during periods of low water, or isolate the work area.
- Isolate work areas from flowing water to prevent the movement of sediment using either pumps or temporary diversion channels, and maintain upstream fish passage, as required, for the duration of construction.
- Install instream isolation during the least risk fish regional least-risk fisheries window of August 1 to September 15, and ensure instream isolation is maintained until the completion of works. If instream works are anticipated to extend beyond the least risk window, ensure works area are completely isolated from instream flow and upstream fish passage is unimpeded. If spawning is observed; all instream works must cease.
- Use fish-friendly screens on all pumps (DFO, 2020).
- Isolate the site using mega bags, lock blocks, sandbags, fish screens, silt curtains, and/or silt fence to mitigate sediment migration.
- Monitor downstream turbidity during construction and compare the results to background measurements collected upstream of the sites.
- Immediately correct any failure of sediment and erosion control measures to contain turbid water in the Project footprint and document the incident.
- Reinstate isolation and salvage fish in the work areas again in the event of inclement weather and resulting high flow.
- Reintroduce water to isolated areas gradually after completing the instream works to prevent a large pulse of sediment from being released downstream.

4.4 Protection of Vegetation

The following general mitigation works are intended to avoid or minimize impacts during vegetation clearing and bank restoration works:

- Minimize vegetation removal, especially large-diameter trees (i.e. >20 cm) and dead standing snags.
- Field-fit access routes to avoid large-diameter trees, dead standing snags, and trees with cavities.
- Choose access points that cause the least damage to terrestrial habitat.

- Specify that barriers be established along the construction limits to prevent accidental intrusion and encroachment on the adjacent forest habitat.
- Restore cleared and disturbed areas by reseeding or planting once construction is complete and use native species in the restoration plan.

4.5 Protection of Wildlife

The following general mitigation measures are intended to avoid or minimize impacts on wildlife:

- Site access routes to avoid sensitive habitat and wildlife features (e.g., Oregon forestsnail habitat, tree cavities).
- Salvage for all species at risk (e.g., western toad, northern red-legged frog, Oregon forestsnail) before construction begins, where they are confirmed in the Project footprint.
- Install appropriate wildlife isolation fencing to prevent salvaged wildlife from returning to the construction area.
- Conduct a daily sweep for amphibians within the Project footprint, before works start.
- Follow Best Management Practices for Raptor Conservation during Urban and Rural Land Development in British Columbia (Demarchi and Bentley 2005).
- Retain large-diameter trees (i.e. >20 cm) and dead standing snags, where possible.
- Survey again for pileated woodpecker nest cavities and protected raptor nests within proposed clearing footprints in advance of works.
- Schedule construction timing to avoid clearing and grubbing within the peak migratory bird nesting window of March 12 to August 17 (Government of Canada 2023). Specify that a nest survey be conducted in advance by a QEP to confirm that there will be no disturbance to occupied bird nests and/or eggs if clearing during the nesting period is unavoidable.
- Educate the contractor and crew of the species at risk that have the potential to occur in the area (i.e., western toad, northern red-legged frog, Oregon forestsnail). If any species at risk are encountered, halt works, contact the EM, and salvage as appropriate.
- Specify that construction avoid typical high-activity periods for wildlife, such as dawn or dusk, whenever possible.
- Specify that standard best management construction practices be implemented to minimize construction noise.
- Implement a waste management system to avoid attracting wildlife, including appropriate containment or removal off site.
- Infill riprap along banks with gravel where possible, or another suitable material, to facilitate travel for small wildlife.
- Salvage and stockpile coarse woody debris and replace it after works are complete to re-establish instream cover and complexing along the channels, where practical.
- Replant all exposed and disturbed areas on the creek banks, under the direction of a QEP, using appropriate native vegetation to re-establish cover for wildlife, including amphibians.
- Revegetate all cleared areas immediately after construction, under the direction of a QEP.

4.6 Weed Management

The *Weed Control Act* (RSBC 1996, c. 487) states that any noxious weed species must be controlled by the owner of the land on which they occur. The following measures are intended to reduce the potential for introduction, transfer, or establishment of invasive plants and noxious weeds:

- Identify areas of invasive plants (e.g., Himalayan blackberry) within the Project footprint, remove the plants with their root structures and dispose of them off site (i.e., to an appropriate location to prevent their proliferation in adjacent areas).
- Handle provincial priority invasive species (e.g., knotweed) according to their management provisions and under the guidance of the EM (BC GOV 2023). Soils near these identified areas will potentially be contaminated (i.e., may contain seeds, root material) and should not be used for site reclamation to prevent further spread. Restore these areas quickly to prevent re-establishment.
- Ensure all vehicles accessing the sites are clean and free of weeds and any associated seeds before entering or leaving the worksites. Implement a program on site to ensure all vehicles and machinery are inspected before they enter or leave the worksites, including a designated cleaning station.
- Design and implement a restoration plan to re-establish disturbed areas after construction.
- Dispose of sediment at an approved facility.

4.7 Erosion and Sediment Control

The following erosion and sediment control measures are intended to avoid or minimize impacts during construction:

- Install appropriate site isolation, including silt fencing, before instream works begin, as required.
- Tie the ends of the silt curtain or silt fence into the shoreline or bank, as required, to prevent the escape of sediment-laden water.
- Restrict isolation to the area required for instream work.
- Install erosion and sediment control measures on all disturbed areas, including banks and access routes.
- Inspect erosion and sediment control structures regularly and after major rainfalls to ensure continued effectiveness, and to identify where replacement or maintenance is required and where trapped sediment needs to be removed. Maintain or repair erosion control structures as soon as practicable.
- Operate all machinery from outside the wetted channel or in isolation of flowing water.
- Monitor downstream turbidity routinely during instream works, and during and after significant rain events (e.g., >25 mm in 24 hours).

4.8 Fuel Storage and Spill Contingency Plan

Storage Facilities

- Contain and store all construction materials, equipment, and liquids at least 30 m away from watercourses.

Orientation and Training

- Train all construction personnel to use spill prevention and control equipment before construction begins.
- Explain the spill reporting procedures to all personnel. Provide all personnel with the spill response and reporting guidelines in an easy-to-follow, written format.

Environmental Best Management Practices

- Ensure that a fully stocked and appropriately sized spill kit is stored nearby and ready for use.
- Refuel at least 30 m from the top of any watercourse, or at such a distance that petroleum products will not be released into surface drainage.
- Prevent fuel overflow or spillage. Ensure that fuel tanks have connections that shut off automatically when the container is full.
- Collect condensation siphoned from fuel tanks in a separate tank for disposal in a licensed facility.
- Ensure all equipment used on site is in sound mechanical condition. No equipment with fuel leaks or deteriorated hydraulic hoses is to be used. Other precautions to be followed are:
    - Inspect equipment daily and keep it clean and free of oil, grease, coolant, and other contaminants.
    - Install drip trays on stationary equipment working on site to contain leakage of fuel, lubricant, or any other fluid.
    - Use biodegradable hydraulic fluids at all times when working in the watercourse channel.
    - Ensure all machinery complies with applicable provincial and federal regulations for operations and exhaust emissions. Exhaust systems must work well enough to control noise to normal operating levels.

Spill Response

- Ensure safety:
    - Ensure personal, public, and environmental safety.
    - Wear appropriate protective gear.
    - Identify the product spilled before cleanup.
    - Warn people in the vicinity.
    - Ensure no ignition sources are present if the spill is flammable.
- Stop the flow:
    - Act quickly to reduce the risk to the environment.
    - Close valves, shut off pumps, or plug leaks.
    - Stop the flow at its source.
- Secure the area:
    - Limit access to the area.
    - Prevent unauthorized entry onto the site.
- Contain the spill:
    - Prevent the spill from entering any drainage structures (e.g., ditches) or watercourses.
    - Use spill-absorbent material to contain the spill.
    - Minimize environmental contamination.
- Notify/report spills (Section 4.9).

The contractor will notify the EM and the project manager of all spills and the cleanup status. The contractor will confirm that spill kits and other spill containment materials are replenished and readily available for use in the future.

4.9 Environmental Incident Reporting

An environmental incident is one that has adversely impacted the environment, including but not limited to:

- Adverse impacts on the quality of air, land, water, wildlife, fish, habitat, aquatic species, or species at risk;
- Unauthorized release or discharge to the environment;

- Exceedance of compliance requirement limits as documented in a regulatory instrument (e.g., permit, order, licence, authorization, agreements);
- Violation of legislation, related policies, or regulations; and
- Alteration of, or damage to, existing infrastructure.

The reporting of spills, is mandated by the *Spill Reporting Regulation* (BC Reg. 263/90) of the *Environmental Management Act*.

Generally, the contractor will be notified by on site personnel of any event that could potentially result in an adverse safety or environmental effect (e.g., wildlife incident, accident on site, fuel or oil spill, concrete spill, machinery failure, or introduction of a deleterious substance into a waterbody). The contractor will then determine, in consultation with the EM, the correct and required course of action. The agreed-on action will be implemented immediately, and the contractor will report the event to the project manager.

The EM will complete an environmental incident report for all environmental incidents including spills. The incident report will include:

- Name and telephone number of the person who reported the incident;
- Name and telephone number of the person who caused the incident;
- Location, cause, and a description of the surrounding area;
- Type (including Material Safety Data Sheet number) and quantity of any spilled material;
- Details of the incident response, including location of disposal site of waste material;
- Names of all people on the scene, including ministry representatives;
- Names of people and agencies notified after the incident;
- Sequence of events, including notifications and timing; and
- Comments on the handling of the incident.

The *Spill Reporting Regulation* requires all persons who manage hazardous materials to report spills of any size into water immediately and to report only significant spills on land to the Provincial Emergency Program (PEP) at 1-800-663-3456. The types of materials likely to be present at the Project site and the amount of spill above which the PEP must be immediately advised include but may not be limited to:

- Fuels, engine oils, and hydraulic oils: 100 L;
- Petroleum oils and emulsions: 100 L;
- Antifreeze: 5 L; and
- Propane: 10 kg.

Under the *Environmental Management Act* (SBC 2003, c. 53), the person who had possession, charge, or control of the substance immediately before its spill must immediately report the spill to the PEP. A report to the PEP must include, where applicable:

- Name and telephone number of the person who reported the spill;
- Name and telephone number of the person who caused the spill;
- Location and time of the spill;
- Type and quantity of the substance spilled;

- Cause and effect of the spill;
- Details of action taken or proposed;
- Description of the spill location and the area surrounding the spill;
- Details of further action contemplated or required;
- Names of any agencies on the scene; and
- Names of other persons or agencies advised concerning the spill.

4.10 Project Area Restoration

The contractor will remove all construction materials from the Project site upon completion of the project. The Project site must be left in a condition acceptable to the EM and the ENV representative. If trees were removed, the EM will recommend planting to replace lost vegetation appropriate to the site-specific conditions by the in a site-specific restoration plan. Access points will be regraded and seeded or planted with native species, as necessary.

After the Project is complete, the EM will prepare a final report summarizing the information collected during monitoring, any actions taken on the part of the contractor, and any potential future environmental impacts that could occur on site. The Project completion report will include the final instream and riparian footprint areas.

Post-construction effectiveness monitoring following the completion of restoration will be carried out according to the terms of the *Water Sustainability Act* change approval and Fisheries and Oceans Canada authorization and is the responsibility of ENV as the Project proponent.

5 ENGAGEMENT

5.1 First Nations

Representatives from Leqamel, Sumas and Matsqui First Nations are members of the Hatzic Valley Emergency Works Task Force, which is a decision-making body that guides the activities related to ENV's flood response through the Flood Debris Management Secretariat. Meeting minutes are available upon request. There have been no environmental issues of concerns specific to this site raised to date.

5.2 Landowners

Private landowners with parcels along the channels where instream works are proposed and where access through the property is required have been notified of ENV's emergency works program, and preliminary engagement is underway (Table 5-1). Zenith Appraisal & Land Consulting Ltd. is working with the affected landowners, on behalf of ENV, to finalize access agreements. The BC Ministry of Transportation and Infrastructure has also been engaged, as some of the proposed works will occur within the Sylvester Road right-of-way.

Table 5-1 Properties Overlapping Proposed Sediment Removal Footprint in Upper Lagace Creek

PID	Property Address	Property Owner
008-799-121	12919 Sylvester Road	Mitchell & Leslie Reed
000-439-665	13001 Sylvester Road	Sorin Rentea

6 SUMMARY

Table 6-1 summarizes the proposed flood restoration works, including the scope of activities and construction schedule.

Table 6-1 Summary of Instream Impacts Associated with Proposed Flood Restoration Works at Upper Lagace and Saporano Creeks in Hatzic Valley

Stream	Description of Works Impacting the Stream (with Rationale)	Area of Impact (Dimensions)			No. of Days Required to Complete Work	Timing of Works	Potential Aquatic and Riparian Benefits and/or Impacts			Proposed Avoidance/Mitigation Measures
		Average Assumed Depth (m)	Volume (m^3) / Area (m^2)	Length Along Creek (m)			Aquatic Ecosystem	Water Quality	Water Quantity	
Upper Lagace Creek	Sediment and debris removal from channel to increase hydraulic capacity in the creek.	Varies; maximum depth assumed to be 1.0 m	250 m^3/ 250 m^2	45	10	August 1 – September 15, 2024	Temporary disturbance of instream habitat during construction	None; appropriate erosion and sediment control measures will be implemented.	None; water will be diverted around the work area.	• Conduct works in the dry, or create a temporary channel to maintain flow of water around isolated work areas. • Restore or improve channel functionality. • Revegetate disturbed banks. • Minimize clearing associated with access routes and revegetate immediately after construction.
Tributary ditch			50 m^3/ 50 m^2	45						

CLOSURE

This report was prepared for the Ministry of Environment and Climate Change Strategy to assess the potential impacts to the environment from the proposed Project design and to recommend mitigation measures to reduce or eliminate the potential impacts of the works on the aquatic and terrestrial environments. The contractor is responsible for implementing the mitigation measures provided in this EMP, under the guidance of an independent EM. Please contact the undersigned if you have any questions or concerns about the information provided.

The services provided by Associated Environmental Consultants Inc. in the preparation of this report were conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practising under similar conditions. No other warranty expressed or implied is made.

Respectfully submitted,

Associated Environmental Consultants Inc.

Submitted digitally

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Environmental Technologist

Reviewed by:

Jennifer Privé, R.P.Bio.
Manager, Environmental Sciences

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Associated Engineering (B.C.) Ltd. (Associated Engineering). 2022. Preliminary Assessment of Potential Areas of Immediate Concern PWC Site ID: S – CR-17 – Lagace Creek Between Pattison Creek and Allan Lake, Hatzic. BC.

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APPENDIX A – PRELIMINARY RISK ASSESSMENT LETTERS

Associated Engineering (B.C.) Ltd.
#500 - 2889 East 12th Avenue
Vancouver, BC, Canada V5M 4T5

TEL: 604.293.1411
FAX: 604.291.6163
www.ae.ca

June 24, 2022
AE File: 2022-2462-00

Fred Bjork, P.Eng.
Price Waterhouse Coopers
Submitted via email: fred.bjork@pwc.com

Re: PRELIMINARY SITE ASSESSMENT OF POTENTIAL AREAS OF IMMEDIATE CONCERN PWC SITE ID: S-CR-17 - LAGACE CREEK BETWEEN PATTISON CREEK AND ALLAN LAKE, HATZIC, BC

Dear Mr. Bjork:

The purpose of this high level and preliminary assessment of identified potential Areas of Immediate Concern is to allow the Province of BC to review and consider risks, potential consequences, and to prioritize urgent mitigation measures, including removal of sediments introduced by the 2021 Atmospheric River event (and other potential mitigation measures). The objective is to avoid hydraulic restrictions in the waterways and associated flooding due to the upcoming 2022 spring freshet, which may cause additional damage to riverbeds, banks, and infrastructure, and pose a significant threat to the safety of people, properties, infrastructure, and the environment.

1 SITE INFORMATION

Site ID: S-CR-17
Site Description: Lagace Creek between Pattison Creek and Allan Lake, Hatzic, BC
Site Locations:
Site 1 – Failed Driveway: 49.235909, -122.218453
Site 2 – Lagace Creek Tributary: 49.240045, -122.217729
Local Government Agency: Fraser Valley River District (FVRD)
Waterbody: Lagace Creek

The site location is shown in **Figure 1** and **Figure 2** located at the end of the letter.

2 SITE HAZARD

2.1 HAZARD ASSESSMENT METHODOLOGY

The assessment of this potential Area of Immediate Concern follows the following general methodology and approach:

1. High level senior engineering level experience and judgement, review of available relevant reference information, site visits and visual inspections, and communication with relevant stakeholders;
2. Risk assessment; and
3. Identification and advice on prioritized and appropriate mitigation measures (if any), their required timing, and further work required to validate such advice.

A Carbon Neutral Company

BEST MANAGED COMPANIES Platinum member

Associated Engineering (AE) completed a high-level, qualitative assessment of the above noted site by visiting the site on April 5, 2022 and reviewing background data as noted in **Section 3**.

2.2 HAZARD ASSESSMENT SUMMARY

The November 2021 Atmospheric River resulted in significant flooding and widespread sediment deposition throughout Lagace Creek. Sediment from the steeper upstream portions of the Hatzic Lake watershed were transported to and deposited throughout downstream reaches of Lagace Creek Sediment deposition is a regular occurrence during high-flow events as noted in the Northwest Hydraulic Consultants (NHC) *Flood Damage Recovery Plan. Lagace Creek, Hatzic Valley* (2005, June) report.

Based on a review of previous assessments of Lagace Creek, it appears that there is a history of deposition and bank erosion along this creek. High flows are generated during fall and winter storms, such as an atmospheric river, rather than a freshet (snowmelt) event.

During our site assessment of the Lagace Creek reach between Allan Lake and the Patterson Creek confluence, we noted the following:

1. There are several residences with private driveways across Lagace Creek, west of Sylvester Road. Most of these driveways consisted of wooden bridges with large hydraulic openings. These crossings are generally considered acceptable form a hydraulic capacity perspective;
2. **Site 1 – Failed Driveway:** At one (1) of the private driveways, the creek crossing consisted of three (3) culverts, estimated at 1.2 m diameter each. Relative to other private crossings, the hydraulic capacity is considered inadequate. Based on discussions with nearby residents, we understand that this location caused a significant increase in upstream water levels which placed several structures at risk of flooding. The driveway embankment failed during the event and eroded sediment which was deposited downstream. We expect that another high-flow event will erode additional sediment which is expected to negatively impact downstream areas if mobilized during a high flow event;
3. **Site 2 – Lagace Creek Tributary**: The Lagace Creek tributary has deposited sediment on the east and west sides of Sylvester Road. Additional sediment from this location appears to have been carried downstream into Lagace Creek. We anticipate that this has reduced the channel capacity in this area. Deposited sediment is located upstream and downstream of Sylvester Road. This sediment restricts local channel and culvert capacity; and
4. Sediment deposition is visible at several various locations along Lagace Creek, particularly in the lower parts of this reach.

3 PRELIMINARY RISK EVALUATION

The Preliminary Risk Evaluation for the site is shown in **Table 3-1**. The risk key is included in **Enclosure A** for ease of reference.

Table 3-1:
Preliminary Risk Evaluation

Category	Preliminary Risk Evaluation	Anticipated Consequence
Public Health and Safety	Low	Inundation of roadways and private property is expected during a high-flow event, however, this is not expected to create a significant public safety concern. Overtopping of Sylvester Road may also occur during lower rainfall events.
River Capacity	Medium	Channel capacity has been reduced which creates an increased risk of flooding adjacent areas.
Environmental	Low	Potential for trees and vegetation along the creek edge to die if inundated for a long time. Additional bank erosion may result in addition to vegetation dying. This vegetation is expected to regrow. The value of the habitat is not known but is not expected to be rare.
Infrastructure	Medium	Potential impacts to nearby private buildings and Sylvester Road.

Based on the preliminary risk evaluation noted above, we assess the risk to be **Medium**. On this basis, our opinion is that the site rating should be revised to an Area of Concern.

The Preliminary Risk Evaluation is based on the following currently available information:

1. Background Reports:
    a. Northwest Hydraulic Consultants (NHC). (2005, June). *Flood Damage Recovery Plan. Lagace Creek, Hatzic Valley.*
    b. Associated Engineering. (1992, August). *Hatzic Prairie Drainage Study Volume 1.*
    c. Stirling Geoscience Ltd. (2021, December 16). *Hatzic Prairie Creek Assessment and Preliminary High-Level Mitigation Cost Estimate, Hatzic Prairie, BC.*
2. Site Assessment completed on April 5, 2022;
3. Google Satellite Imagery;
4. Hydrology mapping provided by Emergency Management BC;
5. Phone Conversation with Jamie Sterling on April 6, 2022; and
6. Communications with FVRD Staff.

4 SITE OPINION AND ADVICE

Based on the hazard and risk assessment, it is our opinion that Site S-CR-17 (Sites 1 and 2) is an Area of Concern (AC), by definition one not requiring sediment removal prior to the 2022 spring freshet but requiring further assessment, emergency work and potential mitigation measures prior to the 2022 fall / winter storm season as follows:

Emergency Works (ASAP):

1. Not applicable.

Long-Term Holistic Solutions (to current Codes and Standards):

1. **Site 1 – Failed Driveway**: Remove sediment from Lagace Creek. Consider reinstating / upgrading the driveway crossing, if required, and associated hydraulic capacity to accommodate larger fall / winter storm events;
2. **Site 2 – Lagace Creek Tributary**: Remove sediment from the Lagace Creek tributary near Sylvester Road. Limits of sediment removal to be confirmed through an additional site review; and
3. Complete a hydraulic capacity assessment of the channel between Allen Lake and Pattison Creek to determine if additional activities are required.

5 CLOSURE

Please contact Andrew Wiens at 403-863-4009 if there are additional questions or concerns.

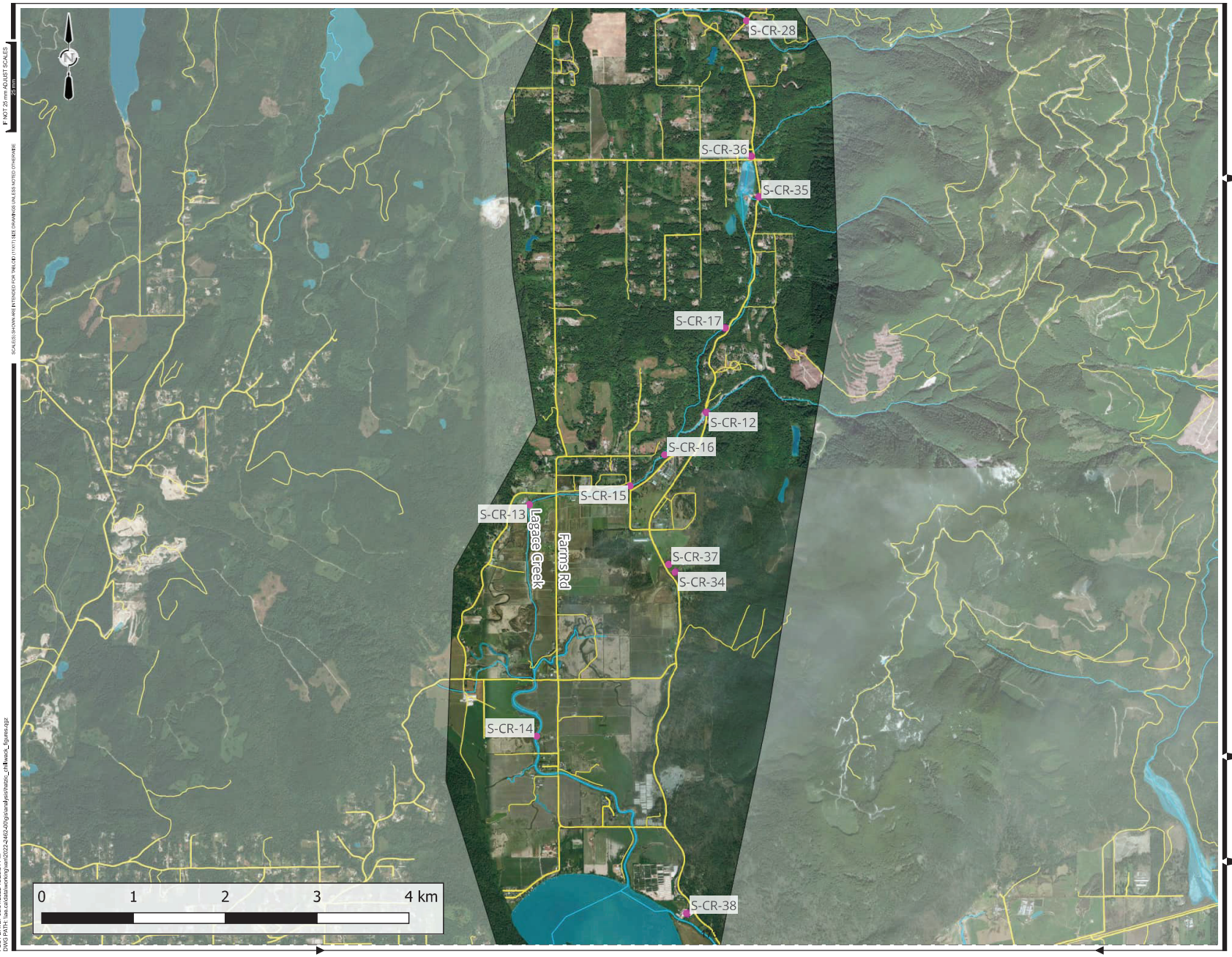
Yours truly,

Prepared by:

For Danielle Nyarko, E.I.T. (Alberta)
Water Resources Engineer
DN/AW/fd/kc

Reviewed by:

Andrew Wiens, P.Eng. (BC)
Senior Water Resources Engineer



Associated Engineering

BEST MANAGED COMPANIES
Platinum member

Legend

- Roads
- Watercourse
- Waterbodies
- Problem Location (Site)

NOTE: AERIAL IMAGERY PROVIDED BY BING AERIAL MAY NOT REFLECT CURRENT CONDITIONS DUE TO FLOOD EVENTS SINCE THE DATE OF COLLECTION

PROJECT LOCATION



pwc

FIGURE 1

PRICEWATERHOUSE COOPERS
BC MINISTRY OF ENVIRONMENT

WATERWAY SEDIMENT ASSESSMENT
PWC HATZIC PRARIE SITE OVERVIEW

AE PROJECT No.	20222462-00
SCALE	AS SHOWN
APPROVED	A. WIENS
DATE	20220531
REV	A
DESCRIPTION	ISSUED FOR FINAL

IF NOT 25 mm ADJUST SCALES
25 mm

SCALES SHOWN ARE INTENDED FOR 11"x17" SIZE DRAWINGS UNLESS NOTED OTHERWISE

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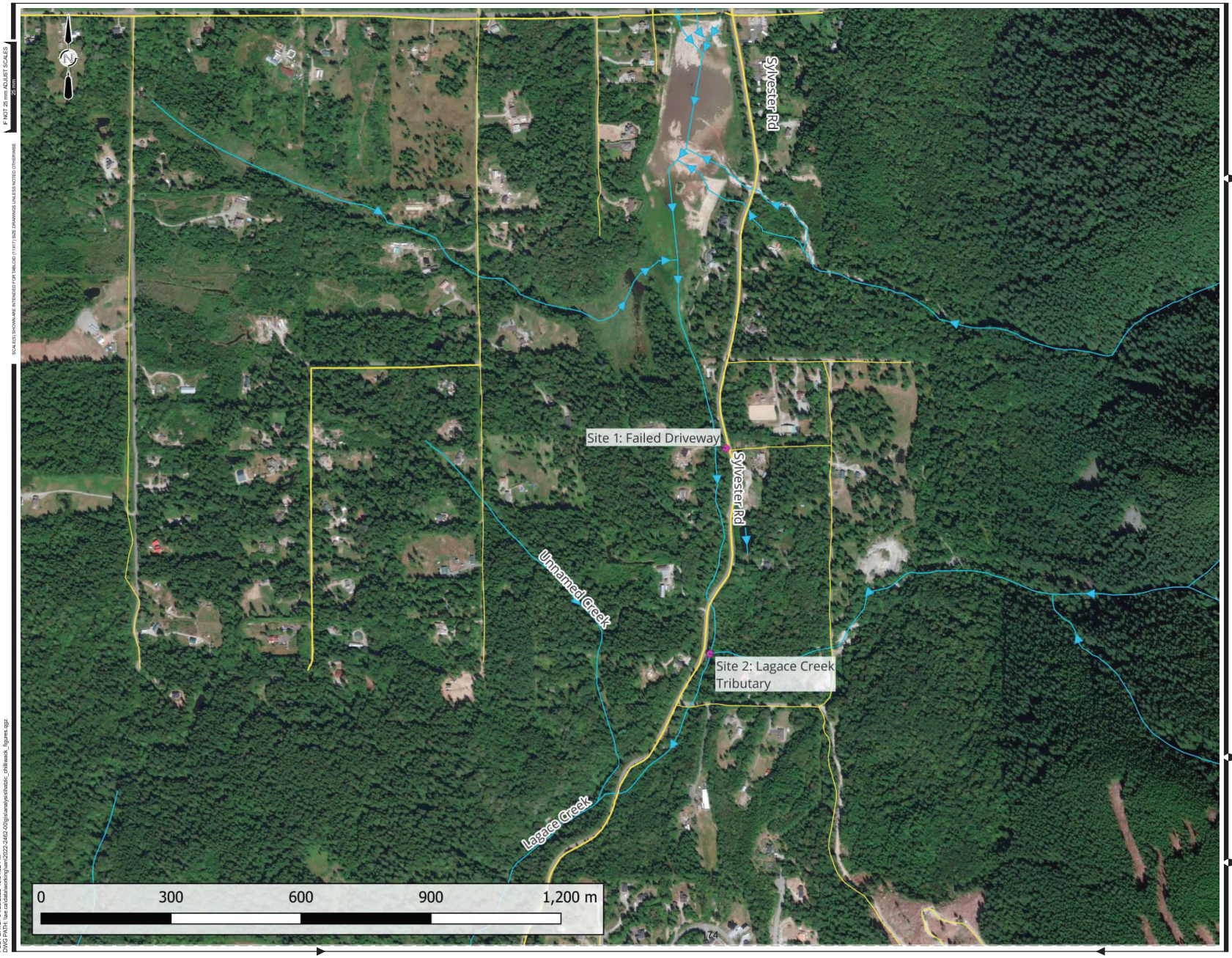


Associated Engineering

BEST MANAGED COMPANIES
Platinum member

Legend

- Roads
- Watercourses
- Waterbodies
- Problem Location (Site)

NOTE: AERIAL IMAGERY PROVIDED BY BING AERIAL MAY NOT REFLECT CURRENT CONDITIONS DUE TO FLOOD EVENTS SINCE THE DATE OF COLLECTION

PROJECT LOCATION



pwc

FIGURE 2

PRICEWATERHOUSE COOPERS
BC MINISTRY OF ENVIRONMENT

WATERWAY SEDIMENT ASSESSMENT
PWC SITE: S-CR-17
LAGACE CREEK NEAR LUNDGREN RD

AE PROJECT No.	20222462-00
SCALE	AS SHOWN
APPROVED	A. WIENS
DATE	20220427
REV	A
DESCRIPTION	ISSUED FOR FINAL

Enclosure A – Risk Matrix

Risk Evaluation and Response						
	Consequence Rating	**Very Low**	**Low**	**Medium**	**High**	**Very High**
Indices	**Public Health and Safety**	Minor disruption to few.	Minor, short term disruption to local community or moderate disruption to few.	Moderate disruption to local community, or substantial disruption to few.	Moderate, long term disruption to local community.	Substantial, long term disruption to region.
	River Capacity	Flow contained within the channel	Flow temporarily floods adjacent land	Flow floods adjacent lands resulting in prolonged flooding	Partial avulsion of flow resulting in flooding, erosion and scour damage to adjacent land and infrastructure	Full avulsion of flow resulting in flooding, erosion and scour damage to adjacent land and infrastructure
	Environmental	No noticeable loss or deterioration of habitat, species, unique landscapes, or culturally valued sites.	Small, short term loss or deterioration of important, unique, rare, or endangered habitat, species, landscapes, or culturally valued sites. Moderate, recoverable loss or damage of less valued habitat, species, landscapes, or sites.	Moderate temporary or small permanent loss or deterioration of important, unique, rare, or endangered habitat, species, landscapes, or culturally valued sites. Moderate loss or damage of less valued habitat, species, landscapes, or sites.	Moderate permanent loss or deterioration of important, unique, rare, or endangered habitat, species, landscapes, or culturally valued sites.	Major permanent loss or deterioration of important, unique, rare, or endangered habitat, species, landscapes, or culturally valued sites.
	Infrastructure	No infrastructure impacted	Impacts to infrastructure (minor erosion or scour, some debris accumulation, partial infilling, etc.) are not expected to have an impact of the operation of the infrastructure.	Impacts to infrastructure (erosion or scour, debris accumulation, infilling, etc.) leave infrastructure vulnerable	Impacts to infrastructure (erosion or scour, debris accumulation, infilling, etc.) should be repaired post-freshet	Impacts to infrastructure (erosion or scour, debris accumulation, infilling, etc.) will likely result in failure or irreparable damage to the infrastructure - repairs should commence pre-freshet
Likelihood	**Annual Exceedance Probability**	**Very Low**	**Low**	**Medium**	**High**	**Very High**
Very Likely	>0.2	**M**	**H**	**H**	**VH**	**VH**
Likely	0.2-0.1	**L**	**M**	**H**	**H**	**VH**
Moderate	0.1-0.02	**L**	**L**	**M**	**H**	**H**
Unlikely	0.02-0.005	**VL**	**L**	**L**	**M**	**H**
Very unlikely	<0.005	**VL**	**VL**	**L**	**L**	**M**

Risk Key			
	VH	Very High	Risk is unacceptable short-term (before next flood season); Risk reduction required
	H	High	Risk is unacceptable medium-term; Risk reduction plan must be developed and implemented in a reasonable time frame
	M	Medium	Risk may be tolerable; more detailed review required
	L	Low	Risk is tolerable; monitor
	VL	Very Low	Risk is broadly acceptable; no further review needed

Enclosure B – Site Photos



Lagace Creek:
Private Bridge



Legace Creek:
Site 1 – Failed Driveway

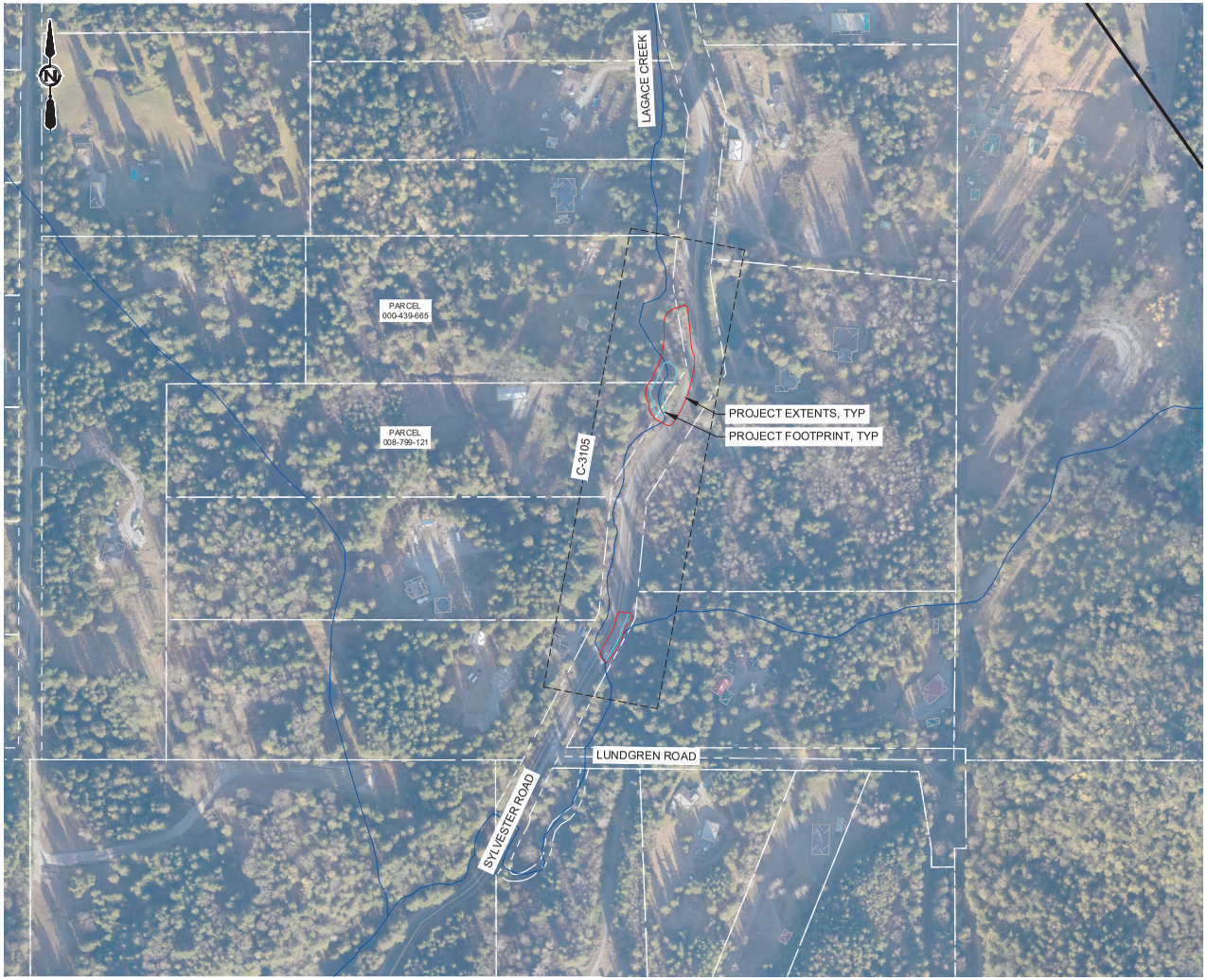
APPENDIX B – DESIGN DRAWINGS

IF NOT 50 mm ADJUST SCALES
50 mm

SCALE(S) SHOWN ARE INTENDED FOR ANSI D (22X34) SIZE DRAWINGS, TABLOID (11X17) SIZE DRAWINGS ARE 1/2 OF SCALE(S) SHOWN UNLESS NOTED OTHERWISE



1 G-3104 PLAN NTS
REGIONAL AREA



2 G-3104 PLAN 1:2000
PROJECT LOCATION

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Associated Engineering

CANADA BEST MANAGED COMPANIES
Platinum member

PERMIT TO PRACTICE
ASSOCIATED ENGINEERING (B.C.) LTD.
PERMIT NUMBER: 1000163
Engineers & Geoscientists BC

REV	DATE	DESIGN	DRAWN	DESCRIPTION
1	2024JUL05	R. KARGAARD	J. ROZON	ISSUED FOR RFP AND PERMITTING
0	2024JUN07	R. KARSGAARD	J. ROZON	ISSUED FOR RFP

BC MINISTRY OF ENVIRONMENT
AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY
WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: AS SHOWN

BRITISH COLUMBIA

CIVIL
PLAN
S-CR-17 SEDIMENT REMOVAL

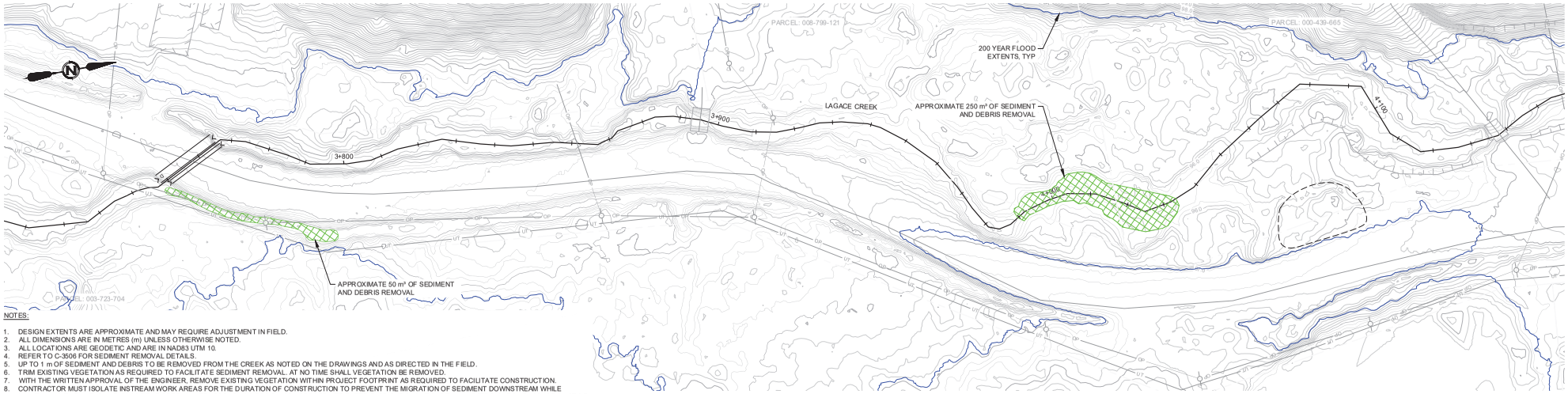
DRAWING	REVISION	SHEET
2632-03-C-3105	1	7

IF NOT 50 mm ADJUST SCALES
50 mm

SCALE(S) SHOWN ARE INTENDED FOR ANSI D (22X34) SIZE DRAWINGS, TABLOID (11X17) SIZE DRAWINGS ARE 1/2 OF SCALE(S) SHOWN UNLESS NOTED OTHERWISE



1 C-3105 PHOTO 1:500
EXISTING CONDITIONS



2 C-3105 PLAN 1:500
EXISTING CONDITIONS

NOTES:

1. DESIGN EXTENTS ARE APPROXIMATE AND MAY REQUIRE ADJUSTMENT IN FIELD.
2. ALL DIMENSIONS ARE IN METRES (m) UNLESS OTHERWISE NOTED.
3. ALL LOCATIONS ARE GEODETIC AND ARE IN NAD83 UTM 10.
4. REFER TO C-3506 FOR SEDIMENT REMOVAL DETAILS.
5. UP TO 1 m OF SEDIMENT AND DEBRIS TO BE REMOVED FROM THE CREEK AS NOTED ON THE DRAWINGS AND AS DIRECTED IN THE FIELD.
6. TRIM EXISTING VEGETATION AS REQUIRED TO FACILITATE SEDIMENT REMOVAL. AT NO TIME SHALL VEGETATION BE REMOVED.
7. WITH THE WRITTEN APPROVAL OF THE ENGINEER, REMOVE EXISTING VEGETATION WITHIN PROJECT FOOTPRINT AS REQUIRED TO FACILITATE CONSTRUCTION.
8. CONTRACTOR MUST ISOLATE INSTREAM WORK AREAS FOR THE DURATION OF CONSTRUCTION TO PREVENT THE MIGRATION OF SEDIMENT DOWNSTREAM WHILE MAINTAINING THE NATURAL FLOW OF THE CREEK VIA TEMPORARY DIVERSION OR APPROPRIATE FILTER FABRIC (E.G. SILT CURTAIN). UPSTREAM FISH PASSAGE MUST BE MAINTAINED FOR THE DURATION OF CONSTRUCTION.
9. THE LOCATION OF ALL UTILITIES SHOWN ARE NOT GUARANTEED TO BE ACCURATE OR COMPLETE AND MUST BE CERTIFIED WITH THE UTILITY PRIOR TO PROCEEDING WITH CONSTRUCTION. THE CONTRACTOR IS RESPONSIBLE FOR CONFIRMING THE LOCATION ALL EXISTING SURFACE INFRASTRUCTURE AND UNDERGROUND UTILITIES WITH UTILITY COMPANIES AND PROPERTY OWNERS.

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PERMIT TO PRACTICE
ASSOCIATED ENGINEERING (B.C.) LTD.
PERMIT NUMBER: 1000163
Engineers & Geoscientists BC

REV	DATE	DESIGN	DRAWN	DESCRIPTION
1	2024JUL05	R. KARSGAARD	J. ROZON	ISSUED FOR RFP AND PERMITTING
0	2024JUN14	R. KARSGAARD	J. ROZON	ISSUED FOR RFP

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

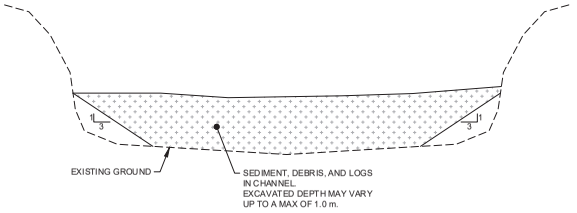
SCALE: AS SHOWN

BRITISH COLUMBIA

CIVIL
PLAN
S-CR-17 SEDIMENT REMOVAL

DRAWING	REVISION	SHEET
2632-03-C-3106	1	8

IF NOT 50 mm ADJUST SCALES
50 mm
SCALE(S) SHOWN ARE INTENDED FOR ANSI D (22X34) SIZE DRAWINGS, TABLOID (11X17) SIZE DRAWINGS ARE 1/2 OF SCALE(S) SHOWN UNLESS NOTED OTHERWISE



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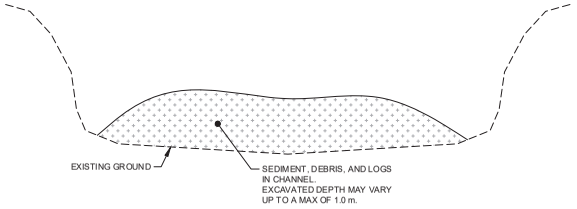
DEBRIS/SEDIMENT REMOVAL - FULL CHANNEL



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DEBRIS/SEDIMENT REMOVAL - PARTIAL CHANNEL

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Associated Engineering

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Platinum member

PERMIT TO PRACTICE
ASSOCIATED ENGINEERING (B.C.) LTD.
PERMIT NUMBER: 1000163
Engineers & Geoscientists BC

REV	DATE	DESIGN	DRAWN	DESCRIPTION
1	2024JUL05	R. KARSGAARD	J. ROZON	ISSUED FOR RFP AND PERMITTING
0	2024JUN14	R. KARSGAARD	J. ROZON	ISSUED FOR RFP

BC MINISTRY OF ENVIRONMENT
AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY
WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: AS SHOWN

BRITISH COLUMBIA

CIVIL
DETAIL 6 OF 6
SEDIMENT REMOVAL

DRAWING	REVISION	SHEET
2632-03-C-3506	1	14

APPENDIX C – EMERGENCY *FISHERIES ACT* AUTHORIZATION FROM FISHERIES AND OCEANS CANADA

Fisheries and Oceans Canada | Pêches et Océans Canada

Paragraphs 34.4(2)(b) and 35(2)(b) *Fisheries Act* Authorization
EMERGENCY AUTHORIZATION

November 2023 Amendment[1]

Authorization issued to
BC Ministry of Environment and Climate Change Strategy (MoECCS)

Attention to:
Thyren Jacobs
PO Box 9337 Stn Prov Govt
Victoria, B.C.
V8W 9M1 *(hereafter referred to as the "Proponent")*

Location of Proposed Project

Nearest community: Mission
District: Fraser Valley Regional District
Province: British Columbia
Name of watercourses and coordinates:

Priority sites:
1. CR-12 - Pattison Creek (near Sylvester Road): 49.224318°, -122.225164°
2. CR-28 - Carratt Creek (at Carratt Road bridge): 49.262427°, -122.217317°
3. CR-38 - Davies Creek: 49.175456°, -122.227440°

Remaining nine (lower priority) sites:
4. CR-13 - Legace Creek (near 11744 Stave Lake Road): 49.215732°, -122.251508°
5. CR-14 - Legace Creek (at 10491 Farms Road): 49.191343°, -122.250592°
6. CR-15 - Legace Creek (at Seux Road): 49.217294°, -122.236456°
7. CR-16 - Legace Creek (from confluence with Pattison Creek to Seux Road Bridge): 49.131411°, -122.135081°
8. CR-17 - Legace Creek (between Pattison Creek and Allan Lake)
   Site 1 - Failed Driveway: 49.235909°, -122.218453°
   Site 2 - Legace Creek Tributary: 49.240045°, -122.217729°
9. CR-34 - South Herford Creek: 49.208806°, -122.230723°
10. CR-35 - McNab Creek: 49.245478°, -122.216991°
11. CR-36 - Eng Creek: 49.249415°, -122.217877°
12. CR-37 - North Herford Creek: 49.209358°, -122.231182°

Valid Authorization Period

This Authorization remains in force from the **Date of Issuance** until **December 31, 2030**.

[1] This is the first amendment to *Fisheries Act* Authorization 22-HPAC-01308 originally issued on October 27, 2022. Amendments to this Authorization will be highlighted in footnotes.

Please note that this Authorization may contain more specific timing requirements and limitations. These are set out in the Conditions of Authorization section.

Description of Proposed Project

The proposed project of which the work, undertaking or activity authorized is a part of involves:

- Emergency works to remove accumulations of sediment, organic debris or anthropogenic debris ("debris") in locations where it poses a risk to downstream infrastructure (e.g., bridges or homes) under high flow conditions between 2022 and 2024[2], and/or
- Completing emergency works to stabilize bank slopes and implement erosion protection measures.

The project is described in the following documents, hereafter referred to collectively as the "Project Plan":

- Application Form and supporting documents for the Issuance of an Authorization under Paragraphs 34.4(2)(b) and 35(2)(b) of the *Fisheries Act* (Emergency Situation) received on October 13, 2022.
- *The Ministry of Environment and Climate Change Strategy: Pattison, Carratt and Davies Creeks – Sediment Removal and Bank Protection Environmental Management Plan* report produced by Associated Environmental Consultants Inc. dated October 2022.

Description of Authorized work(s), undertaking(s) or activity(ies) likely to result in the death of fish by means other than fishing and/or the harmful alteration, disruption or destruction of fish habitat:

- Site isolation using either pumps or temporary diversion channels;
- Removal of watercourse substrate (including sediment or debris) using excavators, large trucks, and hand tools;
- Relocation and/or removal of large woody debris from the watercourses using excavators, large trucks, and hand tools;
- Bank repairs and installation of erosion protection measures; and
- Removal of riparian vegetation for site access.

The authorized work(s), undertaking(s), or activity(ies) are likely to result in the following impacts to fish and fish habitat:

- Alteration and disruption of aquatic habitat including substrate removal and replacement likely to result in a reduction in habitat availability and complexity, and cause sedimentation.
- Site isolation leading to a temporary disruption to fish passage which may impact life history stages including spawning, migration, overwintering and rearing.

[2] November 2023 Amendment: Changed from "in the 2022 fall and 2023 spring periods" to "between 2022 and 2024".

- Alteration and disruption to stream bank habitat likely to result in a reduction in habitat function of both the aquatic and riparian habitat.
- Alteration, disruption and destruction of riparian habitat for site access.

Riparian and aquatic footprints of the above WUAs for Pattison, Carratt and Davies Creeks shall not exceed what is described in the Project Plan. For the nine lower-priority sites, riparian and aquatic footprints shall not exceed what is required to alleviate flood risk based on the Risk Assessment Methodology of the Project Plan.

Conditions of Authorization

The above-described work, undertaking or activity must be carried on in accordance with the following conditions.

1. **Conditions that relate to the period during which the work, undertaking or activity can be carried on**

   The work, undertaking or activity that is/are authorized to be carried on during the following period:

   FROM: Date or Issuance TO: December 31, 2024[3]

   If the Proponent cannot complete the work, undertaking or activity during this period, Fisheries and Oceans Canada (DFO) must be notified in advance of the expiration of the above time period. An application for amendment, suspension or cancellation of the authorization should be submitted to DFO.

   The periods during which other conditions of this authorization must be complied with are provided in their respective sections below.

2. **Conditions that relate to measures and standards to avoid and mitigate impacts to fish and fish habitat**

2.1 Works, undertakings, and activities shall be conducted in a manner that avoids the death of fish.

2.2 A Qualified Environmental Professional will be onsite during high-risk instream and riparian works (e.g., substrate removal, riparian vegetation removal) to oversee/direct avoidance and mitigation measures to reduce impacts to fish and fish habitat and avoid unauthorized death of fish by means other than fishing and harmful alteration, disruption and destruction of fish habitat.

2.2.1 Conduct full time observations for all fish species that may be present near and within the project footprint and modify or direct works to the extent possible to avoid or minimize potential injury and death of fish;

2.2.2 Prior to sediment removal and other instream disturbances, isolate work site(s) and salvage fish;

[3] November 2023 Amendment: Changed from December 31, 2023 to December, 31, 2024.

2.2.3 Fish salvage methodologies should consider the winter nocturnal activity of juvenile salmonids (e.g. Pacific salmon and trout species) that may spend the day concealed in the stream substrates. Where isolation occurs, conduct fish salvage between dusk and dawn (sunset/sunrise) when fish emerge to forage, to avoid and mitigate against the death of juvenile fish;

2.2.4 Relocate all salvaged fish species from the work area, or those holding below a work area, back to the same watercourse in a nearby area that is not impacted by construction or removal works or its zone of influence (i.e., areas of higher turbidity due to instream works);

2.2.5 Conduct full time monitoring for deleterious substance released during the removal of sediment and direct avoidance and mitigation measures to reduce impacts to fish and fish habitat and avoid unauthorized death of fish by means other than fishing and harmful alteration, disruption and destruction of fish habitat and to prevent their further movement into the watercourse; and

2.2.6 Monitor implementation of the conditions of this authorization.

2.3 Sediment and erosion control: Sediment and erosion control measures must be in place and shall be upgraded and maintained, such that release of sediment is avoided at the location of the authorized work, undertaking, or activity. Monitor the watercourse for signs of sedimentation resulting from the works, undertakings or activities and take corrective action if required.

2.3.1 Areas of streambank disturbed during the works shall be rehabilitated to a stable condition (e.g. re-sloped and contoured) and protected from erosion.

2.4 List of measures and standards to avoid and mitigate impacts to fish and fish habitat:

2.4.1 Every reasonable effort should be made to minimize the frequency and duration of instream works, including excavation. Work from established infrastructure, above the high water mark (i.e., top of bank), or at a minimum above the water line when possible. Restrict instream disturbance to the area(s) required to access and remove accumulations of sediment;

2.4.2 Fish passage is to be maintained around the isolated work zones through the implementation of a diversion channel where practicable. Sites with expected adult salmon presence with spawning and/or overwintering habitat upstream should be prioritized for a diversion channel. If a diversion channel is not practicable and fish are observed holding below the work zone, ongoing fish salvage is required to relocate fish around the work zone;

2.4.3 Large woody debris can only be removed from the floodplain if it poses imminent risk to downstream infrastructure and property. Where possible, stockpile the natural debris removed from the floodplain to an area that can be accessed for future restoration work. Reinstall root wads or large woody debris below the high water mark where practicable;

2.4.4 Do not stockpile materials such as rock, riprap, or dirt in areas where the material has the potential to enter fish-bearing waters;

2.4.5 Maintain all machinery on site in a clean condition and free of fluid leaks. All heavy equipment should use environmentally friendly oil ("enviro-oil");

2.4.6 Fuel should be stored a minimum of 30 m from any watercourse. Wash, refuel and service machinery and store fuel and other materials for the machinery in such a way as to prevent any deleterious substances from entering the watercourse;

2.4.7 Have spill containment and clean-up materials within operating machinery and vehicles and on site in case of leaking deleterious substances (e.g., fuel, oil, grease) from extracted anthropogenic debris. Report leaks or spills of deleterious substances that have caused, or are about to cause, the unauthorized death of fish by means other than fishing and/or the harmful alteration, disruption or destruction of fish habitat to DFO.PACViolations-infractionsPAC.MPO@dfo-mpo.gc.ca and to Observe, Record, Report at 1-800-465-4336 or DFO.ORR-ONS.MPO@dfo-mpo.gc.ca;

2.4.8 Dispose of all anthropogenic debris removed at an appropriate waste management facility as required; and

2.4.9 Works must be conducted in the dry. Follow DFO's interim Standard for In-Water Site Isolation: (https://www.dfo-mpo.gc.ca/pnw-ppe/codes/interim-provisoire/site-isolation-confinement-aire-travail-eng.html); DFO's interim Code of Practice for End-of-Pipe Fish Protection Screens for Small Water Intakes in Freshwater: (https://www.dfo-mpo.gc.ca/pnw-ppe/codes/screen-ecran-eng.html); and follow DFO's Code of Practice for Temporary Fords: (https://www.dfo-mpo.gc.ca/pnw-ppe/codes/temporary-fords-traversees-temporaires-eng.html)[4]. If works cannot be conducted in the dry due to high flow conditions, the work area must be decommissioned and fish passage reinitiated until conditions allow for site isolation.

2.5 Avoid removal of riparian vegetation, particularly mature trees, as much as possible. Where removal of riparian vegetation is not avoidable:

2.5.1 Prune or top the vegetation instead of grubbing/uprooting;

2.5.2 Construct access points and approaches perpendicular to the watercourse;

2.5.3 Rehabilitate areas of the streambank disturbed during the works to a stable condition (e.g., sloped and contoured and protected from erosion);

2.5.4 Re-vegetate disturbed areas with native trees, shrubs and grasses species suitable for the site; and

2.5.5 Where possible, incorporate bioengineering (i.e., pocket planting, live staking, root wad placement, etc.) within the bank restoration and erosion protection designs.

[4] November 2023 Amendment: Changed from "DFO's Interim Code of Practice for Temporary Cofferdams and Diversion Channels" to "DFO's interim Standard for In-Water Site Isolation". Also changed from "DFO's Interim Code of Practice for Temporary Stream Crossings" to "DFO's Code of Practice for Temporary Fords".

2.6 Avoid the installation of riprap bank slopes to the extent practicable.

2.7 Avoid works, undertakings or activities in Critical Habitat (as defined under the *Species at Risk Act*), or the handling or harm of species listed as Threatened or Endangered under the *Species at Risk Act*. If these aforementioned works, undertakings, or activities are required, works must stop and Proponent shall contact DFO for additional guidance and/or permitting.

2.8 Contingency measures shall be put in place if monitoring required in section 3 below indicates that the measures and standards to avoid and mitigate impacts to fish and fish habitat are not successful.

2.9 Dates by which these measures and standards shall be implemented: Measures and standards to avoid and mitigate impacts to fish and fish habitat shall be implemented prior to the initiation of works, undertakings or activities.

3. Conditions that relate to monitoring and reporting of measures and standards to avoid and mitigate impacts to fish and fish habitat.

3.1 Monitoring of avoidance and mitigation measures: The Proponent shall monitor the implementation of avoidance and mitigation measures referred to in section 2 of this authorization and report to DFO, within 30 days post-construction, and indicate whether the measures and standards to avoid and mitigate impacts to fish and fish habitat were conducted according to the conditions of this authorization. This shall be done by:

3.1.1 Demonstration of effective implementation and functioning: Providing dated photographs and inspection reports to demonstrate effective implementation and functioning of mitigation measures and standards described above to limit the impacts to fish and fish habitat to what is covered by this authorization; and

3.1.2 Contingency measures: Providing details of any contingency measures that were followed, to prevent impacts greater than those covered by this authorization in the event that mitigation measures did not function as described.

3.2 Other monitoring and reporting conditions:

3.2.1 Providing dated photographs of each debris removal, inspection reports and details outlining how each condition of this Authorization was met, and whether avoidance and mitigation measures were effective in reducing or limiting serious harm to fish to what is authorized herein;

3.2.2 Providing a geospatial polygon that accurately represents the completed HADD footprint(s). Geospatial polygon data should be collected using WGS 1984 to four (4) decimal places (e.g., 28.5234ºN, 80.6830ºW). Geospatial polygon data must be supplied in Shape File (.shp) format to ReferralsPacific@dfo-mpo.gc.ca with reference to DFO file: 22-HPAC-01308. In addition to the geospatial polygon, the following data must also be supplied in an Excel file (i.e., metadata):

- The date of sediment/debris removal, the type of debris removed (e.g., log jam, boulders etc.), the watercourse of removal, the coordinates of removal, if leaks or spills of deleterious substances were documented and mitigation measures to contain and clean leaks and spills;

- The type of HADD (e.g., riparian removal, aquatic footprint, etc.), the date of the HADD, and HADD area per habitat type (based on depth during high and low water seasons, high water mark); and

- Brand name and model of GPS unit, the coordinate system used, and guaranteed accuracy of GPS unit.

3.2.3 Providing a summary of observational mortality for the death of fish (e.g., eggs, alevins, fry) by means other than fishing related to the works, undertakings or activities.

3.2.4 Providing a summary of the fish salvaged. The information summarized shall include dates, the number of individuals salvaged, the location of salvage and relocation, and the nature of any effects to fish salvaged (capture, death, sub-lethal harm, etc.).

3.2.5 Providing details of any contingency measures that were followed, should prescribed mitigations not function as intended, to contain the impacts to fish and fish habitat to that which is authorized herein.

4. Conditions that relate to offsetting

4.1 Upon receipt and review of the monitoring results and supporting documentation outlined in section 3 above, DFO will determine whether offsetting is required.

4.2 If offsetting is required, the Proponent shall prepare a draft offsetting plan, consistent with the DFO's *Policy for Applying Measures to Offset Adverse Effects on Fish and Fish Habitat Under the Fisheries Act* and *Applicant's Guide Supporting the "Authorizations Concerning Fish and Fish Habitat Protection Regulations"* and provide it to DFO within 45 days of receipt that an Offsetting Plan is required.

4.3 If offsetting is required, the offsetting plan shall include the information identified in Schedule 1, Section 16 of the *Authorizations Concerning Fish and Fish Habitat Protection Regulations*, including an offsetting effectiveness monitoring plan.

4.4 Once acceptable to DFO, the offsetting plan shall be implemented with any additional requirements from DFO.

Authorization Limitations and Application Conditions

The Proponent is solely responsible for plans and specifications relating to this authorization and for all design, safety and workmanship aspects of all the works associated with this authorization.

The holder of this authorization is hereby authorized under the authority of Paragraphs 34.4(2)(b) and 35(2)(b) of the *Fisheries Act*. R.S.C., 1985, c.F-14, to carry on the work(s), undertaking(s) and/or activity(ies) that are likely to result in impacts to fish and fish habitat as described herein.

This authorization does not purport to release the applicant from any obligation to obtain permission from or to comply with the requirements of any other regulatory agencies.

This authorization does not permit the deposit of a deleterious substance in water frequented by fish. Subsection 36(3) of the *Fisheries Act* prohibits the deposit of any deleterious substances into waters frequented by fish unless authorized by regulations made by Governor in Council.

It is also your *Duty to Notify* DFO if you have caused, or are about to cause, the unauthorized death of fish by means other than fishing and/or the harmful alteration, disruption or destruction of fish habitat. Such notifications should be directed to DFO.PACViolations-InfractionsPAC.MPO@dfo-mpo.gc.ca **and** to Observe, Record, Report at 1-800-465-4336 or DFO.ORR-ONS.MPO@dfo-mpo.gc.ca.

The failure to comply with any condition of this authorization constitutes an offence under Paragraph 40(3)(a) of the *Fisheries Act*, and may result in charges being laid under said Act.

A copy of this authorization should be kept on site while the work is in progress and upon request be provided to relevant federal or provincial officials. The authorization holder is responsible for ensuring work crews are familiar with, and able to adhere to, the conditions.

This authorization cannot be transferred or assigned to another party. If the work(s), undertaking(s) or activity(ies) authorized to be conducted pursuant to this authorization are expected to be sold or transferred, or other circumstances arise that are expected to result in a new Proponent taking over the work(s), undertaking(s) or activity(ies), the Proponent named in this authorization shall advise DFO in advance.

Date of Issuance: November 23, 2023

Approved by: _____

Brenda Rotinsky
Watershed Operations Regulatory Manager
Fish and Fish Habitat Protection Program, Pacific Region
Fisheries and Oceans Canada

APPENDIX D – SITE PHOTOGRAPHS

Photo 1 Downstream view of Lagace Creek just upstream of the confluence with Pattinson Creek



Photo 2 Lagace Creek with a wide wetted depth, shallow wetted depth, and abundant vegetation cover



Photo 3 **Step pool morphology with cobbles and small boulders, undercut banks and overarching vegetation**



Photo 4 **Large woody debris was found throughout the channel and helped to shape the morphology in many areas.**



Photo 5 Mid-site, where the water flow was becoming lower and less continuous



Photo 6 Concrete and rock weir, covered with vegetation. Creek bed was dry on both sides (upstream and downstream).



Photo 7 **Channel bed just downstream of Allan Lake. Dry, full of grasses. No fish habitat.**



Photo 8 **Allan Lake was completely dry during the field visit, and full of grasses and shrubs. No fish habitat available.**



Photo 9 Mixed forest in the Lagace Creek corridor



Photo 10 Riparian vegetation in the Lagace Creek riparian corridor



Photo 11 Native shrub vegetation above the top of bank near Lagace Creek



Photo 12 Potential wetland area approximately 1.5 km upstream from the confluence of Lagace Creek and Pattison Creek



Photo 13 Potential wetland area approximately 1.8 km upstream from the confluence of Lagace Creek and Pattison Creek



Photo 14 Abandoned/destroyed stick nest in Project Area



Photo 15 Mammal track on the bank of Lagace Creek



Photo 16 Potential sacrum of American black bear in Lagace Creek



Photo 17 Adult northern red-legged frog in Lagace Creek

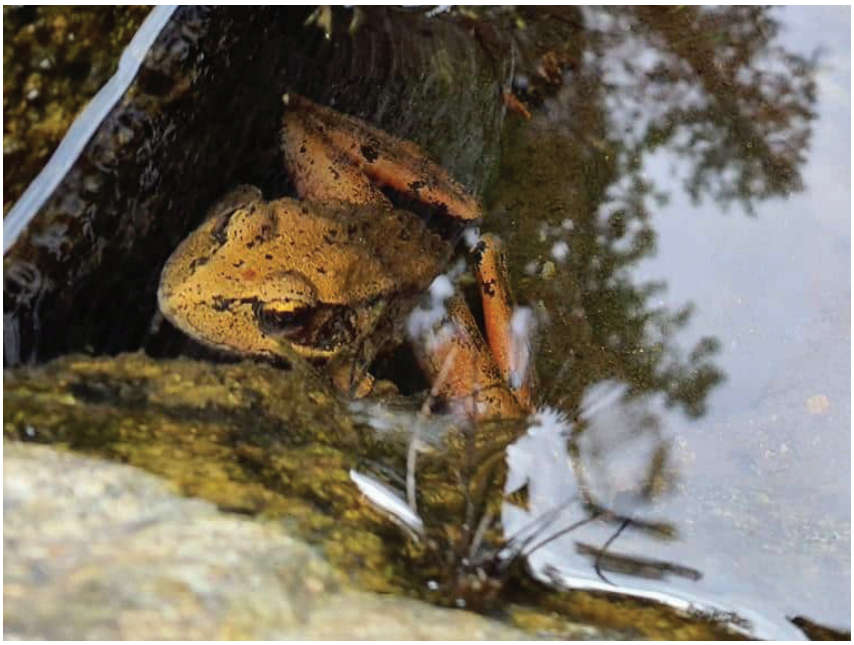
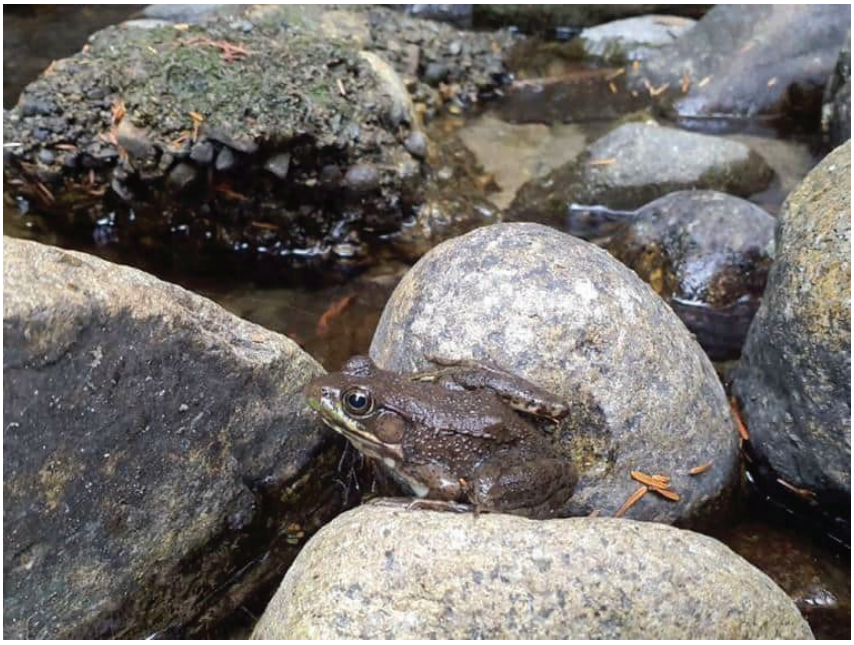


Photo 18 Juvenile western toad in Lagace Creek



Photo 19 Green frog in Lagace Creek



Terms such as "employer", "supervisor", "multiple employer workplace", "owner", "prime contractor", and "worker" have the meanings given those terms under the *Workers' Compensation Act* (*WC Act*) and its regulation.

ARTICLE 1 OTHER SAFETY CONSIDERATIONS

Notice of Project

1.01 Where a Notice of Project is required as set out in the *WC Act* and its regulations, the Contractor, unless otherwise notified in writing by the Province or the Prime Contractor, must submit the Notice of Project in a format acceptable to WorkSafe BC.

1.02 Where the Contractor submits the Notice of Project, a copy must be provided to the Province. Where the Province or Prime Contractor will submit the Notice of Project, the Contractor must provide, upon request, all information necessary to support the Notice of Project and the Contractor will be provided with a copy of the Notice of Project.

1.03 The Contractor will commence and conduct all operations consistently with the Notice of Project.

Reporting

1.04 The Contractor must immediately submit written Notice to the Province on all matters reported to WorkSafe BC by the Contractor or the Contractor's Subcontractors. The written Notice must include all information necessary to allow the Province to adequately collect and address safety or other related incidences, and will be anonymized so as not to include personal information about an identifiable individual including their name, address, telephone number, age, sex, race, religion, sexual orientation, disability, fingerprints, or blood type, health care, educational, financial or employment history and anyone else's opinion about the individual. This scope does not include business contact information (e.g., name, title, address, telephone or fax numbers or email address used for business contact purposes).

1.05 Where a Party brings safety concerns to the attention of the other Party, the Party will give full consideration to the issues raised. Where the Contractor receives safety concerns from the Province, the Contractor will provide the Province with a considered response, including any information necessary to demonstrate that the Contractor is in compliance with *WC Act* and its regulations.

1.06 Upon the Province's request, the Contractor or any of its Subcontractors must provide evidence to the satisfaction of the Province that the Contractor or its Subcontractor(s) has:

(a) an effective business process in place to:

i) remedy any workplace conditions that are hazardous to the health or safety of the employer's workers including safe work practices and procedures;

ii) ensure that the employer's workers::

A. are made aware of all known or reasonably foreseeable health or safety hazards to which they are likely to be exposed by their work;

B. are made aware of their rights and duties under the *WC Act* and its regulations.

(b) established occupational health and safety policies and programs in accordance with the regulations, which includes:

i) first aid assessment and provision services and equipment;

ii) an employee monitoring system that will periodically ensure the well being of all workers working alone or in isolation;

iii) accident injury reporting and investigation;

iv) an emergency response plan and employee understanding of said plan that will ensure adequate and timely response to any emergency that can be reasonably expected to occur in relation to the Works being performed;

v) evidence of training and any required certifications required under *WC Act* or its regulations;

vi) evidence of a maintenance program for all equipment and vehicles owned or operated by the Contractor or its Subcontractors commensurate with the risks associated with such equipment and vehicles;

vii) provision for the regular inspection of premises, work methods and work practices; and

viii) provision by the employer for the instruction and supervision of workers including orientation of workers in the safe performance of their work.

(c) provided and maintained in good condition protective equipment, devices, and clothing as required by the *Occupational Health and Safety Regulation* and ensure that these are used by the employer's workers;

(d) provided the employer's workers all information, instruction, training, and supervision necessary to ensure the health and safety of those workers in carrying out their work and to ensure the health and safety of other workers at the workplace;

(e) a copy of the *WC Act* and its regulations readily available for review by the employer's workers and, at each workplace where workers of the employer are regularly employed, post and keep posted a notice advising where the copy is available for review.

ARTICLE 2 PRIME CONTRACTOR PROVISIONS

2.01 The Contractor acknowledges, agrees, and warrants that:

(a) The Contractor will be considered to be the Prime Contractor and shall enter into a Prime Contractor Agreement with the Province and shall carry out the duties described therein, where any of the following conditions exist:

i) the Province gave Notice that the Successful Bidder would be the Prime Contractor;

ii) the Province designates the Contractor to be the Prime Contractor at any time during the performance of the Work ;

iii) the Contractor creates a multiple employer workplace through subcontracting any of the Work or Service at any time.

2.02 Where the Contractor is being considered as the Prime Contractor as per clause 2.01, the following is applicable:

(a) upon request, the Contractor must satisfy the Province that the Contractor has the experience and capacity to address Prime Contractor responsibilities in accordance with the Agreement and the WC Act and its regulations; and

(b) the Province provides written acknowledgement of the Contractor's experience and capacity to function as Prime Contractor; and

(c) where the Contractor creates a multiple employer workplace, the Contractor will provide or acquire at their own expense all resources necessary to discharge the Prime Contractor responsibilities; or

(d) the Province may, in its sole discretion, give consideration for compensation related to any additional costs where, after commencement of the work, the Province creates a multiple employer workplace and designates the Contractor to be the Prime Contractor.

2.03 The Province may from time to time give prior written Notice that a person other than the Contractor is designated as the Prime Contractor. The Contractor agrees that on receiving such written Notice, the Contractor will cooperate with the Prime Contractor and shall coordinate health and safety activities and ensure compliance with the Prime Contractor's safety program.

2.04 The Contractor shall, upon becoming aware of any apparent deficiencies in the Prime Contractor's work which would affect the Work, shall report such deficiencies in writing to the Ministry Representative.

ARTICLE 3 HAND FALLING

3.01 Where hand falling activity will be taking place under the Agreement and without limiting any other provision of the Agreement or the Contract Documents, the Contractor shall comply with the following safety requirements.

3.02 Hand falling means the falling of trees by any means with at least one person at or near the base of the tree during falling and not inside a protected cab, where the trees are greater than 6 inches diameter at 12 inch stump height, or as may be determined by WorkSafe BC.

3.03 The Contractor must ensure that:

(a) all hand falling is undertaken by fallers certified by BC Forest Safety Council (BCFSC) or ENFORM and are qualified for the slope and timber conditions being addressed;

(b) a qualified Falling Supervisor satisfactory to the Province is designated for all forestry related hand falling activities and for all non-forestry related hand falling activities taking place.

3.04 A Falling Supervisor will be deemed qualified where:

(a) it has satisfactorily completed the BCFSC Falling Supervisor Training course; or

(b) it is BCFSC Falling Supervisor Certified; or

(c) in the Province's sole opinion, evidence of qualifications/certifications and proficiency for the timber and slope for the Work Area and competency to discharge the expectations of a falling supervisor is satisfactory.

3.05 No hand falling operations will commence without the Province's prior satisfaction of acceptable proof of qualification/certification and of the Falling Supervisor's ability and competence.

3.06 The Contractor must, at least five Business Days prior to commencement of any hand falling operations, notify the Ministry Representative of the name of the designated Falling Supervisor or substitution thereof.

3.07 A Falling Plan must be developed with full engagement by the Falling Supervisor in collaboration with Hand Falling personnel and others responsible to discharge aspects of the falling plan.

3.08 The Contractor must ensure:

(a) no work will commence prior to all considerations of the Falling Plan being implemented as established by the designated Falling Supervisor;

(b) all hand falling operations performed occur and are supported in accordance with the Falling Plan; and

(c) upon request of the Ministry representative, provide any documents and evidence to verify adherence to the Falling Plan.

3.09 If the Contractor engages a subcontractor as its Falling Supervisor, the Contractor shall not be relieved from the subcontracted obligations or any obligations under this Agreement.

Not Applicable

See following pages for Project Drawings

SHEET LIST TABLE

SHEET	DRAWING NAME	REVISION	DRAWING TITLE	DRAWING DESCRIPTION
GENERAL				
1	2632-03-G-3001	1	COVER PAGE	
2	2632-03-G-3002	1	LEGEND	
CIVIL				
3	2632-03-C-3101	1	PLAN	S-CR-14 SEDIMENT REMOVAL
4	2632-03-C-3102	1	PLAN	S-CR-14 PROPOSED SAND RECOVERY STATIONS
5	2632-03-C-3103	1	PLAN	S-CR-14 SEDIMENT REMOVAL EXTENTS
6	2632-03-C-3104	1	PLAN	S-CR-14 EROSION PROTECTION
7	2632-03-C-3105	1	PLAN	S-CR-17 SEDIMENT REMOVAL
8	2632-03-C-3106	1	PLAN	S-CR-17 SEDIMENT REMOVAL
9	2632-03-C-3501	1	DETAIL 1 OF 6	EXISTING SAND RECOVERY STATION
10	2632-03-C-3502	1	DETAIL 2 OF 6	PROPOSED SAND RECOVERY STATION
11	2632-03-C-3503	1	DETAIL 3 OF 6	BANK PROTECTION
12	2632-03-C-3504	1	DETAIL 4 OF 6	FENCE AND GATE INSTALLATION
13	2632-03-C-3505	1	DETAIL 5 OF 6	DENSE LIVE STAKING
14	2632-03-C-3506	1	DETAIL 6 OF 6	SEDIMENT REMOVAL

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY HATZIC EMERGENCY WORKS PROGRAM LAGACE CREEK - SITE S-CR-14/17

PLOT DATE: 2024-07-25 11:45:49 AM
SAVE DATE: 2024-07-10 10:34:44 AM SAVED BY: ROZONJ
DWG PATH: \\ae.ca\data\working\nam\2022-2632-03\civil\model (for cad_civil3d only)\2632-03-g-3001.dwg

Associated Engineering

BEST MANAGED COMPANIES
Platinum member

BRITISH COLUMBIA

BC MINISTRY OF ENVIRONMENT
AND CLIMATE CHANGE STRATEGY
HATZIC EMERGENCY
WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

PERMIT TO PRACTICE
ASSOCIATED ENGINEERING (B.C.) LTD.
PERMIT NUMBER: 1000163
Engineers & Geoscientists BC

REV	DATE	DESIGN	DRAWN	DESCRIPTION
1	2024JUL11	R. KARSGAARD	J. ROZON	ISSUED FOR RFP AND PERMITTING
0	2024JUN14	R. KARSGAARD	J. ROZON	ISSUED FOR RFP

DRAWING	REVISION	SHEET
2632-03-G-3001	1	1

IF NOT 50 mm ADJUST SCALES — 50 mm

SCALE(S) SHOWN ARE INTENDED FOR ANSI D (22X34) SIZE DRAWINGS, TABLOID (11X17) SIZE DRAWINGS ARE 1/2 OF SCALE (S) SHOWN UNLESS NOTED OTHERWISE

ROAD

EXISTING	DESIGN	
100+000	100+000	CONTROL LINE
		GRAVEL ROAD
		EDGE OF PAVEMENT
		CURB (ACTUAL WIDTH)
		SIDEWALK (ACTUAL WIDTH)
		CURB DEPRESSION
		GUIDE RAIL

PROFILE VIEW

EXISTING	DESIGN	
		GROUND
		WATER MAIN
		SANITARY SEWER
		STORM SEWER

SURVEY

EXISTING	DESIGN	
HUB		SURVEY HUB
MON		MONUMENT
IP		IRON PIN
IPF		IRON PIN (FOUND)
LP		LEAD PLUG
U		UNIDENTIFIED MANHOLE
MW		MONITORING WELL
PZ		PIEZOMETER
OW		OBSERVATION WELL

CONTOUR

EXISTING	DESIGN	
		MAJOR
		MINOR

PROPERTY

EXISTING	DESIGN	
		PARCEL / LOT LINE
		EASEMENT
		STATUTORY ROW
		ROAD ROW

GAS / OIL

EXISTING	DESIGN	
G	G	GAS
OIL	OIL	OIL
		VAULT BOX
		VALVE BOX
		MANHOLE
		METER

WATER

EXISTING	DESIGN	
W	W	WATER MAIN
F	F	FIRE SUPPRESSION
IR	IR	IRRIGATION
RW	RW	RAW WATER
PW	PW	POTABLE WATER
		VAULT BOX
FH	FH	FIRE HYDRANT
W	W	MANHOLE
W	W	METER CHAMBER
		CROSS FLANGE
		TEE FLANGE
		END CAP / PLUG
		GATE VALVE
		THRUST BLOCK
		45 DEGREE ELBOW
		90 DEGREE ELBOW
		WYE
ESM	ESM	ENCASEMENT
		WATER LEVEL
		COUPLING
		REDUCER
W	W	WELL
CS	CS	CURB STOP / CURB BOX

SANITARY SEWER

EXISTING	DESIGN	
SS	SS	SANITARY SEWER
FM	FM	SANITARY FORCEMAIN
COMB	COMB	SANITARY COMBINED SEWER
S	S	MANHOLE
CB	CB	COMBINED MANHOLE
VC	VC	VALVE CHAMBER
CO	CO	CLEANOUT
		VALVE BOX
		FLOW DIRECTION
LS	LS	LIFT / PUMP STATION

COMMUNICATIONS / TELEPHONE

EXISTING	DESIGN	
CATV	CATV	CABLE
FO	FO	FIBRE OPTIC CABLE
T	T	TELEPHONE / LINE
UT	UT	UNDERGROUND TELEPHONE
		COMMUNICATIONS VAULT BOX
T	T	TELEPHONE MANHOLE
		TELEPHONE VAULT BOX
C	C	COMMUNICATIONS MANHOLE
T	T	TELEPHONE PEDESTAL

STORM DRAINAGE

EXISTING	DESIGN	
CP	CP	CULVERT (Ø AND TYPE)
D	D	STORM SEWER
CB	CB	CATCH BASIN
DCB	DCB	DOUBLE CATCH BASIN
DCB	DCB	DITCH INLET CATCH BASIN
CB	CB	CATCH BASIN / MANHOLE
LB	LB	LAWN BASIN
D	D	MANHOLE
STC	STC	STORMCEPTOR
OI	OI	OIL INTERCEPTOR
		VALVE BOX
CI	CI	CULVERT INLET
CO	CO	CULVERT OUTLET
		HEADWALL
		DITCH FLOW

ELECTRICAL / POWER

EXISTING	DESIGN	
P	P	POWER / COMM / CONDUIT
OP	OP	OVERHEAD POWER
UP	UP	UNDERGROUND POWER
		VAULT / HYDRO BOX
PB	PB	PULL BOX
J	J	JUNCTION BOX
TM	TM	TRANSFORMER VAULT MANHOLE
TP	TP	TRANSFORMER PAD
M	M	METER
E	E	MANHOLE
		LIGHT / LAMP STANDARD
		HYDRO / UTILITY POLE
		GUY WIRE
SIG	SIG	SIGNAL
SIG	SIG	SIGNAL WITH OVERHEAD ARM

MISCELLANEOUS

EXISTING	DESIGN	
X	X	FENCE
O	O	SILT FENCE
ABN		ABANDONED PIPE
		BOTTOM OF BANK
		TOP OF BANK
EW		EDGE OF WATER
		BUILDING
		200 YEAR FLOOD EXTENTS
		PROJECT EXTENTS
		PROJECT FOOTPRINT
		PROPOSED SAND RECOVERY STATION
		DENSE LIVE STAKING
		COCONUT MATTING

MISCELLANEOUS

EXISTING	DESIGN	
MAXIMUS CREEK		CREEK (OVER 3 m WIDE) (WIDTH OF CREEK SHOWN TO SCALE)
TP	TP	TEST PIT
BH	BH	BORE HOLE
FP	FP	FLAG POLE
PM	PM	PARKING METER
MB	MB	MAILBOX
		BOULDER
		RAILWAY SIGNAL LIGHT
BO	BO	POST/BOLLARD (ANNOTATE AS REQUIRED)
		NO POST BARRIER / JERSEY BARRIER (SCALE AS REQUIRED)
		SIGN
		GATE
		BUSH
		TREE (DECIDUOUS) (SCALE AS REQUIRED)
		TREE (CONIFEROUS) (SCALE AS REQUIRED)
EL1000	100.000	SPOT ELEVATION
% 2 1	% 2 1	SLOPE
1234.5 1234		GRID, CO-ORDINATE REGISTRATION

HATCH PATTERNS

- EXISTING SAND RECOVERY STATION
- PROPOSED SAND RECOVERY STATION
- EXISTING RIPRAP
- LIVE STAKE CLUSTERS
- SOIL
- SEDIMENT REMOVAL
- PERMANENT GRAVEL
- TEMPORARY GRAVEL
- COCONUT MATTING AND HYDRAULIC SEEDING

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1	2024JUL22	R. KARSGAARD	J. ROZON	ISSUED FOR RFP AND PERMITTING
0	2024JUN14	R. KARSGAARD	J. ROZON	ISSUED FOR RFP

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: NTS

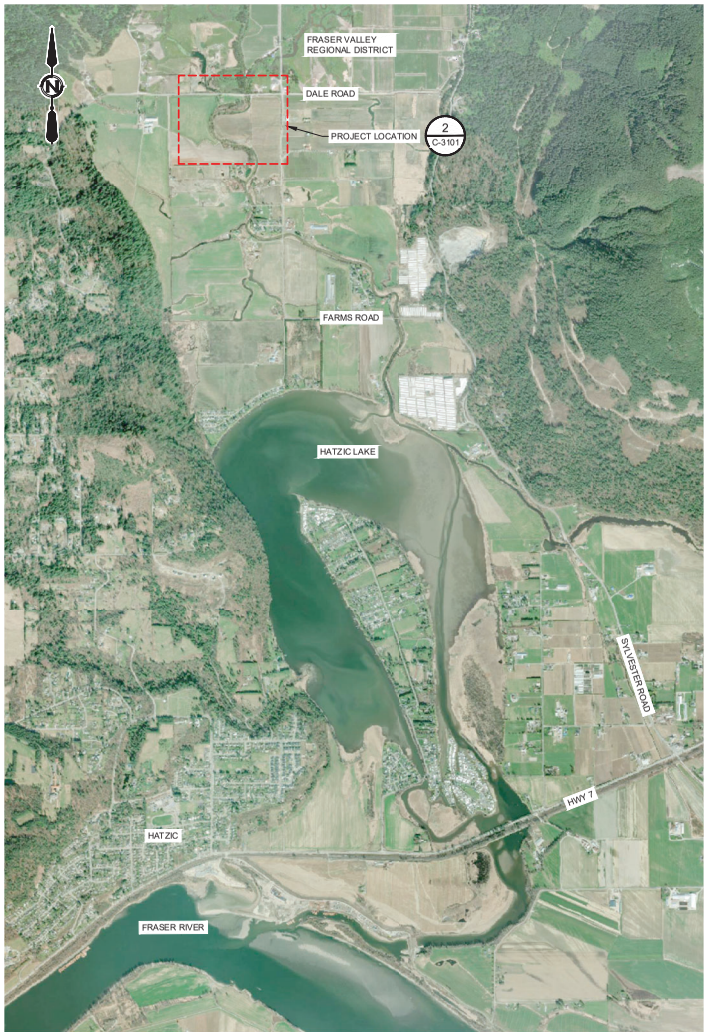
BRITISH COLUMBIA

GENERAL LEGEND

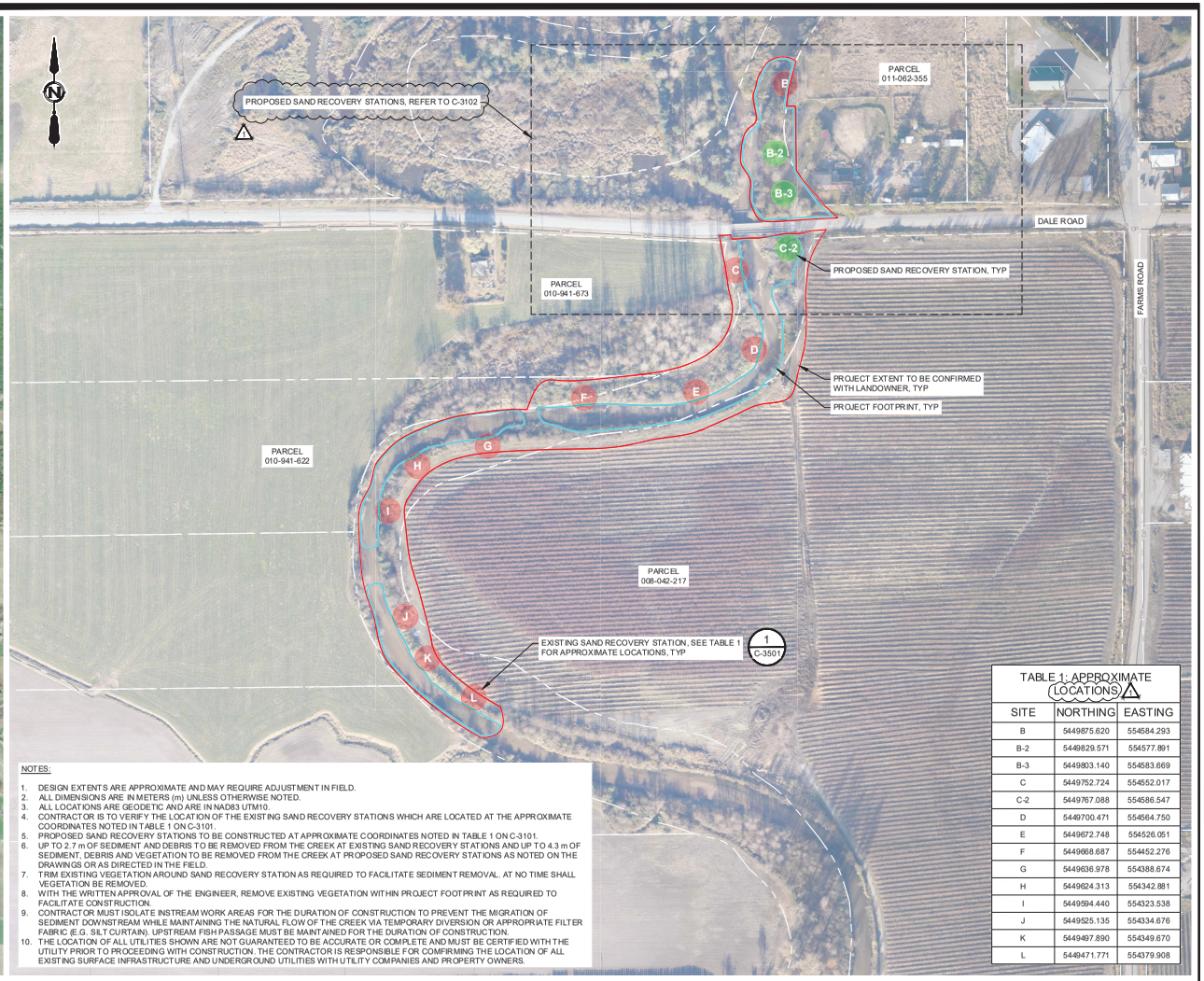
DRAWING	REVISION	SHEET
2632-03-G-3002	1	2

IF NOT 50 mm ADJUST SCALES
50 mm

SCALE(S) SHOWN ARE INTENDED FOR ANSI D (22X34) SIZE DRAWINGS, TABLOID (11X17) SIZE DRAWINGS ARE 1/2 OF SCALE (S) SHOWN UNLESS NOTED OTHERWISE



1 C-3101 PLAN NTS
REGIONAL AREA



2 C-3101 PLAN 1:1500
PROJECT LOCATION

NOTES:

1. DESIGN EXTENTS ARE APPROXIMATE AND MAY REQUIRE ADJUSTMENT IN FIELD.
2. ALL DIMENSIONS ARE IN METERS (m) UNLESS OTHERWISE NOTED.
3. ALL LOCATIONS ARE GEODETIC AND ARE IN NAD83 UTM10.
4. CONTRACTOR IS TO VERIFY THE LOCATION OF THE EXISTING SAND RECOVERY STATIONS WHICH ARE LOCATED AT THE APPROXIMATE COORDINATES NOTED IN TABLE 1 ON C-3101.
5. PROPOSED SAND RECOVERY STATIONS TO BE CONSTRUCTED AT APPROXIMATE COORDINATES NOTED IN TABLE 1 ON C-3101.
6. UP TO 2.7 m OF SEDIMENT AND DEBRIS TO BE REMOVED FROM THE CREEK AT EXISTING SAND RECOVERY STATIONS AND UP TO 4.3 m OF SEDIMENT, DEBRIS AND VEGETATION TO BE REMOVED FROM THE CREEK AT PROPOSED SAND RECOVERY STATIONS AS NOTED ON THE DRAWINGS OR AS DIRECTED IN THE FIELD.
7. TRIM EXISTING VEGETATION AROUND SAND RECOVERY STATION AS REQUIRED TO FACILITATE SEDIMENT REMOVAL. AT NO TIME SHALL VEGETATION BE REMOVED.
8. WITH THE WRITTEN APPROVAL OF THE ENGINEER, REMOVE EXISTING VEGETATION WITHIN PROJECT FOOTPRINT AS REQUIRED TO FACILITATE CONSTRUCTION.
9. CONTRACTOR MUST ISOLATE INSTREAM WORK AREAS FOR THE DURATION OF CONSTRUCTION TO PREVENT THE MIGRATION OF SEDIMENT DOWNSTREAM WHILE MAINTAINING THE NATURAL FLOW OF THE CREEK VIA TEMPORARY DIVERSION OR APPROPRIATE FILTER FABRIC (E.G. SILT CURTAIN). UPSTREAM FISH PASSAGE MUST BE MAINTAINED FOR THE DURATION OF CONSTRUCTION.
10. THE LOCATION OF ALL UTILITIES SHOWN ARE NOT GUARANTEED TO BE ACCURATE OR COMPLETE AND MUST BE CERTIFIED WITH THE UTILITY PRIOR TO PROCEEDING WITH CONSTRUCTION. THE CONTRACTOR IS RESPONSIBLE FOR COMFIRMING THE LOCATION OF ALL EXISTING SURFACE INFRASTRUCTURE AND UNDERGROUND UTILITIES WITH UTILITY COMPANIES AND PROPERTY OWNERS.

TABLE 1: APPROXIMATE LOCATIONS

SITE	NORTHING	EASTING
B	5449875.620	554584.293
B-2	5449829.571	554577.891
B-3	5449803.140	554583.669
C	5449752.724	554552.017
C-2	5449767.088	554586.547
D	5449700.471	554564.750
E	5449672.748	554526.051
F	5449668.687	554452.276
G	5449636.978	554388.674
H	5449624.313	554342.881
I	5449594.440	554323.538
J	5449525.135	554334.676
K	5449497.890	554349.670
L	5449471.771	554379.908

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BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: AS SHOWN

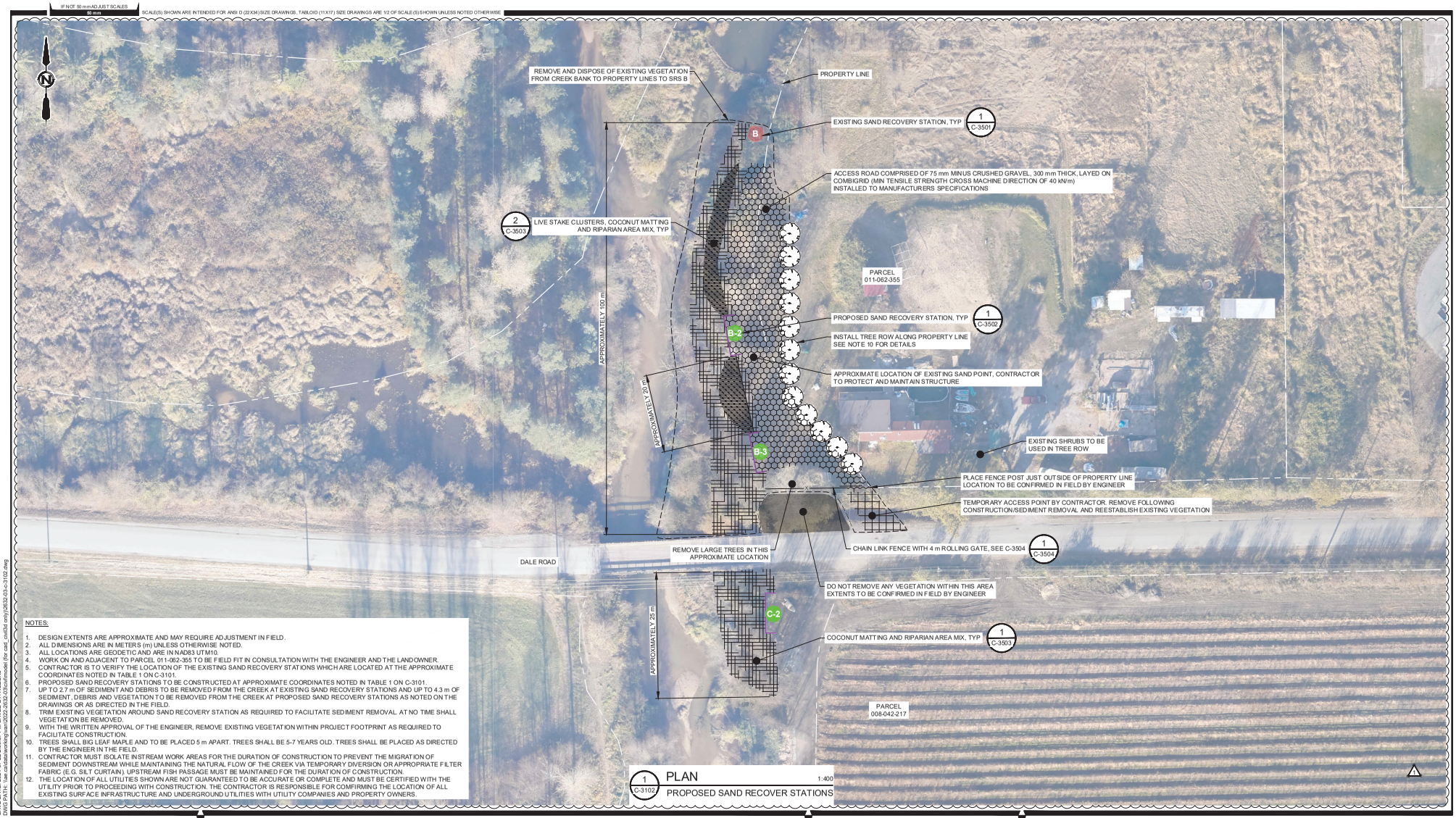
BRITISH COLUMBIA

CIVIL
PLAN
S-CR-14 SEDIMENT REMOVAL

DRAWING	REVISION	SHEET
2632-03-C-3101	1	3

IF NOT 50 mm ADJUST SCALES
50 mm

SCALE(S) SHOWN ARE INTENDED FOR ANSI D (22X34) SIZE DRAWINGS. TABLOID (11X17) SIZE DRAWINGS ARE 1/2 OF SCALE (S) SHOWN UNLESS NOTED OTHERWISE



NOTES:

1. DESIGN EXTENTS ARE APPROXIMATE AND MAY REQUIRE ADJUSTMENT IN FIELD.
2. ALL DIMENSIONS ARE IN METERS (m) UNLESS OTHERWISE NOTED.
3. ALL LOCATIONS ARE GEODETIC AND ARE IN NAD83 UTM10.
4. WORK ON AND ADJACENT TO PARCEL 011-062-355 TO BE FIELD FIT IN CONSULTATION WITH THE ENGINEER AND THE LANDOWNER.
5. CONTRACTOR IS TO VERIFY THE LOCATION OF THE EXISTING SAND RECOVERY STATIONS WHICH ARE LOCATED AT THE APPROXIMATE COORDINATES NOTED IN TABLE 1 ON C-3101.
6. PROPOSED SAND RECOVERY STATIONS TO BE CONSTRUCTED AT APPROXIMATE COORDINATES NOTED IN TABLE 1 ON C-3101.
7. UP TO 2.7 m OF SEDIMENT AND DEBRIS TO BE REMOVED FROM THE CREEK AT EXISTING SAND RECOVERY STATIONS AND UP TO 4.3 m OF SEDIMENT, DEBRIS AND VEGETATION TO BE REMOVED FROM THE CREEK AT PROPOSED SAND RECOVERY STATIONS AS NOTED ON THE DRAWINGS OR AS DIRECTED IN THE FIELD.
8. TRIM EXISTING VEGETATION AROUND SAND RECOVERY STATION AS REQUIRED TO FACILITATE SEDIMENT REMOVAL. AT NO TIME SHALL VEGETATION BE REMOVED.
9. WITH THE WRITTEN APPROVAL OF THE ENGINEER, REMOVE EXISTING VEGETATION WITHIN PROJECT FOOTPRINT AS REQUIRED TO FACILITATE CONSTRUCTION.
10. TREES SHALL BIG LEAF MAPLE AND TO BE PLACED 5 m APART. TREES SHALL BE 5-7 YEARS OLD. TREES SHALL BE PLACED AS DIRECTED BY THE ENGINEER IN THE FIELD.
11. CONTRACTOR MUST ISOLATE INSTREAM WORK AREAS FOR THE DURATION OF CONSTRUCTION TO PREVENT THE MIGRATION OF SEDIMENT DOWNSTREAM WHILE MAINTAINING THE NATURAL FLOW OF THE CREEK VIA TEMPORARY DIVERSION OR APPROPRIATE FILTER FABRIC (E.G. SILT CURTAIN). UPSTREAM FISH PASSAGE MUST BE MAINTAINED FOR THE DURATION OF CONSTRUCTION.
12. THE LOCATION OF ALL UTILITIES SHOWN ARE NOT GUARANTEED TO BE ACCURATE OR COMPLETE AND MUST BE CERTIFIED WITH THE UTILITY PRIOR TO PROCEEDING WITH CONSTRUCTION. THE CONTRACTOR IS RESPONSIBLE FOR COMFIRMING THE LOCATION OF ALL EXISTING SURFACE INFRASTRUCTURE AND UNDERGROUND UTILITIES WITH UTILITY COMPANIES AND PROPERTY OWNERS.

1 C-3102 **PLAN** 1:400
PROPOSED SAND RECOVER STATIONS

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FOR CIVIL FOR BIOENGINEERING

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BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: AS SHOWN

BRITISH COLUMBIA

CIVIL
PLAN
S-CR-14 PROPOSED SAND RECOVERY STATIONS

DRAWING	REVISION	SHEET
2632-03-C-3102	1	4

IF NOT 50 mm ADJUST SCALES
50 mm

SCALE(S) SHOWN ARE INTENDED FOR ANSI D (22X34) SIZE DRAWINGS, TABLOID (11X17) SIZE DRAWINGS ARE 1/2 OF SCALE (S) SHOWN UNLESS NOTED OTHERWISE



NOTES:

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TABLE 2: DEPTH RANGE

#		MIN.	MAX.
1		-2.8 m	-2.1 m
2		-2.1 m	-2.0 m
3		-2.0 m	-1.9 m
4		-1.9 m	-1.6 m
5		-1.6 m	-1.2 m
6		-1.2 m	-0.8 m
7		-0.8 m	-0.4 m
8		-0.4 m	-0.2 m
9		-0.2 m	0.8 m

TABLE 3: APPROXIMATE VOLUME REMOVAL

SITE	CUBIC METERS
B	250
B-2 AND B-3	950
C AND C-2	650
D	450
E	450
F	500
G	450
H	500
I	400
J	600
K	700
L	400
TOTAL	8250

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HATZIC EMERGENCY WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: AS SHOWN

BRITISH COLUMBIA

CIVIL
PLAN
S-CR-14 SEDIMENT REMOVAL EXTENTS

DRAWING	REVISION	SHEET
2632-03-C-3103	1	5

IF NOT 50 mm ADJUST SCALES
50 mm

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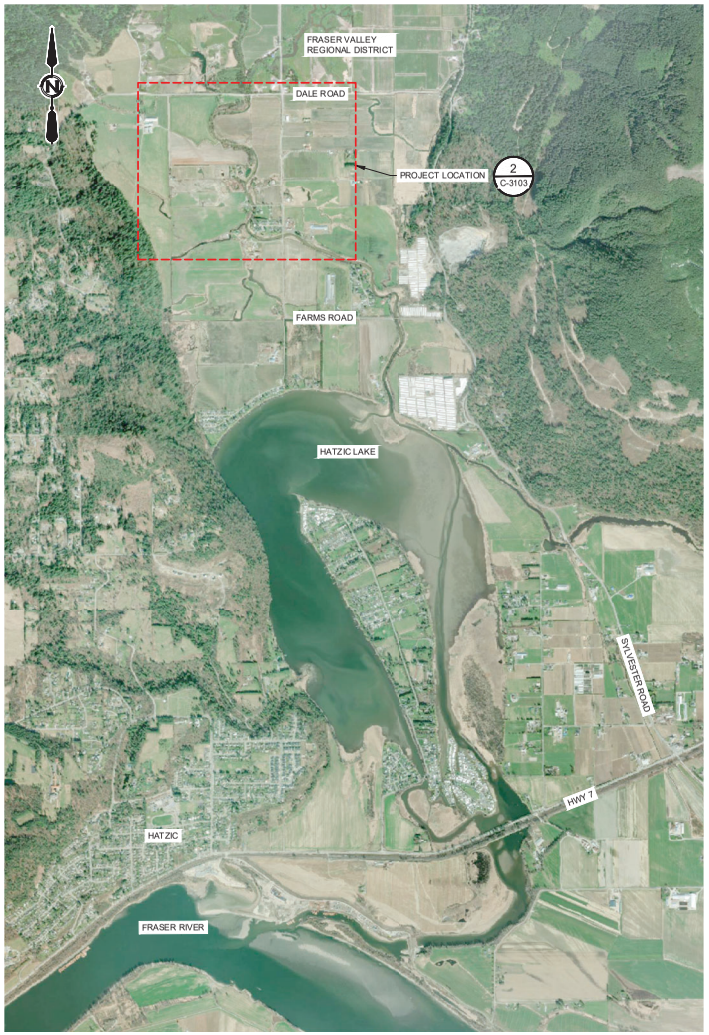
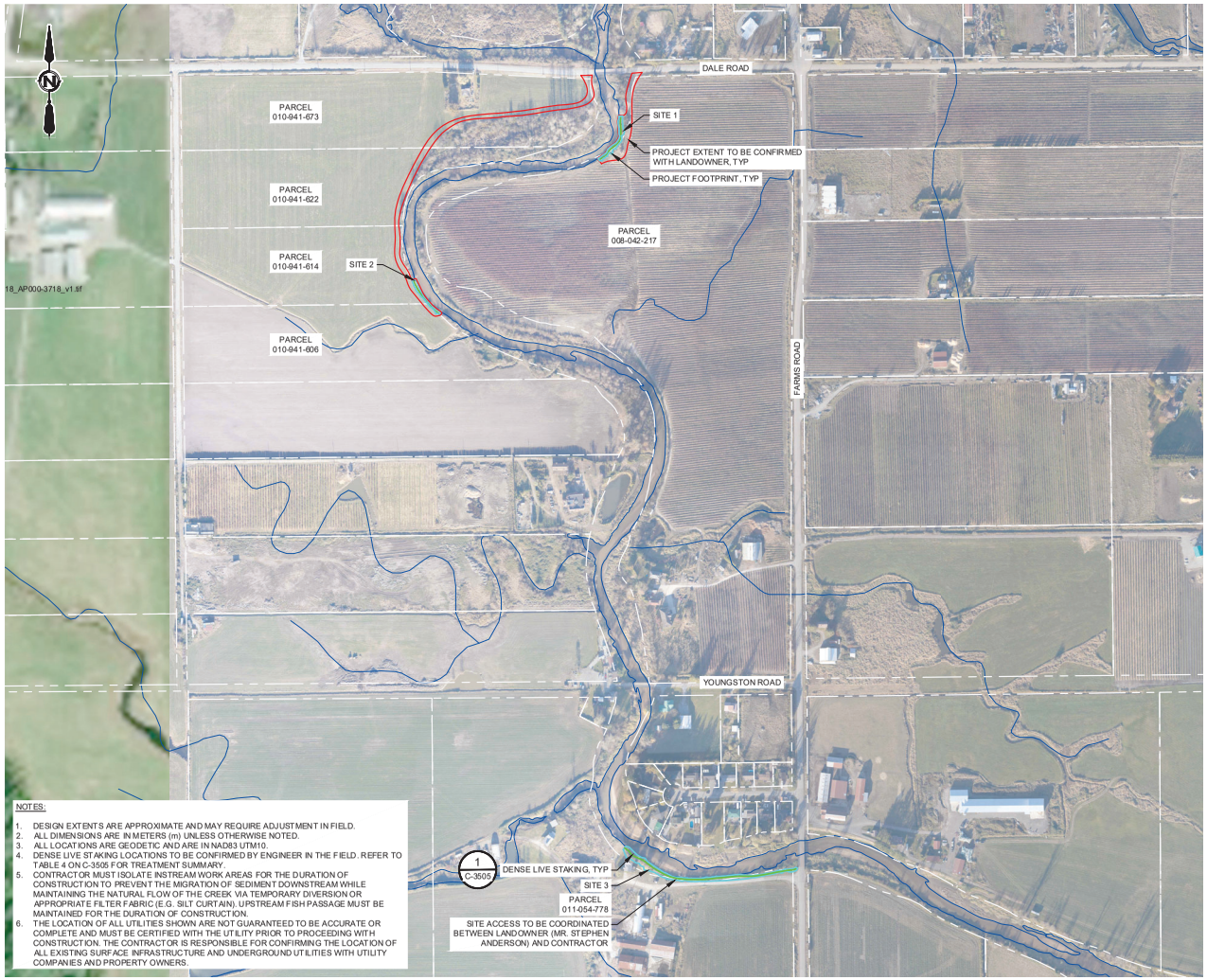


1 C-3103 PLAN NTS
REGIONAL AREA



NOTES:

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2. ALL DIMENSIONS ARE IN METERS (m) UNLESS OTHERWISE NOTED.
3. ALL LOCATIONS ARE GEODETIC AND ARE IN NAD83 UTM10.
4. DENSE LIVE STAKING LOCATIONS TO BE CONFIRMED BY ENGINEER IN THE FIELD. REFER TO TABLE 4 ON C-3505 FOR TREATMENT SUMMARY.
5. CONTRACTOR MUST ISOLATE INSTREAM WORK AREAS FOR THE DURATION OF CONSTRUCTION TO PREVENT THE MIGRATION OF SEDIMENT DOWNSTREAM WHILE MAINTAINING THE NATURAL FLOW OF THE CREEK VIA TEMPORARY DIVERSION OR APPROPRIATE FILTER FABRIC (E.G. SILT CURTAIN). UPSTREAM FISH PASSAGE MUST BE MAINTAINED FOR THE DURATION OF CONSTRUCTION.
6. THE LOCATION OF ALL UTILITIES SHOWN ARE NOT GUARANTEED TO BE ACCURATE OR COMPLETE AND MUST BE CERTIFIED WITH THE UTILITY PRIOR TO PROCEEDING WITH CONSTRUCTION. THE CONTRACTOR IS RESPONSIBLE FOR CONFIRMING THE LOCATION OF ALL EXISTING SURFACE INFRASTRUCTURE AND UNDERGROUND UTILITIES WITH UTILITY COMPANIES AND PROPERTY OWNERS.

2 C-3103 PLAN 1:3000
PROJECT LOCATION

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BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: AS SHOWN

BRITISH COLUMBIA

CIVIL
PLAN
S-CR-14 EROSION PROTECTION

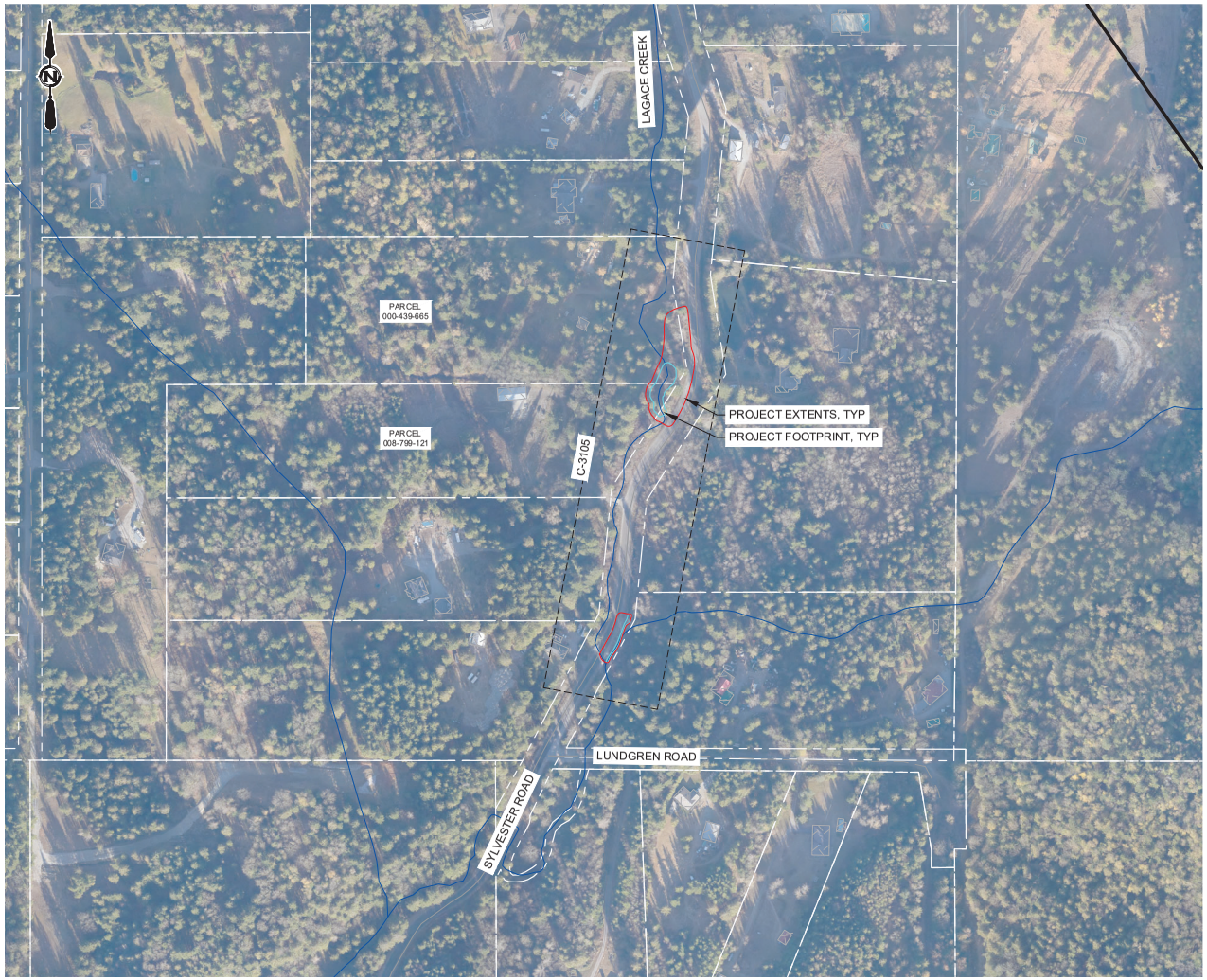
DRAWING	REVISION	SHEET
2632-03-C-3104	1	6

IF NOT 50 mm ADJUST SCALES
50 mm

SCALE(S) SHOWN ARE INTENDED FOR ANSI D (22X34) SIZE DRAWINGS, TABLOID (11X17) SIZE DRAWINGS ARE 1/2 OF SCALE(S) SHOWN UNLESS NOTED OTHERWISE



1 G-3104 PLAN NTS
REGIONAL AREA



2 G-3104 PLAN 1:2000
PROJECT LOCATION

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BC MINISTRY OF ENVIRONMENT
AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY
WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: AS SHOWN

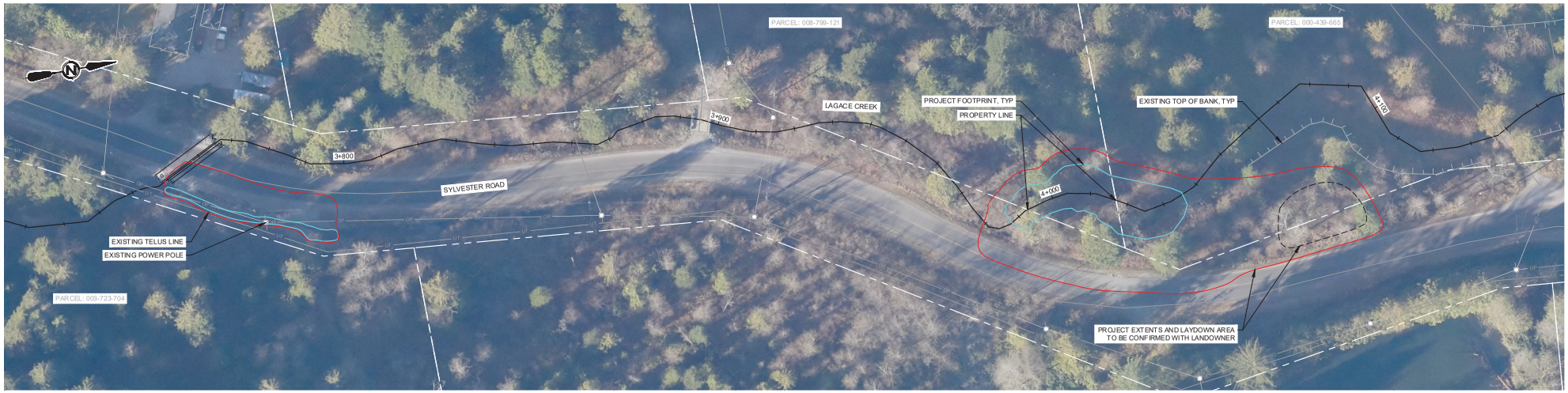
BRITISH COLUMBIA

CIVIL
PLAN
S-CR-17 SEDIMENT REMOVAL

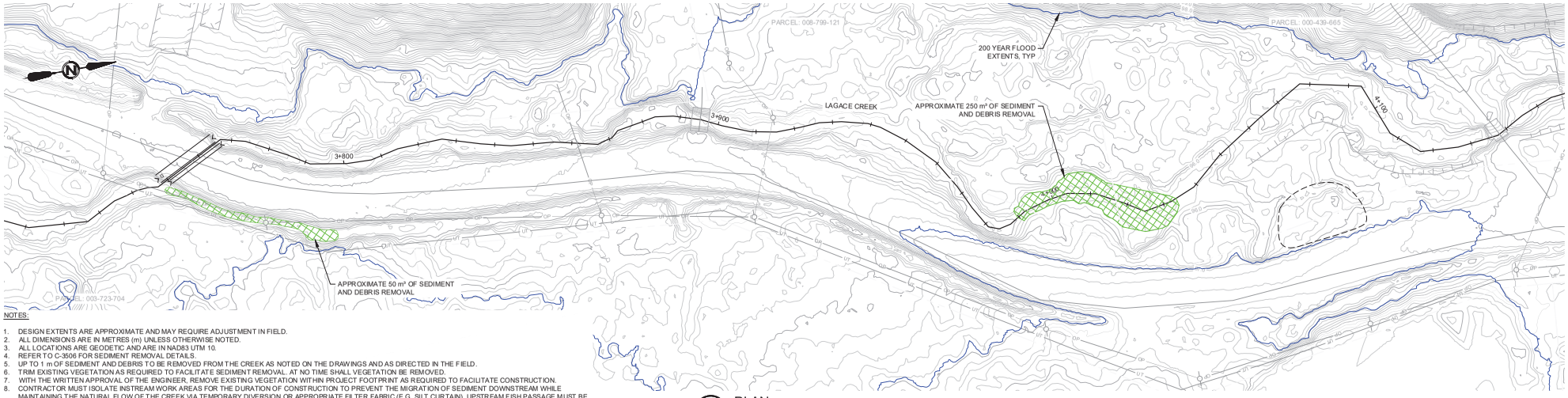
DRAWING	REVISION	SHEET
2632-03-C-3105	1	7

IF NOT 50 mm ADJUST SCALES
50 mm

SCALE(S) SHOWN ARE INTENDED FOR ANSI D (22X34) SIZE DRAWINGS, TABLOID (11X17) SIZE DRAWINGS ARE 1/2 OF SCALE(S) SHOWN UNLESS NOTED OTHERWISE



1 C-3105 PHOTO 1:500
EXISTING CONDITIONS



2 C-3105 PLAN 1:500
EXISTING CONDITIONS

NOTES:

1. DESIGN EXTENTS ARE APPROXIMATE AND MAY REQUIRE ADJUSTMENT IN FIELD.
2. ALL DIMENSIONS ARE IN METRES (m) UNLESS OTHERWISE NOTED.
3. ALL LOCATIONS ARE GEODETIC AND ARE IN NAD83 UTM 10.
4. REFER TO C-3506 FOR SEDIMENT REMOVAL DETAILS.
5. UP TO 1 m OF SEDIMENT AND DEBRIS TO BE REMOVED FROM THE CREEK AS NOTED ON THE DRAWINGS AND AS DIRECTED IN THE FIELD.
6. TRIM EXISTING VEGETATION AS REQUIRED TO FACILITATE SEDIMENT REMOVAL. AT NO TIME SHALL VEGETATION BE REMOVED.
7. WITH THE WRITTEN APPROVAL OF THE ENGINEER, REMOVE EXISTING VEGETATION WITHIN PROJECT FOOTPRINT AS REQUIRED TO FACILITATE CONSTRUCTION.
8. CONTRACTOR MUST ISOLATE INSTREAM WORK AREAS FOR THE DURATION OF CONSTRUCTION TO PREVENT THE MIGRATION OF SEDIMENT DOWNSTREAM WHILE MAINTAINING THE NATURAL FLOW OF THE CREEK VIA TEMPORARY DIVERSION OR APPROPRIATE FILTER FABRIC (E.G. SILT CURTAIN). UPSTREAM FISH PASSAGE MUST BE MAINTAINED FOR THE DURATION OF CONSTRUCTION.
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BC MINISTRY OF ENVIRONMENT
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HATZIC EMERGENCY
WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: AS SHOWN

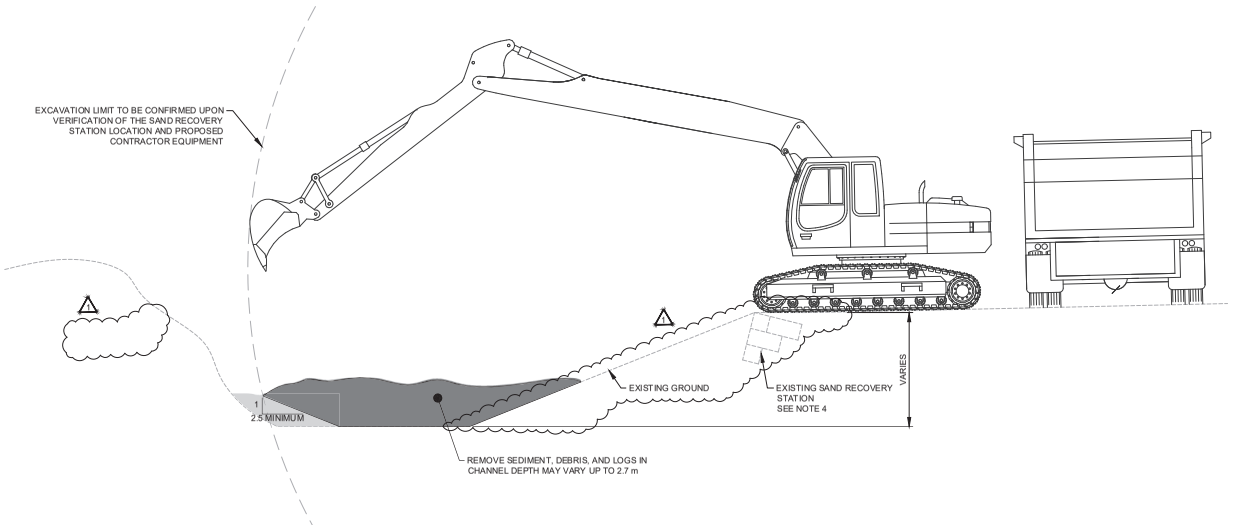
BRITISH COLUMBIA

CIVIL
PLAN
S-CR-17 SEDIMENT REMOVAL

DRAWING	REVISION	SHEET
2632-03-C-3106	1	8

IF NOT 50 mm ADJUST SCALES
50 mm

SCALE(S) SHOWN ARE INTENDED FOR ANSI D (22X34) SIZE DRAWINGS, TABLOID (11X17) SIZE DRAWINGS ARE 1/2 OF SCALE (S) SHOWN UNLESS NOTED OTHERWISE



1 TYPICAL DETAIL NTS
EXISTING SAND RECOVERY STATION EXCAVATION

NOTES:

1. DESIGN EXTENTS ARE APPROXIMATE AND MAY REQUIRE ADJUSTMENT IN FIELD.
2. ALL DIMENSIONS ARE IN METERS (m) UNLESS OTHERWISE NOTED.
3. ALL LOCATIONS ARE GEODETIC AND ARE IN NAD83 UTM10.
4. CONTRACTOR IS TO VERIFY THE LOCATION OF THE EXISTING SAND RECOVERY STATIONS WHICH ARE LOCATED AT THE APPROXIMATE COORDINATES NOTED IN TABLE 1 ON C-3101.
5. PROPOSED SAND RECOVERY STATIONS TO BE CONSTRUCTED AT APPROXIMATE COORDINATES NOTED IN TABLE 1 ON C-3101.
6. UP TO 2.7 m OF SEDIMENT AND DEBRIS TO BE REMOVED FROM THE CREEK AT EXISTING SAND RECOVERY STATIONS AND UP TO 4.3 m OF SEDIMENT, DEBRIS AND VEGETATION TO BE REMOVED FROM THE CREEK AT PROPOSED SAND RECOVERY STATIONS AS NOTED ON THE DRAWINGS OR AS DIRECTED IN THE FIELD.
7. TRIM EXISTING VEGETATION AROUND SAND RECOVERY STATION AS REQUIRED TO FACILITATE SEDIMENT REMOVAL. AT NO TIME SHALL VEGETATION BE REMOVED.
8. WITH THE WRITTEN APPROVAL OF THE ENGINEER, REMOVE EXISTING VEGETATION WITHIN PROJECT FOOTPRINT AS REQUIRED TO FACILITATE CONSTRUCTION.
9. CONTRACTOR MUST ISOLATE INSTREAM WORK AREAS FOR THE DURATION OF CONSTRUCTION TO PREVENT THE MIGRATION OF SEDIMENT DOWNSTREAM WHILE MAINTAINING THE NATURAL FLOW OF THE CREEK VIA TEMPORARY DIVERSION OR APPROPRIATE FILTER FABRIC (E.G. SILT CURTAIN). UPSTREAM FISH PASSAGE MUST BE MAINTAINED FOR THE DURATION OF CONSTRUCTION.
10. THE LOCATION OF ALL UTILITIES SHOWN ARE NOT GUARANTEED TO BE ACCURATE OR COMPLETE AND MUST BE CERTIFIED WITH THE UTILITY PRIOR TO PROCEEDING WITH CONSTRUCTION. THE CONTRACTOR IS RESPONSIBLE FOR COMFIRMING THE LOCATION OF ALL EXISTING SURFACE INFRASTRUCTURE AND UNDERGROUND UTILITIES WITH UTILITY COMPANIES AND PROPERTY OWNERS.

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1	2024JUL22	R. KARGAARD	J. ROZON	ISSUED FOR RFP AND PERMITTING
0	2024JUN14	R. KARSGAARD	J. ROZON	ISSUED FOR RFP

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

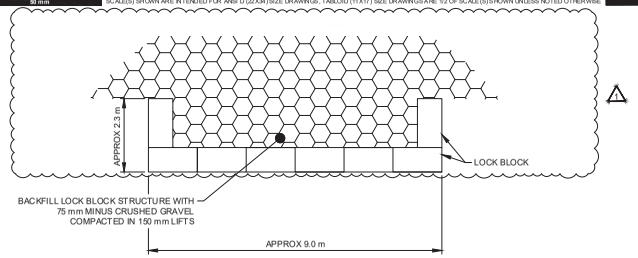
SCALE: AS SHOWN

BRITISH COLUMBIA

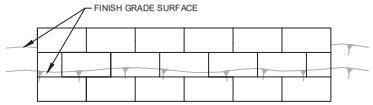
CIVIL
DETAIL 1 OF 6
EXISTING SAND RECOVERY STATION

DRAWING	REVISION	SHEET
2632-03-C-3501	1	9

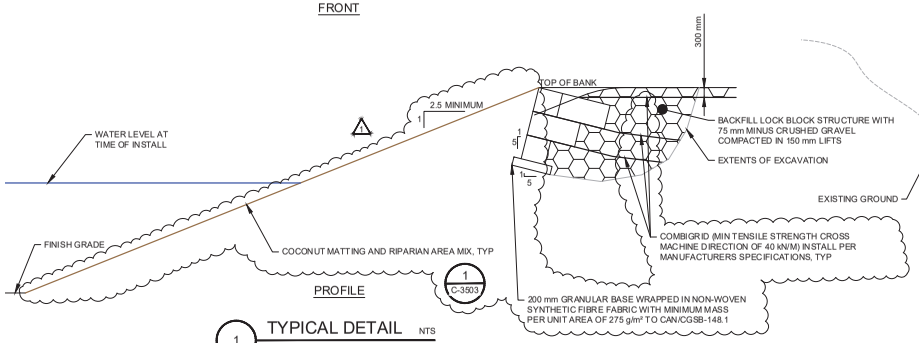
IF NOT 50 mm ADJUST SCALES
50 mm
SCALE(S) SHOWN ARE INTENDED FOR ANSI D (22X34) SIZE DRAWINGS, TABLOID (11X17) SIZE DRAWINGS ARE 1/2 OF SCALE (S) SHOWN UNLESS NOTED OTHERWISE



PLAN

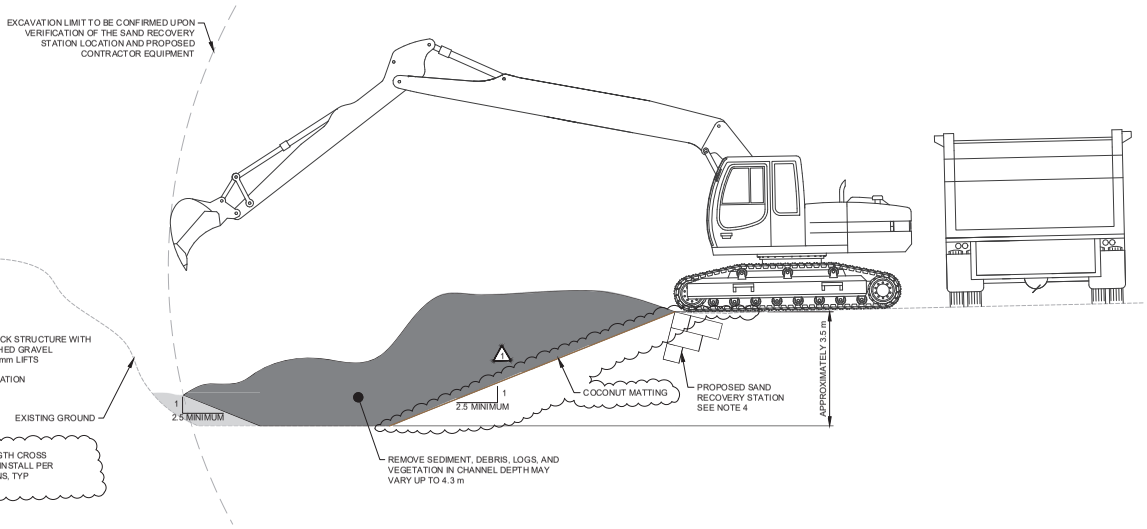


FRONT



PROFILE

1 TYPICAL DETAIL NTS
LOCK BLOCK STRUCTURE



2 TYPICAL DETAIL NTS
PROPOSED SAND RECOVERY STATION EXCAVATION

NOTES:

1. DESIGN EXTENTS ARE APPROXIMATE AND MAY REQUIRE ADJUSTMENT IN FIELD.
2. ALL DIMENSIONS ARE IN METERS (m) UNLESS OTHERWISE NOTED.
3. ALL LOCATIONS ARE GEODETIC AND ARE IN NAD83 UTM10.
4. CONTRACTOR IS TO VERIFY THE LOCATION OF THE EXISTING SAND RECOVERY STATIONS WHICH ARE LOCATED AT THE APPROXIMATE COORDINATES NOTED IN TABLE 1 ON C-3101.
5. PROPOSED SAND RECOVERY STATIONS TO BE CONSTRUCTED AT APPROXIMATE COORDINATES NOTED IN TABLE 1 ON C-3101.
6. UP TO 2.7 m OF SEDIMENT AND DEBRIS TO BE REMOVED FROM THE CREEK AT EXISTING SAND RECOVERY STATIONS AND UP TO 4.3 m OF SEDIMENT, DEBRIS AND VEGETATION TO BE REMOVED FROM THE CREEK AT PROPOSED SAND RECOVERY STATIONS AS NOTED ON THE DRAWINGS OR AS DIRECTED IN THE FIELD.
7. TRIM EXISTING VEGETATION AROUND SAND RECOVERY STATION AS REQUIRED TO FACILITATE SEDIMENT REMOVAL. AT NO TIME SHALL VEGETATION BE REMOVED.
8. WITH THE WRITTEN APPROVAL OF THE ENGINEER, REMOVE EXISTING VEGETATION WITHIN PROJECT FOOTPRINT AS REQUIRED TO FACILITATE CONSTRUCTION.
9. CONTRACTOR MUST ISOLATE INSTREAM WORK AREAS FOR THE DURATION OF CONSTRUCTION TO PREVENT THE MIGRATION OF SEDIMENT DOWNSTREAM WHILE MAINTAINING THE NATURAL FLOW OF THE CREEK VIA TEMPORARY DIVERSION OR APPROPRIATE FILTER FABRIC (E.G. SILT CURTAIN). UPSTREAM FISH PASSAGE MUST BE MAINTAINED FOR THE DURATION OF CONSTRUCTION.
10. THE LOCATION OF ALL UTILITIES SHOWN ARE NOT GUARANTEED TO BE ACCURATE OR COMPLETE AND MUST BE CERTIFIED WITH THE UTILITY PRIOR TO PROCEEDING WITH CONSTRUCTION. THE CONTRACTOR IS RESPONSIBLE FOR COMFIRMING THE LOCATION OF ALL EXISTING SURFACE INFRASTRUCTURE AND UNDERGROUND UTILITIES WITH UTILITY COMPANIES AND PROPERTY OWNERS.

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HATZIC EMERGENCY WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: AS SHOWN

BRITISH COLUMBIA

CIVIL
DETAIL 2 OF 6
PROPOSED SAND RECOVERY STATION

DRAWING	REVISION	SHEET
2632-03-C-3502	1	10

IF NOT 50 mm ADJUST SCALES
50 mm
SCALE(S) SHOWN ARE INTENDED FOR ANSI D (22X34) SIZE DRAWINGS, TABLOID (11X17) SIZE DRAWINGS ARE 1/2 OF SCALE (S) SHOWN UNLESS NOTED OTHERWISE

VEGETATED RIPRAP SPECIFICATIONS:

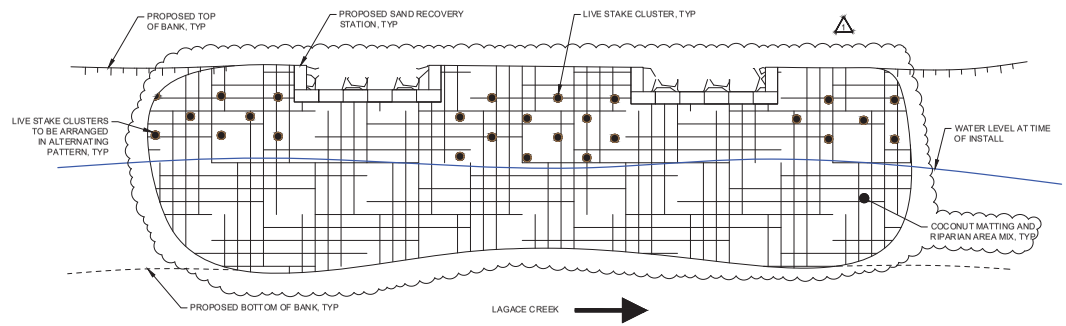
1. HARVESTING:
1.1. THE HARVESTING OF LIVE STAKES IS TO BE CONDUCTED BY A LOCAL NURSERY OR QUALIFIED PROFESSIONAL EXPERIENCED WITH LIVE STAKING WITHIN 48 HOURS OF INSTALLATION. IF THIS TIME PERIOD IS NOT POSSIBLE, STAKES NEED TO BE PROPERLY STORED IN A COOL DARK LOCATION THAT IS CONSISTENTLY LESS THAN 5 DEGREES CELSIUS.
1.2. HARVESTING SUITABLE NATIVE WILLOW AND RED OSIER-DOGWOOD SPECIES FROM WITHIN 100 KM OF THE PROPERTY AND WITHIN 300 M IN ELEVATION.
1.3. SELECT NATIVE PLANTS GROWING IN SIMILAR CONDITIONS TO WHERE THEY WILL BE PLANTED: CONSIDER SUN EXPOSURE, DISTANCE TO WATER, AVAILABILITY OF SOIL NUTRIENTS
1.4. DO NOT HARVEST FROM SENSITIVE AREAS, SUCH AS RIPARIAN AREAS WITH LIMITED VEGETATION OR PROTECTED AREAS.
1.5. HARVESTING STRAIGHT CUTTINGS DURING THE DORMANT SEASON OCTOBER TO APRIL, AFTER LEAF DROP OR BEFORE LEAF OUT.
1.6. SELECTING STRAIGHT STEMS 25 TO 75 MM IN DIAMETER AND 1.5 - 2M IN LENGTH.
1.7. REMOVING SIDE BRANCHES BY CLIPPING THEM CLOSE TO THE MAIN STEM. USE AN AXE TO SHARPEN BOTTOM END OF THE STAKE ENSURING THAT BUD SCARS FACE UPWARD. AFTER INSTALL, CUT THE TOP END OF THE STEM HORIZONTALLY TO CREATE A FLAT SURFACE TO FACILITATE TAPPING IN STAKES, WHERE NEEDED.
1.8. STORING LIVE STAKES IN CLEAN COOL WATER (IN A DRY DARK CELLAR OR A DRY COLD ROOM) FOR AT LEAST 24 HOURS UNTIL PLANTED FOR AT MOST 10 DAYS. IF YOU CANNOT PLANT THE CUTTINGS WITHIN 10 DAYS OF HARVESTING, CUTTINGS CAN BE STORED UNTIL YOU ARE READY TO PLANT THEM IN THE SHOULDER SEASONS (APRIL/MAY OR OCTOBER/NOVEMBER) FOR UP TO 8 WEEKS).

2. LIVE CLUSTER PREPARATION AND STAKING DURING CONSTRUCTION
2.1. TO CREATE SOIL POCKETS FOR THE LIVE STAKE CLUSTERS DURING THE PREFERRED SHOULDER SEASON, SITE PREPARATION REQUIREMENTS INCLUDE:
2.1.1. REMOVING ANY DEBRIS, ROCKS, OR OTHER OBSTRUCTIONS FROM THE PLANTING AREA ALONG THE RIPRAP SLOPE TO CREATE AN EASY PLANTING SURFACE.
2.1.2. EXCAVATING THE SOIL FOR THE POCKET AREA TO A DEPTH OF 0.5 M DEPTH INTO NATIVE SOIL, TO ALLOW FOR ADEQUATE ROOT PENETRATION AND WATER ABSORPTION.
2.1.3. STAGGERING THE PLACEMENT OF LIVE STAKE CLUSTERS SITES, AND SPACE STAKES 0.1 M APART, AS SHOWN IN TYPICAL DETAIL 2 ON C-3503, FOR AN ESTIMATED TOTAL OF 25 CLUSTERS.
2.1.4. ENSURING THAT THE BASE OF THE SOIL POCKET EXCAVATION IS BETWEEN 0.5 m BELOW THE TOP OF BANK AND THE LOW WATER LEVEL AT TIME OF INSTALLATION, AS PER TYPICAL DETAIL 2 ON C-3503.
2.1.5. ADDING TOPSOIL TO THE SOIL POCKET TO IMPROVE SOIL QUALITY AND FERTILITY. IMPORTING WEED-FREE TOPSOIL.
2.1.6. STAKE CLUSTERS SHOULD BE PLACED APPROXIMATELY 0.25 m ABOVE THE TOE OF THE LOW WATER LEVEL AT TIME OF PLANTING.
2.1.7. CUT COCONUT MATTING TO A LENGTH THAT WILL ENTIRELY WRAP AROUND THE SOIL POCKET ONCE BUILT (0.3 M DIAMETER), APPROXIMATELY 1 TO 2 M.
2.1.8. ONCE RIPRAP IS INSTALLED TO THE CORRECT ELEVATION, CUT COCONUT MATTING IS TO BE LAID FLAT ON THE RIPRAP BELOW THE PREPARED SOIL POCKET EXCAVATION AREA.
2.1.9. FOLLOWING TYPICAL DETAIL 2 ON C-3503, SOIL WILL BE PLACED ON THE COCONUT MATTING TO A DIAMETER OF 30 CM UP TO THE DEPTH OF THE RIPRAP. THE COCONUT MATTING ENDS ARE TO BE LEFT FREE TO BE WRAPPED AROUND THE SOIL POCKET.
2.1.10. PLACE FOUR STAKES IN THE SOIL, AT 10 CM DISTANCE APART, THEN WRAP COCONUT MATTING AROUND THE SOIL AND STAKES MAKING A CIRCULAR CLUSTER THAT IS 30 CM IN DIAMETER. THEN CONTINUE PLACING RIPRAP.

3. INSTALLATION
3.1. SUCCESSFUL INSTALLATION OF LIVE STAKING REQUIRES THAT:
3.2. THE INSTALLATION OF LIVE STAKES IS COMPLETED WHILE THEY ARE DORMANT IN EARLY FALL TO MID-SPRING (OCTOBER TO MAY BEFORE LEAF-OUT OR AFTER LEAF DROP), IN UNFROZEN GROUND.
3.3. LIVE STAKES SHOULD BE SOAKED FOR A MINIMUM OF 24 HOURS AND NO LONGER THAN 14 DAYS PRIOR TO PLANTING. CUTTINGS MAY BE SOAKED IN CONTAINERS. WHEN SOAKING, 100 PERCENT OF THE LENGTH OF THE CUTTING SHOULD BE IN CONTACT WITH WATER (ADDING WEIGHT MAY BE NECESSARY IF SOAKING IN HORIZONTAL POSITION). DO NOT STORE CUTTINGS ONSITE IN DRY AND/OR IN DIRECT SUNLIGHT CONDITIONS.
3.4. AVOIDING THE SPLINTERING OR CRUSHING THE TOP OF CUTTINGS.
3.5. A MINIMUM OF 80% BURIAL (CONTACT WITH SOIL) WITH AT LEAST 200 MM OF THE LIVE STAKE ABOVE THE RIPRAP.
3.6. THAT FOUR LEAF BUDS SHOULD REMAIN ABOVE GROUND AND SHOULD BE FACING IN AN UPRIGHT DIRECTION.
3.7. THAT IF CUTTINGS ARE DAMAGED DURING INSTALLATION, ONE IS TO REMOVE THE DAMAGED PORTION BY PROVIDING A CLEAN CUT BELOW THE DAMAGED SECTION.
3.8. TAMPING SOIL AROUND LIVE STAKE AND ADDING SOIL, AS REQUIRED. WATER PRIOR TO AND AFTER INSTALLATION.

4. MAINTENANCE
4.1. ALTHOUGH IT IS WEATHER AND STAKE ESTABLISHMENT DEPENDANT, MAINTENANCE OF THE LIVE STAKE CLUSTERS IS REQUIRED. A QUALIFIED ENVIRONMENTAL PROFESSIONAL (QEP) WILL BE CONSULTED WITH REGARDS TO A MAINTENANCE SCHEDULE. GENERALLY, MAINTENANCE OF THE LIVE STAKE CLUSTERS REQUIRES THAT PLANTINGS BE WATERED FROM APRIL 2024 THROUGH 2025 AT THE FOLLOWING FREQUENCY:
4.2. TWICE PER MONTH APRIL TO MAY,
4.3. ONCE PER WEEK FROM JUNE THROUGH THE END OF JULY,
4.4. TWICE PER WEEK FROM AUGUST TO THE END OF SEPTEMBER, AND
4.5. ONCE PER WEEK FROM EARLY OCT UNTIL PRECIPITATION EVENTS OCCUR (RAIN OR SNOW).

NOTE:
DEPENDING ON PRECIPITATION LEVELS FOR THE FIRST TWO GROWING SEASONS, WATERING MAY NEED TO OCCUR FOR THREE GROWING SEASONS. IN ADDITION TO REGULAR WATERING, REMOVAL OF INVASIVE WEEDS MAY BE REQUIRED.

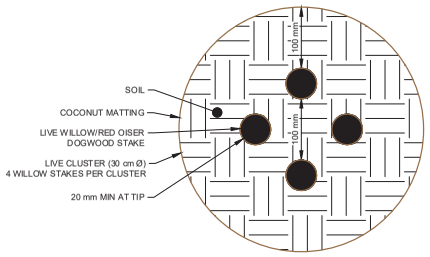


PLAN

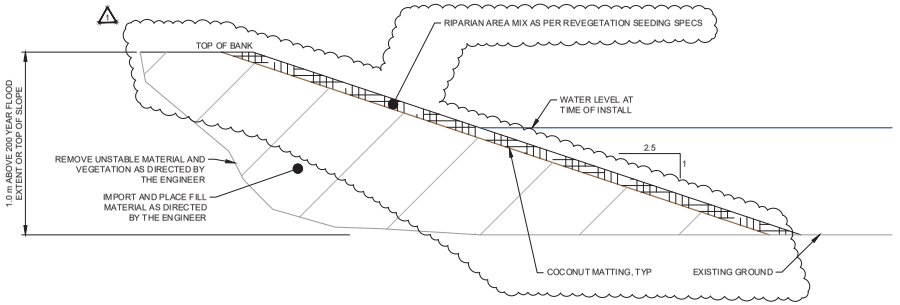
NOTE:
CLUSTER NUMBERS MAY CHANGE DUE TO CHANGING SITE CONDITIONS. THE TARGET IS ONE CLUSTER PER 3 m², 0.5 m BELOW TOP OF BANK, AND 0.25 m ABOVE WATER LEVEL AT TIME OF INSTALL.

1

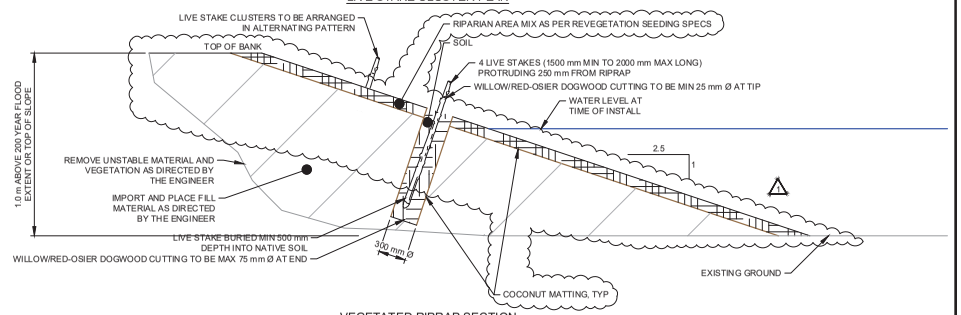
DISCLAIMER:
BIOENGINEERING IS A NATURE-BASED SOLUTION THAT IS DEPENDANT UPON THE VIABILITY OF THE PRESCRIBED MATERIALS, THE EXPERIENCE OF INSTALLERS, AND POST-INSTALLATION WATERING OR WEEDING. SAID VIABILITY IS CONTINGENT ON MANY FACTORS OUTSIDE OF THE DESIGNER'S CONTROL SUCH AS CLIMACTIC CONDITIONS, ENVIRONMENTAL FACTORS, AND HUMAN INTERACTIONS. THE NOTED DESIGN MEETS THE PROJECT DESIGN INTENT; HOWEVER, NO GUARANTEES ARE INFERRED OR IMPLIED.



LIVE STAKE CLUSTER PLAN



1 TYPICAL DETAIL NTS
100 kg CLASS RIPRAP



VEGETATED RIPRAP SECTION

2 TYPICAL DETAIL NTS
VEGETATED RIPRAP

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BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: AS SHOWN

BRITISH COLUMBIA

CIVIL
DETAIL 3 OF 6
BANK PROTECTION

DRAWING	REVISION	SHEET
2632-03-C-3503	1	11

IF NOT 50 mm ADJUST SCALES
50 mm

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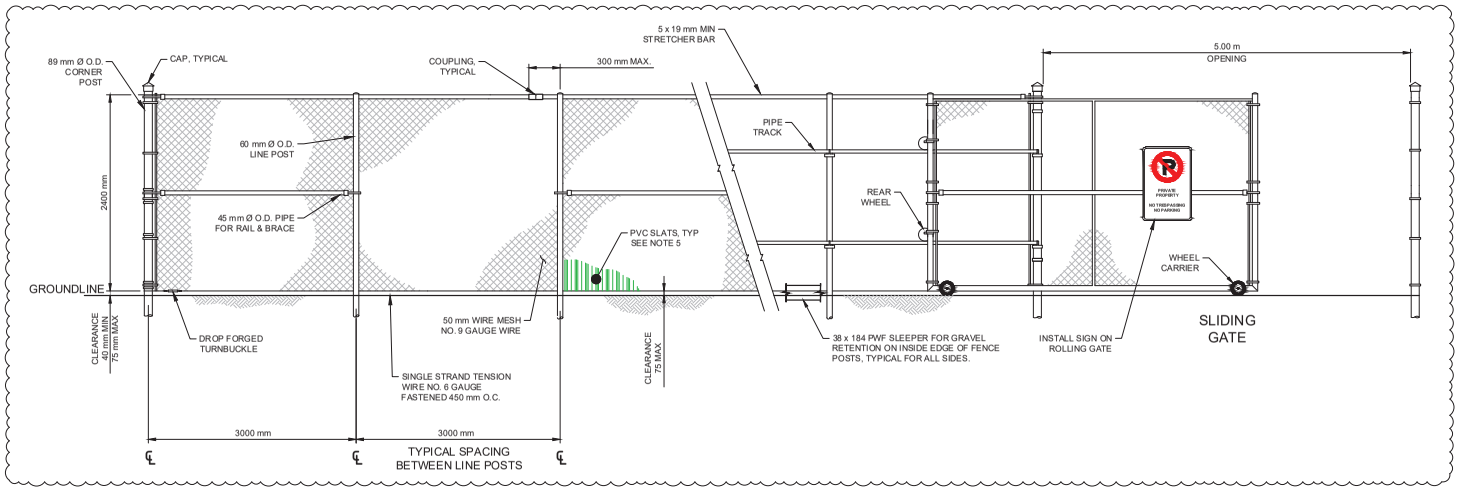
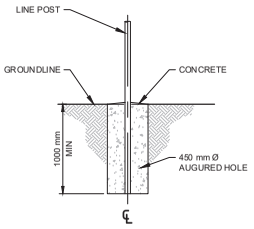
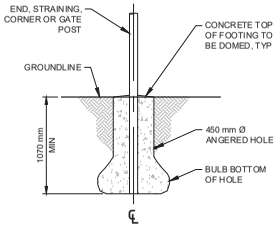


1 C-3102 **DETAIL** NTS
FENCE AND ROLLING GATE



2 **TYPICAL DETAIL** NTS
LINE POST SUPPORT IN EARTH



3 **TYPICAL DETAIL** NTS
CORNER, END AND GATE POST SUPPORT IN EARTH

NOTES:

1. DESIGN EXTENTS ARE APPROXIMATE AND MAY REQUIRE ADJUSTMENT IN FIELD.
2. ALL DIMENSIONS ARE IN METERS (m) UNLESS OTHERWISE NOTED.
3. ALL LOCATIONS ARE GEODETIC AND ARE IN NAD83 UTM10.
4. CONTRACTOR IS TO VERIFY THE PLACEMENT OF FENCE AND GATE WITH ENGINEER AND PROPERTY OWNER.
5. PVC SLATS SHALL BE PLACED WITHIN THE WIRE MESH. COLOUR TO BE GREEN THAT MATCHES THE SURROUNDING VEGETATION.
6. WITH THE WRITTEN APPROVAL OF THE ENGINEER, REMOVE EXISTING VEGETATION WITHIN PROJECT FOOTPRINT AS REQUIRED TO FACILITATE CONSTRUCTION.
7. THE LOCATION OF ALL UTILITIES SHOWN ARE NOT GUARANTEED TO BE ACCURATE OR COMPLETE AND MUST BE CERTIFIED WITH THE UTILITY PRIOR TO PROCEEDING WITH CONSTRUCTION. THE CONTRACTOR IS RESPONSIBLE FOR COMFIRMING THE LOCATION OF ALL EXISTING SURFACE INFRASTRUCTURE AND UNDERGROUND UTILITIES WITH UTILITY COMPANIES AND PROPERTY OWNERS.

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HATZIC EMERGENCY
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LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: AS SHOWN

BRITISH COLUMBIA

CIVIL
DETAIL 4 OF 6
FENCE AND GATE INSTALLATION

DRAWING	REVISION	SHEET
2632-03-C-3504	1	12

IF NOT 50 mm ADJUST SCALES
50 mm

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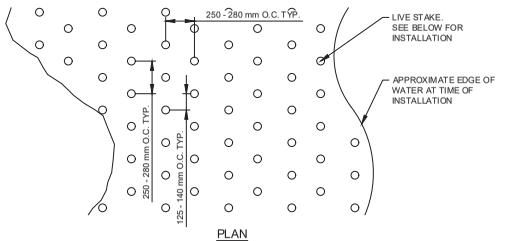
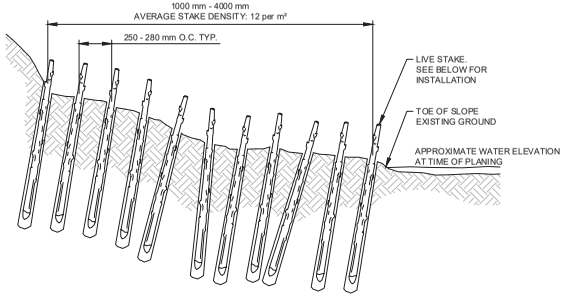
BIOENGINEERING SPECIFICATIONS:

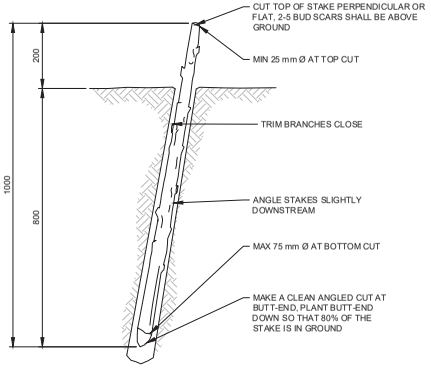
1. PLANT MATERIAL
   - 1.1. ONLY NATIVE SPECIES WILL BE INSTALLED. SOURCE NATIVE PLANT MATERIAL IN CLOSE PROXIMITY TO THE PROJECT SITE. PLANT MATERIAL WILL BE SOURCED FROM WITHIN 100 km OF LAGACE CREEK, SUBJECT TO APPROVAL OF THE OWNER.
   - 1.2. PLANTS SHALL BE GENERALLY TRUE TO TYPE AND STRUCTURALLY SOUND, HEALTHY AND VIGOROUS AND FREE OF DISEASE, INSECT INFESTATIONS, INSECT EGGS, WILDLIFE DAMAGE, SUNSCALD, FROST CRACKS AND MECHANICAL WOUNDS. STEMS SHALL BE COVERED IN SMOOTH BARK (I.E. NOT FURROWED). PRUNING CUTS SHALL SHOW VIGOROUS BARK ON ALL EDGES AND ALL PARTS SHALL BE MOIST AND SHOW LIVE, GREEN CAMBIUM TISSUE WHEN CUT.
   - 1.3. LIVE CUTTINGS FROM NATIVE STANDS:
     - 1.3.1. LOCATION OF CUTTINGS TO BE DOCUMENTED AND SUBMITTED TO THE OWNER PRIOR TO COLLECTION. TARGET HARVESTING FROM WITHIN LAGACE CREEK PROJECT FOOTPRINT (WITHIN THE DREDGING FOOTPRINT), IF THE TIMING WINDOW IS APPROPRIATE FOR HARVESTING, SEE NOTE 1.5.
     - 1.3.2. CUTTINGS WILL NOT BE TAKEN FROM WITHIN LAGACE CREEK CHANNEL MARGINS WHERE NO DREDGING IS OCCURRING.
     - 1.3.3. COLLECTION FOR LIVE STAKING WILL OCCUR UNDER SUPERVISION OF PERSONNEL WITH TRAINING AND EXPERIENCE IN LIVE STAKING.
   - 1.4. ACCEPTABLE SPECIES INCLUDE:
     - 1.4.1. NATIVE WILLOW SPECIES (SALIX SP)
   - 1.5. HARVESTING OF CUTTINGS
     - 1.5.1. HARVEST CUTTINGS ONLY DURING THE DORMANT SEASON (BETWEEN LEAF-OFF IN FALL AND PRIOR TO SPRING BUD BREAK). SELECT STEMS THAT ARE A MINIMUM OF 25 mm AT THE TOP AND A MAXIMUM OF 75 mm AT THE BOTTOM IN DIAMETER, KEEPING THEM FULL LENGTH UNTIL THE TIME OF INSTALLATION WHERE POSSIBLE. DURING HARVEST, SIDE BRANCHES SHOULD BE REMOVED BY CLIPPING THEM CLOSE TO THE MAIN STEM.
     - 1.5.2. STAKE LENGTHS SHOULD BE A MINIMUM OF 1.25 m AND A MAXIMUM OF 2.0 m.
     - 1.5.3. CUT STEMS TO LENGTH BASED ON THE DETAIL DRAWINGS AFTER INSTALLATION.
     - 1.5.4. WRAP CUTTINGS INTO MANAGEABLE BUNDLES USING NATURAL TWINE, AND BURLAP. FOR FUTURE REFERENCE, MARK EACH BUNDLE WITH FLAGGING TAPE, AND RECORD THE SPECIES AND HARVESTING DATE AND GENERAL LOCATION.
     - 1.5.5. HARVEST HEALTHY, STRAIGHT AND LIVE WOOD AT LEAST 1 YEAR OLD.
   - 1.6. PREPARATION:
     - 1.6.1. PRIOR TO INSTALLATION, SOAK CUTTINGS FOR A MINIMUM OF 24 HOURS AND NO LONGER THAN 14 DAYS. CUTTINGS MAY BE SOAKED IN CONTAINERS. POTABLE OR CREEK WATER IS ACCEPTABLE, AND NO ADDITIVES ARE REQUIRED. WATER TEMPERATURE SHOULD MIMIC THE CREEK TEMPERATURE FOR THE TARGETED TIME OF INSTALLATION.
     - 1.6.2. APPROXIMATELY 80 TO 100 PERCENT OF THE LENGTH OF THE CUTTING SHOULD BE IN CONTACT WITH WATER (WEIGHT ON TOP IF SOAKING IN A HORIZONTAL POSITION).
   - 1.7. STORAGE:
     - 1.7.1. IF CUTTINGS ARE NOT INSTALLED WITHIN 14 DAYS, PLACE WRAPPED BUNDLES IN COLD STORAGE (BETWEEN -5 AND -1°C) WITH A MINIMUM OF 80% RELATIVE HUMIDITY. CUTTINGS IN STORAGE >-1°C CAN ONLY BE STORED FOR 2-3 MONTHS. STORAGE FOR OVER 3 MONTHS REQUIRES COLDER TEMPERATURES, STORE STAKES AT THE ULTIMATE MAXIMUM OF 180 DAYS (6 MONTHS); HOWEVER, THE PREFERRED MAXIMUM IS 120 DAYS (4 MONTHS) IF STAKES ARE TO BE STORED FOR MORE THAN 4 MONTHS, HARVEST 1/3 MORE THAN THE PRESCRIPTION REQUIRES TO ACCOUNT FOR DIE-OFF IN STORAGE.
     - 1.7.2. WHEN TAKING STAKES OUT OF STORAGE, PRIOR TO PREPARATION, ENSURE THE STEMS ARE LIVE BY SCRAPING A SMALL SECTION OF THE BARK, GREEN SHOULD BE REVEALED UNDERNEATH.
     - 1.7.3. TRANSPORT TO SITE AND SUBSEQUENT STORAGE PRIOR TO INSTALLATION SHALL OCCUR IN A COOL ENVIRONMENT. STAKES MUST BE INSTALLED WITHIN 24 HOURS OF DELIVERY TO THE SITE. SHOULD INSTALLATION BE DELAYED BEYOND THIS PERIOD, THE STAKES ARE TO BE STORED IN A SHADED AREA WHILE IMMERSED IN WATER.
2. ENVIRONMENTAL MANAGEMENT
   - 2.1. ONLY USE ACCESS POINTS INTO THE CHANNEL AS IDENTIFIED ON DRAWING C-3104.
   - 2.2. FOLLOW ALL BEST MANAGEMENT PRACTICES, EROSION CONTROL MITIGATION MEASURES, SITE ISOLATION METHODS AND ANY OTHER APPLICABLE MEASURES IN THE CEMP AT ALL TIMES.
   - 2.3. WORK "IN THE DRY" AND MAINTAIN AN ISOLATED WORKSITE FROM WATER AND FISH AT ALL TIMES, IF THE WORKSITE BECOMES WETTED FROM SURFACE OR GROUNDWATER SEEPING INTO THE SITE, STOP WORKS AND RE-ISOLATE THE SITE. FISH MUST BE SALVAGED FROM ISOLATED WORK ZONES.
   - 2.4. DO NOT DISTURB, DAMAGE OR REMOVE ANY EXISTING NATIVE VEGETATION. IF VEGETATION IS PRESENT, WORK AROUND THE STEMS WITHOUT DAMAGING THEM.
3. INSTALLATION
   - 3.1. DENSE LIVE STAKING:
     - 3.1.1. LIVE CUTTINGS WILL BE INSTALLED IN THE DORMANT SEASON (WHEN THE LEAVES HAVE DROPPED OFF THE STEMS IN THE LATE FALL, OR BEFORE BUDS START TO GROWN AND OPEN IN THE EARLY SPRING).
     - 3.1.2. ONLY WILLOW CUTTINGS WILL BE USED.
     - 3.1.3. CUTTINGS UP TO 1.25 m LONG ARE INSTALLED APPROXIMATELY 1.0 m DEEP.
     - 3.1.4. CUTTINGS MUST NOT PROTRUDE FROM THE SURFACE MORE THAN 25 cm IN LENGTH.
     - 3.1.5. APPLY THIS TREATMENT ALONG THE TOE OF THE CREEK BANKS SLOPES, IN LOCATIONS SHOWN ON C-3104, WHERE THE CHANNEL MARGIN IS UNVEGETATED. WIDTH OF TREATMENT WILL BE SILECTED IN THE FIELD AND DEPENDS ON SITE CHARACTERISTICS. INSTALL STAKES FROM THE WATERS EDGE UP THE BANK TO A MAXIMUM OF 4 m (HORIZONTAL) WIDTH.
     - 3.1.6. DO NOT INSTALL CUTTINGS WHERE VEGETATION IS GROWING.
     - 3.1.7. MAKE CLEAN CUTS AND DO NOT DAMAGE STAKES OR SPLIT ENDS DURING INSTALLATION; USE A PLANTING BAR (1.5 m LONG STRAIGHT HEAVY IRON BAR WITH A POINTED END) AND CREATE THE PILOT HOLE TO A DEPTH OF 1.0 m. DO NOT USE LIVE STAKES TO CREATE THE PILOT HOLES AS THIS WILL DAMAGE THEIR BARK AND COMPROMISE THE VIABILITY OF THE STAKE. PILOT HOLES CAN ALSO BE CREATED WITH A HAND DRILL AUGER BUT LIVE STAKES MUST BE PLANTED TO A MINIMUM DEPTH OF 0.8 m.
     - 3.1.8. HAND INSTALLATION ONLY.
     - 3.1.9. LIGHTLY TAMP THE STAKE INTO THE HOLE WITH A RUBBER MALLET, TAKING CARE NOT TO SPLIT THE END, TRIM THE STAKE TO DESIRED LENGTH, AND TAMP THE SEDIMENT AROUND THE STAKE FOLLOWING INSTALLATION.
     - 3.1.10. THE INSTALLATION ANGLE OF THE CUTTING IN THE SEDIMENT MAY VARY. SLIGHT ANGLE DOWNSTREAM IS PREFERRED.
     - 3.1.11. KEEP ALL ACTIVITY AND FOOT TRAFFIC ABOVE WATER TO PREVENT EROSION AND SEDIMENTATION.
     - 3.1.12. WIDTH OF TOE STAKING SHALL VARY BASED ON SITE CONDITIONS DURING INSTALLATION.
     - 3.1.13. START TOE STAKING JUST ABOVE WATER AT TIME OF CONSTRUCTION (TO BE INSTALLED DURING LOW FLOW.)
     - 3.1.14. DO NOT DISTURB OR DAMAGE EXISTING NATIVE WOOD VEGETATION GROWING IN TREATMENT AREA.
     - 3.1.15. INSTALL LIVE STAKES IN AND AROUND EXISTING NATIVE WOODY VEGETATION, ADJUST TREATMENT SPECIFICATIONS IN THE FIELD AS NECESSARY TO AVOID WOODY VEGETATION.
4. WATERING
   - 4.1. WATER THE CUTTINGS IMMEDIATELY AFTER INSTALLATION.
   - 4.2. A WATERING PROGRAM WILL BE IMPLEMENTED THE FIRST GROWING SEASON AFTER PLANTING (WHEN SOIL TEMPERATURES ARE 5°C OR ABOVE) AS PER THE SCHEDULE IN 4.5, UNLESS IT HAS RAINED OVER 5 mm WITHIN 2-3 DAYS OF PLANNED WATERING.
   - 4.3. THE CONTRACTOR IS RESPONSIBLE FOR ACQUIRING THE WATER SOURCE AND THE WATERING PROGRAM, ALONG WITH ALL REQUIRED PERMITS AND LAND PERMISSIONS.
   - 4.4. WATERING DEPTH TARGET IS BETWEEN 250 mm MINIMUM AND 500 mm MAXIMUM, TO BE ADJUSTED DEPENDING ON SOIL MOISTURE CONDITIONS. SOIL SHOULD BE MOIST UP TO 1500 mm MINIMUM AFTER WATERING.
   - 4.5. WATERING SCHEDULE:
     - 4.5.1. WATER ONCE PER MONTH WHEN WEEKLY TEMPERATURES ARE, ON DAILY AVERAGE, BETWEEN 5-10°C AT SITE.
     - 4.5.2. WATER TWICE PER MONTH WHEN WEEKLY TEMPERATURES ARE, ON DAILY AVERAGE, BETWEEN 11-15°C AT SITE.
     - 4.5.3. WATER WEEKLY, WHEN WEEKLY TEMPERATURES ARE, ON DAILY AVERAGE, BETWEEN 16-25°C AT SITE.
     - 4.5.4. WATER BI-WEEKLY, WHEN WEEKLY TEMPERATURES ARE, ON DAILY AVERAGE, BETWEEN 26-35°C AT SITE.
     - 4.5.5. WATER THREE TIMES PER WEEK WHEN WEEKLY TEMPERATURES ARE, ON DAILY AVERAGE, 36°C AND ABOVE AT SITE.
   - 4.6. THE SELECTED WATERING METHODOLOGY MUST NOT CAUSE EROSION.
   - 4.7. THE SELECTED WATERING METHODOLOGY MUST NOT CAUSE HARM OR DISTURB NATIVE VEGETATION GROWING ONSITE.



PLAN



CROSS SECTION



CROSS SECTION

1 TYPICAL DETAIL NTS
DENSE LIVE STAKING

TABLE 4: DENSE LIVE STAKING TREATMENT SUMMARY			
LOCATION	APPROXIMATE AREA	APPROXIMATE LINEAR METERS	AVERAGE DENSITY
SITE 1	120 m²	80 m	12 PER m²
SITE 2	100 m²	50 m	
SITE 3	500 m²	240 m	

NOTE:
CONTRACTOR IS SOLELY RESPONSIBLE FOR CONFIRMING THE NUMBER OF STEMS REQUIRED

1

DISCLAIMER:
BIOENGINEERING IS A NATURE-BASED SOLUTION THAT IS DEPENDANT UPON THE VIABILITY OF THE PRESCRIBED MATERIALS, THE EXPERIENCE OF INSTALLERS, AND POST-INSTALLATION WATERING OR WEEDING. SAID VIABILITY IS CONTINGENT ON MANY FACTORS OUTSIDE OF THE DESIGNER'S CONTROL SUCH AS CLIMACTIC CONDITIONS, ENVIRONMENTAL FACTORS, AND HUMAN INTERACTIONS. THE NOTED DESIGN MEETS THE PROJECT DESIGN INTENT; HOWEVER, NO GUARANTEES ARE INFERRED OR IMPLIED.

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Associated Engineering
BEST MANAGED COMPANIES Platinum member

PERMIT TO PRACTICE
ASSOCIATED ENGINEERING (B.C.) LTD.
PERMIT NUMBER: 1000163
Engineers & Geoscientists BC

REV	DATE	DESIGN	DRAWN	DESCRIPTION
1	2024JUL22	R. KARGAARD	J. ROZON	ISSUED FOR RFP AND PERMITTING
0	2024JUN14	R. KARSGAARD	J. ROZON	ISSUED FOR RFP

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

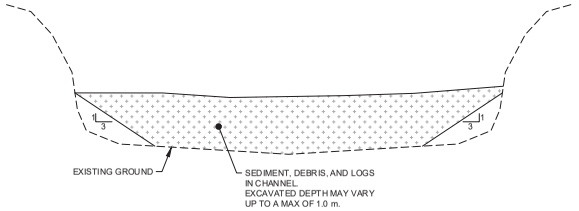
SCALE: AS SHOWN

BRITISH COLUMBIA

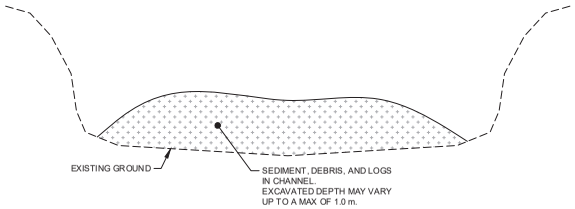
CIVIL
DETAIL 5 OF 6
DENSE LIVE STAKING

DRAWING	REVISION	SHEET
2632-03-C-3505	1	13

IF NOT 50 mm ADJUST SCALES
50 mm
SCALE(S) SHOWN ARE INTENDED FOR ANSI D (22X34) SIZE DRAWINGS, TABLOID (11X17) SIZE DRAWINGS ARE 1/2 OF SCALE(S) SHOWN UNLESS NOTED OTHERWISE



1 TYPICAL SECTION NTS
DEBRIS/SEDIMENT REMOVAL - FULL CHANNEL



2 TYPICAL SECTION NTS
DEBRIS/SEDIMENT REMOVAL - PARTIAL CHANNEL

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Associated Engineering

CANADA BEST MANAGED COMPANIES
Platinum member

PERMIT TO PRACTICE
ASSOCIATED ENGINEERING (B.C.) LTD.
PERMIT NUMBER: 1000163
Engineers & Geoscientists BC

REV	DATE	DESIGN	DRAWN	DESCRIPTION
1	2024JUL05	R. KARGAARD	J. ROZON	ISSUED FOR RFP AND PERMITTING
0	2024JUN14	R. KARSGAARD	J. ROZON	ISSUED FOR RFP

BC MINISTRY OF ENVIRONMENT
AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY
WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: AS SHOWN

BRITISH COLUMBIA

CIVIL
DETAIL 6 OF 6
SEDIMENT REMOVAL

DRAWING	REVISION	SHEET
2632-03-C-3506	1	14

Approved Subcontractors:

Keystone Environmental: Environmental Monitoring

Natural Resource Sector

MAJOR WORKS CONTRACT
SCHEDULE "I" – PRELIMINARY CONSTRUCTION SCHEDULE

ID	Task Mode	Line Item	Task Name	Duration	Start	Finish	Predecessors
1			**Schedule - HATZIC EMERGENCY WORKS PROGRAM LAGACE CREEK – SITES S-CR-14/17**	**51 days**	**Mon 24-08-12**	**Fri 24-10-25**	
2			Bid Package Submitted	1 day	Mon 24-08-12	Mon 24-08-12	
3			Contract Award	1 day	Tue 24-08-13	Tue 24-08-13	2
4			Pre-Project Submittals	8 days	Wed 24-08-14	Fri 24-08-23	3
5			**Construction - HATZIC EMERGENCY WORKS PROGRAM LAGACE CREEK – SITES S-CR-14/17**	**41 days**	**Mon 24-08-26**	**Fri 24-10-25**	
6			**CR-17 Site**	**4 days**	**Mon 24-08-26**	**Thu 24-08-29**	
7			Mobilization and Setup	1 day	Mon 24-08-26	Mon 24-08-26	4
8			Excavation and Off-site Disposal of Sediment	2 days	Tue 24-08-27	Wed 24-08-28	7
9			Removal Temporary Facilities	1 day	Thu 24-08-29	Thu 24-08-29	8
10			Demobilization	0 days	Thu 24-08-29	Thu 24-08-29	9
11			**CR-14 Site**	**41 days**	**Mon 24-08-26**	**Fri 24-10-25**	
12			Mobilization	1 day	Mon 24-08-26	Mon 24-08-26	7SS
13			Tree trimming, pruning, clearing, grubbing, and disposal	4 days	Tue 24-08-27	Fri 24-08-30	12
14			Temporary Access Approach and Setup	1 day	Tue 24-09-03	Tue 24-09-03	13
15			Excavation and Off-site Disposal of Sediment	13 days	Wed 24-09-04	Fri 24-09-20	14
16			Excavation and Off-site Disposal of Contaminated Sediment	1 day	Mon 24-09-23	Mon 24-09-23	15
17			Restoration of Sand Recovery Station	3 days	Wed 24-09-11	Fri 24-09-13	15SS+5 days
18			Installation of New Sand Recovery Station	3 days	Mon 24-09-16	Wed 24-09-18	17
19			Installation of Dense Live Staking	17 days	Wed 24-09-11	Mon 24-10-07	15SS+5 days
20			Installation of Live Stake Cluster	6 days	Tue 24-10-08	Wed 24-10-16	19
21			Installation of Tree Row	2 days	Thu 24-10-17	Fri 24-10-18	20
22			Installation of Coconut Matting and Riparian Are	2 days	Mon 24-10-21	Tue 24-10-22	21
23			Removal Access Route and Temporary Facilities	1 day	Wed 24-10-23	Wed 24-10-23	22
24			Sit Clean and Demobilization	2 days	Thu 24-10-24	Fri 24-10-25	23
25			Project Work Complete	0 days	Fri 24-10-25	Fri 24-10-25	24

Not Applicable

1) In this Schedule:

   a) "Tax Verification Letter" means a letter issued by the Province of British Columbia's Ministry of Finance verifying that the Contractor meets its applicable B.C. corporate income tax filing obligations and provincial sales tax (PST) filing and payment obligations; and

   b) "Valid" means that the Tax Verification Letter's period of validity, as indicated on the Tax Verification Letter, has not ended.

2) As a condition of entering into this Agreement, the Contractor provided to the Province a Valid Tax Verification Letter.

3) Upon request by the Province, the Contractor must provide the Province with a new Valid Tax Verification Letter. Notwithstanding any other provision of this Agreement, the Contractor acknowledges and agrees that any extension or renewal of this Agreement is conditional upon the Province having, or receiving from the Contractor in response to a request from the Province, a Valid Tax Verification Letter prior to any such extension or renewal.

Not Applicable

CONTRACT MODIFICATION AGREEMENT

Natural Resource Ministries

Contract Modification Agreement No. 1

PROJECT NAME: Hatzic Emergency Works Program – Lagace Creek – Sites S-CR-14/17

MINISTRY CONTRACT/FILE NO: MWK25EPFLOOD0001

THIS MODIFICATION AGREEMENT dated for reference: February 11, 2025.

BETWEEN

HIS MAJESTY THE KING IN RIGHT OF THE PROVINCE OF BRITISH COLUMBIA, represented by the MINISTER OF ENVIRONMENT AND PARKS

(the "Province", "we", "us", or "our" as applicable) at the following address:
PO Box 9377, Victoria, BC, V8W 9M1

Telephone: 778-943-6904
Business E-mail Address: Amy.Vallarino@gov.bc.ca

Ministry Representative: Amy Vallarino
Alternate *(if applicable)*: Thyren Jacobs

AND

QM LP, dba QM Environmental

(the "Contractor", "you", or "your" as applicable) at the following address:
200-5035 South Service Road, Burlington, ON L7L 6M9

Telephone: 250-893-8671
E-mail Address: Nicholas.Doucette@QMenv.co

Contractor Representative: Nicholas Doucette
Corporate Business Number: 77885 6922
WorkSafe BC No: 968503 **and/or** POP No.

A. The Parties entered into an Agreement dated for reference AUGUST 23rd, 2024**,** (hereinafter called the "Agreement"),

B. The Parties agree to amend the Agreement as follows:

1. Extend the contract end date from October 30, 2024 to December 4, 2026, in order to incorporate the two-year Plant Warranty Period, as outlined in *Article 19 Warranty* of the Contract.

2. Replace the “Project Work Complete” date from Schedule I – Preliminary Schedule with the following revised date:

   Project Work Complete: December 4, 2024

C. In all other respects, the Agreement is confirmed.

D. Time is of the essence in this Modification Agreement.

The Parties duly execute this Modification Agreement as follows:

SIGNED AND DELIVERED on behalf of the Province by an authorized representative of the Province	**SIGNED AND DELIVERED** by or on behalf of the Contractor (or by an authorized signatory of the Contractor if a corporation)
Doug Hill	Nicholas Doucette
(Signature of authorized Ministry Expense Authority)	(Signature of Contractor or Authorized Signatory)
Doug Hill A/ADM	Nicholas Doucette Vice President, Special Projects & New Markets
(PRINTED NAME of authorized representative)	(PRINTED NAME of Contractor or authorized signatory)
Dated this 13 day of February 2025	Dated this 11 day of February 2025

CONTRACT MODIFICATION AGREEMENT

Natural Resource Ministries

Contract Modification Agreement No. 2

MINISTRY CONTRACT/FILE NO.: MWK25EPFLOOD0001

PROJECT NAME: Hatzic Emergency Works Program – Lagace Creek – Sites S-CR-14/17

THIS MODIFICATION AGREEMENT dated for reference February 26, 2026**.**

BETWEEN

HIS MAJESTY THE KING IN RIGHT OF THE PROVINCE OF BRITISH COLUMBIA, represented by the MINISTER OF Environment and Parks

Environmental Disasters Operation Team (EDOT)

(the "Province", "we", "us", or "our" as applicable) at the following address:

PO Box 9377, Stn Prov Gov, Victoria, BC, V8W 9M1

Telephone: 778-943-6904 Fax: Business E-mail Address: Amy.Vallarino@gov.bc.ca

Ministry Representative: Amy Vallarino

Alternate *(if applicable)*:

AND

QM LP, dba QM Environmental

(the "Contractor", "you", or "your" as applicable) at the following address:

200-5035 South Service Road, Burlington, ON L7L 6M9

Telephone: 647-321-1304 E-mail Address: Michael.Bailey@QMenv.com

Contractor Representative: Michael Bailey

Corporate Business Number: 77885 6922

WorkSafe BC No: 968503 **and/or** POP No.

A. The Parties entered into an Agreement dated for reference August 23, 2024 (hereinafter called the "Agreement"),

A. The Parties agree to amend the Agreement as follows:

1. Schedule B – Fees and Expenses, 1. MAXIMUM AMOUNT PAYABLE: Maximum Amount: Decrease the maximum amount from $1,465,420.00 to a new contract maximum of **$952,786.30.**

B. The Parties agree to Change the Work as follows.

The Contractor agrees to perform forthwith the following Work as extra work or reduction of work, subject to the terms and conditions of the Agreement and to be paid for or credited in accordance with the said terms of the contract.

Unless otherwise indicated, lump sum or unit prices shown below constitute full payment for all labour, materials, equipment, overhead, profit, taxes (including taxes paid or payable by you to a supplier) and other things required to completely incorporate the change(s) into the contract work, but exclusive of Goods and Services Tax (GST) and any applicable Provincial Sales Tax (PST) that you are required to charge the Province as a taxable transaction.

CONTRACT MODIFICATION AGREEMENT

CHANGE OF WORK

			Schedule of Values (Tender)						
Site	**Item**	**Description**	**QTY**	**Unit**	**Unit Rate**	**Price**	**Change QTY**	**Deletion**	**Addition**
S-CR-14	2.01	Tree Trimming, Pruning, Clearing, Grubbing, and Disposal	3500	m2	$8.00	$28,000.00	-1460	-$11,680.00	
S-CR-14	2.04	Supply and Installation of Tree Row per Drawing C-3102	12	Each	$600.00	$7,200.00	-12	-$7,200.00	
S-CR-14	4.03	Supply and Installation of Coconut Matting and Riparian Area Mix per Drawing C-3102	900	m2	$8.00	$7,200.00	-285	-$2,280.00	
S-CR-14	4.04	Excavation and Off-site Disposal of Sediment	8250	m3	$84.00	$693,000.00	-6411	-$538,524.00	
S-CR-14	4.05	Excavation and Off-site Disposal of Contaminated Sediment	500	m3	$473.00	$236,500.00	591.16		$ 279,618.68
S-CR-14	5.01	Supply and Installation of Dense Live Staking per Detail 1 on C-3505	720	m2	$186.00	$133,920.00	-559.83	-$104,128.38	
S-CR-14	5.02	Supply and Installation of Live Stake Cluster per Detail 2 on C-3503	200	m2	$410.00	$82,000.00	-104	-$42,640.00	
S-CR-17	1.01	Mobilization and Demobilization	1	LS	$7,000.00	$7,000.00	-1	-$7,000.00	
S-CR-17	1.02	Traffic Accommodations along Sylvester Road	1	LS	$13,000.00	$13,000.00	-1	-$13,000.00	
S-CR-17	2.02	Environmental Monitoring and Reporting	1	LS	$10,000.00	$10,000.00	-1	-$10,000.00	
S-CR-17	3.01	Excavation and Off-site Disposal of Sediment per Drawing C-3105	300	m3	$186.00	$55,800.00	-300	-$55,800.00	
							TOTAL	-$792,252.38	$279,618.68
							NET	**-$512,633.70**	

As Per Quotation Dated Y M D	Total Price for Additions (PST and GST excluded) $	Total Credit for Deletions - $512,633.70
Recommended and submitted by (Contract Manager/Inspector):		

Continued on Next Page

CONTRACT MODIFICATION AGREEMENT

C. In all other respects, the Agreement is confirmed.

D. Time is of the essence in this Modification Agreement.

The Parties duly execute this Modification Agreement as follows:

The Parties duly execute this Modification Agreement as follows:

SIGNED AND DELIVERED on behalf of the Province by an authorized representative of the Province	**SIGNED AND DELIVERED** by or on behalf of the Contractor (or by an authorized signatory of the Contractor if a corporation)
(Signature of authorized Ministry Expense Authority) Alyson Blackstock, Assistant Deputy Minister, Environmentral Protection Division	(Signature of Contractor or Authorized Signatory) Michael Bailey - Business Unit Lead - Construction Services
(PRINTED NAME of authorized representative) Dated this 13th day of March 2026	(PRINTED NAME of Contractor or authorized signatory) Dated this 5th day of March 2026

APPENDIX F – ACCESS AGREEMENTS

LICENCE OF OCCUPATION

This AGREEMENT (the "Agreement") dated for reference the 24 day of April, 2024 (the "Date of Reference")

BETWEEN:

His Majesty the King in Right of the Province of British Columbia, as represented by the Minister of Environment and Climate Change Strategy (the "Province")

AND:

Robert John Dale (the "Owner")

BACKGROUND

A. The November 2021 atmospheric river event left the Materials in and around the Waterway.

B. The Province is working to complete the Project by undertaking the Activities.

C. The Province, its employees, agents, contractors, sublicensees and invitees need to enter onto private properties, including the Property, to undertake the Activities.

D. The Owner, who is the owner of the Property, will benefit from the Activities given the location of the Property in relation to the Waterway.

NOW THEREFORE for good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the parties agree as follows:

DEFINITIONS

1. In this Agreement,

   (a) **"Activities"** means all activities being carried out by the Province to complete the Project, including the following:

      (i) identification, inspection, investigation (including environmental investigation and archaeological investigation), surveying, or assessment of sites that require bank stabilization, or measures to remove or otherwise address the Materials in and around the Waterway;

      (ii) clearing the Property, including of vegetation;

      (iii) constructing access routes on the Property;

      (iv) undertaking, constructing, reconstructing, maintaining, repairing, improving, altering, installing, placing, or operating the Works and Land Applications in, on or under the Property; and

(v) other activities that the Province determines, in its sole discretion, are necessary to complete the Project, including activities related to removing the Materials, repairing banks of the Waterway, and realigning the Waterway;

(b) **"Date of Reference"** means the date of reference of this Agreement, as specified on the first page of this Agreement;

(c) **"Debris"** includes man-made and woody material;

(d) **"Land Applications"** means establishing, restoring, re-establishing, stabilizing, and enhancing land, habitat, natural features, ecosystems and materials, including the use of vegetation, landscaping, dunes, dikes, and sand and rock placement;

(e) **"Materials"** means either the Debris or the Sediment, or both the Debris and the Sediment;

(f) **"Project"** means the Province's project to stabilize the banks of the Waterway and remove or otherwise address the Materials in and around the Waterway;

(g) **"Property"** means the following described land:

Parcel Identifier: 010-941-606

Legal Description: Lot 5 Section 11 Township 18 New Westminster District Plan 3529

Parcel Identifier: 010-941-614

Legal Description: Lot 6 Section 11 Township 18 New Westminster District Plan 3529

Parcel Identifier: 010-941-622

Legal Description: Lot 7 Section 11 Township 18 New Westminster District Plan 3529

Parcel Identifier: 010-941-673

Legal Description: Lot 8 Section 11 Township 18 New Westminster District Plan 3529

"Sediment" includes soil, silt, gravel, and boulders;

(h) **"Term"** means the term of this Agreement, which is the period of time set out in Paragraph 6 of this Agreement as may be extended under Paragraph 7;

(i) **"Waterway"** means the Legace Creek; and

(j) **"Works"** includes fixtures, structures, and other things erected upon or affixed to land, including sediment traps, culverts, and weirs.

DESCRIPTION OF WORK

2. On the terms and conditions set out in this Agreement, the Owner grants to the Province, its employees, agents, contractors, sublicensees and invitees an irrevocable licence of occupation over the Property for the following purposes:

   (a) to enter, use, labour, go, return, pass and repass along, over and upon the Property with or without materials, machinery, supplies and equipment to undertake the Activities;

   (b) to establish all necessary grades and levels, which may include the placing of rig mats on the Property or the moving of dirt or rocks on the Property;

   (c) to undertake, perform and complete surveys (including topographic surveys), tests, assessments, investigations, inspections and examinations of the Property;

   (d) to remove brush, shrubs, or other vegetation which, in the Province's opinion, need to be removed for the use of the Property for the purposes set out in this Agreement;

   (e) to licence or allow any person to exercise any of the rights granted to the Province on such terms as the Province, in its sole discretion, may decide; and

   (f) to do all acts which, in the Province's opinion, are necessary and incidental to the use of the Property for the purposes set out in this Agreement.

COVENANTS

3. The Province will use and occupy the Property only for the purposes set out in Paragraph 2 of this Agreement.

4. The Province will not place on or make to the Property any improvement except for the purposes set out in this Agreement.

5. On the termination of this Agreement, the Province will peaceably quit and deliver to the Owner possession of the Property in a safe, clean and sanitary condition.

TERM

6. The term of this Agreement commences on the Date of Reference and expires on December 31, 2024.

7. This Agreement may, in the sole discretion of the Province, be renewed for a period of up to 365 days by written notice from the Province to the Owner delivered not later than 10 days before the expiration of the Term (or any renewal of the Term).

FEE

8. The fee for the Term is $1.00, the receipt and sufficiency of which is acknowledged by the Owner.

COMPLETION OF WORKS AND LAND APPLICATIONS

9. When the Province determines, in its sole discretion, that it has completed the Works and Land Applications in, on or under the Property, the Province will provide the Owner with written notice of such completion (the "**Completion Notice**").

10. Upon the Province providing the Owner with the Completion Notice:

    (a) all Works placed, erected or constructed in, on or under the Property pursuant to this Agreement will be considered fixtures of the Property; and

    (b) the Owner, and not the Province, will be responsible for the Works and Land Applications, including any future construction, reconstruction, maintenance, repair, improvement, alteration, installation, placement or operation of the Works and Land Applications in, on or under the Property.

LIMITATION OF LIABILITY

11. The Owner, for itself and its successors and assigns, hereby releases and forever discharges the Province and its employees, agents, contractors, sublicensees and invitees of and from any and all claims, demands, proceedings, actions or causes of action, for damages, costs, debts, expenses and compensation whatsoever and wheresoever, whether at law or in equity and whether known or unknown, suspected or unsuspected which the Owner now has or hereafter can, shall, or may have in relation to this Agreement, and without limiting the generality of the foregoing, with respect to any matter relating to, arising out of, or in any way connected with all claims or potential claims of the Owner arising in relation this Agreement. Without limiting any applicable legislation, the foregoing does not apply to claims arising from:

    (a) anything done or omitted in bad faith by the Province, its employees, agents, contractors, sublicensees and invitees; or

    (b) the wilful misconduct of the Province or its employees, agents, contractors, sublicensees and invitees.

CANCELLATION

12. The Province agrees with the Owner that if the Province fails to observe, abide by and comply with the provisions of this Agreement and its default or failure continues for 60 days after the Owner gives written notice of the default or failure to the Province this Agreement will, at the Owner's option and with or without entry, terminate, and all of the Province's rights, interests and estate in the Property will be absolutely forfeited to the Owner.

13. If the condition complained of requires more time to cure than 60 days, the Province will be deemed to have complied with the remedying of it if the Province commences remedying or curing the condition within 60 days and diligently complete the same.

TRANSFER OF THE PROPERTY

14. The Owner must not transfer the fee simple interest in the Property during the Term of this Agreement to any person without that person (the "**Transferee**") first entering into an agreement with the Province that:

    (a) the Province's rights under this Agreement will continue as though the Transferee was listed as the Owner under this Agreement; and

    (b) the Transferee is bound by all the terms, conditions, covenants, obligations and agreements contained in this Agreement

    in the form provided by the Province.

NOTICE

15. Any notice required to be given by either party to the other will be deemed to be given if mailed by prepaid registered mail in Canada or delivered to the address of the other as follows:

    to the Owner:

    Name: Robert John Dale

    Address: 34782 Dale Road
    Mission, BC, V2V 0B7

    Fax: _____

    Email: rkdale117@gmail.com

    to the Province:

    Attn: Ralph Mohrmann, Flood Debris Management Secretariat
    BC Ministry of Environment and Climate Change Strategy
    PO Box 9337 Stn Prov Govt
    Victoria, BC V8W 9M1
    Ralph.Mohrmann@gov.bc.ca

    or at such other address as a party may, from time to time, direct in writing, and any such notice will be deemed to have been received if delivered, on the day of delivery, and if mailed, 7 days after the time of mailing, except in the case of mail interruption in which case actual receipt is required.

MISCELLANEOUS

16. No provision of this Agreement will be considered to have been waived unless the waiver is in writing, and a waiver of a breach of a provision of this Agreement will not be construed as or constitute a waiver of any further or other breach of the same or any other provision of this Agreement, and a consent or approval to any act requiring consent or approval will

not waive or render unnecessary the requirement to obtain consent or approval to any subsequent same or similar act.

17. No remedy conferred upon or reserved to the Owner under this Agreement is exclusive of any other remedy in this Agreement or provided by law, but that remedy will be in addition to all other remedies in this Agreement or then existing at law, in equity or by statute.

18. This Agreement extends to, is binding upon and ensures to the benefit of the parties, their heirs, executors, administrators, successors and permitted assigns.

19. If, due to a strike, lockout, labour dispute, act of God, inability to obtain labour or materials, law, ordinance, rule, regulation or order of a competent governmental authority, enemy or hostile action, civil commotion, fire or other casualty or any condition or cause beyond the Province's reasonable control, other than normal weather conditions, the Province is delayed in performing any of its obligations under this Agreement, the time for the performance of that obligation will be extended by a period of time equal to the period of time of the delay.

20. The parties agree that nothing in this Agreement constitutes the Province as the agent, joint venturer or partner of the Owner.

21. The Province's obligation to pay money under this Agreement, if any, is subject to the *Financial Administration Act*, which makes that obligation subject to an appropriation being available in the fiscal year of the Province during which payment becomes due.

22. Any sections of this Agreement which, by their terms or nature, are intended to survive the termination of this Agreement, will continue in force indefinitely subject to any applicable limitation period prescribed by law, even after this Agreement ends.

INTERPRETATION

23. In this Agreement:

    (a) "person" includes a corporation, firm or association and wherever the singular or masculine form is used in this Agreement it will be construed as the plural or feminine or neuter form, as the case may be, and vice versa where the context or parties require; and

    (b) "includes" and "including" are not intended to be limiting.

24. The captions and headings contained in this Agreement are for convenience only and do not define or in any way limit the scope or intent of this Agreement.

25. This Agreement will be interpreted according to the laws of the Province of British Columbia.

26. Where there is a reference to an enactment of the Province of British Columbia or of Canada in this Agreement, that reference will include a reference to every amendment to it, every regulation made under it and any subsequent enactment of like effect and, unless otherwise indicated, all enactments referred to in this Agreement are enactments of the Province of British Columbia.

27. If any section of this Agreement, or any part of a section, is found to be illegal or unenforceable, that section or part of a section, as the case may be, will be considered separate and severable and the remainder of this Agreement will not be affected and this Agreement will be enforceable to the fullest extent permitted by law.

28. This Agreement constitutes the entire agreement between the parties and no understanding or agreement, oral or otherwise, exists between the parties with respect to the subject matter of this Agreement except as expressly set out in this Agreement and this Agreement may not be modified except by subsequent agreement in writing between the parties.

29. Each party will, upon the request of the other, do or cause to be done all lawful acts necessary for the performance of the provisions of this Agreement.

30. Time is of the essence of this Agreement and, without limitation, will remain of the essence after any modification or extension of this Agreement, whether or not expressly restated in the document effecting the modification or extension.

31. This Agreement may be executed in one or more counterparts, each of which will be an original, and all of which together will constitute a single instrument. Further, the parties agree that this Agreement may be signed and/or transmitted by fax or by electronic mail of a .PDF document or electronic signature (e.g., DocuSign or similar electronic signature technology) and thereafter maintained in electronic form, and that such electronic record will be valid, and effective to bind the party so signing, as a paper copy bearing such party's handwritten signature. The parties further consent and agree that the electronic signatures appearing on this Agreement will be treated, for the purposes of validity, enforceability, and admissibility, the same as handwritten signatures.

The parties have executed this Agreement as of the Date of Reference.

SIGNED on behalf of **HIS MAJESTY THE KING IN RIGHT OF THE PROVINCE OF BRITISH COLUMBIA** by the Minister of Environment and Climate Change Strategy or the minister's authorized representative

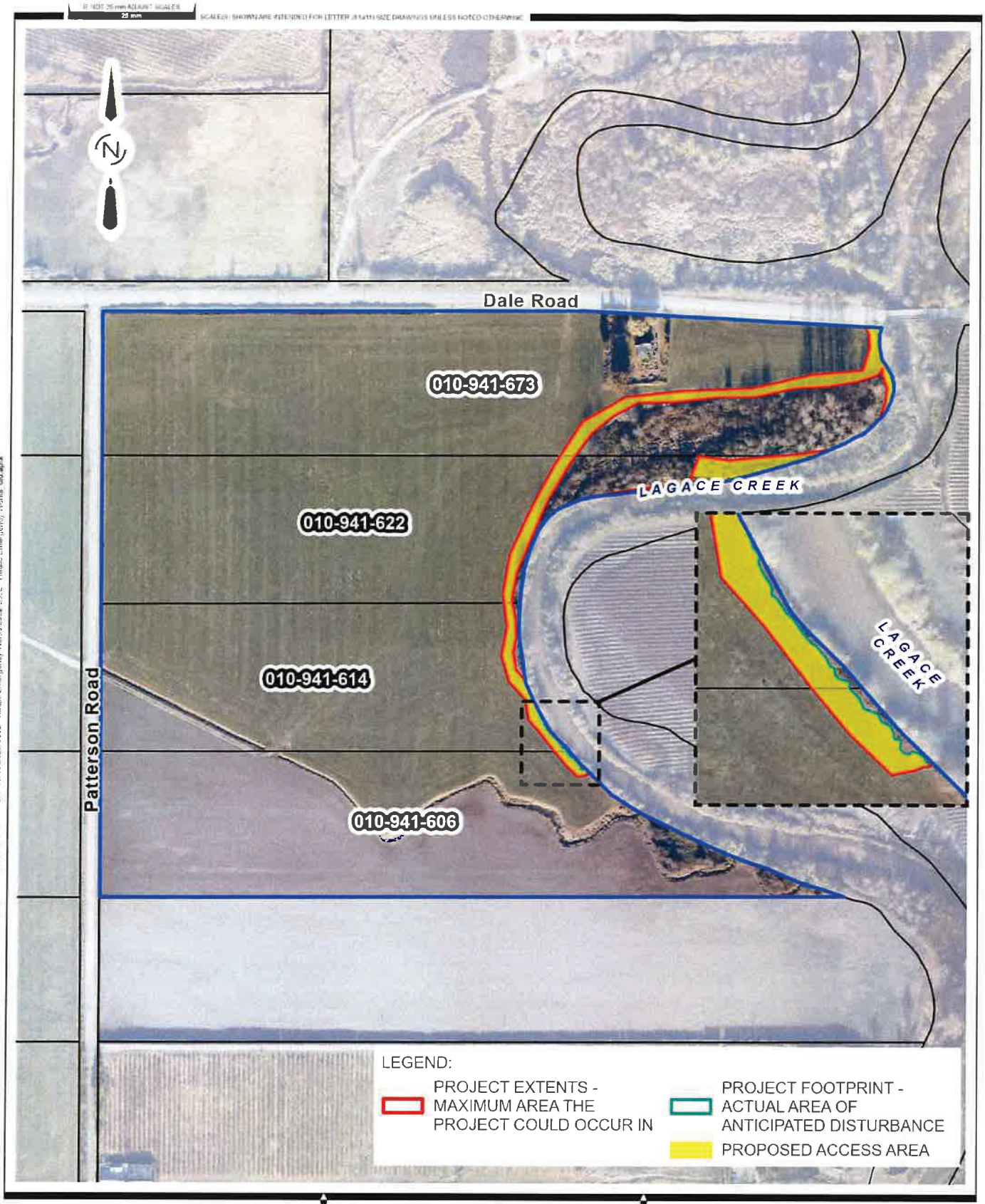
168699

Minister of Environment and Climate Change Strategy
or the minister's authorized representative

SIGNED AND DELIVERED by

Name of Owner(s): Robert John Dale

Signature of Owner(s): Robert J Dale



Associated Engineering

BEST MANAGED COMPANIES

AE PROJECT No.	2022-2632-04
SCALE	1:3,500
APPROVED	R. KARSGAARD
DATE	2024APR17
REV	0
DESCRIPTION	ISSUED FOR INFORMATION

APPENDIX A

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

PARCEL NUMBERS
010-941-673;
010-941-622;
010-941-614;
010-941-606

LICENCE OF OCCUPATION

This AGREEMENT (the "Agreement") dated for reference the 22 day of April, 2024 (the "Date of Reference")

BETWEEN:

His Majesty the King in Right of the Province of British Columbia, as represented by the Minister of Environment and Climate Change Strategy (the "Province")

AND:

Douglas Todd Hancock and Sheri Robina Hancock (the "Owner")

BACKGROUND

A. The November 2021 atmospheric river event left the Materials in and around the Waterway.

B. The Province is working to complete the Project by undertaking the Activities.

C. The Province, its employees, agents, contractors, sublicensees and invitees need to enter onto private properties, including the Property, to undertake the Activities.

D. The Owner, who is the owner of the Property, will benefit from the Activities given the location of the Property in relation to the Waterway.

NOW THEREFORE for good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the parties agree as follows:

DEFINITIONS

1. In this Agreement,

   (a) **"Activities"** means all activities being carried out by the Province to complete the Project, including the following:

      (i) identification, inspection, investigation (including environmental investigation and archaeological investigation), surveying, or assessment of sites that require bank stabilization, or measures to remove or otherwise address the Materials in and around the Waterway;

      (ii) clearing the Property, including of vegetation;

      (iii) constructing access routes on the Property;

      (iv) undertaking, constructing, reconstructing, maintaining, repairing, improving, altering, installing, placing, or operating the Works and Land Applications in, on or under the Property; and

(v) other activities that the Province determines, in its sole discretion, are necessary to complete the Project, including activities related to removing the Materials, repairing banks of the Waterway, and realigning the Waterway;

(b) **"Date of Reference"** means the date of reference of this Agreement, as specified on the first page of this Agreement;

(c) **"Debris"** includes man-made and woody material;

(d) **"Land Applications"** means establishing, restoring, re-establishing, stabilizing, and enhancing land, habitat, natural features, ecosystems and materials, including the use of vegetation, landscaping, dunes, dikes, and sand and rock placement;

(e) **"Materials"** means either the Debris or the Sediment, or both the Debris and the Sediment;

(f) **"Project"** means the Province's project to stabilize the banks of the Waterway and remove or otherwise address the Materials in and around the Waterway;

(g) **"Property"** means the following described land:

Parcel Identifier: 011-062-355

Legal Description: Lot 2 Except: Firstly: Parcel "B" (Reference Plan 7565) Secondly: Parcel "A" (Explanatory Plan 17194); Section 11 Township 18 New Westminster District Plan 4333

"Sediment" includes soil, silt, gravel, and boulders;

(h) **"Term"** means the term of this Agreement, which is the period of time set out in Paragraph 6 of this Agreement as may be extended under Paragraph 7;

(i) **"Waterway"** means the Legace Creek; and

(j) **"Works"** includes fixtures, structures, and other things erected upon or affixed to land, including sediment traps, culverts, and weirs.

DESCRIPTION OF WORK

2. On the terms and conditions set out in this Agreement, the Owner grants to the Province, its employees, agents, contractors, sublicensees and invitees an irrevocable licence of occupation over the Property for the following purposes:

(a) to enter, use, labour, go, return, pass and repass along, over and upon the Property with or without materials, machinery, supplies and equipment to undertake the Activities;

(b) to establish all necessary grades and levels, which may include the placing of rig mats on the Property or the moving of dirt or rocks on the Property;

(c) to undertake, perform and complete surveys (including topographic surveys), tests, assessments, investigations, inspections and examinations of the Property;

(d) to remove brush, shrubs, or other vegetation which, in the Province's opinion, need to be removed for the use of the Property for the purposes set out in this Agreement;

(e) to licence or allow any person to exercise any of the rights granted to the Province on such terms as the Province, in its sole discretion, may decide; and

(f) to do all acts which, in the Province's opinion, are necessary and incidental to the use of the Property for the purposes set out in this Agreement.

COVENANTS

3. The Province will use and occupy the Property only for the purposes set out in Paragraph 2 of this Agreement.

4. The Province will not place on or make to the Property any improvement except for the purposes set out in this Agreement.

5. On the termination of this Agreement, the Province will peaceably quit and deliver to the Owner possession of the Property in a safe, clean and sanitary condition.

TERM

6. The term of this Agreement commences on the Date of Reference and expires on December 31, 2024.

7. This Agreement may, in the sole discretion of the Province, be renewed for a period of up to 365 days by written notice from the Province to the Owner delivered not later than 10 days before the expiration of the Term (or any renewal of the Term).

FEE

8. The fee for the Term is $1.00, the receipt and sufficiency of which is acknowledged by the Owner.

COMPLETION OF WORKS AND LAND APPLICATIONS

9. When the Province determines, in its sole discretion, that it has completed the Works and Land Applications in, on or under the Property, the Province will provide the Owner with written notice of such completion (the "**Completion Notice**").

10. Upon the Province providing the Owner with the Completion Notice:

    (a) all Works placed, erected or constructed in, on or under the Property pursuant to this Agreement will be considered fixtures of the Property; and

(b) the Owner, and not the Province, will be responsible for the Works and Land Applications, including any future construction, reconstruction, maintenance, repair, improvement, alteration, installation, placement or operation of the Works and Land Applications in, on or under the Property.

LIMITATION OF LIABILITY

11. The Owner, for itself and its successors and assigns, hereby releases and forever discharges the Province and its employees, agents, contractors, sublicensees and invitees of and from any and all claims, demands, proceedings, actions or causes of action, for damages, costs, debts, expenses and compensation whatsoever and wheresoever, whether at law or in equity and whether known or unknown, suspected or unsuspected which the Owner now has or hereafter can, shall, or may have in relation to this Agreement, and without limiting the generality of the foregoing, with respect to any matter relating to, arising out of, or in any way connected with all claims or potential claims of the Owner arising in relation this Agreement. Without limiting any applicable legislation, the foregoing does not apply to claims arising from:

    (a) anything done or omitted in bad faith by the Province, its employees, agents, contractors, sublicensees and invitees; or

    (b) the wilful misconduct of the Province or its employees, agents, contractors, sublicensees and invitees.

CANCELLATION

12. The Province agrees with the Owner that if the Province fails to observe, abide by and comply with the provisions of this Agreement and its default or failure continues for 60 days after the Owner gives written notice of the default or failure to the Province this Agreement will, at the Owner's option and with or without entry, terminate, and all of the Province's rights, interests and estate in the Property will be absolutely forfeited to the Owner.

13. If the condition complained of requires more time to cure than 60 days, the Province will be deemed to have complied with the remedying of it if the Province commences remedying or curing the condition within 60 days and diligently complete the same.

TRANSFER OF THE PROPERTY

14. The Owner must not transfer the fee simple interest in the Property during the Term of this Agreement to any person without that person (the "**Transferee**") first entering into an agreement with the Province that:

    (a) the Province's rights under this Agreement will continue as though the Transferee was listed as the Owner under this Agreement; and

    (b) the Transferee is bound by all the terms, conditions, covenants, obligations and agreements contained in this Agreement

in the form provided by the Province.

NOTICE

15. Any notice required to be given by either party to the other will be deemed to be given if mailed by prepaid registered mail in Canada or delivered to the address of the other as follows:

    to the Owner:

    Name: Douglas Todd Hancock and Sheri Robina Hancock

    Address: 35225 Dale Rd.
    Mission BC, V2V 0B7

    Fax: _____

    Email: doug_sheri@telus.net

    to the Province:

    Attn: Ralph Mohrmann, Flood Debris Management Secretariat
    BC Ministry of Environment and Climate Change Strategy
    PO Box 9337 Stn Prov Govt
    Victoria, BC V8W 9M1
    Ralph.Mohrmann@gov.bc.ca

    or at such other address as a party may, from time to time, direct in writing, and any such notice will be deemed to have been received if delivered, on the day of delivery, and if mailed, 7 days after the time of mailing, except in the case of mail interruption in which case actual receipt is required.

MISCELLANEOUS

16. No provision of this Agreement will be considered to have been waived unless the waiver is in writing, and a waiver of a breach of a provision of this Agreement will not be construed as or constitute a waiver of any further or other breach of the same or any other provision of this Agreement, and a consent or approval to any act requiring consent or approval will not waive or render unnecessary the requirement to obtain consent or approval to any subsequent same or similar act.

17. No remedy conferred upon or reserved to the Owner under this Agreement is exclusive of any other remedy in this Agreement or provided by law, but that remedy will be in addition to all other remedies in this Agreement or then existing at law, in equity or by statute.

18. This Agreement extends to, is binding upon and ensures to the benefit of the parties, their heirs, executors, administrators, successors and permitted assigns.

19. If, due to a strike, lockout, labour dispute, act of God, inability to obtain labour or materials, law, ordinance, rule, regulation or order of a competent governmental authority, enemy or hostile action, civil commotion, fire or other casualty or any condition or cause beyond the

Province's reasonable control, other than normal weather conditions, the Province is delayed in performing any of its obligations under this Agreement, the time for the performance of that obligation will be extended by a period of time equal to the period of time of the delay.

20. The parties agree that nothing in this Agreement constitutes the Province as the agent, joint venturer or partner of the Owner.

21. The Province's obligation to pay money under this Agreement, if any, is subject to the *Financial Administration Act*, which makes that obligation subject to an appropriation being available in the fiscal year of the Province during which payment becomes due.

22. Any sections of this Agreement which, by their terms or nature, are intended to survive the termination of this Agreement, will continue in force indefinitely subject to any applicable limitation period prescribed by law, even after this Agreement ends.

INTERPRETATION

23. In this Agreement:

    (a) "person" includes a corporation, firm or association and wherever the singular or masculine form is used in this Agreement it will be construed as the plural or feminine or neuter form, as the case may be, and vice versa where the context or parties require; and

    (b) "includes" and "including" are not intended to be limiting.

24. The captions and headings contained in this Agreement are for convenience only and do not define or in any way limit the scope or intent of this Agreement.

25. This Agreement will be interpreted according to the laws of the Province of British Columbia.

26. Where there is a reference to an enactment of the Province of British Columbia or of Canada in this Agreement, that reference will include a reference to every amendment to it, every regulation made under it and any subsequent enactment of like effect and, unless otherwise indicated, all enactments referred to in this Agreement are enactments of the Province of British Columbia.

27. If any section of this Agreement, or any part of a section, is found to be illegal or unenforceable, that section or part of a section, as the case may be, will be considered separate and severable and the remainder of this Agreement will not be affected and this Agreement will be enforceable to the fullest extent permitted by law.

28. This Agreement constitutes the entire agreement between the parties and no understanding or agreement, oral or otherwise, exists between the parties with respect to the subject matter of this Agreement except as expressly set out in this Agreement and this Agreement may not be modified except by subsequent agreement in writing between the parties.

29. Each party will, upon the request of the other, do or cause to be done all lawful acts

necessary for the performance of the provisions of this Agreement.

30. Time is of the essence of this Agreement and, without limitation, will remain of the essence after any modification or extension of this Agreement, whether or not expressly restated in the document effecting the modification or extension.

31. This Agreement may be executed in one or more counterparts, each of which will be an original, and all of which together will constitute a single instrument. Further, the parties agree that this Agreement may be signed and/or transmitted by fax or by electronic mail of a .PDF document or electronic signature (e.g., DocuSign or similar electronic signature technology) and thereafter maintained in electronic form, and that such electronic record will be valid, and effective to bind the party so signing, as a paper copy bearing such party's handwritten signature. The parties further consent and agree that the electronic signatures appearing on this Agreement will be treated, for the purposes of validity, enforceability, and admissibility, the same as handwritten signatures.

The parties have executed this Agreement as of the Date of Reference.

SIGNED on behalf of **HIS MAJESTY THE KING IN RIGHT OF THE PROVINCE OF BRITISH COLUMBIA** by the Minister of Environment and Climate Change Strategy or the minister's authorized representative

168699

Minister of Environment and Climate Change Strategy
or the minister's authorized representative

SIGNED AND DELIVERED by

Name of Owner(s): Douglas Todd Hancock

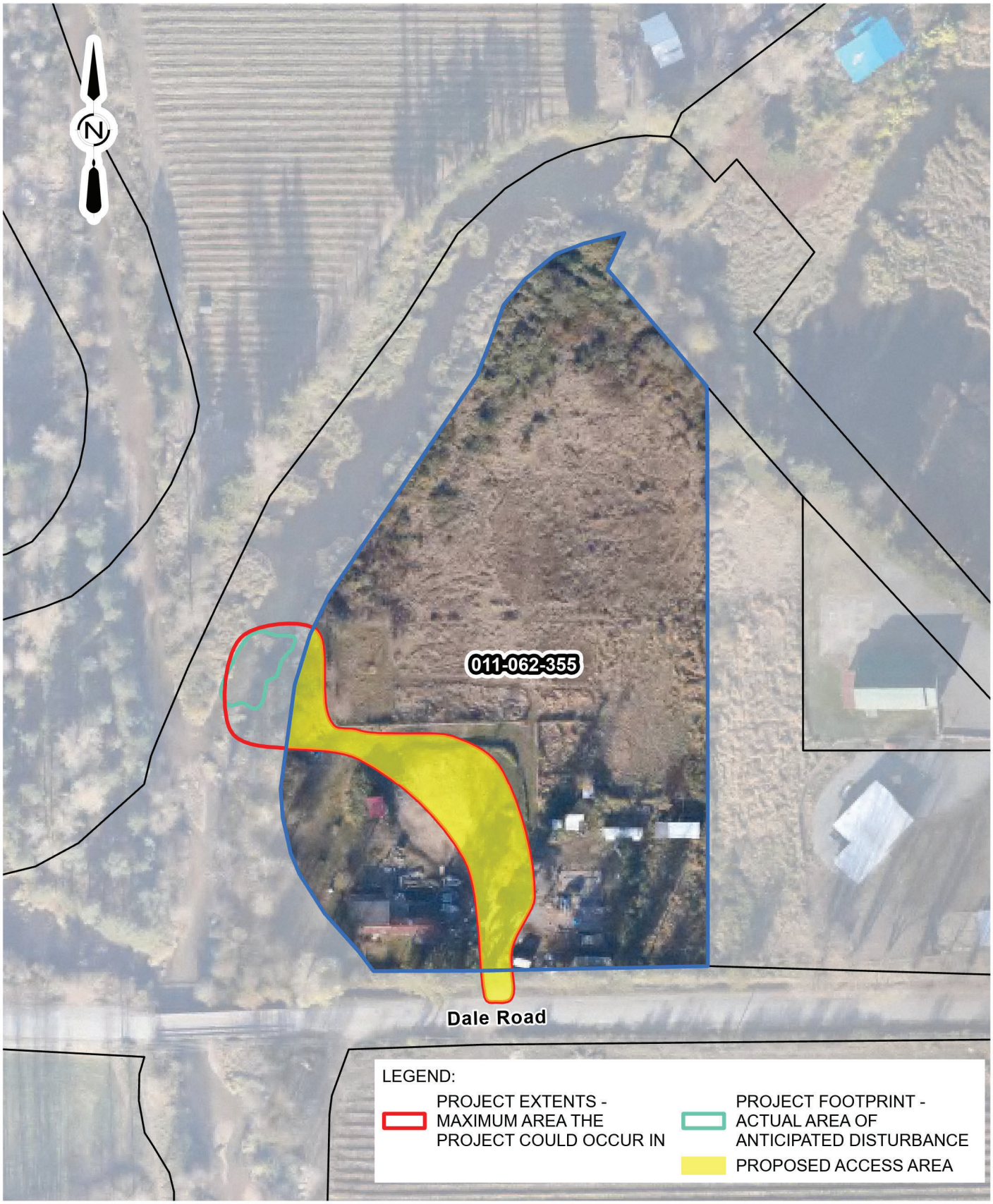
Signature of Owner(s): _____

Name of Owner(s): Sheri Robina Hancock

Signature of Owner(s): _____

IF NOT 25 mm ADJUST SCALES
25 mm

SCALE(S) SHOWN ARE INTENDED FOR LETTER (8.5x11) SIZE DRAWINGS UNLESS NOTED OTHERWISE



PLOT DATE: 2024-04-17 11:58 AM
SAVE DATE: 2024-04-17 11:58 AM SAVED BY:
DWG PATH: D:\PROGRAM_WORK\AcWork\2022-2632 - HATZIC EMERGENCY WORKS\2022-2632 - Hatzic ArcPro\2022-2632 - Hatzic Emergency Works\2022-2632 - Hatzic Emergency Works_old.aprx

Associated Engineering

BEST MANAGED COMPANIES CANADA
Platinum member

AE PROJECT No.	2022-2632-04
SCALE	1:1,500
APPROVED	R. KARSGAARD
DATE	2024APR17
REV	0
DESCRIPTION	ISSUED FOR INFORMATION

APPENDIX A

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

PARCEL NO. 011-062-355

LICENCE OF OCCUPATION

This AGREEMENT (the "Agreement") dated for reference the 22 day of April, 2024 (the "Date of Reference")

BETWEEN:

His Majesty the King in Right of the Province of British Columbia, as represented by the Minister of Environment and Climate Change Strategy (the "Province")

AND:

Nachatter Singh Jhulley and Baljit Kaur Jhulley (the "Owner")

BACKGROUND

A. The November 2021 atmospheric river event left the Materials in and around the Waterway.

B. The Province is working to complete the Project by undertaking the Activities.

C. The Province, its employees, agents, contractors, sublicensees and invitees need to enter onto private properties, including the Property, to undertake the Activities.

D. The Owner, who is the owner of the Property, will benefit from the Activities given the location of the Property in relation to the Waterway.

NOW THEREFORE for good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the parties agree as follows:

DEFINITIONS

1. In this Agreement,

   (a) **"Activities"** means all activities being carried out by the Province to complete the Project, including the following:

      (i) identification, inspection, investigation (including environmental investigation and archaeological investigation), surveying, or assessment of sites that require bank stabilization, or measures to remove or otherwise address the Materials in and around the Waterway;

      (ii) clearing the Property, including of vegetation;

      (iii) constructing access routes on the Property;

      (iv) undertaking, constructing, reconstructing, maintaining, repairing, improving, altering, installing, placing, or operating the Works and Land Applications in, on or under the Property; and

(v) other activities that the Province determines, in its sole discretion, are necessary to complete the Project, including activities related to removing the Materials, repairing banks of the Waterway, and realigning the Waterway;

(b) **"Date of Reference"** means the date of reference of this Agreement, as specified on the first page of this Agreement;

(c) **"Debris"** includes man-made and woody material;

(d) **"Land Applications"** means establishing, restoring, re-establishing, stabilizing, and enhancing land, habitat, natural features, ecosystems and materials, including the use of vegetation, landscaping, dunes, dikes, and sand and rock placement;

(e) **"Materials"** means either the Debris or the Sediment, or both the Debris and the Sediment;

(f) **"Project"** means the Province's project to stabilize the banks of the Waterway and remove or otherwise address the Materials in and around the Waterway;

(g) **"Property"** means the following described land:

Parcel Identifier: 008-042-217

Legal Description: Lot 27 Section 11 Township 18 New Westminster District Plan 3529

"Sediment" includes soil, silt, gravel, and boulders;

(h) **"Term"** means the term of this Agreement, which is the period of time set out in Paragraph 6 of this Agreement as may be extended under Paragraph 7;

(i) **"Waterway"** means the Legace Creek; and

(j) **"Works"** includes fixtures, structures, and other things erected upon or affixed to land, including sediment traps, culverts, and weirs.

DESCRIPTION OF WORK

2. On the terms and conditions set out in this Agreement, the Owner grants to the Province, its employees, agents, contractors, sublicensees and invitees an irrevocable licence of occupation over the Property for the following purposes:

(a) to enter, use, labour, go, return, pass and repass along, over and upon the Property with or without materials, machinery, supplies and equipment to undertake the Activities;

(b) to establish all necessary grades and levels, which may include the placing of rig mats on the Property or the moving of dirt or rocks on the Property;

(c) to undertake, perform and complete surveys (including topographic surveys), tests, assessments, investigations, inspections and examinations of the Property;

(d) to remove brush, shrubs, or other vegetation which, in the Province's opinion, need to be removed for the use of the Property for the purposes set out in this Agreement;

(e) to licence or allow any person to exercise any of the rights granted to the Province on such terms as the Province, in its sole discretion, may decide; and

(f) to do all acts which, in the Province's opinion, are necessary and incidental to the use of the Property for the purposes set out in this Agreement.

COVENANTS

3. The Province will use and occupy the Property only for the purposes set out in Paragraph 2 of this Agreement.

4. The Province will not place on or make to the Property any improvement except for the purposes set out in this Agreement.

5. On the termination of this Agreement, the Province will peaceably quit and deliver to the Owner possession of the Property in a safe, clean and sanitary condition.

TERM

6. The term of this Agreement commences on the Date of Reference and expires on December 31, 2024.

7. This Agreement may, in the sole discretion of the Province, be renewed for a period of up to 365 days by written notice from the Province to the Owner delivered not later than 10 days before the expiration of the Term (or any renewal of the Term).

FEE

8. The fee for the Term is $1.00, the receipt and sufficiency of which is acknowledged by the Owner.

COMPLETION OF WORKS AND LAND APPLICATIONS

9. When the Province determines, in its sole discretion, that it has completed the Works and Land Applications in, on or under the Property, the Province will provide the Owner with written notice of such completion (the "**Completion Notice**").

10. Upon the Province providing the Owner with the Completion Notice:

    (a) all Works placed, erected or constructed in, on or under the Property pursuant to this Agreement will be considered fixtures of the Property; and

    (b) the Owner, and not the Province, will be responsible for the Works and Land Applications, including any future construction, reconstruction, maintenance, repair,

improvement, alteration, installation, placement or operation of the Works and Land Applications in, on or under the Property.

LIMITATION OF LIABILITY

11. The Owner, for itself and its successors and assigns, hereby releases and forever discharges the Province and its employees, agents, contractors, sublicensees and invitees of and from any and all claims, demands, proceedings, actions or causes of action, for damages, costs, debts, expenses and compensation whatsoever and wheresoever, whether at law or in equity and whether known or unknown, suspected or unsuspected which the Owner now has or hereafter can, shall, or may have in relation to this Agreement, and without limiting the generality of the foregoing, with respect to any matter relating to, arising out of, or in any way connected with all claims or potential claims of the Owner arising in relation this Agreement. Without limiting any applicable legislation, the foregoing does not apply to claims arising from:

    (a) anything done or omitted in bad faith by the Province, its employees, agents, contractors, sublicensees and invitees; or

    (b) the wilful misconduct of the Province or its employees, agents, contractors, sublicensees and invitees.

CANCELLATION

12. The Province agrees with the Owner that if the Province fails to observe, abide by and comply with the provisions of this Agreement and its default or failure continues for 60 days after the Owner gives written notice of the default or failure to the Province this Agreement will, at the Owner's option and with or without entry, terminate, and all of the Province's rights, interests and estate in the Property will be absolutely forfeited to the Owner.

13. If the condition complained of requires more time to cure than 60 days, the Province will be deemed to have complied with the remedying of it if the Province commences remedying or curing the condition within 60 days and diligently complete the same.

TRANSFER OF THE PROPERTY

14. The Owner must not transfer the fee simple interest in the Property during the Term of this Agreement to any person without that person (the "**Transferee**") first entering into an agreement with the Province that:

    (a) the Province's rights under this Agreement will continue as though the Transferee was listed as the Owner under this Agreement; and

    (b) the Transferee is bound by all the terms, conditions, covenants, obligations and agreements contained in this Agreement

    in the form provided by the Province.

NOTICE

15. Any notice required to be given by either party to the other will be deemed to be given if mailed by prepaid registered mail in Canada or delivered to the address of the other as follows:

    to the Owner:

    Name: Nachatter Singh Jhulley and Baljit Kaur Jhulley

    Address: 12256 Aurora Street
    Maple Ridge, BC V2X 0R2
    Fax: _____

    Email: kmjhulley@gmail.com

    to the Province:

    Attn: Ralph Mohrmann, Flood Debris Management Secretariat
    BC Ministry of Environment and Climate Change Strategy
    PO Box 9337 Stn Prov Govt
    Victoria, BC V8W 9M1
    Ralph.Mohrmann@gov.bc.ca

    or at such other address as a party may, from time to time, direct in writing, and any such notice will be deemed to have been received if delivered, on the day of delivery, and if mailed, 7 days after the time of mailing, except in the case of mail interruption in which case actual receipt is required.

MISCELLANEOUS

16. No provision of this Agreement will be considered to have been waived unless the waiver is in writing, and a waiver of a breach of a provision of this Agreement will not be construed as or constitute a waiver of any further or other breach of the same or any other provision of this Agreement, and a consent or approval to any act requiring consent or approval will not waive or render unnecessary the requirement to obtain consent or approval to any subsequent same or similar act.

17. No remedy conferred upon or reserved to the Owner under this Agreement is exclusive of any other remedy in this Agreement or provided by law, but that remedy will be in addition to all other remedies in this Agreement or then existing at law, in equity or by statute.

18. This Agreement extends to, is binding upon and ensures to the benefit of the parties, their heirs, executors, administrators, successors and permitted assigns.

19. If, due to a strike, lockout, labour dispute, act of God, inability to obtain labour or materials, law, ordinance, rule, regulation or order of a competent governmental authority, enemy or hostile action, civil commotion, fire or other casualty or any condition or cause beyond the Province's reasonable control, other than normal weather conditions, the Province is delayed in performing any of its obligations under this Agreement, the time for the

performance of that obligation will be extended by a period of time equal to the period of time of the delay.

20. The parties agree that nothing in this Agreement constitutes the Province as the agent, joint venturer or partner of the Owner.

21. The Province's obligation to pay money under this Agreement, if any, is subject to the *Financial Administration Act*, which makes that obligation subject to an appropriation being available in the fiscal year of the Province during which payment becomes due.

22. Any sections of this Agreement which, by their terms or nature, are intended to survive the termination of this Agreement, will continue in force indefinitely subject to any applicable limitation period prescribed by law, even after this Agreement ends.

INTERPRETATION

23. In this Agreement:

    (a) "person" includes a corporation, firm or association and wherever the singular or masculine form is used in this Agreement it will be construed as the plural or feminine or neuter form, as the case may be, and vice versa where the context or parties require; and

    (b) "includes" and "including" are not intended to be limiting.

24. The captions and headings contained in this Agreement are for convenience only and do not define or in any way limit the scope or intent of this Agreement.

25. This Agreement will be interpreted according to the laws of the Province of British Columbia.

26. Where there is a reference to an enactment of the Province of British Columbia or of Canada in this Agreement, that reference will include a reference to every amendment to it, every regulation made under it and any subsequent enactment of like effect and, unless otherwise indicated, all enactments referred to in this Agreement are enactments of the Province of British Columbia.

27. If any section of this Agreement, or any part of a section, is found to be illegal or unenforceable, that section or part of a section, as the case may be, will be considered separate and severable and the remainder of this Agreement will not be affected and this Agreement will be enforceable to the fullest extent permitted by law.

28. This Agreement constitutes the entire agreement between the parties and no understanding or agreement, oral or otherwise, exists between the parties with respect to the subject matter of this Agreement except as expressly set out in this Agreement and this Agreement may not be modified except by subsequent agreement in writing between the parties.

29. Each party will, upon the request of the other, do or cause to be done all lawful acts necessary for the performance of the provisions of this Agreement.

30. Time is of the essence of this Agreement and, without limitation, will remain of the essence after any modification or extension of this Agreement, whether or not expressly restated in the document effecting the modification or extension.

31. This Agreement may be executed in one or more counterparts, each of which will be an original, and all of which together will constitute a single instrument. Further, the parties agree that this Agreement may be signed and/or transmitted by fax or by electronic mail of a .PDF document or electronic signature (e.g., DocuSign or similar electronic signature technology) and thereafter maintained in electronic form, and that such electronic record will be valid, and effective to bind the party so signing, as a paper copy bearing such party's handwritten signature. The parties further consent and agree that the electronic signatures appearing on this Agreement will be treated, for the purposes of validity, enforceability, and admissibility, the same as handwritten signatures.

The parties have executed this Agreement as of the Date of Reference.

SIGNED on behalf of **HIS MAJESTY THE KING IN RIGHT OF THE PROVINCE OF BRITISH COLUMBIA** by the Minister of Environment and Climate Change Strategy or the minister's authorized representative

168699

Minister of Environment and Climate Change Strategy
or the minister's authorized representative

SIGNED AND DELIVERED by

Name of Owner(s): Nachatter Singh Jhulley

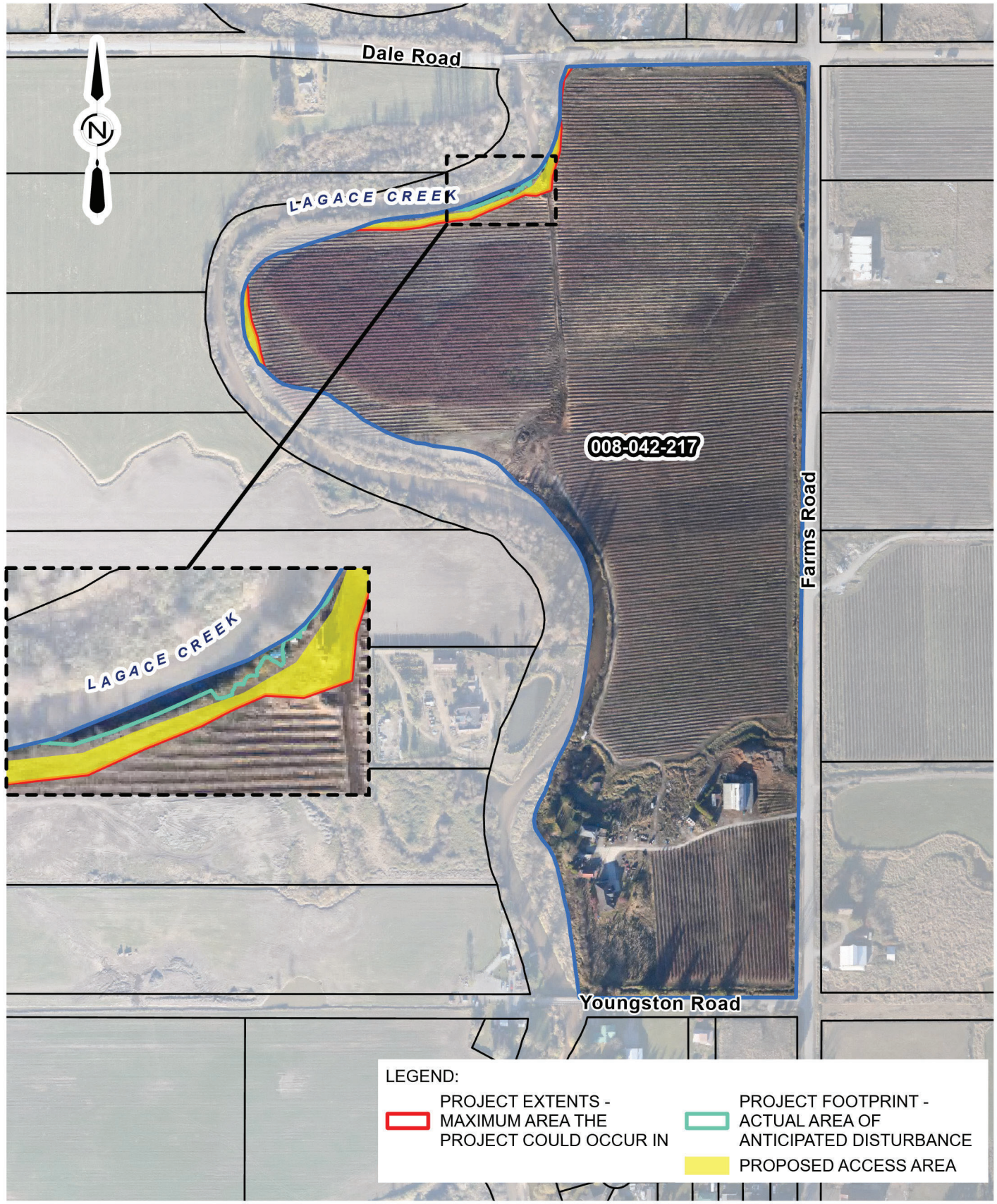
Signature of Owner(s):

Name of Owner(s): Baljit Kaur Jhulley

Signature of Owner(s):

IF NOT 25 mm ADJUST SCALES
25 mm

SCALE(S) SHOWN ARE INTENDED FOR LETTER (8.5x11) SIZE DRAWINGS UNLESS NOTED OTHERWISE



PLOT DATE: 2024-04-17 12:00 PM
SAVE DATE: 2024-04-17 12:00 PM SAVED BY:
DWG PATH: D:\PROGRAM_WORK\AcWork\2022-2632 - HATZIC EMERGENCY WORKS\2022-2632 - Hatzic AcPro\2022-2632 - Hatzic Emergency Works\2022-2632 - Hatzic Emergency Works_old.aprx

Associated Engineering

BEST MANAGED COMPANIES CANADA
Platinum member

AE PROJECT No.	2022-2632-04
SCALE	1:4,500
APPROVED	R. KARSGAARD
DATE	2024APR17
REV	0
DESCRIPTION	ISSUED FOR INFORMATION

APPENDIX A

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

PARCEL NO. 008-042-217

APPENDIX G – FIELD REVIEW REPORTS

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	1
Project:	Legace Creek	**Page:**	1 of 3
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	August 22, 2024
Contract No.:		**Temperature:**	High: 17 Low: 11
Weather:	Overcast		

August 27, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Mel), operator
Keystone Environmental: EM (Kang), (Loc)

Contractor's Equipment:

-Equipment in Use

Excavator

Report, if any, Contact with Occupants:

None Today.

Contact with Owner:

None Today.

Discussions with Keystone Environmental:
8:15AM

- Discussion with Keystone (Kang) – doing bird survey today. Will join us as we walk site to see station locations.

12:00PM

- Discussion with Keystone (Kang and Loc) - Keystone completing sampling of soil and water at sand stations.
- AE (Jordan, Shaemus, Vinizza) – directed them to map coordinates for locates of proposed stations. Told them sampling is up to them and could wait for construction to start if they want to know precise locations of stations.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Discussions with Contractor:

7:45AM

- Discussion with QM (Mel) – AE (Jordan, Shaemus, Vinizza) – Informed we have flagged first 3 sand stations. Will look for others if we have a chance.
- QM – Wants to walk site today to see where stations are located.

Report:

8:45AM

- Site walk with AE (Jordan, Shaemus, Vinizza), QM (Mel, operator), Keystone (Kang, Loc).
- AE showed locations of stations that we flagged.
- AE expressed we flagged first 3 but not the 4th, difficult to get to without equipment, may try again later.
- QM – potential pump under bridge, may release RFI.
- No nests after Keystone bird survey.
- Keystone – said it is okay to lay mats on top of knotweed to prevent contamination spreading when moving around area. Will try to get excavators onto stations without cross knotweed paths.
- QM – Access to station F potentially from other side, will talk to land owner.
- AE to check with Jordon Rozon on if gravel aggregate is required for existing stations or if that is already in place.
- Fish salvage – want to work in dry but might not be feasible. May have to set up metal fencing on each side of excavation extents to prevent fish passing.
- Keystone soil sampling today.

12:00PM

- AE (Jordan, Shaemus, Vinizza) – Flagging sand stations
- Sand stations flagged today: G, H
- Total Flagged: C,D,E,G,H

Testing:

- None today.

Safety Concerns:

- None today.

Traffic Control:

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

- None today.

Photos:



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14&17
Environmental Monitoring Report

Date: August 27, 2024
Weather: Overcast/Rain – 14°C

- Planned work (clearing and grubbing of vegetation) had not started upon arrival.
- The excavator was parked on north side of Dale Road.
- Associated Engineering field staff was conducting surveys to mark soil sampling station locations.
- EMs conducted a bird nest survey prior to clearing activities. Observed species included:
    - Cedar Waxwing (Bombycilla cedrorum)
    - American Robin (Turdus migratorius)
    - European Starling (Sturnus vulgaris)
    - Common Merganser (Mergus merganser)
- Nesting or breeding behaviors were not observed during the survey.
- EMs performed a walkthrough with the operator and site superintendent to inform them about Japanese knotweed locations and potential impacts if spread.
- Recommendations provided as per the CEMP:
    - Avoid grubbing and tracking on knotweed
    - Use geotextile and gravel laid on top of vegetation if access is necessary
- EMs identified sampling stations C, C-2, D, and E with Associated Engineering engineers.
- At 10:30, erosion and sediment control materials were delivered to the site, including geofabric textile, coconut matting, and bulk bags (large woven polypropylene bags used for filling with sand). No installation occurred.
- The geotextile material consists of geogrid and geotextile woven together, providing separation between plant material and gravel, as well as strength and durability for excavator tracking.
- EMs conducted soil and sediment sampling at stations C, C-2, D, and E based on provided coordinates and flagged marking.
- The planned clearing and grubbing work did not take place today as QM Environmental is awaiting confirmation and sign-off on the CEMP.
- QM Environmental personnel left the site at 12 PM.
- Sediment sampling was completed at 13:45. The EMs departed shortly after.

Site Photos






August 27, 2024 1:36 p.m.


August 27, 2024 1:42 p.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	2
Project:	Legace Creek	**Page:**	1 of -
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	August 22, 2024
Contract No.:		**Temperature:**	High: 21 Low: 12
Weather:	Sunny		

August 28, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Mel), operator, Mark, Operations manager (Tyler)
Keystone Environmental: EM (Loc)

Contractor's Equipment:

-Equipment in Use

Excavator

Report, if any, Contact with Occupants:

12:30PM

- Discussion with property owner (Doug) -informed us of water well with line in front of proposed sand station B-2.
- AE (Jordan, Vinizza) flagged station slightly south for purpose of soil sampling.

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

10:45AM

- Discussion with Keystone (Loc) – AE has flagged existing sand stations. Will flagged proposed this afternoon.

Discussions with Contractor:

10:30AM

- Discussion with QM (Mel, Mark, operations manager) –
- AE (Jordan, Vinizza) will flag remaining sand station locations. Including proposed locations.
- QM wants to start filling sandbags with material in old laydown area (near station E). AE (Jordan, Vinizza) to confirm with Ryan if this is ok before any excavation begins.
- QM asked if they need to provide lock blocks for proposed sand stations.
- QM asked how Leq'á: mel should be engaged for this project – Jordan informed they or Keystone are likely needed to contact - Jordan to confirm with Ryan.

12:00PM

- Discussion with QM (Mel, Operations manager) –
- AE (Jordan, Vinizza) informed QM no excavation is to begin until all contract documents are in place. Informed we don't even have the entire package so its difficult for us to answer questions.
- AE (Jordan, Vinizza) – informed all questions should be going to Allison at AE for the time being.

3:15PM

- Discussion with QM (Tyler) – AE (Allison) gave go ahead to start excavating sand from area behind station E, will receive written approval soon.
- CEMP received some edits and changes, should be reviewed and sent back out by tomorrow morning.
- Disussion with QM (Mark) – Loc showed areas to excavate material, will inspect and take samples during process.
- Mark to release RFI relating to lock blocks for proposed stations. Not sure where to supply from or what type. AE (Jordan) Instructed to refer to drawing details and specifications package which he has not yet received the completed version due to the project not executing yet.
- Filling bags for water diversion, will start at station D and work up along river.

4:30PM

- Discussion with Tyler – is there an excavation limit for depth? Don't want to excavate too deep.
- AE (Jordan) said he would look into.

Report:

7:45AM

- AE (Jordan, Vinizza) on site.

9:15AM

- AE (Jordan, Vinizza) – finish flagging existing sand stations.

1:30PM

- SCR 17 site walk with QM (Mel, Operations manager) and Keystone (Loc)

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

- AE (Jordan, Vinizza) showed project location.
- Keystone (Loc) took soil and water samples at locations.
- QM – will likely be doing survey for quantities. Surveying stockpile.

3:00PM
- QM began filling metre sand bags from area behind station E. Site 14.

5:00PM
- QM leaving site.
- AE (Jordan, Vinizza) Drone Flight

5:15PM
- AE (Jordan, Vinizza) leaving site.

Testing:
- Keystone collecting soil and water samples today at existing and proposed sand stations.

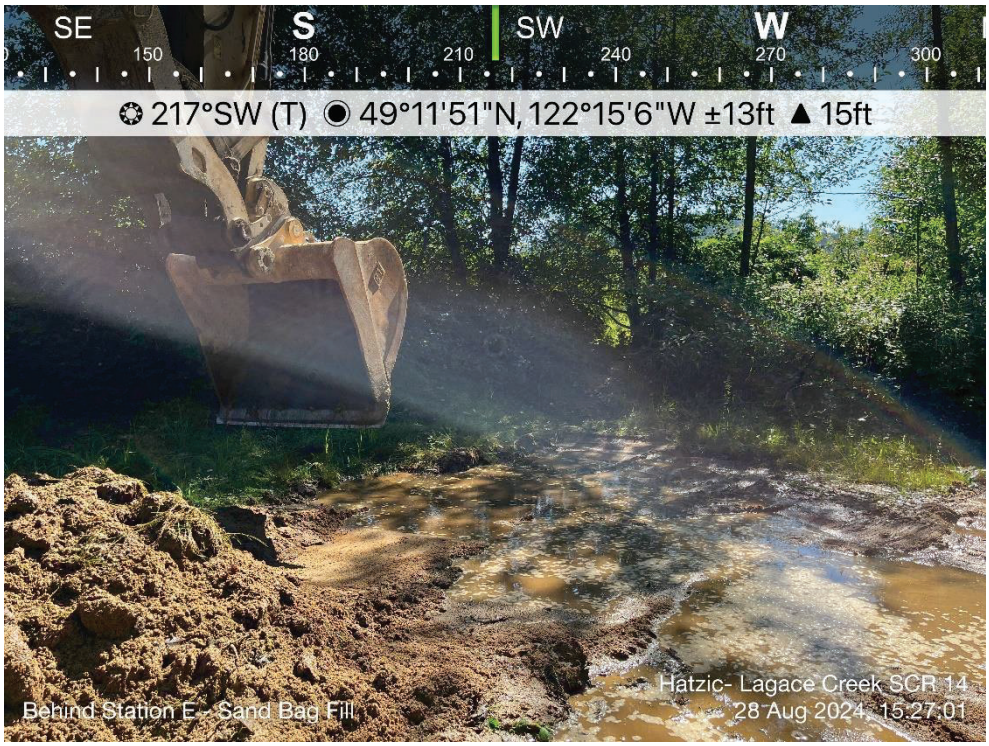
Safety Concerns:
- None today.

Traffic Control:
- None today.

Photos:

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	2
Project:	Legace Creek	**Page:**	1 of 11
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	August 28, 2024
Contract No.:		**Temperature:**	High: 21 Low: 8
Weather:	Sunny, Wind 5 KM/H, Gusts 10 KM/H		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

QM:

QM: Operation Project Manager (Tyler), Site Superintendent (Mel), Mark, 1 Operator (Glenn)
Keystone Environmental: Loc

Contractor's Equipment: - Equipment in use

- Excavator

Report, if any, Contact with Occupants:

None Today.

Contact with Owner:

None Today.

Discussions with Keystone:

8:05 am

- Conversation with Loc (Keystone)
  - He inquired whether we had located all the existing sand recovery stations, as he will be conducting soil sampling today. AE responded that, in the first section from C to F, station F is still difficult to locate due

to vegetation, and in the second section from G to L, only stations G and H were found yesterday. AE Jordan and Vinizza plan to search for the remaining stations today.

Discussions with Contractor:

8: 10 am

- Conversation with Mel & Mark (QM)
  - Mel suggested that if there's an easier way to proceed, AE should just mark the locations as long as they are aligned with the linear layout. This is because they urgently need to send the samples to the laboratory to obtain analytical data for disposal. The main tasks are to mark the sand recovery stations and site 17. They cannot proceed with the work until they receive approval, which they expect to obtain today.

10:40 am

- Conversation with Contractor and Their Queries;
  - Mel requested AE to flag all remaining stations so that Keystone can complete the soil sampling.
  - Mel noted finding lock blocks on the existing stations and inquired if lock blocks are also present on the new stations. He mentioned that the drawings show lock blocks but there are no details on whether they will be supplied by them.
  - Mel asked whether, while waiting for CEMP approval, they are allowed to fill meter bags from the access road (near station E).
  - They were informed that Lequamel First Nation will have periodic site visits, but they do not have a contact number for them.
  - AE responded to confirm with Ryan all the queries.

1:30 pm

- Conversation with Mel (QM):
  - Mel inquired about the volume of material to be excavated on the site 17.
  - AE responded that, according to the drawings, approximately 50 cubic meters are indicated for the southern section (1st section) and 250 cubic meters for the northern section (2nd section).

3:10 pm

- Conversation with Tyler & Mark
  - Tyler & Mark mentioned that they can now proceed filling the meter bags now with some conditions after their meeting with AE.
  - Mark mentioned that CEMP has some amendments and Keystone manager will visit the site tomorrow.
  - Mark mentioned that he will send RFI tomorrow about the proposed lock block.

3:30 pm

- Conversation with Tyler
  - He mentioned to fill 8-10 of meter bags.
  - They will start at station D.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Report:

8:00 am
- AE (Jordan and Vinizza) on site.

8:25 am
- AE (Jordan and Vinizza) - Started locating the sand recovery stations in the area from station I to L.

9:10 am
- AE (Jordan and Vinizza) - Completed locating and flagging the sand recovery stations in the area from station I to L. Please note that the exact locations are approximate due to vegetation and were based on Google Maps using the coordinates provided in the drawings.

9:30 am
- AE (Jordan and Vinizza) - Started locating the sand recovery station F.

10:20 am
- AE (Jordan and Vinizza) - Completed locating and flagging the sand recovery station F. Please note that the exact locations are approximate due to vegetation and were based on Google Maps using the coordinates provided in the drawings.

10:55 am
- Keystone conducted soil sampling at Station L.

11:55 am
- Meeting with Ryan
    - AE discussed the contractor's queries, including their plan to obtain sandbags from the pit/access road near station E.
    - Ryan mentioned that the contractor would address their queries directly with Alison.

12:40 pm
- AE (Jordan and Vinizza) - Located and flagged stations B2 and B3.
- Keystone conducted soil sampling at stations B, B2 and B3.

1:20 pm
- AE (Jordan and Vinizza) on site 17.

1:25 pm
- Walk site through with (AE, QM and Keystone).
- Keystone conducted soil sampling in two sections of Site 17.

1:55 pm
- AE (Jordan and Vinizza) left site 17.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

3:10 pm

- AE (Jordan and Vinizza) on site 14.

3:30 pm

- Starting scraping the soil pavement near Station E.

4:45 pm

- Qm crew filled 17-meter bags near Station E.

4:55 pm

- Preparing to fly the drone in the area.

5:30 pm

- AE (Jordan and Vinizza) left site.

Testing:

- Keystone is collecting soil samples for all the sand recovery stations (both existing and proposed) and for the two sections on Site 17.

Safety Concerns:

- None today.

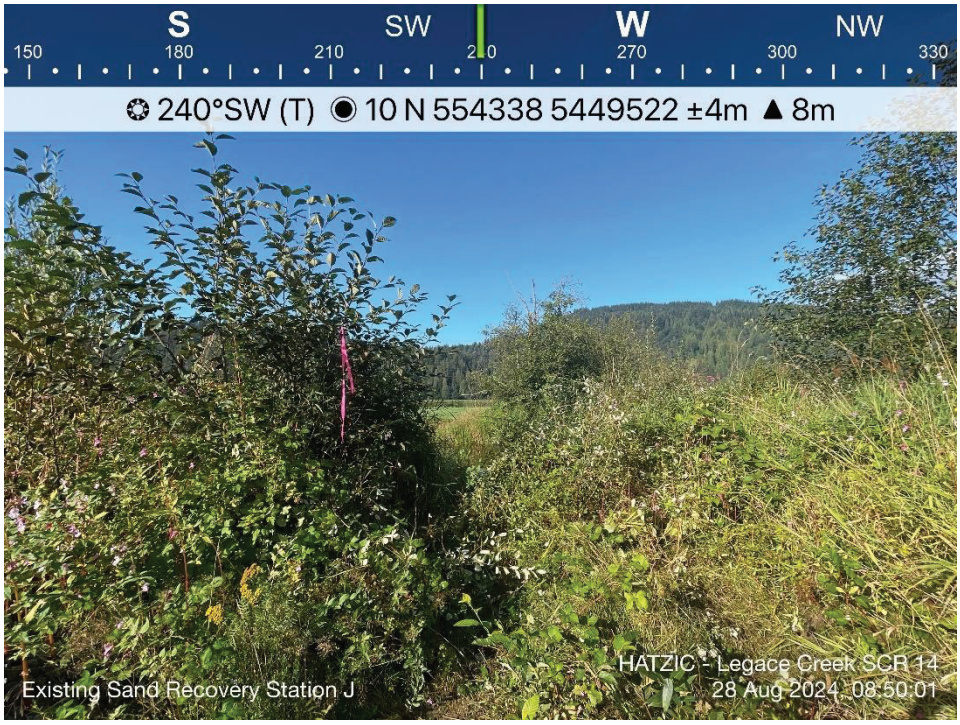
Traffic Control:

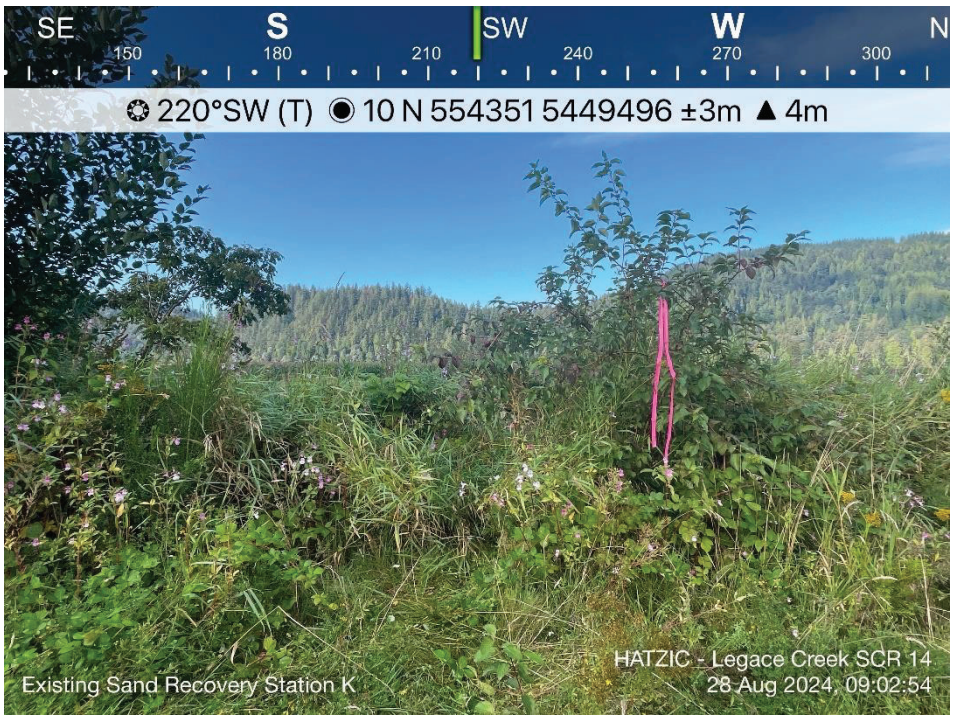
- None today.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

Photos:





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

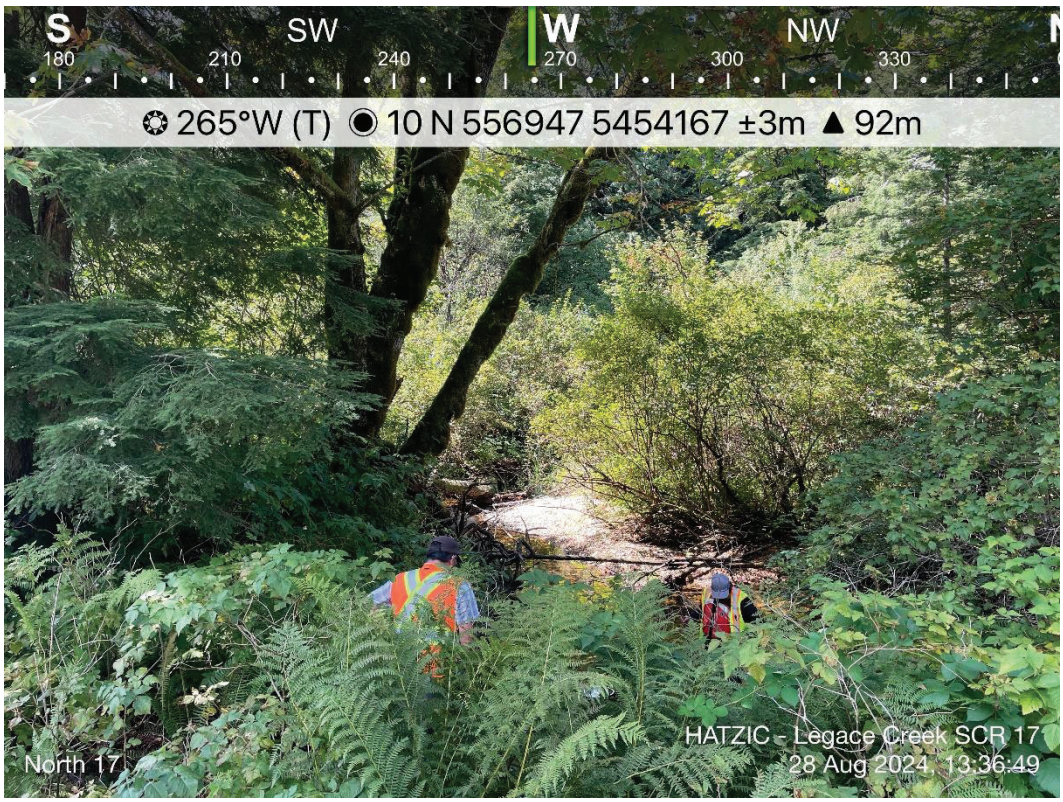




(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14&17
Environmental Monitoring Report

Date: August 28, 2024
Weather: Sun and Clear – 11oC in the morning and average of 20 oC from 12:00-17:00.

- Environmental Monitors (EMs) arrived on site at 7:07 AM.
- Planned work (clearing and grubbing of vegetation) had not started upon arrival.
- Associated Engineering field staff conducted surveys to mark soil sampling station for the remaining locations.
- At 08:52, EM started conducting soil sampling for all remaining stations including Station B, B2, B3, CR17-N, CR17-S, F, G, H, I, J, K and L.
- During the soil sampling work, bird calls and visual observation of birds included:
    - Cedar Waxwing (Bombycilla cedrorum)
    - American Robin (Turdus migratorius)
    - European Starling (Sturnus vulgaris)
    - Great Blue Heron sp. (Ardea herodias)
    - Common Yellowthroat (Geothlypis trichas)
- Nesting or breeding behaviors were not observed.
- EM performed a walkthrough with the operator and site superintendent to inform them about Japanese knotweed locations and potential impacts if spread in proximity to upcoming active work area.
- Recommendations provided as per the CEMP:
    - Avoid grubbing and tracking on knotweed
    - Use geotextile and gravel laid on top of vegetation if access is necessary
- EM completed all sediment samplings at 13:46.
- At 15:00, the crew received verbal confirmation the CEMP had been approved and will be sent out shortly. They wanted to use the backfilled materials (local sediment) in proximity to Station E to fill in the sandbags and communicated that to the EM.
- At 15:15, EM performed a sweep of the area to ensure no amphibians and/or invasive species such as knotweed were present. Amphibian and knotweed were not observed. Work commenced shortly after.
- Grubbing work did not occur and will be started on August 29, 2024.
- EM departed at 16:17 to deliver sediment samples to the lab in Burnaby.

Site Photos




ALS Environmental



Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	3
Project:	Legace Creek	**Page:**	1 of -
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	August 29, 2024
Contract No.:		**Temperature:**	High: 26 Low: 10
Weather:	Sunny		

August 29, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Mel), Operations manager (Tyler), operator, 3 labourers
Keystone Environmental: EM (Loc), 2 supervisors

Contractor's Equipment:

-Equipment in Use

Excavator 324E

Report, if any, Contact with Occupants:

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

11:00AM

- Discussion with Keystone (Loc) – Per CEMP, silt fence and poly is required at each existing SRS for erosion/sediment control and slope stability.
- Concern with knotweed extents at proposed SRS locations, will have to excavated this material potentially for SRS installation. Is going to check with supervisor.

3:45PM

- Discussion with Keystone (Loc) – Fish permit should now be in place. Waiting for amphibian permit before excavation is allowed.
- Soil tests allow work in creek to begin, but no hauling off site.

Discussions with Contractor:

7:00AM

- Toolbox talk QM (Mel) – Arborist on site today taking down trees in front of Doug's property, parallel to Dale road.
- Starting to grub areas for excavator access to SRS (C,D,E,F)
- Lane closure on Dale road for tree cutting.
- QM (Tyler) – wants to get a density gauge out here to determine volumes from hauling trucks.

8:00AM

- Discusison with QM (Mel) – Wanted to know if AE is going to confirm extent of trees being cut to access proposed SRS outside of Doug's property. AE (Jordan) confirmed what needs to be cleared is up to QM, clear what is needed for access and construction of proposed SRS.

9:30AM

- Discussion with QM (Mel) – SRS D has around a 20ft sediment and vegetation build up in front of the SRS. Wondering how to access creek with excavator, won't be able to reach very far. AE (Jordan) to confirm with Ryan.
- Mel wants to confirm extent lengths of excavation limits. AE (Jordan) directed to drawings showing volume and depth limits. Jordan to confirm how to determine excavation limits with Ryan.

10:00AM

- Discussion with QM (Mel), Keystone (Loc) and AE (Jordan, Vinizza, Dave)
- Knotweed branches and leaves stored in laydown on poly, will be transferred to disposal facility, QM still to confirm which facility it is going to.
- Excavator refuel will be done on road, 30m from waterbody.
- Keystone (Loc) – Fish salvage permit still waiting on, should have Thursday.
- Also, waiting on test results from creek sediment and water.
- No birds nests were spotted in area.

12:30PM

- Discussion with QM (Mel) – Around 5.4m of sediment and vegetation on station D between creek and lock blocks, concern excavator arm won't extend over built up sediment. Wants to use swamp mats to drive out over lock blocks.
- AE (Jordan) – Informed QM to submit this as an RFI to our team to address how to access creek.

3:30PM

- Discussion with QM (Tyler) – Just got off call with AE (Ryan and Andrew)

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

- Wants to fill sand bags to get things ready for when fish permit is approved.
- Plan to dewater is to not completely isolate creek, but to place sand bags and fence around excavation area.
- Wants to soil density tests for volume calculations. AE (Ryan) wants this done after dewatering at each SRS location.
- Try to do the soil density testing in the dry, hoping excavator can squeeze out a lot of that moisture.

4:15PM

- Discusison with QM (Mel and Tyler) – AE (Jordan) informed group of excavation extents. Explaining the limits depend on where the fish salvage is conducted. The excavator can reach as far across/left/right as the salvage/dewatering allows it, as long as we are still aiming for volumes specified on drawings, and depths specified on drawings. Field fit project, so it what SRS location allows for excavating extents.

Report:

8:00AM

- QM Clearing access to SRS E.
- Arborist setting up for tree cutting in front of Doug's property.
- Keystone checking knotweed extents near SRS D.

9:00AM

- Arborist removing trees outside of Doug's property.

9:30AM

- Station C cleared.

9:45AM

- AE Enviro (Dave) on site.

11:00AM

- Installing silt fence and poly on SRS C, E, F

3:30PM

- Filling sand bags at SRS E laydown.

4:00PM

- Laying out potential place for silt fence and sand bags for water diversion tomorrow at SRS E.

4:30PM

- Cleaning and leaving site.

5:00PM

- AE (Jordan, Vinizza) measure C and G: including areas C and G beyond lock blocks.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

- SRS C: 4x12m
- SRS D: 15x5m
- SRS E: 7x9m
- Access to station F: 40x5m
- Station F: 11x8m

5:15PM

- AE (Jordan, Vinizza) – drone flight.

Testing:

- None today.

Safety Concerns:

- None today.

Traffic Control:

- Single Lane closure on Dale road.

Photos:

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	3
Project:	Legace Creek	**Page:**	1 of 9
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	August 29, 2024
Contract No.:		**Temperature:**	High: 26 Low: 10
Weather:	Sunny, Wind 4 KM/H, Gusts 6 KM/H		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

QM:

QM: Operation Project Manager (Tyler), Site Superintendent (Mel), Operator (Glenn), 3 laborers
Keystone Environmental: EM (Loc), 2 Supervisors

Contractor's Equipment: - Equipment in use

- Excavator 324E

Report, if any, Contact with Occupants: ss

None Today.

Contact with Owner:

None Today.

Discussions with Keystone:

Discussions with Contractor:

7:00 am

- Mel mentioned that the arborist will cut trees for the project access road outside of Doug's property at Dale Road. Additionally, the station from C to F will be cleared to locate the existing sand recovery station.
- Tyler mentioned that a density test should be conducted to determine the volume of material hauled by the trucks.

9:20 am

- Conversation with Mel
    - He requested the guidelines for the boundary to be excavated along the creek
    - Soil sample results will be available on Tuesday.

10:00 am

- Conversation with QM (Mel), Keystone (Loc), AE (Dave, Jordan, Vinizza).
    - Dave discussed the proper disposal of the knotweed. QM will identify the appropriate disposal facility.
    - Loc mentioned that they are waiting for the fish salvage permit, which may be issued by Thursday evening.
    - Loc also mentioned that soil sampling results will be available on Tuesday. They collected 35 soil samples yesterday.
    - Dave and Loc emphasized that when refueling equipment, it should be done on the road, at least 30 meters from the creek.
    - Loc noted that there are no bird nests in the area.

Report:

7:00 am

- AE (Jordan and Vinizza) on site.

7:05 am

- Sign In. Toolbox Meeting
- Green Valley Traffic Control on site.

8:00 am

- QM has started clearing Station E.

8:10 am

- Keystone has started checking the knotweed in preparation for its removal

8:20 am

- The arborist is preparing to cut trees outside Doug's property along Dale Road, near the bridge.
- Traffic control has already been set up along Dale Road, with two crew members acting as flagmen.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

8:25 am
- AE Jordan and Vinizza left site.

9:15 am
- AE Jordan and Vinizza on site.
- Ongoing tree cutting outside Doug's property along Dale Road, near the bridge.

9:20 am
- Clearing of Station C is complete.

9:30 am
- QM has started clearing Station D.
- At Station D, the ongoing tasks include trimming the knotweed plants and laying them out on the mat.

9:35 am
- AE Environmental Dan arrived on site.

9:45 am
- Done clearing Station E.

11:10 am
- At Station C, a polyethylene mat and silt fence have been installed.

11:40 am
- At Stations E and F, the installation of polyethylene mats and silt fences is ongoing.

12:30 pm
- AE Jordan & Vinizza measured the distance from the lock block to the creek at station D - 5.4 meters.

5:00 pm
- AE Jordan and Vinizza measured the cleared area at Station C (4m x 12m) and the access road width at Station F (4.10m).

5:15 pm
- AE (Jordan and Vinizza) conducted a drone flight in the area.

5:30 pm

- AE (Jordan and Vinizza) left site.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

Testing:

- None today.

Safety Concerns:

- None today.

Traffic Control:

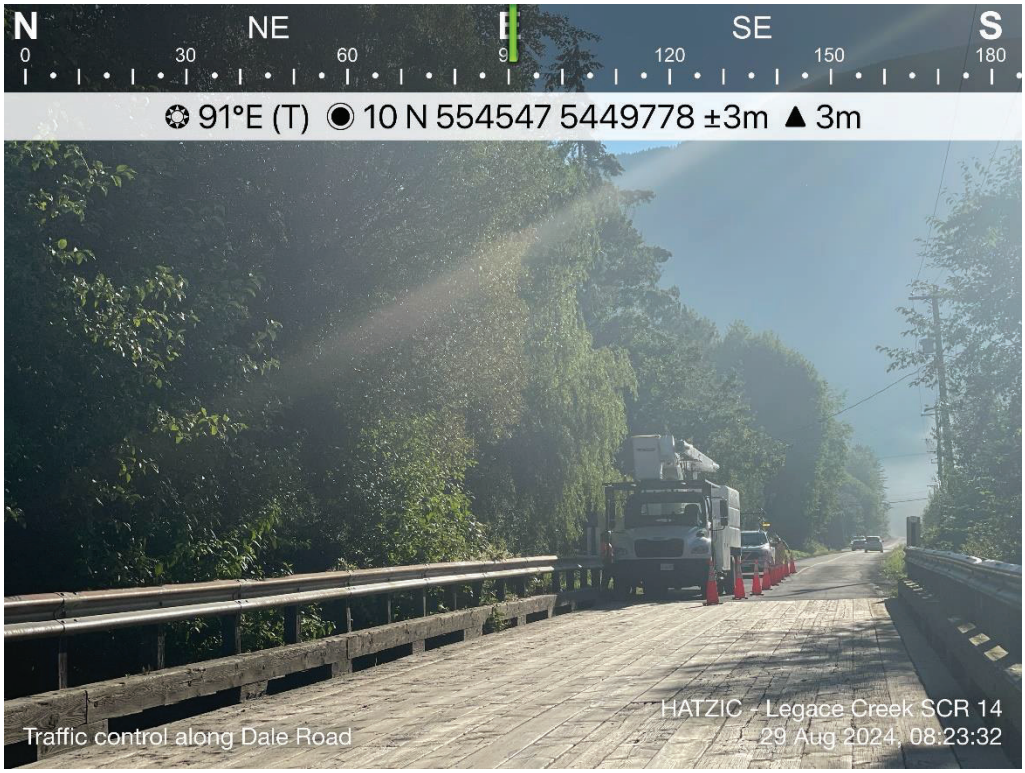
- None today.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

Photos:

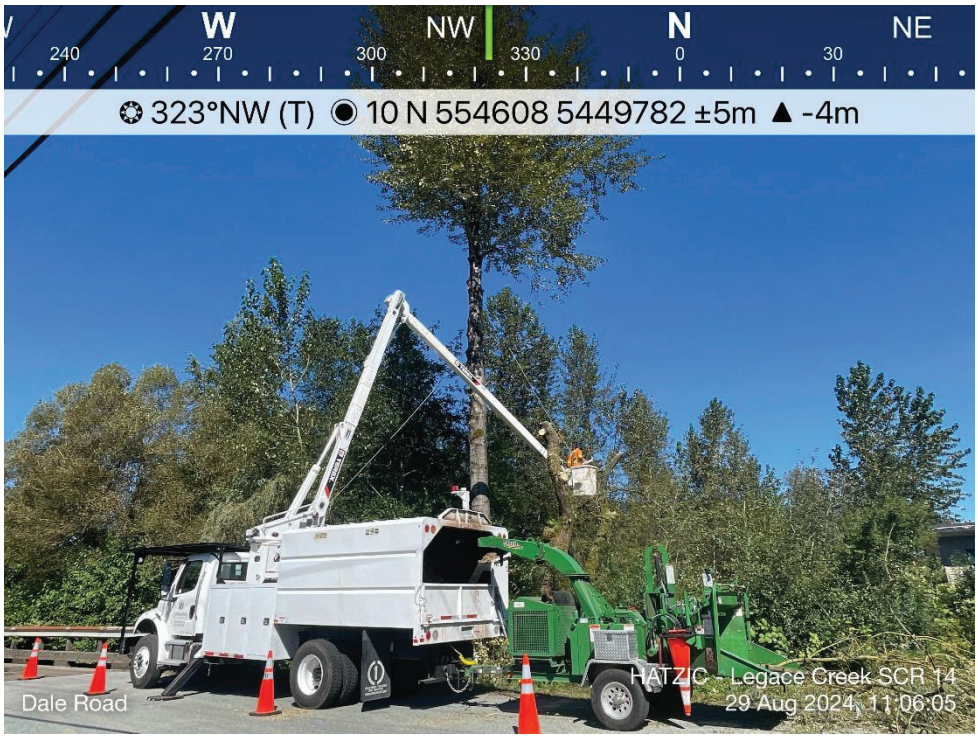




(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

TECHNICAL MEMORANDUM

Issue Date:	August 30, 2024	**File:**	Audit No. 1
To:	**Thyren Jacobs, Flood Debris Management Secretariat**	**Previous Issue Date:**	
From:	Dave Muhlert, R.B.Tech. and Naomi Sands, R.P.Bio.		
Client:	Ministry of Environment and Climate Change Strategy		
Project Name:	Lagace Creek Bank Protection and Sediment Removal - SCR14	**Project No.:**	2022-2632-03
Subject:	Environmental Compliance Audit		
Monitoring Period:	August 27 to 29, 2024		
Contractor:	QM Environmental		
Environmental Monitor:	Keystone Environmental		

1 INTRODUCTION

Associated Environmental Consultants Inc, (Associated) is pleased to provide this environmental audit report summarizing observations of site conditions, environmental protection measures, regulatory compliance, and corrective actions as part of erosion protection works on Lagace Creek, south of Durieu, BC in the Hatzic Valley (the Project, the Site) during the monitoring period August 27 to 29, 2024. The results presented in this audit report are based on conditions observed at the time of the audit inspection(s) and represent a snapshot of the workday. Items identified as non-compliant may have been addressed before the report(s) are submitted. The audit report(s) are submitted to the owner, their agent (Associated Engineering), the Contractor, and their environmental monitor (EM) and are not intended for further distribution.

2 ROLES AND RESPONSIBILITIES

The prime contractor for the Project is QM Environmental. (the Contractor), and works are being monitored for environmental compliance by Keystone Environmental (Keystone) and audited by Associated. As the EM, Keystone is to work with the Contractor to develop measures to protect the environment and to respond to environmental incidents as they occur. Keystone is also responsible for fish and wildlife salvages prior to instream works. Leq'á:mel First Nation (LFN) is the cultural monitor for the Site. The responsibility of the auditor is to ensure on behalf of the owner, who is ultimately the permit holder, that the EM, LFN, and the Contractor adhere to the requirements of the Construction Environmental Monitoring Plan (CEMP)[1], environmental permit conditions and any applicable regulations.

3 SITE INSPECTION

A summary of site conditions as observed during the audit inspection completed during the monitoring period is provided in Table 3-1. At the time of this report, Associated has received monitoring reports covering activities on site August 27 and August 28.

[1] AquaTerra Environmental Ltd. 2024. Hatzic Emergency Program, South Herford Creek Project, Construction Environmental Management Plan (Rev. 1). Prepared for Mission Contractors Ltd. 65 p.

Table 3-1 Site Conditions During Audit Inspection

Date / Time	Auditor (Associated)	Weather	Construction Activities
August 29, 2024 09:30	Dave Muhlert	Sunny. 18°C. No precipitation.[2]	Crew was clearing vegetation and access paths for sand recovery stations C, D, E, and F (south of Dale Road). An arborist was on site limbing/falling trees at station B-3 (north side of Dale Road). Instream works had not yet started at the time of the audit.

4 INSPECTION RESULTS

A checklist of required environmental protection measures and mitigative strategies for the Project is presented in Table 4-1. The checklist has been developed in accordance with terms and conditions of the environmental permits and approvals issued for the Project, environmental protection specifications and requirements as part of the construction contract for the Project, the Contractor's Construction Environmental Management Plan and environmental best management practices and guidelines.

[2] Environment Canada. 2024. Abbotsford Airport Hourly Data Report for August 29, 2024. Available at: https://climate.weather.gc.ca/historical_data/search_historic_data_e.html. Accessed August 30, 2024.

Table 4-1 Summary of Environmental Protection Measures Reviewed and Results of the Inspection

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
	Environmental Monitoring					
1	The EM will attend key site meetings where environmental mitigations and issues may be discussed.	☒Compliant ☐Non-Compliant ☐N/A	EM has been on site daily to attend site meetings.		CEMP Section 2.4	
2	The EM shall supervise all instream works. If temporary diversion installed, EM is onsite daily to check pumps and flow bypasses.	☐Compliant ☐Non-Compliant ☒N/A	No instream works had started yet during the audit.		WSA (h)2.ii, (j)5.i CEMP Section 2.4	
3	The EM will submit daily and bi-weekly monitoring reports to the Contractor for distribution to MoECCS.	☒Compliant ☐Non-Compliant ☐N/A	Associated received August 27 and 28 monitoring reports on August 29.	Submit monitoring reports daily.	CEMP Section 5.1	
4	The EM will complete and submit an Environmental Incident Report (EIR) for non-compliances with the CEMP, reportable spills or other environmental incident.	☐Compliant ☐Non-Compliant ☒N/A	No environmental incidents have been reported to date.		CEMP Section 4	
5	EM is granted authority to stop the work if necessary	☒Compliant ☐Non-Compliant ☐N/A	No work stoppages have been reported to date.		WSA (i) 7 CEMP Section 2.4	
	Erosion and Sediment Control					
6	Appropriate site isolation is installed as required, including silt fencing prior to instream works. Silt fences are installed properly, intact, adequate, clear of accumulated sediment and are functioning.	☒Compliant ☐Non-Compliant ☐N/A	Contractor and EM were installing silt fencing at station C during the audit.		WSA (o), (q) CEMP Section 3.5	Photo 1
7	Riprap or any other engineering material place in channel is clean of any substances deleterious to aquatic life.	☐Compliant ☐Non-Compliant ☒N/A	No riprap or other material was being placed during the audit.		WSA (x) CEMP Section 3.5	
8	Stockpiling and storage areas are located 15 m from the watercourse TOB.	☒Compliant ☐Non-Compliant ☐N/A	No soil stockpiling occurring at the time of the audit. Site laydown is located at station C-2, more than 15 m from the watercourse.		DFO FAA WSA (t) CEMP Section 3.5	
9	Emergency ESC material onsite (e.g., 100 feet of silt fencing, 5 dry bales, and 100sq.m of ECBs/ Coconut matting, or polyethylene sheets)	☒Compliant ☐Non-Compliant ☐N/A	ESC materials were stockpiled at the site laydown.		CEMP Section 3.5	Photo 2
10	Sediment removed from the Site will be disposed of appropriately at a location approved by the EM and MoECCS.	☐Compliant ☐Non-Compliant ☒N/A	Sediment removal had not yet started at the time of the audit. CEMP does not specify the sediment disposal location(s).	Identify sediment disposal location(s) in the CEMP and/or the environmental monitoring reports.	CEMP Section 5.5	
11	Sediment removal boundaries must be clearly delineated prior to commencement of work.	☐Compliant ☐Non-Compliant ☒N/A	Sediment removal had not yet started at the time of the audit. Contractor reported that removal boundaries would be delineated prior to commencement of work.		WSA (opening)	
	Invasive Plant Management					
12	Ensure that machinery is free of invasive plant material that could	☐Compliant ☒Non-Compliant ☐N/A	Knotweed stem was placed on excavator track during removal operation	Ensure that all knotweed cuttings are confined to poly	WSA (opening) CEMP Section 3.4	Photo 3

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
	potentially be transported throughout or between sites.			sheeting to prevent the spread of plant fragments that could potentially propagate. Clean machinery that has worked in knotweed-infested areas before moving it off site or to "clean" areas within the site.		
13	Ensure that invasive species removed from site are disposed of appropriately at an approved facility	☒Compliant ☐Non-Compliant ☐N/A	Invasive species have not yet been transported for disposal. EM reported that the knotweed disposal site has not yet been determined but will be added to the monitoring reports once identified.		WSA (opening) CEMP Section 3.4.1	
14	The Project site shall be regularly monitored by the EM for invasive plant infestations and these infestations will be mapped and managed according to applicable species-specific BMPs.	☒Compliant ☐Non-Compliant ☐N/A	EM was on site directing knotweed management during the audit.		CEMP Section 3.4.1	
16	Knotweed stems are cut close to the ground and contained on poly sheeting away from the immediate work area. Cut knotweed is covered with woven geotextile fabric and crushed rock prior to machine access. Knotweed stems are injected with an appropriate herbicide before being covered.	☐Compliant ☒Non-Compliant ☐N/A	EM and contractor were on site cutting knotweed and laying out on poly sheets. Some knotweed stems were being piled on top of the large sandbags that will be used in the creek for flow isolations. Herbicide injection was not being done during the audit visit.	Ensure that all knotweed cuttings are confined to poly sheeting, and that stem injections are applied as required	CEMP Section 3.4.1 Addendum 1 to the Contract Documents for the Hatzic Emergency Works Program - Lagace Creek – Sites S-CR-14/17	Photo 4
	Waste Management					
17	Dispose of all anthropogenic debris removed at an appropriate waste management facility.	☒Compliant ☐Non-Compliant ☐N/A	No anthropogenic debris was observed during the audit.		WSA (opening) CEMP Section 5.5	
18	Non-hazardous waste stored appropriately and removed offsite daily.	☒Compliant ☐Non-Compliant ☐N/A	No non-hazardous waste was observed during the audit.		CEMP Section 5.5	
19	Hazardous waste stored > 30 m of watercourses.	☒Compliant ☐Non-Compliant ☐N/A	Portable toilet is located at the site laydown, more than 30 m away from watercourses.		CEMP Section 5.5	
20	Secondary containment used for all stored hazardous waste.	☐Compliant ☒Non-Compliant ☐N/A	Portable toilet was not in secondary containment.	Add secondary containment to portable toilet.	CEMP Section 3.6	
	Spill Control and Emergency Response					
21	Machinery operating in channel is equipped with environmentally friendly oil	☒Compliant ☐Non-Compliant ☐N/A	Excavator on site has a sticker confirming that it contains Environ™ biodegradable, non-toxic hydraulic fluid.		WSA (p) 4 CEMP Section 3.6	Photo 5
22	Equipment and machinery are free of leaks	☒Compliant ☐Non-Compliant ☐N/A	No leaks were observed during the audit. Equipment appeared to be clean.		WSA (p) 1 CEMP Section 3.6	

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
23	Drip trays are available and used during refueling and equipment maintenance	☒Compliant ☐Non-Compliant ☐N/A	Equipment was actively working during the audit. Contractor reported that spill trays are available for parked equipment.		CEMP Section 3.6	
24	Fuel is stored > 30 m from Lagace Creeks and any connected drainages	☒Compliant ☐Non-Compliant ☐N/A	Fuel storage on site was limited to double-walled "tidy tanks" in pickups that were parked more than 30 m away from the creek.		WSA (p) 3 CEMP Section 3.6	Photo 6
25	Machinery and vehicles operating onsite are equipped with spill kit.	☒Compliant ☐Non-Compliant ☐N/A	Conditionally compliant - Excavator on site had spill pads on board. Large spill kit at site laydown was low on materials. Contractor reported that additional spill kit materials had already been ordered.	Ensure that spill kits are fully stocked at all times.	WSA (p) 2 CEMP Section 3.6	
26	Should suspected contaminated material be encountered (i.e., soil emitting olfactory cues indicative of hydrocarbon fuel), works should temporarily halt for investigation.	☐Compliant ☐Non-Compliant ☒N/A	No suspected contaminated material has been reported to date. EM has collected sediment samples from each of the sand recovery stations and submitted to ALS Environmental for chemistry analysis.		CEMP Section 2.5	
27	Refuelling of machinery is conducted on level ground over a spill tray.	☒Compliant ☐Non-Compliant ☐N/A	No refuelling was observed during the audit. Contractor reported that refuelling is done on level ground at Dale Road.		CEMP Section 3.6	
	Riparian Area Management					
28	Stockpile LWD and root wads removed from channel for use in site restoration	☐Compliant ☐Non-Compliant ☒N/A	Instream works had not yet started at the time of the audit, therefore no LWD or root wads have been encountered to date.		CEMP Section 3.3	
29	Construct access points and approaches perpendicular to the watercourse;	☒Compliant ☐Non-Compliant ☐N/A			DFO FAA CEMP Section 3.2	
	Instream Works					
30	The EM shall ensure that instream works are isolated from flow and that measures are in place to protect fish and fish habitat, and to mitigate the migration of sediment downstream.	☐Compliant ☐Non-Compliant ☒N/A	Instream works had not yet started at the time of the audit.		WSA (j) CEMP Section 3.1	
31	Pumps and flow bypasses are in proper working condition	☐Compliant ☐Non-Compliant ☒N/A	No pumps or bypasses were in use during the audit.		WSA (j) 5 CEMP Section 3.1	
32	Instream works conducted in the dry / isolation of flow	☐Compliant ☐Non-Compliant ☒N/A	Instream works had not yet started at the time of the audit		WSA (o) CEMP Section 3.1.1	
	Water Quality					
33	Water quality is routinely monitored upstream and downstream of the work area, every day that instream works are occurring Instream water quality is compliant with provincial criteria[3]: **Turbidity**: - <8 NTU from background at any one time for a	☐Compliant ☐Non-Compliant ☒N/A	Instream works had not yet started at the time of the audit		WSA (s) CEMP Section 3.1.2	

[3] British Columbia Ministry of Environment and Climate Change Strategy. 2024. British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture - Guideline Summary – August 2024. Water Quality Guideline Series, WQG-20. Prov. B.C., Victoria B.C. Available at: https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-guidelines/approved-wqgs/wqg_summary_aquaticlife_wildlife_agri.pdf. Accessed August 2024.

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
	duration of 24 h in clear waters; - < 5 NTU from background when background is 8 – 50 NTU; - <10% from background when background is > 50 NTU. **pH:** 6.5-9.0					
	Fish and Wildlife Protection					
34	Full time monitoring for fish during instream works is occurring.	☐Compliant ☐Non-Compliant ☒N/A	Instream works had not yet started at the time of the audit		WSA (j) 6 CEMP Section 2.4	
35	Fish salvages are conducted in advance of instream works where required.	☐Compliant ☐Non-Compliant ☒N/A	Instream works had not yet started at the time of the audit		CEMP Section 3.1 WSA (j) 6	
36	Salvaged fish are relocated back to the same watercourse in a nearby area that is not impacted by construction or removal works or its zone of influence	☐Compliant ☐Non-Compliant ☒N/A	Instream works had not yet started at the time of the audit		DFO FAA Section 2.2.4	
37	Pump intakes are screened for fish and aquatic species in accordance with the "Interim code of practice: End-of-pipe fish protection screens for small water intakes in freshwater"	☐Compliant ☐Non-Compliant ☒N/A	No pumps were in use during the audit.		WSA (j) 5.ii DFO FAA Section 2.4.9 CEMP Section 3.1.1	
38	Obtain required permits prior to salvage(s).	☒Compliant ☐Non-Compliant ☐N/A	EM reported that they were waiting for permits prior to beginning fish salvage.		WSA (Opening) CEMP Section 3.1	
39	EM is on site during disturbance to riparian vegetation and conducting pre-clearing breeding bird surveys prior to clearing.	☒Compliant ☐Non-Compliant ☐N/A	EM reported that they conducted pre-clearing bird nest surveys.		CEMP Section 3.2	
40	Instream works are conducted so as not to lead to fish stranding or other impacts to fish. The works shall not result in depressions that have the ability to trap fish and other aquatic life. Fish passage is maintained where practicable and in accordance with applicable permits.	☒Compliant ☐Non-Compliant ☐N/A	Instream works have been designed to maintain fish passage after completion. Instream works had not yet started at the time of the audit.		WSA (j) 6 (iii) WSA (u) DFO FAA Section 2.4.2 CEMP Section 3.1.1	
	Restoration Requirements					
41	Restoration plans prepared by EM for disturbed area and implemented with EM oversight	☐Compliant ☐Non-Compliant ☒N/A	Restoration plans have not been prepared yet.		WSA (w) CEMP Section 3	
42	All temporary works shall be removed on completion of the project, and the stream channel restored to its natural condition	☐Compliant ☐Non-Compliant ☒N/A	Work is still in progress.		WSA (v) CEMP Section 3	

5 DISCUSSION

5.1 Non-Compliant Items

Knotweed management

Section 3.4.1 of the CEMP requires that knotweed stems are cut close to the ground and placed on poly sheeting away from the immediate work area to prevent spreading plant fragments that could propagate and create new infestations. During the audit, some cut pieces of knotweed were observed on top of the large sandbags that will be used in the creek for flow isolations, and on the tracks of the excavator. In addition, Addendum 1 to the Contract Documents for the Hatzic Emergency Works Program - Lagace Creek – SITES S-CR-14/17 requires that trimmed knotweed stems are injected with an appropriate herbicide.

Recommended action: Ensure that all knotweed cuttings are confined to poly sheeting and stem injection of herbicide is completed as appropriate. Treat cut stems with an appropriate herbicide as per best practices and manufacturer's instructions.

Portable toilet without secondary containment

A portable toilet located at the site laydown adjacent to Dale Road did not have secondary containment. Although the toilet was more than 30 m away from the watercourse, secondary containment would prevent any potential spills from spreading beyond the immediate area.

Recommended action: Add secondary containment to portable toilet.

5.2 Conditionally Compliant Items

Environmental monitoring reports not received daily

The CEMP requires that monitoring reports are produced daily by the EM. At the time of this memo, Associated has received monitoring reports for works on August 27 and 28, but these were both received on August 29.

Recommended action: Submit environmental monitoring reports daily.

Inadequate spill kit materials

A large spill kit was available at the site laydown but was not fully stocked with spill cleanup materials. The Contractor reported that additional materials had already been ordered.

Recommended action: Keep spill kits fully stocked at all times.

6 SUMMARY

A list of environmental issues outstanding to date is provided in Table 6-1, below.

Table 6-1 Tracking Table of Environmental Issues Outstanding to-Date (project commencement August 12, 2024)

Item #(s)	Issue	Date(s) Observed	Recommended Corrective Action(s)	Responsible Party
1	Environmental monitoring reports not received daily	August 29, 2024	Submit environmental monitoring reports daily.	EM
2	Knotweed material outside poly sheet containment, no herbicide treatment	August 29, 2024	Ensure that all knotweed cuttings are confined to poly sheeting. Apply herbicide to remaining stems, as appropriate.	Contractor/EM
3	Portable toilet without secondary containment	August 29, 2024	Add secondary containment to portable toilet.	Contractor

Note: Items marked with an asterisk (*) were reported by the EM.

7 CLOSURE

We trust that the information in this memo is sufficient for your present needs. Should you have questions, please do not hesitate to contact the undersigned.

Prepared by:

for

Dave Muhlert, R.B.Tech.
Environmental Technologist

DM/NS

Reviewed by:

Naomi Sands, R.P.Bio.
Senior Environmental Scientist

Attachments:
- Site Photographs

Attachment 1: Site photographs taken during audit visit on August 30, 2024.

Photo 1: Contractor installing silt fencing / site isolation 		**Photo 2: Erosion and sediment control materials stockpiled at the site laydown** 
Photo 3: Knotweed stem on excavator track 		**Photo 4: Knotweed stems on sandbags that will be used instream for site isolation** 
Photo 5: Sticker on excavator showing that it uses environmentally friendly hydraulic oil 		**Photo 6: Fuel in double-walled tank in pickup** 

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14&17
Environmental Monitoring Report

Date: August 29, 2024
Weather: Sun and Clear – 11°C in the morning and average of 26 °C from 11:00-17:00.

- Environmental Monitors (EMs) arrived on site at 7:00 AM.
- EM discussed with the crew to ensure spill trays will be placed under parked heavy machines to prevent potential spill.
- EM discussed with the crew on managing the invasive species at station D.
- Recommendations provided as per the CEMP:
    - Avoid grubbing and tracking on knotweed if possible. If deemed necessary, cut the stems near the ground, and place it on top of poly tarp and dispose at the designated facility.
    - Use geotextile and gravel (or local sediments) laid on top of vegetation and avoid disturb the ground with the machine's track.
- Bird sweep was completed on Tuesday, August 27 and was still valid until Friday, August 30. In addition, EM conducted quick bird sweep and did not observe any activities.
- Planned work (clearing and grubbing of vegetation) started at 08:00. Tree cutting on adjacent property also started at the same time.
- Grubbing work for stations C and E were completed at 09:20. Knotweed was not observed within the grubbed area.
- Grubbing work at station D at 09:30, where knotweeds were found, was supervised by the EM. Knotweeds were removed using hedge trimmer and the invasive plants were contained in the poly sheeting. The area where machine will anchor will be covered with geotextiles and local sediments.
- Grubbing work at station F commenced at ~10:30 and completed shortly after. Knotweeds were not observed near the grubbed area.
- EM discussed with the crew on installing Erosion Sediment Control (ESC) measures such as silt fencing and poly sheeting where exposed area and slopes were present to protect Lagace Creek from potential sediment runoff from Site.
- Grubbing work and ESC installations completed at 14:02. Completed stations included F, E, C and D.
- During today's EM work, bird calls and visual observation included:
    - Cedar Waxwing (*Bombycilla cedrorum*)
    - American Robin (*Turdus migratorius*)
    - Great Blue Heron sp. (*Ardea herodias*)

Site Photos






324E

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	4
Project:	Legace Creek	**Page:**	1 of 6
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	August 30, 2024
Contract No.:		**Temperature:**	High: 27 Low: 12
Weather:	Sunny		

August 30, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Mel), Operations manager (Tyler), 2 operator, 2 labourers
Keystone Environmental: EM (Loc) (Kang)

Contractor's Equipment:

-Equipment in Use

- CAT Excavator 324E
- Zaxis Excavator EX0689
- Deer Loader 1466

Report, if any, Contact with Occupants:

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

8:00AM

- AE (Jordan) discussion with Keystone (Kang, Loc) – AE informed the addendum in the contract documents states the trimmed knotweed should be injected with herbicide. Noted this does not line up with what is in the CEMP.
- Keystone (Kang) said he will follow up with his supervisor.
- AE (Jordan) to share document with Kang and highlight section this is mentioned.

12:35PM

- Keystone (Kang) – talked to supervisor says herbicide into knotweed after it is trimmed and that close to creek is not best practice.
- AE (Jordan) to provide addendum 1 to Keystone so they can see question being referred to.
- Kang to discuss with supervisor.

2:00PM

- Discussion with Keystone (Kang, Loc) – AE (Jordan) provided addendum to Keystone.
- Kang forward to supervisor to discuss.

Discussions with Contractor:

7:00AM

- Toolbox talk QM (Mel, Tyler)
- Continue clearing at Stations G,H,I,J,K,L today
- Start moving sandbags into creek for dewatering, going to experiment how to make it work.
- AE (Jordan) informed QM (Mel, Tyler) – Leq'a: mel needs to be contacted prior to doing any work in the creek per the contract agreements.
- QM (Tyler) – Informed AE Mert was working on getting into contact with them earlier this week.

9:20AM

- After discussion with Leqa': mel on site SCR 15/16, AE (Jordan, Vinizza) followed up with QM (Mel) and Keystone (Kang) about getting into contact with Leqa': mel.
- AE stressed it is urgent as you are already doing in-stream work, Leqa': mel should be made aware of project as they are supposed to be on site for in-stream works.
- Keystone (Kang) followed up Leq'a: mel and left a message with Tina after this discussion.

9:30AM

- Discussion with QM (Tyler) – Silt fence and sand bags aren't working due to high velocities at areas where creek is constricted. QM is ordering reinforced silt fences and is continuing to place more sand bags in the water.

10:15AM

- Discussion with QM (operator) and Keystone (Loc) – concern with knotweed at SRS H, close to lock blocks.
- AE (Jordan) informed QM and Keystone the excavator must sit within the existing lock blocks.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

- Keystone – knotweed can remain if operator will be able to keep his machine out of it. If it is an issue the knotweed will need to be trimmed and covered with a geotextile. EM to closely monitor this site during excavation.

12:35PM
- Discussion with QM (Mel) – aggregate in lay down is for temporary access into Doug's property.
- Material excavated from creek will be stockpiled next to SRS, dried for however long is adequate to AE and hauled from there.

2:40PM
- Discussion with QM (Mel) – potential waterline that runs parallel through Dale road and into Doug's property.
- Mel says he had a line locator here, wasn't able to pick up waterline due to wet conditions.
- Not currently a concern, not digging into Doug's property. Tomorrow just planning to remove some vegetation on surface for install of temporary road.

3:45PM
- Discussion with QM (Mel) and David Wood – David was expressing he knows the property owners in area, gave Mel his contact because a lot of property owners want the material. Mel confirmed he will reach out and make sure proper documents are in place prior to hauling off site.

4:15PM
- Discussion with QM (Mel and Jim) – discussing how to track quantities of hauled material. Tyler wanted to use density gauge, but he has now left site and not sure if others know where to get one.
- AE (Jordan) suggested Mel get a surveyor prior to excavating to get a topo of the existing ground and compare that to a stockpile survey while material dries.
- AE (Jordan) also will be counting buckets and trucks during hauling.

Report:

7:40AM
- Setting up sand in creek at SRS E.
- Starting in-stream work. Keystone not present during the start of this operation.

9:00
- AE (Jordan, Vinizza) on site at SCR 15/16, discussion with Tina (Leq'a: mel)
- Tina stated she has not been contacted by any project in area of SCR 14/17. AE (Jordan) to follow up with QM on site 14/17.

9:45AM
- Arborists on site to clear trees in front of Doug's property.

10:00AM
- QM beginning to clear SRS G through L, starting at G.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

10:30AM

- Continuing to fill and place sandbags in creek.

11:40AM

- Aggregate load delivery.

12:20PM

- Leqa': mel (Tina) on site.
- Keystone (Kang) showing her through site. Tina observing plan and creek construction.
- No concerns from Leqa': mel at this time. QM to keep Tina in loop and provide construction schedule to her.
- Plan for Keystone to start fish salvage tonight when water diversion is ready.
- Electro fish tomorrow before excavation.

1:00PM

- AE (Jordan, Vinizza) measure cleared SRS today.
- G: 4x11m
- H: 6x8m
- I: 5x9m
- J: 5x11m
- K: 4x11m
- L: 1x9m

3:15PM

- Finishing up sandbag placement, starting fish salvage.

4:30PM

- Cleaning and leaving site.

Testing:

- None today.

Safety Concerns:

- None today.

Traffic Control:

- Single Lane closure on Dale road for arborists.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Photos:





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14&17
Environmental Monitoring Report

Date: August 30, 2024
Weather: Sun and Clear – 13°C in the morning and average of 28 °C throughout the day.

- Environmental Monitors (EMs) arrived on site at 7:20 AM.
- EMs conducted bird nest survey for stations L,K,J,I,H and G at 07:37. Bird nest or nesting activity was not observed at all stations.
- Bird calls and visual observation included:
    - Cedar Waxwing (*Bombycilla cedrorum*)
    - American Robin (*Turdus migratorius*)
    - Swaison's Thrush (*Catharus ustulatus)*
- 08:07 - EMs collected background (BG) Water Quality (WQ) prior to instream work.
    - 08:09 - BG at the bridge = 0.02 NTU
- 08:15 – Instream work commenced, and sandbags were used to isolate work area at Station E.
- 09:03 – WQ reading at Station F (Downstream from Station E) = 5.72 NTU.
- 09:45 – Grubbing work on the south side commenced under Keystone's EM supervision for invasive species.
- 10:30 – Leqamel First Nation was notified via phone by the EMs. Instream work stopped and sandbags were filled.
- 11:17 – Grubbing and prep work on the farm side for stations L,K,J,I,H and G was completed.
- ~11:30 – Leqamel's Guardian visited the Site. EMs and Site superintendent were attended and walked her through today's Site activities.
- 11:30 – Arborist cutting down the cotton wood tree in the adjacent property.
- 14:55 – Swift water and fast flow of redirected water was observed by EMs. Potential bank erosion issue was noticed and communicated to the Site Superintendent. Simple solution such as installing road plate along the south bank to mitigate erosion was also communicate to the crew.
- 15:20 – EMs conducted pole seining to clear all potential fishes within isolated area. Electrofishing was conducted shortly after.
- 16:37 – 521 second of electrofishing effort was completed. EMs did not capture any, but visual observation of fishes was noticed. 6 minnow traps were used to salvage the remaining fishes in the area.
- 17:43 – EM left site. End of workday.

Site Photos









Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	5
Project:	Legace Creek	**Page:**	1 of 5
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	August 22, 2024
Contract No.:		**Temperature:**	High: 29 Low: 12
Weather:	Sunny		

August 31, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Mel), 2 operator, 2 labourers
Keystone Environmental: EM (Loc) (Kang)

Contractor's Equipment:

-Equipment in Use

- CAT Excavator 324E
- Zaxis Excavator EX0689
- Deer Loader 1466

Report, if any, Contact with Occupants:

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

1:30PM

- Discussion with Keystone (Loc) – Turbidity after sandbag fell into creek was not ideal, went away quickly due to low flow. Still forced excavation to stop.

Discussions with Contractor:

7:00AM

- Toolbox talk (Mel) – Finish fish salvage today at SRS E.
- Start pump and excavate at E.
- Jim (QM) – wants to work 7 days a week Jordan (AE) – informed this is likely acceptable, confirm this with AE team.

11:15AM

- Discussion with QM (Mel, Jim) – Concern with volume they will be able to achieve from the stations.
- AE (Jordan) expressed it is a field fit project, what they can excavate is what they can excavate, but that is the quantity they will be getting paid for.
- Using the largest excavator arm they have.

2:00PM

- AE (Jordan) – discussing with QM (Mel, Jim) heat map excavation depths specified in drawings. Colour coordination is not station specific, depths are specified in colours on map.

2:30PM

- Discussion with QM (Mel) – no road plates planning to be used at C. Water is very low, placing bags today likely to start excavation tomorrow.
- Mel is going to worry about the take off for SRS E when it is time to haul.

4:40PM

- AE (Jordan) expressed concern to QM (Mel, Jim) regarding material from the sandbags in the water washing into the creek. Some of the flow passing over the submerged sand bags can see taking some material out of the sand bag.
- QM (Mel) wants to fill remaining sand bags with excavated material from site E.
- AE (Jordan) – expressed this will make tracking quantities very difficult, idea is to mark the bags with sand from SRS E with a ribbon.
- QM (Mel, Jim) – lost 4 sand bags (metre bags) in SRS E excavation. Will need to monitor this if any debris is going back into the water.
- AE (Jordan) – explained station C and C-2 share the same quantity on the drawings.

Report:

7:00AM

- AE (Jordan, Vinizza) on site.

8:00AM

- Excavating at SRS E.
- Fairly wet still – contractor doesn't think can get area any drier.
- AE watching for depths don't exceed specified on drawings.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

- Concern from AE (Jordan) on getting quantities for this location. Sand was excavated from the creek and placed in the lay down, no survey prior.
- Sand was spread around lay down after excavation.
- Having issues getting entire volume to do limited excavation arm.

11:00AM
- Flattening surface in lay down.
- Knotweed wrapped in poly sitting in water in area. AE (Jordan) pointed this out to EM (Loc).

11:30AM
- Sandbag in water diversion falls into excavation.
- EM stops excavation.
- Vinizza taking measurements after excavation – about 200m^3, estimated with tape measure.

1:00PM
- Removing sand bags from SRS E.

2:50PM
- Temporary access to Doug's property built.

3:50PM
- AE (Jordan) observation – sand bags losing some sediment into the creek due to flow passing over them.

Testing:
- None today.

Safety Concerns:
- None today.

Traffic Control:
- Single Lane closure on Dale road.

(If necessary, continue report on another sheet.)

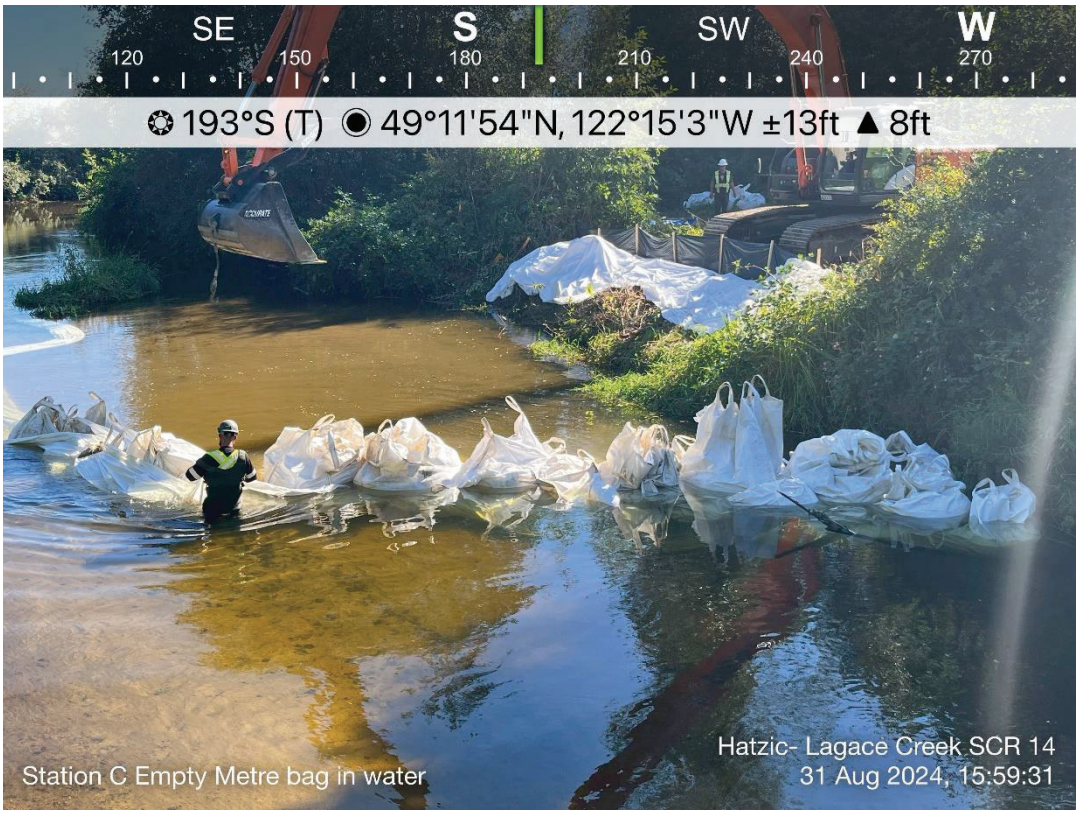
ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	5
Project:	Legace Creek	**Page:**	1 of 7
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	August 31, 2024
Contract No.:		**Temperature:**	High: 30 Low: 13
Weather:	Sunny, Wind 3 KM/H, Gusts 6 KM/H		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

QM:

QM: Site Superintendent (Mel), Operator (Glenn), 4 laborers
Keystone Environmental: EM (Loc & Khang)

Contractor's Equipment: - Equipment in use

- Excavator 324E
- Excavator EXO689
- Loader 1466

Report, if any, Contact with Occupants: ss

None Today.

Contact with Owner:

None Today.

Discussions with Keystone:

3:30 PM

- Conversation with Keystone: AE Vinizza inquired about the consequences of a sandbag fall-off or spill into the creek. Loc responded that it would be acceptable as long as the sand in the sandbags is from the creek.

4:10 PM

- Conversation with Keystone: AE Vinizza asked if fish salvage would occur today. Khang replied that it would not, as there was no isolated area available, station C is still on progress.

Discussions with Contractor:

7:05 AM

- Conversation with QM: Mel discussed the day's tasks, including fish salvage, pumping, and excavating the creeks.
- Jem mentioned that the contract prohibits work on Sundays and Mondays (Holiday). AE Jordan responded that he would contact Ryan for clarification.
- Jordan later confirmed that Ryan said it's okay to change in the work schedule, though a Request for Information (RFI) would be submitted.

4:15 PM

- Conversation with QM: Mel discussed the work plan for tomorrow, which includes filling sandbags with sediments excavated from the creek. AE emphasized the need to track and monitor this process closely to ensure that sediments do not fall back into the creek.

Report:

6:55 AM

- AE (Jordan and Vinizza) arrived on site.

7:00 AM

- Sign-in. Toolbox meeting with QM (Mel), Glenn (Excavator Operator), 1 Operator, and 3 Laborers.

7:20 AM

- AE (Jordan and Vinizza) left the site.

8:40 AM

- AE (Jordan and Vinizza) returned to the site.
- Keystone (Khang and Loc) on site already.
- Ongoing activities: Excavating and pumping the creek at Station E.

8:55 AM

- QM was dumping sediments in the vacant area near Station E. Fish were being caught with the sediments, and Keystone was present to collect them.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

9:05 AM
- Water continued to leak around the sandbags on the west side of the creek, causing some sandbags to fall or not be properly closed. QM worked on repairing the sandbags and silt fence.

9:17 AM
- Excavation of sediments continued at Station E.

10:40 AM
- While dumping sediments, clay soil was excavated on the west side of the creek near the sandbag position at Station E. QM halted excavation in that section.
- Water was still seeping around sandbags on the east side of the creek.

10:50 AM
- Approximately 200 m^3 (estimated) of sediments had been excavated.
- The south side of the creek was at an approximate depth of 2 meters, according to the scope of the excavator (as a reference length).

11:15 AM
- QM resumed excavation at Station E.

11:30 AM
- QM began spreading the sediment stockpile within the designated area.
- Knotweed, trimmed on August 29, 2024, for disposal, was found on the west side of the stockpile area.

12:25 PM
- QM removed sandbags from the creek at Station E to the dumping area (stockpile area).

12:35 PM
- QM transported sandbags to Station C.

12:45 PM
- At Station C (access road), 5 sandbags were hauled.

1:30 PM
- QM took a break.

2:14 PM
- At Station C (access road), 22 sandbags were hauled.
- Ongoing removal of sandbags from the creek at Station E.

2:40 PM
- QM completed the removal of all sandbags from the creek.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

2:45 PM
- QM began transferring sandbags to Station C.

2:55 PM
- Culvert and gravel were laid on the temporary access road outside Doug's property.
- Road plate (4 ft x 8 ft) was on site.

3:00 PM
- At Station C, QM began hauling sandbags back to the creek.

4:07 PM
- Excavator 324 E was mobilized to Station E.

4:40 PM
- QM crew left the site.

4:50 PM
- AE (Jordan and Vinizza) left the site.

Testing:
- Keystone conducted turbidity test.

Safety Concerns:
- None today.

Traffic Control:
- Two flagmen were present on site at Dale Bridge.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

Photos:





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos





Temporary access road outside Dough's property.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14&17
Environmental Monitoring Report

Date: August 31, 2024
Weather: Sunny and Clear, temperatures ranging from 13°C in the morning to an average of 28°C throughout the day.

- Environmental Monitors (EMs) Khang Diep and Loc Ngo (KD & LN) arrived on site at 7:20 AM.
- 07:30 - EMs retrieved minnow traps set the previous night and conducted background water quality tests.
- 08:00 - Fish caught were assessed and released. Results as follows:
    - Chinook salmon (*Oncorhynchus tshawytscha*): 1
    - Prickly sculpin (*Cottus asper*): 6
    - Signal crayfish (*Pacifastacus leniusculus*): 1
    - Three-spined stickleback (*Gasterosteus aculeatus*): 2
- 08:11 - 3-inch pump was set up for dewatering. Spill tray was observed underneath. The intake was field-fitted with a minnow trap to meet DFO end-of-pipe specifications. Discharge was placed in vegetated area for infiltration, flow naturally returned to the stream.
- 08:15 - Sediment removal work at Station E commenced. Long reach excavator removed sediment and side-cast in vicinity. Silt fence at downstream functioned as intended. Turbidity issue was localized/contained within isolated area.
- Turbidity test was taken 25 m downstream of isolated area, no exceedance or elevated levels observed.
- Water quality was sampled every hour during instream work or when instream work begins. Water quality data were summarized in table below.
- Silt fencing deficiencies occurred due to back-water pressure created by the bucket.
- One EM situated downstream to monitor turbidity and fish within work zone. The other EM salvaged fish from side-cast stockpile. Fish observed were salvaged. Results:
    - Pacific lamprey (*Entosphenus tridentatus*): 4
- 11:00 - Work stopped to assess quantity of removed material.
- 11:30 - Work resumed.
- 11:47 - Started grubbing and prep work for culvert installation on Dale Road. Ditch currently dry, roadbase was used to create access to property where Stations A and B are located.
- 11:51 - Station E - Sandbags failed and collapsed into excavation pit, creating a breach that flushed turbid water downstream, pushing silt fencing downstream. Turbidity downstream elevated to 31.5 NTU. The issue was communicated immediately to the Superintendent and work was stopped promptly to assess the situation. EMs recommended allowing turbid water to settle, then slowly removing isolation at downstream end to allow clean water to settle turbidity.
- Mitigation strategy: Maintain at least 1 m buffer zone between excavation and sandbags. Use silt curtain to contain turbidity.
- 12:19 - Started removing isolation downstream.
- 12:40 - Turbidity downstream returned to within guidelines. No impact observed during sandbag removal work.
- 14:00 - Sandbags removed from the stream.
- 14:00 - 15:00 - QM had project meeting.
- 15:05 - Sandbags relocated from Station E to C to prepare for isolation work at C.

- 16:45 - Work completed for the day. Sandbag isolation halfway done, contractor to resume work the following day. Fish salvage not conducted due to site not being isolated.
- 17:15 - EMs departed from site.

Location	Time	Turbidity (NTU)	Status
Background (bridge)	7:39	3.50	Compliant
25 DS from E	8:33	1.99	Compliant
	9:00	5.93	Compliant
	10:04	3.57	Compliant
	10:57	9.08	Compliant
Background (bridge)	11:37	4.28	Compliant
~30 m DS from E	11:54	**31.5**	Non-compliant
	12:40	4.13	Compliant
Background (bridge)	15:12	4.05	Compliant
Station D	15:23	5.29	Compliant
Station D	16:21	4.86	Compliant

Table 1. Water Quality Data

Site Photos






August 31, 2024 11:51 a.m.




August 31, 2024 4:37 p.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	6
Project:	Legace Creek	**Page:**	1 of 6
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 1, 2024
Contract No.:		**Temperature:**	High: 29 Low: 12
Weather:	Sunny		

September 1, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Mel), 2 operator, 2 labourers
Keystone Environmental: EM (Loc) (Kang)

Contractor's Equipment:

-Equipment in Use

- CAT Excavator 324E
- Zaxis Excavator EX0689
- Deer Loader 1466

Report, if any, Contact with Occupants:

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

12:15PM

- Discussion with Keystone (Loc) – turbidity is getting higher D/S from excavation, Loc expressed concern to QM and said if numbers get to high he will shut down the operation.
- Keystone catching fish in top of stockpile during excavation.

Discussions with Contractor:

7:00AM

- Toolbox talk (Mel) – Excavating at SRS C today.
- AE (Jordan, Vinizza) – informed QM (Jim) to remove the vegetated island in the middle of the creek on the edge of the excavation arm limit.

10:15AM

- AE (Jordan) directing QM (Mel) to proposed SRS drawing. Mel unsure how to construct SRS C-2 due to large vegetaion in front of area. AE (Jordan) referred him to slope and elevation above bottom of creek, give him idea where the station should end up.

10:45AM

- Discussion with QM (Jim) – Wants to excavate in the wet today, is not going to pump. OK with this if keystones EM are.
- Jim stated the EM's told him because they are out of the fish window it is ok, they will be monitoring turbidity D/S.

11:00

- AE (Jordan) discussion with QM operator – Make sure not to go past the 2.7m excavation limit shown on drawings. Difficult to tell how deep he is because they didn't dewater.
- Bucket about 6.5 ft.
- AE (Jordan) and QM (Jim, operator) – measured bucket height with tape, considering about 2ft water depth, made a reference point on excavator arm not to excavate deeper than to stay above that maximum depth.

11:15AM

- Discussion with QM (Jim) – AE (Jordan) expressed concern there is no tracking to determine if we are going to hit the volume goal for SRS C. Material is being excavated and immediately hauled to laydown at SRS E.
- Jordan asked Jim to survey O.G. for areas they are going to excavate and place, and then survey the stockpile after.
- Jim – maybe Tuesday they will have surveyor out.

11:30

- AE (Jordan) discussion with QM (Mel, Jim) – Jordan expressed concern with mixing quantities from different stations, we still want to get close to the volumes at each station specified on the drawings. Not going to be able to track this for SRS E and C other than with photos.
- Mel looking at big picture quantity, aiming to get 8000m3 total out of project. Going to aim for depths at each station and excavate as much as we can without bringing up clay or peat.
- Jordan to monitor stock piles closely to ensure now clay is being included.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

1:00PM

- Discussion with QM (Mel) – operation getting close to bank slope. Want to keep 1.5m depth near excavation. Operator made aware.

Report:

9:10AM

- Sand bags placed in water

10:00AM

- Keystone electro fishing

10:15AM

- Filling sand bags with excavated material from SRS E.
- Vinizza tracking quantities of sand bags filled.
- At end of day 55 total metre bags full with excavated material. % full of bags recorded by Vinizza.
- Each bag about 1 excavator bucket.

11:30AM

- Moving excavated sediment from SRS C to SRS E lay down. Quantities excavated from both SRS are now mixed, some quantities are in sand bags. Unsure how we are going to keep track/hit the volumes at each station.

12:40PM

- Clay in excavation being taken out.

1:10PM

- Excavation complete, got most of material from dammed off section, slope got slightly steep in front of SRS.

3:00PM

- Filling sand bags with excavation from SRS C. Vinizza keeping track off filled sand bags.
- AE flagged metre bags filled with excavated material with ribbons. All 55 bags have ribbons.
- Total sand bags with excavated material from both SRS E and C = 55 bags.
- Hauling bags to SRS L.

Testing:

- None today.

Safety Concerns:

- None today.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Traffic Control:

- None today.

Photos:



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	6
Project:	Legace Creek	**Page:**	1 of 7
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 1, 2024
Contract No.:		**Temperature:**	High: 29 Low: 14
Weather:	Sunny, Wind 3 KM/H, Gusts 6 KM/H		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

QM:

QM: Site Superintendent (Mel & Jem), Operator (Glenn & Sandy), 2 laborers (Dallas and Patrick)
Keystone Environmental: EM (Loc & Khang)

Contractor's Equipment: - Equipment in use

- Excavator 324E
- Excavator EXO689
- Loader 1466

Report, if any, Contact with Occupants: ss

None Today.

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Contact with Owner:

None Today.

Discussions with Keystone:

9: 55 AM

- Khang mentioned they need second pass at Station C.

Discussions with Contractor:

7:00 AM
- Mel outlined today's tasks: continue moving sandbags to the creek, conduct fish salvage, pump water out of the creek, and begin excavation.
- Mel also mentioned a cable connected to the well of Dough's house.

10:15 AM
- Jem stated they would start working on another section of the creek from Station L and haul sandbags while awaiting the RFI for Station D & Station F.

Report:

6:50 AM
- AE (Jordan & Vinizza) arrived on site.

7:00 AM
- Toolbox meeting with Mel, Jem, Sandy, and Dallas.

7:15 AM
- QM mobilizing loader equipment to Station E.
- Dallas began preparing the polyethylene sheet at Station C.

7:25 AM
- Keystone (Loc & Khang) arrived on site.

7:30 AM
- At Station C:
  - Dallas started setting up the polyethylene sheet in the creek.
  - Sandbags were being moved to the creek.
- At Station E:
  - Equipment and materials were being prepared and set up for filling sandbags.

7:40 AM
- At Station E, began filling up the sandbags.

8:00 AM
- Backhoe operator (Glenn) disposed of the previous sandbag (approximately 10% full) from August 28 into the excavated material dump area.

9:10 AM

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

- Completed filling and hauling sandbags from Station E to Station C (beside the access road). A total of 33 bags were filled and moved: 6 bags were piled on the access road, and 27 bags were placed in the creek.
- Finished setting up sandbags, the polyethylene sheet, and the silt fence at Station C.

9:20 AM
- Keystone (Loc & Khang) began electrofishing at Station C.

9:30 AM
- At Station E, stockpiling of excavated materials commenced.

9:55 AM
- Keystone (Loc & Khang) completed the first pass of electrofishing at Station C.

10:00 AM
- At Station E, began filling up small sandbags. 2 bags were filled.

10:25 AM
- At Station E, began filling another set of sandbags and placing them along the road from Station E to Station D.

11:14 AM
- At Station E, completed filling 22 sandbags.

1:10 PM
- Ongoing hauling of excavated material from Station C to the Station E piling/dumping area.

2:00 PM
- QM took a break.

2:10 PM
- QM returned to work.

2:40 PM
- At Station C, began moving sandbags from the creek to thes access road beside Station C.

3:45 PM
- While removing sandbags from the creek, it was noted that bags were not being segregated (old vs. new), making it difficult to identify them as some bags were unmarked.

4:15 PM
- Identified and flagged 23 sandbags (filled earlier in the day from the excavated area) with pink ribbons at Station C based on their bag's texture.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

4:30 PM

- At Station L, flagged 10 sandbags (filled earlier in the day from the excavated area).
- In total, 55 sandbags were filled today.

4:45 PM

- QM crew left the site.

5:00S PM

- AE left the site.

Testing:

- Keystone conducted turbidity test.

Safety Concerns:

- Needs traffic control along the Dale Road especially near the bridge when the loader going back & forth in hauling the sandbags.

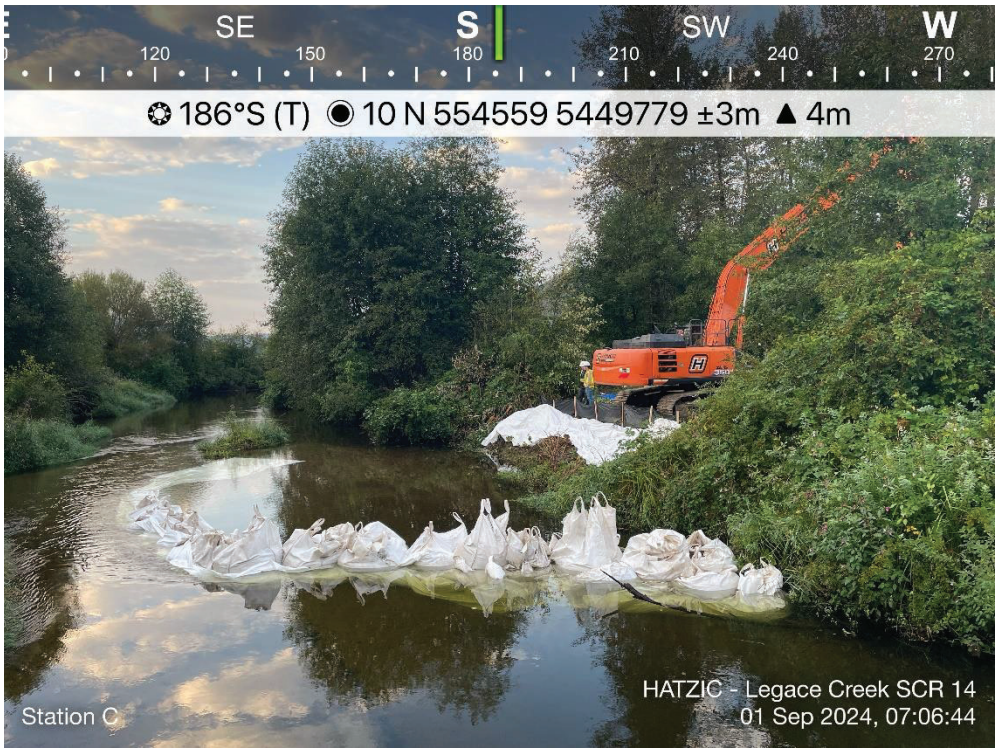
Traffic Control:

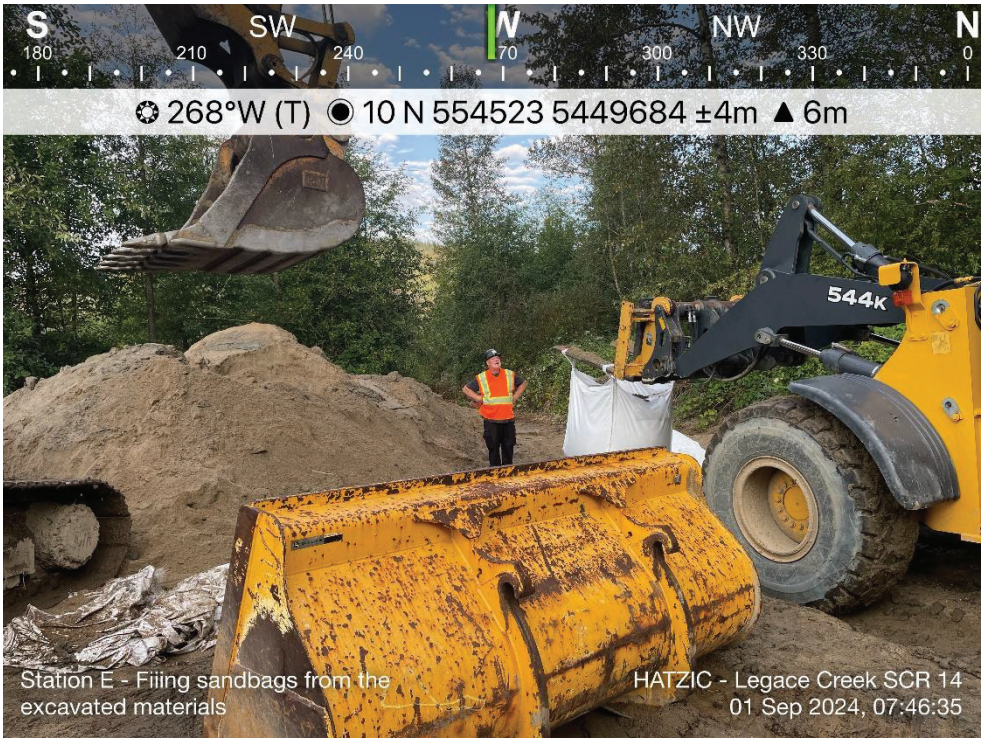
- None today.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

Photos:





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

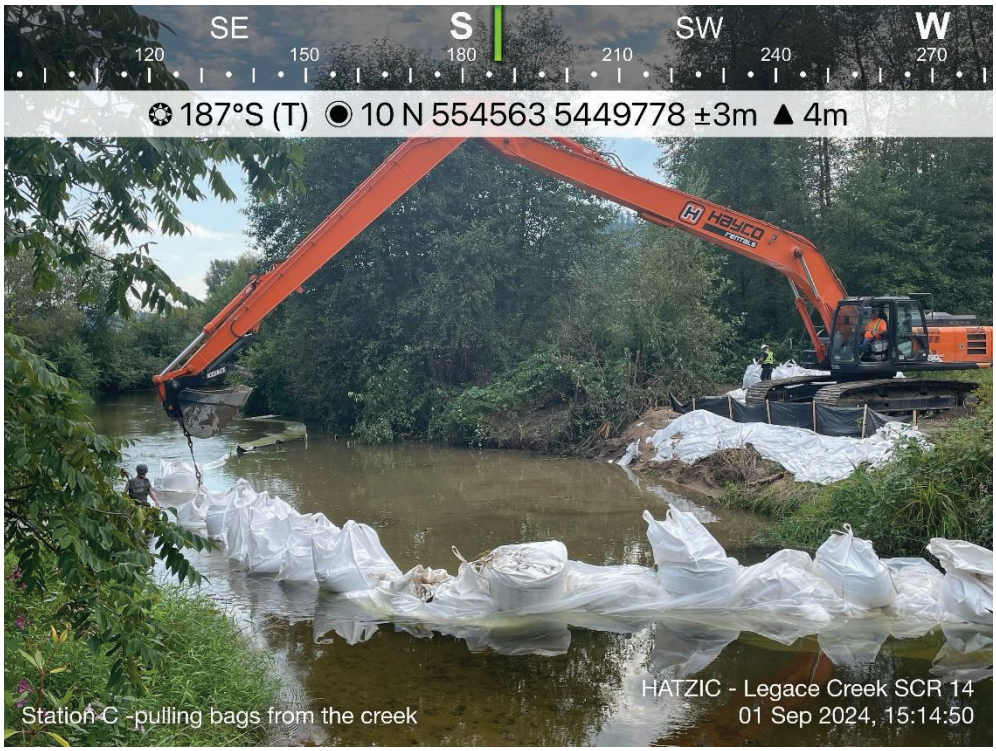


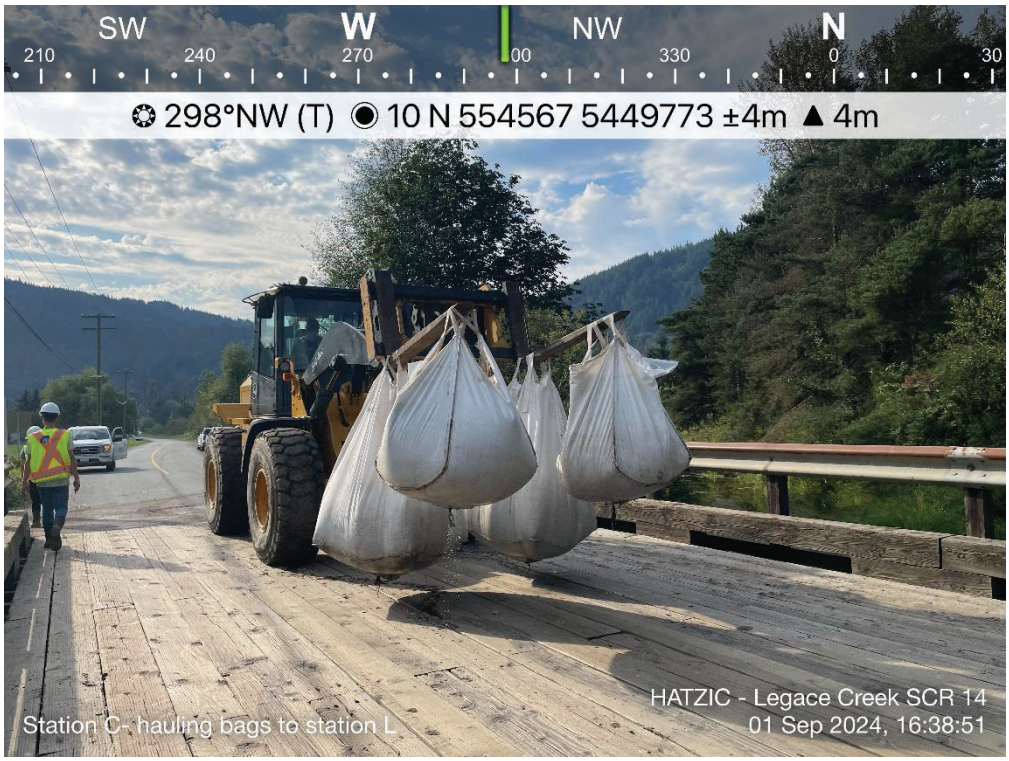
Keystone – ongoing electrofishing at Station C



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14&17
Environmental Monitoring Report

Date: September 1, 2024
Weather: Temperatures ranging from 15°C in the morning to a high of 29°C throughout the day.

- Environmental Monitors (EMs) arrived on site at 7:20 AM.
- 07:30 - EMs collected background water quality samples.
- 07:32 - Sandbags dam isolation work at Station C continued from what was left off the previous day.
- 07:45 - EM collected water quality sample downstream (DS) from active work area, at Station D, and the result was compliant. Water quality data will be summarized in table below.
- Sandbag placement is considered low-risk activity; erosion and turbidity-related issues were not observed.
- 09:15 - Isolation work completed.
- 09:16 - EMs conducted fish salvage using electrofisher.
- Water temperature: 18.2°C
- First pass: 663 seconds - Results:
    - 7 prickly sculpins (Cottus asper)
    - 2 Pacific lamprey (Entosphenus tridentatus)
    - 1 three-spined stickleback (Gasterosteus aculeatus)
- Second pass: 664 seconds (1327 - 663 seconds) - Results:
    - 2 prickly sculpins
- 10:40 - Electrofishing completed as reasonable effort was put in - second pass has significantly fewer fish.
- 10:42 - Sediment removal work commenced
- Isolation worked as intended, turbidity was contained within the sandbags dam
- One EM monitored at the downstream while the other stayed on the bank with the machine to salvage fish in the sediment stockpile.
- Fish salvage results from side casting material:
    - 14 Pacific lamprey
    - 1 sculpin
- 11:15 - The EMs continued to monitor and observe for fish, but none was observed as the excavating depth extended beyond the typical fish habitation zone.
- 11:32 - EM observed turbid water started flowing downstream. Site superintendent was immediately notified. EMs recommended the contractor reinforce DS isolation area to maintain compliance.
- Silt fencing was used to keep turbidity within active work zone.
- 12:18 - Sediment plume was observed outside of isolation area; however, the plume was localized. Turbidity at 30 m downstream remained compliant.
- 13:20 - Sediment removal completed. The contractor began relocating the stockpile of sediment from this current Station to Station E using a loader.
- 14:37 - Sediment work completed.
- 14:50 - The contractor started to remove sandbags dams. The EMs continued to monitor turbidity plume and water quality.
- Isolation was removed at the downstream end first to avoid sudden burst of sediment-laden water into fish habitat.

- Turbidity plumes were observed but dissipated quickly. Water quality remained compliant.
- 15:43 - Water quality at the downstream end (Station E) was 17 NTU, 8 units above the background. The issue was notified to site superintendent. It's important to note that the elevated turbidity level was not caused by the sandbag removal itself, but rather by the previously contained turbid water now being released from the work zone as isolation was removed.
- Mitigation strategy was discussed: silt curtains should be used, or sandbags removal should be postponed overnight to allow sediment to settle.
- 15:53 - Water quality turbidity level returned to acceptable range compared to the background.
- 16:25 - Last sandbag was removed. Instream works completed. Concurrently, the sandbags removed from the stream were being transported to Station I by a loader.
- 16:50 - Work completed for the day
- 17:15 - The EMs departed from site after debriefing work activities with KEL PM.

Site Photos




September 01, 2024 10:58 a.m.


September 01, 2024 3:39 p.m.


September 01, 2024 10:42 a.m.


September 01, 2024 4:41 p.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	7
Project:	Legace Creek	**Page:**	1 of
Location:	Farms – Seux Roads, Fraser Valley, BC 49°13'00" N, 122°14"36" W	**Project No.:**	S-CR-215/16 2022-2632-04
Contractor:	Milestone Delta Aggregates JV	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 2, 2024
Contract No.:		**Temperature:**	High: - Low: -
Weather:	Overcast		

September 2, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Mel), Jim, 2 operator, 2 labourers
Keystone Environmental: EM (Jeff) (Kang)

Contractor's Equipment:

-Equipment in Use

- CAT Excavator 324E
- Zaxis Excavator EX0689
- Deer Loader 1466

Report, if any, Contact with Occupants:

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

12:30PM

- Discussion with Keystone PM (Jeff) –
- Herbicide injection into knotweed not practical for scenario.
- Need plant to be growing in order to treat it with herbicide. Cutting and injecting won't rid it.

- Too close to creek to excavate. Happy with cutting and covering with geotextile.
- 3 year maintenance period window is where knotweed should be injected with herbicide.
- Said he would give AE some sort of formal reply to addendum 1, question 2.

2:45PM
- Discussion Keystone (Kang) – Keystone directed QM to place excavated clay on embankments of river.

Discussions with Contractor:

7:00AM
- Toolbox talk QM (Mel) – Moving sand bags and focusing on SRS L today.
- AE (Jordan) asked to leave a little more material on the slope compared to SRS C.
- AE (Jordan) – Asked QM to provide road signs on Dale road. Mel – signs will be here Tuesday Sep 3.
- Another crew will here for Tuesday Sep 4.
- Another loader + operator will be here Wednesday Sep 4.
- Mel planning to fill some small sand bags with excavated material from SRS E laydown.

11:50AM
- Discussion with QM (Jim) – SRS L has higher water level than expected.
- 3 metre bags stacked high for water diversion.
- Not going to pump from this station – Keystone OK with this, will be monitoring turbidity.

2:45PM
- Discussion with QM (Jim) – wants to go back in at SRS L, didn't get enough material.
- Is going to poke bucket around and see if any sand comes up, or if it is all clay.
- Will likely put forward a claim, due to amount of time it took to setup at SRS L and the amount of material they excavated compared to the project 400m^3 on drawings.

Report:

7:20AM
- Moving Zaxis excavator to SRS L.

11:45AM
- Keystone Electo Fishing SRS L.

12:00PM
- Clearing area next to SRS L for stockpile.
- Jim got approval from land owner.

12:50PM
- Start excavating at SRS L.
- 2.5ft of water depth.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

- Operator aiming for same mark on excavator arm about 3m high. – 2.5ft of water + 2m max excavation.

1:10PM
- Excavator rolling back and forth along embankment instead of parking on lock blocks to extend excavators reach.
- AE (Jordan) – expressed concern to QM (Jim, operator), lock blocks are in place to be parked on, don't want embankment fail.

1:45PM
- Excavation complete, about 100m^3 of sediment removed and stockpiled next to SRS L.
- Excavating clay, not getting anymore sediment anywhere.

2:30PM
- Cleaning access at SRS C to E.
- Scooping into bucket and adding to stockpile at SRS E, some dirty material adding to stockpile.

2:40PM
- Filling metre bags with excavated material at SRS E stockpile.
- Running total of excavated material sand bags: 57.

3:45PM
- Clearing trees at K.
- Keystone measuring turbidity at SRS L, will remove sand bags tomorrow.

Additional notes:
- Removing sand bags from SRS L after 'testing for clay' delayed when they could remove the sand bags, increased turbidity and keystone advised too high to remove sand bags.
- Not dewatering with pumps increased opportunity for turbidity.

Testing:
- None today.

Safety Concerns:
- None today.

Traffic Control:
- None today.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Photos:





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	7
Project:	Legace Creek	**Page:**	1 of 8
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 2, 2024
Contract No.:		**Temperature:**	High: 23 Low: 15
Weather:	Sunny, Wind 7 KM/H, Gusts 17 KM/H		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

QM:

QM: Site Superintendent (Mel & Jem), Operator (Glenn & Sandy), laborers (Dallas, Patrick, Damian)
Keystone Environmental: EM (Loc & their Project Manager)

Contractor's Equipment: - Equipment in use

- Excavator 324E
- Excavator EXO689
- Loader 1466

Report, if any, Contact with Occupants:

None Today.

Contact with Owner:

None Today.

Discussions with Keystone:

9:30 AM

- Loc noted that once QM completes piling the isolated area, fish salvage will be conducted.

10:40 AM
- Keystone mentioned that they would not allow simultaneous excavation (2 excavator).

Discussions with Contractor:

7:05 AM
- Mel emphasized today's tasks at Station L, including hauling sandbags from Station C to Station L, piling sandbags by the creek, pumping, fish salvage, and excavation.

10:20 AM
- Conversation with loader operator (Glenn):
  - AE Vinizza inquired about additional sandbags needed at Station L. Glenn reported that 10 more bags are required.

11:40 AM
- Mel mentioned that additional equipment and crew will be added on Wednesday.

Report:

6:55 AM
- AE team (Jordan, Vinizza, and Duncan) arrived on site.

7:05 AM
- Toolbox meeting with Mel, Jem, Dallas, Sandy, and Damian (new laborer).
- AE Jordan highlighted the need for traffic control due to the frequent movement of equipment between sections of the creek.

7:20 AM
- Mobilizing excavator EXO689 from Station C to Station L.
- Keystone team (Loc and PM) arrived on site.

7:22 AM
- Mel mentioned to fill up the small sandbags today.

7:43 AM
- AE inspected the sandbags excavated from the creek yesterday: 12 bags at Station L and 21 bags at Station C.
- Excavator EXO689 arrived at Station L.

8:02 AM
- At Station L: Began moving sandbags closer to the lock block and creek.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

8:05 AM
- Commenced hauling sandbags from Station C to Station L using a loader.

9:05 AM
- Ongoing moving sandbags to the creek; half of the area is now piled with sandbags.

9:25 AM
- Keystone conducted a turbidity test at Station L.

9:55 AM
- Farmer visited the site at Station L without complete PPEs.

10:10 AM
- Station C: One bag left.

10:45 AM
- Started hauling sandbags from Station E to Station L.

11:10 AM
- Keystone conducted another turbidity test at Station L.

11:20 AM
- Completed piling and setting up the sandbags around the creek at Station L.

11:30 AM
- Keystone conducted fish salvage.

12:45 PM
- There are no more sandbags available at Station E. Twenty-two bags have been hauled to Station L.

.

1:00 PM
- Began excavation at Station L.
- No pumping of water happens.

1:15 PM
- AE (Vinizza & Duncan) left the site 14 & proceed to Site 15 for fish net cleaning.

3:40 PM
- AE (Vinizza & Duncan) returned to the site.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

3:55 PM

- AE Jordan stated that additional 2 bags were being filled up, in total of 57 bags from excavated area on site.
- QM crew left the site.

4:10 PM

- AE (Jordan) started flying the drone.

4:35 PM

- AE (Jordan, Vinizza & Duncan) left the site 14 & proceed to Site 15 for continuing the fish net cleaning.

Testing:

- Keystone conducted turbidity test.

Safety Concerns:

- Needs traffic control along the Dale Road especially near the bridge when the loader going back & forth in hauling the sandbags.

Traffic Control:

- None today.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

Photos:





(If necessary, continue report on another sheet.)

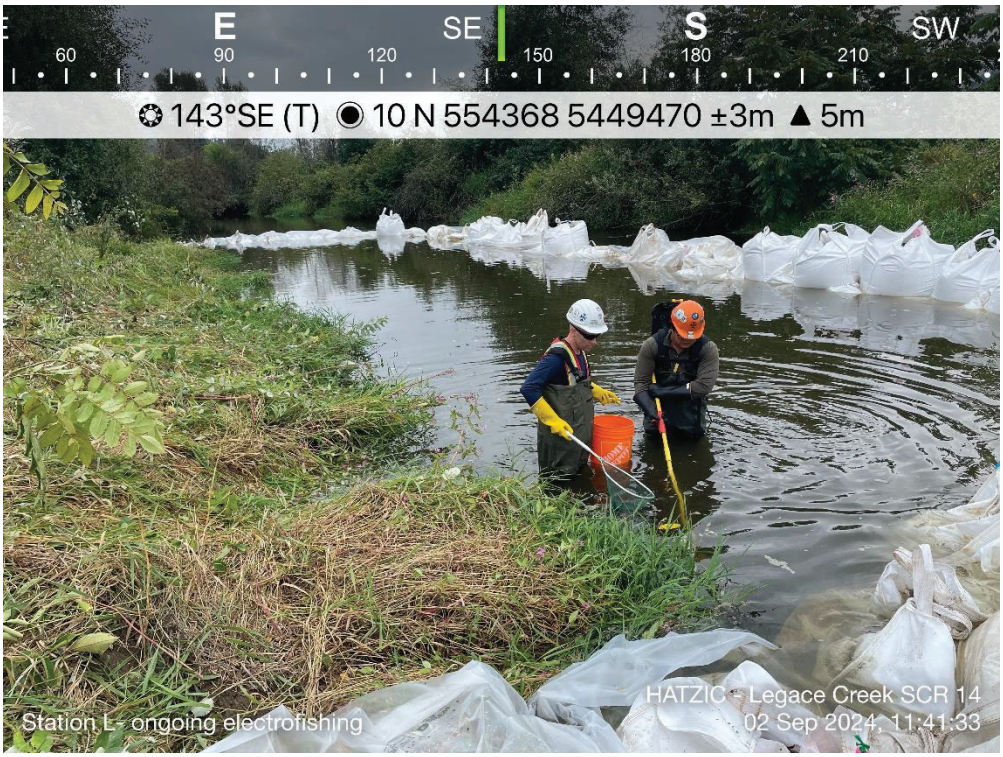
ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos



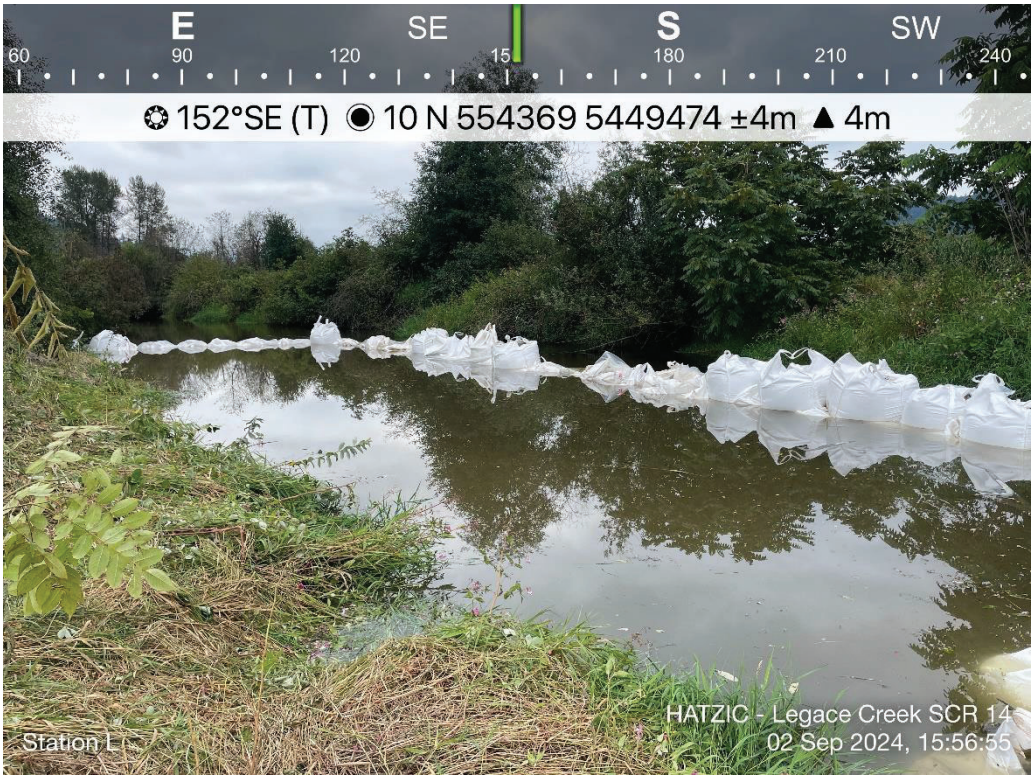


(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos



Excavated material from the creek of Station L.



Station L – after excavation.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: September 2, 2024
Weather: Temperatures ranging from 16°C in the morning to a high of 22°C throughout the day.

- Environmental Monitors (EMs) arrived on site at 7:15 AM.
- 07:28 - EMs collected background water quality samples.
- 08:00 - Sandbags dam isolation work at Station L commenced.
- EM collected water quality sample ~25m downstream (DS) from active work area (Station L) hourly. Water Quality data was compliant throughout the day.
    - Sandbag placement is considered low-risk activity; erosion and turbidity-related issues were not observed.
- 11:40 - Isolation work completed.
- 11:45 - EMs conducted fish salvage using electrofisher.
    - Water temperature: 16.5°C
    - First pass: 434 seconds - Results:
        - 1 prickly sculpin *(Cottus asper)*
    - Second pass: 218 seconds - Results:
        - 2 prickly sculpins
- 12:45 - Electrofishing completed as reasonable effort was put in and increase in number of fish was not observed.
- 12:50 - Sediment removal work commenced
- Isolation worked as intended, turbidity was contained within the sandbags dam
- One EM monitored at the downstream while the other actively salvage aquatic species in the sediment stockpile.
- Results from side casting material:
    - 19 Pacific lampreys
- Sediment plume was observed outside of isolation area; however, the plume was localized, and the crew was notified. The gap was reinforced immediately. Turbidity at 25m downstream remained compliant.
- 13:52 - Sediment removal completed.
- Sandbags dams remained intact to allow the sediment in the work area to settle down prior to dam removal to ensure turbidity stay compliant.
- 14:51 – EM collected sample from the work area à high turbidity reading when compared to the background.
- 15:45 - Work completed for the day. Sandbag dam will be removed on September 03, 2024, prior to work commence once the turbidity level in the isolated work area returns to normal.
- 16:15 - The EMs departed from site after debriefing work activities with KEL PM.

Site Photos






September 02, 2024 1:32 p.m.


September 02, 2024 1:03 p.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	8
Project:	Legace Creek	**Page:**	1 of
Location:	Farms – Seux Roads, Fraser Valley, BC 49°13'00" N, 122°14"36" W	**Project No.:**	S-CR-215/16 2022-2632-04
Contractor:	Milestone Delta Aggregates JV	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 3, 2024
Contract No.:		**Temperature:**	High: 23 Low: 12
Weather:	Overcast		

September 3, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Mel), Jim, 2 operator, 4 labourers
Keystone Environmental: EM (Jeff) (Kang)
Tree fallers: 3

Contractor's Equipment:

-Equipment in Use

- CAT Excavator 324E
- Zaxis Excavator EX0689
- Deer Loader 1466

Report, if any, Contact with Occupants:

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

Discussions with Contractor:

11:00AM

- Discussion with QM (Jim) – Push pack on meeting today about dewatering isolation areas.
- Will put 3" pumps in isolation area.
- Wants equalization on sand bags from water on inside of isolation area.
- Keystone (Kang) – doesn't think dewatering is necessary for environmental POV.

2:30PM

- Discussion QM (Mel), AE (Jordan, Ryan, Vinizza, Cynthia) – water levels will come down due to water release at Hatzic lake.

3:20PM

- Discussion with QM (Jim) – wants to start excavation today, will be working till 6:30pm, wants to start at 6:30am tomorrow.
- AE (Jordan) said to communicate this with AE (Vinizza) as I will not be on site tomorrow.

Report:

8:00AM

- Tree falling at SRS B3.
- Hauling material for access road today.
- Pulling bags out of SRS L.

9:25AM

- Lost sandbag while removing sand bags from SRS L.
- New running total 56?
- Placed this bag after but it was half full, keep running count at 57.

10:30AM

- Placing bags at SRS K

2:30PM

- Setting up 2 -3" dewatering pumps in SRS K.
- Silt curtain installed 15m D/S.

3:30PM

- Filling sand bags at SRS E laydown
- Filled 32 metre bags today.
- New running total 57+32 = 89.

4:00PM

- AE (Ryan) informed field crew no excavation is to take place until adequate pumps are in the water. QM is aware of this.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Testing:

- None today.

Safety Concerns:

- None today.

Traffic Control:

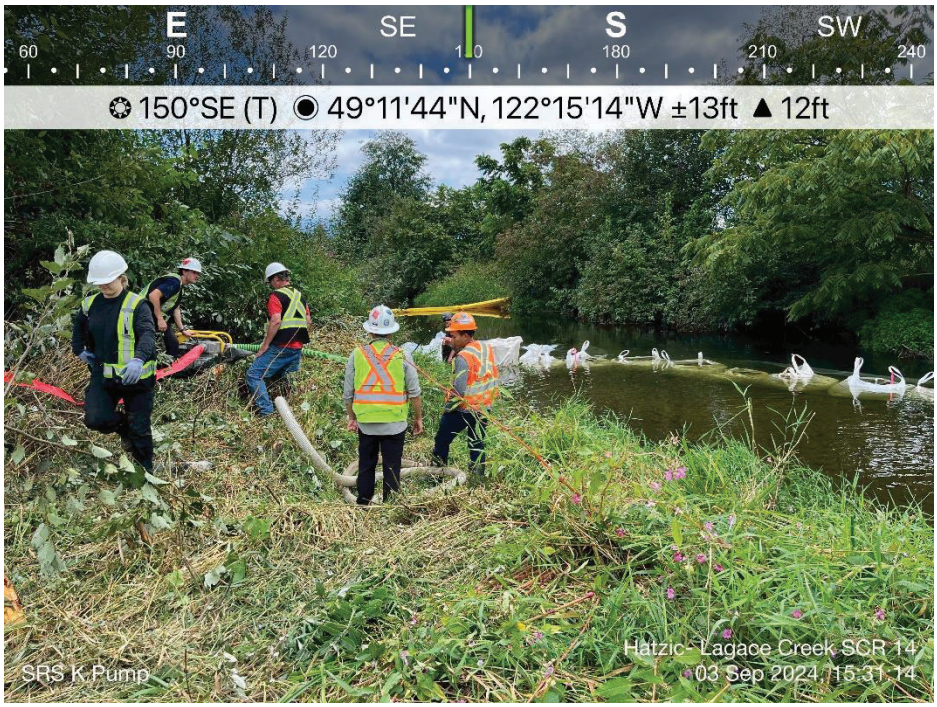
- None today.

Photos:



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	8
Project:	Legace Creek	**Page:**	1 of 8
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 3, 2024
Contract No.:		**Temperature:**	High: 22 Low: 15
Weather:	Sunny, Wind 8 KM/H, Gusts 17 KM/H		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

QM:

QM: Site Superintendent (Mel & Jem), Operator (Glenn & Sandy), laborers (Dallas, Patrick) + 3 new laborers
Keystone Environmental: EM (Khang and John)

Contractor's Equipment: - Equipment in use

- Excavator 324Es
- Excavator EXO689
- Loader 1466

Report, if any, Contact with Occupants:

None Today.

Contact with Owner:

None Today.

Discussions with Keystone:

7:48 am

- Conversation with Keystone (Khang):
  - He mentioned that mixing excavated materials from different stations might cause issues if they have different soil test results.

- Test results will be available tonight, and he will contact the laboratory today.

Discussions with Contractor:

7:00 am
- Sign In. Toolbox talk with Mel, Jem, Glenn, Sandy, and Dallas.
- AE (Vinizza) asked for their work to be completed today. Mel stated dismantling Station L and continuing with Station K.

11:00 am
- Glenn mentioned that they will fill more bags.

3:10 pm
- Conversation with Jem:
  - AE Vinizza inquired if they plan to excavate today. Jem responded that they will, as there is still time. Khang also mentioned they can perform fish salvage for an estimated 1 hour.

Report:

6:55 am
- AE Vinizza arrived on site.

7:02 am
- Keystone (Khang and John) arrived on site.

7:10 am
- Three additional QM laborers arrived on site.

7:30 am
- Keystone (Khang) began flagging the knotweed at Station H.
- Ongoing removal of sandbags from the creek at Station L, starting from the east side.
- Ongoing transfer of sandbags from Station L to Station K beside the access road.

8:10 am
- Approximately 50% of the sandbags in the creek at Station L have been pulled up.

8:27 am
- Approximately 80% of the sandbags in the creek at Station L have been pulled up.

9:15 am
- Keystone conducted a turbidity test at Station L.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

9:19 am
- AE (Ryan, Jordan, Duncan) arrived on site.
- Ryan emphasized the importance of documenting all site updates, especially regarding dewatering, and using the correct size of pump.

9:25 am
- One bag fell off (old, unmarked bag) leaving 10% of the sediments inside.

9:30 am
- Two additional bags fell off (marked and unmarked).

9:32 am
- Removal of bags from the creek at Station L completed.
- AE checked the bags that fell off: 4 bags total—1 marked, 2 old bags half full, and 1 almost empty.
- QM crew on a break.

10:00 am
- Back to work.
- Stations J & K: QM ongoing clearing.

10:30 am
- AE (Vinizza) left the site.

10:55 am
- AE (Vinizza) returned to the site.
- AE (Jordan & Duncan) already on site.

11:00 am
- At Station K: Ongoing moving of sandbags to the creek.
- Ongoing setup of sandbags and poly sheet.

11:35 am
- Two new laborers setting up the silt fence around the excavated materials at Station L.

12:00 pm
- Ongoing setup of sandbags and poly sheet at Station K (70% completed). Water is still coming in from the west side of the isolated area.

12:17 pm
- QM lunch break.

12:50 pm
- At Station E: Ongoing filling of bags (Glenn & Pat). AE Vinizza flagged filled bags.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

1:20 pm
- Work resumed at Station K.

1:34 pm
- Ongoing transfer of 4 bags that fell off; 1 is an empty bag, and 3 bags are piled up.

1:50 pm
- Preparation for setting up the turbidity curtain.

2:07 pm
- Ongoing setup of the 3" water pump.

2:45 pm
- Conversation with Ryan and Mel:
  - Dewatering from 15/16 to be documented in writing.
  - Mel discussed having a 3" water pipe and 6 hoses.

2:55 pm
- At Station K: Piling sandbags in the space where water is still coming in.

3:00 pm
- At Station K: The 3" water pump has been set up. There are 4 hoses, each 50 ft long. The pump's outlet is downstream of Station L, approximately 30 meters from the station.

3:05 pm
- Fish screen protection installed at the inlet of the pipe in preparation for pumping.

3:35 pm
- At Station E: QM has filled up 30-meter bags and is ongoing with 2 additional bags.

3:50 pm
- Conversation with AE (Ryan, Jordan, Vinizza & Cynthia):
  - Ryan emphasized that work must conducted in the dry. A 2-3 inch pipe is not the right size.

4:00 pm
- AE (Ryan, Jordan, & Cynthia) left the site.

4:20 pm
- Keystone started fish salvage.

4:40 pm
- QM crew left the site.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

4:50 pm

- AE Vinizza left the site.

Testing:

- Keystone conducted turbidity test.

Safety Concerns:

- None today.

Traffic Control:

- Green Valley Traffic Control provided traffic management along Dale Road near the bridge.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

Photos:

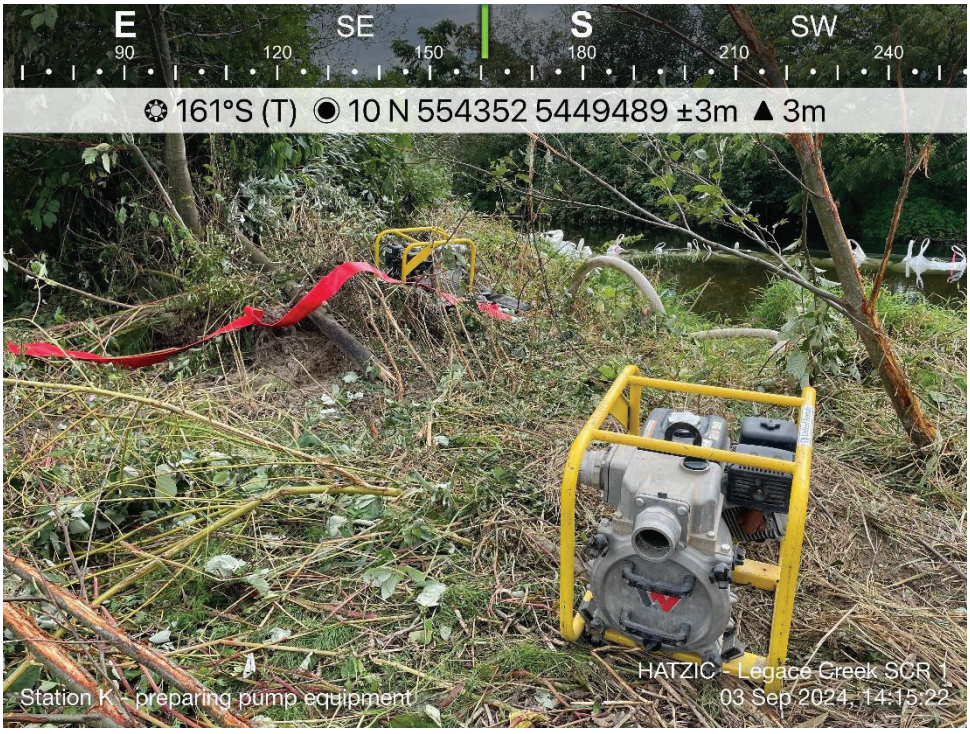




(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: September 3, 2024
Weather: Overcast in the morning to sunny breaks in the afternoon. Temperatures ranging from a low of 15 °C to a high of 22°C throughout the day.

- Environmental Monitors (EMs) arrived on site at 7:00 AM.
- 07:15 - EMs collected background water quality samples (WQ sampling results are provided below).
- 07:30 – QM crews began removing the sandbag isolation from Station L. Sandbags removed from Station L were subsequently transported to Station K.
- 07:45 – One EM continued the monitoring of instream work, while the other EM checked for Japanese knotweed presence around Station K.
- 08:52 – EMs collected a downstream water quality sample from Station L while the QM crews continued to remove the sandbag isolation.
- 09:25 – Excavator, in attempts to remove the sandbag isolation, spilled the sediment content of the sandbag into the stream. However, there was no concern of contamination except for turbidity.
- 09:34 – Another sandbag was spilled instream due to the sandbag rolling over from fast flowing water current.
- 09:38 – Sandbag isolation removal work at Station L was completed. The EMs noted that the turbidity plume dissipated quickly during work, but extra caution should be exercised, including the use of silt curtain/booms.
- 09:40 – Sandbags removed from Station L were transported to Station K by wheeled loader.
- 10:24 – Background WQ sample at Station K was collected.
- 10:26 – QM crews began setting up the sandbag isolation in Station K.
    - Sandbags were laid on top of poly sheeting and the poly is then rolled over top. Sandbags wall is higher than water surface level. The work area is efficiently isolated and thus concern for fish entering the work zone is minimal.
    - Water seeping through underneath the sandbags, dewatering with pumps will create back pressure and make the walls cave in and collapse, dewatering is not practical due to high flow.
- 10:40 – The EMs noted that the QM crews deployed silt fences around the stockpile of excavated sediment from Station L. Poly sheeting was also observed covering the stockpile, providing an additional layer of protection against potential sediment erosion into the stream.
- 12:15 – The QM crews continued the installation of sandbag isolation around Station K. The EMs continued the WQ monitoring downstream to check for any elevation in turbidity downstream.
- 12:20 – Lunch break.
- 13:00 – Finished lunch break.
- 14:00 – QM crews deployed a silt curtain on the downstream section of Station K. Silt curtain was fully extended across the stream to reduce the turbidity downstream from Station K.

- 16:00 – Station K sandbag isolation was completed. Dewatering pump was set up but was not required as there was no excavation that took place during the workday. The intakes were fitted with fish screen protection as per the DFO end-of-pipe specifications.
- 16:30 – The EMs began the fish salvage operation at Station K. A total of three (3) passes were conducted with electrofisher, with a total of 2181 seconds of active time on the electrofisher.
- 17:51 – The EMs finished the fish salvage via electrofisher. Total of one (1) Three-spined stickleback, two (2) Pumpkinseed Sunfish, and eleven (11) Prickly Sculpins were salvaged. Invasive pumpkinseed sunfish was humanely euthanized, and native fish were released behind the silt curtain that will now act as additional fish isolation.
- 18:00 – Dissolved oxygen (DO) measurement was taken at Station K and yielded 8.84 mg/L before deploying minnow traps. This DO level complies with DFO requirements for protecting aquatic life. For cold water biota, DFO recommends DO levels ≥ 6.5 mg/L for optimal conditions in most life stages, and levels should not fall below 5.0 mg/L. The measured 8.84 mg/L is well within the acceptable range, indicating suitable conditions for fish and appropriate for deploying minnow traps without risking hypoxic stress to the fish.18:10 – A total of 6 minnow traps were deployed in Station K. The traps are to soak overnight and to be picked up the following morning prior to excavation.
- 18:30 – The EMs departed from site after debriefing work activities with KEL PM.

Location	Time	Turbidity (NTU)
Background (Station K)	7:15	2.87
Within the isolation at L	7:16	5.87
BG (Station K)	8:52	2.43
10 m DS from L	9:00	4.08
10 m DS from L	09:30	4.47
10 m DS from L	09:33	**13.3**
10 m DS from L	09:38	5.67
Station K	10:24	3.34
Station K	15:51	2.72
Station J	16:11	3.05
Station K	15:23	5.29
Station K	16:21	4.86

Site Photos






September 03, 2024 7:22 a.m.


September 03, 2024 1:09 p.m.


September 03, 2024 2:13 p.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

DAILY CONSTRUCTION REPORT

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	9
Project:	Legace Creek	**Page:**	1 of 5
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 4, 2024
Contract No.:		**Temperature:**	High: 31 Low: 19
Weather:	Sunny, Winds SSW at 10 to 15 km/h		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Labour Force:

Quantum Murray (QM): 2 Site Superintendents, 2 Operators, 4 Labourers
Keystone Environmental (KE): Khang and John
Associated Engineering (AE): Jack Dai Tang and Vinizza Pingos

Contractor's Equipment:

2 - Hitachi ZX350LC-6 Long Reach
2 - DEERE 544K Wheel Loaders
2 – 3" Trash Pumps (demobilized from construction site)
2 – 6" Vacuum Assisted Pumps

Report, if, any, Contact with Occupants:

N/A

Contact with Owner:

N/A

Safety Concerns:

N/A

Traffic Control:

N/A

Report:

7:00 AM – 9:00 AM

- Arrived at Site 17 for toolbox meeting

9:00 AM – 10:00 AM

- Arrived at Site 14 at 9:00 AM
- Station K - QM refueled the two 3" pumps and began pumping water out.
- Sandbags were packed and transferred from Station L to Station J.

10:00 AM - 11:00 AM

- QM began placing sandbags to Station J.
- Station J
    - It was observed that some sandbags were submerged due to water level.
    - QM restacked the sandbags.
- Station K
    - One of the 3" pumps ran out of fuel and stopped. QM refueled and restarted the pump.
    - Minimal water level difference was observed between the stream and station K.

11:00 AM – 12:00 PM

- Station K
    - Two 6" pumps and a fish cage arrived at site
    - QM shut down the two existing 3" pumps and demobilized them along with the truck that transported the 6" pumps.
    - QM began assembling the two 6" pumps

12:00 PM – 1:00 PM

- Station K
    - QM raised the concern to KE about the fish cage was not suitable for placement due to the low water depth. KE advised QM to excavate a sump for the cage.
    - The fish cage was placed at the station, and it was confirmed that the sump was no longer required.

1:00 PM – 3:00 PM

- Station K
    - Water level remains unchanged.
    - QM started one of the 6" pumps and it was not pumping water.
    - The second 6" pump was started and successfully pumped water.
        - The cloth attached to the discharge pipe became detached. QM reattached the cloth to the discharge pipe.
    - QM identified an issue with the first 6" pump due to improper pipe sealing, causing air intake. The issue was addressed by wrapping the connection with a poly sheet and duct tape.
    - After addressing the first pump's issue, it was observed that the second 6" pump was not pumping at full capacity. QM suspected a blockage at the pump intake.
    - QM attempted to resolve the blockage issue with the second pump, but it remained unresolved.

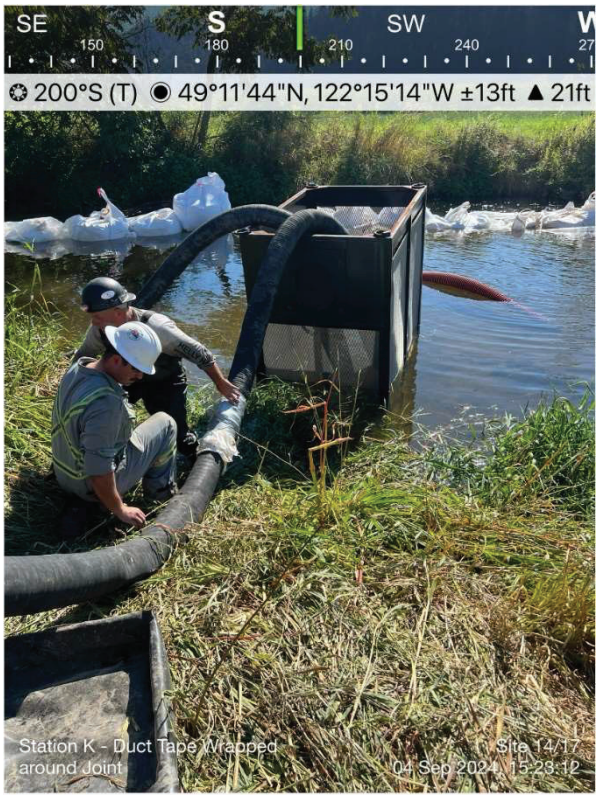
3:00 PM – 4:00 PM

- Station J
    - QM resumed placing sandbags.
    - Approximately 70% of sandbags were placed.
    - Approximately 49 sandbags packed today.

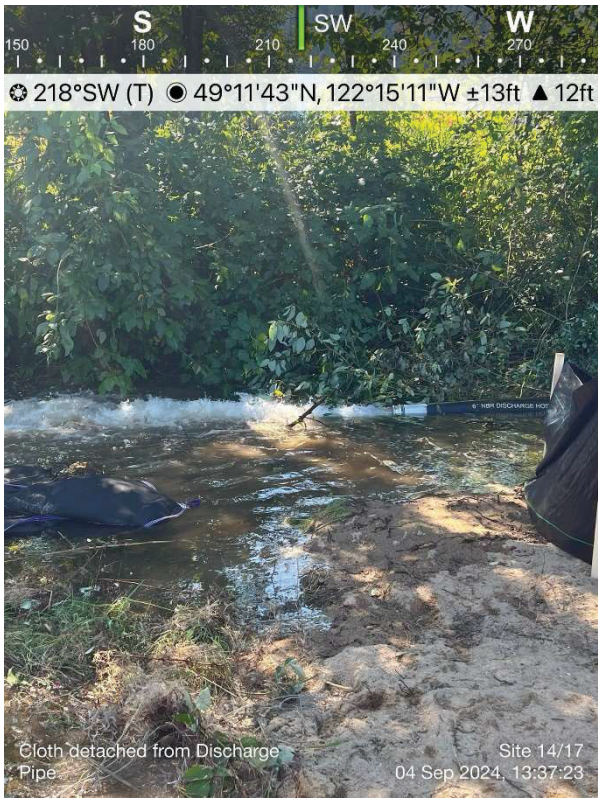
4:00 PM – 5:00 PM

- QM shut down for the day at 4:20 PM.
- AE inspectors left site at 4:20 PM.


W 270 300 NW 330 N 0 30
325°NW (T) 49°11'45"N, 122°15'15"W ±13ft 33ft
Sandbag Placement at Station J
Site 14/17
04 Sep 2024, 09:48:38


SE 150 S 180 SW 210 240
200°S (T) 49°11'44"N, 122°15'14"W ±13ft 21ft
Station K - Duct Tape Wrapped around Joint
Site 14/17
04 Sep 2024, 15:23:12


SE
S
SW
150
180
210
240
196°S (T) 49°11'45"N, 122°15'14"W ±9ft 33ft
6" Pump Arrival
Site 14/17
04 Sep 2024, 11:21:51


S
SW
W
150
180
210
240
270
218°SW (T) 49°11'43"N, 122°15'11"W ±13ft 12ft
Cloth detached from Discharge Pipe
Site 14/17
04 Sep 2024, 13:37:23

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	9
Project:	Legace Creek	**Page:**	1 of 7
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 4, 2024
Contract No.:		**Temperature:**	High: 28 Low: 12
Weather:	Sunny, Wind 3 KM/H, Gusts 5 KM/H		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

QM:

QM: Site Superintendent (Mel & Jem), Operator (Glenn & Sandy), 4 laborers
Keystone Environmental: EM (Khang and John)

Contractor's Equipment: - Equipment in use

- Excavator 324E
- Excavator EXO689
- Excavator 2720
- Loader 1466
- 2 - 6" Vacuum Assisted Pumps
- 2 – 3" Trash PumpsSS

Report:

6:55 AM

- AE (Vinizza) arrived on site.

7:00 AM

- Toolbox talk with Mel, Jem, Glenn, Dallas, Sandy, and 4 laborers.
- Jem discussed to start dewatering, adding two additional 4" water pumps, and to continue filling sandbags with excavated materials from Station L.
- He also expressed concerns that once the isolated area dries out, the sandbags might fall off, creating a mess. Additionally, he noted the potential risk of flooding at the discharge area once the water is pumped out.

7:35 AM

- Keystone (Khang & John) arrived on site.

7:40 AM
- Conversation with Keystone.
    - Khang reported that fish salvage was completed last night at Station K, and the fish trap was placed overnight.
    - Keystone was removing the fish trap, noting that there were still fish caught.

7:45 AM
- Preparing to fill up bags at Station L for Station J.

7:50 AM
- Keystone released the fish at Station L downstream.

7:55 AM
- Mobilized new equipment on site: Excavator #2720.

8:00 AM
- Conversation with Jem.
    - Jem mentioned that road plates for Station K would be arriving soon.

8:04 AM
- Started pumping out water at Station K using two 3" water pumps.

8:23 AM
- Began placing steel plates (4ft x 8ft) on the upstream (west side) of the creek at Station K.

8:25 AM
- QM began refilling the fuel of the water pump (with the spill tray underneath) approximately 4 meters from the creek.

8:55 AM
- AE (Ryan and Jack) arrived on site.

9:00 AM
- Jem mentioned that they would use a 6" water pump.

9:10 AM
- Ongoing filling of sandbags from excavated materials at Station L to be hauled to Station J.

9:15 AM
- Station K: One water pump stopped. Eight steel plates already placed.

9:25 AM
- QM refilled the fuel of the water pump with the spill tray underneath, approximately 4 meters from the creek.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

9:30 AM
- Station K: Ongoing pumping with the 2 x 3” water pump for the second time.

9:33 AM
- Hauling of sandbags from Station L to Station J using a wheel loader.

10:00 AM
- Removing and taking out water-filled sandbags from Station J.

10:08 AM
- Adjusting the poly sheet at Station J to cover the sandbags and prevent water ingress.

10:28 AM
- Eight new sandbags filled at Station E.

10:35 AM
- Keystone conducted a turbidity test.

11:07 AM
- One pump shut down. Fuel refilling at its original position (approximately 4 meters from the creek) with spill containment mats in place. Pump turned back on after refilling.

11:20 AM
- Delivered a 6” water pump to Station K (one with a case, one without a case).

11:25 AM
- Shut down the 3” water pump.

1:01 PM
- Station J: Approximately 35 bags used; 65% completion in isolating the area.
- Ongoing filling and hauling of bags from Station L to Station J.

1:15 PM
- Started using the 6” water pump. One pump (with a case) operational; one pump (without a case) not working.

1:30 PM
- Approximately 49 sandbags pack up and hauled to Station J from Station L.

1:37 PM
- At the water outlet area, approximately 30 meters downstream from Station L, the cloth attached to the discharge end of the pipe came loose.

1:42 PM
- QM fixed the cloth and turned the water pump back on.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

1:52 PM
- QM attempted to fix the non-operational water pump (without a case) but it remained non-functional.

2:15 PM
- At Dale Road: poured gravel at the temporary access road and laid geotextile sheet underneath to prevent contamination from knotweed in the area.

2:25 PM
- QM continued fixing the first pump (without a case), they suspect that improper sealing, which caused air intake, was the issue. To address this, they wrapped the pump with a poly sheet and duct tape.

3:20 PM
- Continued setting up sandbags at Station J to isolate the area.

3:30 PM
- The pump (without a case) is now working, while the second pump (with a case) was shut down due to a possible clog issue as per QM.
- Transferred fish box protection with pumping inlet from east to the center part of the isolated area (Station K).
- QM flagged a marker on a piece of wood to monitor water level changes.

4:20 PM
- QM called it a day.

4:30 PM
- QM crew left the site.

4:40 PM
- AE (Vinizza & Jack) left the site.

Testing:
- Keystone conducted turbidity test.

Safety Concerns:
- None today.

Traffic Control:
- Green Valley Traffic Control provided traffic management along Dale Road near the bridge.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Photos:

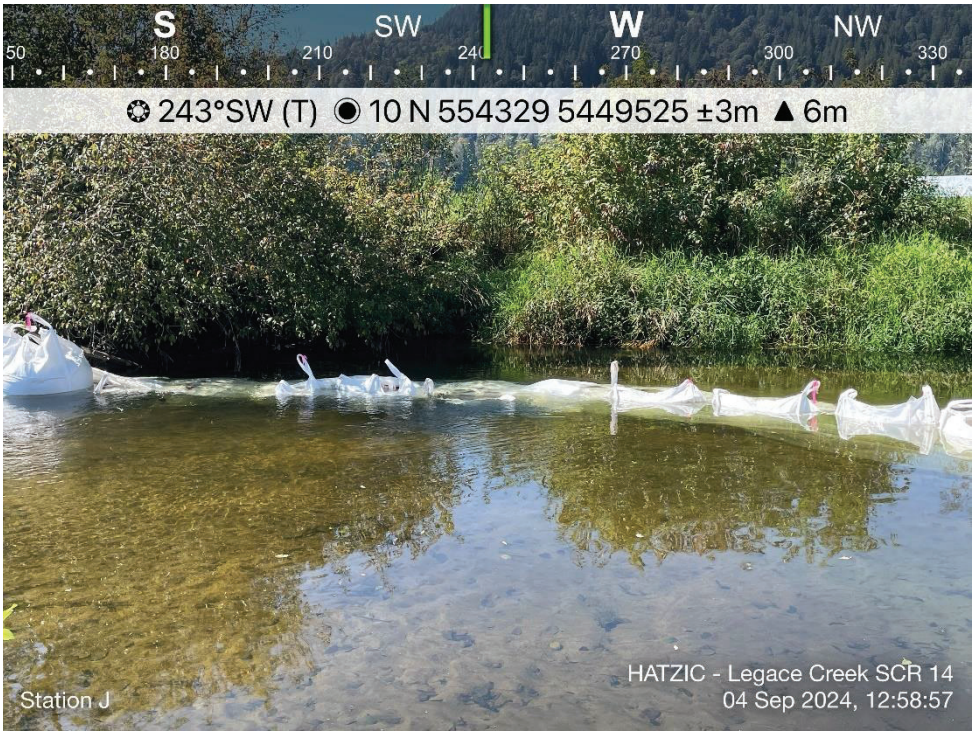




(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos





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(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: September 4, 2024
Weather: Foggy in the morning, sunny throughout the day. Temperatures ranged from 12°C to 25°C throughout the day.

- 7:15 AM: Environmental Monitors (EMs) arrived on-site.
- 7:30 AM: Quick toolbox meeting was conducted prior to the start of the workday.
- 7:40 AM: The EMs collected six (6) minnow traps from Station K:
    - 1 Rainbow trout
    - 3 Pumpkinseed sunfish
    - 2 Three-spined sticklebacks
    - 9 Prickly sculpins
    - Native fish were released downstream away from the work area.
    - Three (3) Pumpkinseed sunfish were euthanized.
- 7:58 AM: Background water quality (WQ) sample was collected at Station K (WQ sampling results provided below).
- 8:04 AM: Two (2) 3-inch dewatering pumps were set up at Station K:
    - Fish protection screen was observed on both intake hoses.
    - Both pumps were placed on spill tray to mitigate the risk of oil spillage near the stream.
    - Outlet hoses were directed onto downstream bank vegetation at the downstream end of Station L to reduce turbidity before the water re-entered the stream.
- 8:15 AM: The EMs observed a turbidity bloom downstream from the dewatering pumps discharge, with signs of erosion at the outlet points:
    - The EMs recommended installing a poly-sheeting spillway armored with gravel to minimize erosion and reduce turbidity.
- 8:25 AM: QM crews installed road plates on the upstream side of Station K to prevent water from seeping through the sandbag isolation.
- 8:37 AM: Downstream WQ sample was collected at Station K (WQ sampling results provided below).
- 8:40 AM: Poly-sheeting spillway armored with gravel was constructed at the dewatering pumps discharge outlets at the downstream end of Station L.
- 9:47 AM: QM crews initiated the installation of sandbag exclusion at Station J:
    - Background WQ sample was collected upstream of Station J.
    - Downstream WQ sample was collected downstream of Station J (WQ sampling results provided below).
- 10:47 AM: A WQ sample was taken approximately 5 meters downstream of the dewatering pumps outlets. Results confirmed that the poly-sheeting spillway was effectively reducing turbidity (WQ sampling results provided below).
- 11:20 AM: Two (2) 6-inch dewatering pumps were staged on-site, with a fish protection screen cage observed.
- 11:28 AM: Two (2) 3-inch dewatering pumps were demobilized from the site.

- 11:55 AM: Diffuser bags were brought to the site.
- 12:15 PM: QM crews conducted Japanese knotweed pruning at Station B. The EMs confirmed that pruned Japanese knotweed plants were isolated inside a bulk bag.
- 1:43 PM: The first 6-inch dewatering pump was activated at Station K:
    - The EMs confirmed that the dewatering pump inlet was placed inside a fish protection cage, and no adverse impacts on fish were observed.
    - The discharge outlet was directed towards the downstream end of Station L, connected to a diffuser bag and placed over a poly-sheeting spillway to minimize turbidity and prevent bank erosion
    - A background WQ sample was collected upstream of the 6-inch dewatering pump discharge outlet (WQ sampling results provided below).
- 2:07 PM: A minor turbidity bloom was observed downstream from the pump discharge. In-situ WQ sampling indicated a turbidity of 10.44 NTU (compared to background turbidity of 4.28 NTU). The turbidity bloom quickly dissipated downstream and remained within compliance.
- 2:20 PM: QM crews reported that the inlet hose on the second 6-inch dewatering pump was leaking, causing delays:
    - The leaking section of the hose was removed, and the fish protection cage was adjusted to accommodate the now shorter inlet hose.
- 3:30 PM: The second 6-inch dewatering pump was activated, with its outlet hose directed towards upstream end of Station L, through a diffuser bag and over a poly-sheeting spillway.
- 3:45 PM: The EMs noted that the first 6-inch dewatering pump was inactive.
- 3:50 PM: The EMs noted that neither of the dewatering pumps was discharging at full capacity. The two (2) 6-inch dewatering pumps were not effective at lowering the water level inside the Station K exclusion. QM crews indicated that both pumps were rental units from United Rentals, and arrangements were made for a technician to be on-site to address the issue. The pumps were shut down for the day.
    - The two (2) 3-inch pumps were active for approximately 3.5 hours.
    - The first 6-inch pump was active for approximately 2 hours.
    - The second 6-inch pump was active for approximately 45 minutes.
- 4:00 PM: The EMs recommended moving the two (2) 6-inch dewatering pump discharge outlets from their respective current locations to the upstream side of the silt curtain, located between Stations L and K, to reduce the turbidity downstream from the dewatering pumps discharge.
- 4:18 PM: Work ended for the day. The sandbag exclusion installation at Station J was not completed and will continue the following day.
- 4:30 PM: The EMs deployed nine (9) minnow traps inside the Station K exclusion, to be collected the following day prior to excavation. In addition, one (1) minnow trap was deployed in the Station J.
- 5:30 PM: The EMs departed from site after debriefing work activities with KEL PM.

Location	Time	Turbidity (NTU)
Background (Station K)	7:58	2.95
Station L (DS from road plate installation at K)	8:36	2.85
Station L (DS from road plate installation at K)	9:14	5.72
BG (Station J)	9:50	5.52
10 m DS from J	9:55	4.85
10 m DS from J	10:22	5.74
Background (Station K)	10:40	3.92
DS of Station L @ two 2-in pumps discharge outlets	10:47	4.59
Background (1st 6-in pump discharge)	14:02	4.28
10m DS of 1st 6-in pump discharge outlet	14:07	10.44
10m DS of 1st 6-in pump discharge outlet	14:20	8.70
10m DS of 1st 6-in pump discharge outlet	14:35	8.22
Background (2nd 6-in pump discharge)	15:32	5.11
10m DS of 2nd 6-in pump discharge	15:35	6.27
10m DS of 2nd 6-in pump discharge	15:55	7.09

Site Photos






2024-09-04 3:36 p.m.


September 04, 2024 5:20 p.m.


September 04, 2024 12:03 p.m.


September 04, 2024 10:21 a.m.


September 04, 2024 9:26 a.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

DAILY CONSTRUCTION REPORT

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	10
Project:	Legace Creek	**Page:**	1 of 8
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 5, 2024
Contract No.:		**Temperature:**	High: 32 Low: 16
Weather:	Sunny, Winds SSW at 10 to 15 km/h		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Labour Force:

Quantum Murray (QM): 2 Site Superintendents, 2 Operators, 4 Labourers
Keystone Environmental/Environmental Monitors (KE/EM): Khang and Loc
Associated Engineering (AE): Jack Dai Tang, Vinizza Pingos, and Naomi Sands (11:20 AM – 12:00 PM)

Contractor's Equipment:

2 - Hitachi ZX350LC-6 Long Reach
1 - DEERE 544K Wheel Loader
2 – 6" Vacuum Assisted Pumps

Report, if, any, Contact with Occupants:

N/A

Contact with Owner:

At 10:40 AM, an individual claiming to be the owner of the farmland approached the AE inspector to express concerns about the project's progress. The individual appeared to have a limited understanding of the scope of work, believing it only involved simple excavation and hauling away sediment from the creek. He questioned the necessity of the dewatering systems, complaining that they were an unnecessary expense and that project funds were being wasted. The AE inspector attempted to explain the complexity of the work, but communication was hindered by a language barrier. The individual then approached the contractor for further information and left the site at 11:00 AM.

Safety Concerns:

N/A

Testing:

EM measured 4.26 NTU upstream.

At 9:12 PM, a spike of 25.2 NTU was observed at the discharge pipe outlet. EM took another water sample 15 meters downstream from the outlet, recording 9.22 NTU. EM confirmed that this result complies with the requirement of no more than an 8 NTU increase compared to the upstream reading.

Traffic Control:

The AE inspectors observed the following at the site entrance:

1 – Traffic Control Vehicle

2 – Traffic Control Workers

Report:

7:00 AM – 7:50 AM

- Arrived at Site 14/17 at 7:00 AM
- Station K
  - QM was already on-site, working on station dewatering.
  - It was observed the 6" pumps were not operating at full capacity.
  - QM resolved the issue by replacing the intake pipes with flexible ones.
  - Pumping resumed and dewatering of the station began.
  - At 7:14 a.m., the water level drops to 4 inches.
- Station E & D
  - Forty sandbags are still piled along the station from D to E.
- Along Dale Road
  - Traffic management at the site.

7:50 AM – 9:00 AM

- AE inspectors attended daily site construction meeting.
  - It was noted to remind QM that they are required to locate the existing watermain along Legace Road before setting up the sand recovery station. Additionally, coordinate with Fraser Valley Regional District on the offset distance.

9:00 AM – 10:00 AM

- Water Testing:
  - At 9:12 AM, 25.2 NTU was measured at discharge pipe outlet.
  - EM indicated that they might instruct QM to shut down the pumps to allow turbidity to decrease.
  - Another water sample was taken 15 meters downstream from the discharge pipe, showing a reading of 9.22 NTU. Since this complied with the requirements, the pumps remained in operation.
- Station J
  - QM continued placing sandbags.
  - At 9:05 am, water is entering from the west side of the isolated area. The poly sheet did not cover the sandbags properly, and one sandbag is open and exposed to the water.
  - At 9:10 a.m., QM continued placing sandbags to tie in with Station K.
- Station K
  - The water level in the station was observed to have decreased.
  - Several points were identified where water was entering the station from the creek. QM addressed this by adding more sandbags and adjusting poly sheets. AE inspector recorded the condition and footage is available.

10:00 AM – 12:00 PM

- Visitor: AE Environmental – Naomi Sands on-site from 11:20 AM to 12:00 PM
- Water Testing:
    - At 10:12 AM, 6.28 NTU was measured at 5 meters downstream of the discharge pipe. QM was adjusting the fish cage as the water level within the station dropped.
    - At 11:14 AM, readings of 4.52 and 5.38 NTU were taken at the discharge pipes while dewatering continued at Station K.
- Station K
    - QM had to adjust the fish cage with a deeper sump due to lowered water level. They dug approximately 4 scoops with the excavator bucket.
    - Water was still entering the station at several points, which QM continued to address.
- Station J
    - 22 sandbags were hauled from Station E to Station J.

12:00 PM – 1:00 PM

- Station K
    - QM identified that the pumps were not operating at full capacity due to the intake pump suctioning against the steel bottom of the fish cage. As QM worked on resolving this issue, the water level rose significantly, returning to near-normal levels.
    - At 12:25 pm., QM needs to readjust the fish cage, they dug approximately 3 scoops with the excavator bucket.

1:00 PM – 3:00 PM

- Station K
    - After QM adjusted the fish cage and restored normal pump operation, the water level in the station dropped significantly by 26.5 cm.
- At Dale Road
    - The temporary access road was laid with gravel and had combigrid underneath, covering approximately 5 m x 17 m.
    - At 2:30 am crew left site (crew for the Dale Road).

3:00 PM – 5:00 PM

- Station K
    - QM was unsure whether the station met “dry” conditions and sought advice from EM.
    - QM informed AE inspectors that their upper management would contact the Department of Fisheries and Oceans (DFO) to assess the station’s “dry” condition.
    - At 3:30 PM, the pumps were shut down.
- Station J
    - With the pumps off at Station K, QM proceeded with completing the placement of sandbags. The sandbags were filled with sand from either Station L or Station K (sourced from the sump created for the fish cage).
    - At 3:57 p.m., QM filled 14 sandbags at Station K.
    - At 4:25 p.m., QM removed 3 steel plates from the isolated area of Station K. 6 steel plates remained.

- General
    - QM consulted the AE inspectors on the work limits for Site 17, asking if AE inspectors could:
        - Mark down the work extent for QM, including the starting and ending points.
        - Provide the coordinates for the starting and ending points.
    - QM also asked for clarifications on the sand recovery stations B-2/B-3/C-2, inquiring if AE inspectors could:
        - Lay out the sand recovery stations.
        - Provide the lengths and coordinates for each station.
    - AE inspectors advised QM to submit a Request for Information (RFI) for further clarification on these questions.
- QM shut down for the day at 5:00 PM.
- EM placed minnow traps at Station J.
- AE inspectors left site at 5:20 PM.


W
NW
N
240
270
300
330
0
304°NW (T) 49°11'44"N, 122°15'14"W ±9ft 15ft
Station K - Contractor
Attempting to Stop Water
Entering by Adding a Sandbag
Site 14/17
05 Sep 2024, 09:56:13


SW
W
NW
210
240
270
300
259°W (T) 49°11'44"N, 122°15'14"W ±9ft 13ft
Station K - Contractor Digging into the Station to Adjust Fish Cage
Site 14/17
05 Sep 2024, 10:09:39


SE
S
SW
150
180
210
240
197°S (T)
49°11'45"N, 122°15'14"W ±9ft
28ft
Station K - EM Measuring
Sandbag Berm Dimensions
Site 14/17
05 Sep 2024, 14:10:46


W
NW
N
240
270
300
330
0
308°NW (T)
49°11'45"N, 122°15'14"W ±9ft
25ft
Station J - Contractor
Continued Placing Sandbags
Site 14/17
05 Sep 2024, 15:57:24

TECHNICAL MEMORANDUM

Issue Date:	September 10, 2024	**File:**	Audit No. 2
To:	**Thyren Jacobs, Flood Debris Management Secretariat**	**Previous Issue Date:**	
From:	Naomi Sands, R.P.Bio.		
Client:	Ministry of Environment and Climate Change Strategy		
Project Name:	Lagace Creek Bank Protection and Sediment Removal - SCR14	**Project No.:**	2022-2632-03
Subject:	Environmental Compliance Audit		
Monitoring Period:	August 30 – September 5, 2024		
Contractor:	QM Environmental		
Environmental Monitor:	Keystone Environmental		

1 INTRODUCTION

Associated Environmental Consultants Inc, (Associated) is pleased to provide this environmental audit report summarizing observations of site conditions, environmental protection measures, regulatory compliance, and corrective actions as part of erosion protection works on Lagace Creek, south of Durieu, BC in the Hatzic Valley (the Project, the Site) during the monitoring period August 30 to September 5, 2024. The results presented in this audit report are based on conditions observed at the time of the audit inspection(s) and represent a snapshot of the workday. Items identified as non-compliant may have been addressed before the report(s) are submitted. The audit report(s) are submitted to the owner, their agent (Associated Engineering), the Contractor, and their environmental monitor (EM) and are not intended for further distribution.

2 ROLES AND RESPONSIBILITIES

The prime contractor for the Project is QM Environmental. (the Contractor), and works are being monitored for environmental compliance by Keystone Environmental (Keystone) and audited by Associated. As the EM, Keystone is to work with the Contractor to develop measures to protect the environment and to respond to environmental incidents as they occur. Keystone is also responsible for fish and wildlife salvages prior to instream works. Leq'á:mel First Nation (LFN) is the cultural monitor for the Site. The responsibility of the auditor is to ensure on behalf of the owner, who is ultimately the permit holder, that the EM, LFN, and the Contractor adhere to the requirements of the Construction Environmental Monitoring Plan (CEMP)[1], environmental permit conditions and any applicable regulations.

3 SITE INSPECTION

A summary of site conditions as observed during the audit inspection completed during the monitoring period is provided in Table 3-1. Monitoring reports have been submitted for the auditing period.

[1] AquaTerra Environmental Ltd. 2024. Hatzic Emergency Program, South Herford Creek Project, Construction Environmental Management Plan (Rev. 1). Prepared for Mission Contractors Ltd. 65 p.

Table 3-1 Site Conditions During Audit Inspection

Date / Time	Auditor (Associated)	Weather	Construction Activities
September 5, 2024 11:10	Naomi Sands	Sunny. 26°C. No precipitation.	Crew was attempting to isolate and dewater Station K (south of Dale Road).

4 INSPECTION RESULTS

A checklist of required environmental protection measures and mitigative strategies for the Project is presented in Table 4-1. The checklist has been developed in accordance with terms and conditions of the environmental permits and approvals issued for the Project, environmental protection specifications and requirements as part of the construction contract for the Project, the Contractor's Construction Environmental Management Plan and environmental best management practices and guidelines.

Table 4-1 Summary of Environmental Protection Measures Reviewed and Results of the Inspection

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
	Environmental Monitoring					
1	The EM will attend key site meetings where environmental mitigations and issues may be discussed.	☒Compliant ☐Non-Compliant ☐N/A	EM has been on site daily to attend site meetings.		CEMP Section 2.4	
2	The EM shall supervise all instream works. If temporary diversion installed, EM is onsite daily to check pumps and flow bypasses.	☒Compliant ☐Non-Compliant ☐N/A	EM was onsite to conduct salvage and oversee dewatering attempts.		WSA (h)2.ii, (j)5.i CEMP Section 2.4	
3	The EM will submit daily and bi-weekly monitoring reports to the Contractor for distribution to MoECCS.	☒Compliant ☐Non-Compliant ☐N/A	Monitoring reports are submitted daily, or the following morning.		CEMP Section 5.1	
4	The EM will complete and submit an Environmental Incident Report (EIR) for non-compliances with the CEMP, reportable spills or other environmental incident.	☐Compliant ☐Non-Compliant ☒N/A	No reportable environmental incidents have been documented to date.		CEMP Section 4	
5	EM is granted authority to stop the work if necessary	☒Compliant ☐Non-Compliant ☐N/A	EM has not exercised stop work to-date.		WSA (i) 7 CEMP Section 2.4	
	Erosion and Sediment Control					
6	Appropriate site isolation is installed as required, including silt fencing prior to instream works. Silt fences are installed properly, intact, adequate, clear of accumulated sediment and are functioning.	☐Compliant ☒Non-Compliant ☐N/A	Instream isolation is not adequate to support dewatering attempts. Water is leaking under and between the sandbags.	Contractor has request ENV seek amendment to permits to allow dredging in the wet.	WSA (o), (q) CEMP Section 3.5	Photo 1
7	Riprap or any other engineering material place in channel is clean of any substances deleterious to aquatic life.	☐Compliant ☐Non-Compliant ☒N/A	No riprap or other material was being placed during the audit.		WSA (x) CEMP Section 3.5	
8	Stockpiling and storage areas are located 15 m from the watercourse TOB.	☒Compliant ☐Non-Compliant ☐N/A	Sediment stockpiles are located >15 m from the watercourse OR have silt fence installed around the base.		DFO FAA WSA (t) CEMP Section 3.5	Photo 2 Photo 3
9	Emergency ESC material onsite (e.g., 100 feet of silt fencing, 5 dry bales, and 100sq.m of ECBs/ Coconut matting, or polyethylene sheets)	☒Compliant ☐Non-Compliant ☐N/A	ESC materials were stockpiled at the site laydown.		CEMP Section 3.5	
10	Sediment removed from the Site will be disposed of appropriately at a location approved by the EM and MoECCS.	☐Compliant ☐Non-Compliant ☒N/A	Excavated sediment is currently being stockpiled onsite.	Identify sediment disposal location(s) in the CEMP and/or the environmental monitoring reports.	CEMP Section 5.5	
11	Sediment removal boundaries must be clearly delineated prior to commencement of work.	☐Compliant ☐Non-Compliant ☒N/A	No sediment removal occurring at time of inspection.		WSA (opening)	
	Invasive Plant Management					
12	Ensure that machinery is free of invasive plant material that could potentially be transported throughout or between sites.	☐Compliant ☐Non-Compliant ☒N/A	No machinery observed leaving site during inspection.		WSA (opening) CEMP Section 3.4	

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
13	Ensure that invasive species removed from site are disposed of appropriately at an approved facility	☐Compliant ☒Non-Compliant ☐N/A	Japanese knotweed was bagged onsite awaiting offsite disposal. It appears that knotweed has been cut to ground, but not yet treated with herbicide. Knotweed management protocols are not clearly understood nor documented in monitoring reports.	Ensure knotweed management adheres to approved BMPs and contract, and document methodology.	WSA (opening) CEMP Section 3.4.1	Photo 4
14	The Project site shall be regularly monitored by the EM for invasive plant infestations and these infestations will be mapped and managed according to applicable species-specific BMPs.	☐Compliant ☒Non-Compliant ☐N/A	EM appears to be overseeing invasive species management, however, knotweed is not being managed according to the BMPs and approved methods.	Where knotweed is pruned, stems left in ground are to be injected with approved herbicide suitable for use in riparian area.	CEMP Section 3.4.1	
16	Knotweed stems are cut close to the ground and contained on poly sheeting away from the immediate work area. Cut knotweed is covered with woven geotextile fabric and crushed rock prior to machine access. Knotweed stems are injected with an appropriate herbicide before being covered.	☐Compliant ☒Non-Compliant ☐N/A	Cut knotweed was bagged awaiting offsite disposal. Herbicide injection was not being done during the audit visit.	Confirm if stem injections are occurring as required. Confirm disposal site.	CEMP Section 3.4.1 Addendum 1 to the Contract Documents for the Hatzic Emergency Works Program - Lagace Creek – Sites S-CR-14/17	
	Waste Management					
17	Dispose of all anthropogenic debris removed at an appropriate waste management facility.	☒Compliant ☐Non-Compliant ☐N/A	Garbage / debris is starting to accumulate around site.	Ensure site is cleaned daily.	WSA (opening) CEMP Section 5.5	
18	Non-hazardous waste stored appropriately and removed offsite daily.	☒Compliant ☐Non-Compliant ☐N/A	No non-hazardous waste was observed during the audit.		CEMP Section 5.5	
19	Hazardous waste stored > 30 m of watercourses.	☒Compliant ☐Non-Compliant ☐N/A	Portable toilet is located at the site laydown, more than 30 m away from watercourses.		CEMP Section 5.5	
20	Secondary containment used for all stored hazardous waste.	☐Compliant ☒Non-Compliant ☐N/A	Portable toilet was not in secondary containment.	Add secondary containment to portable toilet.	CEMP Section 3.6	Photo 5
	Spill Control and Emergency Response					
21	Machinery operating in channel is equipped with environmentally friendly oil	☒Compliant ☐Non-Compliant ☐N/A	Excavator on site has a sticker confirming that it contains Environ™ biodegradable, non-toxic hydraulic fluid.		WSA (p) 4 CEMP Section 3.6	
22	Equipment and machinery are free of leaks	☒Compliant ☐Non-Compliant ☐N/A	No leaks were observed during the audit. Equipment appeared to be clean.		WSA (p) 1 CEMP Section 3.6	
23	Drip trays are available and used during refueling and equipment maintenance	☒Compliant ☐Non-Compliant ☐N/A	Equipment was actively working during the audit. Spill trays were observed around site.		CEMP Section 3.6	
24	Fuel is stored > 30 m from Lagace Creeks and any connected drainages	☒Compliant ☐Non-Compliant ☐N/A			WSA (p) 3 CEMP Section 3.6	
25	Machinery and vehicles operating onsite are equipped with spill kit.	☒Compliant ☐Non-Compliant ☐N/A	Large spill kit at site laydown was low on materials. Stocked spill kit provided near active work area.	Ensure that spill kits are fully stocked at all times.	WSA (p) 2 CEMP Section 3.6	

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
26	Should suspected contaminated material be encountered (i.e., soil emitting olfactory cues indicative of hydrocarbon fuel), works should temporarily halt for investigation.	☐Compliant ☐Non-Compliant ☒N/A	No suspected contaminated material has been reported to date. EM has collected sediment samples from each of the sand recovery stations and submitted to ALS Environmental for chemistry analysis.		CEMP Section 2.5	
27	Refuelling of machinery is conducted on level ground over a spill tray.	☒Compliant ☐Non-Compliant ☐N/A	No refuelling was observed during the audit.		CEMP Section 3.6	
	Riparian Area Management					
28	Stockpile LWD and root wads removed from channel for use in site restoration	☐Compliant ☐Non-Compliant ☒N/A	No LWD or root wads stockpiled onsite.		CEMP Section 3.3	
29	Construct access points and approaches perpendicular to the watercourse;	☒Compliant ☐Non-Compliant ☐N/A			DFO FAA CEMP Section 3.2	
	Instream Works					
30	The EM shall ensure that instream works are isolated from flow and that measures are in place to protect fish and fish habitat, and to mitigate the migration of sediment downstream.	☐Compliant ☒Non-Compliant ☐N/A	EM reports from Aug 31, Sep 1 and Sep 2 show dredging of sediment in the wet occurring.	Provide adequate instream isolation and appropriate equipment to effectively dewater work area.	WSA (j) CEMP Section 3.1	
31	Pumps and flow bypasses are in proper working condition	☒Compliant ☐Non-Compliant ☐N/A	Pumps appear to be in proper working condition.		WSA (j) 5 CEMP Section 3.1	
32	Instream works conducted in the dry / isolation of flow	☐Compliant ☒Non-Compliant ☐N/A	Instream works had been conducted in the wet during the audit period.	Ensure work area is adequately isolated and dewatered prior to excavating sediment.	WSA (o) CEMP Section 3.1.1	
	Water Quality					
33	Water quality is routinely monitored upstream and downstream of the work area, every day that instream works are occurring Instream water quality is compliant with provincial criteria[2]: **Turbidity**: - <8 NTU from background at any one time for a duration of 24 h in clear waters; - < 5 NTU from background when background is 8 – 50 NTU; - <10% from background when background is > 50 NTU. **pH:** 6.5-9.0	☒Compliant ☐Non-Compliant ☐N/A	EM is routinely monitoring water quality, and halting instream works where short-term exceedances are noted. Sediment curtains have been installed downstream of instream works. Excavated sediment is being used to fill the sandbags that are installed for instream isolation. Occasionally the sandbags tip over or rip when being relocated, resulting in localized turbidity.	The contractor must exercise due care when handling sandbags instream and the EM to provide appropriate guidance to mitigation any potential risk to fish and fish habitat.	WSA (s) CEMP Section 3.1.2	
	Fish and Wildlife Protection					
34	Full time monitoring for fish during instream works is occurring.	☒Compliant ☐Non-Compliant ☐N/A	EM is onsite full time		WSA (j) 6 CEMP Section 2.4	

[2] British Columbia Ministry of Environment and Climate Change Strategy. 2024. British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture - Guideline Summary – August 2024. Water Quality Guideline Series, WQG-20. Prov. B.C., Victoria B.C. Available at: https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-guidelines/approved-wqgs/wqg_summary_aquaticlife_wildlife_agri.pdf. Accessed August 2024.

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
35	Fish salvages are conducted in advance of instream works where required.	☒Compliant ☐Non-Compliant ☐N/A	EM is conducting salvages in advance of sediment excavation.		CEMP Section 3.1 WSA (j) 6	
36	Salvaged fish are relocated back to the same watercourse in a nearby area that is not impacted by construction or removal works or its zone of influence	☒Compliant ☐Non-Compliant ☐N/A	EM is relocating fish outside the isolated work zone.		DFO FAA Section 2.2.4	
37	Pump intakes are screened for fish and aquatic species in accordance with the "Interim code of practice: End-of-pipe fish protection screens for small water intakes in freshwater"	☒Compliant ☐Non-Compliant ☐N/A	Conditionally compliant - pumps were situated within a mesh box. EM report dated Aug 31 notes that pump was field-fitted with a minnow trap as a fish-friendly screen.	Pumps should be fitted with appropriate fish exclusion screens designed for the intended purpose.	WSA (j) 5.ii DFO FAA Section 2.4.9 CEMP Section 3.1.1	Photo 6
38	Obtain required permits prior to salvage(s).	☒Compliant ☐Non-Compliant ☐N/A	EM has obtained salvage permits.		WSA (Opening) CEMP Section 3.1	
39	EM is on site during disturbance to riparian vegetation and conducting pre-clearing breeding bird surveys prior to clearing.	☒Compliant ☐Non-Compliant ☐N/A	EM is conducting nest surveys at stations as required.		CEMP Section 3.2	
40	Instream works are conducted so as not to lead to fish stranding or other impacts to fish. The works shall not result in depressions that have the ability to trap fish and other aquatic life. Fish passage is maintained where practicable and in accordance with applicable permits.	☒Compliant ☐Non-Compliant ☐N/A	Instream works have been designed to maintain fish passage after completion. Upstream fish passage is impeded due to turbidity curtain installed across the channel.	EM must be monitoring for fish full-time and should have a plan for moving adult fish upstream around the work area, if observed staging below the work zone.	WSA (j) 6 (iii) WSA (u) DFO FAA Section 2.4.2 CEMP Section 3.1.1	
	Restoration Requirements					
41	Restoration plans prepared by EM for disturbed area and implemented with EM oversight	☐Compliant ☐Non-Compliant ☒N/A	Restoration plans have not been prepared yet.		WSA (w) CEMP Section 3	
42	All temporary works shall be removed on completion of the project, and the stream channel restored to its natural condition	☐Compliant ☐Non-Compliant ☒N/A	Work is still in progress.		WSA (v) CEMP Section 3	

5 DISCUSSION

5.1 Non-Compliant Items

Knotweed management

Addendum 1 to the Contract Documents for the Hatzic Emergency Works Program - Lagace Creek – SITES S-CR-14/17 requires that trimmed knotweed stems are injected with an appropriate herbicide.

Recommended action: Provide documentation of knotweed management and ensure it adheres to approved BMPs. Confirm if knotweed stems have been injected with appropriate herbicide.

Portable toilet without secondary containment

A portable toilet located at the site laydown adjacent to Dale Road did not have secondary containment. Although the toilet was more than 30 m away from the watercourse, secondary containment would prevent any potential spills from spreading beyond the immediate area.

Recommended action: Add secondary containment to portable toilet.

Dredging of sediment occurring in the wet

The emergency *Fisheries Act* authorization requires that instream works are conducted in the dry. EM reports from Aug 31, Sep 1 and 2 show dredging of sediment in the wet.

Recommended action: Contractor must adhere to the conditions of existing environmental permits and seek amendments where necessary. Works must be completed in adherence to applicable permits until amendments are approved.

5.2 Conditionally Compliant Items

Pumps to be fitted with fish screens per DFO's end-of-pipe specifications

Based on the Aug 31 EM report, pumps have been field-fitted with minnow traps to function as fish exclusion screens and may not be suitable for this purpose.

Recommended action: Pumps should be equipped with fish exclusion screens that have been designed for the intended purpose.

6 SUMMARY

A list of environmental issues outstanding to date is provided in Table 6-1, below.

Table 6-1 Tracking Table of Environmental Issues Outstanding to-Date (project commencement August 12, 2024)

Item #(s)	Issue	Date(s) Observed	Recommended Corrective Action(s)	Responsible Party
2	Knotweed material outside poly sheet containment, no herbicide treatment	August 29, 2024 September 5, 2024	Ensure that all knotweed cuttings are confined to poly sheeting. Apply herbicide to remaining stems, as appropriate. Document methodology and ensure it adheres to approved BMPs.	Contractor/EM
3	Portable toilet without secondary containment	August 29, 2024	Add secondary containment to portable toilet.	Contractor
4	Inadequate instream isolation and failed dewatering attempts resulting in instream works conducted in the wet.	August 31, 2024 September 1, 2024 September 2, 2024 (EM reports)	Need to provide adequate isolation and dewatering to maintain dry work area OR obtain permission to dredge in the wet	Contractor

Note: Items marked with an asterisk (*) were reported by the EM.

7 CLOSURE

We trust that the information in this memo is sufficient for your present needs. Should you have questions, please do not hesitate to contact the undersigned.

Prepared by:

Naomi Sands, R.P.Bio.
Environmental Scientist

Reviewed by:

Jennifer Privé, R.P.Bio.
Manager, Environmental Sciences

NS/JP

Attachments:
- Site Photographs

Attachment 1: Site photographs taken during audit visit on September 5, 2024.

Photo 1: Instream isolation and dewatering attempts are unsuccessful. 		**Photo 2: Soil stockpile < 15 m from watercourse with silt fence surrounding.** 
Photo 3: Soil stockpile >15 m from watercourse 		**Photo 4: Knotweed bagged onsite awaiting offsite disposal.** 
Photo 5: Portable toilet requires secondary containment. 		**Photo 6: Pump intakes in mesh cage.** 

Table A2: Tracking Table of Resolved Non-Compliance Issues

Item #(s)	Issue	Date(s) Observed	Date Corrected	Corrective Action(s)	Responsible Party
1	Environmental monitoring reports not received daily	August 29, 2024	September 5, 2024	Monitoring reports received daily, or following morning.	EM

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: September 5, 2024
Weather: Low 14°C, High 31°C; cloudy in the early morning, then sunny for the rest of the day

- 07:30 - Environmental Monitors (EMs) arrived on site.
- 07:35 - EMs began retrieving 9 traps from Station K and 1 trap from Station J. The trap at Station J was set for preliminary survey purposes, not for salvage, as Station J was not yet fully isolated.
- 07:45 - Two dewatering pumps were operational on-site; however, one pump was not running at its maximum capacity.
- Discharge outlets were equipped with sediment filter bags at the end of the pipe to diffuse energy and minimize turbidity issues.
- One discharge was placed on the stream bank with poly sheeting underneath and behind a silt curtain.
- The other discharge was positioned 35 m downstream of the first one in a riparian vegetation area. This discharge was eventually directed to the stream via a poly and rock spillway.
- 08:03 - Fish salvage results were as follows:
    - Two (2) prickly sculpin
    - Six (6) three-spined stickleback
    - One (1) pumpkinseed sunfish (euthanized)
- 08:12 - The contractor excavated a sump to situate the fish protection cage in a deeper location, allowing pump intakes to draw out more water efficiently and achieve required working conditions. EM monitored the work; no adverse impacts to fish or fish habitat were observed. Turbidity-related issues were not observed as sediment settled quickly.
- 08:30 - Access road construction and Japanese knotweed pruning work commenced at Station B.
- 08:43 - A United Rental Technician arrived on site to maintain and inspect the malfunctioning pump.
- The pump was successfully repaired and now operates at full capacity.
- 09:00 - The EM conducted a turbidity test at the far end discharge outlet (where discharge was placed in the riparian area and directed toward the constructed spillway) and observed a turbidity plume. However, measured turbidity remained compliant, staying within the 8 NTU above background level threshold. The initial flush from the pump, now running at full capacity, may have mobilized sediment from the stream bank. EMs recommended installing a second turbidity curtain downstream to mitigate any potential turbidity issues as pumping continued.
- 09:15 - The contractor continued installing sandbags and road plates to further reinforce the sandbag isolation and create a seal. However, underseepage flow posed a challenge in achieving water level reduction. The underseepage caused water to flow through the porous materials beneath the sandbags, which in turn began dislodging and transporting sediment outward. This can lead to erosion issues, potentially affecting the stability of the isolation structure.

- 10:00 - Turbidity plume was no longer observable.
- 10:50 - Second turbidity curtain was installed.
- 11:00 - EMs continued monitoring water quality throughout the day at hourly intervals.
- 12:20 - The contractor repositioned the pump intakes along with the screen protection cage at a deeper water level. Additional sandbags were placed to seal any interstitial gaps.
- 15:52 - EMs conducted an invasive species assessment on the east bank of Lagace Creek at Stations D and F.
- 16:00 - Despite maximum efforts to achieve "in-the-dry" conditions, the attempt was unsuccessful. Pumps were shut off for reassessment, and work was concluded for the day.
- 16:54 - EMs measured Dissolved Oxygen (DO) before setting minnow traps. Result: 9.03 mg/L
- 17:10 - 10 minnow traps were set in Station J.
- 17:50 - EMs visited Station B and documented that Knotweed had been pruned and disposed of in bulk bags.
- An access road was constructed using geofabric and geogrid overlaid with gravel to protect and separate machinery from plant material.
- 17:55 - EMs departed from the site.
- Water Quality Sampling Results:

Location	Time	Turbidity (NTU)
Discharge 1 (downstream from L)	8:17	8.10
Discharge 2 (downstream from K)	8:20	4.59
BG (Station I)	8:28	4.26
15 m downstream from discharge 1	9:05	9.23
15 m downstream from discharge 1	10:14	6.28
Discharge 2	10:27	6.33
Discharge 1	11:08	5.38
Discharge 2	11:10	4.52
Downstream from L	12:17	4.30
Downstream from K	12:21	4.40
Downstream from L	13:11	5.05
Downstream from K	13:16	5.34
Downstream from L	14:36	4.37
Downstream from K	14:40	5.40

Site Photos






September 05, 2024 9:44 a.m.


September 05, 2024 9:59 a.m.


September 05, 2024 11:04 a.m.


September 05, 2024 11:52 a.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

DAILY CONSTRUCTION REPORT

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	11
Project:	Legace Creek	**Page:**	1 of 6
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 6, 2024
Contract No.:		**Temperature:**	High: 31 Low: 19
Weather:	Clear skies. Winds light and variable		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Labour Force:

Quantum Murray (QM): 2 Site Superintendents, 2 Operators, 3 Labourers
Keystone Environmental/Environmental Monitors (KE/EM): John and Loc
Associated Engineering (AE): Jack Dai Tang, Vinizza Pingos

Contractor's Equipment:

2 - Hitachi ZX350LC-6 Long Reach
1 - DEERE 544K Wheel Loaders
2 – Tandem Truck
2 – 6" Vacuum Assisted Pumps (Not in operation)

Report, if, any, Contact with Occupants:

N/A

Contact with Owner:

N/A

Safety Concerns:

N/A

Testing:

No constant water sample testing was conducted as there was no pump in operation at Station K. EM performed one water testing at upstream and one water testing at downstream when the fallen sandbags were discovered at Station K.

Traffic Control:

Two traffic control vehicles
Two traffic control persons

Report:

7:00 AM – 7:50 AM

- Arrived at Site 14/17 at 7:00 AM
- Station K
    - No work was performed. QM indicated that they are awaiting DFO's response.
- Jem discussed coordinating with the owner of the land on the opposite side of Station D & F, as they plan to stock sandbags there. He also mentioned that they will be filling sandbags today.
- At 7:16 am, Keystone (Loc & John) arrived on site. Loc mentioned they will collect the fish trap at Station J today.
- At 7:20 am., Station L: Ongoing filling and hauling of bags from Station L to Station I.
- At 7:43 am., 10 bags have been hauled from Station L.
- At 7:50 am., No traffic management observed along Dale Road.

7:50 AM – 9:30 AM

- AE inspectors attended the daily site construction meeting.
    - It was noted that QM had submitted a field memo requesting clarification on Site 14 at Stations B2/B3/C2 and the extent of work at Site 17.
- At 8:55 am., AE Inspectors returned to site. Traffic management is in place on site along Dale Road.

9:00 AM – 12:00 PM

- Station I
    - QM filled up sandbags using sand materials from Station E and transported them to the sand recovery station at Station F.
    - At 9:00 am., 33 bags hauled from Station L.
    - At 9:27 am., began trimming and brooming.
    - At 9:45 am., QM completed trimming the area.
    - At 9:40 am., completed filling and hauling bag to Station I: 44 bags in total.
- Station H
    - At 9:48 AM, the QM excavator operator arrived at Station H and began trimming and brooming. The EM witnessed this and urgently requested the operator to stop the work, as it had not been authorized due to the presence of knotweed. However, the excavator made contact with the knotweed. The EM requested QM to brush and wash the excavator bucket at Station H as mitigation.
- Station F
    - QM mobilized one excavator to approach the existing sand recovery station.
    - At 11:45 AM, under EM's supervision, trimming and brooming were conducted to obtain access to the station.
    - QM noted that they had obtained approval from the landowner to remove the existing fences on the south bank. AE inspectors confirmed with QM that the fences will be reinstated with new ones once the work is completed at Station F.
    - An access road was built using sand materials extracted from Station E.
    - QM filled up sandbags using sand materials from Station E and transported them to the sand recovery station at Station F.
- Station B2/B3
    - QM continued to transport gravel materials to complete the access road to the stations.

- At 10:35 AM, it was observed that the culvert was covered by the gravel materials. QM was notified, and it was confirmed that the culvert will be cleared afterward.
- At 10:39 am., Glenn mentioned that approximately 16 loads have been delivered on site.
- Approximately 32 meters of length have been covered with gravel, Combigrid underneath.

12:00 PM – 2:30 PM

- Station D
  - QM noted that they had obtained approval from the landowner to remove the existing fences on the south bank. AE inspectors confirmed with QM that the fences will be reinstated with new ones once the work is completed at Station D.
  - QM began trimming and brooming to gain access to the station.
- Station F
  - QM continued filling sandbags with sand from Station E and transporting them to the sand recovery station at Station F.
- Station C2
  - The EM indicated that trimming and brooming could commence at Station C2, with careful consideration of the nearby knotweed.

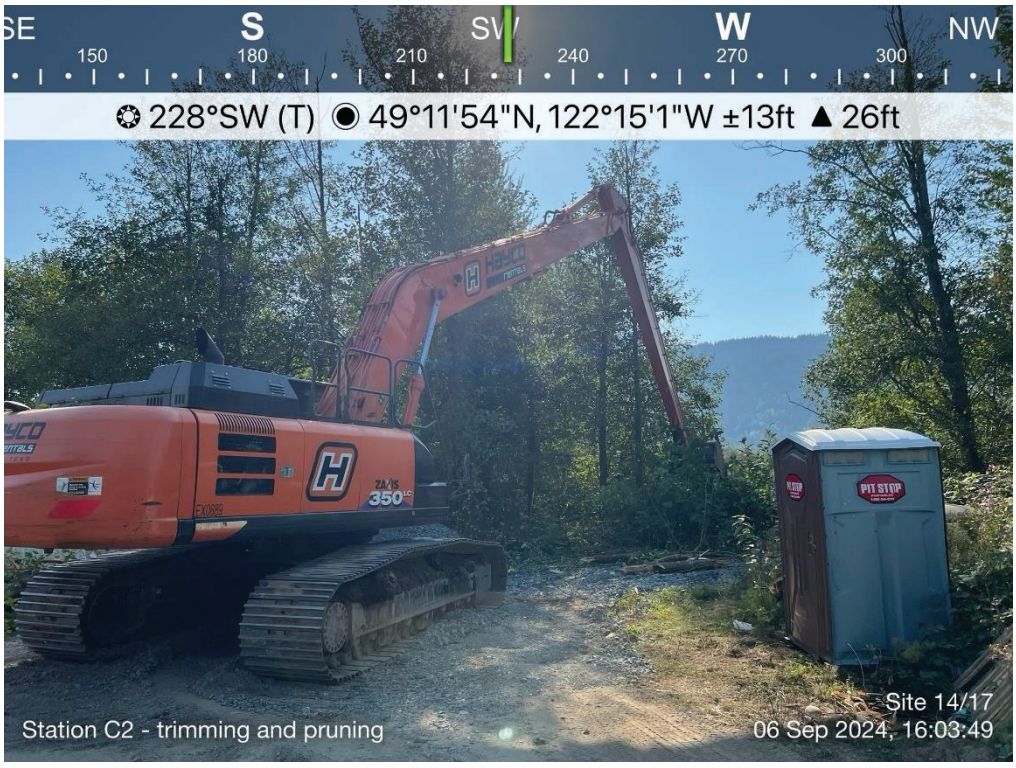
12:00 PM – 4:00 PM

- Station K
  - At 2:35 PM, AE inspectors and the EM arrived at Station K and observed that one of the sandbags had fallen, allowing water to flow into the station. The EM indicated that Station K was no longer isolated and would require environmental procedures (including but not limited to fish salvaging, placing minnow traps, and electrofishing) to meet the requirements.
  - The EM notified QM, and it was confirmed that QM would rectify the issue immediately.
  - AE inspectors observed that spill trays under the pumps (not in operation) were not placed properly. They notified the EM, who adjusted the spill tray and reminded QM to ensure spill trays are placed when equipment is not in operation.
- Station D
  - At 2:26 PM, AE inspectors and the EM observed a broken pipe at the access road on the southeast side of the creek, with minor outflow. The EM noted that the pipe had been discovered and documented previously but without any observed flow.
  - The water flowed toward the farmland, not into the creek.
- Station E
  - At 1:00 p.m., hauled the 18 bags from E to Station F.
  - At 1:05 p.m., began filling up the sandbags.
- Station F
  - Filled and hauled 30 sandbags from E to Station F.

- At the temporary access road
  - At 3:50 pm., Mel is fixing and clearing the culvert, which is covered with gravel.

4:00 PM – 5:00 PM

- Station K
  - At 4:20 PM, AE inspectors were unable to access Station K due to trimming and brooming at Station C2. AE inspectors contacted the EM, who confirmed that QM had placed the sandbag to re-establish the isolated area. The EM also conducted electrofishing within the isolated station.
- Station C2
  - At 4:00 PM, QM began trimming and brooming around Station C2 with the EM's authorization. Knotweed was identified in the area, but the EM advised QM to avoid it during the work.
- QM shut down for the day at 5:00 PM.
- AE inspectors confirmed that Station K had been re-established and left the site at 6:10 PM.


SE S SW W NW
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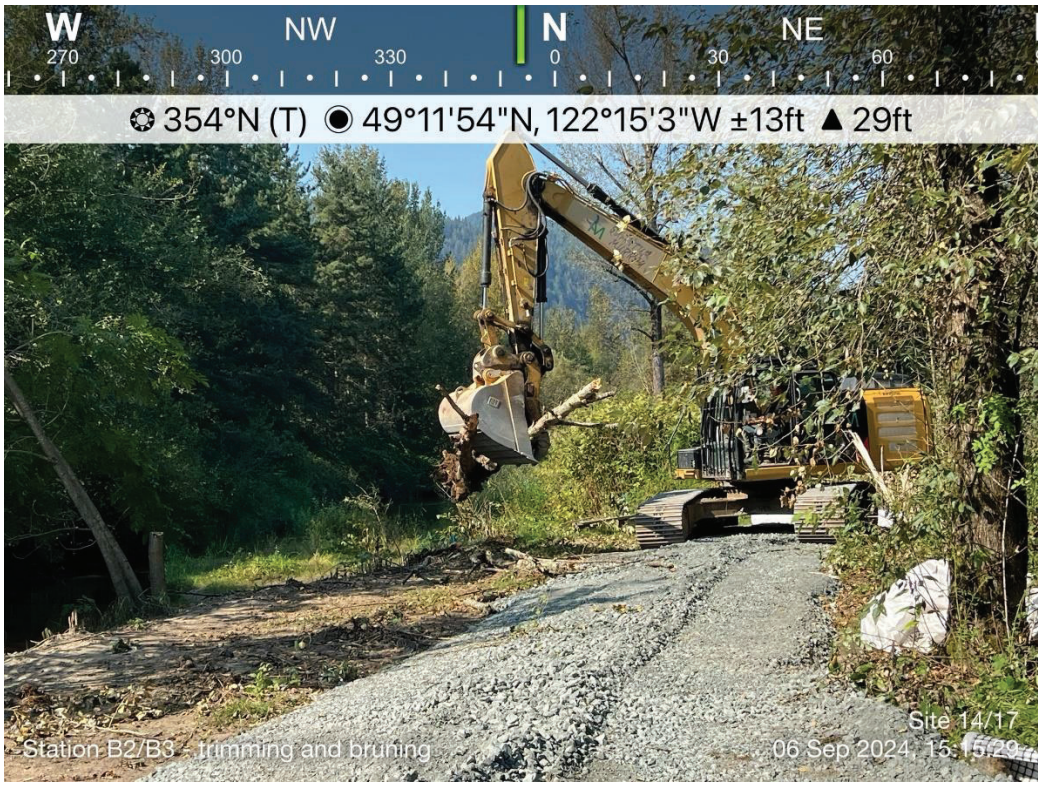
Site 14/17
Station C2 - trimming and pruning
06 Sep 2024, 16:03:49


W NW N NE
270 300 330 0 30 60
354°N (T) 49°11'54"N, 122°15'3"W ±13ft 29ft
Site 14/17
Station B2/B3 - trimming and pruning
06 Sep 2024, 15:15:29


S SW W NW
180 210 240 270 300 330
254°W (T) 49°11'49"N, 122°15'14"W ±13ft 26ft
Station H - Contractor Brushing and Washing Excavator Bucket
Site 14/17
06 Sep 2024, 10:10:03


E SE S SW
90 120 150 180 210 240
161°S (T) 49°11'44"N, 122°15'14"W ±13ft 20ft
Station K - Fallen Sandbag and no longer isolated station
Site 14/17
06 Sep 2024, 14:31:15

RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: September 6, 2024
Weather: Low 15°C, High 32°C; clear skies and sun throughout the day.

- 07:15 - Environmental Monitors (EMs) arrived on site.
- 07:20 – EM discussed with QM on grubbing work and the potential of collapse bank along the south side bank (farm side) at Station D and F where lock blocks were not installed.
- 07:45 - EMs began retrieving 10 traps from Station J.
- 07:50 - Two dewatering pumps were l on-site, located in proximity to Station K.
    - *In-stream work was not observed as the crew was waiting for permission to dig and updates on DFO authorization work condition.*
- 08:10 - Fish salvage results were as follows:
    - Four (4) prickly sculpins
    - One (1) Coho Salmon
- Fishes were released behind the 2nd silt curtain downstream from Station L
- 08:25 – EMs re-trapped Station J. Ten (10) minnow traps were set. DO = 8.84 mg/L
- 09:00 - Access road construction and Japanese knotweed pruning work continued at station B2, B3 and B. Geotextile and geo rids were used to build the access road. Gravels were placed on top of the georids (300) as per drawing to prevent disturbance of contaminated ground. Pruned knotweeds were observed storing in the sandbags to dispose off site.
- 09:26 – Grubbing work at station I commenced after Ems completed invasive species survey.
- 09:45-10:22 – Operator of the long reach machine unintentionally conducted grubbing work at station H, where knotweed was found just west of already grubbed area. EMs discussed with QM's crew and recommended them to clean the bucket with brushes and water prior to any grubbing work commence at station D and F. Ems documented the cleaning task and checked for any potential knotweed parts. The bucket was deemed clean shorty after and continued grubbing work at station F.
- 10:33 – BG sample collection ⍰ See table
- 11:22 – Grubbing work at station F on both sides commenced after EMs completed invasive species survey.
- 12:40 - Grubbing work at station D on the south side commenced after EMs completed invasive species survey
- 13:05 – More sandbags were made at station E.
- 13:10 - EMs conducted an invasive species assessment at Station C-2. No invasive species was observed within the footprinted.
- 14:31 – Sandbags on the downstream end of station K failed and a breach was observed. The Site was no longer deemed as isolated. QM was notified immediately.
- 14:40 – QM's crew was reminded that all equipment on Site is required to have spill tray in place to prevent any potential leakage during the duration of the project.

- 14:45 – EMs retrieved 10 traps in Station J. No fish was caught.
- 15:00 – QM reinstated Station K with sandbags.
- 15:48 – Isolation work for station K was completed.
- 16:00 - EMs conducted 2 passes of Electrofishing (Pass 1 = 496 seconds, pass 2 = 349 seconds). Second pass observed with significantly reduction in number of fishes.
    - Results: One(1) coho, Four (4) sculpins, and One (1) pumpkinseed sunfish (euthanized)
- 16:22 – QM commenced grubbing work at station C-2.
- 17:12 – EM set 10 minnow traps along the bank at station K.
- 17: 36 – EMs inspected all equipment on Site at the end of workday. Spill trays were observed in place.
- 17:40 – EMs debrief with KEL's PM.
- 18:00 – EM left the Site
- Water Quality Sampling Results:

Location	Time	Turbidity (NTU)
BG (The Bridge)	10:33	3.93
Downstream from L	14:40	5.41

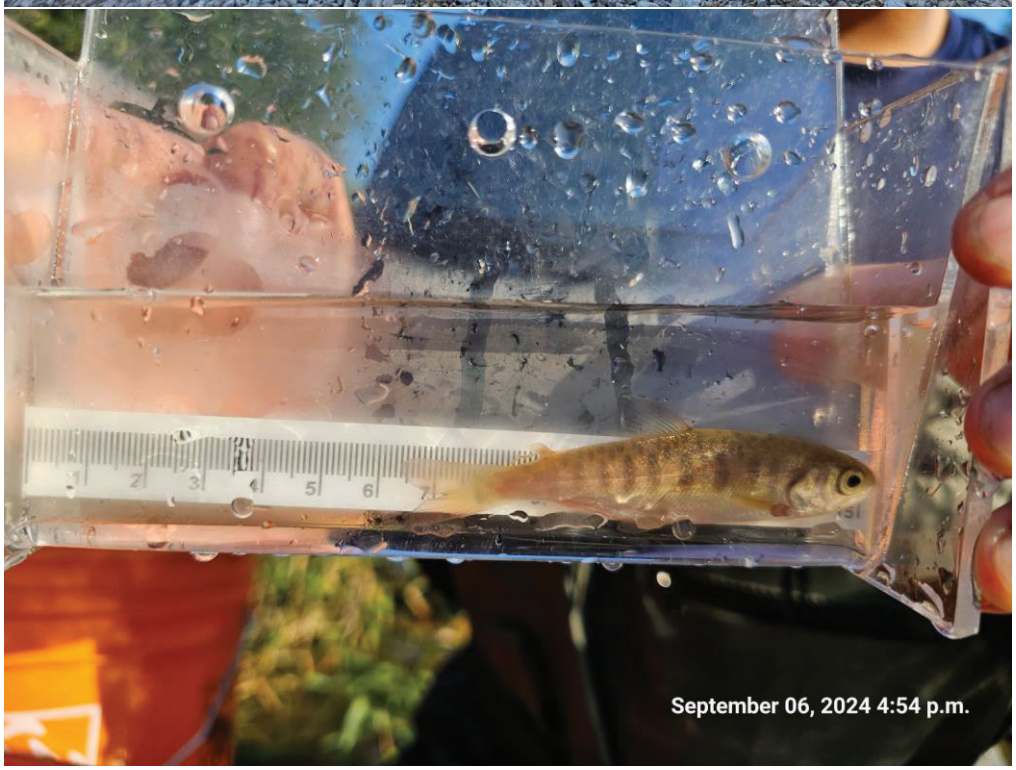
Site Photos




DEERE
SPILL KIT
September 06, 2024 5:25 p.m.


September 06, 2024 2:30 p.m.


September 06, 2024 5:27 p.m.


September 06, 2024 4:54 p.m.


September 06, 2024 5:26 p.m.


HAYCO
rentals
September 06, 2024 9:32 a.m.


September 06, 2024 5:15 p.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

DAILY CONSTRUCTION REPORT

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	12
Project:	Legace Creek	**Page:**	1 of 5
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 7, 2024
Contract No.:		**Temperature:**	High: 27 Low: 16
Weather:	Clear skies, winds light and variable		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Labour Force:

Quantum Murray (QM): 2 Site Superintendents, 2 Operators, 3 Labourers
Keystone Environmental/Environmental Monitors (KE/EM): Loc and Curbin
Associated Engineering (AE): Jack Dai Tang, Vinizza Pingos

Contractor's Equipment:

2 - Hitachi ZX350LC-6 Long Reach
1 - DEERE 544K Wheel Loaders
2 – 6" Vacuum Assisted Pumps (Not in operation)

Report, if, any, Contact with Occupants:

N/A

Contact with Owner:

N/A

Safety Concerns:

N/A

Testing:

N/A

Traffic Control:

N/A

Report:

7:00 AM – 7:50 AM

- Arrived at Site 14/17 at 7:00 AM
- At 7:00 AM, hauling of sandbags from Station I to Station F (on the other side) was ongoing.

carbon neutral since2009

BEST MANAGED COMPANIES Platinum member

- At 7:50 AM, AE inspectors confirmed with QM the plan for the day. QM indicated they would finish placing sandbags up to Station F, proceed with general site cleanup, and likely shut down the site early. No work is anticipated tomorrow. (September 8th, 2024)
- Station K
    - No work was performed. QM mentioned they are still awaiting a response from DFO.
- Station F
    - At 7:20 AM, AE inspectors observed that sandbag placement in the stream was approximately 25% complete. AE inspectors did not capture the action nor the EM and were unable to determine when the sandbags were placed. The EM later confirmed that QM placed the sandbags near the end of the day on September 6th, 2024. At that time, the EM was working on electrofishing at Station K while AE inspectors were at Station C2 documenting trimming and pruning activities. The EM admitted that they authorized QM to place sandbags into the stream at Station F if the EM is on site. EM was on site but in Station K.

7:50 AM – 9:00 AM

- AE inspectors attended daily site construction meeting.
    - AE inspectors were instructed to confirm with the EM regarding chemical treatment for knotweed.
    - AE inspectors were reminded to take photos of the stations at the end of the day.

9:00 AM – 12:30 PM

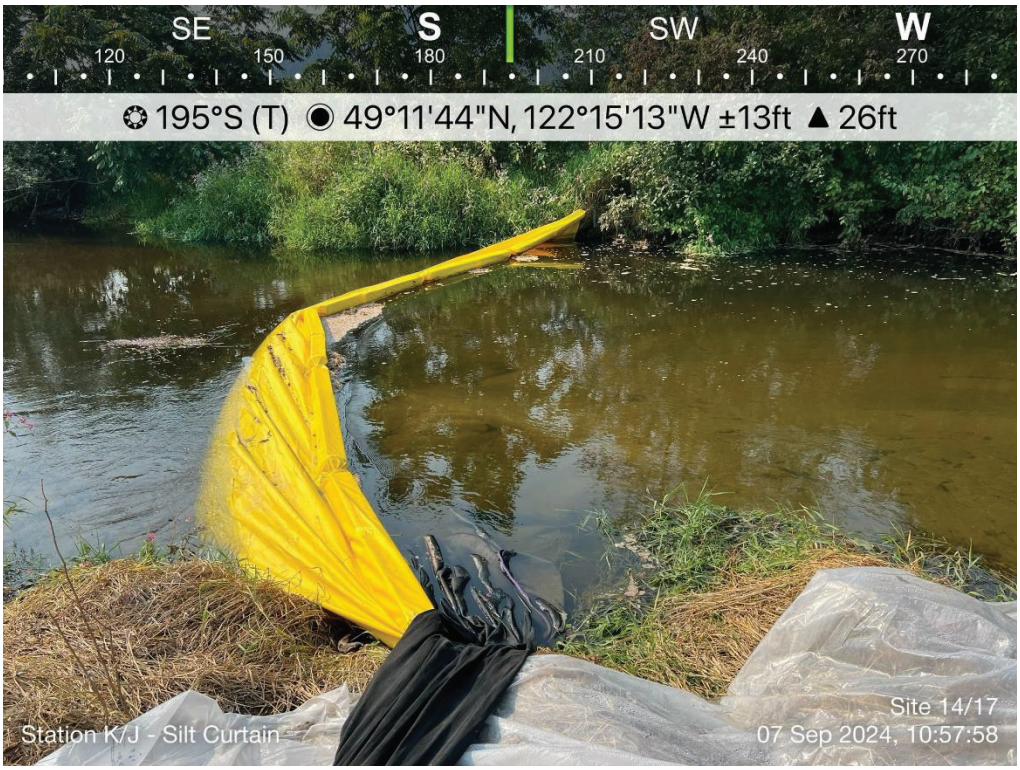
- Station F
    - At 9:00 AM, AE inspectors observed QM continues to place sandbags into the stream for isolation.
    - At 9:30 AM, AE inspectors noted that excavators were operating on both sides of Station F. AE inspectors confirmed with the EM that QM had been reminded that the excavators should only operate at the sand recovery stations, which are designed to support the load and prevent bank failure. AE inspectors directly reminded QM again of this requirement and emphasized the potential consequences of bank failure, such as fines from the DFO.
    - At 10:35 AM, the excavator on the other side (without SRS) completed placing the sandbags and then mobilized to Station L for general cleanup on site.
    - The QM superintendent mentioned that a relevant RFI had been submitted to AE regarding working from both sides of the creek at Station D/F. When asked if a response had been received, the QM superintendent stated that he was unaware of any response but decided to proceed with the work on both sides of the creek at Station F.
    - At 11:25 AM, QM began placing a silt fence and poly sheet beside the lock block, extending to the end of the cleared area.
    - At 11:50 AM, approximately 95% of the isolation was completed. QM noted that they left an open area since they are not digging yet, allowing water to pass through.

- Station B
    - At 9:37 AM, AE inspectors, the QM superintendent, and the EM conducted a walkthrough of Station B. It was observed that there was an excessive amount of knotweed. The QM superintendent consulted the EM on removal procedures. The EM recommended trimming the knotweed stems, disposing of them appropriately, and then placing geotextile and gravel as required.

- General
    - At 9:13 AM, AE inspectors consulted with the EM regarding knotweed mitigation procedures, including the use of chemical treatment.
    - The EM explained three (3) levels of approaches to deal with knotweed.
        1. Identify the extent of knotweed and work around it.
        2. Trim the stems, dispose of the knotweed properly, and place geotextile and gravel as required.
        3. Inject chemicals into the knotweed's stems. However, the EM noted that chemical treatment is the last resort, given the proximity to the stream. A special chemical is available for use near streams, but it is only accessible through the province.
    - At 10:35 AM, the EM discussed with AE inspectors on current environmental concerns:
        1. Some clearing and grubbing were done on the pathway to access the sand recovery station at Station F. The EM advised QM to implement ESC measures, such as silt fencing and tarps for runoff protection.
        2. The EM observed debris accumulating on the silt curtains downstream. The EM advised QM that the silt curtains are only required during sediment removal at the stations and can be removed when no work is being performed.
        3. As QM placed sandbags at Station F, the EM monitored water quality downstream every hour.
        4. QM is not expecting to work tomorrow (September 8th, 2024) and was advised by the EM to move the 6" pumps away from Station K as a precaution against oil spills into the stream.
    - QM conducted a general site clean up,
    - QM removed the silt curtains.

12:30 PM – 1:00 PM

- At 12:30 PM, QM shut down Site 14 for the rest of the day.
- At 12:40 PM, QM, EM, and AE inspector arrived at Site 17 to discuss upcoming work.
- QM indicated that they plan to begin work at Site 17 on Wednesday (September 11th, 2024).
- QM intends to use a hydrovac truck to complete sediment removal at Site 17 STA 3+750.
- QM emphasized the need for someone to mark the work limits at Site 17, STA 4+000. AE inspectors reminded QM to refer to the general notes on the construction drawings or submit a RFI if needed.
- QM confirmed that no work is planned for Sunday September 8th, 2024.


SE S SW W
120 150 180 210 240 270
195°S (T) 49°11'44"N, 122°15'13"W ±13ft 26ft
Station K/J - Silt Curtain
Site 14/17
07 Sep 2024, 10:57:58


NE E SE S
30 60 90 12 150 180 210
122°SE (T) 49°11'50"N, 122°15'9"W ±13ft 26ft
Station F - Placing Sandbags
Site 14/17
07 Sep 2024, 09:01:06



Station F: Placing sandbags from both sides (w/ and w/o SRS)



RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: September 7, 2024
Weather: Low 15°C, High 29°C; clear skies and sun throughout the day.

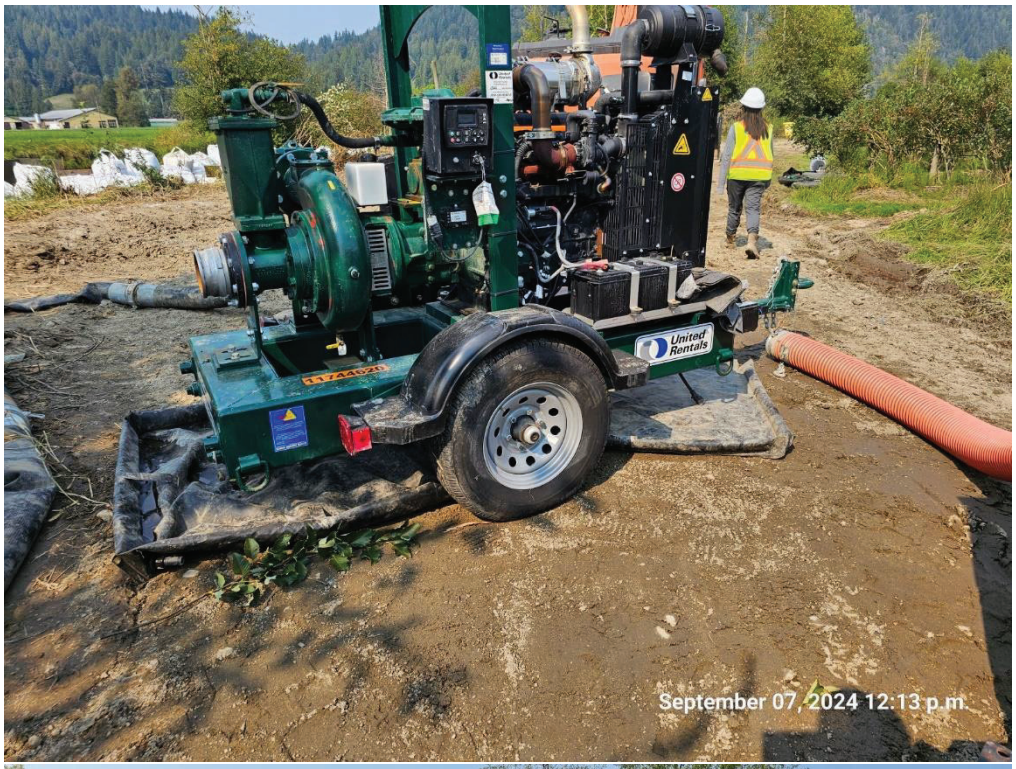
- 07:15 - Environmental Monitors (EMs) arrived on site. WQ was collected by EM throughout the day during instream work. See WQ table for more details.
- 07:30 – EA discussed with EMs and brought up concern that the contractor started placing sandbag instream prior to EM arrival. EMs discussed with QM and was informed that sandbags were placed on September 06, 2024, shortly after the grubbing work completion.
- 07:52 – QM commenced sandbag berms installation after EM collected Background Water Sample.
- 08:15 – EM pulled 10 traps from station K.
- 08:40 - Fish salvage results were as follows:
    - Six (6) prickly sculpins
    - One (1) Coho Salmon
    - Three (3) pumpkin seed (euthanized)
- Fishes were released downstream from Station L
- 09:06 – Loader moved sandbags from station I to F.
- 10:29 – EM was informed that there will be no work (to be confirm) on Sunday September 08. EM discuss with QM's personnel on current environmental concerns:
    - Exposed area at station F, resulting from grubbing work on September 06, required additional ESC measures such as silt fencing and poly sheeting to prevent potential runoff sediment.
    - EM observed debris accumulation by the silt curtain downstream from station K. Since there would be no excavation or water pumping, EM recommended that silt curtain could be removed and reinstall later when instream works commence.
    - Potential bank erosion where sandbags berm isolation located was brought up by the EM. Recommendation included installing road plates to protect the bank from potential erosion if deemed necessary.
    - All equipment stored on Site required spill tray in place (2 long reach excavators, 1 excavator and 1 loader). Two (2) 6 inches pumps shall be relocated away from the Creek and protected with spill trays.
- 10:50 – QM installed additional ESC measures at station F.
- 11:44 – QM cleaned up Site, removing used materials and trashes such as used poly sheeting, silt fencing etc. Pumps were relocated away from the creek and spill tray was installed.
- 11:45 – Sandbags placement work completed.
- 12:25 – EM received confirmation work will be canceled on September 08, 2024.
- 12:30 – QM crew, EAs and EM visited CR17 Site.
- 13:15 – End of Day. EM debriefed with PM and left Site shortly after.

- Water Quality Sampling Results:

Location	Time	Turbidity (NTU)
BG (The Bridge)	07:42	3.55
Downstream from G	08:17	2.87
Downstream from G	09:18	3.25
Downstream from G	10:52	5.06
Downstream from L	12:10	1.68

Site Photos




United Rentals
September 07, 2024 12:13 p.m.


September 07, 2024 11:47 a.m.


September 07, 2024 8:41 a.m.


September 07, 2024 12:07 p.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	9
Project:	Legace Creek	**Page:**	1 of 6
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 9, 2024
Contract No.:		**Temperature:**	High: 20 Low: 14
Weather:	Overcast/Drizzle		

September 9, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Mel), Jim, 2 operator, 2 labourers
Keystone Environmental: EM (John) (Kang)
Flaggers: 2

Contractor's Equipment:

-Equipment in Use

- CAT Excavator 324E
- Zaxis Excavator EX0689
- Zaxis excavator 2720
- Deer Loader 1466
- Pumping equipment: generator, 2 – 6" pumps.

Report, if any, Contact with Occupants:

10:30AM

- Discussion with land owner (Bob), AE (Jordan, Vinizza), Leq'a:mel (Melissa) –
- Bob owns land south of blueberry farm parcel (Jahoolie?). Land Bob owns is outside of construction zone.
- Bob expressed great concern with Jahoolie placing an electrical cord in the creek.
- AE (Jordan) – explained if it is outside of our construction zone, it is out of our control.
- Bob said electrical cord is south of SRS L.
- Leq'a:mel (Melissa) – only concern from today was drip tray not under and excavator that was parked.

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

10:20AM
- Discussion with Keystone (Kang) – lot of fish caught at SRS F, going to do more passes with electro-fisher.

4:30PM
- Discussion with Keystone (John) – SRS F is fish salvaged. Placed traps in for overnight, will check in morning but should be ready for excavation.

Discussions with Contractor:

7:00AM
- Toolbox QM (Mel) – Repairing bags at SRS K.
- Moving bags from K to F.
- Still need to excavate at K.
- EM's to inspect fallen bag at SRS K, station still need to be electro-fished.

7:10AM
- Discussion with QM (Jim) – bag from SRS K fell in yesterday when no one was on site.
- Going to re-install silt curtain D/S from SRS K.

9:50AM
- Discussion with QM (Jim) – need confirmation from DFO before beginning excavation today.
- Currently E-fishing at SRS F.
- Going to be filling additional sand bags at SRS E.
- Setting up silt fence opposite side of creek from SRS D.

10:30AM
- Discussion with QM (Jim) – AE (Jordan) expressed concern working in stream from opposite side of creek, excavator not operating on lock blocks.
- Jim – no excavation will take place from this side of creek, only sand bag placing.
- Jim – QM and Mert are aware of and bank failure will be on QM. Is confident the bank will hold and is monitoring it during bag placement.

Report:

7:00AM
- AE (Jordan, Vinizza) on site.
- Observation – a lot of clearing at SRS I. Keep in mind of work is being completed not directly on lock blocks.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

7:15AM
- Installing silt curtain D/S from SRS K.

8:00AM
- Site inspectors call at SCR 15/16 – AE (Jordan, Vinizza, Duncan, Cynthia, Jordon R).

9:45AM
- AE (Jordan) – back on site SCR 14.
- Electro-fishing at SRS F ongoing.

9:50AM
- Leq'a:mel (Melissa) on site.

10:50AM
- Filling sand bags at SRS E.
- Today's count 12, all flagged.

11:30AM
- Aggregate dump for temporary access road.
- 4 Truck loads today.

12:00PM
- AE (Jordan, Vinizza) – re-measure trimming in pruning at SRS stations.
- Station trimming and pruning have been expanded since measuring initially.
- Additional trimming due to sand bag placement from opposite side of creek, and for more area for excavator to move back and forth on lock blocks parallel to creek. (Both concerns have been flagged to QM by AE (Jordan)).
- SRS F – 18x32m
- SRS F Access – 7x40m
- Opposite side of creek SRS F – 9x14m
- SRS I – 22x8m
- SRS J and K combined – 12x37m
- SRS L – 24x4m.

12:30PM
- Clearing at SRS D
- Placing gravel on geotextile on knotweed that has been trimmed.
- Knotweed in area on either side of SRS.
- EM monitoring clearing.
- Trimming knotweed on sides of SRS, placing stems/leaves in empty metre bags.
- Keystone (John) – removal required so excavator can operate without hitting knotweed with bucket.
- John inspecting cleared areas.

2:00-4:00PM

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

- AE (Jordan) on site SCR 15/16.

4:30PM

- All groups leaving site.

Testing:

- None today.

Safety Concerns:

- None today.

Traffic Control:

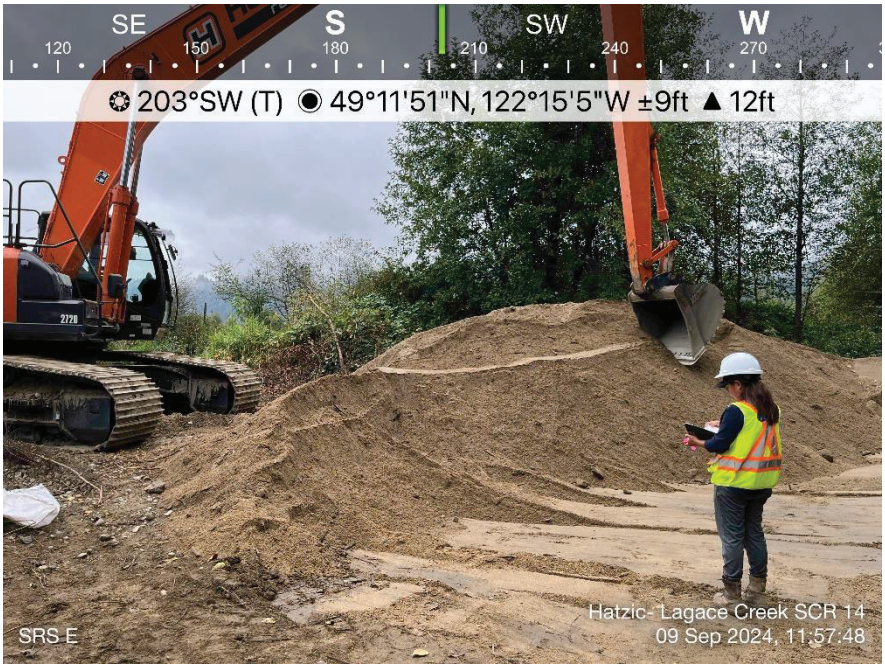
- Flaggers on Dale Road.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Photos:





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

DAILY CONSTRUCTION REPORT

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	13
Project:	Legace Creek	**Page:**	1 of 6
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 9, 2024
Contract No.:		**Temperature:**	High: 21°C Low: 14°C
Weather:	Sunny, Wind: 4 KM/H, Gusts: 13 KM/H		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Labour Force:

Quantum Murray (QM): 2 Site Superintendents (Mel & Jem), 3 Operators (Sandy, Glenn & Greg), 2 Labourers (Dallas & Rick)
Keystone Environmental/Environmental Monitors (KE/EM): Khang and John
Associated Engineering (AE): Jordan Fiske, Vinizza Pingos

Contractor's Equipment: Equipment in use

- Excavator 324E
- Excavator EXO689
- Excavator 2720
- Loader 1466
- 2 - 6" Vacuum Assisted Pumps

Report, if, any, Contact with Occupants:

N/A

Contact with Owner:

N/A

Safety Concerns:

N/A

Testing:

N/A

Traffic Control:

Green Valley Traffic Control provided traffic management along Dale Road near the bridge.

Report:

7:00 AM
- AE (Jordan and Vinizza) arrived on site.
- Traffic management was established on site.
- Hauling of sandbags from Station I to Station F continued.

7:15 AM
- Sign-in and toolbox.
- QM (Jem) reported that sandbags had fallen off at Station K. Today's work plan includes filling and hauling sandbags to Station F, awaiting the arrival of the DFO representative, and conducting fish salvage at both Station K and Station F.

7:19 AM
- Keystone (Khang & John) arrived on site.
- Station K:
    - AE inspectors observed that approximately 3-4 sandbags had fallen on the east side of the creek, in the same location as last week.
- Reinstalled turbidity curtains between Station L and Station K, and one downstream of Station L.

7:55 AM
- Attended daily construction meeting at Site 15.

8:30 AM
- AE (Vinizza) returned to site.

8:35 AM
- Station F:

Ongoing placement of sandbags.
- Station I:
    - 1 bag remaining.
- Station K:
    - 3 bags remaining.

8:38 AM
- Station K:
    - Keystone began electrofishing.

8:50 AM
- Station C2:
    - QM trimmed the area. AE inspector observed that a root had been pulled from the excavator.

9:28 AM

- Station F:
  - AE inspector observed that 1 bag (SE) had fallen off and sand had spilled. Additionally, 3 bags (center side) were not properly sealed and were exposed to water.

9:35 AM

- Station F:
  - Keystone began electrofishing.

9:50 AM

- Station F:
  - AE inspector informed QM about the fallen bottom bag and the exposed, improperly sealed bags. QM laborer responded that they would leave it as is, as it would be similar if removed.

9:56 AM

- Jem indicated that 10-12 bags would be built at Station E to be hauled to Station F and that a silt fence would be placed on the opposite side of Station D.

10:20 AM

- Station D (opposite side, without SRS):
  - QM installed a silt fence.

10:57 AM

- Station E:
  - Began filling and hauling sandbags from Station E to Station F.

11:30 AM

- Completed filling sandbags. 3 bags were hauled to Station F, and 9 bags remained at Station E.

11:57 AM

- Stations E & F:
  - AE inspectors flagged all filled and hauled bags.

12:00 PM

- Stations L, K, J, I, F:
  - AE inspectors measured the trimmed areas.
    Station F (opposite side): 9m x 14m
    Station F: 18m x 32m
    Station E to Station F (access road): 7m x 40m
    Station I: 8m x 22m
    Station J&K: 12m X 37m
    Station L: 4m x 24m

12:50 PM

- Station D:
    - QM trimmed knotweed and disposed of it in the bags.

1:30 PM

- QM Project Manager (Greg) arrived on site.

2:40 PM

- Traffic management left the site.

3:45 PM

- Keystone began fish trapping.
    - John reported that the second pass for electrofishing had been completed and that the fish trap would be left overnight.

3:57 PM

- Keystone released the fish at Station E.

4:40 PM

- QM left the site.
- Keystone left the site.

4:50 PM

- AE (Jordan & Vinizza) left the site.

Photos:


NE E SE S S
60 90 120 150 180 210
130°SE (T) 10 N 554434 5449673 ±4m 11m
Station F - silt fencing
HATZIC - Legace Creek SCR 14
09 Sep 2024, 09:23:32


SE S SW W
120 150 180 210 240 270 30
206°SW (T) 10 N 554459 5449670 ±10m 6m
Station F - electrofishing
HATZIC - Legace Creek SCR 14
09 Sep 2024, 09:52:23


NW N NE E S
330 0 30 60 90 120
41°NE (T) 10 N 554564 5449692 ±4m 5m
Station D: Trimming the knotweed
HATZIC - Legace Creek SCR 14
09 Sep 2024, 12:53:37


NW N NE E
300 330 0 30 60 90
14°N (T) 10 N 554588 5449784 ±4m 9m
Temp access road
HATZIC - Legace Creek SCR 14
09 Sep 2024, 16:38:15

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17

Environmental Monitoring Report

Date: September 9, 2024
Weather: Low 15°C, High 20°C. Cloudy throughout the day and clear skies in the afternoon.

- 07:10 - Environmental Monitors (EMs) arrived on site. A section of the sandbag dam at station K had collapsed, and water breached the area. Additional fish salvage was warranted.
- 07:30 - QM crew installed a silt curtain downstream of station K.
- A green frog was captured by the EM and euthanized following the methods and protocols as per the BC Animal Care Form and Wildlife Permit SU24-886757.
- 07:55 - QM crew started to reinstate the sandbags at station K.
- 08:10 - The EMs started electrofishing following the isolation repair at K.
- A total of 1 (one) pass of electrofishing was completed - 746 seconds on the e-fisher. Results:
    - One (1) Pacific Lamprey
    - Five (5) Prickly Sculpin
- 09:45 - The EMs conducted fish salvage at station F.
- 2 passes of electrofishing
- Station F has more suitable habitat for salmonids with characteristics such as woody debris, aquatic vegetation, and overhanging riparian vegetation.
- 1478 seconds in total
- Results are as follows:
- First pass:
    - 2 largemouth bass
    - 26 prickly sculpins
    - 1 rainbow trout
    - 3 coho salmon
    - 1 Chinook salmon
    - 2 pumpkinseed sunfish
- Second pass:
    - 7 coho salmon
    - 2 Chinook salmon
    - 1 largemouth bass
    - 7 prickly sculpin
- 10 traps were set in station F.
- 12:00 - The EMs assessed the Japanese Knotweed at Station D
- Geotextile and rock were laid on the surface where the excavator will be situated.
- The knotweed was removed to avoid accidental spreading when the excavator's counterweight swings. The EMs monitored the cutting work
- 14:00 – The EMs monitored knotweed cutting work at Station B.
- 15:30 – The EMs retrieved traps set at Sation F.

- Results are as follows:
    - 1 Chinook Salmon
    - 1 pumpkinseed sunfish
    - 10 prickly sculpin
- The traps were then reset and will be retrieved on the following day.
- 16:30 – the EMs departed from site.

Site Photos




2024-09-09 7:17 a.m.


September 09, 2024 10:09 a.m.


2024-09-09 12:37 p.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	10
Project:	Legace Creek	**Page:**	1 of 5
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 10, 2024
Contract No.:		**Temperature:**	High: 22 Low: 12
Weather:	Overcast		

September 10, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Mel), Jim, 2 operator, 2 labourers
Keystone Environmental: EM (Jeff) (Loc)

Contractor's Equipment:

-Equipment in Use

- CAT Excavator 324E
- Zaxis Excavator EX0689
- Zaxis excavator 2720
- Deer Loader 1466
- Pumping equipment: generator, 2 – 6" pumps.

Report, if any, Contact with Occupants:

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

8:40AM

- Discussion with Keystone (Loc) – knotweed at SRS B2, has been trimmed, may be burned during excavation, said that is common practice.
- Will have to verify with landfill how they want it removed from site.

5:10PM
- Discussion with Keystone (Loc) - Salvaged at SCR 17 today, caught lots of fish, set traps. Should be ready for excavation by Friday.

Discussions with Contractor:

7:00AM
- Toolbox Talk QM (Mel) – same plan as yesterday, sand bags are in place, waiting for DFO to begin excavating.

8:30AM
- Discusion with QM (Mel) – unloading lock blocks only work today.
- Unsure as of now how they are going to construct proposed SRS.
- Site walk to SCR 17 with Keystone today, unsure how they are going to clear site and remove sediment in large area.

10:50AM
- Discussion with QM (Mel) after SCR 17 walk with Keystone (Jeff) –
- Planning to start at small section when they begin at SCR 17.
- Unsure how they are going to clear the larger section.
- Going to receive a bin today so they can clean up site, not expecting any other work.

3:00PM
- Discussion with QM (Mel, Jim) –
- Unsure what vegetation is to be removed north and south of Dale road bridge – referring to dashed line (remove and dispose of existing vegetation) on drawing 2623-03-C-3102, dashed line not present south of bridge.
- Also unsure of SRS locations with vegetation in front/how far to reach.
- AE (Jordan) to confirm vegetation removal with Ryan.

3:30PM
- Discussion with QM (Mel, Jim) – following discussion with Ryan, AE (Jordan) informed QM all vegetation in dashed area is to be removed, and south of bridge whatever is necessary for excavation purposes.
- Trees in between Doug PL and creek to be removed as well.
- Jordan showing approximate areas of proposed SRS', Jim taking photos.

3:30PM
- RFI 12 – Excavation extents meeting with AE (Jordan, Jordon, Alyson), QM (Mert, Jim, Nicholas).
- Discussion regarding layout of SRS stations, what vegetation to be removed.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

- AE (Jordan, Vinizza) to layout top of bank for SRS lock blocks.
- Excavation extent to be excavator reach.
- Removal of trees at C2 to facilitate excavation.
- QM thinks clear and grub required for Site 17 – no line item in contract.

4:45PM
- Discussion with QM (Jim) – starting at 6AM tomorrow.
- Moving things around, continuing to clear proposed SRS C2 tomorrow.
- Will be clearing trees and arborist on site.
- Begin excavating for lock blocks.
- Going to move temp access road closer to property line.
- Asking AE (Jordan) to layout SCR 17, larger area.
- Jordan – referred them to drawing and stationing on drawing.
- Jordan – explained up to supervisor if they want me doing the layout, will check with Ryan.

5:30PM
- Discussion with QM (Mel, Operator) –
- AE (Jordan, Vinizza) confirmed trees and stumps in front of SRS C2 should be removed.

Report:

8:00AM
- Leq'a:mel (Melissa) on site.

8:30AM
- Lock block delivery.
- 0.75x0.75x1.5m.

1:50PM
- Disposal bin delivery.

4:00PM
- AE (Jordan, Vinizza) – layout top of bank for proposed SRS.
- Try to connect bridge abutment (Dale road) to existing SRS B.

5:15PM
- Clearing at SRS C2.

5:40PM
- Removing knotweed at SRS B.

6:10PM
- All groups leaving site.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Testing:

- None today.

Safety Concerns:

- None today.

Traffic Control:

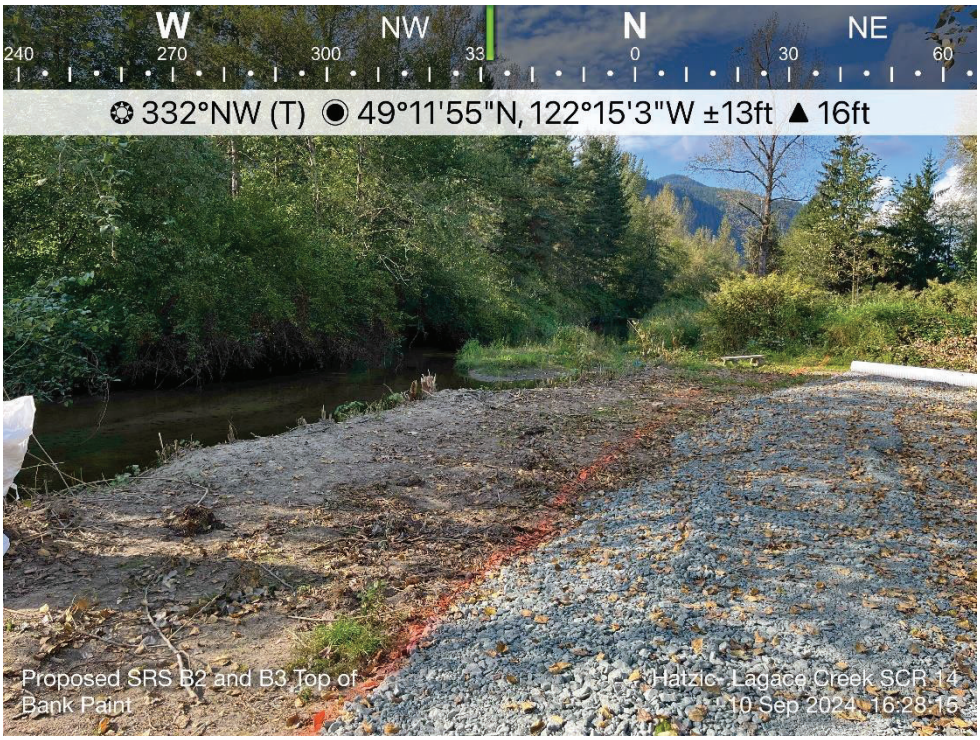
- None today.

Photos:



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: September 10, 2024
Weather: Low 14°C, High 22°C. Mix of cloud and clear skies throughout the day.

- 07:20 - Environmental Monitors (EMs) arrived on site.
- 08:00 – EMs pulled 10 traps from station F.
- Results:
    - 2 Chinook Salmons
    - 29 Prickly Sculpins
    - 1 Crawfish
    - 3 Threespine stickleback (TSS)
- 09:30 – EMs visited CR17 Site with the Site superintendent and was informed that work will occur once the CEMP is approved. Potential work day Thursday or Friday September 12&13.
- 10:46: EMs left site to pick up equipment required for fish isolations for CR17 – South.
- 12:22 – EMs commenced fish isolation work at CR17-South.
- 13:30 – Upstream and downstream fish isolations were completed.
- 13:45 – EMs conducted 4 passes of Electrofishing within the isolated area.
- Results are as follows:
- First pass – 326 seconds:
    - 15 coho salmon
    - 5 TSS
- Second pass – 136 seconds:
    - 5 coho salmon
    - 1 Rainbow trout
    - 1 Cutthroat trout
    - 1 TSS
- Third pass – 97 seconds:
    - 15 coho salmon
- Fourth pass – 335 seconds:
    - 1 chinook salmon
    - 3 TSS
    - 31 coho salmon
- 8 traps were set in CR17-South to get the remaining fishes out.
- 16:45 – EMs returned to CR14 Site and were informed that terrestrial works including grubbing of approximately 3000m2 of vegetation area at station C-2, B-2,B-3, and B will be commenced. Removal of infested knotweed soil was discuss with Jeff Prowse on Site.
- 17:00 – QM's crew pruned down the knotweed plants at station B2,B3 and B. Pruned stems and leaves were stored in the sandbags and will be hauled to designated facility.
- 15:15 – QM's operator commenced grubbing work at station C-2 with EM on Site.
- 18:15 – EMs left Site

Site Photos






September 10, 2024 5:58 p.m.


September 10, 2024 6:17 p.m.


September 10, 2024 2:48 p.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	11
Project:	Legace Creek	**Page:**	1 of
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 11, 2024
Contract No.:		**Temperature:**	High: 18 Low: 12
Weather:	Rainy		

September 11, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Mel), Jim, PM (Mert), 3 operator, 2 labourers
Keystone Environmental: EM (Vincent) (Loc)

Contractor's Equipment:

-Equipment in Use

- CAT Excavator 324E
- Zaxis Excavator EX0689
- Zaxis excavator 2720
- Deer Loader 1466
- Pumping equipment: generator, 2 – 6" pumps.

Report, if any, Contact with Occupants:

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

7:50AM

- Discussion with Keystone (Loc) – Will E-fish SRS K again today.

- Checking for frogs / knotweed at SRS B today as well.

Discussions with Contractor:

7:00AM

- Discussion with QM (Jim) – Trying to pump at SRS K this morning. If QM can get water down/out they are going to try to excavate.
- Water level in creek has come down slightly.
- QM (Jim) and Keystone (Loc) – material testing from SRS C, E, L material was clean.
- All other existing and proposed SRS are high in salt.
- SCR 17 high metallic content.

8:05AM

- Discussion with QM (Mert, Mel, Jim) –
- Mel – Not excavating for proposed SRS today. Arborist on site, will do more clearing.
- Mert – SCR 17 drawing, who do we go to for written approval for required vegetation clearing/removal as stated in drawings? AE (Jordan) – this would be submitted to Ryan or Alyson, I cannot be the one to approve that.
- Jim – asked about Jordan doing layout at SCR 17. AE (Jordan) – per the contract layout is the contractors responsibility, I won't be doing any layout at 17 unless instructed by PM's, that would be something QM would need to discuss with AE PM's.
- Jordan – QM is to determine layout/what sediment is to be removed, Mert – unsure how to determine that.
- Mert – Quantities on drawing 2632-03-C-3103 do not add to 8250 m^3. Jordan – payment will be based on the quantities removed in the field, not what is specified on drawings.
- QM (Mert) – wants to start clearing SCR 17 this week.

10:15AM

- Discussion with QM (Mel, operator) – Mel confirmed they are planning to get a surveyor out to do layout.
- AE (Jordan) – asked Mel to get surveyor to do O.G. topo of areas where proposed SRS are going to be constructed.
- AE (Jordan) – existing vegetation is to remain on existing SRS locations. Proposed SRS locations will be cleared and coconut matting installed.

12:40PM

- Discussion with QM (Jim) – QM is planning to excavate C2 without lock blocks, and build lock blocks after.
- Going to build up existing deposited sediment to drive excavator onto, and then pull the material as the excavator moves back on slope.
- Going to place sand bags and tie into existing island, thinks will be able to do this excavation in dry.
- Jim iterated QM is willing to take risk for this location.

12:45PM

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

- Discussion with QM (Mel) – Area of bush north of Dale road is smaller than appears on drawings.
- AE (Jordan) – iterated purpose is to prevent people from accessing creek. Want to open up creek best as possible.

2:40PM
- AE (Jordan) confirming discussion with QM (Jim) about excavating at SRS C2.
- AE (Jordan) made QM (Jim) aware the risks and potential consequences if an excavator ends up in the creek.
- QM is willing to take risk, thinks this is an opportunity to get a lot of material out of this section and be able to complete it in the dry.
- Only proposed location QM is planning to do this at.
- QM unsure where they will put the material after excavating.
- Planning to start excavating tomorrow.

Report:

6:30AM
- AE (Jordan) – on site.

7:00AM
- Pumping at SRS K – 2 – 6" pumps in operation. Pumping past SRS L into trees again.
- Lost sandbag – excavator back over and ripped bag.

7:35AM
- Excavating stopped – bags failing on left side of dam.

8:00AM
- Arborists on site – clearing SRS C2.

8:30AM
- Fixing bags at SRS K have been repaired.

9:20AM
- Diversion dam at SRS K has been repaired.
- Keystone starting E-fish.

10:20AM
- Pumping at SRS K.
- Right side not bad isolation, small amount of water leaking into creek.
- Left side poor isolation, lots of water coming through diversion, pump can't successfully clear area.
- AE (Jordan) – determined too wet for excavation.

10:30AM
- Moving sand bags to J – going to try pumping here today.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

12:00PM

- Trying to fix sand bag water diversion on SRS K.

1:20

- AE (Jordan, Vinizza) measuring additional clearing areas –
- B3 access road to Doug's property: 9x9m
- SRS B2 to B3 clearing along bank edge: 32x4m
- Across from SRS D: 14x5m.
- SRS D: 17x9m.

2:30PM

- Still fixing sand bags at SRS K.
- Moving filled sand bags from SRS E to SRS C2.

4:15PM

- Silt curtain delivery.

4:45PM

- E-Fish at SRS J complete.

5:00PM

- Pumping at SRS J.
- Unsuccessful – unable to divert water to dry area.

Testing:

- None today.

Safety Concerns:

- None today.

Traffic Control:

- Traffic control on Dale road.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Photos:

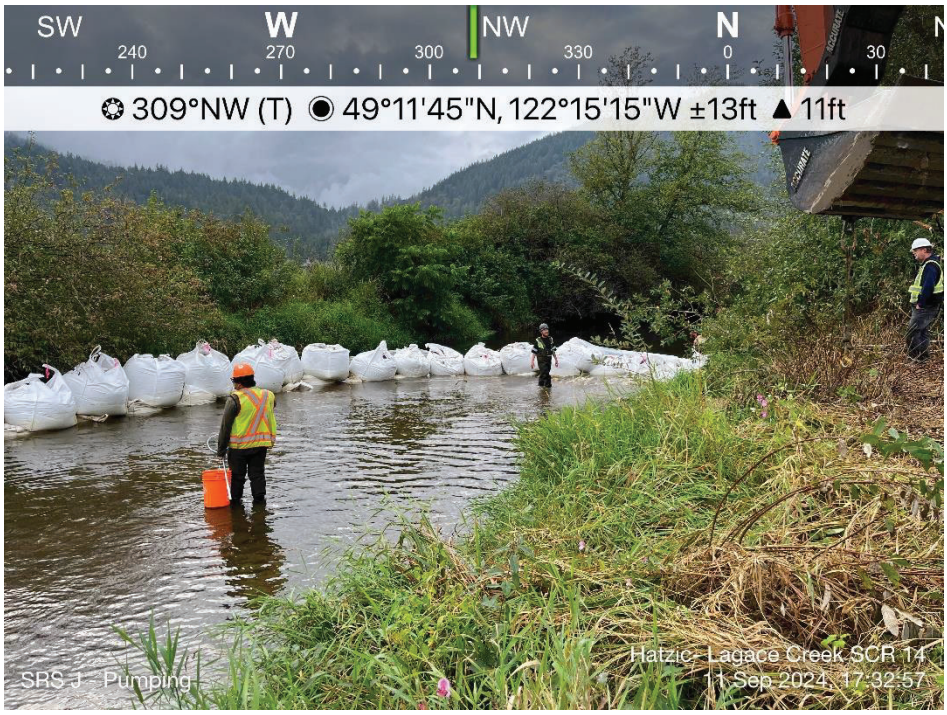




(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17

Environmental Monitoring Report

Date: September 11, 2024
Weather: Low 13°C, High 18°C. Rain in the morning and overcast throughout the day.

- 06:10 - EM arrived on site.
- 06:37 – QM operator grubbed small area to appropriately placed spill tray underneath.
- 07:25 – Pumping started at station K.
- 08:52 – QM started repair sandbag berm at station K.
- 09:16 – EM conducted 2 passes of Electrofishing at station K.
- Results: Pass 1 = 325s
    - 1 coho, 1 lamprey, 4 TSS
- Pass 2 = 416s
    - 4 lampreys
    - 1 largemouth bass
    - 1 coho
    - 4 sculpins
    - 1 TSS
- 11:00 – Grubbing work at Station C-2 and knotweed removal at station B2 and B3 commenced. EM conducted amphibian sweep prior to work commence for both Sites and did not observe any amphibian present.
- 11:41 – EMs pulled 8 traps located at CR14-South.
    - Results: 27 coho, 3 TSS, 1 chinook, 3 rainbow trout.
- 12:40 – EM completed reset all 8 traps back in CR17 – South in attempt to salvage any remaining fish in the isolated work area.
- 14:58 – EMs conducted 2 passes of Electrofishing within the isolated area.
- Results are as follows:
    - First pass – 402 seconds:
        - 5 coho salmon
        - 1 chinook salmon
        - 1 largemouth bass
        - 2 TSS
        - 5 sculpins
    - Second pass – 303 seconds:
        - 1 chinook salmon
        - 1 TSS
        - 1 Crayfish
- 15:30 – Grubbing work and sandbag hauling completed at station C-2.
- 16:58 – Completed Electrofishing at station K
- 17:32 – Started pumping at station J
- 18:06 – Dewatering work stopped. QM was not able to properly dewater station J, as well as K.
- 18:22 – QM installed poly tarp to cover newly exposed area at station C-2 to prevent potential sediment runoff to Lagace Creek.
- 18:30 – End of Workday. EMs debriefed with KEL's PM

- 18:45 – EMs left Site

Site Photos






Sep 11, 2024 2:37:19 p.m.
49.1983637N 122.25077933W
174° S


September 11, 2024 6:43 p.m.


N
W
E
S
Sep 11, 2024 11:43:17 a.m.
49.23578095N 122.21843009W
0° N


September 11, 2024 5:38 p.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	12
Project:	Legace Creek	**Page:**	1 of 7
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 11, 2024
Contract No.:		**Temperature:**	High: 21 Low: 12
Weather:	Overcast		

September 12, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Mel), Jim, 3 operator, 4 labourers
Keystone Environmental: EM (John) (Loc), +1

Contractor's Equipment:

-Equipment in Use

- CAT Excavator 324E
- Zaxis Excavator EX0689
- Zaxis excavator 2720
- Deer Loader 1466
- Pumping equipment: generator, 2 – 6" pumps.

Report, if any, Contact with Occupants:

5:40PM

- Discussion with Landowner (Doug) – AE (Jordan) – explaining QM's diversion plan using existing berm sitting in creek, shared it was part of quantity we want removed.
- Doug – wants the island removed, says it can cause debris build up and could implicate the downstream bridge with material.

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

10:15AM

- Discussion with Keystone group and QM operator – clearing knotweed at SRS B3, remaining cleared area has been deemed clean by keystone – can be disposed at regular facility.

5:00PM

- Discussion with Keystone (Loc) - insisted per the CEMP that the excavation extents of the creek area in front of SRS B is within 20m distance and 2m depth of the knotweed infested bank, therefore implying that all material excavated from this creek section is deemed contaminated.
- Equipment used for this excavation will need to stay at this location until properly cleaned.

Discussions with Contractor:

6:30AM

- Toolbox QM (James (Jim)) – going to set up sandbags at C-2, not sure when going to excavate as they do not have a place to place the excavated material without blocking the access road or double handling.
- Keystone (Loc) – wants to know when they plan to do north part of SCR 17. May take 1-2 days to fish salvage.
- QM cleaning up pumps and hoses at SRS J and K.
- AE (Jorda) – releasing field memo regarding discussing of operating excavator off of SRS blocks.

8:45AM

- Discussion with QM (Mel) and Keystone –
- SRS B knotweed has been trimmed and removed, cloth and gravel placed on time of cut plant.
- QM has determined extent/location of lock blocks for SRS B.

12:00PM

- Discussion with QM (James), AE Enviro (Dave), AE (Jordan) –
- QM – SRS B has lots of knotweed, entire excavation will need to be treated as contaminated. Knotweed on island in middle of creek.
- QM unsure if material placed under temporary access road to B3, B2, B is combi grid.
- AE (Jordan) – confirm combi grid is to be placed under access road and at SRS, should be same material.

2:00PM

- Discussion with QM (James) – hauling contaminated material from SRS B tomorrow. Will load right into truck from creek. 4-5hr round trip.
- 4 trucks coming hold about 8m3 each.

4:30PM

- Discusison with QM (Jim) –
- AE (Jordan) – made Jim aware the berm they tied their sand bags into for water diversion is part of the quantity we want to remove.
- Jim – the excavator can not reach any further.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

5:20PM
- QM (James) confirming AE is aware of there plan for excavation and hauling to contaminated site.
- AE (Jordan) – going to talk to Ryan.

Report:

7:30AM
- Placing sand bags at C-2.
- Complete at 8:30AM.

9:00AM
- Cleaning pumps and hoses at SRS K and J

10:00AM
- Surveyor on site, shooting control points along access road.

10:00AM
- Excavator smoothing access road near SRS L.

11:30PM
- Placing sandbags at SRS B.

12:00PM
- AE Enviro (Dave) on site.
- Shifting SRS B3 access road closer to property line.

1:00PM
- Electo-fish at SRS B
- Small sand bags filled at E

2:00PM
- Filling sand bags at SRS E
- 10 Filled – hauled to SRS B

3:10PM
- Loading clearing and grubbing bin.

3:30PM
- Start pumping at SRS B
- 2 – 6" pumps.

4:30PM
- Excavating:

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

- Water diversion at SRS B was done using sandbags that tied into the existing berm in the middle of the creek. Bags were placed on the upstream and downstream ends of the diversion.
- AE (Jordan) made QM (James) aware the berm is part of the quantity we want to remove; James insisted the excavator could not reach the outskirts of the berm.
- Pumping with 2 – 6" pumps out of the isolation. Overall, the isolation managed to lower the water level. Small amounts of water were seeping under the sand.
- Began excavating to the left of SRS B, initially were excavating this material and using it to reinforce the berm on the right side, QM (James) said this material would be removed at the end of excavation.
- 5:40PM - The excavated side of the isolation began to fill up, it was expected to be lower than the ground water level, shut the pumps off and continued to move material from the left side of the isolation and stockpile it on the right side of the isolation.
- James current plan is to have this pile (currently sitting in the isolated work area) surveyed tomorrow morning before they plan to haul it off to a contaminated site.
- The disposal facility is 2 hours away (4 hour round trip) and they have 4 trucks (8m^3 in volume) coming to haul.

6:00PM

- Done excavating - shutting down for day.

Testing:

- None today.

Safety Concerns:

- None today.

Traffic Control:

- None today.

Photos:

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

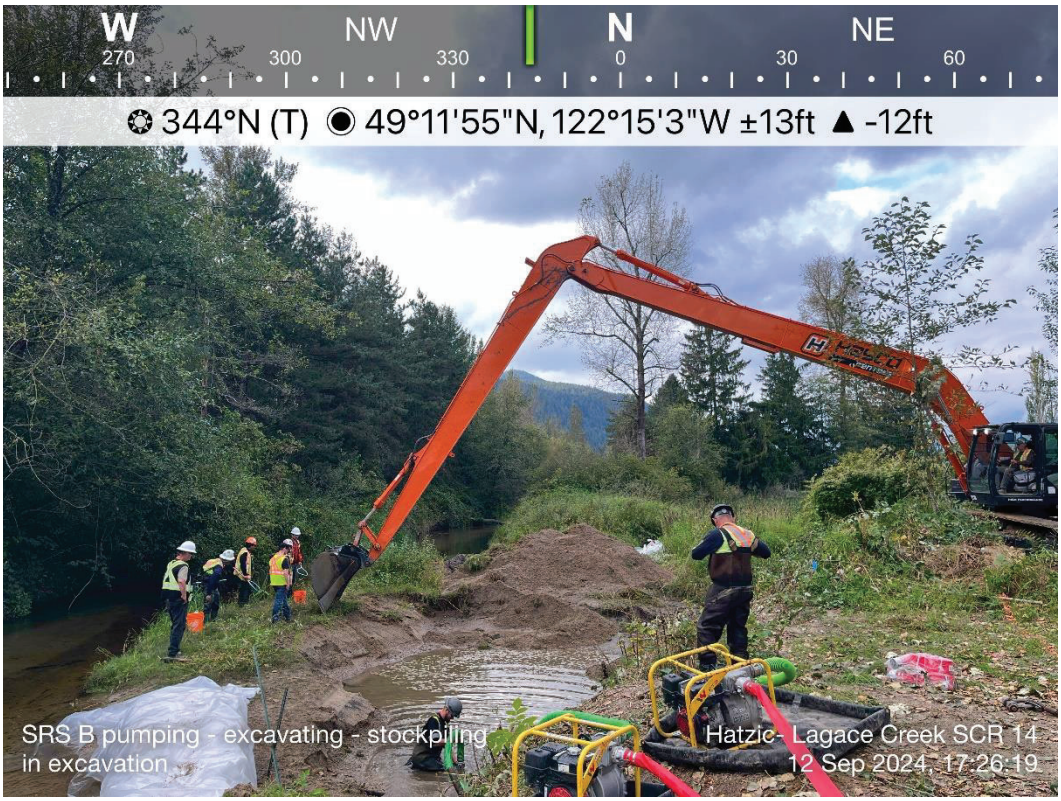
ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

TECHNICAL MEMORANDUM

Issue Date:	September 13, 2024	**File:**	Audit No. 3
To:	**Thyren Jacobs, Flood Debris Management Secretariat**	**Previous Issue Date:**	
From:	Dave Muhlert, R.B.Tech. and Naomi Sands, R.P.Bio.		
Client:	Ministry of Environment and Climate Change Strategy		
Project Name:	Lagace Creek Bank Protection and Sediment Removal - SCR14	**Project No.:**	2022-2632-03
Subject:	Environmental Compliance Audit		
Monitoring Period:	September 6, – September 12, 2024		
Contractor:	QM Environmental		
Environmental Monitor:	Keystone Environmental		

1 INTRODUCTION

Associated Environmental Consultants Inc, (Associated) is pleased to provide this environmental audit report summarizing observations of site conditions, environmental protection measures, regulatory compliance, and corrective actions as part of erosion protection works on Lagace Creek, south of Durieu, BC in the Hatzic Valley (the Project, the Site) during the monitoring period September 6 to September 12, 2024. The results presented in this audit report are based on conditions observed at the time of the audit inspection(s) and represent a snapshot of the workday. Items identified as non-compliant may have been addressed before the report(s) are submitted. The audit report(s) are submitted to the owner, their agent (Associated Engineering), the Contractor, and their environmental monitor (EM) and are not intended for further distribution.

2 ROLES AND RESPONSIBILITIES

The prime contractor for the Project is QM Environmental (the Contractor), and works are being monitored for environmental compliance by Keystone Environmental (Keystone) and audited by Associated. As the EM, Keystone is to work with the Contractor to develop measures to protect the environment and to respond to environmental incidents as they occur. Keystone is also responsible for fish and wildlife salvages prior to instream works. Leq'á:mel First Nation (LFN) is the cultural monitor for the Site. The responsibility of the auditor is to ensure on behalf of the owner, who is ultimately the permit holder, that the EM, LFN, and the Contractor adhere to the requirements of the Construction Environmental Monitoring Plan (CEMP)[1], environmental permit conditions and any applicable regulations.

3 SITE INSPECTION

A summary of site conditions as observed during the audit inspection completed during the monitoring period is provided in Table 3-1. Monitoring reports have been submitted for the auditing period.

[1] AquaTerra Environmental Ltd. 2024. Hatzic Emergency Program, South Herford Creek Project, Construction Environmental Management Plan (Rev. 1). Prepared for Mission Contractors Ltd. 65 p.

Table 3-1 Site Conditions During Audit Inspection

Date / Time	Auditor (Associated)	Weather	Construction Activities
September 12, 2024 11:00	Dave Muhlert	Sunny. 18°C. No precipitation.	Contractors were installing sandbag isolation at station B2 (north of Dale Road).

4 INSPECTION RESULTS

A checklist of required environmental protection measures and mitigative strategies for the Project is presented in Table 4-1. The checklist has been developed in accordance with terms and conditions of the environmental permits and approvals issued for the Project, environmental protection specifications and requirements as part of the construction contract for the Project, the Contractor's Construction Environmental Management Plan and environmental best management practices and guidelines.

Table 4-1 Summary of Environmental Protection Measures Reviewed and Results of the Inspection

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
	Environmental Monitoring					
1	The EM will attend key site meetings where environmental mitigations and issues may be discussed.	☒Compliant ☐Non-Compliant ☐N/A	EM has been on site daily to attend site meetings.	As instream works progress outside the least risk fish window, EM reports should document consideration of increased risk and if enhanced mitigation is required.	CEMP Section 2.4	
2	The EM shall supervise all instream works. If temporary diversion installed, EM is onsite daily to check pumps and flow bypasses.	☒Compliant ☐Non-Compliant ☐N/A	EM was onsite to conduct salvage and oversee dewatering attempts.		WSA (h)2.ii, (j)5.i CEMP Section 2.4	
3	The EM will submit daily and bi-weekly monitoring reports to the Contractor for distribution to MoECCS.	☒Compliant ☐Non-Compliant ☐N/A	Monitoring reports are submitted daily, or the following morning.		CEMP Section 5.1	
4	The EM will complete and submit an Environmental Incident Report (EIR) for non-compliances with the CEMP, reportable spills or other environmental incident.	☐Compliant ☐Non-Compliant ☒N/A	No reportable environmental incidents have been documented to date.		CEMP Section 4	
5	EM is granted authority to stop the work if necessary	☒Compliant ☐Non-Compliant ☐N/A	EM has not exercised stop work to-date.		WSA (i) 7 CEMP Section 2.4	
	Erosion and Sediment Control					
6	Appropriate site isolation is installed as required, including silt fencing prior to instream works. Silt fences are installed properly, intact, adequate, clear of accumulated sediment and are functioning.	☐Compliant ☒Non-Compliant ☐N/A	Installation of sandbag isolation underway; no excavation. Water levels in the creek have dropped and dry conditions have been achieved at some stations to permit excavation. EM reported some attempts at dewatering have failed, and excavation wasn't able to proceed.	DFO and WLRS permit amendments, to allow dredging in the wet, are pending. In there interim, instream works must adhere to existing permit conditions.	WSA (o), (q) CEMP Section 3.5	
7	Riprap or any other engineering material place in channel is clean of any substances deleterious to aquatic life.	☐Compliant ☐Non-Compliant ☒N/A	No riprap or other material was being placed during the audit.		WSA (x) CEMP Section 3.5	
8	Stockpiling and storage areas are located 15 m from the watercourse TOB.	☒Compliant ☐Non-Compliant ☐N/A	Sediment stockpiles are located >15 m from the watercourse.		DFO FAA WSA (t) CEMP Section 3.5	
9	Emergency ESC material onsite (e.g., 100 feet of silt fencing, 5 dry bales, and 100sq.m of ECBs/ Coconut matting, or polyethylene sheets)	☒Compliant ☐Non-Compliant ☐N/A	ESC materials were stockpiled at the site laydown.		CEMP Section 3.5	Photo 1
10	Sediment removed from the Site will be disposed of appropriately at a location approved by the EM and MoECCS.	☐Compliant ☐Non-Compliant ☒N/A	Excavated sediment is currently being stockpiled onsite.	Identify sediment disposal location(s) in the CEMP and/or the environmental monitoring reports.	CEMP Section 5.5	
11	Sediment removal boundaries must be clearly delineated prior to commencement of work.	☐Compliant ☐Non-Compliant ☒N/A	No sediment removal occurring at time of inspection.		WSA (opening)	
	Invasive Plant Management					

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
12	Ensure that machinery is free of invasive plant material that could potentially be transported throughout or between sites.	☐Compliant ☐Non-Compliant ☒N/A	No machinery observed leaving site during inspection.		WSA (opening) CEMP Section 3.4	
13	Ensure that invasive species removed from site are disposed of appropriately at an approved facility	☐Compliant ☒Non-Compliant ☐N/A	Japanese knotweed was bagged onsite awaiting offsite disposal. It appears that knotweed has been cut to ground, but not yet treated with herbicide. Knotweed management protocols are not clearly understood nor documented in monitoring reports.	Ensure knotweed management adheres to approved BMPs and contract, and document methodology.	WSA (opening) CEMP Section 3.4.1	
14	The Project site shall be regularly monitored by the EM for invasive plant infestations and these infestations will be mapped and managed according to applicable species-specific BMPs.	☐Compliant ☒Non-Compliant ☐N/A	EM appears to be overseeing invasive species management; however, knotweed is not being managed according to the BMPs and approved methods. Patches of knotweed adjacent to access roads and work areas were not delineated; there is signs of accidental encroachment on these patches.	If alternative approaches to knotweed management are proposed, once approved, CEMP should be updated. Patches of knotweed adjacent to access and work areas should be delineated and monitored to prevent accidental encroachment and spread.	CEMP Section 3.4.1	
16	Knotweed stems are cut close to the ground and contained on poly sheeting away from the immediate work area. Cut knotweed is covered with woven geotextile fabric and crushed rock prior to machine access. Knotweed stems are injected with an appropriate herbicide before being covered.	☐Compliant ☒Non-Compliant ☐N/A	Cut knotweed was bagged awaiting offsite disposal. Herbicide injection was not being done during the audit visit.	Confirm if stem injections are occurring as required. Confirm disposal site.	CEMP Section 3.4.1 Addendum 1 to the Contract Documents for the Hatzic Emergency Works Program - Lagace Creek – Sites S-CR-14/17	
	Waste Management					
17	Dispose of all anthropogenic debris removed at an appropriate waste management facility.	☒Compliant ☐Non-Compliant ☐N/A	No anthropogenic debris was observed on site.		WSA (opening) CEMP Section 5.5	
18	Non-hazardous waste stored appropriately and removed offsite daily.	☒Compliant ☐Non-Compliant ☐N/A	No non-hazardous waste was observed during the audit.		CEMP Section 5.5	
19	Hazardous waste stored > 30 m of watercourses.	☒Compliant ☐Non-Compliant ☐N/A	Two portable toilets are located at the site laydown, more than 30 m away from watercourses.		CEMP Section 5.5	
20	Secondary containment used for all stored hazardous waste.	☐Compliant ☒Non-Compliant ☐N/A	Portable toilets were not in secondary containment.	Add secondary containment to portable toilets.	CEMP Section 3.6	Photo 2
	Spill Control and Emergency Response					
21	Machinery operating in channel is equipped with environmentally friendly oil	☒Compliant ☐Non-Compliant ☐N/A	Excavator on site has a sticker confirming that it contains Environ™ biodegradable, non-toxic hydraulic fluid.		WSA (p) 4 CEMP Section 3.6	

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
22	Equipment and machinery are free of leaks	☒Compliant ☐Non-Compliant ☐N/A	No leaks were observed during the audit. Equipment appeared to be clean.		WSA (p) 1 CEMP Section 3.6	Photo 3
23	Drip trays are available and used during refueling and equipment maintenance	☒Compliant ☐Non-Compliant ☐N/A	Equipment was actively working during the audit. Spill trays were observed around site. Parked excavator had a spill tray under the engine.		CEMP Section 3.6	
24	Fuel is stored > 30 m from Lagace Creeks and any connected drainages	☒Compliant ☐Non-Compliant ☐N/A			WSA (p) 3 CEMP Section 3.6	
25	Machinery and vehicles operating onsite are equipped with spill kit.	☒Compliant ☐Non-Compliant ☐N/A	Stocked spill kits were available near active work areas.		WSA (p) 2 CEMP Section 3.6	
26	Should suspected contaminated material be encountered (i.e., soil emitting olfactory cues indicative of hydrocarbon fuel), works should temporarily halt for investigation.	☒Compliant ☐Non-Compliant ☐N/A	EM collected sediment samples from each of the sand recovery stations and submitted to ALS Environmental for chemistry analysis. EM reported high concentrations of sodium and some other metals and additional analysis and reporting are pending.		CEMP Section 2.5	
27	Refuelling of machinery is conducted on level ground over a spill tray.	☒Compliant ☐Non-Compliant ☐N/A	No refuelling was observed during the audit.		CEMP Section 3.6	
	Riparian Area Management					
28	Stockpile LWD and root wads removed from channel for use in site restoration	☐Compliant ☐Non-Compliant ☒N/A	No LWD or root wads stockpiled onsite.		CEMP Section 3.3	
29	Construct access points and approaches perpendicular to the watercourse;	☒Compliant ☐Non-Compliant ☐N/A			DFO FAA CEMP Section 3.2	
	Instream Works					
30	The EM shall ensure that instream works are isolated from flow and that measures are in place to protect fish and fish habitat, and to mitigate the migration of sediment downstream.	☒Compliant ☐Non-Compliant ☐N/A	Installation of sediment isolation underway; no excavation. EM reported that work was stopped when site isolation failed on September 9 and 11.	Improve instream isolation to prevent a failure during instream works.	WSA (j) CEMP Section 3.1	Photo 4
31	Pumps and flow bypasses are in proper working condition	☐Compliant ☐Non-Compliant ☒N/A	Pumps were not operating during the audit visit.		WSA (j) 5 CEMP Section 3.1	
32	Instream works conducted in the dry / isolation of flow	☒Compliant ☐Non-Compliant ☐N/A	Instream works (other than placing sandbags for isolation) were not in progress during the audit visit. EM reported that work was stopped on September 11 when Station J and K could not be fully dewatered.	Procure and install appropriate equipment for isolation and dewatering.	WSA (o) CEMP Section 3.1.1	Photo 4
	Water Quality					
33	Water quality is routinely monitored upstream and downstream of the work area, every day that instream works are occurring Instream water quality is compliant with provincial criteria[2]:	☒Compliant ☐Non-Compliant ☐N/A	EM is routinely monitoring water quality, and halting instream works where short-term exceedances are noted. Sediment curtains have been installed downstream of instream works.	The contractor must exercise due care when handling sandbags instream and the EM to provide appropriate guidance to mitigate any	WSA (s) CEMP Section 3.1.2	

[2] British Columbia Ministry of Environment and Climate Change Strategy. 2024. British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture - Guideline Summary – August 2024. Water Quality Guideline Series, WQG-20. Prov. B.C., Victoria B.C. Available at: https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-guidelines/approved-wqgs/wqg_summary_aquaticlife_wildlife_agri.pdf. Accessed August 2024.

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
	Turbidity: - <8 NTU from background at any one time for a duration of 24 h in clear waters; - < 5 NTU from background when background is 8 – 50 NTU; - <10% from background when background is > 50 NTU. **pH:** 6.5-9.0		Excavated sediment is being used to fill the sandbags that are installed for instream isolation. Occasionally the sandbags tip over or rip when being relocated, resulting in localized turbidity.	potential risk to fish and fish habitat.		
	Fish and Wildlife Protection					
34	Full time monitoring for fish during instream works is occurring.	☒Compliant ☐Non-Compliant ☐N/A	EM is onsite full time		WSA (j) 6 CEMP Section 2.4	
35	Fish salvages are conducted in advance of instream works where required.	☒Compliant ☐Non-Compliant ☐N/A	EM is conducting salvages in advance of sediment excavation.		CEMP Section 3.1 WSA (j) 6	
36	Salvaged fish are relocated back to the same watercourse in a nearby area that is not impacted by construction or removal works or its zone of influence	☒Compliant ☐Non-Compliant ☐N/A	EM is relocating fish outside the isolated work zone.		DFO FAA Section 2.2.4	
37	Pump intakes are screened for fish and aquatic species in accordance with the "Interim code of practice: End-of-pipe fish protection screens for small water intakes in freshwater"	☒Compliant ☐Non-Compliant ☐N/A	Conditionally compliant – Pumps were not operating during the audit visit. Pump intakes shown in EM reports were placed within a mesh box. Contractor was installing an additional mesh screen over a pump intake during the audit.		WSA (j) 5.ii DFO FAA Section 2.4.9 CEMP Section 3.1.1	Photo 5
38	Obtain required permits prior to salvage(s).	☒Compliant ☐Non-Compliant ☐N/A	EM has obtained salvage permits.		WSA (Opening) CEMP Section 3.1	
39	EM is on site during disturbance to riparian vegetation and conducting pre-clearing breeding bird surveys prior to clearing.	☒Compliant ☐Non-Compliant ☐N/A	EM is conducting nest surveys at stations as required.		CEMP Section 3.2	
40	Instream works are conducted so as not to lead to fish stranding or other impacts to fish. The works shall not result in depressions that have the ability to trap fish and other aquatic life. Fish passage is maintained where practicable and in accordance with applicable permits.	☒Compliant ☐Non-Compliant ☐N/A	Instream works have been designed to maintain fish passage after completion. Upstream fish passage is impeded due to turbidity curtain installed across the channel.	EM must be monitoring for fish full-time and should have a plan for moving adult fish upstream around the work area, if observed staging below the work zone.	WSA (j) 6 (iii) WSA (u) DFO FAA Section 2.4.2 CEMP Section 3.1.1	
	Restoration Requirements					
41	Restoration plans prepared by EM for disturbed area and implemented with EM oversight	☐Compliant ☐Non-Compliant ☒N/A	Restoration plans have not been prepared yet.		WSA (w) CEMP Section 3	
42	All temporary works shall be removed on completion of the project, and the stream	☐Compliant ☐Non-Compliant ☒N/A	Work is still in progress.		WSA (v) CEMP Section 3	

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
	channel restored to its natural condition					

5 DISCUSSION

5.1 Non-Compliant Items

Knotweed management

Addendum 1 to the Contract Documents for the Hatzic Emergency Works Program - Lagace Creek – SITES S-CR-14/17 requires that trimmed knotweed stems are injected with an appropriate herbicide.

Recommended action: Provide documentation of knotweed management and ensure it adheres to approved BMPs. Confirm if knotweed stems have been injected with appropriate herbicide. If this is not practical, suggest alternative approach with rationale, and update documentation (e.g., CEMP).

Portable toilets without secondary containment

Two portable toilets located at the site laydown adjacent to Dale Road did not have secondary containment. Although the toilets were more than 30 m away from the watercourse, secondary containment would prevent any potential spills from spreading beyond the immediate area.

Recommended action: Add secondary containment to portable toilets.

5.2 Conditionally Compliant Items

EM reporting to document risk and mitigation

As instream works progress beyond the least risk fish window, the EM must provide guidance and advice to the contractor regarding any changes in risk associated with working past the window and required mitigation.

Recommended action: EM reports should document their consideration of any increased risk with working past the least risk and identify if enhanced mitigation is required. EM should continue to document implementation of mitigation measures, evaluate changing conditions, and report any incidents or near-misses.

Site isolation failing during instream works

The emergency *Fisheries Act* authorization requires that instream works are conducted in the dry. EM reports from September 9 and September 11 state that isolation measures have failed during instream works. Although the EM reported that dredging was stopped during these failures, isolation measures should be improved to prevent failure during works.

Recommended action: Permit amendment applications are pending; contractor must adhere to the conditions of existing environmental permits until approved. Isolation measures should be sufficient to maintain isolation for the duration of the work.

6 SUMMARY

A list of environmental issues outstanding to date is provided in Table 6-1, below.

Table 6-1 Tracking Table of Environmental Issues Outstanding to-Date (project commencement August 12, 2024)

Item #(s)	Issue	Date(s) Observed	Recommended Corrective Action(s)	Responsible Party
2	Knotweed material outside poly sheet containment, no herbicide treatment	August 29, 2024 September 5, 2024	Ensure that all knotweed cuttings are confined to poly sheeting. Apply herbicide to remaining stems, as appropriate. Document methodology and ensure it adheres to approved BMPs.	Contractor/EM
3	Portable toilets without secondary containment	August 29, 2024	Add secondary containment to portable toilets.	Contractor
4	Inadequate instream isolation and failed dewatering attempts resulting in instream works conducted in the wet.	August 31, 2024 September 1, 2024 September 2, 2024 September 11, 2024 (EM reports)	Need to provide adequate isolation and dewatering to maintain dry work area OR obtain permission to dredge in the wet	Contractor

Note: Items marked with an asterisk (*) were reported by the EM.

7 CLOSURE

We trust that the information in this memo is sufficient for your present needs. Should you have questions, please do not hesitate to contact the undersigned.

Prepared by:

for Dave Muhlert, R.B.Tech.
Environmental Technologist

DM/NS

Reviewed by:

Naomi Sands, R.P.Bio.
Environmental Scientist

Attachments:
- Site Photographs

Attachment 1: Site photographs taken during audit visit on September 12, 2024.

Photo 1: ESC materials stockpiled at the site laydown 		**Photo 2: Portable toilet at laydown without secondary containment** 
Photo 3: Front end loader working on site appeared to be clean and free of leaks 		**Photo 4: Sandbag isolation was not sufficient to keep water out of the work area** 
Photo 5: Metal mesh fish screen being installed on pump intake 		

Table A2: Tracking Table of Resolved Non-Compliance Issues

Item #(s)	Issue	Date(s) Observed	Date Corrected	Corrective Action(s)	Responsible Party
1	Environmental monitoring reports not received daily	August 29, 2024	September 5, 2024	Monitoring reports received daily, or following morning.	EM
2	Inappropriate fish screen on pump intake	September 5, 2024	September 12, 2024	EM reports show pump intakes in mesh screen boxes. Wire mesh screen was being fitted to an additional pump intake during the audit visit.	Contractor

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: September 12, 2024
Environmental Monitors: John Choi, Loc Ngo, Corbin Manson.
Weather: Low 13°C, High 20°C. Overcast in the morning with sunny breaks in the afternoon.

- 06:40 AM: Environmental Monitors (EMs) arrived on-site.
- 06:45 AM: EMs attended a toolbox meeting with QM personnel.
- 07:05 AM: QM personnel removed the two (2) silt curtains located downstream from Stations J and K.
- 07:20 AM: QM personnel began installing sandbag exclusion at Station C-2. EMs periodically checked downstream water quality to confirm elevated turbidity levels associated with the installation. (Please refer to the water quality table for results.)
- 07:41 AM: Two (2) EMs traveled to Station CR-17 South to retrieve eight (8) traps deployed the previous day. One (1) EM remained at Station C-2 to monitor the sandbag exclusion work.
- Results of trap retrieval:
    - 1 Chinook salmon
    - 1 Three-spined stickleback
    - 8 Coho salmon
    - 2 Rainbow trout
- Ten (10) traps were redeployed to soak overnight and are scheduled for retrieval the following morning.
- Salvaged fish were measured and released downstream.
- 08:22 AM: Sandbag exclusion placement at Station C-2 was completed.
- 09:36 AM: Grubbing work and the placement of an access pad covered with gravel were completed at Station B to minimize the spread of Japanese knotweed during instream work. EMs monitored the work and did not observe any excavator contact with adjacent knotweed growth.
- 11:00 AM: QM initiated isolation prep work at Station B.
- 11:20 AM: Riteway Tree Service Ltd., contracted by BC Hydro, was observed felling trees along Dale Road, adjacent to the Japanese knotweed growth for the blueberry farm access point.
- 11:30 AM: The first sandbag was placed instream at Station B. EMs periodically checked downstream water quality to monitor turbidity levels during the exclusion installation.
- 12:31 PM: An AE inspector inquired about the disposal of Japanese knotweed on-site. The QM Site Superintendent confirmed that knotweed would be hauled off-site and incinerated at the end of the project.
- 12:35 PM: Sandbag exclusion installation at Station B was completed.
- 12:46 PM: EMs conducted electrofishing (e-fishing) at the now-isolated Station B.

- Results of Pass 1 (600s):
    - 3 Coho salmon
    - 1 Rainbow trout
    - 1 Cutthroat trout
    - 70 Prickly sculpins
    - 3 Signal crayfish
    - 1 Largemouth bass
- 15:05 PM: EMs performed a second e-fishing pass at Station B.
- Results of Pass 2 (590s):
    - 3 Signal crayfish
    - 10 Prickly sculpins
    - 1 Pacific lamprey
    - 2 Coho salmon
    - 1 Rainbow trout
- 15:29 PM: A silt curtain was installed downstream from Station B. Due to the strong current in Legace Creek, the curtain could not be fully sunk but was still expected to act as a partial barrier. EMs closely monitored downstream water quality.
- 15:35 PM: Two (2) 3-inch dewatering pumps were installed at Station B, with the discharge outlet placed downstream of the silt curtain. A silt bag was installed at the outlet and set on a poly-sheeted waterway to minimize erosion. Fish protection baskets were confirmed on both inlets.
- 15:42 PM: The two (2) dewatering pumps began operation, and EMs periodically checked downstream water quality for turbidity.
- 15:45 PM: EMs performed active fish salvage during the dewatering process.
- Results:
    - 11 Coho salmon
    - 40 Prickly sculpins
    - 41 Pacific lampreys
    - 14 Signal crayfish
    - 1 Rainbow trout
    - 2 Three-spined sticklebacks
    - 1 Pumpkinseed sunfish
    - 1 Northern red-legged frog
    - 21 American bullfrogs (various stages of development)
- 16:05 PM: A section of vegetation on the sandbank at Station B was grubbed to accommodate sediment stockpiles.
- 17:05 PM: The isolated Station B was nearly dry, though some water continued to seep through the sandbag exclusions and from the surrounding water table. The AE inspector approved the salvaging and dewatering process, allowing excavation to begin.
- 17:10 PM: Sediment from Station B was stockpiled on the cleared sandbank to dry overnight. It will be hauled off-site for appropriate disposal, classified as Class B under the Provincial Knotweed Guidelines (Appendix D).

- 18:10 PM: Sediment excavation work at Station B was completed for the day.
- 18:12 PM: QM personnel refueled the dewatering pumps at Station B. EMs confirmed that the pump was moved away from the bank and placed on a spill tray during refueling. No spillage or leakage was observed.
- 18:25 PM: EMs euthanized various invasive species (i.e., bullfrog, Largemouth bass, Pumpkinseed sunfish) salvaged throughout the workday.
- 18:35 PM: Spill trays were placed under various machinery to prevent potential hydrocarbon leakage into the stream.
- 18:40 PM: EMs observed poly-sheeting placed on the grubbed Station C-2 to minimize potential sediment erosion into the stream.
- 18:45 PM: EMs debriefed with the KEL Project Manager.
- 18:55 PM: EMs departed from the site.
- Water Quality Sampling Results:

Location	Time	Turbidity (NTU)
Station B (Background for Station C-2)	7:20	1.64
Station D (downstream from Station C-2)	7:25	4.96
Upstream from Station B	11:24	2.12
Downstream from Station B	11:38	5.23
Downstream from Station B	15:38	2.67
Downstream from Station B	15:42	7.32
Downstream from Station B	16:02	5.69
Downstream from Station B	16:14	4.34
Downstream from Station B	16:34	5.05
Downstream from Station B	17:40	3.40

Site Photos


ABC Recycling
604.522.9727
September 12, 2024 3:54 p.m.


September 12, 2024 9:37 a.m.


September 12, 2024 5:04 p.m.


September 12, 2024 9:32 a.m.


September 12, 2024 11:30 a.m.


September 12, 2024 3:29 p.m.


September 12, 2024 5:34 p.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	12
Project:	Legace Creek	**Page:**	1 of 7
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 13, 2024
Contract No.:		**Temperature:**	High: 18 Low: 13
Weather:	Rainy		

September 13, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Mel), Jim, 3 operator, 4 labourers
Keystone Environmental: EM (John) (Loc) (Corbin)
2 flaggers

Contractor's Equipment:

-Equipment in Use

- CAT Excavator 324E
- Zaxis Excavator EX0689
- Zaxis excavator 2720
- Deer Loader 1466
- Pumping equipment: generator, 4 – 3" pumps.

Report, if any, Contact with Occupants:

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

Discussions with Contractor:

6:30AM
- Toolbox (James) – Lots of water entered excavation over night, going to get 2 more 3" pumps (4 total).
- Planning on 1 truck coming initially. 4 trucks ended up coming each with a wagon.

6:45AM
- Discussion with Enviro Green (Hauling company) – Doing hauling today, have 4 trucks. All trucks will be tarped.

10:00AM
- Discussion QM (James) – final hauling truck. Will continue excavating in isolation area and stockpiling.
- Plan to build SRS this weekend.

11:00AM
- Discussion with QM (James, Mel) – Planning to give brush clearing to farmer Charlie (Jahoolie). Confirming if that is acceptable.
- AE (Jordan) – ensure no knotweed is in it if its going to the farmer. As far as Jordan is aware QM is to decide where the material leaving site is going.
- Current clearing is going to disposal facility in Abbotsford.

11:15AM
- Discussion with QM (James) – going to keep excavating and stockpiling at SRS B.
- Trucks are coming back at 4:00 to be pre-loaded for tomorrow. Planning to keep hauling this weekend.
- AE (Jordan) asked if remaining stockpile location with be surveyed for this mornings haul, prior to filling it up with excavated material again.
- QM (James) – Mert said that is not required, the morning survey is sufficient.

2:00PM
- Discussion with QM (James) – AE (Jordan) asked to get survey back prior to loading out 2nd stockpile this afternoon, survey crew has done O.G. in B2, B3, B area.
- James said survey crew is unavailable. Will load out anyway.

1:45PM
- Discussion with QM (James, labourer) – after labourer seen refueling pumps on berm in creek.
- AE (Jordan) – reminded group CEMP outlines refueling equipment is to be done 30m from creek.

Report:

6:30AM
- AE (Jordan) – on site.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

6:45AM
- Surveyor on stockpile in SRS B isolation area doing topo. Surveying pile to water level.

7:00AM
- 2 – 3" pumps on at SRS B.

7:50 – 10:45AM
- Loading and Hauling trucks.
- 4 trucks, all with wagons.
- Loading from excavated pile in isolated area to the right of SRS B.
- Each truck about 21m3 for truck + wagon together, roughly 80m3 hauled
- Survey was completed for this stockpile only prior to loading out.
- Material was excavated and loaded into trucks wet.

8:30AM
- Disposal truck for C and G hauling bin off site.

11:15AM
- Removing excavation in isolated zone, reinforcing water diversion on right side of isolation. 2 – 3" pumps in operation.

12:50PM
- All 4 – 6" pumps in operation.

2:15PM
- Gravel delivery at B2

1:30 - 3:00PM
- Excavating remainder of SRS B isolation and placing material on access road next to B.
- Stockpile looks to be roughly 250m^3

3:15PM
- At end of excavation, berm used to divert water began to fail, pumps were placed on top of berm.
- Pumps were quickly removed, in doing so were violently swinging as moving off of creek.
- 1 pump had clear liquid spill out of it while on top of creek, the smell of gas followed.
- In process 1 sand bag was lost.

3:30PM
- Electo-fishing at C2.

3:45PM – 6:00PM
- Afternoon truck loading.
- 4 trucks, all with wagons. Estimated volume per truck and wagon 21m3, 80m3 total.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

- Loading excavated material placed on access road beside B.
- Excavation was wet at time of loading, also raining.
- No survey completed prior to material being loaded.
- Trucks are keeping material over weekend and dumping on Monday at contaminated site.

4:30PM

- Clearing at C2.

6:00PM

- Leaving site, QM awaiting pump delivery.

Testing:

- None today.

Safety Concerns:

- None today.

Traffic Control:

- Traffic control on Dale road.

Photos:

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: September 13, 2024
Environmental Monitors: Loc Ngo, Khang Diep, Corbin Manson.
Weather: Low 13°C, High 18°C. Overcast in the morning and rain in the afternoon.

- 06:30 AM: Environmental Monitor – Corbin, arrived on-site.
- 07:00 AM: Dewater at Station B commenced with EM on Site. EM was actively salvaging fishes during the dewatering.
- 07:30 AM: Loc Ngo and Khang Diep arrived on Site.
- 07:47 AM: Knotweed loadout commenced (hauling off site using dump trucks).
- 08:19 AM: QM's excavator inspected for knotweed directed QM to brush excavator bucket.
- 08:30 AM: Sediment bag at the discharge hose blew out. However, exceedance of turbidity was not observed (See WQ table).
- 08:45 AM: QM repaired the sediment bag and continued dewatering Station B.
- Active salvage results:
    - 7 prickly sculpins
    - 7 Lampreys
    - 2 Signal Crayfish
- 09:47 AM: Loc Ngo and Corbin Manson traveled to Station CR-17 South to retrieve ten (10) traps deployed the previous day. Khang Diep remained at Station B to monitor the dewatering and sediment excavation work.
- Results of trap retrieval:
    - 30 coho salmon
    - 1 chinook salmon
- Ten (10) traps were redeployed to soak and are scheduled for retrieval the following morning.
- Salvaged fish were measured and released downstream.
- 11:12 AM: EMs swept the area within the isolated area at Station B for amphibians prior to excavation. Amphibians were not observed by EMs and excavation work commenced shortly after.
- 11:38 AM: EMs noticed sediment plume and proceeded to take a WQ downstream from B (behind the silt curtain). Turbidity reading was compliant at the time but also indicated potential exceedance if the plume persisted. EM notified QM immediately and recommendations were discussed:
- Reinstall the sediment bag at the discharge station to mitigate sediment plume.
- Reinstate the silt curtain to capture sediment plume.
- 11:45 AM: Pumps were temporarily off. QM initiated sediment bag repair to mitigate sediment plume.
- Active salvage results:
    - 6 Lampreys
    - 1 Signal Crayfish
    - 1 coho (mort)

- 12:11 PM: Sediment bag replacement work completed. QM initiated the pumps again and EM collected WQ downstream from B. Reading was compliant.
- 13:37 PM: Stockpiling contaminated sediments upland to dry confirmed only knotweed contaminated excavator working in the area.
- 13:45 PM: Loc Ngo and Khang Diep left CR14 Site and went to CR17-South Site to enhance the fish isolations prior to rain event. 10 minnow traps were also pulled for fish salvage work in C-2. Corbin Manson remained on CR14 – Station B to active salvage during excavating work.
- Minnow trap results:
    - 9 coho salmon
    - 1 rainbow trout
    - Active salvage results:
    - 1 coho salmon
    - 9 prickly sculpin
    - 2 lamprey
    - 2 signal crayfish
    - 1 bullfrog tadpole (humanly euthanized).
- 14:41 PM: Crushed rocks arrived on Site.
- 15:05 PM: Dewatering working at station B completed.
- 15:10 PM: Station B's upstream isolation failed due to sediment excavating and flow was reintroduced to the isolated area. However, water seemed to slowly fill in the excavated area and turbid water remained isolated from the creek by the downstream sandbag berm. EM conducted WQ at the downstream location from B. Exceedance was not observed.
- 15:23 PM: EMs conducted electrofishing (e-fishing) at the isolated Station C-2.
- Results of Pass 1 (261s):
    - 3 Prickly sculpins
- 15:15 PM: electrofishing completed for safety concern when it rained. 10 minnow traps were deployed at station C-2 and to be retrieved prior to work commence on September 14, 2024. EMs will conduct another electrofishing pass if weather condition improves.
- 16:13 PM: EM completed minnow traps
- 17:00 PM: Contractor completed the sump excavation (in dry) in preparation for excavation work at C-2 Station for tomorrow.
- 17:21 PM: EM checked in with QM to ensure all exposed area will be protected with poly tarp to prevent potential sediment runoff from the rain.
- 17:40 PM: Last hauling trucks were observed
- 18:00 PM: EM debrief with KEL's PM.
- 18:45 PM: EM inspected the Site at the end of workday. Stockpile and exposed area were properly protected with poly tarps. Spill trays were also observed in place.
- 18:50 PM: EM left Site.
- Water Quality Sampling Results:

Location	Time	Turbidity (NTU)
BG – Upstream from Station B	7:48	4.61
~ 50m Downstream rom Station B	7:58	7.00
BG – Upstream from Station B	9:24	2.39
~ 50m Downstream rom Station B	9:25	2.68
BG – Upstream from Station B	11:23	2.15
~ 50m Downstream rom Station B	11:28	9.78
~ 70m Downstream rom Station B	11:38	10:15
~ 70m Downstream rom Station B	12:15	8.08
BG – Upstream from Station B	13:17	3.24
~ 50m Downstream rom Station B	13:20	6.28
BG – Upstream from Station B	14:21	2.46
~ 50m Downstream rom Station B	14:26	5.96
BG – Upstream from Station B	16:27	5.19
~ 50m Downstream rom Station B	16:31	6.05

Site Photos


SPILL KIT
September 13, 2024 6:42 p.m.


LaMotte
T7
Turbidity WB (NT
8.08 NTU
Scan Blank
Scan Sample
11:13:58 009/500+
2020i TURBIDIMETER
September 13, 2024 12:11 p.m.


September 13, 2024 7:50 a.m.


September 13, 2024 6:40 p.m.


September 13, 2024 11:52 a.m.


September 13, 2024 6:42 p.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	13
Project:	Legace Creek	**Page:**	1 of 7
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 14, 2024
Contract No.:		**Temperature:**	High: 17 Low: 12
Weather:	Rainy		

September 14, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Mel), Jim, 3 operator, 4 labourers
Keystone Environmental: EM (John) (Kang)

Contractor's Equipment:

-Equipment in Use

- CAT Excavator 324E
- Zaxis Excavator EX0689
- Zaxis excavator 2720
- Deer Loader 1466
- Pumping equipment: generator, 1 – 6" pumps.

Report, if any, Contact with Occupants:

2:45PM

- Discussion with Doug property owner – Explaining how creek flows into yard behind SRS B during winter months and periods of high rain. Disappointed QM didn't remove berm in front of station and remove more material to the right of station, there is a beaver creek U/S causes flow issues.
- Creek crested into property 3 times last year.

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

4:45PM

- Discussion with Keystone (John) – turbidity was high D/S during pumping today, had to keep stopping pumping.

Discussions with Contractor:

6:30AM

- Toolbox QM (James) – Removing bags at SRS B.
- Planning to start SRS B2 today.
- Also will be excavating at C2.
- Survey at C2 stockpile where there is Y in road – using LiDAR drones.
- AE (Jordan) – expressed concern this area isn't flat, asked if it will be flattened. James thought was flat.

8:00AM

- Discussion with QM (James, labourer) – discussing SRS B2 and B3 plan.
- QM planning to place geotextile 1.5 – 2m in length.
- Have tamper on site for compaction.
- Have general idea for locations – trying to line up with SRS B and Dale road bridge abutment.
- Will excavate back behind slope first and place lock blocks before opening up to creek. Pumping ground water will be required.
- All material from section B3 to B will be contaminated. James mentioned there was discussion of a change order amongst the PM's, won't be removing more than 500m3 before that is released.
- AE (Jordan) – expressing concerns of yesterdays quantity tracking with survey. No O.G. of stockpile locations or survey of stockpile before 2nd load out.
- James – QM going to get bathymetry of SRS B. Thinks between bathymetry, pile survey in isolation, and truck counting should be able to get quantity.
- Jordan also expressed concern of material being fairly wet.
- James – going forward will be easier, surveying whole site with LiDAR drone today.

11:00AM

- Discussion AE (Duncan) and Lucas Geomatics survey group –
- Lucas Geo thinks they are coming for final survey at end of project but have not been finalized.
- Did topo pass and 6 LiDAR passes – should be accurate to material in area.
- Didn't tie into points on bridge, had own reference points near SRS C2 stockpile.

1:30PM

- Discussion with QM (Mel) – not opening up SRS B2 excavation due to rain today. Will prepare area for tomorrow morning.
- Discussion with QM Operator (Craig) – doing layout for SRS B2.
- AE (Jordan) – directed to line SRS B2 with B, top of bank will curve around B3 towards Dale road bridge abutment.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Report:

7:00AM
- Removing sand bags at SRS B

7:25AM
- 2 – 6" pumps delivered on site.

8:30AM
- Moving SRS B contaminated stockpile from SRS B access road to SRS B3 location.

9:00AM
- Moving sandbags from SRS B to C2.

10:00AM
- Clearing area at C2
- Clearing/topsoil removal – rock truck used to transport material from SRS C2 to laydown – down access road outlines by Mert.

10:40AM
- Clearing at B3

11:00AM
- Setting up access for pumps and pumps.
- Pumping 20m downstream into trees.

12:00PM
- Moving lock blocks to B2

1:00PM
- Installing silt curtain D/S C2
- Excavating sump for C2.

1:40PM
- Began pumping at SRS C2, isolation initially unsuccessful.

2:15PM
- Excavator unstable on C2 slope, fell forward, caught itself with bucket.

2:45PM
- 10 Small sandbags filled at SRS E and moved to SRS C2 for isolation.

4:30PM

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

- Placing bags and hoses for isolation at C2 tomorrow.
- 2nd 6" pump delivered to site.

5:10PM
- Left site.

Testing:

- None today.

Safety Concerns:

- None today.

Traffic Control:

- None today.

Photos:

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17

Environmental Monitoring Report

Date: September 14, 2024
Weather: Low 13°C, High 18°C. Overcast in the morning and rain in the afternoon.

- 06:30: The Environmental Monitors arrived on-site.
- 06:45: Retrieved 10 minnow traps. Fish salvage results:
    - 2 Coho salmon
    - 20 prickly sculpin
    - 1 Chinook salmon
    - 2 pumpkinseed sunfish (euthanized)
    - 2 green frogs (euthanized)
- 07:00 – 07:50: QM crew removed sandbags isolation at Station B.
- 07:15: Two 6-inch dewatering pumps arrived on site.
- 08:20: QM crew began setup at Station C-2.
- Removed poly sheeting.Installed additional sandbags.
- Positioned and set up dewatering pumps.
- 08:45: Began hauling sediment material from C-2 that is not instream, stockpiling near the blueberry farm.
- 10:30: QM crew began installing and preparing for discharge outlets. Selected discharge location was vegetated. Poly sheeting was laid to protect the surface from erosion. Discharge hose was placed inside sediment filter bag to divert water energy, and the bag was placed on top of the poly and positioned between the flood plain of the riparian area and the stream.
- 12:10: Transported lock blocks from the laydown area to station B-2 for construction of recovery sand station.
- 12:50: Excavated a deeper sump to have sufficient volume of water for the fish protection cage and pump intakes.
- 13:12: Silt curtain was installed downstream of C-2 and the discharge point. Only one curtain was available for the time being.
- 13:15: Dewatering pump was activated. Only 1 pump was functional. The other pump was missing parts / having defective parts.
- 13:36: Notable turbidity plume was observed downstream of the silt curtain. The EM recommended stopping the pumps and adjusting the silt curtain and discharge outlet.The EMs conducted active fish salvage at Station C-2 during dewatering.
- 15:00: Discharge overwhelmed and flooded the bank, and water began to flow back into site. The pump was stopped, discharge outlet and silt curtain were adjusted once more.
- 16:00: Instream works including dewatering were ceased for the day. QM crew continued to set up the second pump and prepared the site for dewatering the following day.
- 16:10: The EMs released fish to upstream of Station B.

- Active salvage results:
  - 1 Chinook salmon
  - 1 Coho salmon
  - 16 prickly sculpins
  - 12 lampreys
  - 2 signal crayfish
- 16:35: Additional sandbags were installed at Station C-2.
- 17:00: Poly sheeting was installed for exposed surface at Bs and C-2.
- 18:25: The EMs arrived at SCR 17 to inspect the fish isolation, and it remained intact and functional.
- 18:30: EMs departed from site.

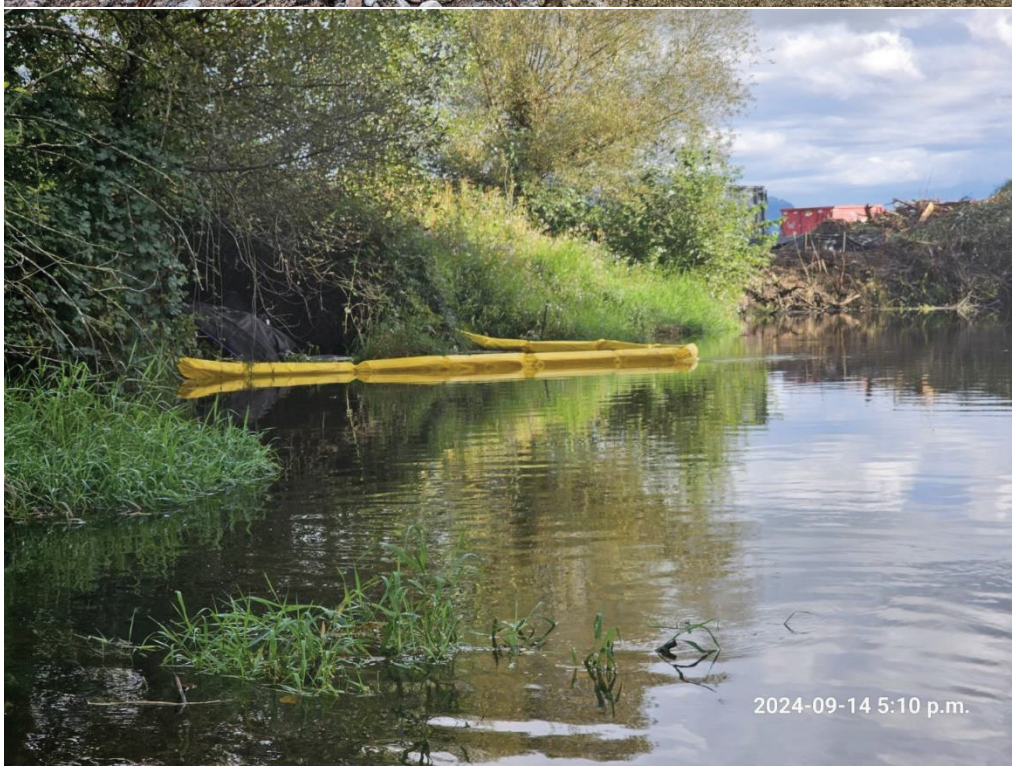
Site Photos




September 14, 2024 1:15 p.m.


September 14, 2024 5:08 p.m.


September 14, 2024 6:24 p.m.


2024-09-14 5:10 p.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	14
Project:	Legace Creek	**Page:**	1 of 4
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 15, 2024
Contract No.:		**Temperature:**	High: 22 Low: 12
Weather:	Sunny		

September 15, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Jim), 2 operator, 2 labourers
Keystone Environmental: EM (John) (Loc)

Contractor's Equipment:

-Equipment in Use

- CAT Excavator 324E
- Zaxis Excavator EX0689
- Zaxis excavator 2720
- Deer Loader 1466
- Pumping equipment: generator, 4 – 3" pumps.

Report, if any, Contact with Occupants:

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Discussions with Contractor:

6:45AM
- Toolbox (James) – Adding another silt curtain at C2 due to high turbidity yesterday using only 1 pump.
- Starting excavation for lock blocks at B2 today.
- Extension from WSA till 30th, nothing from DFO.
- Sand bags at J and K still holding up.

7:00AM
- Discussion with QM (Jim, Craig) – lock block layout.
- Entire bank to be regraded at 2.5:1 from SRS B to bridge abutment (anywhere coco-matting is going). AE (Jordan) confirmed with Ryan.
- AE (Jordan) – referred to RFI 12 while doing layout, drawings show B more north than actual location is. Want B in line with B2 and parallel to creek. Top of bank will curve back towards bridge abutment.

9:00AM
- Discussion on site regarding excavated material from SRS B2 and where it is included in price.
- AE (Jordan) – instructed group to keep separate from excavated pile from SRS B, both are considered contaminated but unsure if proposed SRS excavations are included in price of disposal.
- Mert was under assumption material excavated for SRS lock blocks is included in disposal quantity.
- Jordan discussed with Ryan and he is to confirm. For the time being on site we are going to keep the stockpiles separate and track the volumes separate, the PM's cab decide how the quantity is paid.
- Jordan discussed with Ryan and confirmed with QM (Jim, Craig) – combigrid at the bottom of the SRS excavation is acceptable followed by the base layer wrapped in geotextile. Advised QM not to place gravel in between combigrid and base layer.
- Small tamper on site (lawn mower size) confirmed to be sufficient for SRS install by Ryan.

1:00PM
- Discussion with QM (James) – need to get more base for other proposed SRS. Ordered 9m3 and used all of it on SRS B2. Lots used to get 1:5 slope, clay material too difficult to grade.
- Pumps off at C2, will try diverting pumps to 2 different locations, try to keep turbidity down.

3:00PM
- Discussion with QM (James) – going to be late day. Need to backfill SRS B2 excavation prior to tomorrow because they are hauling material sitting in B3 area, need the space.

6:00PM
- Discussion with QM (Jim) – getting survey tomorrow for stockpiles from B, B2 excavation and C2 topsoil being stockpiled in Jahoolie field.

Report:

7:30AM
- Pumping at C2.
- Preparing SRS B2 lock block area.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

8:20AM
- Excavating at B2 and stockpiling.

9:20AM
- Moving excavated stockpiles SRS B and SRS B2 lock block material and clearing in B3 area to make space for more material being excavated. Keeping SRS B and B2 lock block excavation separate.

1:00PM
- Pumping at C2 off.

12:00PM –
- Placing lock blocks in SRS B2 excavation.
- Outside blocks combigrid and gravel placed between filter and base.
- 3:00PM 5 south most blocks placed and began tamping.
- 4:00 Placing 6th block on first layer, north most.
- Ongoing tamping in lifts during placement of gravel.
- 5:00 Combi grid on top of 1st layer.
- 6:20PM 2nd lock block layer installed. 7 -8 degree slope on blocks.

7:30PM
- Left site.

Testing:

- None today.

Safety Concerns:

12:00PM
- Slope on excavation at south end of SRS B2 excavation for lock blocks, excavator parked at top, running water into excavation
- Slope flattened shortly after.

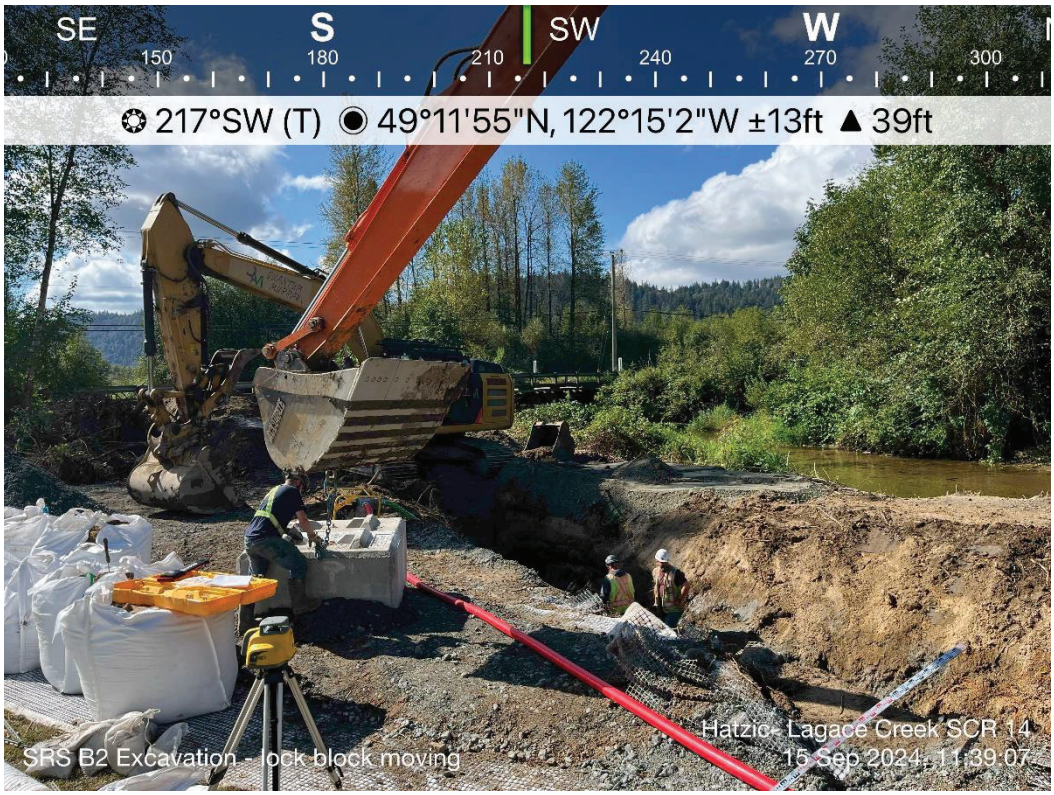
Traffic Control:

- None today.

Photos:

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: September 15, 2024
Environmental Monitors: John Choi, Loc Ngo, Corbin Manson
Weather: Low of 10°C, High of 19°C. Sunny throughout the day.

- 06:30 AM: EMs arrived on-site at CR14.
- 07:10 AM: EMs retrieved ten (10) minnow traps deployed the previous day.
- Results of trap retrieval:
    - 1 Signal crayfish
    - 7 Coho salmon
    - 14 Three-spine sticklebacks
    - 15 Prickly sculpins
    - 2 Pumpkinseed sunfish
- One (1) minnow trap was observed crushed.
- Salvaged fish were measured and released downstream.
- Two (2) invasive Pumpkinseed sunfish were euthanized.
- 07:30 AM: Dewatering at Station C2 was initiated using one (1) 6-inch pump. The discharge hose was directed towards the poly-sheeting waterway installed about 40m downstream. A silt bag was installed on the discharge outlet, and a fish protection basket was observed on the intake hose.
- 07:40 AM: EM observed a notable turbidity bloom traveling downstream from the discharge point. The dewatering pump was temporarily shut down. (Please refer to the water quality result table.)
- 07:45 AM: EMs discussed mitigation strategies with QM to address the turbidity exceedance downstream of Station C2.
- QM noted that the pressure from the discharge was too strong, pushing the turbidity bloom past the silt curtain.
- 08:31 AM: The silt curtain was repositioned across the stream to better accommodate the pressure from the dewatering pump discharge.
- 08:32 AM: The dewatering pump at Station C2 was restarted under the supervision of the EM.
- 08:49 AM: Turbidity bloom persisted near the discharge outlet. (Please see the water quality result table.) EMs informed QM personnel, and the pump was shut down.
- EMs recommended installing poly-sheeting under the silt bag to minimize sediment disturbance on the stream floor during discharge.
- 09:40 AM: The dewatering pump at Station C2 was restarted. EM actively monitored downstream water quality.
- 10:29 AM: Excavator arrived at Stations B2, and excavation work for the SR5 lock-blocks installation began.
- 10:57 AM: The poly-sheeting under the silt bag appeared effective, as turbidity downstream of Station C2 stabilized. (Please refer to the water quality results table.)

- 11:35 AM: Only one (1) dewatering pump was used at Station C2. EMs raised concerns about potential turbidity issues if two (2) dewatering pumps discharge at the same location. QM will set up a second poly-sheeting waterway for the second 6-inch dewatering pump.
- 12:47 PM: QM confirmed no further work at Station C2 for the day, and the dewatering pump was shut down.
- 13:01 PM: EMs deployed nine (9) minnow traps at Station C2 to soak overnight for retrieval the following morning.
- 13:10 PM: Intermittent groundwater discharge from SR5 excavation at Station B2 was observed. Two (2) 3-inch dewatering pumps were used, with discharge directed towards the vegetated bank upstream of Station B. EMs noted that discharged water did not enter the stream.
- 14:15 PM: EMs drove to Station CR17 and noted that the fish isolation barriers were in good condition.
- 16:20 PM: EM Corbin Manson arrived on-site to relieve John and Loc.
- 16:25 PM: EMs (John and Loc) left the site.
- 16:30 PM: SR5 lock-blocks installation continued at Stations B2.
- 17:33 PM: Refueling of the excavator was observed at Stations B2.
- 18:28 PM: The site was shut down for the day.
- 18:35 PM: EM (Corbin) left the site.
- Water Quality Sampling Results:

Location	Time	Turbidity (NTU)
Station B (Background for Station C-2)	7:30	3.05
Station D (~ 50 m downstream from Station C-2)	7:45	**19.06**
Station B (Background for Station C-2)	8:41	3.11
Station D (~ 50 m downstream from Station C-2)	8:49	10.15
Station D (~ 70 m downstream from Station C-2, behind silt curtain)	10:01	10.49
Station D (~ 50 m downstream from Station C-2)	10:08	**15.60**
Station D (~ 50 m downstream from Station C-2)	10:57	5.10
Station D (~ 70 m downstream from Station C-2, behind silt curtain)	12:33	9.67
Upstream from Station B (Background)	15:44	3.09
Downstream from Station B	15:52	7.63

Site Photos






2024-09-15 9:42 a.m.


2024-09-15 9:59 a.m.


2024-09-15 2:26 p.m.


2024-09-15 7:41 a.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	15
Project:	Legace Creek	**Page:**	1 of
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 16, 2024
Contract No.:		**Temperature:**	High: 22 Low: 9
Weather:	Overcast		

September 16, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Jim), 3 operator, 4 labourers
Keystone Environmental: EM (John) (Loc)
Lucas geomatics – survey crew
2 Flaggers

Contractor's Equipment:

-Equipment in Use

- CAT Excavator 324E
- Zaxis Excavator EX0689
- Zaxis excavator 2720
- Deer Loader 1466
- Pumping equipment: generator, 2 – 6" pumps.

Report, if any, Contact with Occupants:

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

3:40PM

- Discussion with QM (Corbin) – AE (Jordan) asking about knotweed management related to in stream works.
- Corbin – was not present when they excavated at B.
- The 20m radius 2m depth is not based on the biology of the plant. Would not expect knotweed to be growing under the creek.
- BC Government flood mitigation manual for invasive species is where the EM's reference the radius and depth buffer. It is more used as a safety / risk mitigation because the knotweed is so predominant on the slope from B to B3. More of a liability aspect in case a seed or stem ends up in the excavated material and it gets hauled to a clean disposal.

Discussions with Contractor:

6:30AM

- Discussion with QM (James) – Haul out material from B and B2 SRS excavation today.
- Survey here this morning will shoot stock piles.
- Leaving B2 lock blocks for now, will try to isolate C2 today.

8:30AM

- Discussion with QM (James, Craig) – AE (Jordan) following discussion with Ryan and Jordon, proposed SRS B2 combigrid and aggregate was improperly installed yesterday.
- The combigrid and aggregate must extent the entire length of the station (excavator distance), it cannot be stepped.
- Must excavate area again and properly install.
- QM – the design drawings do not show a length for how far back the combi grid and aggregate is to extent.
- Jordan asked James to provide submittal for combigrid to AE.

11:00AM

- Discussion with QM (James) – length of combi grid and aggregate for SRS is to be length of excavator.
- QM proposed their excavator is 8m, AE (Jordan) confirmed with AE (Jordon) length is acceptable.
- James got combi grid spec to AE.

1:00PM

- Discussion with QM (James) – James and AE (Jordan) in agreeance isolation at C2 is looking good.
- QM will continue to manage/monitor water and pump during excavation.
- Will be excavating into truck and hauling to stockpile at Jahoolie's, same as topsoil from this location.

1:05PM

- Extension of SRS combi grid and aggregate may reach doug's property for back slope to make excavation safe.
- James to confirm with Doug.
- Jordan confirmed from AE (Jordon) combi grid should have minimum 1m overlap.
- Going to prep B2 area to do it tomorrow.

1:10PM

- Discussion with QM (James) – estimated about 200m3 taken when they excavated C. Will get a lot of material from C2. Won't be finishing today.
- James not concerned with excavator on slope.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

1:30PM
- Discussion with QM (James, Craig) and property owner (Doug) – Doug confirming he is okay with back slope onto edge of his property.

4:15PM
- Discussion with Foreman (Craig) – 5m length for extent of combi grid and aggregate for SRS B2 is what Ryan and Mert agreed upon. Field memo to be released.

Report:

7:15AM
- Stockpiling B2 lock block excavated material near C2.

7:30AM
- Flaggers on site.

7:40AM
- Pumps on at C2
- LiDAR drone active.

8:30AM
- Removing topsoil at C2 and hauling to stockpile on Charlies land (Jahoolie).

9:00AM
- AE (Nicola and Braeden) on site

9:30AM
- Lock block delivery

9:40AM – 10:40AM
- Hauling contaminated material from SRS B2 lock block excavation
- 4 trucks with wagons – same trucks around 21m3 total per truck.

12:00PM
- Removing gravel and combi grid from SRS B2.

1:00PM
- Ongoing pumping and surface excavation at C2.

1:50PM
- Stopped excavation to adjust pump.

4:00PM
- Ongoing excavation at C2

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

- Preparing B2 area for lock blocks tomorrow.
- No longer pumping with cage.

5:45PM

- Left site

Testing:

- None today.

Safety Concerns:

- None today

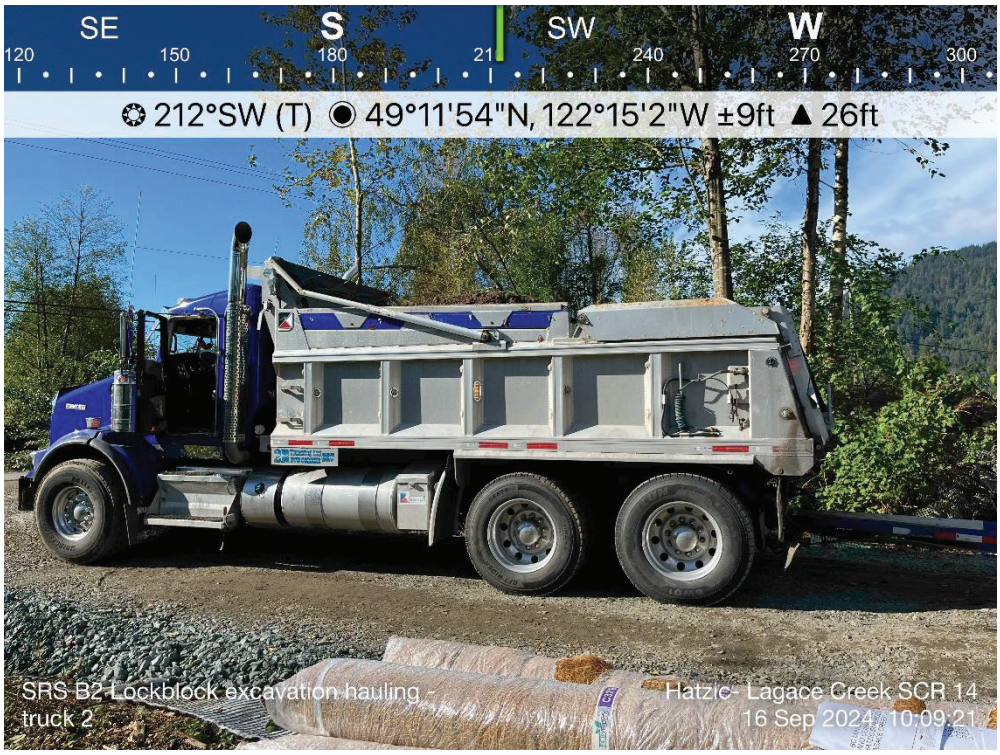
Traffic Control:

- Traffic control on Dale road.

Photos:

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: September 16, 2024
Weather: Low of 10°C, High of 21°C. Partly cloudy throughout the day.

- 0630: EMs arrived on site at CR14.
- 0713: EMs retrieved nine (9) minnow traps deployed the previous day.
    - Trapping Results
        - 2 coho salmon
        - 15 prickly sculpin
        - 28 Three-spine stickleback
- 0735: New dewatering discharge point installed downstream of C2. Original discharge point is now discharge 1, new discharge point is discharge 2.
- 0741: Dewatering at Station C2 was initiated using one (1) 6-inch pump fitted with a screened intake basket. The discharge hose was directed towards a poly sheeting waterway and silt bag combination located about 40m downstream from the intake.
- 0810: Additional 6-inch pump fitted with a screened intake basket started at Station C2. This pump discharged to discharge 2 which was fitted with a poly sheeting waterway and silt bag combination.
- 0830: Active fish salvage commenced at Station C2.
- 0840: Discharge 2 silt bag observed to have failed.
- 0848: The 6-inch pump discharging to discharge 2 was deactivated, as no new silt bags were available to replace the failed one.
- 1040: Dewatering at Station C2 halted due to imminent isolation barrier failure. Placement of sand bags and reinforcement commenced.
- 1129: Excavation and removal of material from Station C2 observed.
- 1158: Ongoing placement of isolation barrier reinforcements observed.
- 1226: Removal of geogrid material was observed near Station B3. Site staff communicated that 6 m of additional gravel behind the lock block walls was required, so excavation and dewatering of the area is expected tomorrow, September 17. Geogrid material was being transported across the road and stored in metal containers. The EM evaluated the risk of the front loader spreading Japanese knotweed when moving across the road to be negligible, due to the vehicle only operating on the crushed rock road base.
- 1237: Dewatering recommenced using a single 6-inch pump fitted with a screened intake basket, discharging to a poly sheeting waterway and silt bag combination.
- 1300: Active fish salvage complete.
    - Active Salvage Results
        - 2 chinook salmon
        - 34 Pacific lamprey
        - 16 prickly sculpin

  - 25 Three-spined stickleback
  - 2 coho salmon
  - 5 signal crayfish
  - 5 green frogs (humanely euthanized)
- 1700: Dewatering at C2 was ceased.
- 1800: Works stopped, isolation at Station C2 was observed to be intact. 5 fish traps were deployed in case of the failure of the isolation barrier. EM offsite.
- Water Quality Sampling Results:

Location	**Time**	**Turbidity (NTU)**
Bridge (Background for Station C2)	0707	5.77
Bridge	0830	8.37
50 m Downstream of Station C2	0836	15.9
Bridge	1030	11.8
50 m Downstream of Station C2	1035	13.6
Bridge	1247	8.31
50 m Downstream of Station C2	1253	**22.17**
100 m Downstream of Station C2	1307	9.31
Bridge	1435	7.12
50 m Downstream of Station C2	1440	**21.8**
100 m Downstream of Station C2	1452	14.0
Bridge	1542	10.31
50 m Downstream of Station C2	1547	11.27
Bridge	1639	4.36
50 m Downstream of Station C2	1645	**16.9**
100 m Downstream of Station C2	1657	13.6

Site Photos









RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: September 16, 2024
Weather: Low of 10°C, High of 21°C. Partly cloudy throughout the day.

- ***Works are being conducted outside of the least-risk window for in-stream works under the supervision and guidance of the Environmental Monitor.***
- 0630: EMs arrived on site at CR14.
- 0713: EMs retrieved nine (9) minnow traps deployed the previous day.
    - Trapping Results
        - 2 coho salmon
        - 15 prickly sculpin
        - 28 Three-spine stickleback
- 0735: New dewatering discharge point installed downstream of C2. Original discharge point is now discharge 1, new discharge point is discharge 2.
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    - Active Salvage Results
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  - 5 signal crayfish
  - 5 green frogs (humanely euthanized)
- 1700: Dewatering at C2 was ceased.
- 1800: Works stopped, isolation at Station C2 was observed to be intact. 5 fish traps were deployed in case of the failure of the isolation barrier. EM offsite.
- Water Quality Sampling Results:

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50 m Downstream of Station C2	1035	13.6
Bridge	1247	8.31
50 m Downstream of Station C2	1253	**22.17**
100 m Downstream of Station C2	1307	9.31
Bridge	1435	7.12
50 m Downstream of Station C2	1440	**21.8**
100 m Downstream of Station C2	1452	14.0
Bridge	1542	10.31
50 m Downstream of Station C2	1547	11.27
Bridge	1639	4.36
50 m Downstream of Station C2	1645	**16.9**
100 m Downstream of Station C2	1657	13.6

Site Photos









Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	16
Project:	Legace Creek	**Page:**	1 of 5
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 17, 2024
Contract No.:		**Temperature:**	High: 17 Low: 10
Weather:	Overcast		

September 17, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Jim), 2 operator, 5 labourers
Keystone Environmental: EM (Corbin)

Contractor's Equipment:

-Equipment in Use

- CAT Excavator 324E
- Zaxis Excavator EX0689
- Zaxis excavator 2720
- Deer Loader 1466
- Pumping equipment: generator, 2 – 6" pumps.

Report, if any, Contact with Occupants:

Contact with Owner:

None Today.

Discussions with Keystone Environmental:
None today.

Discussions with Contractor:

6:45AM

- Toolbox QM (James) – Asked if SRS B2 will be extra work.
- AE (Jordan) – Mert and Ryan decided together yesterday that 5m length of edge of lock block is acceptable. AE PM's will decide if it is extra work, as for today we will note work being conducted in case it is deemed extra.
- Mark up on FM 7 extends past the excavation, this is incorrect, the excavation is to be 5m from lock block edge.

10:15AM

- Discussion with QM (James) and Keystone (Corbin) – AE and QM in agreeance during excavation at SRS B Keystone deemed entire excavation contaminated.
- James asking Corbin to provide AE documentation where the 20m radius and 2m depth comes from for contamination.
- James wants combigrid in bottom of SRS B2 excavation, wants Ryan aware this will be extra charge, wants Jordan to confirm this with Ryan.

11:15AM

- Discussion with QM (James) – Around 500m3 of material he is expecting from SRS C2 excavation.

2:45PM

- Discussion with QM (James) – almost done at C2.
- Measured current slope at C2 around 25 degrees with smart level. (2.5:1 = 22 degrees)

Report:

7:00AM – PM
SRS B2 Lock block installation:
7:10AM – Setting up / layout for SRS B2.
7:20AM – 2 labourers setting up pumps.
7:25AM – 1 excavator starts digging
7:40AM – 2nd excavator starts digging with excavator 1.
7:50AM – 1 – 3" Pump turned on.
8:00AM – 2 operators and 3 labourers
8:30AM – Removing 2nd layer lock blocks.
9:10AM – Removing previous combi grid from top of layer 1.
9:30AM – 2 Labourers and 2 operators
9:45 – 10:25 – Stopped work
10:25AM – Putting combigrid on bottom layer.
10:30AM – Excavator backfilling 1st layer with aggregate
11:30AM – 2 excavators in operation on SRS B2 build – laying aggregate

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

11:50AM – Tamping 3rd time on aggregate layer 1
12:30PM – 2 Operators, 1 labourer
12:30PM – Tamping 4th lift for aggregate layer 1
12:40PM – Laying final lift of gravel
1:00PM – tamping final lift on aggregate layer 1
1:10PM – Fitting lock blocks on bottom layer
2:20 – 2nd layer lock blocks installed
2:20-2:45 – Stopped work
2:45 – 1st aggregate lift, 2nd layer
3:20PM – 2nd layer, 1st lift tamped – 2 operators, 1 labourer
3:45PM – Tamping 2nd lift, 2nd layer
4:45PM – Tamping lift 4, layer 2

7:30AM

- Excavation and pumping at C2.

1:30PM

- Environmental monitor from BC on government for permits.

1:50PM

- Ongoing excavation and hauling to Jahoolie laydown on C2.

3:00PM

- Filled small sand bags at E, around 10.

3:30PM

- Removing pumps at C2, hauling truck to Jahoolie finished.

Testing:

- None today.

Safety Concerns:

- None today

Traffic Control:

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

- None today.

Photos:



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

DAILY CONSTRUCTION REPORT

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	15
Project:	Legace Creek	**Page:**	1 of 7
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 17, 2024
Contract No.:		**Temperature:**	High: 18°C Low: 11°C
Weather:	Partly Cloudy, Wind: 3 KM/H, Gusts: 5 KM/H		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Labour Force:

Quantum Murray (QM): 1 Site Superintendent (Jem), 3 Operators, 4 Labourers
Keystone Environmental/Environmental Monitors (KE/EM): Curbin
Associated Engineering (AE): Jordan Fiske, Vinizza Pingos

Contractor's Equipment: Equipment in use

- Excavator 324E
- Excavator EXO689
- Excavator 2720
- Loader 1466
- 2 – 3" water pump
- 2 - 6" Vacuum Assisted Pumps

Report, if, any, Contact with Occupants:

N/A

Contact with Owner:

N/A

Safety Concerns:

N/A

Testing:

N/A

Traffic Control:

No traffic management on site.

Report:

6:55 AM
- AE (Vinizza) arrived on site.

7:00 AM
- Sign in.

At Station B2: 2 Excavator Operators & 3 Laborers.
7:15 AM
- 2 x 3" water pumps delivered to Station B2.

7:25 AM
- Ongoing excavation of the proposed SRS (Excavator 324E).

7:35 AM
- Ongoing excavation of the proposed SRS (Excavator 2720).
- Water started seeping in.

7:48 AM
- Began pumping the water with the 3" water pumps.

8:00 AM
- Online meeting with Jordon.

8:28 AM
- Ongoing removal of the blocks from the previous installation (2nd layer).

8:35 AM
- Station C:
- Ongoing setup of the 6" water pump.

At Station B2:
8:40 AM
- Finished removing the lock blocks from the previous installation (2nd layer).

9:08 AM
- Removing the combigrid from the previous lock blocks installation.

9:45 AM

- Break.
- Ongoing water pumping.

At Station B2; 1st layer of lock block (bottom):
10:27 AM

- Began laying the combigrid (approximately 9m x 5m with 1m overlap).

10:33 AM

- Laying gravel.

10:54 AM

- Completed the 1st layer of gravel.

10:56 AM

- Began compacting the 1st layer.

11:04 AM

- Finished compacting the 1st layer.

11:06 AM

- Ongoing laying of gravel (2nd layer).

11:18 AM

- Began compacting the 2nd layer.

11:28 AM

- Finished compacting the 2nd layer.

11:30 AM

- Ongoing laying of gravel (3rd layer).

11:48 AM

- Began compacting the 3rd layer.

12:00 PM

- Ongoing laying of gravel (4th layer).

At Station B2; 1st layer of lock block (bottom); 2 Excavator Operators, 1 Loader Operator, 1 Laborer:
12:18 PM

- Began compacting the 4th layer.

12:30 PM
- Finished compacting the 4th layer.

12:42 PM
- Ongoing laying of gravel (5th layer).

12:55 PM
- Began compacting the 5th layer.

1:05 PM
- Finished compacting the 5th layer.

1:18 PM
- Began laying the combigrid (3 sheets approximately 4m x 6m with 1m overlap).
- Began installing the lock blocks (2nd layer).

2:20 PM
- Finished installing the lock blocks (2nd layer).

2:45 PM
- Measuring the slope at Station C2; approximately 25˚.

At Station B2; 2nd layer of lock block (middle); 2 Excavator Operators, 1 Loader Operator, 2 Laborers:
2:49 PM
- Began laying the gravel (1st layer).

3:05 PM
- Finished laying the gravel (1st layer).

3:09 PM
- Began compacting the 1st layer.

3:28 PM
- Laying gravel (2nd layer/lift).

3:44 PM
- Compacting the 2nd layer/lift.

3:54 PM
- Finished compacting the 2nd layer/lift.

3:55 PM
- Laying gravel (3rd layer/lift).

4:14 PM

- Compacting the 3rd layer/lift.

4:22 PM

- Finished compacting the 3rd layer/lift.

4:28 PM

- Laying gravel (4th layer/lift).

4:48 PM

- Compacting the 4th layer/lift.

5:00 PM

- Finished compacting the 4th layer/lift.

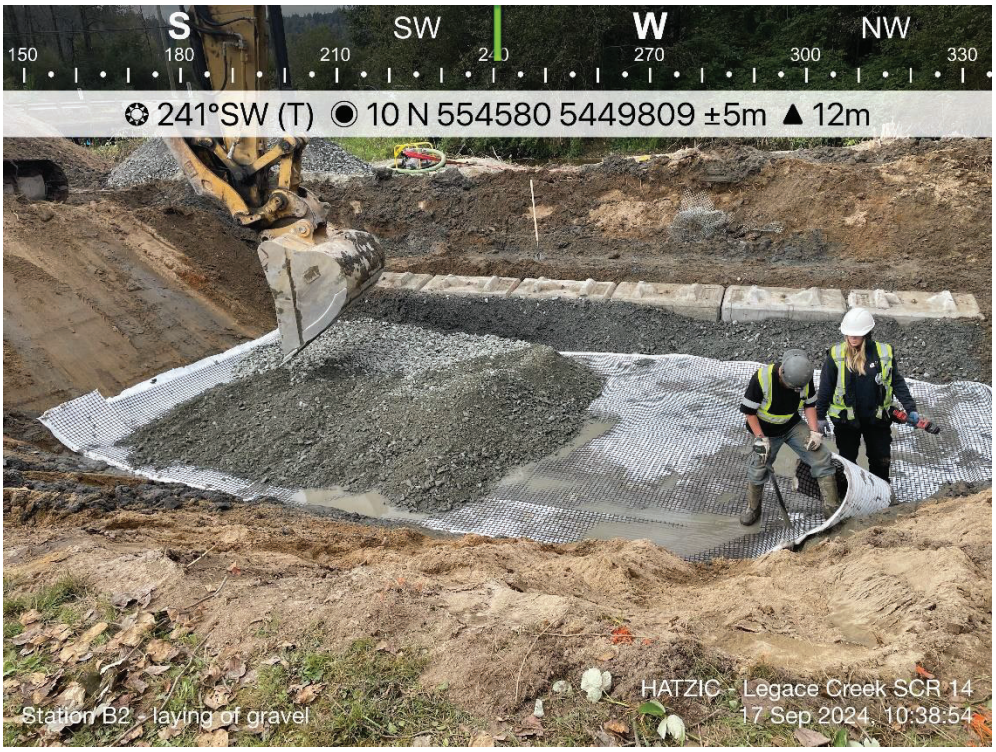
5:40 PM

- QM left the site.

5:50 PM

- AE (Vinizza) left the site.

Photos:


S SW W NW
150 180 210 240 270 300 330
241°SW (T) 10 N 554580 5449809 ±5m 12m
Station B2 - laying of gravel
HATZIC - Legace Creek SCR 14
17 Sep 2024, 10:38:54


SW W NW N
210 240 270 300 330 0
284°W (T) 10 N 554584 5449812 ±3m 1m
Station B2 - 2nd layer of lock block: began laying the gravel
HATZIC - Legace Creek SCR 14
17 Sep 2024, 14:50:54


SW 210 240 W 270 NW 300 330 N 0
285°W (T) 10 N 554585 5449816 ±3m -5m
Station B2: 2nd layer lock block-compacted 4th layer/lift
HATZIC - Legace Creek SCR 14
17 Sep 2024, 17:37:44


E 90 120 SE 150 S 180 210 SW 240
159°S (T) 10 N 554566 5449775 ±4m 0m
Station C2: EOD
HATZIC - Legace Creek SCR 14
17 Sep 2024, 17:40:15

RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: September 17, 2024
Weather: Cloudy with 30% chance of showers. High 18°C, Low 10°C.

- ***Works are being conducted outside of the least-risk window for in-stream works under the supervision and guidance of the Environmental Monitor.***
- ***KEL undertook the following additional measures to reduce the risk of impacts to fish and fish habitat during works conducted outside the instream works least-risk window:***
    - *Overnight trapping of Station C2. Based on the intact isolation and repeated sampling of the work area with no fish caught, we normally would not require additional salvage at Station C2. However, out of an abundance of caution, trapping was conducted overnight. No fish were detected.*
    - *Water quality management. The EM closely monitored downstream water quality and adjusted sediment control measures as neccessary. On September 17th, reinforcements were made to the C2 isolation barrier, and the silt sack at Discharge 1 was replaced when it was observed to be burst.*

- 0630: EM arrived on site at CR14. Isolation at Station C2 appeared intact.
- 0644: EMs retrieved five (5) minnow traps deployed the previous day.
    - Trapping Results
        - No fish captured
    - Based on the trapping results, KEL advised that dewatering could proceed. One 6-inch pump fitted with a screened intake basket was started, and discharge was directed through a silt sack and poly waterway combination at Discharge 1.
- 0722: Placement of two (2) 3-inch trash pumps fitted with spill trays was observed at Station B lock block installation area.
- 0811: Discharge from the 3-inch trash pumps was observed to be directed to a vegetated area upstream of station B.
- 0839: Dewatering was observed to be halted at Station C2 while one 6-inch pump was swapped with the backup pump.
- 0848: Dewatering at Station C2 observed to be resumed.
- 0858: Dewatering at Station B observed to be halted.
- 0925: Discharge at Station B observed to be restarted.
- 1219: Isolation barrier at Station C2 was observed to be deteriorating. Sandbag reinforcements were observed being installed.
- 1355: Staff from the BC Ministry of Water, Land, and Resource Stewardship were on-Site. Per KEL discussion with WLRS, the Ministry will allow excavation in an isolated-but-leaking Station C2. WLRS requested KEL EM be diligent and strict with water quality guidelines.
- 1355: Silt sack at Discharge 1 observed to be replaced.
- 1457: Downstream water quality observed to be improved following installation of new silt sack.

- 1520: Dewatering at Station C2 was observed to be halted.
- 1723: Works observed to be halted for the day.
- 1729: Poly being placed on Japanese knotweed stockpiles based on risk of rain.
- Water Quality Sampling Results:

Location	Time	Turbidity (NTU)
20 m Upstream of Station B	0707	6.39
20 m Upstream of Station B	0808	7.54
Bridge	0801	11.03
50 m Downstream of Station C2	0754	6.58
20 m Upstream of Station B	0901	9.71
Bridge	0910	10.77
50 m Downstream of Station C2	0917	**24.8**
100 m Downstream of Station C2	0922	14.7
20 m Upstream of Station B	1029	5.17
Bridge	1037	5.07
50 m Downstream of Station C2	1041	8.72
20 m Upstream of Station B	1131	4.15
Bridge	1137	3.18
50 m Downstream of Station C2	1143	**14.8**
100 m Downstream of Station C2	1151	11.8
20 m Upstream of Station B	1240	5.00
Bridge	1245	5.29
50 m Downstream of Station C2	1251	12.6
20 m Upstream of Station B	1335	5.26
Bridge	1341	11.9
50 m Downstream of Station C2	1347	15.1
20 m Upstream of Station B	1446	4.96
Bridge	1451	6.31
50 m Downstream of Station C2	1456	9.55

Site Photos











Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	17
Project:	Legace Creek	**Page:**	1 of 5
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 18, 2024
Contract No.:		**Temperature:**	High: 20 Low: 17
Weather:	Overcast		

September 18, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Jim), 3 operator, 4 labourers
Keystone Environmental: EM (Corbin, Vincent)

Contractor's Equipment:

-Equipment in Use

- CAT Excavator 324E
- Zaxis Excavator EX0689
- Zaxis excavator 2720
- Deer Loader 1466
- Pumping equipment: generator, 2 – 6" pumps.

Report, if any, Contact with Occupants:

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

Discussion with Contractor:

7:00AM

- Toolbox talk with QM (James) – plan to finish B2 lock block structure today.
- Removing bags from C2
- Start excavation for C2 lock blocks
- Hauling contaminated material from B and B2 lock block excavation
- Survey on site for C2 stockpiles in Jahoolie yard
- Not planning on change order SRS B2 re-excavation, not a lot of work. Wants to keep everyone happy now that we are on the same page with the contaminated material.

9:25AM

- Discussion with QM (James) – after finishing removing bags at C2 then will start excavating there.
- Also planning to start removing material from B3, once there is space for stockpile.
- Surveyor shooting stockpiles from C2 in Jahoolie field today, also shot contaminated piles.

11:10AM

- Discussion with foreman (Craig) – no width of the access road is specified in the drawings.
- Jordan – refer to PL on drawings and work off that.

11:30AM

- Discussion with QM (Jim, Craig) – asking about extent of combigrid from road surface into SRS.
- AE (Jordan, Vinizza) – want to tie in that combigrid from the road structure on the top layer to the back of the lock blocks, 1m overlap still applies.

2:05PM

- Discussion with QM Foreman (Craig) – left section of combigrid under filter fabric next to SRS B2, will be able to lift this layer up to tie into road with 1m overlap for combigrid.

5:00PM

- Discussion with QM (James) – DFO permit is now in place, waiting on a few comments to be addressed form AE, then will be able to excavate in the wet likely tomorrow.
- Will be ramping up, likely 3 crews by end of week to excavate/build stations.
- Waiting on some permits before giving excavated material from C2 to Jahoolie, Jahoolie pushing because they want to plant crops this week.

5:30PM

- Wondering how far back to extend the access road to SRS B. Gap shown on drawings. Jordan to confirm with AE (Jordon).

Report:

7:15AM

- Hauling contaminated material from B2 lock block excavation and SRS B excavation.

8:00AM

- Surveyor on site, using total station.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

8:15AM
- Removing sand bags and clean up from SRS C2
- Lost 2 bags

8:40AM
- Ongoing aggregate deliveries today.

9:15AM
- SRS B2 excavation
- Final lift on layer 2 – 2 operators 2 laborers

10:10AM
- Combigrid on 2nd layer of SRS B2

11:00AM
- Lucas geomatics – LiDAR survey – on site

11:10AM
- 1st layer lift on top layer SRS B2 – 2 labourers, 2 operators

12:40PM
- 3rd contaminated hauling truck on site – Vinizza tracking trucks today.
- Tarping on Farms road.

2:05PM
- Laying final layer of combigrid (road surface)

3:00PM
- 4th contaminated hauling truck.

4:00PM
- SRS B2 lock block structure complete, back filling surrounding area with stockpile that was surveyed today.

4:00PM
- Fixing bags at SRS J and K

Testing:

- None today.

Safety Concerns:

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

- None today

Traffic Control:

- None today.

Photos:



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

DAILY CONSTRUCTION REPORT

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	16
Project:	Legace Creek	**Page:**	1 of 6
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 18, 2024
Contract No.:		**Temperature:**	High: 19°C Low: 12°C
Weather:	Partly Cloudy, Wind: 3 KM/H, Gusts: 5 KM/H		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Labour Force:

Quantum Murray (QM): 1 Site Superintendent (Jem), 3 Operators, 4 Labourers
Keystone Environmental/Environmental Monitors (KE/EM): 2 staff
Associated Engineering (AE): Jordan Fiske, Vinizza Pingos

Contractor's Equipment:

s
Equipment in use

- Excavator 324E
- Excavator EXO689
- Excavator 2720
- Loader 1466
- 2 – 3" water pump
- 2 - 6" Vacuum Assisted Pumps

Report, if, any, Contact with Occupants:

N/A

Contact with Owner:

N/A

Safety Concerns:

N/A

Testing:

N/A

Traffic Control:

Traffic management control, consisting of one flagman, arrived on site at 9:29 AM and left at 2:45 PM.

Report:

6:40 AM
- AE (Jordan & Vinizza) on site.

6:45 AM
- Sign-in completed. Toolbox talk conducted with QM and Keystone.
- Jem outlined today's tasks: hauling excavated materials from Station B, surveying the excavated materials, and continuing the SRS at Station B2.

7:18 AM
- Commenced hauling excavated materials from Station B.

7:57 AM
- Hauled excavated materials using two trucks with wagons.

8:00 AM
- Online meeting with Jordon.

8:13 AM
- Surveyor arrived

Station C with one operator and three laborers.
8:25 AM
- Began removing sandbags from Station C2.

8:50 AM
- Ongoing delivery of gravel to Station B2.

8:55 AM
- Ongoing survey of excavated materials

At Station B2 with one operator and two laborers. Continuation of the proposed SRS and installation of the second layer of lock blocks.
9:10 AM
- Started laying gravel (5th lift).

9:26 AM
- Compacted the gravel (5th lift).

9:29 AM
- Left site 14; traffic management in place on site.

9:35 AM
- Arrived at site 17.

10:08 AM
- Returned to site 14.

10:10 AM
- Laying combigrid and installing lock blocks (3rd layer).

10:11 AM
- Left site 14.

10:16 AM
- Arrived at site 17.

10:20 AM
- Flagged the north side area for sediment removal.

11:03 AM
- Returned to site 14.

At Station B2: installed the 3rd layer of lock blocks with two operators and two laborers.
11:04 AM
- Completed installation of the 3rd layer of lock blocks.
- Ongoing laying of gravel (1st lift).

11:34 AM
- Ongoing compaction of the 1st lift.

11:50 AM
- Completed compaction of the 1st lift.

12:00 PM
- Online meeting with Jordan.

12:52 PM
- Hauling excavated materials at Station B2 using the 3rd truck with a wagon.

1:15 PM
- At Station C2: transferring sandbags from Station C2 to Station D (opposite side).

1:25 PM
- Laying combigrid and nonwoven cloth on both sides.

1:45 PM
- Laying gravel on the combigrid.

2:14 PM
- Compacting the gravel (1st lift).

2:28 PM
- Laying gravel for the 2nd lift.

2:42 PM
- Ongoing delivery of gravel to Station B2.

2:45 PM
- Traffic management personnel left the site.

2:56 PM
- 4th truck for hauling excavated materials arrived on site.

3:15 PM
- 5th truck for hauling excavated materials arrived on site.

3:32 PM
- 6th truck for hauling excavated materials arrived on site.

3:35 PM
- Surveyed excavated materials were utilized for the proposed SRS at B2.

Station J:
4:15 PM
- Loader transported sandbags from Station D to Station J and placed them at Station J.

4:30 PM
- Installation of lock blocks at Station B2 has been completed.
- Hauled the excavated materials from B2 using 6 trucks + wagon (approximately 21 m^3 $each\ truck$)

4:55 PM
- AE (Vinizza) left the site.

Photos:


E 90 SE 120 150 S 180 SW 210 240
170°S (T) 10 N 554576 5449778 ±4m 6m
Station C2 - removing sandbags
HATZIC - Legace Creek SCR 14
18 Sep 2024, 08:43:55


SW 210 240 W 270 300 NW 330 N 0
284°W (T) 10 N 554585 5449813 ±3m 0m
Station B2
HATZIC - Legace Creek SCR 14
18 Sep 2024, 13:29:28


SW W NW N
210 240 270 300 330 0 30
299°NW (T) 10 N 554583 5449813 ±3m 2m
Station B2
HATZIC - Legace Creek SCR 14
18 Sep 2024, 16:41:31


SE S SW W NW
150 180 210 240 270 300
223°SW (T) 10 N 554583 5449805 ±7m 5m
Station B2- 6th truck
HATZIC - Legace Creek SCR 14
18 Sep 2024, 15:35:55

RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: September 18, 2024
Weather: Partly cloudy. High 17°C, Low 10°C.

- ***Works are being conducted outside of the least-risk window for in-stream works under the supervision and guidance of the Environmental Monitor.***
- ***Keystone Environmental undertook the following additional measures to reduce the risk of impacts to fish and fish habitat during works conducted outside the instream works least-risk window:***
    - *Overnight trapping of Station F. Based on the intact isolation and sampling of the Station F with no fish caught, we normally would not require additional salvage at Station F prior to excavation. However, out of an abundance of caution, four (4) baited minnow traps were deployed at Station F.*
    - *Isolation barrier maintenance, overnight trapping, and intensive dip netting of Station K. The isolation barrier at Station K was observed to have failed with one (1) sandbag having slumped and allowed streamflow to overtop the barrier. The barrier was repaired, and five (5) baited minnow traps were set overnight. The EM undertook intensive systematic dip netting of the area for 44 minutes, yielding no catch. The EM will evaluate the status of Station K following a trap check in the morning.*
    - *Water quality management. The EM closely monitored downstream water quality and adjusted sediment control measures as necessary. On September 18th, the Station C2 isolation barrier was disassembled following confirmation that the turbidity within the isolated area had declined to an acceptable level. No downstream water quality issues were observed. The isolation barrier at Station F was inspected and found to be intact. The isolation barriers at Stations J and K were inspected and both found to have failed at a single point. The EM observed repairs being made to the isolation barriers. The EM also observed a silt curtain being staged upland at Station K in preparation for installation downstream to reduce the release of sediments during excavation. Exposed soils were observed to be covered with poly sheets prior to the end of work today.*

- **0630:** EM arrived on site at CR14. Isolation at Station C2 appeared intact.
- **0652**: QM advised that they intended to walk an excavator from a knotweed contaminated area to an uncontaminated area. The EM advised that the excavator would have to be visibly free from soil and plant parts including high contact areas such as the bucket, treads, and floor of the cab. QM expressed concerns about being unable to remove hardened dirt efficiently. The EM advised that a 5:1 dilution of ammonia bleach with water, sprayed onto difficult to clean areas until wet but not running off, will mitigate knotweed risks associated with hardened dirt.
- **0720:** Loadout of knotweed soil from Station B observed. Transport trucks observed to be covered when leaving the Site.
- **0752:** Japanese knotweed clone observed at the sandbar near Station B2, supporting the idea that stream sediments are knotweed contaminated. Yellow flag iris was also observed to be present.

- **0800:** The isolation barrier at Station C2 was observed to be removed.
- **0806:** First water quality sample collected.
- **0917:** Second water quality sample collected.
- **1009:** Third water quality sample collected.
- **1044:** Excavator observed removing remaining isolation barrier materials.
- **1110:** Fourth water quality sample collected
- **1130:** Final isolation barrier materials observed to be removed by hand. Turbidity within the Station C2 basin observed to be draining slowly into the channel.
- **1227:** Fifth and final water quality sample collected.
- **1250:** Tracking of sediments from south side of Dale Road observed as knotweed transport trucks reverse into loading area. Directed QM to sweep the road and scrape the mud at the north side of the Site to reduce tracking. Knotweed contamination was not suspected in the tracked soils.
- **1309:** Sweeping of Dale Road observed.
- **1427:** Dissolved Oxygen data collected. QM advised that excavation was planned for Stations F and K the following day.
- **1449:** Four (4) baited minnow traps set at Station F. Isolation barrier inspected and found to be intact.
- **1514:** Five (5) baited minnow traps set at Station K. Isolation barrier inspected and found to be breached at a single point. QM notified of breach.
- **1552:** Japanese knotweed soil loadout observed to be ongoing. Transport truck observed to be using rubber tarps to secure load.
- **1610:** Isolation at Station K appears repaired. Active fish salvage via dip netting commenced.
- **1629:** Isolation repaired at Station J. Two (2) systematic dip net passes of Station K completed with no catch.
- **1654**: Five (5) total systematic dip net passes at Station K completed with no catch.
- **1658:** QM asked if there were any CEMP or permit restrictions in relation to moving the stockpiled soils around the neighbour's property to facilitate blueberry planting. Keystone Environmental advised that erosion and sediment control measures would be required if the risk of runoff to Lagace Creek or another watercourse was noted.
- **1735:** Poly sheets observed to be installed at Station C2 to cover exposed soils.
- **1741:** Excavation underway at B3. Trench appears dry and isolated.
- **1813:** Works observed to be halted for the day. Keystone Environmental off Site.
- Water Quality Sampling Results:

Location	Time	Turbidity (NTU)
Bridge	0807	4.72
50 m Downstream of Station C2	0811	5.20
50 m Downstream of Station C2	0917	2.67
Bridge	1009	6.08
50 m Downstream of Station C2	1009	5.53
Bridge	1110	10.27
50 m Downstream of Station C2	1110	9.06
Bridge	1227	6.60
50 m Downstream of Station C2	1231	4.05

Site Photos









Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	18
Project:	Legace Creek	**Page:**	1 of 5
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 19, 2024
Contract No.:		**Temperature:**	High: 19 Low: 10
Weather:	Overcast		

September 19, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Jim), 3 operator, 7 labourers
Keystone Environmental: EM (Corbin, Vincent)

Contractor's Equipment:

-Equipment in Use

- CAT Excavator 324E
- Zaxis Excavator EX0689
- Zaxis excavator 2720
- Deer Loader 1466
- Pumping equipment: generator, 2 – 6" pumps.

Report, if any, Contact with Occupants:

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

Discussion with Contractor:

7:00AM
- Toolbox talk QM (James) –
- Permit from DFO is in place, need amendment to WAS permit because the extension did not include working in the wet.
- Going to extend access to SRS B.
- Hauling contaminated this morning.
- Aggregate deliveries today.
- Finish SRS B2 + road area.
- Starting to excavate at B3 – this is material they are hauling.
- Layout at C2 – unsure if there is space to stockpile excavation for the lock block structure.
- Plan to give Charlie (Jahoolie) material once he signs off for it – stockpile has been surveyed.

7:10AM
- Discussion with QM (James) – discussing where we want B3 SRS.
- James – planning to leave large berm in creek next to bridge in order to excavate in dry, as well based on where original SRS B3 layout was in relation to bridge abutment.
- AE (Jordan) to confirm with Jordon Rozon.

8:00AM
- Discussion with QM (James, Mert), AE (Jordan Vinizza) –
- AE wants berm at B3 removed, explained this is most important section of project. QM wants to use berm for isolation, based on their excavator extent from original lock block layout it is as far as they can reach.
- QM – AE should have addressed moving blocks sooner, has contaminated trucks coming today to move this material, does not want to cancel trucks.
- Extending this area will increase contaminated quantity cost.
- Plan is to currently remove 80 – 90 % of this berm so they can still load out trucks.
- Jordan and Vinizza will help layout where SRS blocks should be.

9:20AM
- Discussion with QM (James) –
- AE (Jordan) and QM measured length of long arm excavator for lock block reference.
- QM will isolate this section and remove the berm. Still gives them ability to load out material today and get the rest after.

11:15AM
- Discussion with QM (James, Craig) – Jahoolie will not sign off on permit to accept material, process can take up to 60 days for agricultural use.
- James and Mert to talk to Doug about material.

11:20AM
- Discussion with QM (James) –
- AE (Jordan) confirming this will be pulling back slope from B to bridge with cocomatting, QM planning to do this after B3 excavation.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

3:15PM

- Discussion with QM (James) – Jordan (AE) asked James to get the edge of the sediment where sand bags are being tied in at. James wants to get BC first out to locate watermain running under bridge before digging any closer to the bridge.

4:15PM

- Discussion with QM (James) –
- After investigating a line locate was already complete at the beginning of this project. Because of the wet location they were unable to determine exactly where the line runs under the bridge because it is a PVC pipe.
- James was advised to stay 5m off the north side of the bridge, but is concerned in the sediment they will be losing.
- Jordan (AE) after talking to Jordon Rozon (AE) is going to provide QM with as-built drawings from Fraser Valley for the 250mm PVC water main running under bridge.

Report:

7:00AM

- AE (Jordan, Vinizza) – measure C2 clearing
- 17m x 22m

7:05AM

- Doing layout at C2 SRS.

8:00AM

- Lock block delivery.

9:30 – 10:15AM

- Hauling trucks all with wagons.
- Same trucks.
- 4 trucks with wagons total.
- Around 21 m3 each.

10:50AM

- Began excavated SRS C2 for lock blocks.

11:00AM

- Placing sand bags at B3 for isolation.

11:20AM

- Placing access road from B2 to B.

12:00PM

- AE Enviro (Naomi) on site.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

12:30PM
- Moving material excavated from SRS C2 lock block to SRS L laydown area.

5:00PM
- Left site

Testing:

- None today.

Safety Concerns:

- None today

Traffic Control:

- None today.

Photos:

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

DAILY CONSTRUCTION REPORT

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	17
Project:	Legace Creek	**Page:**	1 of 5
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 19, 2024
Contract No.:		**Temperature:**	High: 18°C Low: 10°C
Weather:	Partly Cloudy, Wind: 3 KM/H, Gusts: 5 KM/H		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Labour Force:

Quantum Murray (QM): 1 Site Superintendent (Jem), 3 Operators, 7 Labourers
Keystone Environmental/Environmental Monitors (KE/EM): 2 staff
Associated Engineering (AE): Jordan Fiske, Vinizza Pingos

Contractor's Equipment: Equipment in use

- Excavator 324E
- Excavator EXO689
- Excavator 2720
- Loader 1466
- 2 – 3" water pump
- 2 - 6" Vacuum Assisted Pumps

Report, if, any, Contact with Occupants:

N/A

Contact with Owner:

N/A

Safety Concerns:

N/A

Testing:

N/A

Traffic Control:

Traffic management control, consisting of two flagmen, arrived on site at 6:40 AM and left at 3:20 PM.

Report:

6:35 AM
- AE (Jordan & Vinizza) arrived on site.

6:40 AM
- Sign-in. Toolbox with QM (11) & Keystone (1).
- Jem discussed the day's work plan, which includes:
  - Layout of Station C2 for the SRS
  - Continuing gravel placement to Station B for the access road
  - Spreading excavated material onto Charlie's land
  - Hauling excavated materials
  - Delivering gravel
- Traffic management control established on site (2 flagmen).

7:02 AM
- AE measured the Station B3 (17m x 22m).
- QM laid out Station C2 for the proposed SRS.

7:05 AM
- Cleared the area for the access road to Station B.

8:21 AM
- Lock block delivery arrived.

9:40 AM
- Ongoing excavation at Station B3 (inland sediments).

9:44 AM
- Second truck + wagon arrived for hauling excavated materials from Station B3.

9:50 AM
- Third truck + wagon arrived for hauling excavated materials from Station B3.

10:10 AM
- Fourth truck +wagon arrived for hauling excavated materials from Station B3.

10:50 AM
- Excavator 27290 transferred to Station B3.

11:05 AM
- At Station B3:
  - Setting up the isolation area and placing poly sheet.

11:14 AM
- At Station B3:
  - Placing sandbags.

11:30 AM
- Laying gravel on the access road to Station B.

12:10 PM
- AE Naomi arrived on site.

12:45 PM
- Hauling excavated materials from Station C2 to Station L.
- Transferring sandbags from Station D (opposite side) to Station B3.

1:06 PM
- AE Naomi left the site.

1:30 PM
- Continuing to lay gravel on the access road to Station B.

1:36 PM
- Ongoing excavation of inland sediments at Station C2 in preparation for the proposed SRS installation.
- Ongoing hauling of excavated materials from C2 to L.

2:03 PM
- Transferred the 6” water pump to Station B3.

2:20 PM
- Setting up the 6” water pump at Station B3.

3:00 PM
- Ongoing placement of bags.

3:20 PM
- Traffic management control left the site.

4:30 PM
- At Station B3:
    - Sandbags and polysheet in place.

5:10 PM
- QM left the site.

5:15 PM
- AE (Vinizza) left the site.

Photos:


E SE S SW
90 120 150 180 210 240
170°S (T) 10 N 554579 5449779 ±3m ▲7m
Station C2-hauling excavated materials from C2 to L
HATZIC - Legace Creek SCR 14
19 Sep 2024, 13:35:47


SW W NW N
210 240 270 300 330 0
293°NW (T) 10 N 554590 5449758 ±4m ▲1m
Station C2-in preparation for the SRS installation
HATZIC - Legace Creek SCR 14
19 Sep 2024, 16:56:20


N NE E SE
0 30 60 90 120 150
73°E (T) 10 N 554546 5449783 ±4m 1m
Station B3-isolated area
HATZIC - Legace Creek SCR 14
19 Sep 2024, 16:53:40


W NW N NE
270 300 330 0 30 60
338°N (T) 10 N 554577 5449811 ±4m 0m
Station B2- SRS & access road to Sta. B
HATZIC - Legace Creek SCR 14
19 Sep 2024, 16:50:38

TECHNICAL MEMORANDUM

Issue Date:	September 24, 2024	**File:**	Audit No. 4
To:	**Thyren Jacobs, Flood Debris Management Secretariat**	**Previous Issue Date:**	
From:	Naomi Sands, R.P.Bio.		
Client:	Ministry of Environment and Climate Change Strategy		
Project Name:	Lagace Creek Bank Protection and Sediment Removal - SCR14	**Project No.:**	2022-2632.03
Subject:	Environmental Compliance Audit		
Monitoring Period:	September 13 – September 19, 2024		
Contractor:	QM Environmental		
Environmental Monitor:	Keystone Environmental		

1 INTRODUCTION

Associated Environmental Consultants Inc, (Associated) is pleased to provide this environmental audit report summarizing observations of site conditions, environmental protection measures, regulatory compliance, and corrective actions as part of erosion protection works on Lagace Creek, south of Durieu, BC in the Hatzic Valley (the Project, the Site) during the monitoring period September 13 to September 19, 2024. The results presented in this audit report are based on conditions observed at the time of the audit inspection(s) and represent a snapshot of the workday. Items identified as non-compliant may have been addressed before the report(s) are submitted. The audit report(s) are submitted to the owner, their agent (Associated Engineering), the Contractor, and their environmental monitor (EM) and are not intended for further distribution.

2 ROLES AND RESPONSIBILITIES

The prime contractor for the Project is QM Environmental (the Contractor), and works are being monitored for environmental compliance by Keystone Environmental (Keystone) and audited by Associated. As the EM, Keystone is to work with the Contractor to develop measures to protect the environment and to respond to environmental incidents as they occur. Keystone is also responsible for fish and wildlife salvages prior to instream works. Leq'á:mel First Nation (LFN) is the cultural monitor for the Site. The responsibility of the auditor is to ensure on behalf of the owner, who is ultimately the permit holder, that the EM, LFN, and the Contractor adhere to the requirements of the Construction Environmental Monitoring Plan (CEMP)[1], environmental permit conditions and any applicable regulations.

3 SITE INSPECTION

A summary of site conditions as observed during the audit inspection completed during the monitoring period is provided in Table 3-1. Monitoring reports have been submitted for the auditing period.

[1] AquaTerra Environmental Ltd. 2024. Hatzic Emergency Program, South Herford Creek Project, Construction Environmental Management Plan (Rev. 1). Prepared for Mission Contractors Ltd. 65 p.

Table 3-1 Site Conditions During Audit Inspection

Date / Time	Auditor (Associated)	Weather	Construction Activities
September 19, 2024 12:00	Naomi Sands	Sun & cloud. 17°C. No precipitation.	Contractors were excavating new sand stations C2 and B3, above wetted channel.

4 INSPECTION RESULTS

A checklist of required environmental protection measures and mitigative strategies for the Project is presented in Table 4-1. The checklist has been developed in accordance with terms and conditions of the environmental permits and approvals issued for the Project, environmental protection specifications and requirements as part of the construction contract for the Project, the Contractor's Construction Environmental Management Plan and environmental best management practices and guidelines.

Table 4-1 Summary of Environmental Protection Measures Reviewed and Results of the Inspection

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
	Environmental Monitoring					
1	The EM will attend key site meetings where environmental mitigations and issues may be discussed.	☒Compliant ☐Non-Compliant ☐N/A	EM has been on site daily to attend site meetings.	As instream works continue outside the least risk fish window, EM reports should continue to document consideration of increased risk and if enhanced mitigation is required.	CEMP Section 2.4	
2	The EM shall supervise all instream works. If temporary diversion installed, EM is onsite daily to check pumps and flow bypasses.	☒Compliant ☐Non-Compliant ☐N/A	EM was onsite to oversee works in and about the channel.		WSA (h)2.ii, (j)5.i CEMP Section 2.4	
3	The EM will submit daily and bi-weekly monitoring reports to the Contractor for distribution to MoECCS.	☒Compliant ☐Non-Compliant ☐N/A	Monitoring reports are submitted daily, or the following morning.		CEMP Section 5.1	
4	The EM will complete and submit an Environmental Incident Report (EIR) for non-compliances with the CEMP, reportable spills or other environmental incident.	☐Compliant ☐Non-Compliant ☒N/A	No reportable environmental incidents have been documented to date.		CEMP Section 4	
5	EM is granted authority to stop the work if necessary	☒Compliant ☐Non-Compliant ☐N/A	EM has not exercised stop work to-date.		WSA (i) 7 CEMP Section 2.4	
	Erosion and Sediment Control					
6	Appropriate site isolation is installed as required, including silt fencing prior to instream works. Silt fences are installed properly, intact, adequate, clear of accumulated sediment and are functioning.	☒Compliant ☐Non-Compliant ☐N/A	Sandbag isolation installed at stations J, K. Waiting approval to proceed in the wet. Current excavation is above the wetted channel. Silt fences installed around sediment stockpiles.	WLRS permit amendment, to allow dredging in the wet, is still pending. In the interim, instream works must adhere to existing permit conditions.	WSA (o), (q) CEMP Section 3.5	Photo 1 Photo 2
7	Riprap or any other engineering material place in channel is clean of any substances deleterious to aquatic life.	☐Compliant ☐Non-Compliant ☒N/A	No riprap or other material was being placed during the audit.		WSA (x) CEMP Section 3.5	
8	Stockpiling and storage areas are located 15 m from the watercourse TOB.	☒Compliant ☐Non-Compliant ☐N/A	Sediment stockpiles are located >15 m from the watercourse OR surrounded by silt fencing.		DFO FAA WSA (t) CEMP Section 3.5	Photo 3
9	Emergency ESC material onsite (e.g., 100 feet of silt fencing, 5 dry bales, and 100sq.m of ECBs/ Coconut matting, or polyethylene sheets)	☒Compliant ☐Non-Compliant ☐N/A	ESC materials were stockpiled at the site laydown. Lots of exposed sediment onsite.	With forecast rain, EM should ensure site is stabilized.	CEMP Section 3.5	
10	Sediment removed from the Site will be disposed of appropriately at a location approved by the EM and MoECCS.	☐Compliant ☐Non-Compliant ☒N/A	Excavated sediment is currently being stockpiled onsite. Offsite disposal location still to be determined.	Identify sediment disposal location(s) in the CEMP and/or the environmental monitoring reports.	CEMP Section 5.5	
11	Sediment removal boundaries must be clearly delineated prior to commencement of work.	☒Compliant ☐Non-Compliant ☐N/A	Sediment boundaries determined in consultation with AE inspector.		WSA (opening)	
	Invasive Plant Management					

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
12	Ensure that machinery is free of invasive plant material that could potentially be transported throughout or between sites.	☐Compliant ☐Non-Compliant ☒N/A	No machinery observed leaving site during inspection.		WSA (opening) CEMP Section 3.4	
13	Ensure that invasive species removed from site are disposed of appropriately at an approved facility	☐Compliant ☒Non-Compliant ☐N/A	Japanese knotweed removal is ongoing, however, management protocols in CEMP still do not align with approach in field.	Ensure knotweed management adheres to approved BMPs and contract, and document methodology.	WSA (opening) CEMP Section 3.4.1	
14	The Project site shall be regularly monitored by the EM for invasive plant infestations and these infestations will be mapped and managed according to applicable species-specific BMPs.	☐Compliant ☒Non-Compliant ☐N/A	Patches of knotweed adjacent to work areas have been flagged but still no barrier to prevent accidental encroachment on these patches.	Continually monitor works adjacent to knotweed patches to ensure no accidental encroachment.	CEMP Section 3.4.1	Photo 4
16	Knotweed stems are cut close to the ground and contained on poly sheeting away from the immediate work area. Cut knotweed is covered with woven geotextile fabric and crushed rock prior to machine access. Knotweed stems are injected with an appropriate herbicide before being covered.	☐Compliant ☒Non-Compliant ☐N/A	Knotweed management still not adequately documented.	Update CEMP to document revised knotweed approach.	CEMP Section 3.4.1 Addendum 1 to the Contract Documents for the Hatzic Emergency Works Program - Lagace Creek – Sites S-CR-14/17	
	Waste Management					
17	Dispose of all anthropogenic debris removed at an appropriate waste management facility.	☒Compliant ☐Non-Compliant ☐N/A	No anthropogenic debris was observed on site.		WSA (opening) CEMP Section 5.5	
18	Non-hazardous waste stored appropriately and removed offsite daily.	☒Compliant ☐Non-Compliant ☐N/A	No non-hazardous waste was observed during the audit.		CEMP Section 5.5	
19	Hazardous waste stored > 30 m of watercourses.	☒Compliant ☐Non-Compliant ☐N/A	Two portable toilets are located at the site laydown, more than 30 m away from watercourses.		CEMP Section 5.5	
20	Secondary containment used for all stored hazardous waste.	☐Compliant ☒Non-Compliant ☐N/A	Portable toilets were not in secondary containment.	Add secondary containment to portable toilets.	CEMP Section 3.6	
	Spill Control and Emergency Response					
21	Machinery operating in channel is equipped with environmentally friendly oil	☒Compliant ☐Non-Compliant ☐N/A	Excavator on site has a sticker confirming that it contains Environ™ biodegradable, non-toxic hydraulic fluid.		WSA (p) 4 CEMP Section 3.6	
22	Equipment and machinery are free of leaks	☒Compliant ☐Non-Compliant ☐N/A	No leaks were observed during the audit. Equipment appeared to be clean.		WSA (p) 1 CEMP Section 3.6	
23	Drip trays are available and used during refueling and equipment maintenance	☒Compliant ☐Non-Compliant ☐N/A	Equipment was actively working during the audit. Spill trays were observed around site. Parked excavator had a spill tray under the engine.		CEMP Section 3.6	

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
24	Fuel is stored > 30 m from Lagace Creeks and any connected drainages	☒Compliant ☐Non-Compliant ☐N/A			WSA (p) 3 CEMP Section 3.6	
25	Machinery and vehicles operating onsite are equipped with spill kit.	☒Compliant ☐Non-Compliant ☐N/A	Stocked spill kits were available near active work areas.		WSA (p) 2 CEMP Section 3.6	
26	Should suspected contaminated material be encountered (i.e., soil emitting olfactory cues indicative of hydrocarbon fuel), works should temporarily halt for investigation.	☒Compliant ☐Non-Compliant ☐N/A	EM reported high concentrations of sodium and some other metals and additional analysis and reporting are pending.		CEMP Section 2.5	
27	Refuelling of machinery is conducted on level ground over a spill tray.	☒Compliant ☐Non-Compliant ☐N/A	No refuelling was observed during the audit.		CEMP Section 3.6	
	Riparian Area Management					
28	Stockpile LWD and root wads removed from channel for use in site restoration	☐Compliant ☐Non-Compliant ☒N/A	No LWD or root wads stockpiled onsite. Vegetation clearing should be limited to stations and access points only. Any riparian disturbance must be restored post-construction.		CEMP Section 3.3	Photo 5
29	Construct access points and approaches perpendicular to the watercourse;	☒Compliant ☐Non-Compliant ☐N/A			DFO FAA CEMP Section 3.2	
	Instream Works					
30	The EM shall ensure that instream works are isolated from flow and that measures are in place to protect fish and fish habitat, and to mitigate the migration of sediment downstream.	☒Compliant ☐Non-Compliant ☐N/A	Sediment curtains installed in channel. Excavation was restricted to above wetted channel.	Improve instream isolation to prevent a failure during instream works.	WSA (j) CEMP Section 3.1	Photo 6
31	Pumps and flow bypasses are in proper working condition	☐Compliant ☐Non-Compliant ☒N/A	Pumps were not operating during the audit visit.		WSA (j) 5 CEMP Section 3.1	
32	Instream works conducted in the dry / isolation of flow	☒Compliant ☐Non-Compliant ☐N/A	Instream works (other than placing sandbags for isolation) were not in progress during the audit visit. Excavation was restricted to above wetted channel.	Procure and install appropriate equipment for isolation and dewatering.	WSA (o) CEMP Section 3.1.1	Photo 6
	Water Quality					
33	Water quality is routinely monitored upstream and downstream of the work area, every day that instream works are occurring Instream water quality is compliant with provincial criteria[2]: **Turbidity**: - <8 NTU from background at any one time for a duration of 24 h in clear waters; - < 5 NTU from background when background is 8 – 50 NTU;	☒Compliant ☐Non-Compliant ☐N/A	EM is routinely monitoring water quality, and halting instream works where short-term exceedances are noted. Sediment curtains have been installed downstream of instream works. Excavated sediment is being used to fill the sandbags that are installed for instream isolation. Occasionally the sandbags tip over or rip when being relocated, resulting in localized turbidity.	The contractor must exercise due care when handling sandbags instream and the EM to provide appropriate guidance to mitigate any potential risk to fish and fish habitat.	WSA (s) CEMP Section 3.1.2	

[2] British Columbia Ministry of Environment and Climate Change Strategy. 2024. British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture - Guideline Summary – August 2024. Water Quality Guideline Series, WQG-20. Prov. B.C., Victoria B.C. Available at: https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-guidelines/approved-wqgs/wqg_summary_aquaticlife_wildlife_agri.pdf. Accessed August 2024.

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
	- <10% from background when background is > 50 NTU. **pH:** 6.5-9.0					
	Fish and Wildlife Protection					
34	Full time monitoring for fish during instream works is occurring.	☒Compliant ☐Non-Compliant ☐N/A	EM is onsite full time		WSA (j) 6 CEMP Section 2.4	
35	Fish salvages are conducted in advance of instream works where required.	☒Compliant ☐Non-Compliant ☐N/A	EM is conducting salvages in advance of sediment excavation.		CEMP Section 3.1 WSA (j) 6	
36	Salvaged fish are relocated back to the same watercourse in a nearby area that is not impacted by construction or removal works or its zone of influence	☒Compliant ☐Non-Compliant ☐N/A	EM is relocating fish outside the isolated work zone.		DFO FAA Section 2.2.4	
37	Pump intakes are screened for fish and aquatic species in accordance with the "Interim code of practice: End-of-pipe fish protection screens for small water intakes in freshwater"	☐Compliant ☐Non-Compliant ☒N/A	Pumps were not operating during the audit visit.		WSA (j) 5.ii DFO FAA Section 2.4.9 CEMP Section 3.1.1	Photo 5
38	Obtain required permits prior to salvage(s).	☒Compliant ☐Non-Compliant ☐N/A	EM has obtained salvage permits.		WSA (Opening) CEMP Section 3.1	
39	EM is on site during disturbance to riparian vegetation and conducting pre-clearing breeding bird surveys prior to clearing.	☒Compliant ☐Non-Compliant ☐N/A	EM is conducting nest surveys at stations as required.		CEMP Section 3.2	
40	Instream works are conducted so as not to lead to fish stranding or other impacts to fish. The works shall not result in depressions that have the ability to trap fish and other aquatic life. Fish passage is maintained where practicable and in accordance with applicable permits.	☒Compliant ☐Non-Compliant ☐N/A	Instream works have been designed to maintain fish passage after completion. Upstream fish passage is impeded due to turbidity curtain installed across the channel.	EM must be monitoring for fish full-time and should have a plan for moving adult fish upstream around the work area, if observed staging below the work zone. This plan should be documented in routine monitoring reports.	WSA (j) 6 (iii) WSA (u) DFO FAA Section 2.4.2 CEMP Section 3.1.1	
	Restoration Requirements					
41	Restoration plans prepared by EM for disturbed area and implemented with EM oversight	☐Compliant ☐Non-Compliant ☒N/A	Restoration plans have not been prepared yet.		WSA (w) CEMP Section 3	
42	All temporary works shall be removed on completion of the project, and the stream channel restored to its natural condition	☐Compliant ☐Non-Compliant ☒N/A	Work is still in progress.		WSA (v) CEMP Section 3	

5 DISCUSSION

5.1 Non-Compliant Items

Knotweed management

Knotweed removal onsite is ongoing however the CEMP has not been updated with revised approach.

Recommended action: Provide documentation of knotweed management and ensure it adheres to approved BMPs. Provide details on alternative approach with rationale, and update documentation (e.g., CEMP).

Portable toilets without secondary containment

Two portable toilets located at the site laydown adjacent to Dale Road did not have secondary containment. Although the toilets were more than 30 m away from the watercourse, secondary containment would prevent any potential spills from spreading beyond the immediate area.

Recommended action: Add secondary containment to portable toilets.

5.2 Conditionally Compliant Items

EM reporting to document risk and mitigation

As instream works progress beyond the least risk fish window, the EM must provide guidance and advice to the contractor regarding any changes in risk associated with working past the window and required mitigation.

Recommended action: EM reports should document their consideration of any increased risk with working past the least risk and identify if enhanced mitigation is required. EM should continue to document implementation of mitigation measures, evaluate changing conditions, and report any incidents or near-misses.

6 SUMMARY

A list of environmental issues outstanding to date is provided in Table 6-1, below.

Table 6-1 Tracking Table of Environmental Issues Outstanding to-Date (project commencement August 12, 2024)

Item #(s)	Issue	Date(s) Observed	Recommended Corrective Action(s)	Responsible Party
2	Knotweed material outside poly sheet containment, no herbicide treatment	August 29, 2024 September 5, 2024	Ensure that all knotweed cuttings are confined to poly sheeting. Apply herbicide to remaining stems, as appropriate. Document methodology and ensure it adheres to approved BMPs.	Contractor/EM
3	Portable toilets without secondary containment	August 29, 2024	Add secondary containment to portable toilets.	Contractor
4	Inadequate instream isolation and failed dewatering attempts resulting in instream works conducted in the wet.	August 31, 2024 September 1, 2024 September 2, 2024 September 11, 2024 (EM reports)	Need to provide adequate isolation and dewatering to maintain dry work area OR obtain permission to dredge in the wet	Contractor

Note: Items marked with an asterisk (*) were reported by the EM.

7 CLOSURE

We trust that the information in this memo is sufficient for your present needs. Should you have questions, please do not hesitate to contact the undersigned.

Prepared by:

Naomi Sands, R.P.Bio.
Environmental Scientist

Reviewed by:

Jennifer Privé, R.P.Bio.
Manager, Environmental Sciences

NS/JP

Attachments:
- Site Photographs

Attachment 1: Site photographs taken during audit visit on September 19, 2024.

Photo 1: Instream isolation at Station J and K 		**Photo 2: Silt fence installed onsite around cleared stations** 
Photo 3: Silt fence installed around soil stockpiles 		**Photo 4: Knotweed patches adjacent to work areas must be monitored closely during operations** 
Photo 5: Vegetation clearing should be restricted to minimum required for access and riparian habitat must be restored post-construction. 		**Photo 6: Excavation restricted to above wetted channel; sediment curtain installed across channel as back-up.** 

Table A2: Tracking Table of Resolved Non-Compliance Issues

Item #(s)	Issue	Date(s) Observed	Date Corrected	Corrective Action(s)	Responsible Party
1	Environmental monitoring reports not received daily	August 29, 2024	September 5, 2024	Monitoring reports received daily, or following morning.	EM
2	Inappropriate fish screen on pump intake	September 5, 2024	September 12, 2024	EM reports show pump intakes in mesh screen boxes. Wire mesh screen was being fitted to an additional pump intake during the audit visit.	Contractor

RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: September 19, 2024
Weather: Partly cloudy. High 15°C, Low 7°C.

- ***Works are being conducted outside of the least-risk window for in-stream works under the supervision and guidance of the Environmental Monitor.***
- ***Keystone Environmental undertook the following additional measures to reduce the risk of impacts to fish and fish habitat during works conducted outside the instream works least-risk window:***
    - *Overnight trapping of Station F. After observing fish in the minnow traps at Station F, a decision was made to continue trapping within the isolation barrier until a decline in catch per unit effort. Four baited minnow traps were redeployed at station F.*
    - *Overnight trapping of Station J. Following the repair of the isolation barriers on Wednesday, September 18th at Stations J and K, Keystone Environmental undertook additional overnight trapping at Station K. Following the decision to conclude salvage activities at Station K, five baited minnow traps were moved to Station J and left overnight.*
- 0630: EMs on site. Station B3 excavation observed to be filled with water.
- 0715: 4 baited minnow traps checked and reset at station F.
    - Fish Salvage Results:
        - 1 Coho salmon
        - 9 prickly sculpin
    - All fish were released unharmed in similar habitat nearby within the same stream.
- 0734: Poly sheet waterway and silt sack being removed at Discharge 1 downstream of station C2. Poly and silt sack observed to be already removed at Discharge 2.
- 0804: 5 baited minnow traps removed at Station K.
    - Fish Salvage Results:
        - 1 Three-spined stickleback
    - All fish were released unharmed in similar habitat nearby within the same stream.
    - Following repeated salvages, the repair of the isolation barrier, and the low trap yield, we evaluated the risk of negative effects on fish during excavation at station K to be sufficiently mitigated.
- 0815: Reset 5 baited minnow traps at Station J.
- 0928: Japanese knotweed haul truck observed arriving at site.
- 0943: Japanese knotweed haul truck observed leaving site. Load observed to be covered.
- 1008: Silt curtain installation downstream of Station B3 observed.
- 1037: Lock block trench at Station C observed to be open.
- 1141: Isolation barrier observed being installed at Station B3.
- 1203: Contractor inquired if tarps and filter fabric stored on disturbed soil at Station B3 were considered knotweed contaminated. Keystone Environmental advised that the material should be disposed of with the Japanese knotweed stems.

- 1347: Excavation was observed to be ongoing at Station C2. Isolation barrier installation was observed to be ongoing at B3.
- 1415: 6-inch pump installation observed at Station B3.
- 1608: Contractor communicated that a water main was suspected to be below grade immediately north of the bridge and close to the B3 excavation. Due to the material of the pipe, a utility locate is not possible.
- 1629: Intake hose with mesh intake screen fitted to 6-inch pump at Station B3.
- 1645: EM off site.
- No water quality data was collected, as no in-stream works or dewatering discharge was observed.

Site Photos









Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	19
Project:	Legace Creek	**Page:**	1 of
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 20, 2024
Contract No.:		**Temperature:**	High: 18 Low: 10
Weather:	Overcast		

September 20, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Jim), 3 operator, 5 labourers
Keystone Environmental: EM (Corbin, Liz)

Contractor's Equipment:

-Equipment in Use

- CAT Excavator 324E
- Zaxis Excavator EX0689
- Zaxis excavator 2720
- Deer Loader 1466
- Pumping equipment: generator, 2 – 6" pumps.

Report, if any, Contact with Occupants:

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

Discussion with Contractor:

6:45AM
- Toolbox QM (Jim) – loading out material from Jahoolie field today
- Disposing at a site, 3hr round trip, 7 trucks.
- Hopefully starting excavation at B3, want to probe for watermain first.

1:05PM
- Discussion with QM Foreman (Craig) –
- Ready to start excavating at B3.
- Going to work around the berm and excavate depth first, planning to pull in berm after.

Report:

7:00AM
- Hauling clean material from Jahoolie field.
- This is material from C2 lock block excavation – has been surveyed
- Vinizza counting trucks.

7:30AM
- Probing for watermain at SRS B3.

8:30AM-1:00PM
- AE (Jordan) on site 15/16

1:00PM
- Beginning excavation at SRS B3.
- 1 – 6" pump and 1 - 3" pump

1:15PM
- Hauling trucks round 3.

3:20PM
- Excavation at SRS B3 stopped.

3:30PM
- Moving remaining material that was not hauled out of Jahoolie field to area next to SRS L stockpile.
- This material has been surveyed
- Topsoil stockpile from this area is being moved to lay down.
- This has also been surveyed.
- Current stockpile at SRS L is from SRS C2 lock block excavation. This material has not been surveyed. Ensured the stockpiles are not mixed.

4:30PM
- AE (Jordan, Vinizza) leaving site
- Crew finishing moving material from Jahoolie field to SRS L stockpile area

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Testing:

- None today.

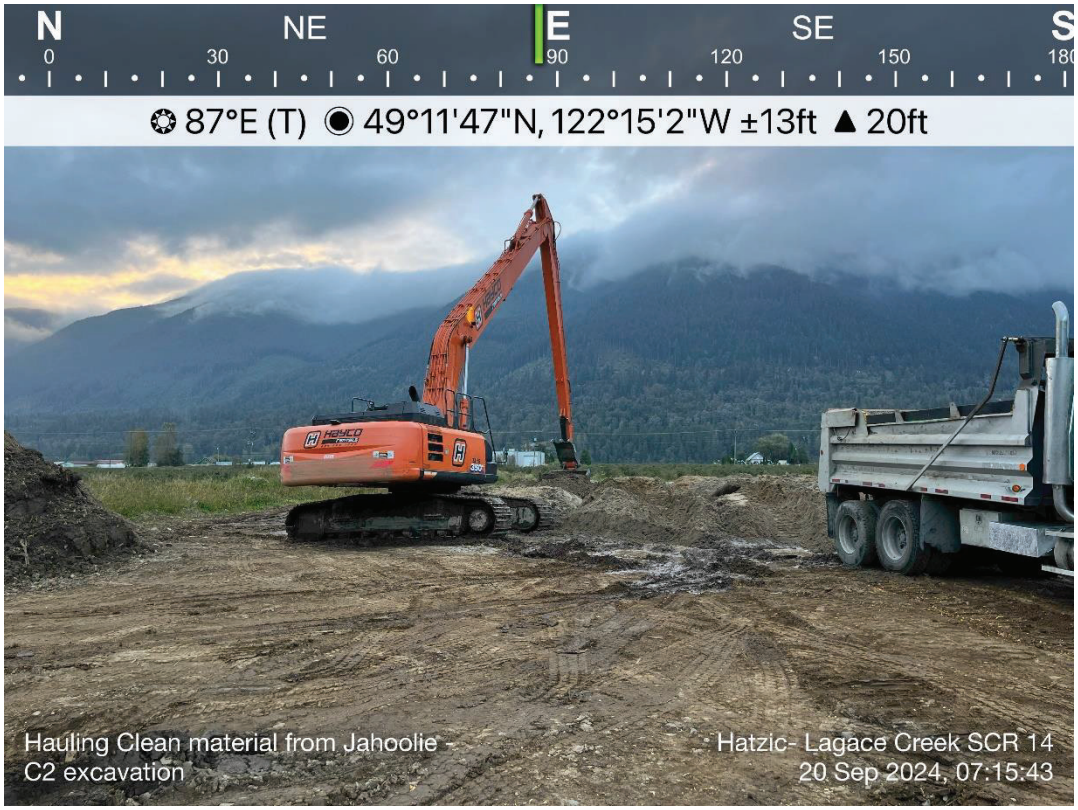
Safety Concerns:

- None today

Traffic Control:

- None today.

Photos:



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

DAILY CONSTRUCTION REPORT

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	18
Project:	Legace Creek	**Page:**	1 of 5
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 20, 2024
Contract No.:		**Temperature:**	High: 18°C Low: 10°C
Weather:	Mostly Cloudy, Wind: 6 KM/H, Gusts: 16 KM/H		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Labour Force:

Quantum Murray (QM): 1 Site Superintendent, 3 Operators, 5 Labourers
Keystone Environmental/Environmental Monitors (KE/EM): Corbin and Liz
Associated Engineering (AE): Jordan Fiske, Vinizza Pingos

Contractor's Equipment: Equipment in uses

- Excavator 324E
- Excavator EXO689
- Excavator 2720
- Loader 1466
- 1 – 3" water pump
- 1 - 6" Vacuum Assisted Pumps

Report, if, any, Contact with Occupants:

N/A

Contact with Owner:

N/A

Safety Concerns:

N/A

Testing:

N/A

Traffic Control:

No traffic management control.

Report:

6:35 AM
- AE (Vinizza & Jordan) arrived on site.

6:40 AM
- Signed in and toolbox talk.
- Jem discussed today's work plan:
  - Seven trucks scheduled for a 3-hour round trip to haul excavated materials from Charlie's field/stockpile area.
  - Locating the existing water main line near the Dale Bridge and Station B3.
- No traffic management control on site.

7:06 AM
- Arrival of the first batch of seven trucks to haul clean excavated materials from Charlie's field to the disposal area.

7:44 AM
- Completed the first batch of hauling clean excavated materials from C2 in Charlie's field/stockpile to the disposal area (3-hour round trip).

7:50 AM
- Continued locating the existing water main line near the Dale Bridge.

8:00 AM
- Online meeting with Jordan.

8:30 AM
- Transferring lock blocks from C2 to B.

9:20 AM
- Ongoing pumping of water using a 6-inch water pump (without silt protection) while locating the existing water main line.

10:18 AM
- Arrival of the second batch of seven trucks to haul clean excavated materials from Charlie's parcel.

10:49 AM
- Completed the second batch of hauling clean excavated materials from Charlie's field/stockpile area to the disposal area (3-hour round trip).

11:15 AM
- At Station B3: switched to a 3-inch water pump due to the 6-inch pump malfunctioning.

12:20 PM

- Conversation with Jem:
    - Jem inquired about the height of the pier of the bridge. AE Vinizza responded that no record drawing is available.

1:30 PM

- Continued excavation of existing inland sediments at Station B3.

1:32 PM

- Arrival of the third batch of trucks to haul clean excavated materials from Charlie's parcel.

1:54 PM

- Completed the third batch of hauling clean excavated materials from Charlie's field/stockpile to the disposal area with 4 trucks.

2:00 PM

- Ongoing hauling of clean excavated materials to the laydown area near Station L on Charlie's land with 3 trucks.

4:00 PM

- QM (half of the laborers) left the site, while the remaining operators continued moving materials from Charlie's field to the Station L stockpile area.

4:40 PM

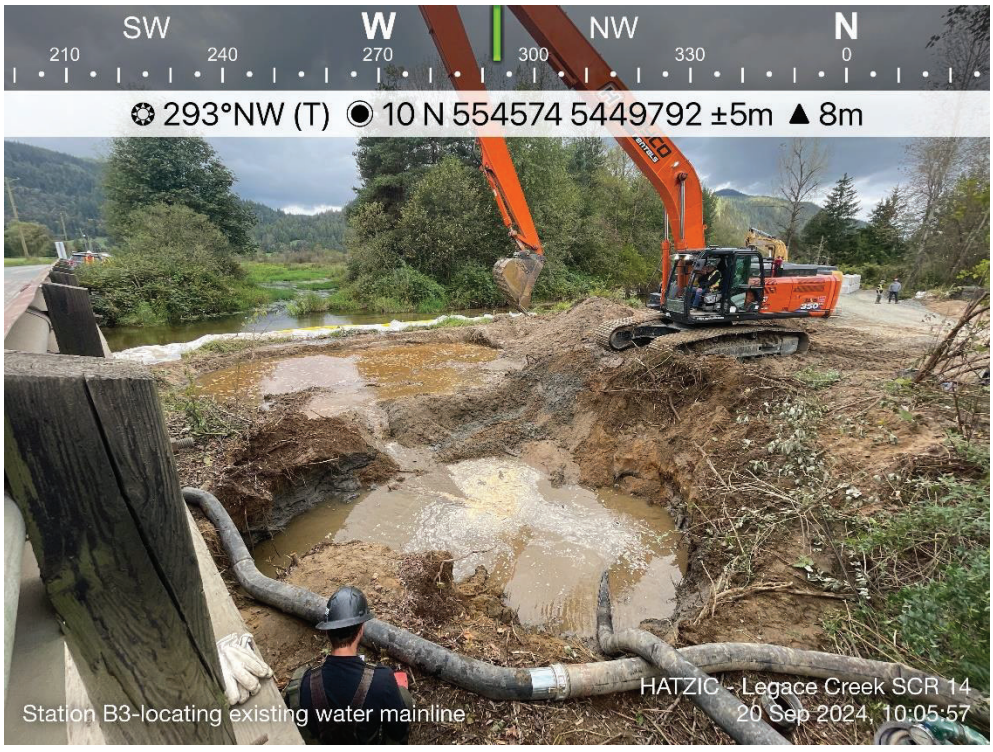
- AE (Vinizza & Jordan) left the site.

Photos:


NW N NE E
00 330 0 30 60 90 120
34°NE (T) 10 N 554599 5449556 ±4m 4m
1st truck-hauling clean materials
HATZIC - Legace Creek SCR 14
20 Sep 2024, 07:09:22


NE E SE S
30 60 90 120 150 180 210
121°SE (T) 10 N 554592 5449574 ±12m -6m
Stockpile
HATZIC - Legace Creek SCR 14
20 Sep 2024, 14:11:07


NW N NE E
300 330 0 30 60 90 120
30°NE (T) 10 N 554555 5449781 ±4m 11m
Station B3-
HATZIC - Legace Creek SCR 14
20 Sep 2024, 10:56:25


SW W NW N
210 240 270 300 330 0
293°NW (T) 10 N 554574 5449792 ±5m 8m
Station B3-locating existing water mainline
HATZIC - Legace Creek SCR 14
20 Sep 2024, 10:05:57

RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: September 20, 2024
Weather: Foggy in the morning, partly cloudy throughout the day. High 19°C, Low 10°C.

- ***Works are being conducted outside of the least-risk window for in-stream works under the supervision and guidance of the Environmental Monitor.***
- ***Keystone Environmental undertook the following additional measures to reduce the risk of impacts to fish and fish habitat during works conducted outside the instream works least-risk window:***
    - *Overnight trapping of Station F. After observing fish in the minnow traps at Station F, a decision was made to continue trapping within the isolation barrier until a decline in catch per unit effort. Four baited minnow traps were redeployed at station F.*
    - *Overnight trapping of Station J. Following the capture of fish within Station J, five baited minnow traps were left overnight within the isolation area.*
    - *Water quality management. The EM closely monitored downstream water quality and adjusted sediment control measures as necessary. On September 20th, dewatering discharge of the excavation at Station B3 was passed through a silt sack on a poly sheet waterway into the channel, where it was further intercepted by a silt curtain. Downstream water quality was observed to be compliant while this system was functioning. A single exceedance was observed when the silt sack burst. Discharge was promptly ceased, and the outlet hose fitted with a new silt sack. Dewatering was delayed, allowing the sediment plume to travel downstream before work was restarted.*

- 0630: EMs on site. Excavation at Station B3 and soil hauling to occur today.
- 0737: 4 baited minnow traps checked and reset at Station F.
    - Fish Salvage Results:
        - 2 prickly sculpin
- 0744: All fish captured at Station F were released unharmed in similar habitat nearby within the same stream.
- 0814: 5 baited minnow traps removed at Station J
    - Fish Salvage Results:
        - 3 prickly sculpin
- 0817: All fish captured at Station J were released unharmed in similar habitat nearby within the same stream.
- 0845: Dewatering commenced at Station B3 excavation with a 6-inch pump fitted with a mesh intake filter and discharging through a silt sack on a poly sheet waterway.
- 1035: Dewatering discharged from Station B3 excavation halted. 6-inch pump swapped for 3-inch trash pump due to high downstream turbidity. The new pumping system yielded compliant readings for the remainder of the day.
- 1253: The internal barrier within the B3 isolation area was knocked down, allowing all water within that excavation to mix. Dewatering continued at this Station.

- 1321: 4 baited minnow traps set at F.
- 1325: A second 3-inch trash pump was installed at Station B3.
- 1453: The EM observed a knotweed decontamination of one of the excavators working within the knotweed contaminated area. Brooms and shovels were observed being used to dislodge visible soil, while a dilute bleach solution was sprayed on to hardened or caked material.
- 1459: Decontaminated excavator crossed road to the south side.
- 1602: Soil loadout activities observed to be ongoing at the blueberry farm north of Dale Road. No dewatering or instream works observed. EM off site.
- Water Quality Sampling Results:

Location	Time	Turbidity	Dissolved Oxygen
Upstream of B3	0915	4.81	84.5% / 9.2 mg/L
50 Downstream of C2	0929	3.97	89.2% / 9.68 mg/L
Upstream of B3	1025	3.47	X
50 Downstream of C2	1040	13.03	X
Upstream of B3	1133	5.18	X
50 Downstream of C2	1142	5.18	X
Upstream of B3	1235	5.58	X
50 Downstream of C2	1245	3.99	X
Upstream of B3	1407	3.86	X
50 Downstream of C2	1416	3.58	X

Site Photos









Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

DAILY CONSTRUCTION REPORT

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	19
Project:	Legace Creek	**Page:**	1 of 6
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 21, 2024
Contract No.:		**Temperature:**	High: 18°C Low: 10°C
Weather:	Partly Cloudy, Wind: 3 KM/H, Gusts: 5 KM/H		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Labour Force:

Quantum Murray (QM): 2 Site Superintendent (Jem & Mel), 3 Operators, 7 Labourers
Keystone Environmental/Environmental Monitors (KE/EM): Loc
Associated Engineering (AE): Jordan Fiske, Vinizza Pingos

Contractor's Equipment: Equipment in use

- Excavator 324E
- Excavator EXO689
- Excavator 2720
- Loader 1466
- 2 – 3" water pump
- 2 - 6" Vacuum Assisted Pumps

Report, if, any, Contact with Occupants:

N/A

Contact with Owner:

N/A

Safety Concerns:

N/A

Testing:

N/A

Traffic Control:

No traffic management control. QM assigned laborers as flagmen in the morning while hauling the excavated materials.

Report:

6:40 AM
- AE (Vinizza & Jordan) arrived on site.

6:45 AM
- Signed in and conducted a toolbox talk.
- Jem discussed today's work plan:
  - Four trucks to haul excavated materials at Station B3.
  - Complete moving topsoil from Charlie's land.
  - At Station B3: continue water pumping and remove additional materials to dry for Monday.
  - At Station C2: layout preparation.
- No traffic management control on site.
- Moving stockpile from Charlie's field to the end of the laydown section.

7:10 AM
- At Station L: Stockpiled materials from C2 excavation were hauled to Charlie's parcel and then rehauled to Station L.

7:28 AM
- Transferred the 6" water pump from Station C2 to Station B3, replacing the pump used yesterday due to sediment clogging.

7:45 AM
- Two laborers acted as flagmen on site.
- The first truck and wagon arrived to haul excavated materials from B3.

8:00 AM
- Meeting with Jordan.
- The second truck and wagon arrived on site.

8:32 AM
- Completed hauling with three trucks and wagons.

9:00 AM
- At Charlie's land/stockpile area:
  - Transferred excavated materials (topsoil from B2) to the corner section near Station D (opposite side).

9:10 AM
- At Station B3:
  - Ongoing water pumping.
  - The fourth truck and wagon arrived on site.

9:37 AM

- Keystone conducted a turbidity test at Station C2 (discharge area from B3).
- Suggested shutting down the water pump to allow turbidity levels to settle.
- QM fixed the cloth bag and added a poly sheet at the discharge area.

9:45 AM

- QM began layout work at Station C2 SRS.

10:43 AM

- At Station C2: laying down granular base.
- Fixed the cloth bag and poly sheet at the discharge area of B3.

10:55 AM

- At Charlie's land/stockpile area:
    - Spread remaining materials within the parcel.

11:02 AM

- Started pumping with both the 3" and 6" water pumps at Station B3.

11:08 AM

- Excavating inland sediments at Station B3.

11:20 AM

- Two discharge cloth bags burst while pumping; water pumps were shut down.

11:31 AM

- Keystone conducted another turbidity test.

11:50 AM

- Noted water seeping in at Station B3.

11:55 AM

- Conversation with Loc and Jem:
    - Loc reported that following the cloth bag bursts, the turbidity level was initially 14.8 (non-compliant) but dropped to 9.49 (compliant) after 10 minutes.
    - Loc also indicated that water at Station B3 was seeping in and needed isolation to prevent fish from entering the area.
    - Jem responded that they would address the isolation and implement an additional turbidity curtain.

12:22 PM

- Installed a turbidity curtain at Station B3.

12:00 PM

- At Station C2: prepared lock block base and slope.

12:50 PM

- At Station C2: ongoing installation of the first layer of lock blocks with non-woven fabric underneath.

1:00 PM

- Completed work at Station C3 until conditions allowed for digging in wet areas. Removed water pump from Station B3.

1:15 PM

- Finished installing the first layer of lock blocks at Station C2.

2:15 PM

- Laid poly sheet over the SRS and excavated materials.

2:30 PM

- Two bags fell at Station J.

3:00 PM

- QM left the site.

3:10 PM

- AE (Vinizza) left the site.

Photos:


W NW N NE
240 270 300 330 0 30
326°NW (T) 10 N 554577 5449785 ±4m 8m
Station B3
HATZIC - Legace Creek SCR 14
21 Sep 2024, 07:13:26


SE S SW W NW
150 180 210 240 270 300
229°SW (T) 10 N 554587 5449819 ±4m 8m
Station B3: 1st truck
HATZIC - Legace Creek SCR 14
21 Sep 2024, 07:48:08


W NW N NE
270 300 330 0 30 60
345°N (T) 10 N 554587 5449755 ±3m 18m
Station C2: installing lock blocks
HATZIC - Legace Creek SCR 14
21 Sep 2024, 12:51:12


W NW N NE
240 270 300 330 0 30
326°NW (T) 10 N 554592 5449763 ±4m 7m
Station C2-1st layer of lock block
SRS installed
HATZIC - Legace Creek SCR 14
21 Sep 2024, 14:34:20

RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: September 21, 2024
Weather: Partly Cloudy. High 14°C, Low 7°C.

- ***Works are being conducted outside of the least-risk window for in-stream works under the supervision and guidance of the Environmental Monitor.***
- ***Keystone Environmental undertook the following additional measures to reduce the risk of impacts to fish and fish habitat during works conducted outside the instream works least-risk window:***
    - *Erosion Sediment Control (ESC):*
        - *Rain is forecasted on Sunday, September 22, 2024. Hence, all exposed areas adjacent to Lagace Creek, including sediment stockpile, are protected with poly tarp to prevent potential sediment runoff into Lagace Creek.*
    - *Water quality management:*
        - *The EM closely monitored downstream water quality and adjusted sediment control measures as necessary. On September 21st, dewatering discharge of the excavation at Station B3 was passed through a silt sack on a poly sheet waterway into the channel, where it was further intercepted by a silt curtain. Downstream water quality was observed to be compliant while this system was functioning. A single exceedance was observed when the silt sack burst. Discharge was promptly ceased, allowing the turbidity to settle. WQ returned to acceptable range within 30 minutes.*
    - *Spill Response and Mitigation:*
        - *Spill trays were put under heavy machines to prevent potential spill over the weekend. Spill kits were also located nearby and fully filled with spill pads, booms, and absorbent materials.*
- 0645: EM on site.
- 0650: EM attended toolbox meeting with contractors.
- 0739: 5 baited minnow traps at Station J were retrieved.
    - Fish Salvage Results:
        - 3 Three-spine sticklebacks (TSS)
- 0744: All fish captured at Station J were released unharmed in similar habitat nearby within the same stream.
- 0751: Soil hauling commenced at station B3.
- 0758: EM noticed sheens on the water surface in B3 isolated work area and proceeded to investigate. Confirmed it was bacteria sheen as it broke into small platelets when disturbed and did not quickly reform as per petroleum sheen characteristic.

- 0759 4 baited minnow traps retrieved at Station F
    - Fish Salvage Results:
        - 1 Rainbow trout
        - 3 Prickly sculpins
        - All fish captured at Station J were released unharmed in similar habitat nearby within the same stream.
- 0800: Fish cage was installed in Station B3. A 6inches and 3 inches pump were used for dewatering. Silt sacks were implemented at the discharge location downstream from B3 to mitigate disturbance.
- 0915: Dewatering commenced. Initial sediment plume was observed as expected. EM continued monitoring WQ closely.
- 0942: EM observed the sediment plume was flowing DS and did not improve after 30mins. EM identified the source was from the 6inches discharge hose since water was flowing out of the silt sack and hit the creek bed, which disturbed the sediment below it. Mitigation method implemented by QM was installing poly tarp under the silt sack to mitigate disturbance from creek bed when discharging.
- 1003: EM conducted WQ and confirmed turbidity returned to acceptable range. QM continued silt sack reinforcement.
- 1024: Dewatering commenced. However, water observed to backflow into C2 area without protection from silt curtain nor silt sack. Pumps were shut down to readjust the discharge hose.
- 1100: Lock block installation at Station C2 commenced
- 1112: Dewatering resumed. EM conducted WQ 30m DS from discharge location. Result yielded compliant. Another sample was taken at Station D (Approximately 55m DS from C2), which yielded compliant reading as well.
- 1125: Shortly after EM conducted compliant WQ, both silt sacks burst, resulted in 1 exceedance.
- 1130-1140: EM discussed with Keystone's Project Manager. QM and KEL's EM were actively monitored WQ, and the burst event was unavoidable. In addition, QM reacted immediately by turning off the pumps to prevent further disturbance. The exceedance noted at 11:33AM and turbidity returned to acceptable range at 11:40AM (10 minutes). Therefore, the Site was deemed compliant.
- 1154: EM noticed a section of sandbag isolation at station B3 sunk and slowly discharged sediment-laden water. QM personnel was notified and reinforcement using additional silt curtain and sandbags was implemented immediately.
- 1245: Reinforcement work completed. EM did not observe any leakage from B3 isolation.
- 1300: Pumps were removed from B3.
- 1338: EM left CR14 and went to CR17 to check on fish isolation fences on the South side.
- 1349: Fish isolations located at CR17 remained in place with no damaged.
- 1415-1430: QM covered exposed areas and stockpile with poly tarp prior to the rain event on Sunday, September 22, 2024.
- 1440: EM performed last inspection before leaving Site.
- 1500: End of workday. EM left Site.

- Water Quality Sampling Results:

Location	Time	Turbidity	Dissolved Oxygen
BG – US of B3	1000	3.16	88.3% / 9.92 mg/L
30m DS of B3	1003	8.24	X
30m DS of B3	1112	9.80	X
~55m DS of B3 – Station D	1120	7.72	X
30m DS of B3	1133	14.8	X
30m DS of B3	1140	9.49	X

Site Photos



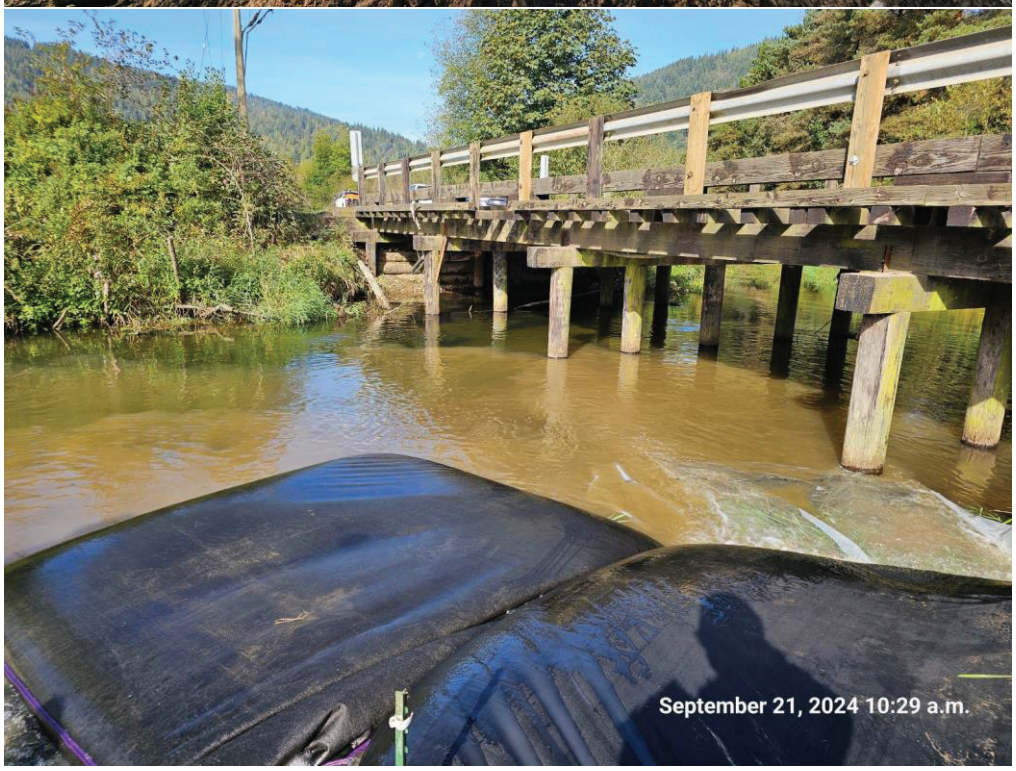

September 21, 2024 2:36 p.m.


September 21, 2024 11:48 a.m.


September 21, 2024 7:52 a.m.


September 21, 2024 2:39 p.m.


September 21, 2024 2:36 p.m.


September 21, 2024 10:29 a.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	20
Project:	Legace Creek	**Page:**	1 of 5
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 23, 2024
Contract No.:		**Temperature:**	High: 19 Low: 13
Weather:	Rainy		

September 23, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Jim), 3 operator, 4 labourers
Keystone Environmental: EM (Loc, Kang)
2 Flaggers

Contractor's Equipment:

-Equipment in Use

- CAT Excavator 324E
- Zaxis Excavator EX0689
- Zaxis excavator 2720
- Deer Loader 1466
- Pumping equipment: generator, 2 – 3" pumps.

Report, if any, Contact with Occupants:

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

12:30PM

- Discussion with Keystone (Loc, Kang) – everything north of Dale road bridge is considered contaminated including what is in the water. Everything south of bridge is considered clean except for SRS D and H will be considered contaminated since knotweed is growing on stations.

Discussion with Contractor:

6:45AM
- Toolbox (James) –
- Continue building C2 lock blocks today
- Hauling contaminated material from B3 creek excavation
- Filling sand bags at E for B2 isolation
- SCR 17 south still a go, planning to vac-truck it.
- Beginning SRS B3 lock block structure excavation

10:30AM
- Discussion with QM (Mel) asking about extent of top of bank
- AE (Jordan) – the top of bank is to be pulled back to line up with the SRS stations being installed and station B. Cocomatting installed here

10:40AM
- Discussion with QM (Jim and Craig) – B3 layout, will be closer to B2 than 20m due to B2 moving down due to Doug's well.
- Facing the creek on bend, will get as tight to existing vegetation as possible. Moved up pasted bridge abutment due to excess material.

1:00PM
- Discussion with QM (James) –
- Have currently removed and hauled almost 1200 tons of contaminated material.
- CO included up to 1700 tons but is afraid we will surpass that now.
- Still have to excavate SRS B3 lock blocks, SRS B2 creek and pull back the slope for the cocomatting from B to the bridge.
- James is estimating now around 3000 tons of contaminated material.
- AE (Jordan) to make AE (Jordon Rozon) aware.

1:10PM
- Discussion with QM (James) –
- AE (Jordan) – put forward a formal change order to our team regarding the change in quantity. Do not surpass the 1700 tons until confirmed with AE.

1:30PM
- Discussion with QM (James) –
- Filter fabric and geogrid came separate for remaining lock block installs. Asking if filter fabric needs to extend into lock blocks.
- AE (Jordan) and James decided that's what the detail shows and both the filter fabric and geogrid need to extend into the lock blocks for SRS C2 install.

3:20PM

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

- Discussion with QM (James) – James confirmed with EM's stations D and H will be considered contaminated removals.

3:30PM
- Discussion with QM (James, Craig) – filter fabric to be below geogrid for SRS C2, same as SRS B2 station.

Report:

7:00AM
- Surveyor on site
- Doing B3 contaminated stockpile (already partly hauled and hauling today)
- Doing clean sediment at E (been moved / loaded into sand bags)
- Jahoolie field after all sediment has been removed.
- SRS L laydown from SRS C2 lock block excavation (potentially surveyed before stockpiling was complete.

7:15AM
- Excavator flattening access road to L / laying gravel on road for accessibility
- Ongoing aggregate deliveries today.

9:00AM
- Filling sand bags at E
- 38 bags filled today

10:30AM
- 3 contaminated hauling trucks today from SRS B3 excavation

10:40AM
- Excavating C2 lock block structure (clean material) and hauling to SRS L laydown.

11:20AM
- Excavating SRS B3 lock block structure

5:15PM
- AE (Jordan) left site.
- AE (Vinizza) on site till end of day

Testing:

- None today.

Safety Concerns:

- None today

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Traffic Control:

- 2 flaggers on Dale road bridge

Photos:



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

DAILY CONSTRUCTION REPORT

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	20
Project:	Legace Creek	**Page:**	1 of 7
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 23, 2024
Contract No.:		**Temperature:**	High: 19°C Low: 14°C
Weather:	Rainy,		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Labour Force:

Quantum Murray (QM): 2 Site Superintendent (Jem & Mel), 3 Operators, 4 Labourers
Keystone Environmental/Environmental Monitors (KE/EM): Loc & Khang
Associated Engineering (AE): Jordan Fiske, Vinizza Pingos

Contractor's Equipment: Equipment in use

- Excavator 324E
- Excavator EXO689
- Excavator 2720
- Loader 1466
- 2 – 3" water pump
- 2 - 6" Vacuum Assisted Pumps

Report, if, any, Contact with Occupants:

N/A

Contact with Owner:

N/A

Safety Concerns:

N/A

Testing:

N/A

Traffic Control:

Traffic management control arrived at 7:10 am and left the site at 3:30 pm.

Report:

6:40 AM
- AE (Vinizza & Jordan) arrived on site.

6:45 AM
- Signed in and conducted a toolbox meeting.
- Jem discussed the work plan for the day:
  - Filling bags at Station E for B2 isolation.
  - Fixing sandbags at Stations F, J, and K.
  - Repairing the isolated area of B3 and starting lock block installation.
  - Hauling excavated materials from B3.
  - Surveying excavated materials.
  - Continuing lock block installation at Station C2.

6:50 AM
- Surveyor arrived on site.

7:10 AM
- Traffic management control personnel arrived on site.

8:00 AM
- Online meeting with Jordon.

8:30 AM
- Surveyed Station E.

8:40 AM
- Delivery trucks of gravel arrived on site.

8:55 AM
- Laid gravel on the access road near Station H to address muddy and uneven surfaces.
- Lequamel arrived on site.

9:00 AM
- Continued filling bags at Station E.

9:30 AM
- Trucks arrived to haul excavated materials from B3.

10:27 AM
- Completed hauling of three trucks and a wagon from the excavated materials at B3.

10:40 AM
- Ongoing hauling of bags from Station E to B2.

10:42 AM
- At Station C2, continued excavating the lock block structure and hauling materials to Station L.

11:00 AM
- At Station B3, moved stockpile to B2 in preparation for lock block structure excavation.

11:20 AM
- Began excavation at Station B3 in preparation for lock block installation.

12:15 PM
- Hauled sandbags from Station E to Station B3.

12:25 PM
- At Station C2, began digging 5m from the lock block.

12:30 PM
- Conversation with Keystone:
    - Loc mentioned that the northern part of Dale Road Station Bs and the southern parts of Stations D & H are considered contaminated, including the instream areas.

12:34 PM
- At Station B3 (SRS/lock block): Started pumping using a 3” water pump.

1:00 PM
- Placed silt fence around the excavated materials at B3.

1:20 PM
- At Station C2, first layer of lock block:
    - Laid gravel for the first layer/lift.

1:48 PM
- At Station C2, compacted gravel for the first layer/lift.

2:02 PM
- At Station C2, began laying gravel for the second layer/lift.

2:25 PM
- Compacted gravel for the second layer/lift at Station C2.

3:18 PM
- Ongoing water pumping at Station B3 using 2-3” water pumps.

3:30 PM
- Traffic management control personnel left the site.

4:05 PM
- AE flagged the sandbags from Station E; 38 sandbags were filled today.

5:10 PM
- At Station C2, the second layer of lock block was installed.

5:20 PM
- Laid gravel for the first layer/lift at Station C2.

5:32 PM
- Compacted gravel for the first layer/lift at Station C2.

5:42 PM
- Laid gravel for the second layer/lift at Station C2.

5:56 PM
- Compacted gravel for the second layer/lift at Station C2.

6:25 PM
- QM left the site.

6:30 PM
- AE (Vinizza) left the site.

Photos:


SE S SW W
20 150 180 210 240 270 300
214°SW (T) 10 N 554601 5449777 ±3m 6m
Surveyor on site.
HATZIC - Legace Creek SCR 14
23 Sep 2024, 07:00:44


SE S SW W
150 180 210 240 270 300
221°SW (T) 10 N 554585 5449821 ±3m 12m
Station B3- 3rd truck: hauling of excavated materials
HATZIC - Legace Creek SCR 14
23 Sep 2024, 10:17:25


S SW W NW N
180 210 240 270 300 330 0
271°W (T) 10 N 554587 5449807 ±13m 28m
Station B3-digging in preparation for lock block installation
HATZIC - Legace Creek SCR 14
23 Sep 2024, 12:10:45


SW W NW N
210 240 270 300 330 0
286°W (T) 10 N 554585 5449800 ±3m 8m
Station B3-excavated lock block area
HATZIC - Legace Creek SCR 14
23 Sep 2024, 18:09:31


SE S SW W N
150 180 210 240 270 300
219°SW (T) 10 N 557662 5449361 ±5240m 10m
Station C2-digging 5 meters from the lockblock
HATZIC - Legace Creek SCR 14
23 Sep 2024, 12:23:43


S SW W NW
150 180 210 240 270 300
231°SW (T) 10 N 554595 5449765 ±4m 4m
Station C2: 2nd layer lock block installed
HATZIC - Legace Creek SCR 14
23 Sep 2024, 18:22:50

RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: September 23, 2024
Weather: Scattered Showers. High 18°C, Low 13°C.

- ***Works are being conducted outside of the least-risk window for in-stream works under the supervision and guidance of the Environmental Monitor.***
- ***Keystone Environmental undertook the following additional measures to reduce the risk of impacts to fish and fish habitat during works conducted outside the instream works least-risk window:***
- ***Erosion Sediment Control (ESC):***
    - *Exposed areas adjacent to Lagace Creek, including sediment stockpiles, are protected with poly tarp to prevent potential sediment runoff into Lagace Creek.*
- ***Water quality management:***
    - *Discharge of groundwater from Station B-3 was closely monitored throughout the day and water quality remained compliant. Any elevated turbidity measurement was notified to the contractor and corrective action was carried out promptly.*
- ***Spill Response and Mitigation:***
    - *Spill trays were placed under heavy machinery to prevent any spill or leakage. Spill kits were also located nearby and fully stocked with spill pads, booms, and absorbent materials.*
- 0630: EMs arrived on site.
- 0645: EMs attended toolbox meeting with the contractor and engineers.
- 0700: QM crew cleaned and brushed the excavator bucket and loader in the north area of the site where the Japanese knotweed issue was present to remove any plant material. Machinery was then moved to the south side for other tasks.
- 0822: Dump trucks carrying 3" crushed rock arrived on site. The material was used to build a sand recovery station and for road repair.
- 0830: Lock block installation commenced at Station C-2. The work was completed above the high water mark, and no concerns were noted.
- 0911: Additional sandbags were installed at Station E.
- 0915: Access road on the south side (blueberry farm) was repaired using the 3" crushed material.

APPENDIX G – FIELD REVIEW REPORTS

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	1
Project:	Legace Creek	**Page:**	1 of 3
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	August 22, 2024
Contract No.:		**Temperature:**	High: 17 Low: 11
Weather:	Overcast		

August 27, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Mel), operator
Keystone Environmental: EM (Kang), (Loc)

Contractor's Equipment:

-Equipment in Use

Excavator

Report, if any, Contact with Occupants:

None Today.

Contact with Owner:

None Today.

Discussions with Keystone Environmental:
8:15AM

- Discussion with Keystone (Kang) – doing bird survey today. Will join us as we walk site to see station locations.

12:00PM

- Discussion with Keystone (Kang and Loc) - Keystone completing sampling of soil and water at sand stations.
- AE (Jordan, Shaemus, Vinizza) – directed them to map coordinates for locates of proposed stations. Told them sampling is up to them and could wait for construction to start if they want to know precise locations of stations.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Discussions with Contractor:

7:45AM

- Discussion with QM (Mel) – AE (Jordan, Shaemus, Vinizza) – Informed we have flagged first 3 sand stations. Will look for others if we have a chance.
- QM – Wants to walk site today to see where stations are located.

Report:

8:45AM

- Site walk with AE (Jordan, Shaemus, Vinizza), QM (Mel, operator), Keystone (Kang, Loc).
- AE showed locations of stations that we flagged.
- AE expressed we flagged first 3 but not the 4th, difficult to get to without equipment, may try again later.
- QM – potential pump under bridge, may release RFI.
- No nests after Keystone bird survey.
- Keystone – said it is okay to lay mats on top of knotweed to prevent contamination spreading when moving around area. Will try to get excavators onto stations without cross knotweed paths.
- QM – Access to station F potentially from other side, will talk to land owner.
- AE to check with Jordon Rozon on if gravel aggregate is required for existing stations or if that is already in place.
- Fish salvage – want to work in dry but might not be feasible. May have to set up metal fencing on each side of excavation extents to prevent fish passing.
- Keystone soil sampling today.

12:00PM

- AE (Jordan, Shaemus, Vinizza) – Flagging sand stations
- Sand stations flagged today: G, H
- Total Flagged: C,D,E,G,H

Testing:

- None today.

Safety Concerns:

- None today.

Traffic Control:

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

- None today.

Photos:



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14&17
Environmental Monitoring Report

Date: August 27, 2024
Weather: Overcast/Rain – 14°C

- Planned work (clearing and grubbing of vegetation) had not started upon arrival.
- The excavator was parked on north side of Dale Road.
- Associated Engineering field staff was conducting surveys to mark soil sampling station locations.
- EMs conducted a bird nest survey prior to clearing activities. Observed species included:
    - Cedar Waxwing (Bombycilla cedrorum)
    - American Robin (Turdus migratorius)
    - European Starling (Sturnus vulgaris)
    - Common Merganser (Mergus merganser)
- Nesting or breeding behaviors were not observed during the survey.
- EMs performed a walkthrough with the operator and site superintendent to inform them about Japanese knotweed locations and potential impacts if spread.
- Recommendations provided as per the CEMP:
    - Avoid grubbing and tracking on knotweed
    - Use geotextile and gravel laid on top of vegetation if access is necessary
- EMs identified sampling stations C, C-2, D, and E with Associated Engineering engineers.
- At 10:30, erosion and sediment control materials were delivered to the site, including geofabric textile, coconut matting, and bulk bags (large woven polypropylene bags used for filling with sand). No installation occurred.
- The geotextile material consists of geogrid and geotextile woven together, providing separation between plant material and gravel, as well as strength and durability for excavator tracking.
- EMs conducted soil and sediment sampling at stations C, C-2, D, and E based on provided coordinates and flagged marking.
- The planned clearing and grubbing work did not take place today as QM Environmental is awaiting confirmation and sign-off on the CEMP.
- QM Environmental personnel left the site at 12 PM.
- Sediment sampling was completed at 13:45. The EMs departed shortly after.

Site Photos






August 27, 2024 1:36 p.m.


August 27, 2024 1:42 p.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	2
Project:	Legace Creek	**Page:**	1 of -
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	August 22, 2024
Contract No.:		**Temperature:**	High: 21 Low: 12
Weather:	Sunny		

August 28, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Mel), operator, Mark, Operations manager (Tyler)
Keystone Environmental: EM (Loc)

Contractor's Equipment:

-Equipment in Use

Excavator

Report, if any, Contact with Occupants:

12:30PM

- Discussion with property owner (Doug) -informed us of water well with line in front of proposed sand station B-2.
- AE (Jordan, Vinizza) flagged station slightly south for purpose of soil sampling.

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

10:45AM

- Discussion with Keystone (Loc) – AE has flagged existing sand stations. Will flagged proposed this afternoon.

Discussions with Contractor:

10:30AM

- Discussion with QM (Mel, Mark, operations manager) –
- AE (Jordan, Vinizza) will flag remaining sand station locations. Including proposed locations.
- QM wants to start filling sandbags with material in old laydown area (near station E). AE (Jordan, Vinizza) to confirm with Ryan if this is ok before any excavation begins.
- QM asked if they need to provide lock blocks for proposed sand stations.
- QM asked how Leq'á: mel should be engaged for this project – Jordan informed they or Keystone are likely needed to contact - Jordan to confirm with Ryan.

12:00PM

- Discussion with QM (Mel, Operations manager) –
- AE (Jordan, Vinizza) informed QM no excavation is to begin until all contract documents are in place. Informed we don't even have the entire package so its difficult for us to answer questions.
- AE (Jordan, Vinizza) – informed all questions should be going to Allison at AE for the time being.

3:15PM

- Discussion with QM (Tyler) – AE (Allison) gave go ahead to start excavating sand from area behind station E, will receive written approval soon.
- CEMP received some edits and changes, should be reviewed and sent back out by tomorrow morning.
- Disussion with QM (Mark) – Loc showed areas to excavate material, will inspect and take samples during process.
- Mark to release RFI relating to lock blocks for proposed stations. Not sure where to supply from or what type. AE (Jordan) Instructed to refer to drawing details and specifications package which he has not yet received the completed version due to the project not executing yet.
- Filling bags for water diversion, will start at station D and work up along river.

4:30PM

- Discussion with Tyler – is there an excavation limit for depth? Don't want to excavate too deep.
- AE (Jordan) said he would look into.

Report:

7:45AM

- AE (Jordan, Vinizza) on site.

9:15AM

- AE (Jordan, Vinizza) – finish flagging existing sand stations.

1:30PM

- SCR 17 site walk with QM (Mel, Operations manager) and Keystone (Loc)

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

- AE (Jordan, Vinizza) showed project location.
- Keystone (Loc) took soil and water samples at locations.
- QM – will likely be doing survey for quantities. Surveying stockpile.

3:00PM
- QM began filling metre sand bags from area behind station E. Site 14.

5:00PM
- QM leaving site.
- AE (Jordan, Vinizza) Drone Flight

5:15PM
- AE (Jordan, Vinizza) leaving site.

Testing:
- Keystone collecting soil and water samples today at existing and proposed sand stations.

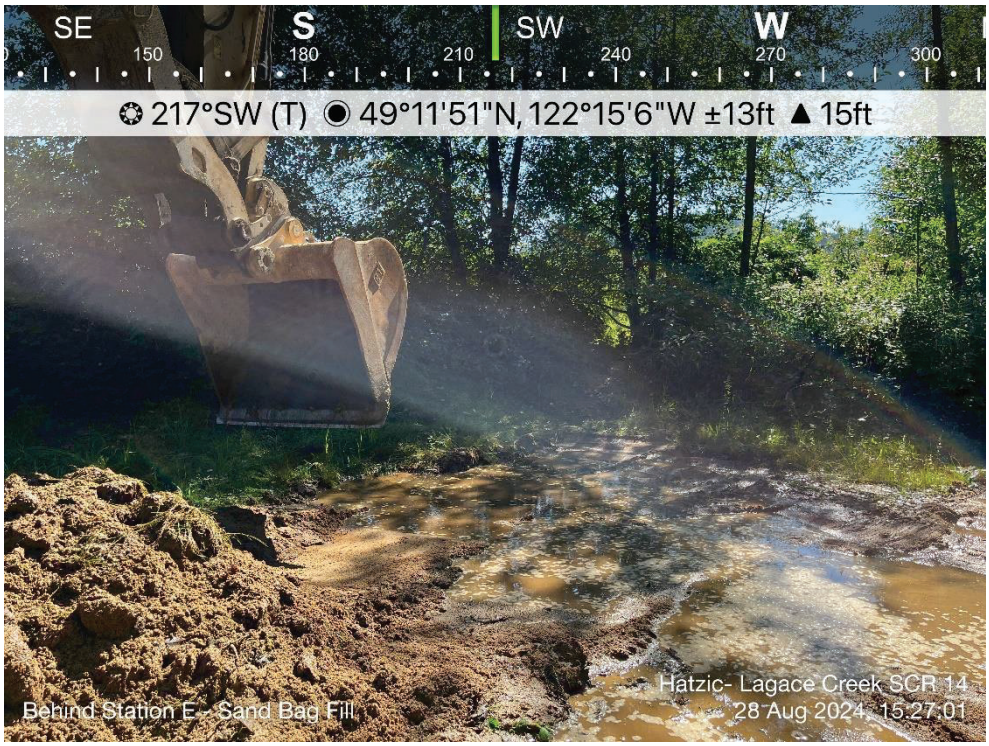
Safety Concerns:
- None today.

Traffic Control:
- None today.

Photos:

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	2
Project:	Legace Creek	**Page:**	1 of 11
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	August 28, 2024
Contract No.:		**Temperature:**	High: 21 Low: 8
Weather:	Sunny, Wind 5 KM/H, Gusts 10 KM/H		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

QM:

QM: Operation Project Manager (Tyler), Site Superintendent (Mel), Mark, 1 Operator (Glenn)
Keystone Environmental: Loc

Contractor's Equipment: - Equipment in use

- Excavator

Report, if any, Contact with Occupants:

None Today.

Contact with Owner:

None Today.

Discussions with Keystone:

8:05 am

- Conversation with Loc (Keystone)
  - He inquired whether we had located all the existing sand recovery stations, as he will be conducting soil sampling today. AE responded that, in the first section from C to F, station F is still difficult to locate due

to vegetation, and in the second section from G to L, only stations G and H were found yesterday. AE Jordan and Vinizza plan to search for the remaining stations today.

Discussions with Contractor:

8: 10 am

- Conversation with Mel & Mark (QM)
  - Mel suggested that if there's an easier way to proceed, AE should just mark the locations as long as they are aligned with the linear layout. This is because they urgently need to send the samples to the laboratory to obtain analytical data for disposal. The main tasks are to mark the sand recovery stations and site 17. They cannot proceed with the work until they receive approval, which they expect to obtain today.

10:40 am

- Conversation with Contractor and Their Queries;
  - Mel requested AE to flag all remaining stations so that Keystone can complete the soil sampling.
  - Mel noted finding lock blocks on the existing stations and inquired if lock blocks are also present on the new stations. He mentioned that the drawings show lock blocks but there are no details on whether they will be supplied by them.
  - Mel asked whether, while waiting for CEMP approval, they are allowed to fill meter bags from the access road (near station E).
  - They were informed that Lequamel First Nation will have periodic site visits, but they do not have a contact number for them.
  - AE responded to confirm with Ryan all the queries.

1:30 pm

- Conversation with Mel (QM):
  - Mel inquired about the volume of material to be excavated on the site 17.
  - AE responded that, according to the drawings, approximately 50 cubic meters are indicated for the southern section (1st section) and 250 cubic meters for the northern section (2nd section).

3:10 pm

- Conversation with Tyler & Mark
  - Tyler & Mark mentioned that they can now proceed filling the meter bags now with some conditions after their meeting with AE.
  - Mark mentioned that CEMP has some amendments and Keystone manager will visit the site tomorrow.
  - Mark mentioned that he will send RFI tomorrow about the proposed lock block.

3:30 pm

- Conversation with Tyler
  - He mentioned to fill 8-10 of meter bags.
  - They will start at station D.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Report:

8:00 am
- AE (Jordan and Vinizza) on site.

8:25 am
- AE (Jordan and Vinizza) - Started locating the sand recovery stations in the area from station I to L.

9:10 am
- AE (Jordan and Vinizza) - Completed locating and flagging the sand recovery stations in the area from station I to L. Please note that the exact locations are approximate due to vegetation and were based on Google Maps using the coordinates provided in the drawings.

9:30 am
- AE (Jordan and Vinizza) - Started locating the sand recovery station F.

10:20 am
- AE (Jordan and Vinizza) - Completed locating and flagging the sand recovery station F. Please note that the exact locations are approximate due to vegetation and were based on Google Maps using the coordinates provided in the drawings.

10:55 am
- Keystone conducted soil sampling at Station L.

11:55 am
- Meeting with Ryan
    - AE discussed the contractor's queries, including their plan to obtain sandbags from the pit/access road near station E.
    - Ryan mentioned that the contractor would address their queries directly with Alison.

12:40 pm
- AE (Jordan and Vinizza) - Located and flagged stations B2 and B3.
- Keystone conducted soil sampling at stations B, B2 and B3.

1:20 pm
- AE (Jordan and Vinizza) on site 17.

1:25 pm
- Walk site through with (AE, QM and Keystone).
- Keystone conducted soil sampling in two sections of Site 17.

1:55 pm
- AE (Jordan and Vinizza) left site 17.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

3:10 pm

- AE (Jordan and Vinizza) on site 14.

3:30 pm

- Starting scraping the soil pavement near Station E.

4:45 pm

- Qm crew filled 17-meter bags near Station E.

4:55 pm

- Preparing to fly the drone in the area.

5:30 pm

- AE (Jordan and Vinizza) left site.

Testing:

- Keystone is collecting soil samples for all the sand recovery stations (both existing and proposed) and for the two sections on Site 17.

Safety Concerns:

- None today.

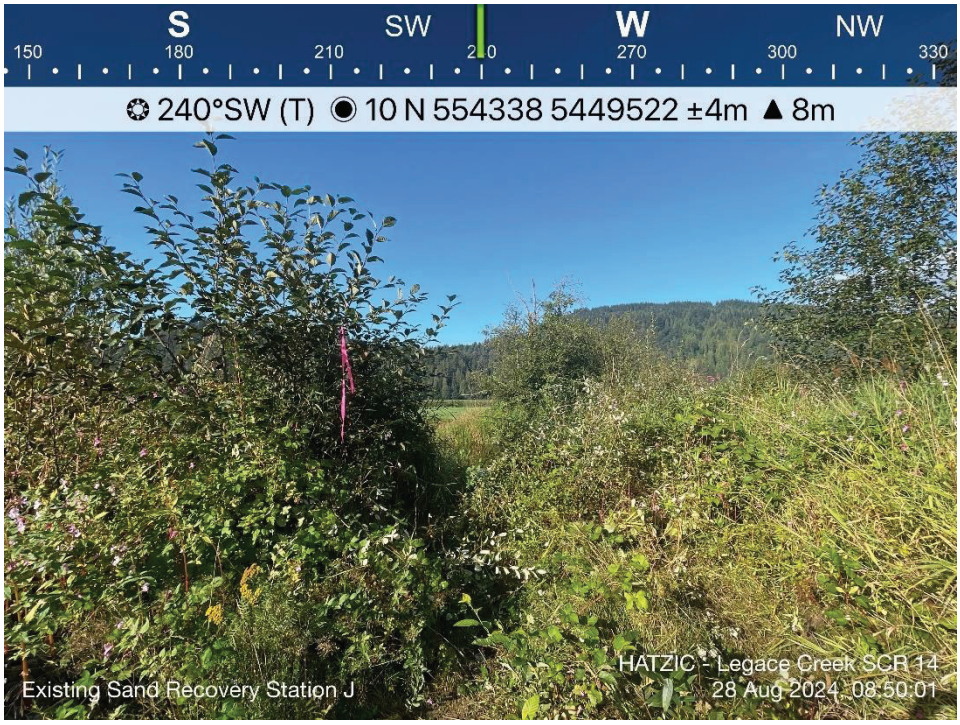
Traffic Control:

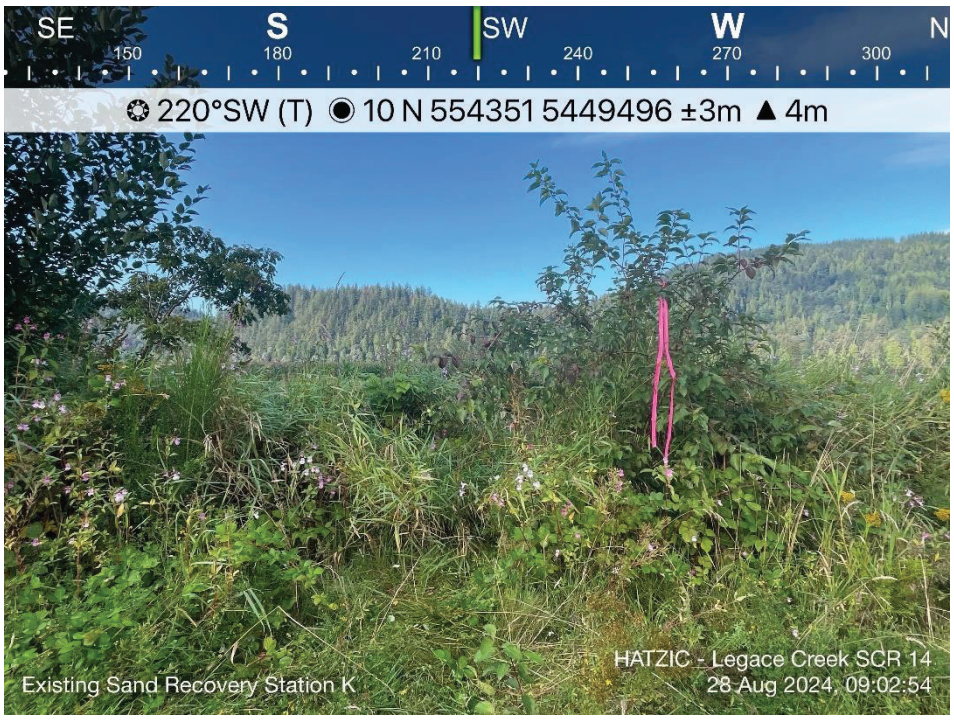
- None today.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

Photos:





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

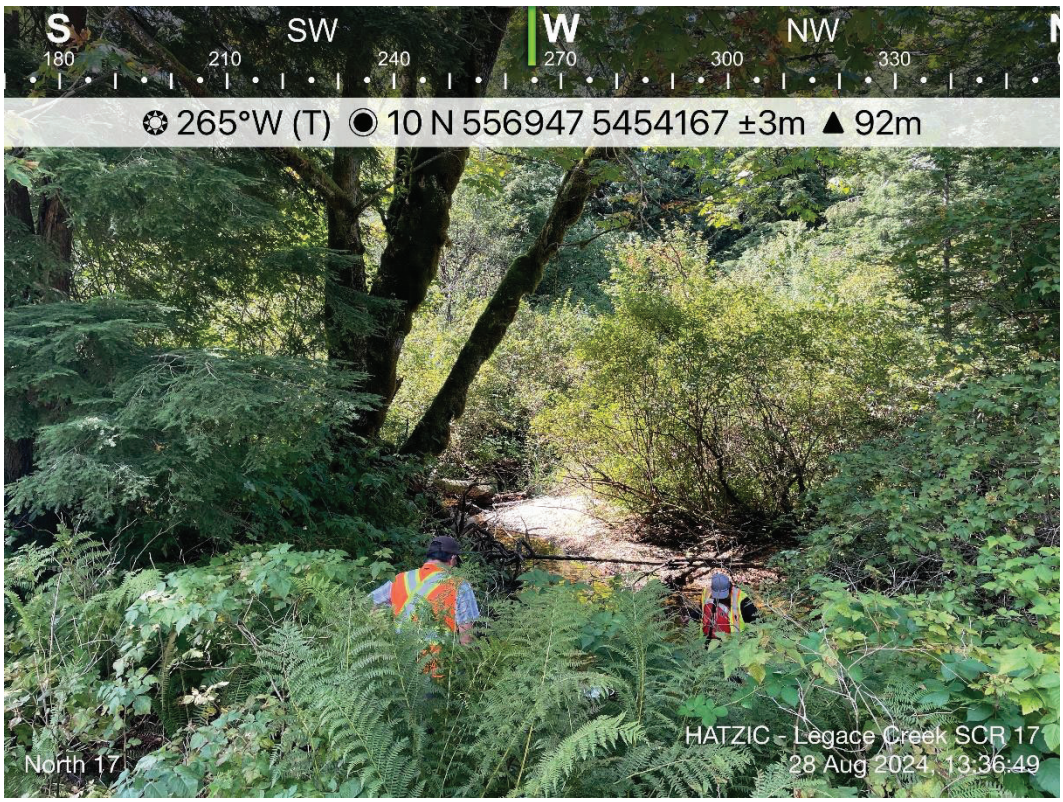




(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14&17
Environmental Monitoring Report

Date: August 28, 2024
Weather: Sun and Clear – 11oC in the morning and average of 20 oC from 12:00-17:00.

- Environmental Monitors (EMs) arrived on site at 7:07 AM.
- Planned work (clearing and grubbing of vegetation) had not started upon arrival.
- Associated Engineering field staff conducted surveys to mark soil sampling station for the remaining locations.
- At 08:52, EM started conducting soil sampling for all remaining stations including Station B, B2, B3, CR17-N, CR17-S, F, G, H, I, J, K and L.
- During the soil sampling work, bird calls and visual observation of birds included:
    - Cedar Waxwing (Bombycilla cedrorum)
    - American Robin (Turdus migratorius)
    - European Starling (Sturnus vulgaris)
    - Great Blue Heron sp. (Ardea herodias)
    - Common Yellowthroat (Geothlypis trichas)
- Nesting or breeding behaviors were not observed.
- EM performed a walkthrough with the operator and site superintendent to inform them about Japanese knotweed locations and potential impacts if spread in proximity to upcoming active work area.
- Recommendations provided as per the CEMP:
    - Avoid grubbing and tracking on knotweed
    - Use geotextile and gravel laid on top of vegetation if access is necessary
- EM completed all sediment samplings at 13:46.
- At 15:00, the crew received verbal confirmation the CEMP had been approved and will be sent out shortly. They wanted to use the backfilled materials (local sediment) in proximity to Station E to fill in the sandbags and communicated that to the EM.
- At 15:15, EM performed a sweep of the area to ensure no amphibians and/or invasive species such as knotweed were present. Amphibian and knotweed were not observed. Work commenced shortly after.
- Grubbing work did not occur and will be started on August 29, 2024.
- EM departed at 16:17 to deliver sediment samples to the lab in Burnaby.

Site Photos




ALS Environmental



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Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	3
Project:	Legace Creek	**Page:**	1 of -
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	August 29, 2024
Contract No.:		**Temperature:**	High: 26 Low: 10
Weather:	Sunny		

August 29, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Mel), Operations manager (Tyler), operator, 3 labourers
Keystone Environmental: EM (Loc), 2 supervisors

Contractor's Equipment:

-Equipment in Use

Excavator 324E

Report, if any, Contact with Occupants:

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

11:00AM

- Discussion with Keystone (Loc) – Per CEMP, silt fence and poly is required at each existing SRS for erosion/sediment control and slope stability.
- Concern with knotweed extents at proposed SRS locations, will have to excavated this material potentially for SRS installation. Is going to check with supervisor.

3:45PM

- Discussion with Keystone (Loc) – Fish permit should now be in place. Waiting for amphibian permit before excavation is allowed.
- Soil tests allow work in creek to begin, but no hauling off site.

Discussions with Contractor:

7:00AM

- Toolbox talk QM (Mel) – Arborist on site today taking down trees in front of Doug's property, parallel to Dale road.
- Starting to grub areas for excavator access to SRS (C,D,E,F)
- Lane closure on Dale road for tree cutting.
- QM (Tyler) – wants to get a density gauge out here to determine volumes from hauling trucks.

8:00AM

- Discusison with QM (Mel) – Wanted to know if AE is going to confirm extent of trees being cut to access proposed SRS outside of Doug's property. AE (Jordan) confirmed what needs to be cleared is up to QM, clear what is needed for access and construction of proposed SRS.

9:30AM

- Discussion with QM (Mel) – SRS D has around a 20ft sediment and vegetation build up in front of the SRS. Wondering how to access creek with excavator, won't be able to reach very far. AE (Jordan) to confirm with Ryan.
- Mel wants to confirm extent lengths of excavation limits. AE (Jordan) directed to drawings showing volume and depth limits. Jordan to confirm how to determine excavation limits with Ryan.

10:00AM

- Discussion with QM (Mel), Keystone (Loc) and AE (Jordan, Vinizza, Dave)
- Knotweed branches and leaves stored in laydown on poly, will be transferred to disposal facility, QM still to confirm which facility it is going to.
- Excavator refuel will be done on road, 30m from waterbody.
- Keystone (Loc) – Fish salvage permit still waiting on, should have Thursday.
- Also, waiting on test results from creek sediment and water.
- No birds nests were spotted in area.

12:30PM

- Discussion with QM (Mel) – Around 5.4m of sediment and vegetation on station D between creek and lock blocks, concern excavator arm won't extend over built up sediment. Wants to use swamp mats to drive out over lock blocks.
- AE (Jordan) – Informed QM to submit this as an RFI to our team to address how to access creek.

3:30PM

- Discussion with QM (Tyler) – Just got off call with AE (Ryan and Andrew)

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

- Wants to fill sand bags to get things ready for when fish permit is approved.
- Plan to dewater is to not completely isolate creek, but to place sand bags and fence around excavation area.
- Wants to soil density tests for volume calculations. AE (Ryan) wants this done after dewatering at each SRS location.
- Try to do the soil density testing in the dry, hoping excavator can squeeze out a lot of that moisture.

4:15PM

- Discusison with QM (Mel and Tyler) – AE (Jordan) informed group of excavation extents. Explaining the limits depend on where the fish salvage is conducted. The excavator can reach as far across/left/right as the salvage/dewatering allows it, as long as we are still aiming for volumes specified on drawings, and depths specified on drawings. Field fit project, so it what SRS location allows for excavating extents.

Report:

8:00AM

- QM Clearing access to SRS E.
- Arborist setting up for tree cutting in front of Doug's property.
- Keystone checking knotweed extents near SRS D.

9:00AM

- Arborist removing trees outside of Doug's property.

9:30AM

- Station C cleared.

9:45AM

- AE Enviro (Dave) on site.

11:00AM

- Installing silt fence and poly on SRS C, E, F

3:30PM

- Filling sand bags at SRS E laydown.

4:00PM

- Laying out potential place for silt fence and sand bags for water diversion tomorrow at SRS E.

4:30PM

- Cleaning and leaving site.

5:00PM

- AE (Jordan, Vinizza) measure C and G: including areas C and G beyond lock blocks.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

- SRS C: 4x12m
- SRS D: 15x5m
- SRS E: 7x9m
- Access to station F: 40x5m
- Station F: 11x8m

5:15PM

- AE (Jordan, Vinizza) – drone flight.

Testing:

- None today.

Safety Concerns:

- None today.

Traffic Control:

- Single Lane closure on Dale road.

Photos:

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	3
Project:	Legace Creek	**Page:**	1 of 9
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	August 29, 2024
Contract No.:		**Temperature:**	High: 26 Low: 10
Weather:	Sunny, Wind 4 KM/H, Gusts 6 KM/H		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

QM:

QM: Operation Project Manager (Tyler), Site Superintendent (Mel), Operator (Glenn), 3 laborers
Keystone Environmental: EM (Loc), 2 Supervisors

Contractor's Equipment: - Equipment in use

- Excavator 324E

Report, if any, Contact with Occupants: ss

None Today.

Contact with Owner:

None Today.

Discussions with Keystone:

Discussions with Contractor:

7:00 am

- Mel mentioned that the arborist will cut trees for the project access road outside of Doug's property at Dale Road. Additionally, the station from C to F will be cleared to locate the existing sand recovery station.
- Tyler mentioned that a density test should be conducted to determine the volume of material hauled by the trucks.

9:20 am

- Conversation with Mel
    - He requested the guidelines for the boundary to be excavated along the creek
    - Soil sample results will be available on Tuesday.

10:00 am

- Conversation with QM (Mel), Keystone (Loc), AE (Dave, Jordan, Vinizza).
    - Dave discussed the proper disposal of the knotweed. QM will identify the appropriate disposal facility.
    - Loc mentioned that they are waiting for the fish salvage permit, which may be issued by Thursday evening.
    - Loc also mentioned that soil sampling results will be available on Tuesday. They collected 35 soil samples yesterday.
    - Dave and Loc emphasized that when refueling equipment, it should be done on the road, at least 30 meters from the creek.
    - Loc noted that there are no bird nests in the area.

Report:

7:00 am

- AE (Jordan and Vinizza) on site.

7:05 am

- Sign In. Toolbox Meeting
- Green Valley Traffic Control on site.

8:00 am

- QM has started clearing Station E.

8:10 am

- Keystone has started checking the knotweed in preparation for its removal

8:20 am

- The arborist is preparing to cut trees outside Doug's property along Dale Road, near the bridge.
- Traffic control has already been set up along Dale Road, with two crew members acting as flagmen.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

8:25 am
- AE Jordan and Vinizza left site.

9:15 am
- AE Jordan and Vinizza on site.
- Ongoing tree cutting outside Doug's property along Dale Road, near the bridge.

9:20 am
- Clearing of Station C is complete.

9:30 am
- QM has started clearing Station D.
- At Station D, the ongoing tasks include trimming the knotweed plants and laying them out on the mat.

9:35 am
- AE Environmental Dan arrived on site.

9:45 am
- Done clearing Station E.

11:10 am
- At Station C, a polyethylene mat and silt fence have been installed.

11:40 am
- At Stations E and F, the installation of polyethylene mats and silt fences is ongoing.

12:30 pm
- AE Jordan & Vinizza measured the distance from the lock block to the creek at station D - 5.4 meters.

5:00 pm
- AE Jordan and Vinizza measured the cleared area at Station C (4m x 12m) and the access road width at Station F (4.10m).

5:15 pm
- AE (Jordan and Vinizza) conducted a drone flight in the area.

5:30 pm

- AE (Jordan and Vinizza) left site.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

Testing:

- None today.

Safety Concerns:

- None today.

Traffic Control:

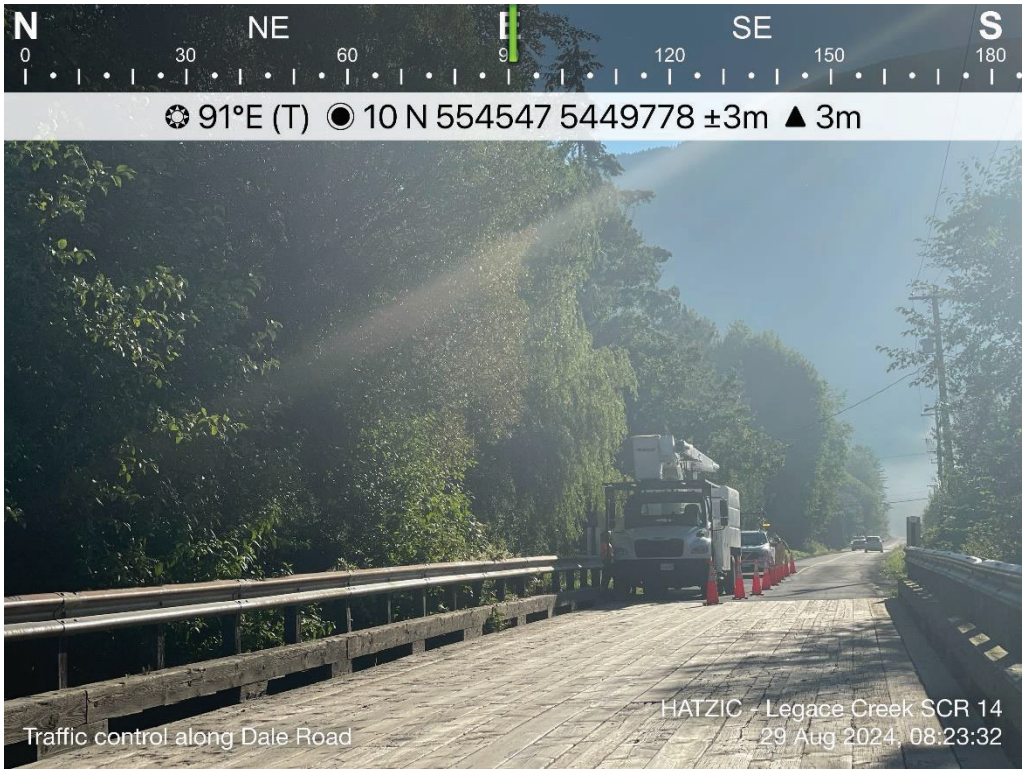
- None today.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

Photos:

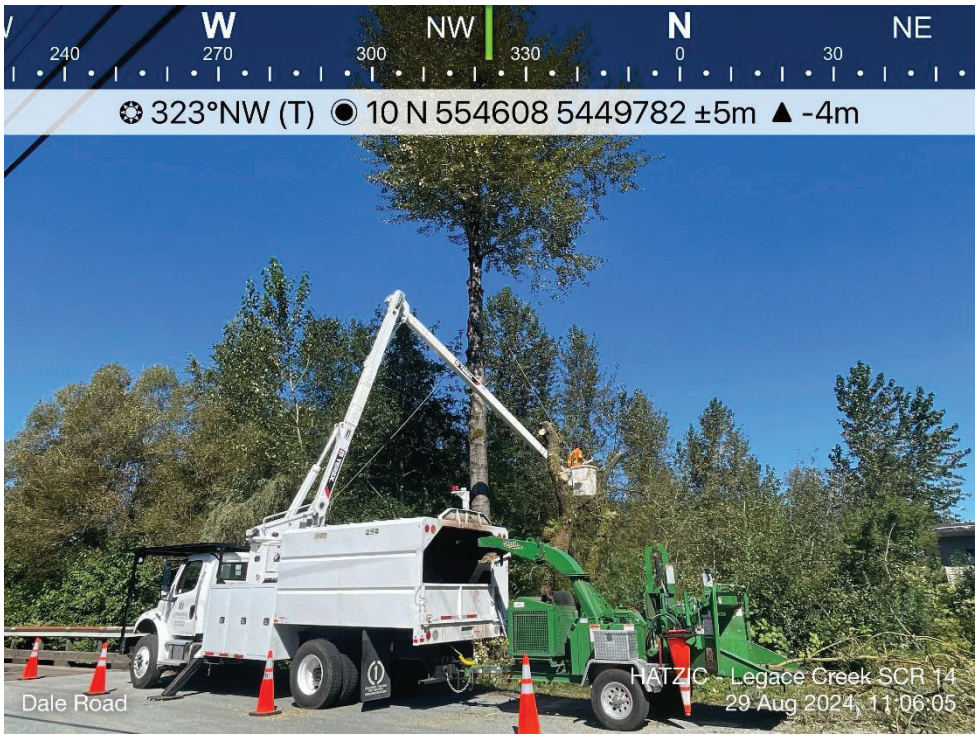




(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

TECHNICAL MEMORANDUM

Issue Date:	August 30, 2024	**File:**	Audit No. 1
To:	**Thyren Jacobs, Flood Debris Management Secretariat**	**Previous Issue Date:**	
From:	Dave Muhlert, R.B.Tech. and Naomi Sands, R.P.Bio.		
Client:	Ministry of Environment and Climate Change Strategy		
Project Name:	Lagace Creek Bank Protection and Sediment Removal - SCR14	**Project No.:**	2022-2632-03
Subject:	Environmental Compliance Audit		
Monitoring Period:	August 27 to 29, 2024		
Contractor:	QM Environmental		
Environmental Monitor:	Keystone Environmental		

1 INTRODUCTION

Associated Environmental Consultants Inc, (Associated) is pleased to provide this environmental audit report summarizing observations of site conditions, environmental protection measures, regulatory compliance, and corrective actions as part of erosion protection works on Lagace Creek, south of Durieu, BC in the Hatzic Valley (the Project, the Site) during the monitoring period August 27 to 29, 2024. The results presented in this audit report are based on conditions observed at the time of the audit inspection(s) and represent a snapshot of the workday. Items identified as non-compliant may have been addressed before the report(s) are submitted. The audit report(s) are submitted to the owner, their agent (Associated Engineering), the Contractor, and their environmental monitor (EM) and are not intended for further distribution.

2 ROLES AND RESPONSIBILITIES

The prime contractor for the Project is QM Environmental. (the Contractor), and works are being monitored for environmental compliance by Keystone Environmental (Keystone) and audited by Associated. As the EM, Keystone is to work with the Contractor to develop measures to protect the environment and to respond to environmental incidents as they occur. Keystone is also responsible for fish and wildlife salvages prior to instream works. Leq'á:mel First Nation (LFN) is the cultural monitor for the Site. The responsibility of the auditor is to ensure on behalf of the owner, who is ultimately the permit holder, that the EM, LFN, and the Contractor adhere to the requirements of the Construction Environmental Monitoring Plan (CEMP)[1], environmental permit conditions and any applicable regulations.

3 SITE INSPECTION

A summary of site conditions as observed during the audit inspection completed during the monitoring period is provided in Table 3-1. At the time of this report, Associated has received monitoring reports covering activities on site August 27 and August 28.

[1] AquaTerra Environmental Ltd. 2024. Hatzic Emergency Program, South Herford Creek Project, Construction Environmental Management Plan (Rev. 1). Prepared for Mission Contractors Ltd. 65 p.

Table 3-1 Site Conditions During Audit Inspection

Date / Time	Auditor (Associated)	Weather	Construction Activities
August 29, 2024 09:30	Dave Muhlert	Sunny. 18°C. No precipitation.[2]	Crew was clearing vegetation and access paths for sand recovery stations C, D, E, and F (south of Dale Road). An arborist was on site limbing/falling trees at station B-3 (north side of Dale Road). Instream works had not yet started at the time of the audit.

4 INSPECTION RESULTS

A checklist of required environmental protection measures and mitigative strategies for the Project is presented in Table 4-1. The checklist has been developed in accordance with terms and conditions of the environmental permits and approvals issued for the Project, environmental protection specifications and requirements as part of the construction contract for the Project, the Contractor's Construction Environmental Management Plan and environmental best management practices and guidelines.

[2] Environment Canada. 2024. Abbotsford Airport Hourly Data Report for August 29, 2024. Available at: https://climate.weather.gc.ca/historical_data/search_historic_data_e.html. Accessed August 30, 2024.

Table 4-1 Summary of Environmental Protection Measures Reviewed and Results of the Inspection

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
	Environmental Monitoring					
1	The EM will attend key site meetings where environmental mitigations and issues may be discussed.	☒Compliant ☐Non-Compliant ☐N/A	EM has been on site daily to attend site meetings.		CEMP Section 2.4	
2	The EM shall supervise all instream works. If temporary diversion installed, EM is onsite daily to check pumps and flow bypasses.	☐Compliant ☐Non-Compliant ☒N/A	No instream works had started yet during the audit.		WSA (h)2.ii, (j)5.i CEMP Section 2.4	
3	The EM will submit daily and bi-weekly monitoring reports to the Contractor for distribution to MoECCS.	☒Compliant ☐Non-Compliant ☐N/A	Associated received August 27 and 28 monitoring reports on August 29.	Submit monitoring reports daily.	CEMP Section 5.1	
4	The EM will complete and submit an Environmental Incident Report (EIR) for non-compliances with the CEMP, reportable spills or other environmental incident.	☐Compliant ☐Non-Compliant ☒N/A	No environmental incidents have been reported to date.		CEMP Section 4	
5	EM is granted authority to stop the work if necessary	☒Compliant ☐Non-Compliant ☐N/A	No work stoppages have been reported to date.		WSA (i) 7 CEMP Section 2.4	
	Erosion and Sediment Control					
6	Appropriate site isolation is installed as required, including silt fencing prior to instream works. Silt fences are installed properly, intact, adequate, clear of accumulated sediment and are functioning.	☒Compliant ☐Non-Compliant ☐N/A	Contractor and EM were installing silt fencing at station C during the audit.		WSA (o), (q) CEMP Section 3.5	Photo 1
7	Riprap or any other engineering material place in channel is clean of any substances deleterious to aquatic life.	☐Compliant ☐Non-Compliant ☒N/A	No riprap or other material was being placed during the audit.		WSA (x) CEMP Section 3.5	
8	Stockpiling and storage areas are located 15 m from the watercourse TOB.	☒Compliant ☐Non-Compliant ☐N/A	No soil stockpiling occurring at the time of the audit. Site laydown is located at station C-2, more than 15 m from the watercourse.		DFO FAA WSA (t) CEMP Section 3.5	
9	Emergency ESC material onsite (e.g., 100 feet of silt fencing, 5 dry bales, and 100sq.m of ECBs/ Coconut matting, or polyethylene sheets)	☒Compliant ☐Non-Compliant ☐N/A	ESC materials were stockpiled at the site laydown.		CEMP Section 3.5	Photo 2
10	Sediment removed from the Site will be disposed of appropriately at a location approved by the EM and MoECCS.	☐Compliant ☐Non-Compliant ☒N/A	Sediment removal had not yet started at the time of the audit. CEMP does not specify the sediment disposal location(s).	Identify sediment disposal location(s) in the CEMP and/or the environmental monitoring reports.	CEMP Section 5.5	
11	Sediment removal boundaries must be clearly delineated prior to commencement of work.	☐Compliant ☐Non-Compliant ☒N/A	Sediment removal had not yet started at the time of the audit. Contractor reported that removal boundaries would be delineated prior to commencement of work.		WSA (opening)	
	Invasive Plant Management					
12	Ensure that machinery is free of invasive plant material that could	☐Compliant ☒Non-Compliant ☐N/A	Knotweed stem was placed on excavator track during removal operation	Ensure that all knotweed cuttings are confined to poly	WSA (opening) CEMP Section 3.4	Photo 3

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
	potentially be transported throughout or between sites.			sheeting to prevent the spread of plant fragments that could potentially propagate. Clean machinery that has worked in knotweed-infested areas before moving it off site or to "clean" areas within the site.		
13	Ensure that invasive species removed from site are disposed of appropriately at an approved facility	☒Compliant ☐Non-Compliant ☐N/A	Invasive species have not yet been transported for disposal. EM reported that the knotweed disposal site has not yet been determined but will be added to the monitoring reports once identified.		WSA (opening) CEMP Section 3.4.1	
14	The Project site shall be regularly monitored by the EM for invasive plant infestations and these infestations will be mapped and managed according to applicable species-specific BMPs.	☒Compliant ☐Non-Compliant ☐N/A	EM was on site directing knotweed management during the audit.		CEMP Section 3.4.1	
16	Knotweed stems are cut close to the ground and contained on poly sheeting away from the immediate work area. Cut knotweed is covered with woven geotextile fabric and crushed rock prior to machine access. Knotweed stems are injected with an appropriate herbicide before being covered.	☐Compliant ☒Non-Compliant ☐N/A	EM and contractor were on site cutting knotweed and laying out on poly sheets. Some knotweed stems were being piled on top of the large sandbags that will be used in the creek for flow isolations. Herbicide injection was not being done during the audit visit.	Ensure that all knotweed cuttings are confined to poly sheeting, and that stem injections are applied as required	CEMP Section 3.4.1 Addendum 1 to the Contract Documents for the Hatzic Emergency Works Program - Lagace Creek – Sites S-CR-14/17	Photo 4
	Waste Management					
17	Dispose of all anthropogenic debris removed at an appropriate waste management facility.	☒Compliant ☐Non-Compliant ☐N/A	No anthropogenic debris was observed during the audit.		WSA (opening) CEMP Section 5.5	
18	Non-hazardous waste stored appropriately and removed offsite daily.	☒Compliant ☐Non-Compliant ☐N/A	No non-hazardous waste was observed during the audit.		CEMP Section 5.5	
19	Hazardous waste stored > 30 m of watercourses.	☒Compliant ☐Non-Compliant ☐N/A	Portable toilet is located at the site laydown, more than 30 m away from watercourses.		CEMP Section 5.5	
20	Secondary containment used for all stored hazardous waste.	☐Compliant ☒Non-Compliant ☐N/A	Portable toilet was not in secondary containment.	Add secondary containment to portable toilet.	CEMP Section 3.6	
	Spill Control and Emergency Response					
21	Machinery operating in channel is equipped with environmentally friendly oil	☒Compliant ☐Non-Compliant ☐N/A	Excavator on site has a sticker confirming that it contains Environ™ biodegradable, non-toxic hydraulic fluid.		WSA (p) 4 CEMP Section 3.6	Photo 5
22	Equipment and machinery are free of leaks	☒Compliant ☐Non-Compliant ☐N/A	No leaks were observed during the audit. Equipment appeared to be clean.		WSA (p) 1 CEMP Section 3.6	

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
23	Drip trays are available and used during refueling and equipment maintenance	☒Compliant ☐Non-Compliant ☐N/A	Equipment was actively working during the audit. Contractor reported that spill trays are available for parked equipment.		CEMP Section 3.6	
24	Fuel is stored > 30 m from Lagace Creeks and any connected drainages	☒Compliant ☐Non-Compliant ☐N/A	Fuel storage on site was limited to double-walled "tidy tanks" in pickups that were parked more than 30 m away from the creek.		WSA (p) 3 CEMP Section 3.6	Photo 6
25	Machinery and vehicles operating onsite are equipped with spill kit.	☒Compliant ☐Non-Compliant ☐N/A	Conditionally compliant - Excavator on site had spill pads on board. Large spill kit at site laydown was low on materials. Contractor reported that additional spill kit materials had already been ordered.	Ensure that spill kits are fully stocked at all times.	WSA (p) 2 CEMP Section 3.6	
26	Should suspected contaminated material be encountered (i.e., soil emitting olfactory cues indicative of hydrocarbon fuel), works should temporarily halt for investigation.	☐Compliant ☐Non-Compliant ☒N/A	No suspected contaminated material has been reported to date. EM has collected sediment samples from each of the sand recovery stations and submitted to ALS Environmental for chemistry analysis.		CEMP Section 2.5	
27	Refuelling of machinery is conducted on level ground over a spill tray.	☒Compliant ☐Non-Compliant ☐N/A	No refuelling was observed during the audit. Contractor reported that refuelling is done on level ground at Dale Road.		CEMP Section 3.6	
	Riparian Area Management					
28	Stockpile LWD and root wads removed from channel for use in site restoration	☐Compliant ☐Non-Compliant ☒N/A	Instream works had not yet started at the time of the audit, therefore no LWD or root wads have been encountered to date.		CEMP Section 3.3	
29	Construct access points and approaches perpendicular to the watercourse;	☒Compliant ☐Non-Compliant ☐N/A			DFO FAA CEMP Section 3.2	
	Instream Works					
30	The EM shall ensure that instream works are isolated from flow and that measures are in place to protect fish and fish habitat, and to mitigate the migration of sediment downstream.	☐Compliant ☐Non-Compliant ☒N/A	Instream works had not yet started at the time of the audit.		WSA (j) CEMP Section 3.1	
31	Pumps and flow bypasses are in proper working condition	☐Compliant ☐Non-Compliant ☒N/A	No pumps or bypasses were in use during the audit.		WSA (j) 5 CEMP Section 3.1	
32	Instream works conducted in the dry / isolation of flow	☐Compliant ☐Non-Compliant ☒N/A	Instream works had not yet started at the time of the audit		WSA (o) CEMP Section 3.1.1	
	Water Quality					
33	Water quality is routinely monitored upstream and downstream of the work area, every day that instream works are occurring Instream water quality is compliant with provincial criteria[3]: **Turbidity**: - <8 NTU from background at any one time for a	☐Compliant ☐Non-Compliant ☒N/A	Instream works had not yet started at the time of the audit		WSA (s) CEMP Section 3.1.2	

[3] British Columbia Ministry of Environment and Climate Change Strategy. 2024. British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture - Guideline Summary – August 2024. Water Quality Guideline Series, WQG-20. Prov. B.C., Victoria B.C. Available at: https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-guidelines/approved-wqgs/wqg_summary_aquaticlife_wildlife_agri.pdf. Accessed August 2024.

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
	duration of 24 h in clear waters; - < 5 NTU from background when background is 8 – 50 NTU; - <10% from background when background is > 50 NTU. **pH:** 6.5-9.0					
	Fish and Wildlife Protection					
34	Full time monitoring for fish during instream works is occurring.	☐Compliant ☐Non-Compliant ☒N/A	Instream works had not yet started at the time of the audit		WSA (j) 6 CEMP Section 2.4	
35	Fish salvages are conducted in advance of instream works where required.	☐Compliant ☐Non-Compliant ☒N/A	Instream works had not yet started at the time of the audit		CEMP Section 3.1 WSA (j) 6	
36	Salvaged fish are relocated back to the same watercourse in a nearby area that is not impacted by construction or removal works or its zone of influence	☐Compliant ☐Non-Compliant ☒N/A	Instream works had not yet started at the time of the audit		DFO FAA Section 2.2.4	
37	Pump intakes are screened for fish and aquatic species in accordance with the "Interim code of practice: End-of-pipe fish protection screens for small water intakes in freshwater"	☐Compliant ☐Non-Compliant ☒N/A	No pumps were in use during the audit.		WSA (j) 5.ii DFO FAA Section 2.4.9 CEMP Section 3.1.1	
38	Obtain required permits prior to salvage(s).	☒Compliant ☐Non-Compliant ☐N/A	EM reported that they were waiting for permits prior to beginning fish salvage.		WSA (Opening) CEMP Section 3.1	
39	EM is on site during disturbance to riparian vegetation and conducting pre-clearing breeding bird surveys prior to clearing.	☒Compliant ☐Non-Compliant ☐N/A	EM reported that they conducted pre-clearing bird nest surveys.		CEMP Section 3.2	
40	Instream works are conducted so as not to lead to fish stranding or other impacts to fish. The works shall not result in depressions that have the ability to trap fish and other aquatic life. Fish passage is maintained where practicable and in accordance with applicable permits.	☒Compliant ☐Non-Compliant ☐N/A	Instream works have been designed to maintain fish passage after completion. Instream works had not yet started at the time of the audit.		WSA (j) 6 (iii) WSA (u) DFO FAA Section 2.4.2 CEMP Section 3.1.1	
	Restoration Requirements					
41	Restoration plans prepared by EM for disturbed area and implemented with EM oversight	☐Compliant ☐Non-Compliant ☒N/A	Restoration plans have not been prepared yet.		WSA (w) CEMP Section 3	
42	All temporary works shall be removed on completion of the project, and the stream channel restored to its natural condition	☐Compliant ☐Non-Compliant ☒N/A	Work is still in progress.		WSA (v) CEMP Section 3	

5 DISCUSSION

5.1 Non-Compliant Items

Knotweed management

Section 3.4.1 of the CEMP requires that knotweed stems are cut close to the ground and placed on poly sheeting away from the immediate work area to prevent spreading plant fragments that could propagate and create new infestations. During the audit, some cut pieces of knotweed were observed on top of the large sandbags that will be used in the creek for flow isolations, and on the tracks of the excavator. In addition, Addendum 1 to the Contract Documents for the Hatzic Emergency Works Program - Lagace Creek – SITES S-CR-14/17 requires that trimmed knotweed stems are injected with an appropriate herbicide.

Recommended action: Ensure that all knotweed cuttings are confined to poly sheeting and stem injection of herbicide is completed as appropriate. Treat cut stems with an appropriate herbicide as per best practices and manufacturer's instructions.

Portable toilet without secondary containment

A portable toilet located at the site laydown adjacent to Dale Road did not have secondary containment. Although the toilet was more than 30 m away from the watercourse, secondary containment would prevent any potential spills from spreading beyond the immediate area.

Recommended action: Add secondary containment to portable toilet.

5.2 Conditionally Compliant Items

Environmental monitoring reports not received daily

The CEMP requires that monitoring reports are produced daily by the EM. At the time of this memo, Associated has received monitoring reports for works on August 27 and 28, but these were both received on August 29.

Recommended action: Submit environmental monitoring reports daily.

Inadequate spill kit materials

A large spill kit was available at the site laydown but was not fully stocked with spill cleanup materials. The Contractor reported that additional materials had already been ordered.

Recommended action: Keep spill kits fully stocked at all times.

6 SUMMARY

A list of environmental issues outstanding to date is provided in Table 6-1, below.

Table 6-1 Tracking Table of Environmental Issues Outstanding to-Date (project commencement August 12, 2024)

Item #(s)	Issue	Date(s) Observed	Recommended Corrective Action(s)	Responsible Party
1	Environmental monitoring reports not received daily	August 29, 2024	Submit environmental monitoring reports daily.	EM
2	Knotweed material outside poly sheet containment, no herbicide treatment	August 29, 2024	Ensure that all knotweed cuttings are confined to poly sheeting. Apply herbicide to remaining stems, as appropriate.	Contractor/EM
3	Portable toilet without secondary containment	August 29, 2024	Add secondary containment to portable toilet.	Contractor

Note: Items marked with an asterisk (*) were reported by the EM.

7 CLOSURE

We trust that the information in this memo is sufficient for your present needs. Should you have questions, please do not hesitate to contact the undersigned.

Prepared by:

for

Dave Muhlert, R.B.Tech.
Environmental Technologist

DM/NS

Reviewed by:

Naomi Sands, R.P.Bio.
Senior Environmental Scientist

Attachments:
- Site Photographs

Attachment 1: Site photographs taken during audit visit on August 30, 2024.

Photo 1: Contractor installing silt fencing / site isolation 		**Photo 2: Erosion and sediment control materials stockpiled at the site laydown** 
Photo 3: Knotweed stem on excavator track 		**Photo 4: Knotweed stems on sandbags that will be used instream for site isolation** 
Photo 5: Sticker on excavator showing that it uses environmentally friendly hydraulic oil 		**Photo 6: Fuel in double-walled tank in pickup** 

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14&17
Environmental Monitoring Report

Date: August 29, 2024
Weather: Sun and Clear – 11°C in the morning and average of 26 °C from 11:00-17:00.

- Environmental Monitors (EMs) arrived on site at 7:00 AM.
- EM discussed with the crew to ensure spill trays will be placed under parked heavy machines to prevent potential spill.
- EM discussed with the crew on managing the invasive species at station D.
- Recommendations provided as per the CEMP:
    - Avoid grubbing and tracking on knotweed if possible. If deemed necessary, cut the stems near the ground, and place it on top of poly tarp and dispose at the designated facility.
    - Use geotextile and gravel (or local sediments) laid on top of vegetation and avoid disturb the ground with the machine's track.
- Bird sweep was completed on Tuesday, August 27 and was still valid until Friday, August 30. In addition, EM conducted quick bird sweep and did not observe any activities.
- Planned work (clearing and grubbing of vegetation) started at 08:00. Tree cutting on adjacent property also started at the same time.
- Grubbing work for stations C and E were completed at 09:20. Knotweed was not observed within the grubbed area.
- Grubbing work at station D at 09:30, where knotweeds were found, was supervised by the EM. Knotweeds were removed using hedge trimmer and the invasive plants were contained in the poly sheeting. The area where machine will anchor will be covered with geotextiles and local sediments.
- Grubbing work at station F commenced at ~10:30 and completed shortly after. Knotweeds were not observed near the grubbed area.
- EM discussed with the crew on installing Erosion Sediment Control (ESC) measures such as silt fencing and poly sheeting where exposed area and slopes were present to protect Lagace Creek from potential sediment runoff from Site.
- Grubbing work and ESC installations completed at 14:02. Completed stations included F, E, C and D.
- During today's EM work, bird calls and visual observation included:
    - Cedar Waxwing (*Bombycilla cedrorum*)
    - American Robin (*Turdus migratorius*)
    - Great Blue Heron sp. (*Ardea herodias*)

Site Photos






324E

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	4
Project:	Legace Creek	**Page:**	1 of 6
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	August 30, 2024
Contract No.:		**Temperature:**	High: 27 Low: 12
Weather:	Sunny		

August 30, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Mel), Operations manager (Tyler), 2 operator, 2 labourers
Keystone Environmental: EM (Loc) (Kang)

Contractor's Equipment:

-Equipment in Use

- CAT Excavator 324E
- Zaxis Excavator EX0689
- Deer Loader 1466

Report, if any, Contact with Occupants:

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

8:00AM

- AE (Jordan) discussion with Keystone (Kang, Loc) – AE informed the addendum in the contract documents states the trimmed knotweed should be injected with herbicide. Noted this does not line up with what is in the CEMP.
- Keystone (Kang) said he will follow up with his supervisor.
- AE (Jordan) to share document with Kang and highlight section this is mentioned.

12:35PM

- Keystone (Kang) – talked to supervisor says herbicide into knotweed after it is trimmed and that close to creek is not best practice.
- AE (Jordan) to provide addendum 1 to Keystone so they can see question being referred to.
- Kang to discuss with supervisor.

2:00PM

- Discussion with Keystone (Kang, Loc) – AE (Jordan) provided addendum to Keystone.
- Kang forward to supervisor to discuss.

Discussions with Contractor:

7:00AM

- Toolbox talk QM (Mel, Tyler)
- Continue clearing at Stations G,H,I,J,K,L today
- Start moving sandbags into creek for dewatering, going to experiment how to make it work.
- AE (Jordan) informed QM (Mel, Tyler) – Leq'a: mel needs to be contacted prior to doing any work in the creek per the contract agreements.
- QM (Tyler) – Informed AE Mert was working on getting into contact with them earlier this week.

9:20AM

- After discussion with Leqa': mel on site SCR 15/16, AE (Jordan, Vinizza) followed up with QM (Mel) and Keystone (Kang) about getting into contact with Leqa': mel.
- AE stressed it is urgent as you are already doing in-stream work, Leqa': mel should be made aware of project as they are supposed to be on site for in-stream works.
- Keystone (Kang) followed up Leq'a: mel and left a message with Tina after this discussion.

9:30AM

- Discussion with QM (Tyler) – Silt fence and sand bags aren't working due to high velocities at areas where creek is constricted. QM is ordering reinforced silt fences and is continuing to place more sand bags in the water.

10:15AM

- Discussion with QM (operator) and Keystone (Loc) – concern with knotweed at SRS H, close to lock blocks.
- AE (Jordan) informed QM and Keystone the excavator must sit within the existing lock blocks.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

- Keystone – knotweed can remain if operator will be able to keep his machine out of it. If it is an issue the knotweed will need to be trimmed and covered with a geotextile. EM to closely monitor this site during excavation.

12:35PM
- Discussion with QM (Mel) – aggregate in lay down is for temporary access into Doug's property.
- Material excavated from creek will be stockpiled next to SRS, dried for however long is adequate to AE and hauled from there.

2:40PM
- Discussion with QM (Mel) – potential waterline that runs parallel through Dale road and into Doug's property.
- Mel says he had a line locator here, wasn't able to pick up waterline due to wet conditions.
- Not currently a concern, not digging into Doug's property. Tomorrow just planning to remove some vegetation on surface for install of temporary road.

3:45PM
- Discussion with QM (Mel) and David Wood – David was expressing he knows the property owners in area, gave Mel his contact because a lot of property owners want the material. Mel confirmed he will reach out and make sure proper documents are in place prior to hauling off site.

4:15PM
- Discussion with QM (Mel and Jim) – discussing how to track quantities of hauled material. Tyler wanted to use density gauge, but he has now left site and not sure if others know where to get one.
- AE (Jordan) suggested Mel get a surveyor prior to excavating to get a topo of the existing ground and compare that to a stockpile survey while material dries.
- AE (Jordan) also will be counting buckets and trucks during hauling.

Report:

7:40AM
- Setting up sand in creek at SRS E.
- Starting in-stream work. Keystone not present during the start of this operation.

9:00
- AE (Jordan, Vinizza) on site at SCR 15/16, discussion with Tina (Leq'a: mel)
- Tina stated she has not been contacted by any project in area of SCR 14/17. AE (Jordan) to follow up with QM on site 14/17.

9:45AM
- Arborists on site to clear trees in front of Doug's property.

10:00AM
- QM beginning to clear SRS G through L, starting at G.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

10:30AM

- Continuing to fill and place sandbags in creek.

11:40AM

- Aggregate load delivery.

12:20PM

- Leqa': mel (Tina) on site.
- Keystone (Kang) showing her through site. Tina observing plan and creek construction.
- No concerns from Leqa': mel at this time. QM to keep Tina in loop and provide construction schedule to her.
- Plan for Keystone to start fish salvage tonight when water diversion is ready.
- Electro fish tomorrow before excavation.

1:00PM

- AE (Jordan, Vinizza) measure cleared SRS today.
- G: 4x11m
- H: 6x8m
- I: 5x9m
- J: 5x11m
- K: 4x11m
- L: 1x9m

3:15PM

- Finishing up sandbag placement, starting fish salvage.

4:30PM

- Cleaning and leaving site.

Testing:

- None today.

Safety Concerns:

- None today.

Traffic Control:

- Single Lane closure on Dale road for arborists.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Photos:





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14&17
Environmental Monitoring Report

Date: August 30, 2024
Weather: Sun and Clear – 13°C in the morning and average of 28 °C throughout the day.

- Environmental Monitors (EMs) arrived on site at 7:20 AM.
- EMs conducted bird nest survey for stations L,K,J,I,H and G at 07:37. Bird nest or nesting activity was not observed at all stations.
- Bird calls and visual observation included:
    - Cedar Waxwing (*Bombycilla cedrorum*)
    - American Robin (*Turdus migratorius*)
    - Swaison's Thrush (*Catharus ustulatus)*
- 08:07 - EMs collected background (BG) Water Quality (WQ) prior to instream work.
    - 08:09 - BG at the bridge = 0.02 NTU
- 08:15 – Instream work commenced, and sandbags were used to isolate work area at Station E.
- 09:03 – WQ reading at Station F (Downstream from Station E) = 5.72 NTU.
- 09:45 – Grubbing work on the south side commenced under Keystone's EM supervision for invasive species.
- 10:30 – Leqamel First Nation was notified via phone by the EMs. Instream work stopped and sandbags were filled.
- 11:17 – Grubbing and prep work on the farm side for stations L,K,J,I,H and G was completed.
- ~11:30 – Leqamel's Guardian visited the Site. EMs and Site superintendent were attended and walked her through today's Site activities.
- 11:30 – Arborist cutting down the cotton wood tree in the adjacent property.
- 14:55 – Swift water and fast flow of redirected water was observed by EMs. Potential bank erosion issue was noticed and communicated to the Site Superintendent. Simple solution such as installing road plate along the south bank to mitigate erosion was also communicate to the crew.
- 15:20 – EMs conducted pole seining to clear all potential fishes within isolated area. Electrofishing was conducted shortly after.
- 16:37 – 521 second of electrofishing effort was completed. EMs did not capture any, but visual observation of fishes was noticed. 6 minnow traps were used to salvage the remaining fishes in the area.
- 17:43 – EM left site. End of workday.

Site Photos









Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	5
Project:	Legace Creek	**Page:**	1 of 5
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	August 22, 2024
Contract No.:		**Temperature:**	High: 29 Low: 12
Weather:	Sunny		

August 31, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Mel), 2 operator, 2 labourers
Keystone Environmental: EM (Loc) (Kang)

Contractor's Equipment:

-Equipment in Use

- CAT Excavator 324E
- Zaxis Excavator EX0689
- Deer Loader 1466

Report, if any, Contact with Occupants:

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

1:30PM

- Discussion with Keystone (Loc) – Turbidity after sandbag fell into creek was not ideal, went away quickly due to low flow. Still forced excavation to stop.

Discussions with Contractor:

7:00AM

- Toolbox talk (Mel) – Finish fish salvage today at SRS E.
- Start pump and excavate at E.
- Jim (QM) – wants to work 7 days a week Jordan (AE) – informed this is likely acceptable, confirm this with AE team.

11:15AM

- Discussion with QM (Mel, Jim) – Concern with volume they will be able to achieve from the stations.
- AE (Jordan) expressed it is a field fit project, what they can excavate is what they can excavate, but that is the quantity they will be getting paid for.
- Using the largest excavator arm they have.

2:00PM

- AE (Jordan) – discussing with QM (Mel, Jim) heat map excavation depths specified in drawings. Colour coordination is not station specific, depths are specified in colours on map.

2:30PM

- Discussion with QM (Mel) – no road plates planning to be used at C. Water is very low, placing bags today likely to start excavation tomorrow.
- Mel is going to worry about the take off for SRS E when it is time to haul.

4:40PM

- AE (Jordan) expressed concern to QM (Mel, Jim) regarding material from the sandbags in the water washing into the creek. Some of the flow passing over the submerged sand bags can see taking some material out of the sand bag.
- QM (Mel) wants to fill remaining sand bags with excavated material from site E.
- AE (Jordan) – expressed this will make tracking quantities very difficult, idea is to mark the bags with sand from SRS E with a ribbon.
- QM (Mel, Jim) – lost 4 sand bags (metre bags) in SRS E excavation. Will need to monitor this if any debris is going back into the water.
- AE (Jordan) – explained station C and C-2 share the same quantity on the drawings.

Report:

7:00AM

- AE (Jordan, Vinizza) on site.

8:00AM

- Excavating at SRS E.
- Fairly wet still – contractor doesn't think can get area any drier.
- AE watching for depths don't exceed specified on drawings.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

- Concern from AE (Jordan) on getting quantities for this location. Sand was excavated from the creek and placed in the lay down, no survey prior.
- Sand was spread around lay down after excavation.
- Having issues getting entire volume to do limited excavation arm.

11:00AM
- Flattening surface in lay down.
- Knotweed wrapped in poly sitting in water in area. AE (Jordan) pointed this out to EM (Loc).

11:30AM
- Sandbag in water diversion falls into excavation.
- EM stops excavation.
- Vinizza taking measurements after excavation – about 200m^3, estimated with tape measure.

1:00PM
- Removing sand bags from SRS E.

2:50PM
- Temporary access to Doug's property built.

3:50PM
- AE (Jordan) observation – sand bags losing some sediment into the creek due to flow passing over them.

Testing:
- None today.

Safety Concerns:
- None today.

Traffic Control:
- Single Lane closure on Dale road.

(If necessary, continue report on another sheet.)

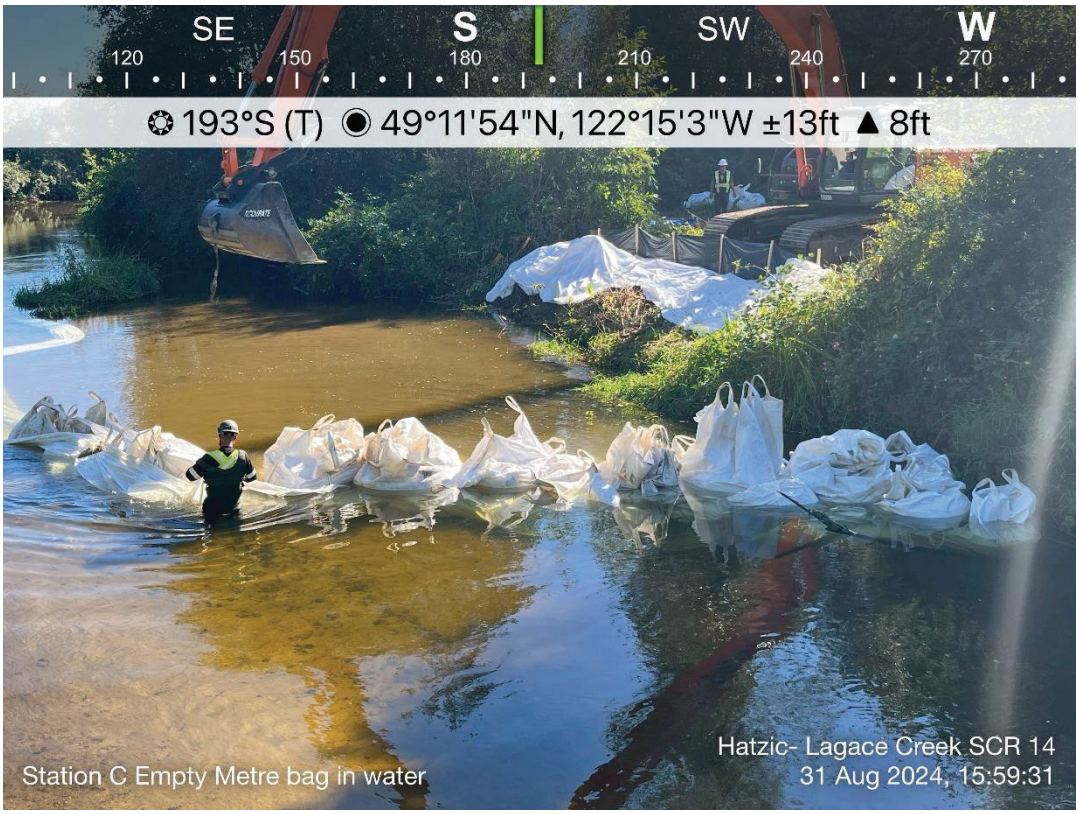
ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	5
Project:	Legace Creek	**Page:**	1 of 7
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	August 31, 2024
Contract No.:		**Temperature:**	High: 30 Low: 13
Weather:	Sunny, Wind 3 KM/H, Gusts 6 KM/H		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

QM:

QM: Site Superintendent (Mel), Operator (Glenn), 4 laborers
Keystone Environmental: EM (Loc & Khang)

Contractor's Equipment: - Equipment in use

- Excavator 324E
- Excavator EXO689
- Loader 1466

Report, if any, Contact with Occupants: ss

None Today.

Contact with Owner:

None Today.

Discussions with Keystone:

3:30 PM

- Conversation with Keystone: AE Vinizza inquired about the consequences of a sandbag fall-off or spill into the creek. Loc responded that it would be acceptable as long as the sand in the sandbags is from the creek.

4:10 PM

- Conversation with Keystone: AE Vinizza asked if fish salvage would occur today. Khang replied that it would not, as there was no isolated area available, station C is still on progress.

Discussions with Contractor:

7:05 AM

- Conversation with QM: Mel discussed the day's tasks, including fish salvage, pumping, and excavating the creeks.
- Jem mentioned that the contract prohibits work on Sundays and Mondays (Holiday). AE Jordan responded that he would contact Ryan for clarification.
- Jordan later confirmed that Ryan said it's okay to change in the work schedule, though a Request for Information (RFI) would be submitted.

4:15 PM

- Conversation with QM: Mel discussed the work plan for tomorrow, which includes filling sandbags with sediments excavated from the creek. AE emphasized the need to track and monitor this process closely to ensure that sediments do not fall back into the creek.

Report:

6:55 AM

- AE (Jordan and Vinizza) arrived on site.

7:00 AM

- Sign-in. Toolbox meeting with QM (Mel), Glenn (Excavator Operator), 1 Operator, and 3 Laborers.

7:20 AM

- AE (Jordan and Vinizza) left the site.

8:40 AM

- AE (Jordan and Vinizza) returned to the site.
- Keystone (Khang and Loc) on site already.
- Ongoing activities: Excavating and pumping the creek at Station E.

8:55 AM

- QM was dumping sediments in the vacant area near Station E. Fish were being caught with the sediments, and Keystone was present to collect them.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

9:05 AM
- Water continued to leak around the sandbags on the west side of the creek, causing some sandbags to fall or not be properly closed. QM worked on repairing the sandbags and silt fence.

9:17 AM
- Excavation of sediments continued at Station E.

10:40 AM
- While dumping sediments, clay soil was excavated on the west side of the creek near the sandbag position at Station E. QM halted excavation in that section.
- Water was still seeping around sandbags on the east side of the creek.

10:50 AM
- Approximately 200 m^3 (estimated) of sediments had been excavated.
- The south side of the creek was at an approximate depth of 2 meters, according to the scope of the excavator (as a reference length).

11:15 AM
- QM resumed excavation at Station E.

11:30 AM
- QM began spreading the sediment stockpile within the designated area.
- Knotweed, trimmed on August 29, 2024, for disposal, was found on the west side of the stockpile area.

12:25 PM
- QM removed sandbags from the creek at Station E to the dumping area (stockpile area).

12:35 PM
- QM transported sandbags to Station C.

12:45 PM
- At Station C (access road), 5 sandbags were hauled.

1:30 PM
- QM took a break.

2:14 PM
- At Station C (access road), 22 sandbags were hauled.
- Ongoing removal of sandbags from the creek at Station E.

2:40 PM
- QM completed the removal of all sandbags from the creek.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

2:45 PM
- QM began transferring sandbags to Station C.

2:55 PM
- Culvert and gravel were laid on the temporary access road outside Doug's property.
- Road plate (4 ft x 8 ft) was on site.

3:00 PM
- At Station C, QM began hauling sandbags back to the creek.

4:07 PM
- Excavator 324 E was mobilized to Station E.

4:40 PM
- QM crew left the site.

4:50 PM
- AE (Jordan and Vinizza) left the site.

Testing:
- Keystone conducted turbidity test.

Safety Concerns:
- None today.

Traffic Control:
- Two flagmen were present on site at Dale Bridge.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

Photos:





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos





Temporary access road outside Dough's property.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14&17
Environmental Monitoring Report

Date: August 31, 2024
Weather: Sunny and Clear, temperatures ranging from 13°C in the morning to an average of 28°C throughout the day.

- Environmental Monitors (EMs) Khang Diep and Loc Ngo (KD & LN) arrived on site at 7:20 AM.
- 07:30 - EMs retrieved minnow traps set the previous night and conducted background water quality tests.
- 08:00 - Fish caught were assessed and released. Results as follows:
    - Chinook salmon (*Oncorhynchus tshawytscha*): 1
    - Prickly sculpin (*Cottus asper*): 6
    - Signal crayfish (*Pacifastacus leniusculus*): 1
    - Three-spined stickleback (*Gasterosteus aculeatus*): 2
- 08:11 - 3-inch pump was set up for dewatering. Spill tray was observed underneath. The intake was field-fitted with a minnow trap to meet DFO end-of-pipe specifications. Discharge was placed in vegetated area for infiltration, flow naturally returned to the stream.
- 08:15 - Sediment removal work at Station E commenced. Long reach excavator removed sediment and side-cast in vicinity. Silt fence at downstream functioned as intended. Turbidity issue was localized/contained within isolated area.
- Turbidity test was taken 25 m downstream of isolated area, no exceedance or elevated levels observed.
- Water quality was sampled every hour during instream work or when instream work begins. Water quality data were summarized in table below.
- Silt fencing deficiencies occurred due to back-water pressure created by the bucket.
- One EM situated downstream to monitor turbidity and fish within work zone. The other EM salvaged fish from side-cast stockpile. Fish observed were salvaged. Results:
    - Pacific lamprey (*Entosphenus tridentatus*): 4
- 11:00 - Work stopped to assess quantity of removed material.
- 11:30 - Work resumed.
- 11:47 - Started grubbing and prep work for culvert installation on Dale Road. Ditch currently dry, roadbase was used to create access to property where Stations A and B are located.
- 11:51 - Station E - Sandbags failed and collapsed into excavation pit, creating a breach that flushed turbid water downstream, pushing silt fencing downstream. Turbidity downstream elevated to 31.5 NTU. The issue was communicated immediately to the Superintendent and work was stopped promptly to assess the situation. EMs recommended allowing turbid water to settle, then slowly removing isolation at downstream end to allow clean water to settle turbidity.
- Mitigation strategy: Maintain at least 1 m buffer zone between excavation and sandbags. Use silt curtain to contain turbidity.
- 12:19 - Started removing isolation downstream.
- 12:40 - Turbidity downstream returned to within guidelines. No impact observed during sandbag removal work.
- 14:00 - Sandbags removed from the stream.
- 14:00 - 15:00 - QM had project meeting.
- 15:05 - Sandbags relocated from Station E to C to prepare for isolation work at C.

- 16:45 - Work completed for the day. Sandbag isolation halfway done, contractor to resume work the following day. Fish salvage not conducted due to site not being isolated.
- 17:15 - EMs departed from site.

Location	Time	Turbidity (NTU)	Status
Background (bridge)	7:39	3.50	Compliant
25 DS from E	8:33	1.99	Compliant
	9:00	5.93	Compliant
	10:04	3.57	Compliant
	10:57	9.08	Compliant
Background (bridge)	11:37	4.28	Compliant
~30 m DS from E	11:54	**31.5**	Non-compliant
	12:40	4.13	Compliant
Background (bridge)	15:12	4.05	Compliant
Station D	15:23	5.29	Compliant
Station D	16:21	4.86	Compliant

Table 1. Water Quality Data

Site Photos






August 31, 2024 11:51 a.m.




August 31, 2024 4:37 p.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	6
Project:	Legace Creek	**Page:**	1 of 6
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 1, 2024
Contract No.:		**Temperature:**	High: 29 Low: 12
Weather:	Sunny		

September 1, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Mel), 2 operator, 2 labourers
Keystone Environmental: EM (Loc) (Kang)

Contractor's Equipment:

-Equipment in Use

- CAT Excavator 324E
- Zaxis Excavator EX0689
- Deer Loader 1466

Report, if any, Contact with Occupants:

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

12:15PM

- Discussion with Keystone (Loc) – turbidity is getting higher D/S from excavation, Loc expressed concern to QM and said if numbers get to high he will shut down the operation.
- Keystone catching fish in top of stockpile during excavation.

Discussions with Contractor:

7:00AM

- Toolbox talk (Mel) – Excavating at SRS C today.
- AE (Jordan, Vinizza) – informed QM (Jim) to remove the vegetated island in the middle of the creek on the edge of the excavation arm limit.

10:15AM

- AE (Jordan) directing QM (Mel) to proposed SRS drawing. Mel unsure how to construct SRS C-2 due to large vegetaion in front of area. AE (Jordan) referred him to slope and elevation above bottom of creek, give him idea where the station should end up.

10:45AM

- Discussion with QM (Jim) – Wants to excavate in the wet today, is not going to pump. OK with this if keystones EM are.
- Jim stated the EM's told him because they are out of the fish window it is ok, they will be monitoring turbidity D/S.

11:00

- AE (Jordan) discussion with QM operator – Make sure not to go past the 2.7m excavation limit shown on drawings. Difficult to tell how deep he is because they didn't dewater.
- Bucket about 6.5 ft.
- AE (Jordan) and QM (Jim, operator) – measured bucket height with tape, considering about 2ft water depth, made a reference point on excavator arm not to excavate deeper than to stay above that maximum depth.

11:15AM

- Discussion with QM (Jim) – AE (Jordan) expressed concern there is no tracking to determine if we are going to hit the volume goal for SRS C. Material is being excavated and immediately hauled to laydown at SRS E.
- Jordan asked Jim to survey O.G. for areas they are going to excavate and place, and then survey the stockpile after.
- Jim – maybe Tuesday they will have surveyor out.

11:30

- AE (Jordan) discussion with QM (Mel, Jim) – Jordan expressed concern with mixing quantities from different stations, we still want to get close to the volumes at each station specified on the drawings. Not going to be able to track this for SRS E and C other than with photos.
- Mel looking at big picture quantity, aiming to get 8000m3 total out of project. Going to aim for depths at each station and excavate as much as we can without bringing up clay or peat.
- Jordan to monitor stock piles closely to ensure now clay is being included.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

1:00PM

- Discussion with QM (Mel) – operation getting close to bank slope. Want to keep 1.5m depth near excavation. Operator made aware.

Report:

9:10AM

- Sand bags placed in water

10:00AM

- Keystone electro fishing

10:15AM

- Filling sand bags with excavated material from SRS E.
- Vinizza tracking quantities of sand bags filled.
- At end of day 55 total metre bags full with excavated material. % full of bags recorded by Vinizza.
- Each bag about 1 excavator bucket.

11:30AM

- Moving excavated sediment from SRS C to SRS E lay down. Quantities excavated from both SRS are now mixed, some quantities are in sand bags. Unsure how we are going to keep track/hit the volumes at each station.

12:40PM

- Clay in excavation being taken out.

1:10PM

- Excavation complete, got most of material from dammed off section, slope got slightly steep in front of SRS.

3:00PM

- Filling sand bags with excavation from SRS C. Vinizza keeping track off filled sand bags.
- AE flagged metre bags filled with excavated material with ribbons. All 55 bags have ribbons.
- Total sand bags with excavated material from both SRS E and C = 55 bags.
- Hauling bags to SRS L.

Testing:

- None today.

Safety Concerns:

- None today.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Traffic Control:

- None today.

Photos:



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	6
Project:	Legace Creek	**Page:**	1 of 7
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 1, 2024
Contract No.:		**Temperature:**	High: 29 Low: 14
Weather:	Sunny, Wind 3 KM/H, Gusts 6 KM/H		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

QM:

QM: Site Superintendent (Mel & Jem), Operator (Glenn & Sandy), 2 laborers (Dallas and Patrick)
Keystone Environmental: EM (Loc & Khang)

Contractor's Equipment: - Equipment in use

- Excavator 324E
- Excavator EXO689
- Loader 1466

Report, if any, Contact with Occupants: ss

None Today.

S

Contact with Owner:

None Today.

Discussions with Keystone:

9: 55 AM

- Khang mentioned they need second pass at Station C.

Discussions with Contractor:

7:00 AM
- Mel outlined today's tasks: continue moving sandbags to the creek, conduct fish salvage, pump water out of the creek, and begin excavation.
- Mel also mentioned a cable connected to the well of Dough's house.

10:15 AM
- Jem stated they would start working on another section of the creek from Station L and haul sandbags while awaiting the RFI for Station D & Station F.

Report:

6:50 AM
- AE (Jordan & Vinizza) arrived on site.

7:00 AM
- Toolbox meeting with Mel, Jem, Sandy, and Dallas.

7:15 AM
- QM mobilizing loader equipment to Station E.
- Dallas began preparing the polyethylene sheet at Station C.

7:25 AM
- Keystone (Loc & Khang) arrived on site.

7:30 AM
- At Station C:
  - Dallas started setting up the polyethylene sheet in the creek.
  - Sandbags were being moved to the creek.
- At Station E:
  - Equipment and materials were being prepared and set up for filling sandbags.

7:40 AM
- At Station E, began filling up the sandbags.

8:00 AM
- Backhoe operator (Glenn) disposed of the previous sandbag (approximately 10% full) from August 28 into the excavated material dump area.

9:10 AM

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

- Completed filling and hauling sandbags from Station E to Station C (beside the access road). A total of 33 bags were filled and moved: 6 bags were piled on the access road, and 27 bags were placed in the creek.
- Finished setting up sandbags, the polyethylene sheet, and the silt fence at Station C.

9:20 AM
- Keystone (Loc & Khang) began electrofishing at Station C.

9:30 AM
- At Station E, stockpiling of excavated materials commenced.

9:55 AM
- Keystone (Loc & Khang) completed the first pass of electrofishing at Station C.

10:00 AM
- At Station E, began filling up small sandbags. 2 bags were filled.

10:25 AM
- At Station E, began filling another set of sandbags and placing them along the road from Station E to Station D.

11:14 AM
- At Station E, completed filling 22 sandbags.

1:10 PM
- Ongoing hauling of excavated material from Station C to the Station E piling/dumping area.

2:00 PM
- QM took a break.

2:10 PM
- QM returned to work.

2:40 PM
- At Station C, began moving sandbags from the creek to thes access road beside Station C.

3:45 PM
- While removing sandbags from the creek, it was noted that bags were not being segregated (old vs. new), making it difficult to identify them as some bags were unmarked.

4:15 PM
- Identified and flagged 23 sandbags (filled earlier in the day from the excavated area) with pink ribbons at Station C based on their bag's texture.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

4:30 PM

- At Station L, flagged 10 sandbags (filled earlier in the day from the excavated area).
- In total, 55 sandbags were filled today.

4:45 PM

- QM crew left the site.

5:00S PM

- AE left the site.

Testing:

- Keystone conducted turbidity test.

Safety Concerns:

- Needs traffic control along the Dale Road especially near the bridge when the loader going back & forth in hauling the sandbags.

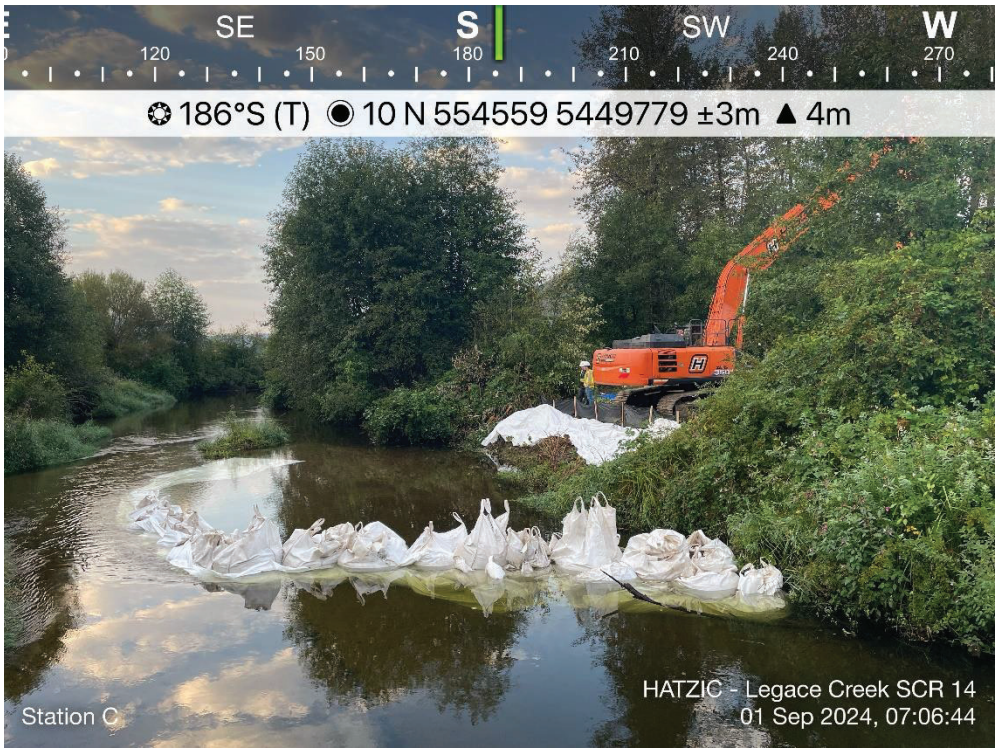
Traffic Control:

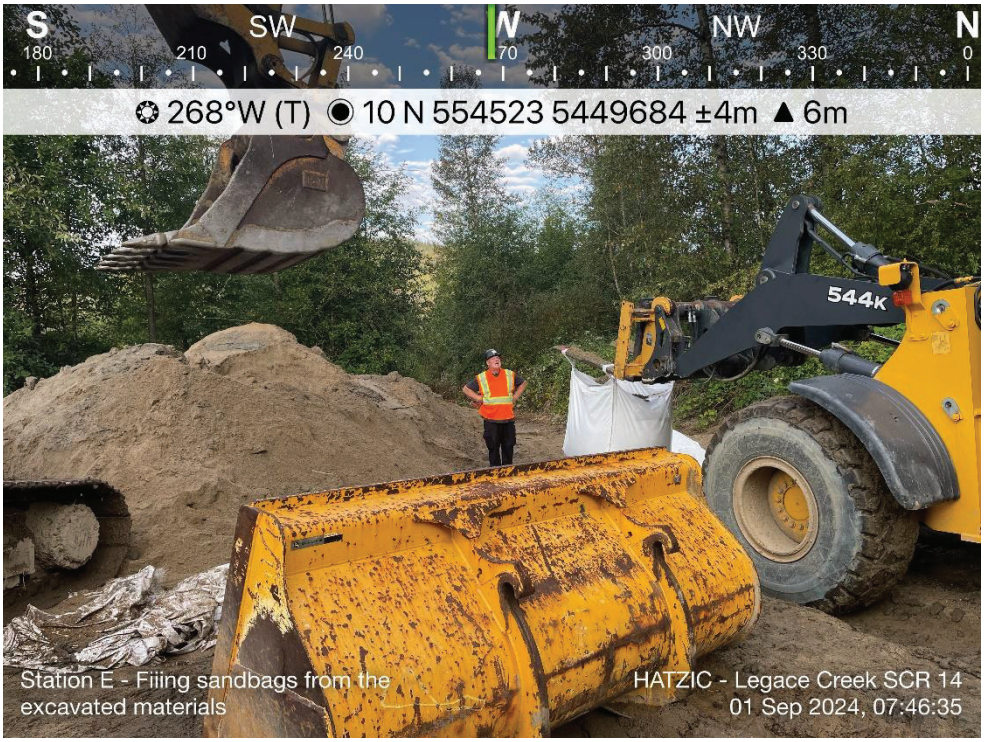
- None today.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

Photos:





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

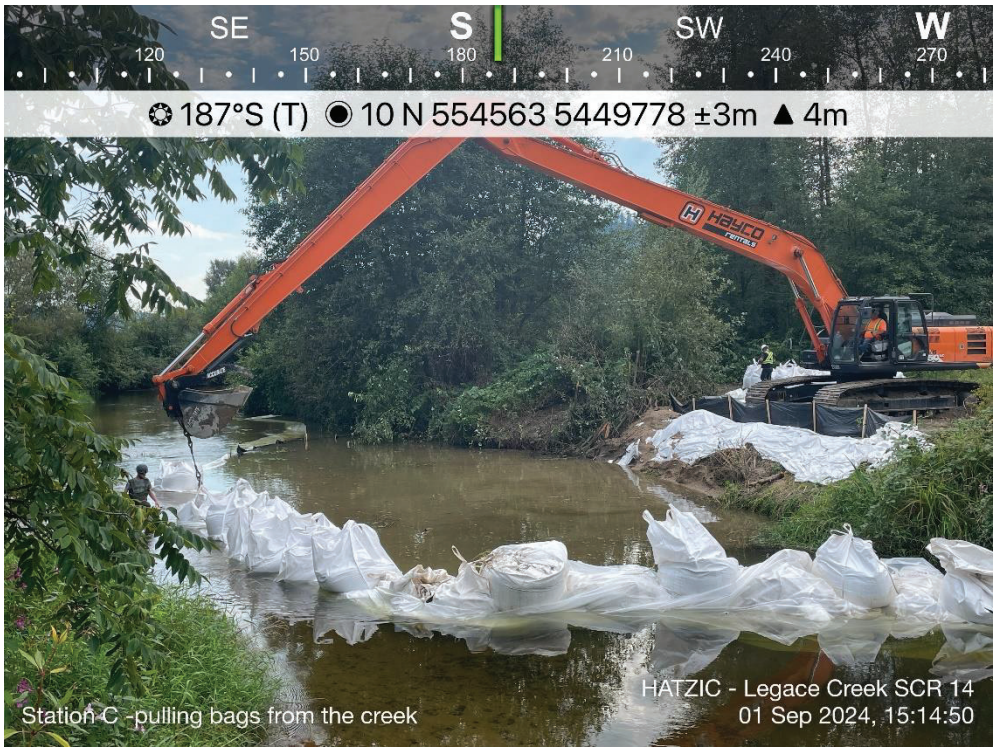


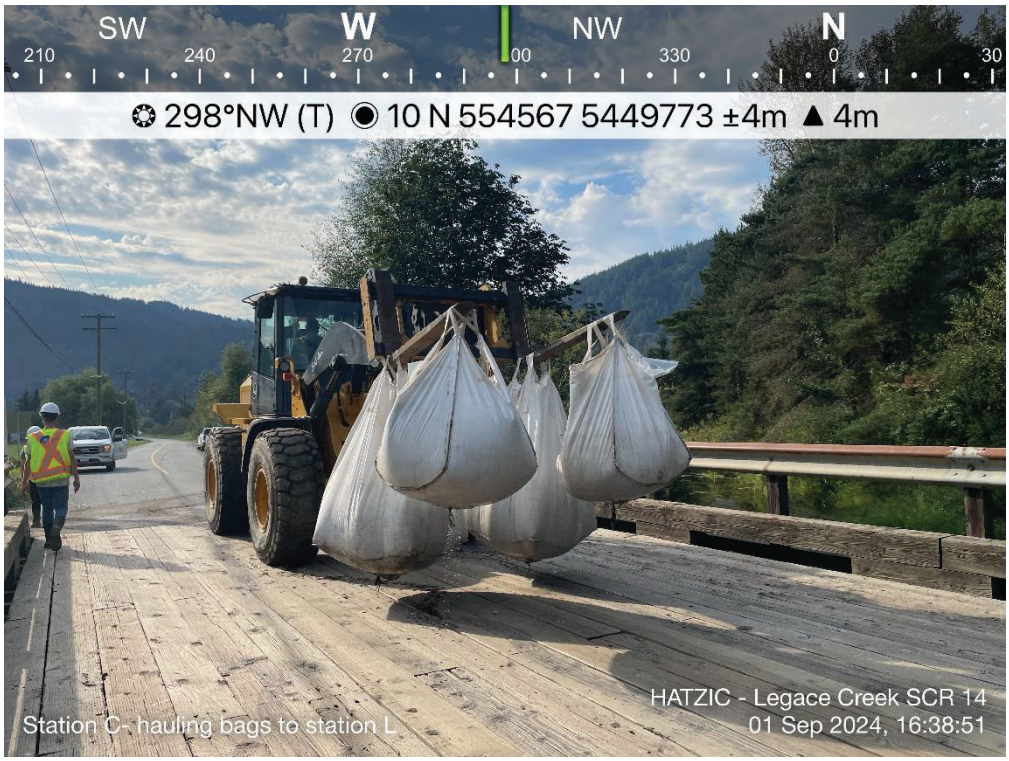
Keystone – ongoing electrofishing at Station C



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14&17
Environmental Monitoring Report

Date: September 1, 2024
Weather: Temperatures ranging from 15°C in the morning to a high of 29°C throughout the day.

- Environmental Monitors (EMs) arrived on site at 7:20 AM.
- 07:30 - EMs collected background water quality samples.
- 07:32 - Sandbags dam isolation work at Station C continued from what was left off the previous day.
- 07:45 - EM collected water quality sample downstream (DS) from active work area, at Station D, and the result was compliant. Water quality data will be summarized in table below.
- Sandbag placement is considered low-risk activity; erosion and turbidity-related issues were not observed.
- 09:15 - Isolation work completed.
- 09:16 - EMs conducted fish salvage using electrofisher.
- Water temperature: 18.2°C
- First pass: 663 seconds - Results:
    - 7 prickly sculpins (Cottus asper)
    - 2 Pacific lamprey (Entosphenus tridentatus)
    - 1 three-spined stickleback (Gasterosteus aculeatus)
- Second pass: 664 seconds (1327 - 663 seconds) - Results:
    - 2 prickly sculpins
- 10:40 - Electrofishing completed as reasonable effort was put in - second pass has significantly fewer fish.
- 10:42 - Sediment removal work commenced
- Isolation worked as intended, turbidity was contained within the sandbags dam
- One EM monitored at the downstream while the other stayed on the bank with the machine to salvage fish in the sediment stockpile.
- Fish salvage results from side casting material:
    - 14 Pacific lamprey
    - 1 sculpin
- 11:15 - The EMs continued to monitor and observe for fish, but none was observed as the excavating depth extended beyond the typical fish habitation zone.
- 11:32 - EM observed turbid water started flowing downstream. Site superintendent was immediately notified. EMs recommended the contractor reinforce DS isolation area to maintain compliance.
- Silt fencing was used to keep turbidity within active work zone.
- 12:18 - Sediment plume was observed outside of isolation area; however, the plume was localized. Turbidity at 30 m downstream remained compliant.
- 13:20 - Sediment removal completed. The contractor began relocating the stockpile of sediment from this current Station to Station E using a loader.
- 14:37 - Sediment work completed.
- 14:50 - The contractor started to remove sandbags dams. The EMs continued to monitor turbidity plume and water quality.
- Isolation was removed at the downstream end first to avoid sudden burst of sediment-laden water into fish habitat.

- Turbidity plumes were observed but dissipated quickly. Water quality remained compliant.
- 15:43 - Water quality at the downstream end (Station E) was 17 NTU, 8 units above the background. The issue was notified to site superintendent. It's important to note that the elevated turbidity level was not caused by the sandbag removal itself, but rather by the previously contained turbid water now being released from the work zone as isolation was removed.
- Mitigation strategy was discussed: silt curtains should be used, or sandbags removal should be postponed overnight to allow sediment to settle.
- 15:53 - Water quality turbidity level returned to acceptable range compared to the background.
- 16:25 - Last sandbag was removed. Instream works completed. Concurrently, the sandbags removed from the stream were being transported to Station I by a loader.
- 16:50 - Work completed for the day
- 17:15 - The EMs departed from site after debriefing work activities with KEL PM.

Site Photos




September 01, 2024 10:58 a.m.


September 01, 2024 3:39 p.m.


September 01, 2024 10:42 a.m.


September 01, 2024 4:41 p.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	7
Project:	Legace Creek	**Page:**	1 of
Location:	Farms – Seux Roads, Fraser Valley, BC 49°13'00" N, 122°14"36" W	**Project No.:**	S-CR-215/16 2022-2632-04
Contractor:	Milestone Delta Aggregates JV	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 2, 2024
Contract No.:		**Temperature:**	High: - Low: -
Weather:	Overcast		

September 2, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Mel), Jim, 2 operator, 2 labourers
Keystone Environmental: EM (Jeff) (Kang)

Contractor's Equipment:

-Equipment in Use

- CAT Excavator 324E
- Zaxis Excavator EX0689
- Deer Loader 1466

Report, if any, Contact with Occupants:

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

12:30PM

- Discussion with Keystone PM (Jeff) –
- Herbicide injection into knotweed not practical for scenario.
- Need plant to be growing in order to treat it with herbicide. Cutting and injecting won't rid it.

- Too close to creek to excavate. Happy with cutting and covering with geotextile.
- 3 year maintenance period window is where knotweed should be injected with herbicide.
- Said he would give AE some sort of formal reply to addendum 1, question 2.

2:45PM
- Discussion Keystone (Kang) – Keystone directed QM to place excavated clay on embankments of river.

Discussions with Contractor:

7:00AM
- Toolbox talk QM (Mel) – Moving sand bags and focusing on SRS L today.
- AE (Jordan) asked to leave a little more material on the slope compared to SRS C.
- AE (Jordan) – Asked QM to provide road signs on Dale road. Mel – signs will be here Tuesday Sep 3.
- Another crew will here for Tuesday Sep 4.
- Another loader + operator will be here Wednesday Sep 4.
- Mel planning to fill some small sand bags with excavated material from SRS E laydown.

11:50AM
- Discussion with QM (Jim) – SRS L has higher water level than expected.
- 3 metre bags stacked high for water diversion.
- Not going to pump from this station – Keystone OK with this, will be monitoring turbidity.

2:45PM
- Discussion with QM (Jim) – wants to go back in at SRS L, didn't get enough material.
- Is going to poke bucket around and see if any sand comes up, or if it is all clay.
- Will likely put forward a claim, due to amount of time it took to setup at SRS L and the amount of material they excavated compared to the project 400m^3 on drawings.

Report:

7:20AM
- Moving Zaxis excavator to SRS L.

11:45AM
- Keystone Electo Fishing SRS L.

12:00PM
- Clearing area next to SRS L for stockpile.
- Jim got approval from land owner.

12:50PM
- Start excavating at SRS L.
- 2.5ft of water depth.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

- Operator aiming for same mark on excavator arm about 3m high. – 2.5ft of water + 2m max excavation.

1:10PM
- Excavator rolling back and forth along embankment instead of parking on lock blocks to extend excavators reach.
- AE (Jordan) – expressed concern to QM (Jim, operator), lock blocks are in place to be parked on, don't want embankment fail.

1:45PM
- Excavation complete, about 100m^3 of sediment removed and stockpiled next to SRS L.
- Excavating clay, not getting anymore sediment anywhere.

2:30PM
- Cleaning access at SRS C to E.
- Scooping into bucket and adding to stockpile at SRS E, some dirty material adding to stockpile.

2:40PM
- Filling metre bags with excavated material at SRS E stockpile.
- Running total of excavated material sand bags: 57.

3:45PM
- Clearing trees at K.
- Keystone measuring turbidity at SRS L, will remove sand bags tomorrow.

Additional notes:
- Removing sand bags from SRS L after 'testing for clay' delayed when they could remove the sand bags, increased turbidity and keystone advised too high to remove sand bags.
- Not dewatering with pumps increased opportunity for turbidity.

Testing:
- None today.

Safety Concerns:
- None today.

Traffic Control:
- None today.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Photos:





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	7
Project:	Legace Creek	**Page:**	1 of 8
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 2, 2024
Contract No.:		**Temperature:**	High: 23 Low: 15
Weather:	Sunny, Wind 7 KM/H, Gusts 17 KM/H		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

QM:

QM: Site Superintendent (Mel & Jem), Operator (Glenn & Sandy), laborers (Dallas, Patrick, Damian)
Keystone Environmental: EM (Loc & their Project Manager)

Contractor's Equipment: - Equipment in use

- Excavator 324E
- Excavator EXO689
- Loader 1466

Report, if any, Contact with Occupants:

None Today.

Contact with Owner:

None Today.

Discussions with Keystone:

9:30 AM

- Loc noted that once QM completes piling the isolated area, fish salvage will be conducted.

10:40 AM
- Keystone mentioned that they would not allow simultaneous excavation (2 excavator).

Discussions with Contractor:

7:05 AM
- Mel emphasized today's tasks at Station L, including hauling sandbags from Station C to Station L, piling sandbags by the creek, pumping, fish salvage, and excavation.

10:20 AM
- Conversation with loader operator (Glenn):
  - AE Vinizza inquired about additional sandbags needed at Station L. Glenn reported that 10 more bags are required.

11:40 AM
- Mel mentioned that additional equipment and crew will be added on Wednesday.

Report:

6:55 AM
- AE team (Jordan, Vinizza, and Duncan) arrived on site.

7:05 AM
- Toolbox meeting with Mel, Jem, Dallas, Sandy, and Damian (new laborer).
- AE Jordan highlighted the need for traffic control due to the frequent movement of equipment between sections of the creek.

7:20 AM
- Mobilizing excavator EXO689 from Station C to Station L.
- Keystone team (Loc and PM) arrived on site.

7:22 AM
- Mel mentioned to fill up the small sandbags today.

7:43 AM
- AE inspected the sandbags excavated from the creek yesterday: 12 bags at Station L and 21 bags at Station C.
- Excavator EXO689 arrived at Station L.

8:02 AM
- At Station L: Began moving sandbags closer to the lock block and creek.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

8:05 AM
- Commenced hauling sandbags from Station C to Station L using a loader.

9:05 AM
- Ongoing moving sandbags to the creek; half of the area is now piled with sandbags.

9:25 AM
- Keystone conducted a turbidity test at Station L.

9:55 AM
- Farmer visited the site at Station L without complete PPEs.

10:10 AM
- Station C: One bag left.

10:45 AM
- Started hauling sandbags from Station E to Station L.

11:10 AM
- Keystone conducted another turbidity test at Station L.

11:20 AM
- Completed piling and setting up the sandbags around the creek at Station L.

11:30 AM
- Keystone conducted fish salvage.

12:45 PM
- There are no more sandbags available at Station E. Twenty-two bags have been hauled to Station L.

.

1:00 PM
- Began excavation at Station L.
- No pumping of water happens.

1:15 PM
- AE (Vinizza & Duncan) left the site 14 & proceed to Site 15 for fish net cleaning.

3:40 PM
- AE (Vinizza & Duncan) returned to the site.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

3:55 PM

- AE Jordan stated that additional 2 bags were being filled up, in total of 57 bags from excavated area on site.
- QM crew left the site.

4:10 PM

- AE (Jordan) started flying the drone.

4:35 PM

- AE (Jordan, Vinizza & Duncan) left the site 14 & proceed to Site 15 for continuing the fish net cleaning.

Testing:

- Keystone conducted turbidity test.

Safety Concerns:

- Needs traffic control along the Dale Road especially near the bridge when the loader going back & forth in hauling the sandbags.

Traffic Control:

- None today.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

Photos:





(If necessary, continue report on another sheet.)

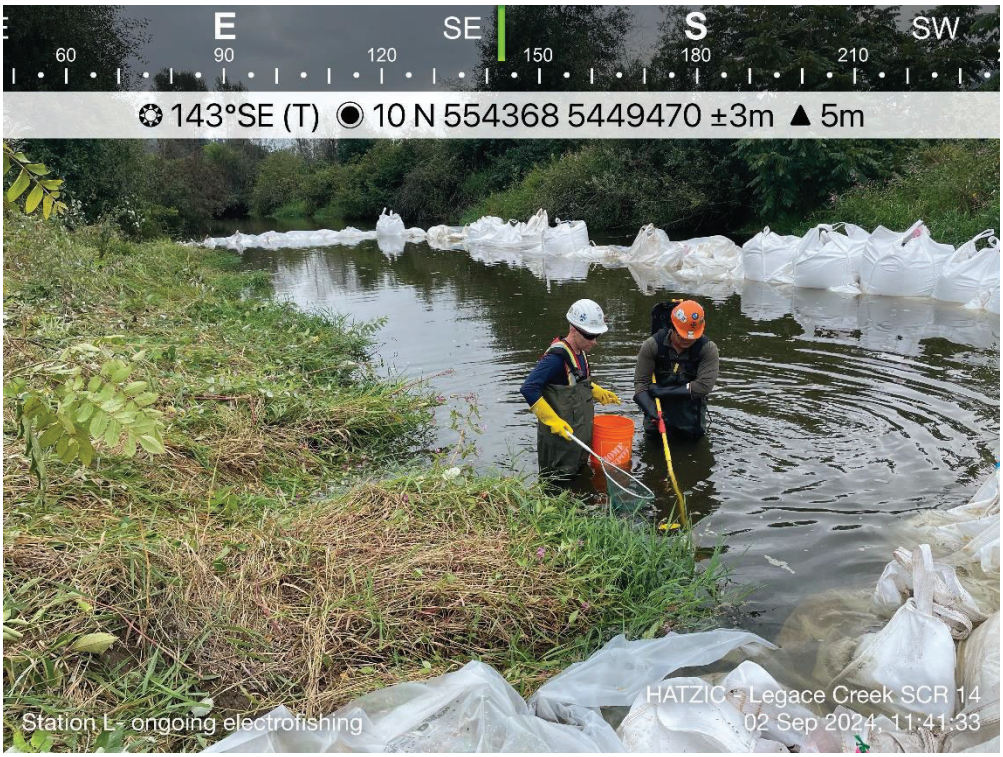
ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos



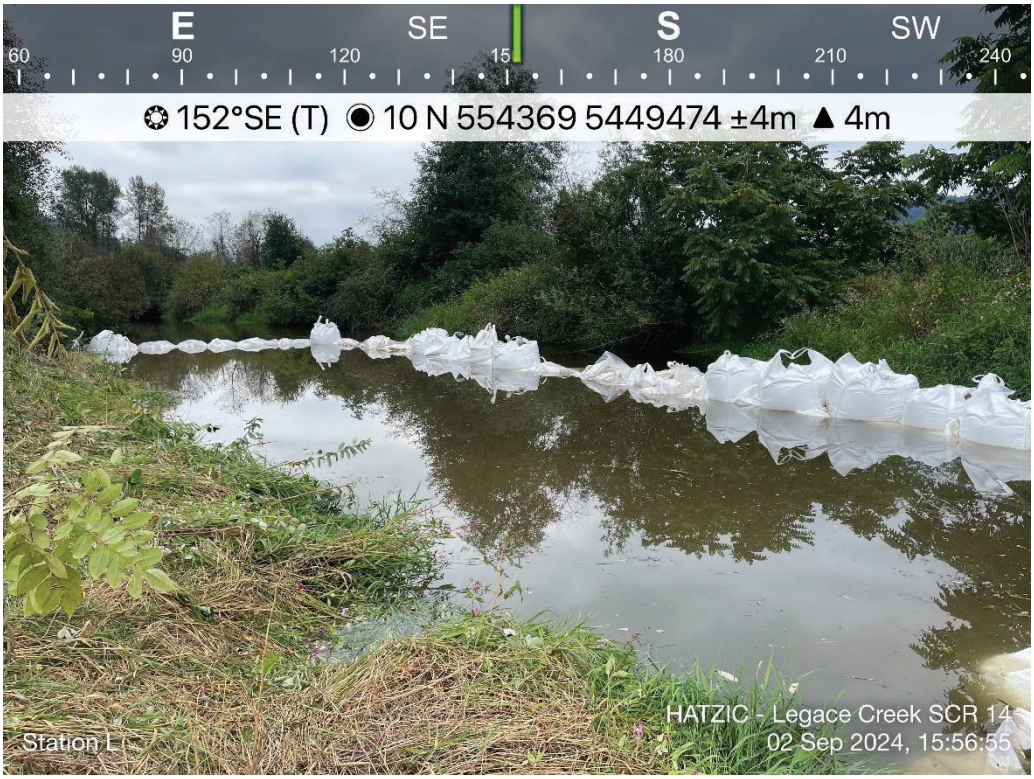


(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos



Excavated material from the creek of Station L.



Station L – after excavation.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: September 2, 2024
Weather: Temperatures ranging from 16°C in the morning to a high of 22°C throughout the day.

- Environmental Monitors (EMs) arrived on site at 7:15 AM.
- 07:28 - EMs collected background water quality samples.
- 08:00 - Sandbags dam isolation work at Station L commenced.
- EM collected water quality sample ~25m downstream (DS) from active work area (Station L) hourly. Water Quality data was compliant throughout the day.
    - Sandbag placement is considered low-risk activity; erosion and turbidity-related issues were not observed.
- 11:40 - Isolation work completed.
- 11:45 - EMs conducted fish salvage using electrofisher.
    - Water temperature: 16.5°C
    - First pass: 434 seconds - Results:
        - 1 prickly sculpin *(Cottus asper)*
    - Second pass: 218 seconds - Results:
        - 2 prickly sculpins
- 12:45 - Electrofishing completed as reasonable effort was put in and increase in number of fish was not observed.
- 12:50 - Sediment removal work commenced
- Isolation worked as intended, turbidity was contained within the sandbags dam
- One EM monitored at the downstream while the other actively salvage aquatic species in the sediment stockpile.
- Results from side casting material:
    - 19 Pacific lampreys
- Sediment plume was observed outside of isolation area; however, the plume was localized, and the crew was notified. The gap was reinforced immediately. Turbidity at 25m downstream remained compliant.
- 13:52 - Sediment removal completed.
- Sandbags dams remained intact to allow the sediment in the work area to settle down prior to dam removal to ensure turbidity stay compliant.
- 14:51 – EM collected sample from the work area à high turbidity reading when compared to the background.
- 15:45 - Work completed for the day. Sandbag dam will be removed on September 03, 2024, prior to work commence once the turbidity level in the isolated work area returns to normal.
- 16:15 - The EMs departed from site after debriefing work activities with KEL PM.

Site Photos






September 02, 2024 1:32 p.m.


September 02, 2024 1:03 p.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	8
Project:	Legace Creek	**Page:**	1 of
Location:	Farms – Seux Roads, Fraser Valley, BC 49°13'00" N, 122°14"36" W	**Project No.:**	S-CR-215/16 2022-2632-04
Contractor:	Milestone Delta Aggregates JV	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 3, 2024
Contract No.:		**Temperature:**	High: 23 Low: 12
Weather:	Overcast		

September 3, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Mel), Jim, 2 operator, 4 labourers
Keystone Environmental: EM (Jeff) (Kang)
Tree fallers: 3

Contractor's Equipment:

-Equipment in Use

- CAT Excavator 324E
- Zaxis Excavator EX0689
- Deer Loader 1466

Report, if any, Contact with Occupants:

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

Discussions with Contractor:

11:00AM

- Discussion with QM (Jim) – Push pack on meeting today about dewatering isolation areas.
- Will put 3" pumps in isolation area.
- Wants equalization on sand bags from water on inside of isolation area.
- Keystone (Kang) – doesn't think dewatering is necessary for environmental POV.

2:30PM

- Discussion QM (Mel), AE (Jordan, Ryan, Vinizza, Cynthia) – water levels will come down due to water release at Hatzic lake.

3:20PM

- Discussion with QM (Jim) – wants to start excavation today, will be working till 6:30pm, wants to start at 6:30am tomorrow.
- AE (Jordan) said to communicate this with AE (Vinizza) as I will not be on site tomorrow.

Report:

8:00AM

- Tree falling at SRS B3.
- Hauling material for access road today.
- Pulling bags out of SRS L.

9:25AM

- Lost sandbag while removing sand bags from SRS L.
- New running total 56?
- Placed this bag after but it was half full, keep running count at 57.

10:30AM

- Placing bags at SRS K

2:30PM

- Setting up 2 -3" dewatering pumps in SRS K.
- Silt curtain installed 15m D/S.

3:30PM

- Filling sand bags at SRS E laydown
- Filled 32 metre bags today.
- New running total 57+32 = 89.

4:00PM

- AE (Ryan) informed field crew no excavation is to take place until adequate pumps are in the water. QM is aware of this.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Testing:

- None today.

Safety Concerns:

- None today.

Traffic Control:

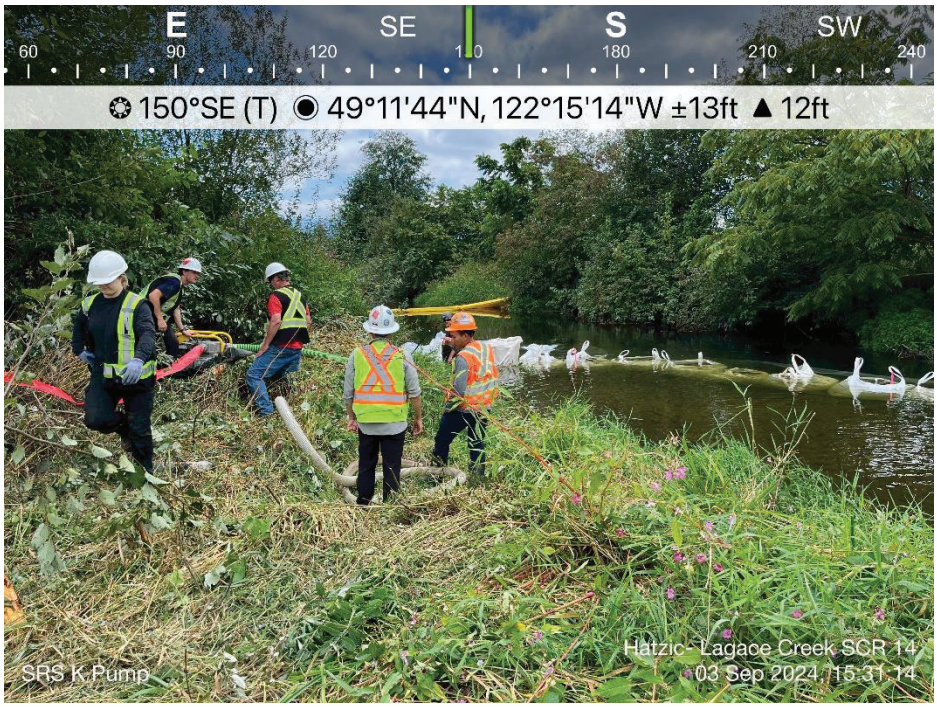
- None today.

Photos:



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	8
Project:	Legace Creek	**Page:**	1 of 8
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 3, 2024
Contract No.:		**Temperature:**	High: 22 Low: 15
Weather:	Sunny, Wind 8 KM/H, Gusts 17 KM/H		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

QM:

QM: Site Superintendent (Mel & Jem), Operator (Glenn & Sandy), laborers (Dallas, Patrick) + 3 new laborers
Keystone Environmental: EM (Khang and John)

Contractor's Equipment: - Equipment in use

- Excavator 324Es
- Excavator EXO689
- Loader 1466

Report, if any, Contact with Occupants:

None Today.

Contact with Owner:

None Today.

Discussions with Keystone:

7:48 am

- Conversation with Keystone (Khang):
  - He mentioned that mixing excavated materials from different stations might cause issues if they have different soil test results.

- Test results will be available tonight, and he will contact the laboratory today.

Discussions with Contractor:

7:00 am
- Sign In. Toolbox talk with Mel, Jem, Glenn, Sandy, and Dallas.
- AE (Vinizza) asked for their work to be completed today. Mel stated dismantling Station L and continuing with Station K.

11:00 am
- Glenn mentioned that they will fill more bags.

3:10 pm
- Conversation with Jem:
  - AE Vinizza inquired if they plan to excavate today. Jem responded that they will, as there is still time. Khang also mentioned they can perform fish salvage for an estimated 1 hour.

Report:

6:55 am
- AE Vinizza arrived on site.

7:02 am
- Keystone (Khang and John) arrived on site.

7:10 am
- Three additional QM laborers arrived on site.

7:30 am
- Keystone (Khang) began flagging the knotweed at Station H.
- Ongoing removal of sandbags from the creek at Station L, starting from the east side.
- Ongoing transfer of sandbags from Station L to Station K beside the access road.

8:10 am
- Approximately 50% of the sandbags in the creek at Station L have been pulled up.

8:27 am
- Approximately 80% of the sandbags in the creek at Station L have been pulled up.

9:15 am
- Keystone conducted a turbidity test at Station L.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

9:19 am
- AE (Ryan, Jordan, Duncan) arrived on site.
- Ryan emphasized the importance of documenting all site updates, especially regarding dewatering, and using the correct size of pump.

9:25 am
- One bag fell off (old, unmarked bag) leaving 10% of the sediments inside.

9:30 am
- Two additional bags fell off (marked and unmarked).

9:32 am
- Removal of bags from the creek at Station L completed.
- AE checked the bags that fell off: 4 bags total—1 marked, 2 old bags half full, and 1 almost empty.
- QM crew on a break.

10:00 am
- Back to work.
- Stations J & K: QM ongoing clearing.

10:30 am
- AE (Vinizza) left the site.

10:55 am
- AE (Vinizza) returned to the site.
- AE (Jordan & Duncan) already on site.

11:00 am
- At Station K: Ongoing moving of sandbags to the creek.
- Ongoing setup of sandbags and poly sheet.

11:35 am
- Two new laborers setting up the silt fence around the excavated materials at Station L.

12:00 pm
- Ongoing setup of sandbags and poly sheet at Station K (70% completed). Water is still coming in from the west side of the isolated area.

12:17 pm
- QM lunch break.

12:50 pm
- At Station E: Ongoing filling of bags (Glenn & Pat). AE Vinizza flagged filled bags.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

1:20 pm
- Work resumed at Station K.

1:34 pm
- Ongoing transfer of 4 bags that fell off; 1 is an empty bag, and 3 bags are piled up.

1:50 pm
- Preparation for setting up the turbidity curtain.

2:07 pm
- Ongoing setup of the 3" water pump.

2:45 pm
- Conversation with Ryan and Mel:
  - Dewatering from 15/16 to be documented in writing.
  - Mel discussed having a 3" water pipe and 6 hoses.

2:55 pm
- At Station K: Piling sandbags in the space where water is still coming in.

3:00 pm
- At Station K: The 3" water pump has been set up. There are 4 hoses, each 50 ft long. The pump's outlet is downstream of Station L, approximately 30 meters from the station.

3:05 pm
- Fish screen protection installed at the inlet of the pipe in preparation for pumping.

3:35 pm
- At Station E: QM has filled up 30-meter bags and is ongoing with 2 additional bags.

3:50 pm
- Conversation with AE (Ryan, Jordan, Vinizza & Cynthia):
  - Ryan emphasized that work must conducted in the dry. A 2-3 inch pipe is not the right size.

4:00 pm
- AE (Ryan, Jordan, & Cynthia) left the site.

4:20 pm
- Keystone started fish salvage.

4:40 pm
- QM crew left the site.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

4:50 pm

- AE Vinizza left the site.

Testing:

- Keystone conducted turbidity test.

Safety Concerns:

- None today.

Traffic Control:

- Green Valley Traffic Control provided traffic management along Dale Road near the bridge.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

Photos:

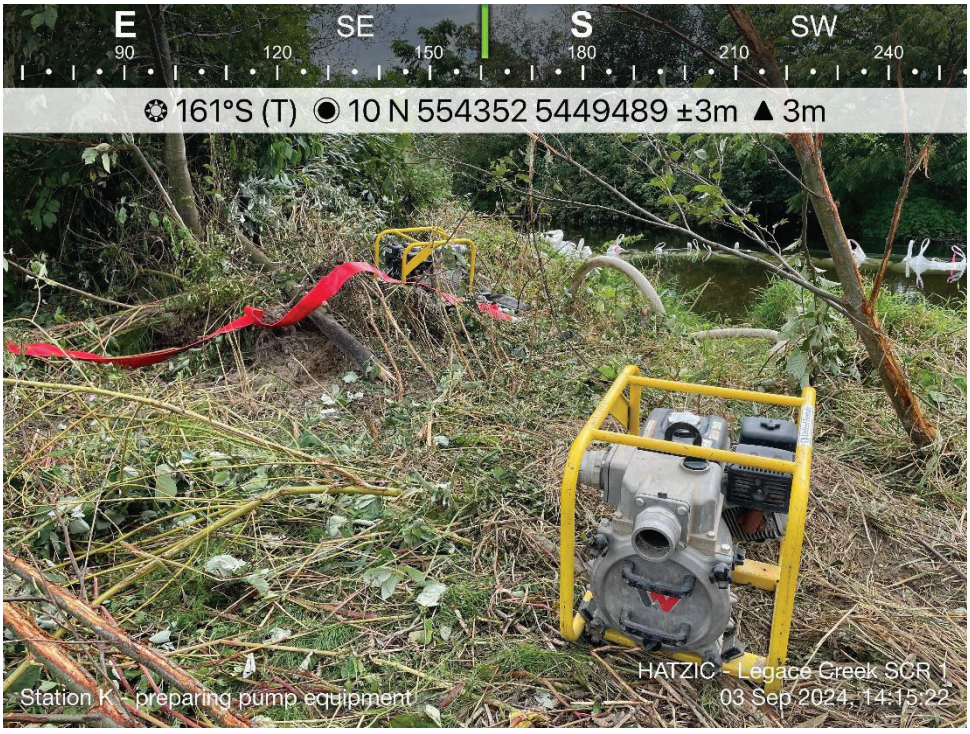




(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: September 3, 2024
Weather: Overcast in the morning to sunny breaks in the afternoon. Temperatures ranging from a low of 15 °C to a high of 22°C throughout the day.

- Environmental Monitors (EMs) arrived on site at 7:00 AM.
- 07:15 - EMs collected background water quality samples (WQ sampling results are provided below).
- 07:30 – QM crews began removing the sandbag isolation from Station L. Sandbags removed from Station L were subsequently transported to Station K.
- 07:45 – One EM continued the monitoring of instream work, while the other EM checked for Japanese knotweed presence around Station K.
- 08:52 – EMs collected a downstream water quality sample from Station L while the QM crews continued to remove the sandbag isolation.
- 09:25 – Excavator, in attempts to remove the sandbag isolation, spilled the sediment content of the sandbag into the stream. However, there was no concern of contamination except for turbidity.
- 09:34 – Another sandbag was spilled instream due to the sandbag rolling over from fast flowing water current.
- 09:38 – Sandbag isolation removal work at Station L was completed. The EMs noted that the turbidity plume dissipated quickly during work, but extra caution should be exercised, including the use of silt curtain/booms.
- 09:40 – Sandbags removed from Station L were transported to Station K by wheeled loader.
- 10:24 – Background WQ sample at Station K was collected.
- 10:26 – QM crews began setting up the sandbag isolation in Station K.
    - Sandbags were laid on top of poly sheeting and the poly is then rolled over top. Sandbags wall is higher than water surface level. The work area is efficiently isolated and thus concern for fish entering the work zone is minimal.
    - Water seeping through underneath the sandbags, dewatering with pumps will create back pressure and make the walls cave in and collapse, dewatering is not practical due to high flow.
- 10:40 – The EMs noted that the QM crews deployed silt fences around the stockpile of excavated sediment from Station L. Poly sheeting was also observed covering the stockpile, providing an additional layer of protection against potential sediment erosion into the stream.
- 12:15 – The QM crews continued the installation of sandbag isolation around Station K. The EMs continued the WQ monitoring downstream to check for any elevation in turbidity downstream.
- 12:20 – Lunch break.
- 13:00 – Finished lunch break.
- 14:00 – QM crews deployed a silt curtain on the downstream section of Station K. Silt curtain was fully extended across the stream to reduce the turbidity downstream from Station K.

- 16:00 – Station K sandbag isolation was completed. Dewatering pump was set up but was not required as there was no excavation that took place during the workday. The intakes were fitted with fish screen protection as per the DFO end-of-pipe specifications.
- 16:30 – The EMs began the fish salvage operation at Station K. A total of three (3) passes were conducted with electrofisher, with a total of 2181 seconds of active time on the electrofisher.
- 17:51 – The EMs finished the fish salvage via electrofisher. Total of one (1) Three-spined stickleback, two (2) Pumpkinseed Sunfish, and eleven (11) Prickly Sculpins were salvaged. Invasive pumpkinseed sunfish was humanely euthanized, and native fish were released behind the silt curtain that will now act as additional fish isolation.
- 18:00 – Dissolved oxygen (DO) measurement was taken at Station K and yielded 8.84 mg/L before deploying minnow traps. This DO level complies with DFO requirements for protecting aquatic life. For cold water biota, DFO recommends DO levels ≥ 6.5 mg/L for optimal conditions in most life stages, and levels should not fall below 5.0 mg/L. The measured 8.84 mg/L is well within the acceptable range, indicating suitable conditions for fish and appropriate for deploying minnow traps without risking hypoxic stress to the fish.18:10 – A total of 6 minnow traps were deployed in Station K. The traps are to soak overnight and to be picked up the following morning prior to excavation.
- 18:30 – The EMs departed from site after debriefing work activities with KEL PM.

Location	Time	Turbidity (NTU)
Background (Station K)	7:15	2.87
Within the isolation at L	7:16	5.87
BG (Station K)	8:52	2.43
10 m DS from L	9:00	4.08
10 m DS from L	09:30	4.47
10 m DS from L	09:33	**13.3**
10 m DS from L	09:38	5.67
Station K	10:24	3.34
Station K	15:51	2.72
Station J	16:11	3.05
Station K	15:23	5.29
Station K	16:21	4.86

Site Photos






September 03, 2024 7:22 a.m.


September 03, 2024 1:09 p.m.


September 03, 2024 2:13 p.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

DAILY CONSTRUCTION REPORT

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	9
Project:	Legace Creek	**Page:**	1 of 5
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 4, 2024
Contract No.:		**Temperature:**	High: 31 Low: 19
Weather:	Sunny, Winds SSW at 10 to 15 km/h		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Labour Force:

Quantum Murray (QM): 2 Site Superintendents, 2 Operators, 4 Labourers
Keystone Environmental (KE): Khang and John
Associated Engineering (AE): Jack Dai Tang and Vinizza Pingos

Contractor's Equipment:

2 - Hitachi ZX350LC-6 Long Reach
2 - DEERE 544K Wheel Loaders
2 – 3" Trash Pumps (demobilized from construction site)
2 – 6" Vacuum Assisted Pumps

Report, if, any, Contact with Occupants:

N/A

Contact with Owner:

N/A

Safety Concerns:

N/A

Traffic Control:

N/A

Report:

7:00 AM – 9:00 AM

- Arrived at Site 17 for toolbox meeting

9:00 AM – 10:00 AM

- Arrived at Site 14 at 9:00 AM
- Station K - QM refueled the two 3" pumps and began pumping water out.
- Sandbags were packed and transferred from Station L to Station J.

10:00 AM - 11:00 AM

- QM began placing sandbags to Station J.
- Station J
    - It was observed that some sandbags were submerged due to water level.
    - QM restacked the sandbags.
- Station K
    - One of the 3" pumps ran out of fuel and stopped. QM refueled and restarted the pump.
    - Minimal water level difference was observed between the stream and station K.

11:00 AM – 12:00 PM

- Station K
    - Two 6" pumps and a fish cage arrived at site
    - QM shut down the two existing 3" pumps and demobilized them along with the truck that transported the 6" pumps.
    - QM began assembling the two 6" pumps

12:00 PM – 1:00 PM

- Station K
    - QM raised the concern to KE about the fish cage was not suitable for placement due to the low water depth. KE advised QM to excavate a sump for the cage.
    - The fish cage was placed at the station, and it was confirmed that the sump was no longer required.

1:00 PM – 3:00 PM

- Station K
    - Water level remains unchanged.
    - QM started one of the 6" pumps and it was not pumping water.
    - The second 6" pump was started and successfully pumped water.
        - The cloth attached to the discharge pipe became detached. QM reattached the cloth to the discharge pipe.
    - QM identified an issue with the first 6" pump due to improper pipe sealing, causing air intake. The issue was addressed by wrapping the connection with a poly sheet and duct tape.
    - After addressing the first pump's issue, it was observed that the second 6" pump was not pumping at full capacity. QM suspected a blockage at the pump intake.
    - QM attempted to resolve the blockage issue with the second pump, but it remained unresolved.

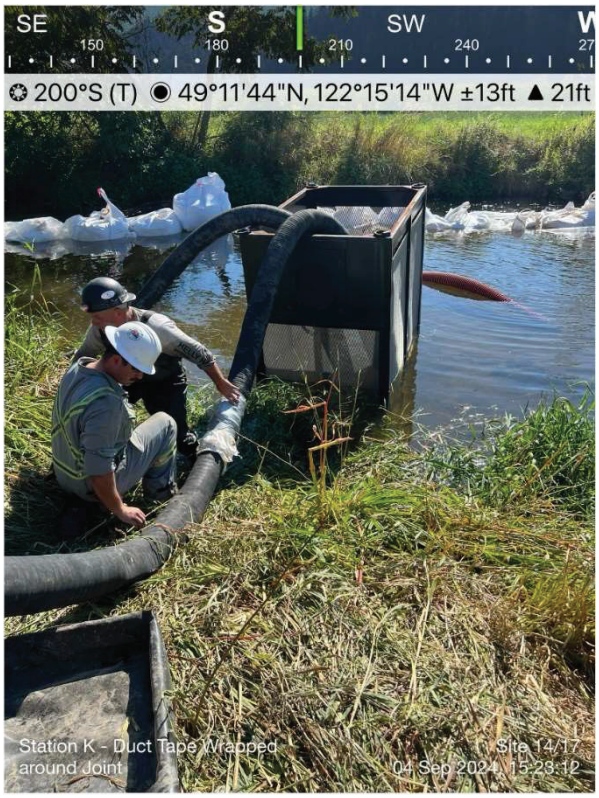
3:00 PM – 4:00 PM

- Station J
    - QM resumed placing sandbags.
    - Approximately 70% of sandbags were placed.
    - Approximately 49 sandbags packed today.

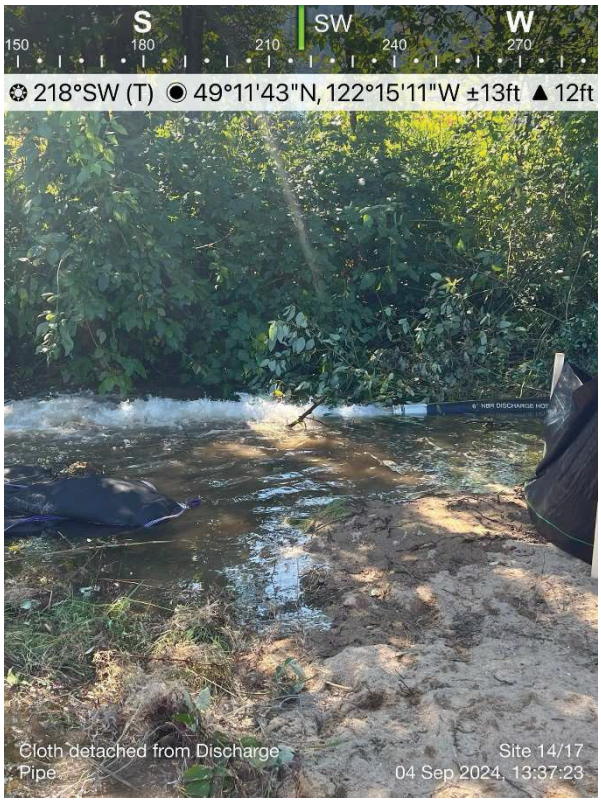
4:00 PM – 5:00 PM

- QM shut down for the day at 4:20 PM.
- AE inspectors left site at 4:20 PM.


W 270 300 NW 330 N 0 30
325°NW (T) 49°11'45"N, 122°15'15"W ±13ft 33ft
Sandbag Placement at Station J
Site 14/17
04 Sep 2024, 09:48:38


SE 150 S 180 SW 210 240
200°S (T) 49°11'44"N, 122°15'14"W ±13ft 21ft
Station K - Duct Tape Wrapped around Joint
Site 14/17
04 Sep 2024, 15:23:12


SE
S
SW
150
180
210
240
196°S (T) 49°11'45"N, 122°15'14"W ±9ft 33ft
6" Pump Arrival
Site 14/17
04 Sep 2024, 11:21:51


S
SW
W
150
180
210
240
270
218°SW (T) 49°11'43"N, 122°15'11"W ±13ft 12ft
Cloth detached from Discharge Pipe
Site 14/17
04 Sep 2024, 13:37:23

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	9
Project:	Legace Creek	**Page:**	1 of 7
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 4, 2024
Contract No.:		**Temperature:**	High: 28 Low: 12
Weather:	Sunny, Wind 3 KM/H, Gusts 5 KM/H		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

QM:

QM: Site Superintendent (Mel & Jem), Operator (Glenn & Sandy), 4 laborers
Keystone Environmental: EM (Khang and John)

Contractor's Equipment: - Equipment in use

- Excavator 324E
- Excavator EXO689
- Excavator 2720
- Loader 1466
- 2 - 6" Vacuum Assisted Pumps
- 2 – 3" Trash PumpsSS

Report:

6:55 AM

- AE (Vinizza) arrived on site.

7:00 AM

- Toolbox talk with Mel, Jem, Glenn, Dallas, Sandy, and 4 laborers.
- Jem discussed to start dewatering, adding two additional 4" water pumps, and to continue filling sandbags with excavated materials from Station L.
- He also expressed concerns that once the isolated area dries out, the sandbags might fall off, creating a mess. Additionally, he noted the potential risk of flooding at the discharge area once the water is pumped out.

7:35 AM

- Keystone (Khang & John) arrived on site.

7:40 AM
- Conversation with Keystone.
    - Khang reported that fish salvage was completed last night at Station K, and the fish trap was placed overnight.
    - Keystone was removing the fish trap, noting that there were still fish caught.

7:45 AM
- Preparing to fill up bags at Station L for Station J.

7:50 AM
- Keystone released the fish at Station L downstream.

7:55 AM
- Mobilized new equipment on site: Excavator #2720.

8:00 AM
- Conversation with Jem.
    - Jem mentioned that road plates for Station K would be arriving soon.

8:04 AM
- Started pumping out water at Station K using two 3" water pumps.

8:23 AM
- Began placing steel plates (4ft x 8ft) on the upstream (west side) of the creek at Station K.

8:25 AM
- QM began refilling the fuel of the water pump (with the spill tray underneath) approximately 4 meters from the creek.

8:55 AM
- AE (Ryan and Jack) arrived on site.

9:00 AM
- Jem mentioned that they would use a 6" water pump.

9:10 AM
- Ongoing filling of sandbags from excavated materials at Station L to be hauled to Station J.

9:15 AM
- Station K: One water pump stopped. Eight steel plates already placed.

9:25 AM
- QM refilled the fuel of the water pump with the spill tray underneath, approximately 4 meters from the creek.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

9:30 AM
- Station K: Ongoing pumping with the 2 x 3” water pump for the second time.

9:33 AM
- Hauling of sandbags from Station L to Station J using a wheel loader.

10:00 AM
- Removing and taking out water-filled sandbags from Station J.

10:08 AM
- Adjusting the poly sheet at Station J to cover the sandbags and prevent water ingress.

10:28 AM
- Eight new sandbags filled at Station E.

10:35 AM
- Keystone conducted a turbidity test.

11:07 AM
- One pump shut down. Fuel refilling at its original position (approximately 4 meters from the creek) with spill containment mats in place. Pump turned back on after refilling.

11:20 AM
- Delivered a 6” water pump to Station K (one with a case, one without a case).

11:25 AM
- Shut down the 3” water pump.

1:01 PM
- Station J: Approximately 35 bags used; 65% completion in isolating the area.
- Ongoing filling and hauling of bags from Station L to Station J.

1:15 PM
- Started using the 6” water pump. One pump (with a case) operational; one pump (without a case) not working.

1:30 PM
- Approximately 49 sandbags pack up and hauled to Station J from Station L.

1:37 PM
- At the water outlet area, approximately 30 meters downstream from Station L, the cloth attached to the discharge end of the pipe came loose.

1:42 PM
- QM fixed the cloth and turned the water pump back on.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

1:52 PM
- QM attempted to fix the non-operational water pump (without a case) but it remained non-functional.

2:15 PM
- At Dale Road: poured gravel at the temporary access road and laid geotextile sheet underneath to prevent contamination from knotweed in the area.

2:25 PM
- QM continued fixing the first pump (without a case), they suspect that improper sealing, which caused air intake, was the issue. To address this, they wrapped the pump with a poly sheet and duct tape.

3:20 PM
- Continued setting up sandbags at Station J to isolate the area.

3:30 PM
- The pump (without a case) is now working, while the second pump (with a case) was shut down due to a possible clog issue as per QM.
- Transferred fish box protection with pumping inlet from east to the center part of the isolated area (Station K).
- QM flagged a marker on a piece of wood to monitor water level changes.

4:20 PM
- QM called it a day.

4:30 PM
- QM crew left the site.

4:40 PM
- AE (Vinizza & Jack) left the site.

Testing:
- Keystone conducted turbidity test.

Safety Concerns:
- None today.

Traffic Control:
- Green Valley Traffic Control provided traffic management along Dale Road near the bridge.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Photos:

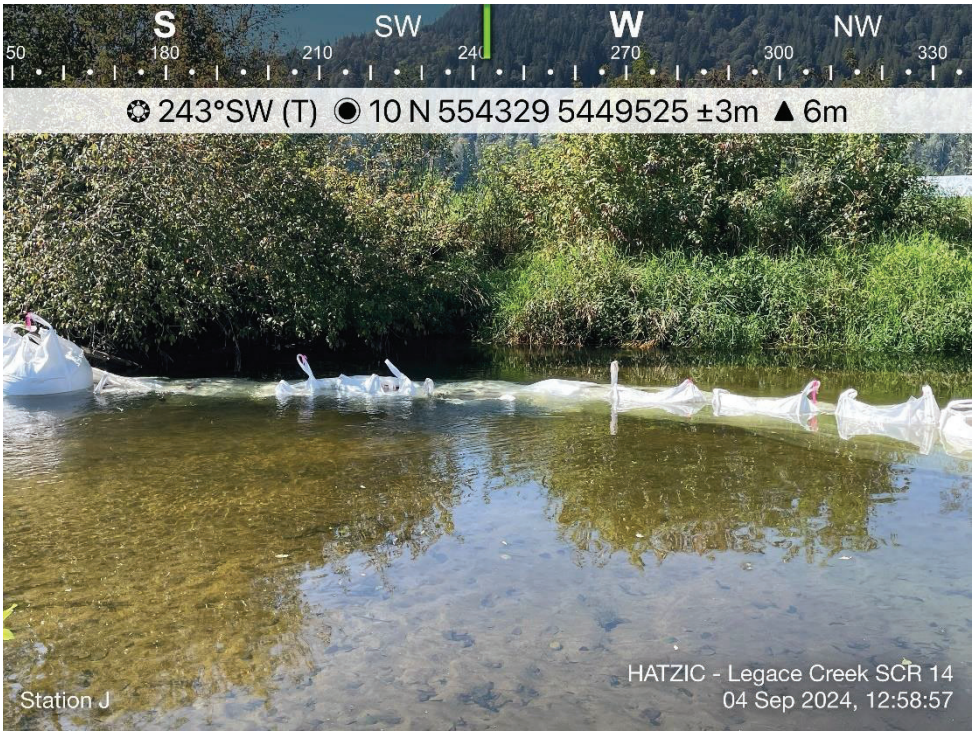




(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos





*

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Vinizza Pingos

RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: September 4, 2024
Weather: Foggy in the morning, sunny throughout the day. Temperatures ranged from 12°C to 25°C throughout the day.

- 7:15 AM: Environmental Monitors (EMs) arrived on-site.
- 7:30 AM: Quick toolbox meeting was conducted prior to the start of the workday.
- 7:40 AM: The EMs collected six (6) minnow traps from Station K:
    - 1 Rainbow trout
    - 3 Pumpkinseed sunfish
    - 2 Three-spined sticklebacks
    - 9 Prickly sculpins
    - Native fish were released downstream away from the work area.
    - Three (3) Pumpkinseed sunfish were euthanized.
- 7:58 AM: Background water quality (WQ) sample was collected at Station K (WQ sampling results provided below).
- 8:04 AM: Two (2) 3-inch dewatering pumps were set up at Station K:
    - Fish protection screen was observed on both intake hoses.
    - Both pumps were placed on spill tray to mitigate the risk of oil spillage near the stream.
    - Outlet hoses were directed onto downstream bank vegetation at the downstream end of Station L to reduce turbidity before the water re-entered the stream.
- 8:15 AM: The EMs observed a turbidity bloom downstream from the dewatering pumps discharge, with signs of erosion at the outlet points:
    - The EMs recommended installing a poly-sheeting spillway armored with gravel to minimize erosion and reduce turbidity.
- 8:25 AM: QM crews installed road plates on the upstream side of Station K to prevent water from seeping through the sandbag isolation.
- 8:37 AM: Downstream WQ sample was collected at Station K (WQ sampling results provided below).
- 8:40 AM: Poly-sheeting spillway armored with gravel was constructed at the dewatering pumps discharge outlets at the downstream end of Station L.
- 9:47 AM: QM crews initiated the installation of sandbag exclusion at Station J:
    - Background WQ sample was collected upstream of Station J.
    - Downstream WQ sample was collected downstream of Station J (WQ sampling results provided below).
- 10:47 AM: A WQ sample was taken approximately 5 meters downstream of the dewatering pumps outlets. Results confirmed that the poly-sheeting spillway was effectively reducing turbidity (WQ sampling results provided below).
- 11:20 AM: Two (2) 6-inch dewatering pumps were staged on-site, with a fish protection screen cage observed.
- 11:28 AM: Two (2) 3-inch dewatering pumps were demobilized from the site.

- 11:55 AM: Diffuser bags were brought to the site.
- 12:15 PM: QM crews conducted Japanese knotweed pruning at Station B. The EMs confirmed that pruned Japanese knotweed plants were isolated inside a bulk bag.
- 1:43 PM: The first 6-inch dewatering pump was activated at Station K:
    - The EMs confirmed that the dewatering pump inlet was placed inside a fish protection cage, and no adverse impacts on fish were observed.
    - The discharge outlet was directed towards the downstream end of Station L, connected to a diffuser bag and placed over a poly-sheeting spillway to minimize turbidity and prevent bank erosion
    - A background WQ sample was collected upstream of the 6-inch dewatering pump discharge outlet (WQ sampling results provided below).
- 2:07 PM: A minor turbidity bloom was observed downstream from the pump discharge. In-situ WQ sampling indicated a turbidity of 10.44 NTU (compared to background turbidity of 4.28 NTU). The turbidity bloom quickly dissipated downstream and remained within compliance.
- 2:20 PM: QM crews reported that the inlet hose on the second 6-inch dewatering pump was leaking, causing delays:
    - The leaking section of the hose was removed, and the fish protection cage was adjusted to accommodate the now shorter inlet hose.
- 3:30 PM: The second 6-inch dewatering pump was activated, with its outlet hose directed towards upstream end of Station L, through a diffuser bag and over a poly-sheeting spillway.
- 3:45 PM: The EMs noted that the first 6-inch dewatering pump was inactive.
- 3:50 PM: The EMs noted that neither of the dewatering pumps was discharging at full capacity. The two (2) 6-inch dewatering pumps were not effective at lowering the water level inside the Station K exclusion. QM crews indicated that both pumps were rental units from United Rentals, and arrangements were made for a technician to be on-site to address the issue. The pumps were shut down for the day.
    - The two (2) 3-inch pumps were active for approximately 3.5 hours.
    - The first 6-inch pump was active for approximately 2 hours.
    - The second 6-inch pump was active for approximately 45 minutes.
- 4:00 PM: The EMs recommended moving the two (2) 6-inch dewatering pump discharge outlets from their respective current locations to the upstream side of the silt curtain, located between Stations L and K, to reduce the turbidity downstream from the dewatering pumps discharge.
- 4:18 PM: Work ended for the day. The sandbag exclusion installation at Station J was not completed and will continue the following day.
- 4:30 PM: The EMs deployed nine (9) minnow traps inside the Station K exclusion, to be collected the following day prior to excavation. In addition, one (1) minnow trap was deployed in the Station J.
- 5:30 PM: The EMs departed from site after debriefing work activities with KEL PM.

Location	Time	Turbidity (NTU)
Background (Station K)	7:58	2.95
Station L (DS from road plate installation at K)	8:36	2.85
Station L (DS from road plate installation at K)	9:14	5.72
BG (Station J)	9:50	5.52
10 m DS from J	9:55	4.85
10 m DS from J	10:22	5.74
Background (Station K)	10:40	3.92
DS of Station L @ two 2-in pumps discharge outlets	10:47	4.59
Background (1st 6-in pump discharge)	14:02	4.28
10m DS of 1st 6-in pump discharge outlet	14:07	10.44
10m DS of 1st 6-in pump discharge outlet	14:20	8.70
10m DS of 1st 6-in pump discharge outlet	14:35	8.22
Background (2nd 6-in pump discharge)	15:32	5.11
10m DS of 2nd 6-in pump discharge	15:35	6.27
10m DS of 2nd 6-in pump discharge	15:55	7.09

Site Photos






2024-09-04 3:36 p.m.


September 04, 2024 5:20 p.m.


September 04, 2024 12:03 p.m.


September 04, 2024 10:21 a.m.


September 04, 2024 9:26 a.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

DAILY CONSTRUCTION REPORT

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	10
Project:	Legace Creek	**Page:**	1 of 8
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 5, 2024
Contract No.:		**Temperature:**	High: 32 Low: 16
Weather:	Sunny, Winds SSW at 10 to 15 km/h		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Labour Force:

Quantum Murray (QM): 2 Site Superintendents, 2 Operators, 4 Labourers
Keystone Environmental/Environmental Monitors (KE/EM): Khang and Loc
Associated Engineering (AE): Jack Dai Tang, Vinizza Pingos, and Naomi Sands (11:20 AM – 12:00 PM)

Contractor's Equipment:

2 - Hitachi ZX350LC-6 Long Reach
1 - DEERE 544K Wheel Loader
2 – 6" Vacuum Assisted Pumps

Report, if, any, Contact with Occupants:

N/A

Contact with Owner:

At 10:40 AM, an individual claiming to be the owner of the farmland approached the AE inspector to express concerns about the project's progress. The individual appeared to have a limited understanding of the scope of work, believing it only involved simple excavation and hauling away sediment from the creek. He questioned the necessity of the dewatering systems, complaining that they were an unnecessary expense and that project funds were being wasted. The AE inspector attempted to explain the complexity of the work, but communication was hindered by a language barrier. The individual then approached the contractor for further information and left the site at 11:00 AM.

Safety Concerns:

N/A

Testing:

EM measured 4.26 NTU upstream.

At 9:12 PM, a spike of 25.2 NTU was observed at the discharge pipe outlet. EM took another water sample 15 meters downstream from the outlet, recording 9.22 NTU. EM confirmed that this result complies with the requirement of no more than an 8 NTU increase compared to the upstream reading.

Traffic Control:

The AE inspectors observed the following at the site entrance:

1 – Traffic Control Vehicle

2 – Traffic Control Workers

Report:

7:00 AM – 7:50 AM

- Arrived at Site 14/17 at 7:00 AM
- Station K
  - QM was already on-site, working on station dewatering.
  - It was observed the 6" pumps were not operating at full capacity.
  - QM resolved the issue by replacing the intake pipes with flexible ones.
  - Pumping resumed and dewatering of the station began.
  - At 7:14 a.m., the water level drops to 4 inches.
- Station E & D
  - Forty sandbags are still piled along the station from D to E.
- Along Dale Road
  - Traffic management at the site.

7:50 AM – 9:00 AM

- AE inspectors attended daily site construction meeting.
  - It was noted to remind QM that they are required to locate the existing watermain along Legace Road before setting up the sand recovery station. Additionally, coordinate with Fraser Valley Regional District on the offset distance.

9:00 AM – 10:00 AM

- Water Testing:
  - At 9:12 AM, 25.2 NTU was measured at discharge pipe outlet.
  - EM indicated that they might instruct QM to shut down the pumps to allow turbidity to decrease.
  - Another water sample was taken 15 meters downstream from the discharge pipe, showing a reading of 9.22 NTU. Since this complied with the requirements, the pumps remained in operation.
- Station J
  - QM continued placing sandbags.
  - At 9:05 am, water is entering from the west side of the isolated area. The poly sheet did not cover the sandbags properly, and one sandbag is open and exposed to the water.
  - At 9:10 a.m., QM continued placing sandbags to tie in with Station K.
- Station K
  - The water level in the station was observed to have decreased.
  - Several points were identified where water was entering the station from the creek. QM addressed this by adding more sandbags and adjusting poly sheets. AE inspector recorded the condition and footage is available.

10:00 AM – 12:00 PM

- Visitor: AE Environmental – Naomi Sands on-site from 11:20 AM to 12:00 PM
- Water Testing:
    - At 10:12 AM, 6.28 NTU was measured at 5 meters downstream of the discharge pipe. QM was adjusting the fish cage as the water level within the station dropped.
    - At 11:14 AM, readings of 4.52 and 5.38 NTU were taken at the discharge pipes while dewatering continued at Station K.
- Station K
    - QM had to adjust the fish cage with a deeper sump due to lowered water level. They dug approximately 4 scoops with the excavator bucket.
    - Water was still entering the station at several points, which QM continued to address.
- Station J
    - 22 sandbags were hauled from Station E to Station J.

12:00 PM – 1:00 PM

- Station K
    - QM identified that the pumps were not operating at full capacity due to the intake pump suctioning against the steel bottom of the fish cage. As QM worked on resolving this issue, the water level rose significantly, returning to near-normal levels.
    - At 12:25 pm., QM needs to readjust the fish cage, they dug approximately 3 scoops with the excavator bucket.

1:00 PM – 3:00 PM

- Station K
    - After QM adjusted the fish cage and restored normal pump operation, the water level in the station dropped significantly by 26.5 cm.
- At Dale Road
    - The temporary access road was laid with gravel and had combigrid underneath, covering approximately 5 m x 17 m.
    - At 2:30 am crew left site (crew for the Dale Road).

3:00 PM – 5:00 PM

- Station K
    - QM was unsure whether the station met “dry” conditions and sought advice from EM.
    - QM informed AE inspectors that their upper management would contact the Department of Fisheries and Oceans (DFO) to assess the station’s “dry” condition.
    - At 3:30 PM, the pumps were shut down.
- Station J
    - With the pumps off at Station K, QM proceeded with completing the placement of sandbags. The sandbags were filled with sand from either Station L or Station K (sourced from the sump created for the fish cage).
    - At 3:57 p.m., QM filled 14 sandbags at Station K.
    - At 4:25 p.m., QM removed 3 steel plates from the isolated area of Station K. 6 steel plates remained.

- General
    - QM consulted the AE inspectors on the work limits for Site 17, asking if AE inspectors could:
        - Mark down the work extent for QM, including the starting and ending points.
        - Provide the coordinates for the starting and ending points.
    - QM also asked for clarifications on the sand recovery stations B-2/B-3/C-2, inquiring if AE inspectors could:
        - Lay out the sand recovery stations.
        - Provide the lengths and coordinates for each station.
    - AE inspectors advised QM to submit a Request for Information (RFI) for further clarification on these questions.
- QM shut down for the day at 5:00 PM.
- EM placed minnow traps at Station J.
- AE inspectors left site at 5:20 PM.


W
NW
N
240
270
300
330
0
304°NW (T) 49°11'44"N, 122°15'14"W ±9ft 15ft
Station K - Contractor
Attempting to Stop Water
Entering by Adding a Sandbag
Site 14/17
05 Sep 2024, 09:56:13


SW
W
NW
210
240
270
300
259°W (T) 49°11'44"N, 122°15'14"W ±9ft 13ft
Station K - Contractor Digging into the Station to Adjust Fish Cage
Site 14/17
05 Sep 2024, 10:09:39


SE
S
SW
150
180
210
240
197°S (T)
49°11'45"N, 122°15'14"W ±9ft
28ft
Station K - EM Measuring
Sandbag Berm Dimensions
Site 14/17
05 Sep 2024, 14:10:46


W
NW
N
240
270
300
330
0
308°NW (T)
49°11'45"N, 122°15'14"W ±9ft
25ft
Station J - Contractor
Continued Placing Sandbags
Site 14/17
05 Sep 2024, 15:57:24

TECHNICAL MEMORANDUM

Issue Date:	September 10, 2024	**File:**	Audit No. 2
To:	**Thyren Jacobs, Flood Debris Management Secretariat**	**Previous Issue Date:**	
From:	Naomi Sands, R.P.Bio.		
Client:	Ministry of Environment and Climate Change Strategy		
Project Name:	Lagace Creek Bank Protection and Sediment Removal - SCR14	**Project No.:**	2022-2632-03
Subject:	Environmental Compliance Audit		
Monitoring Period:	August 30 – September 5, 2024		
Contractor:	QM Environmental		
Environmental Monitor:	Keystone Environmental		

1 INTRODUCTION

Associated Environmental Consultants Inc, (Associated) is pleased to provide this environmental audit report summarizing observations of site conditions, environmental protection measures, regulatory compliance, and corrective actions as part of erosion protection works on Lagace Creek, south of Durieu, BC in the Hatzic Valley (the Project, the Site) during the monitoring period August 30 to September 5, 2024. The results presented in this audit report are based on conditions observed at the time of the audit inspection(s) and represent a snapshot of the workday. Items identified as non-compliant may have been addressed before the report(s) are submitted. The audit report(s) are submitted to the owner, their agent (Associated Engineering), the Contractor, and their environmental monitor (EM) and are not intended for further distribution.

2 ROLES AND RESPONSIBILITIES

The prime contractor for the Project is QM Environmental. (the Contractor), and works are being monitored for environmental compliance by Keystone Environmental (Keystone) and audited by Associated. As the EM, Keystone is to work with the Contractor to develop measures to protect the environment and to respond to environmental incidents as they occur. Keystone is also responsible for fish and wildlife salvages prior to instream works. Leq'á:mel First Nation (LFN) is the cultural monitor for the Site. The responsibility of the auditor is to ensure on behalf of the owner, who is ultimately the permit holder, that the EM, LFN, and the Contractor adhere to the requirements of the Construction Environmental Monitoring Plan (CEMP)[1], environmental permit conditions and any applicable regulations.

3 SITE INSPECTION

A summary of site conditions as observed during the audit inspection completed during the monitoring period is provided in Table 3-1. Monitoring reports have been submitted for the auditing period.

[1] AquaTerra Environmental Ltd. 2024. Hatzic Emergency Program, South Herford Creek Project, Construction Environmental Management Plan (Rev. 1). Prepared for Mission Contractors Ltd. 65 p.

Table 3-1 Site Conditions During Audit Inspection

Date / Time	Auditor (Associated)	Weather	Construction Activities
September 5, 2024 11:10	Naomi Sands	Sunny. 26°C. No precipitation.	Crew was attempting to isolate and dewater Station K (south of Dale Road).

4 INSPECTION RESULTS

A checklist of required environmental protection measures and mitigative strategies for the Project is presented in Table 4-1. The checklist has been developed in accordance with terms and conditions of the environmental permits and approvals issued for the Project, environmental protection specifications and requirements as part of the construction contract for the Project, the Contractor's Construction Environmental Management Plan and environmental best management practices and guidelines.

Table 4-1 Summary of Environmental Protection Measures Reviewed and Results of the Inspection

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
	Environmental Monitoring					
1	The EM will attend key site meetings where environmental mitigations and issues may be discussed.	☒Compliant ☐Non-Compliant ☐N/A	EM has been on site daily to attend site meetings.		CEMP Section 2.4	
2	The EM shall supervise all instream works. If temporary diversion installed, EM is onsite daily to check pumps and flow bypasses.	☒Compliant ☐Non-Compliant ☐N/A	EM was onsite to conduct salvage and oversee dewatering attempts.		WSA (h)2.ii, (j)5.i CEMP Section 2.4	
3	The EM will submit daily and bi-weekly monitoring reports to the Contractor for distribution to MoECCS.	☒Compliant ☐Non-Compliant ☐N/A	Monitoring reports are submitted daily, or the following morning.		CEMP Section 5.1	
4	The EM will complete and submit an Environmental Incident Report (EIR) for non-compliances with the CEMP, reportable spills or other environmental incident.	☐Compliant ☐Non-Compliant ☒N/A	No reportable environmental incidents have been documented to date.		CEMP Section 4	
5	EM is granted authority to stop the work if necessary	☒Compliant ☐Non-Compliant ☐N/A	EM has not exercised stop work to-date.		WSA (i) 7 CEMP Section 2.4	
	Erosion and Sediment Control					
6	Appropriate site isolation is installed as required, including silt fencing prior to instream works. Silt fences are installed properly, intact, adequate, clear of accumulated sediment and are functioning.	☐Compliant ☒Non-Compliant ☐N/A	Instream isolation is not adequate to support dewatering attempts. Water is leaking under and between the sandbags.	Contractor has request ENV seek amendment to permits to allow dredging in the wet.	WSA (o), (q) CEMP Section 3.5	Photo 1
7	Riprap or any other engineering material place in channel is clean of any substances deleterious to aquatic life.	☐Compliant ☐Non-Compliant ☒N/A	No riprap or other material was being placed during the audit.		WSA (x) CEMP Section 3.5	
8	Stockpiling and storage areas are located 15 m from the watercourse TOB.	☒Compliant ☐Non-Compliant ☐N/A	Sediment stockpiles are located >15 m from the watercourse OR have silt fence installed around the base.		DFO FAA WSA (t) CEMP Section 3.5	Photo 2 Photo 3
9	Emergency ESC material onsite (e.g., 100 feet of silt fencing, 5 dry bales, and 100sq.m of ECBs/ Coconut matting, or polyethylene sheets)	☒Compliant ☐Non-Compliant ☐N/A	ESC materials were stockpiled at the site laydown.		CEMP Section 3.5	
10	Sediment removed from the Site will be disposed of appropriately at a location approved by the EM and MoECCS.	☐Compliant ☐Non-Compliant ☒N/A	Excavated sediment is currently being stockpiled onsite.	Identify sediment disposal location(s) in the CEMP and/or the environmental monitoring reports.	CEMP Section 5.5	
11	Sediment removal boundaries must be clearly delineated prior to commencement of work.	☐Compliant ☐Non-Compliant ☒N/A	No sediment removal occurring at time of inspection.		WSA (opening)	
	Invasive Plant Management					
12	Ensure that machinery is free of invasive plant material that could potentially be transported throughout or between sites.	☐Compliant ☐Non-Compliant ☒N/A	No machinery observed leaving site during inspection.		WSA (opening) CEMP Section 3.4	

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
13	Ensure that invasive species removed from site are disposed of appropriately at an approved facility	☐Compliant ☒Non-Compliant ☐N/A	Japanese knotweed was bagged onsite awaiting offsite disposal. It appears that knotweed has been cut to ground, but not yet treated with herbicide. Knotweed management protocols are not clearly understood nor documented in monitoring reports.	Ensure knotweed management adheres to approved BMPs and contract, and document methodology.	WSA (opening) CEMP Section 3.4.1	Photo 4
14	The Project site shall be regularly monitored by the EM for invasive plant infestations and these infestations will be mapped and managed according to applicable species-specific BMPs.	☐Compliant ☒Non-Compliant ☐N/A	EM appears to be overseeing invasive species management, however, knotweed is not being managed according to the BMPs and approved methods.	Where knotweed is pruned, stems left in ground are to be injected with approved herbicide suitable for use in riparian area.	CEMP Section 3.4.1	
16	Knotweed stems are cut close to the ground and contained on poly sheeting away from the immediate work area. Cut knotweed is covered with woven geotextile fabric and crushed rock prior to machine access. Knotweed stems are injected with an appropriate herbicide before being covered.	☐Compliant ☒Non-Compliant ☐N/A	Cut knotweed was bagged awaiting offsite disposal. Herbicide injection was not being done during the audit visit.	Confirm if stem injections are occurring as required. Confirm disposal site.	CEMP Section 3.4.1 Addendum 1 to the Contract Documents for the Hatzic Emergency Works Program - Lagace Creek – Sites S-CR-14/17	
	Waste Management					
17	Dispose of all anthropogenic debris removed at an appropriate waste management facility.	☒Compliant ☐Non-Compliant ☐N/A	Garbage / debris is starting to accumulate around site.	Ensure site is cleaned daily.	WSA (opening) CEMP Section 5.5	
18	Non-hazardous waste stored appropriately and removed offsite daily.	☒Compliant ☐Non-Compliant ☐N/A	No non-hazardous waste was observed during the audit.		CEMP Section 5.5	
19	Hazardous waste stored > 30 m of watercourses.	☒Compliant ☐Non-Compliant ☐N/A	Portable toilet is located at the site laydown, more than 30 m away from watercourses.		CEMP Section 5.5	
20	Secondary containment used for all stored hazardous waste.	☐Compliant ☒Non-Compliant ☐N/A	Portable toilet was not in secondary containment.	Add secondary containment to portable toilet.	CEMP Section 3.6	Photo 5
	Spill Control and Emergency Response					
21	Machinery operating in channel is equipped with environmentally friendly oil	☒Compliant ☐Non-Compliant ☐N/A	Excavator on site has a sticker confirming that it contains Environ™ biodegradable, non-toxic hydraulic fluid.		WSA (p) 4 CEMP Section 3.6	
22	Equipment and machinery are free of leaks	☒Compliant ☐Non-Compliant ☐N/A	No leaks were observed during the audit. Equipment appeared to be clean.		WSA (p) 1 CEMP Section 3.6	
23	Drip trays are available and used during refueling and equipment maintenance	☒Compliant ☐Non-Compliant ☐N/A	Equipment was actively working during the audit. Spill trays were observed around site.		CEMP Section 3.6	
24	Fuel is stored > 30 m from Lagace Creeks and any connected drainages	☒Compliant ☐Non-Compliant ☐N/A			WSA (p) 3 CEMP Section 3.6	
25	Machinery and vehicles operating onsite are equipped with spill kit.	☒Compliant ☐Non-Compliant ☐N/A	Large spill kit at site laydown was low on materials. Stocked spill kit provided near active work area.	Ensure that spill kits are fully stocked at all times.	WSA (p) 2 CEMP Section 3.6	

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
26	Should suspected contaminated material be encountered (i.e., soil emitting olfactory cues indicative of hydrocarbon fuel), works should temporarily halt for investigation.	☐Compliant ☐Non-Compliant ☒N/A	No suspected contaminated material has been reported to date. EM has collected sediment samples from each of the sand recovery stations and submitted to ALS Environmental for chemistry analysis.		CEMP Section 2.5	
27	Refuelling of machinery is conducted on level ground over a spill tray.	☒Compliant ☐Non-Compliant ☐N/A	No refuelling was observed during the audit.		CEMP Section 3.6	
	Riparian Area Management					
28	Stockpile LWD and root wads removed from channel for use in site restoration	☐Compliant ☐Non-Compliant ☒N/A	No LWD or root wads stockpiled onsite.		CEMP Section 3.3	
29	Construct access points and approaches perpendicular to the watercourse;	☒Compliant ☐Non-Compliant ☐N/A			DFO FAA CEMP Section 3.2	
	Instream Works					
30	The EM shall ensure that instream works are isolated from flow and that measures are in place to protect fish and fish habitat, and to mitigate the migration of sediment downstream.	☐Compliant ☒Non-Compliant ☐N/A	EM reports from Aug 31, Sep 1 and Sep 2 show dredging of sediment in the wet occurring.	Provide adequate instream isolation and appropriate equipment to effectively dewater work area.	WSA (j) CEMP Section 3.1	
31	Pumps and flow bypasses are in proper working condition	☒Compliant ☐Non-Compliant ☐N/A	Pumps appear to be in proper working condition.		WSA (j) 5 CEMP Section 3.1	
32	Instream works conducted in the dry / isolation of flow	☐Compliant ☒Non-Compliant ☐N/A	Instream works had been conducted in the wet during the audit period.	Ensure work area is adequately isolated and dewatered prior to excavating sediment.	WSA (o) CEMP Section 3.1.1	
	Water Quality					
33	Water quality is routinely monitored upstream and downstream of the work area, every day that instream works are occurring Instream water quality is compliant with provincial criteria[2]: **Turbidity**: - <8 NTU from background at any one time for a duration of 24 h in clear waters; - < 5 NTU from background when background is 8 – 50 NTU; - <10% from background when background is > 50 NTU. **pH:** 6.5-9.0	☒Compliant ☐Non-Compliant ☐N/A	EM is routinely monitoring water quality, and halting instream works where short-term exceedances are noted. Sediment curtains have been installed downstream of instream works. Excavated sediment is being used to fill the sandbags that are installed for instream isolation. Occasionally the sandbags tip over or rip when being relocated, resulting in localized turbidity.	The contractor must exercise due care when handling sandbags instream and the EM to provide appropriate guidance to mitigation any potential risk to fish and fish habitat.	WSA (s) CEMP Section 3.1.2	
	Fish and Wildlife Protection					
34	Full time monitoring for fish during instream works is occurring.	☒Compliant ☐Non-Compliant ☐N/A	EM is onsite full time		WSA (j) 6 CEMP Section 2.4	

[2] British Columbia Ministry of Environment and Climate Change Strategy. 2024. British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture - Guideline Summary – August 2024. Water Quality Guideline Series, WQG-20. Prov. B.C., Victoria B.C. Available at: https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-guidelines/approved-wqgs/wqg_summary_aquaticlife_wildlife_agri.pdf. Accessed August 2024.

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
35	Fish salvages are conducted in advance of instream works where required.	☒Compliant ☐Non-Compliant ☐N/A	EM is conducting salvages in advance of sediment excavation.		CEMP Section 3.1 WSA (j) 6	
36	Salvaged fish are relocated back to the same watercourse in a nearby area that is not impacted by construction or removal works or its zone of influence	☒Compliant ☐Non-Compliant ☐N/A	EM is relocating fish outside the isolated work zone.		DFO FAA Section 2.2.4	
37	Pump intakes are screened for fish and aquatic species in accordance with the "Interim code of practice: End-of-pipe fish protection screens for small water intakes in freshwater"	☒Compliant ☐Non-Compliant ☐N/A	Conditionally compliant - pumps were situated within a mesh box. EM report dated Aug 31 notes that pump was field-fitted with a minnow trap as a fish-friendly screen.	Pumps should be fitted with appropriate fish exclusion screens designed for the intended purpose.	WSA (j) 5.ii DFO FAA Section 2.4.9 CEMP Section 3.1.1	Photo 6
38	Obtain required permits prior to salvage(s).	☒Compliant ☐Non-Compliant ☐N/A	EM has obtained salvage permits.		WSA (Opening) CEMP Section 3.1	
39	EM is on site during disturbance to riparian vegetation and conducting pre-clearing breeding bird surveys prior to clearing.	☒Compliant ☐Non-Compliant ☐N/A	EM is conducting nest surveys at stations as required.		CEMP Section 3.2	
40	Instream works are conducted so as not to lead to fish stranding or other impacts to fish. The works shall not result in depressions that have the ability to trap fish and other aquatic life. Fish passage is maintained where practicable and in accordance with applicable permits.	☒Compliant ☐Non-Compliant ☐N/A	Instream works have been designed to maintain fish passage after completion. Upstream fish passage is impeded due to turbidity curtain installed across the channel.	EM must be monitoring for fish full-time and should have a plan for moving adult fish upstream around the work area, if observed staging below the work zone.	WSA (j) 6 (iii) WSA (u) DFO FAA Section 2.4.2 CEMP Section 3.1.1	
	Restoration Requirements					
41	Restoration plans prepared by EM for disturbed area and implemented with EM oversight	☐Compliant ☐Non-Compliant ☒N/A	Restoration plans have not been prepared yet.		WSA (w) CEMP Section 3	
42	All temporary works shall be removed on completion of the project, and the stream channel restored to its natural condition	☐Compliant ☐Non-Compliant ☒N/A	Work is still in progress.		WSA (v) CEMP Section 3	

5 DISCUSSION

5.1 Non-Compliant Items

Knotweed management

Addendum 1 to the Contract Documents for the Hatzic Emergency Works Program - Lagace Creek – SITES S-CR-14/17 requires that trimmed knotweed stems are injected with an appropriate herbicide.

Recommended action: Provide documentation of knotweed management and ensure it adheres to approved BMPs. Confirm if knotweed stems have been injected with appropriate herbicide.

Portable toilet without secondary containment

A portable toilet located at the site laydown adjacent to Dale Road did not have secondary containment. Although the toilet was more than 30 m away from the watercourse, secondary containment would prevent any potential spills from spreading beyond the immediate area.

Recommended action: Add secondary containment to portable toilet.

Dredging of sediment occurring in the wet

The emergency *Fisheries Act* authorization requires that instream works are conducted in the dry. EM reports from Aug 31, Sep 1 and 2 show dredging of sediment in the wet.

Recommended action: Contractor must adhere to the conditions of existing environmental permits and seek amendments where necessary. Works must be completed in adherence to applicable permits until amendments are approved.

5.2 Conditionally Compliant Items

Pumps to be fitted with fish screens per DFO's end-of-pipe specifications

Based on the Aug 31 EM report, pumps have been field-fitted with minnow traps to function as fish exclusion screens and may not be suitable for this purpose.

Recommended action: Pumps should be equipped with fish exclusion screens that have been designed for the intended purpose.

6 SUMMARY

A list of environmental issues outstanding to date is provided in Table 6-1, below.

Table 6-1 Tracking Table of Environmental Issues Outstanding to-Date (project commencement August 12, 2024)

Item #(s)	Issue	Date(s) Observed	Recommended Corrective Action(s)	Responsible Party
2	Knotweed material outside poly sheet containment, no herbicide treatment	August 29, 2024 September 5, 2024	Ensure that all knotweed cuttings are confined to poly sheeting. Apply herbicide to remaining stems, as appropriate. Document methodology and ensure it adheres to approved BMPs.	Contractor/EM
3	Portable toilet without secondary containment	August 29, 2024	Add secondary containment to portable toilet.	Contractor
4	Inadequate instream isolation and failed dewatering attempts resulting in instream works conducted in the wet.	August 31, 2024 September 1, 2024 September 2, 2024 (EM reports)	Need to provide adequate isolation and dewatering to maintain dry work area OR obtain permission to dredge in the wet	Contractor

Note: Items marked with an asterisk (*) were reported by the EM.

7 CLOSURE

We trust that the information in this memo is sufficient for your present needs. Should you have questions, please do not hesitate to contact the undersigned.

Prepared by:

Naomi Sands, R.P.Bio.
Environmental Scientist

Reviewed by:

Jennifer Privé, R.P.Bio.
Manager, Environmental Sciences

NS/JP

Attachments:
- Site Photographs

Attachment 1: Site photographs taken during audit visit on September 5, 2024.

Photo 1: Instream isolation and dewatering attempts are unsuccessful. 		**Photo 2: Soil stockpile < 15 m from watercourse with silt fence surrounding.** 
Photo 3: Soil stockpile >15 m from watercourse 		**Photo 4: Knotweed bagged onsite awaiting offsite disposal.** 
Photo 5: Portable toilet requires secondary containment. 		**Photo 6: Pump intakes in mesh cage.** 

Table A2: Tracking Table of Resolved Non-Compliance Issues

Item #(s)	Issue	Date(s) Observed	Date Corrected	Corrective Action(s)	Responsible Party
1	Environmental monitoring reports not received daily	August 29, 2024	September 5, 2024	Monitoring reports received daily, or following morning.	EM

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: September 5, 2024
Weather: Low 14°C, High 31°C; cloudy in the early morning, then sunny for the rest of the day

- 07:30 - Environmental Monitors (EMs) arrived on site.
- 07:35 - EMs began retrieving 9 traps from Station K and 1 trap from Station J. The trap at Station J was set for preliminary survey purposes, not for salvage, as Station J was not yet fully isolated.
- 07:45 - Two dewatering pumps were operational on-site; however, one pump was not running at its maximum capacity.
- Discharge outlets were equipped with sediment filter bags at the end of the pipe to diffuse energy and minimize turbidity issues.
- One discharge was placed on the stream bank with poly sheeting underneath and behind a silt curtain.
- The other discharge was positioned 35 m downstream of the first one in a riparian vegetation area. This discharge was eventually directed to the stream via a poly and rock spillway.
- 08:03 - Fish salvage results were as follows:
    - Two (2) prickly sculpin
    - Six (6) three-spined stickleback
    - One (1) pumpkinseed sunfish (euthanized)
- 08:12 - The contractor excavated a sump to situate the fish protection cage in a deeper location, allowing pump intakes to draw out more water efficiently and achieve required working conditions. EM monitored the work; no adverse impacts to fish or fish habitat were observed. Turbidity-related issues were not observed as sediment settled quickly.
- 08:30 - Access road construction and Japanese knotweed pruning work commenced at Station B.
- 08:43 - A United Rental Technician arrived on site to maintain and inspect the malfunctioning pump.
- The pump was successfully repaired and now operates at full capacity.
- 09:00 - The EM conducted a turbidity test at the far end discharge outlet (where discharge was placed in the riparian area and directed toward the constructed spillway) and observed a turbidity plume. However, measured turbidity remained compliant, staying within the 8 NTU above background level threshold. The initial flush from the pump, now running at full capacity, may have mobilized sediment from the stream bank. EMs recommended installing a second turbidity curtain downstream to mitigate any potential turbidity issues as pumping continued.
- 09:15 - The contractor continued installing sandbags and road plates to further reinforce the sandbag isolation and create a seal. However, underseepage flow posed a challenge in achieving water level reduction. The underseepage caused water to flow through the porous materials beneath the sandbags, which in turn began dislodging and transporting sediment outward. This can lead to erosion issues, potentially affecting the stability of the isolation structure.

- 10:00 - Turbidity plume was no longer observable.
- 10:50 - Second turbidity curtain was installed.
- 11:00 - EMs continued monitoring water quality throughout the day at hourly intervals.
- 12:20 - The contractor repositioned the pump intakes along with the screen protection cage at a deeper water level. Additional sandbags were placed to seal any interstitial gaps.
- 15:52 - EMs conducted an invasive species assessment on the east bank of Lagace Creek at Stations D and F.
- 16:00 - Despite maximum efforts to achieve "in-the-dry" conditions, the attempt was unsuccessful. Pumps were shut off for reassessment, and work was concluded for the day.
- 16:54 - EMs measured Dissolved Oxygen (DO) before setting minnow traps. Result: 9.03 mg/L
- 17:10 - 10 minnow traps were set in Station J.
- 17:50 - EMs visited Station B and documented that Knotweed had been pruned and disposed of in bulk bags.
- An access road was constructed using geofabric and geogrid overlaid with gravel to protect and separate machinery from plant material.
- 17:55 - EMs departed from the site.
- Water Quality Sampling Results:

Location	Time	Turbidity (NTU)
Discharge 1 (downstream from L)	8:17	8.10
Discharge 2 (downstream from K)	8:20	4.59
BG (Station I)	8:28	4.26
15 m downstream from discharge 1	9:05	9.23
15 m downstream from discharge 1	10:14	6.28
Discharge 2	10:27	6.33
Discharge 1	11:08	5.38
Discharge 2	11:10	4.52
Downstream from L	12:17	4.30
Downstream from K	12:21	4.40
Downstream from L	13:11	5.05
Downstream from K	13:16	5.34
Downstream from L	14:36	4.37
Downstream from K	14:40	5.40

Site Photos






September 05, 2024 9:44 a.m.


September 05, 2024 9:59 a.m.


September 05, 2024 11:04 a.m.


September 05, 2024 11:52 a.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

DAILY CONSTRUCTION REPORT

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	11
Project:	Legace Creek	**Page:**	1 of 6
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 6, 2024
Contract No.:		**Temperature:**	High: 31 Low: 19
Weather:	Clear skies. Winds light and variable		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Labour Force:

Quantum Murray (QM): 2 Site Superintendents, 2 Operators, 3 Labourers
Keystone Environmental/Environmental Monitors (KE/EM): John and Loc
Associated Engineering (AE): Jack Dai Tang, Vinizza Pingos

Contractor's Equipment:

2 - Hitachi ZX350LC-6 Long Reach
1 - DEERE 544K Wheel Loaders
2 – Tandem Truck
2 – 6" Vacuum Assisted Pumps (Not in operation)

Report, if, any, Contact with Occupants:

N/A

Contact with Owner:

N/A

Safety Concerns:

N/A

Testing:

No constant water sample testing was conducted as there was no pump in operation at Station K. EM performed one water testing at upstream and one water testing at downstream when the fallen sandbags were discovered at Station K.

Traffic Control:

Two traffic control vehicles
Two traffic control persons

Report:

7:00 AM – 7:50 AM

- Arrived at Site 14/17 at 7:00 AM
- Station K
    - No work was performed. QM indicated that they are awaiting DFO's response.
- Jem discussed coordinating with the owner of the land on the opposite side of Station D & F, as they plan to stock sandbags there. He also mentioned that they will be filling sandbags today.
- At 7:16 am, Keystone (Loc & John) arrived on site. Loc mentioned they will collect the fish trap at Station J today.
- At 7:20 am., Station L: Ongoing filling and hauling of bags from Station L to Station I.
- At 7:43 am., 10 bags have been hauled from Station L.
- At 7:50 am., No traffic management observed along Dale Road.

7:50 AM – 9:30 AM

- AE inspectors attended the daily site construction meeting.
    - It was noted that QM had submitted a field memo requesting clarification on Site 14 at Stations B2/B3/C2 and the extent of work at Site 17.
- At 8:55 am., AE Inspectors returned to site. Traffic management is in place on site along Dale Road.

9:00 AM – 12:00 PM

- Station I
    - QM filled up sandbags using sand materials from Station E and transported them to the sand recovery station at Station F.
    - At 9:00 am., 33 bags hauled from Station L.
    - At 9:27 am., began trimming and brooming.
    - At 9:45 am., QM completed trimming the area.
    - At 9:40 am., completed filling and hauling bag to Station I: 44 bags in total.
- Station H
    - At 9:48 AM, the QM excavator operator arrived at Station H and began trimming and brooming. The EM witnessed this and urgently requested the operator to stop the work, as it had not been authorized due to the presence of knotweed. However, the excavator made contact with the knotweed. The EM requested QM to brush and wash the excavator bucket at Station H as mitigation.
- Station F
    - QM mobilized one excavator to approach the existing sand recovery station.
    - At 11:45 AM, under EM's supervision, trimming and brooming were conducted to obtain access to the station.
    - QM noted that they had obtained approval from the landowner to remove the existing fences on the south bank. AE inspectors confirmed with QM that the fences will be reinstated with new ones once the work is completed at Station F.
    - An access road was built using sand materials extracted from Station E.
    - QM filled up sandbags using sand materials from Station E and transported them to the sand recovery station at Station F.
- Station B2/B3
    - QM continued to transport gravel materials to complete the access road to the stations.

- At 10:35 AM, it was observed that the culvert was covered by the gravel materials. QM was notified, and it was confirmed that the culvert will be cleared afterward.
- At 10:39 am., Glenn mentioned that approximately 16 loads have been delivered on site.
- Approximately 32 meters of length have been covered with gravel, Combigrid underneath.

12:00 PM – 2:30 PM

- Station D
  - QM noted that they had obtained approval from the landowner to remove the existing fences on the south bank. AE inspectors confirmed with QM that the fences will be reinstated with new ones once the work is completed at Station D.
  - QM began trimming and brooming to gain access to the station.
- Station F
  - QM continued filling sandbags with sand from Station E and transporting them to the sand recovery station at Station F.
- Station C2
  - The EM indicated that trimming and brooming could commence at Station C2, with careful consideration of the nearby knotweed.

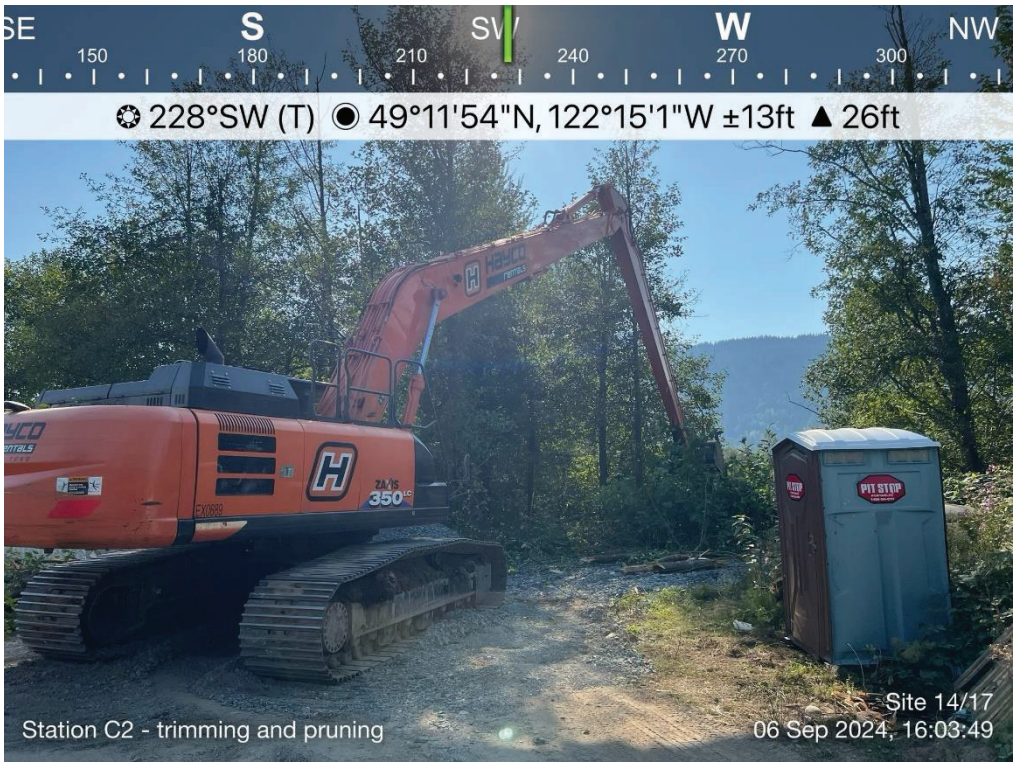
12:00 PM – 4:00 PM

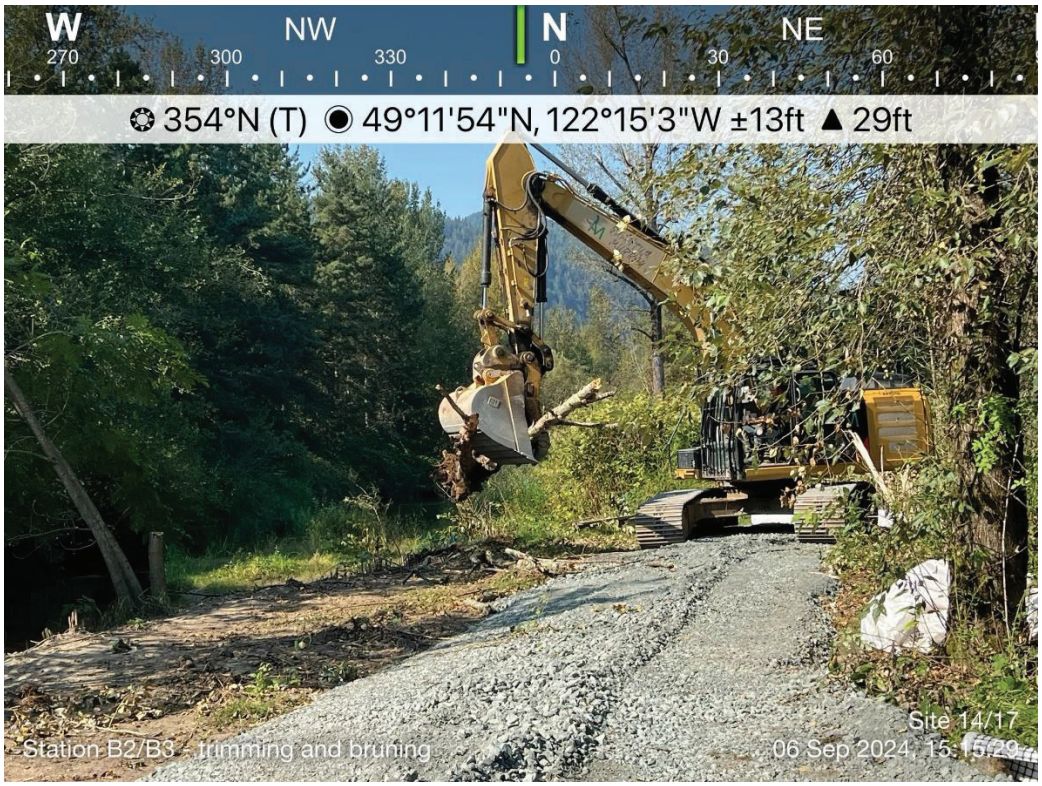
- Station K
  - At 2:35 PM, AE inspectors and the EM arrived at Station K and observed that one of the sandbags had fallen, allowing water to flow into the station. The EM indicated that Station K was no longer isolated and would require environmental procedures (including but not limited to fish salvaging, placing minnow traps, and electrofishing) to meet the requirements.
  - The EM notified QM, and it was confirmed that QM would rectify the issue immediately.
  - AE inspectors observed that spill trays under the pumps (not in operation) were not placed properly. They notified the EM, who adjusted the spill tray and reminded QM to ensure spill trays are placed when equipment is not in operation.
- Station D
  - At 2:26 PM, AE inspectors and the EM observed a broken pipe at the access road on the southeast side of the creek, with minor outflow. The EM noted that the pipe had been discovered and documented previously but without any observed flow.
  - The water flowed toward the farmland, not into the creek.
- Station E
  - At 1:00 p.m., hauled the 18 bags from E to Station F.
  - At 1:05 p.m., began filling up the sandbags.
- Station F
  - Filled and hauled 30 sandbags from E to Station F.

- At the temporary access road
  - At 3:50 pm., Mel is fixing and clearing the culvert, which is covered with gravel.

4:00 PM – 5:00 PM

- Station K
  - At 4:20 PM, AE inspectors were unable to access Station K due to trimming and brooming at Station C2. AE inspectors contacted the EM, who confirmed that QM had placed the sandbag to re-establish the isolated area. The EM also conducted electrofishing within the isolated station.
- Station C2
  - At 4:00 PM, QM began trimming and brooming around Station C2 with the EM's authorization. Knotweed was identified in the area, but the EM advised QM to avoid it during the work.
- QM shut down for the day at 5:00 PM.
- AE inspectors confirmed that Station K had been re-established and left the site at 6:10 PM.


SE S SW W NW
150 180 210 240 270 300
228°SW (T) 49°11'54"N, 122°15'1"W ±13ft 26ft
Site 14/17
Station C2 - trimming and pruning
06 Sep 2024, 16:03:49


W NW N NE
270 300 330 0 30 60
354°N (T) 49°11'54"N, 122°15'3"W ±13ft 29ft
Site 14/17
Station B2/B3 - trimming and pruning
06 Sep 2024, 15:15:29


S SW W NW
180 210 240 270 300 330
254°W (T) 49°11'49"N, 122°15'14"W ±13ft 26ft
Station H - Contractor Brushing and Washing Excavator Bucket
Site 14/17
06 Sep 2024, 10:10:03


E SE S SW
90 120 150 180 210 240
161°S (T) 49°11'44"N, 122°15'14"W ±13ft 20ft
Station K - Fallen Sandbag and no longer isolated station
Site 14/17
06 Sep 2024, 14:31:15

RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: September 6, 2024
Weather: Low 15°C, High 32°C; clear skies and sun throughout the day.

- 07:15 - Environmental Monitors (EMs) arrived on site.
- 07:20 – EM discussed with QM on grubbing work and the potential of collapse bank along the south side bank (farm side) at Station D and F where lock blocks were not installed.
- 07:45 - EMs began retrieving 10 traps from Station J.
- 07:50 - Two dewatering pumps were l on-site, located in proximity to Station K.
    - *In-stream work was not observed as the crew was waiting for permission to dig and updates on DFO authorization work condition.*
- 08:10 - Fish salvage results were as follows:
    - Four (4) prickly sculpins
    - One (1) Coho Salmon
- Fishes were released behind the 2nd silt curtain downstream from Station L
- 08:25 – EMs re-trapped Station J. Ten (10) minnow traps were set. DO = 8.84 mg/L
- 09:00 - Access road construction and Japanese knotweed pruning work continued at station B2, B3 and B. Geotextile and geo rids were used to build the access road. Gravels were placed on top of the georids (300) as per drawing to prevent disturbance of contaminated ground. Pruned knotweeds were observed storing in the sandbags to dispose off site.
- 09:26 – Grubbing work at station I commenced after Ems completed invasive species survey.
- 09:45-10:22 – Operator of the long reach machine unintentionally conducted grubbing work at station H, where knotweed was found just west of already grubbed area. EMs discussed with QM's crew and recommended them to clean the bucket with brushes and water prior to any grubbing work commence at station D and F. Ems documented the cleaning task and checked for any potential knotweed parts. The bucket was deemed clean shorty after and continued grubbing work at station F.
- 10:33 – BG sample collection ⍰ See table
- 11:22 – Grubbing work at station F on both sides commenced after EMs completed invasive species survey.
- 12:40 - Grubbing work at station D on the south side commenced after EMs completed invasive species survey
- 13:05 – More sandbags were made at station E.
- 13:10 - EMs conducted an invasive species assessment at Station C-2. No invasive species was observed within the footprinted.
- 14:31 – Sandbags on the downstream end of station K failed and a breach was observed. The Site was no longer deemed as isolated. QM was notified immediately.
- 14:40 – QM's crew was reminded that all equipment on Site is required to have spill tray in place to prevent any potential leakage during the duration of the project.

- 14:45 – EMs retrieved 10 traps in Station J. No fish was caught.
- 15:00 – QM reinstated Station K with sandbags.
- 15:48 – Isolation work for station K was completed.
- 16:00 - EMs conducted 2 passes of Electrofishing (Pass 1 = 496 seconds, pass 2 = 349 seconds). Second pass observed with significantly reduction in number of fishes.
    - Results: One(1) coho, Four (4) sculpins, and One (1) pumpkinseed sunfish (euthanized)
- 16:22 – QM commenced grubbing work at station C-2.
- 17:12 – EM set 10 minnow traps along the bank at station K.
- 17: 36 – EMs inspected all equipment on Site at the end of workday. Spill trays were observed in place.
- 17:40 – EMs debrief with KEL's PM.
- 18:00 – EM left the Site
- Water Quality Sampling Results:

Location	Time	Turbidity (NTU)
BG (The Bridge)	10:33	3.93
Downstream from L	14:40	5.41

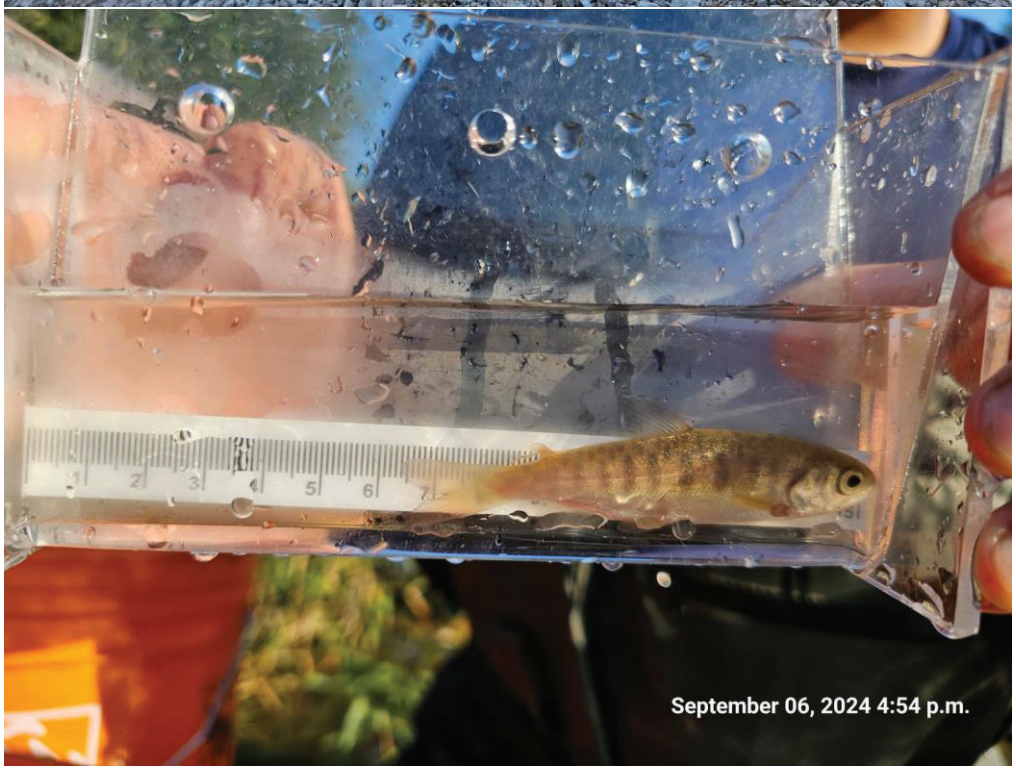
Site Photos




DEERE
SPILL KIT
September 06, 2024 5:25 p.m.


September 06, 2024 2:30 p.m.


September 06, 2024 5:27 p.m.


September 06, 2024 4:54 p.m.


September 06, 2024 5:26 p.m.


HAYCO
rentals
September 06, 2024 9:32 a.m.


September 06, 2024 5:15 p.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

DAILY CONSTRUCTION REPORT

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	12
Project:	Legace Creek	**Page:**	1 of 5
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 7, 2024
Contract No.:		**Temperature:**	High: 27 Low: 16
Weather:	Clear skies, winds light and variable		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Labour Force:

Quantum Murray (QM): 2 Site Superintendents, 2 Operators, 3 Labourers
Keystone Environmental/Environmental Monitors (KE/EM): Loc and Curbin
Associated Engineering (AE): Jack Dai Tang, Vinizza Pingos

Contractor's Equipment:

2 - Hitachi ZX350LC-6 Long Reach
1 - DEERE 544K Wheel Loaders
2 – 6" Vacuum Assisted Pumps (Not in operation)

Report, if, any, Contact with Occupants:

N/A

Contact with Owner:

N/A

Safety Concerns:

N/A

Testing:

N/A

Traffic Control:

N/A

Report:

7:00 AM – 7:50 AM

- Arrived at Site 14/17 at 7:00 AM
- At 7:00 AM, hauling of sandbags from Station I to Station F (on the other side) was ongoing.

carbon neutral since2009

BEST MANAGED COMPANIES Platinum member

- At 7:50 AM, AE inspectors confirmed with QM the plan for the day. QM indicated they would finish placing sandbags up to Station F, proceed with general site cleanup, and likely shut down the site early. No work is anticipated tomorrow. (September 8th, 2024)
- Station K
    - No work was performed. QM mentioned they are still awaiting a response from DFO.
- Station F
    - At 7:20 AM, AE inspectors observed that sandbag placement in the stream was approximately 25% complete. AE inspectors did not capture the action nor the EM and were unable to determine when the sandbags were placed. The EM later confirmed that QM placed the sandbags near the end of the day on September 6th, 2024. At that time, the EM was working on electrofishing at Station K while AE inspectors were at Station C2 documenting trimming and pruning activities. The EM admitted that they authorized QM to place sandbags into the stream at Station F if the EM is on site. EM was on site but in Station K.

7:50 AM – 9:00 AM

- AE inspectors attended daily site construction meeting.
    - AE inspectors were instructed to confirm with the EM regarding chemical treatment for knotweed.
    - AE inspectors were reminded to take photos of the stations at the end of the day.

9:00 AM – 12:30 PM

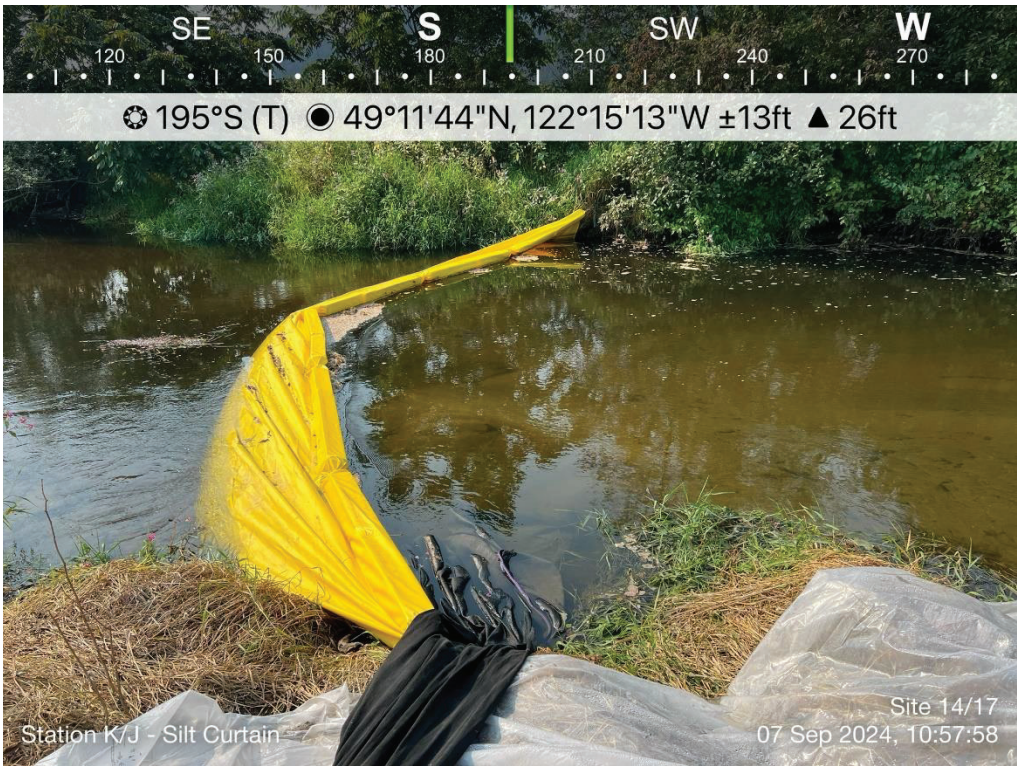
- Station F
    - At 9:00 AM, AE inspectors observed QM continues to place sandbags into the stream for isolation.
    - At 9:30 AM, AE inspectors noted that excavators were operating on both sides of Station F. AE inspectors confirmed with the EM that QM had been reminded that the excavators should only operate at the sand recovery stations, which are designed to support the load and prevent bank failure. AE inspectors directly reminded QM again of this requirement and emphasized the potential consequences of bank failure, such as fines from the DFO.
    - At 10:35 AM, the excavator on the other side (without SRS) completed placing the sandbags and then mobilized to Station L for general cleanup on site.
    - The QM superintendent mentioned that a relevant RFI had been submitted to AE regarding working from both sides of the creek at Station D/F. When asked if a response had been received, the QM superintendent stated that he was unaware of any response but decided to proceed with the work on both sides of the creek at Station F.
    - At 11:25 AM, QM began placing a silt fence and poly sheet beside the lock block, extending to the end of the cleared area.
    - At 11:50 AM, approximately 95% of the isolation was completed. QM noted that they left an open area since they are not digging yet, allowing water to pass through.

- Station B
    - At 9:37 AM, AE inspectors, the QM superintendent, and the EM conducted a walkthrough of Station B. It was observed that there was an excessive amount of knotweed. The QM superintendent consulted the EM on removal procedures. The EM recommended trimming the knotweed stems, disposing of them appropriately, and then placing geotextile and gravel as required.

- General
    - At 9:13 AM, AE inspectors consulted with the EM regarding knotweed mitigation procedures, including the use of chemical treatment.
    - The EM explained three (3) levels of approaches to deal with knotweed.
        1. Identify the extent of knotweed and work around it.
        2. Trim the stems, dispose of the knotweed properly, and place geotextile and gravel as required.
        3. Inject chemicals into the knotweed's stems. However, the EM noted that chemical treatment is the last resort, given the proximity to the stream. A special chemical is available for use near streams, but it is only accessible through the province.
    - At 10:35 AM, the EM discussed with AE inspectors on current environmental concerns:
        1. Some clearing and grubbing were done on the pathway to access the sand recovery station at Station F. The EM advised QM to implement ESC measures, such as silt fencing and tarps for runoff protection.
        2. The EM observed debris accumulating on the silt curtains downstream. The EM advised QM that the silt curtains are only required during sediment removal at the stations and can be removed when no work is being performed.
        3. As QM placed sandbags at Station F, the EM monitored water quality downstream every hour.
        4. QM is not expecting to work tomorrow (September 8th, 2024) and was advised by the EM to move the 6" pumps away from Station K as a precaution against oil spills into the stream.
    - QM conducted a general site clean up,
    - QM removed the silt curtains.

12:30 PM – 1:00 PM

- At 12:30 PM, QM shut down Site 14 for the rest of the day.
- At 12:40 PM, QM, EM, and AE inspector arrived at Site 17 to discuss upcoming work.
- QM indicated that they plan to begin work at Site 17 on Wednesday (September 11th, 2024).
- QM intends to use a hydrovac truck to complete sediment removal at Site 17 STA 3+750.
- QM emphasized the need for someone to mark the work limits at Site 17, STA 4+000. AE inspectors reminded QM to refer to the general notes on the construction drawings or submit a RFI if needed.
- QM confirmed that no work is planned for Sunday September 8th, 2024.


SE S SW W
120 150 180 210 240 270
195°S (T) 49°11'44"N, 122°15'13"W ±13ft 26ft
Station K/J - Silt Curtain
Site 14/17
07 Sep 2024, 10:57:58


NE E SE S
30 60 90 12 150 180 210
122°SE (T) 49°11'50"N, 122°15'9"W ±13ft 26ft
Station F - Placing Sandbags
Site 14/17
07 Sep 2024, 09:01:06



Station F: Placing sandbags from both sides (w/ and w/o SRS)



RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: September 7, 2024
Weather: Low 15°C, High 29°C; clear skies and sun throughout the day.

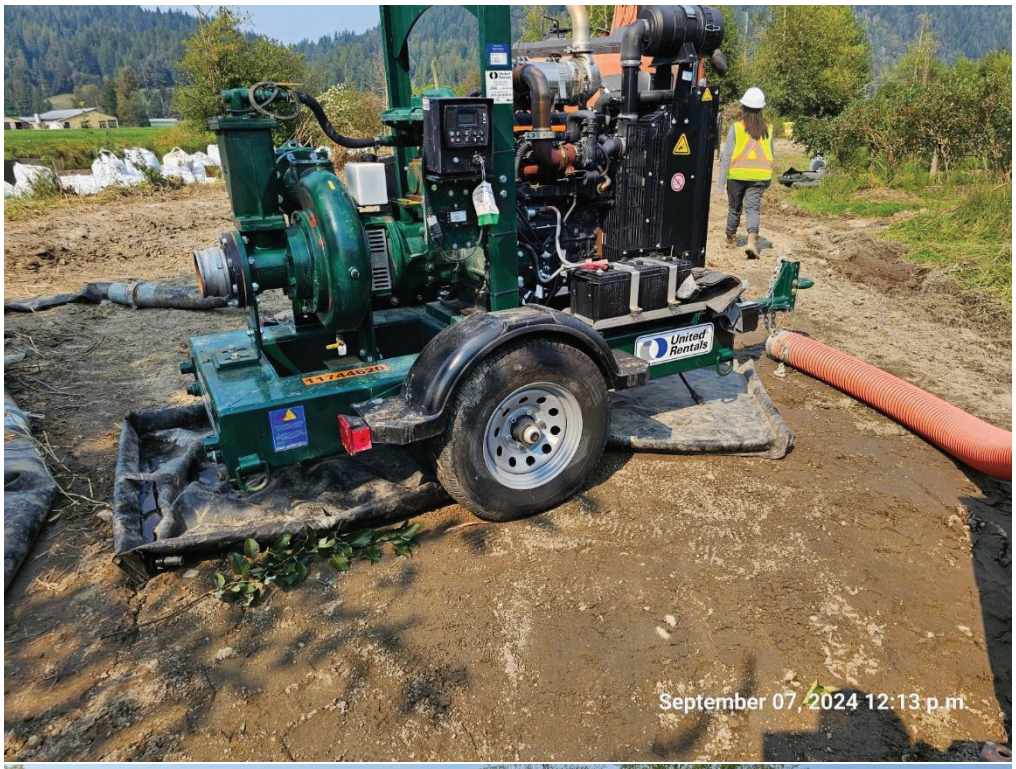
- 07:15 - Environmental Monitors (EMs) arrived on site. WQ was collected by EM throughout the day during instream work. See WQ table for more details.
- 07:30 – EA discussed with EMs and brought up concern that the contractor started placing sandbag instream prior to EM arrival. EMs discussed with QM and was informed that sandbags were placed on September 06, 2024, shortly after the grubbing work completion.
- 07:52 – QM commenced sandbag berms installation after EM collected Background Water Sample.
- 08:15 – EM pulled 10 traps from station K.
- 08:40 - Fish salvage results were as follows:
    - Six (6) prickly sculpins
    - One (1) Coho Salmon
    - Three (3) pumpkin seed (euthanized)
- Fishes were released downstream from Station L
- 09:06 – Loader moved sandbags from station I to F.
- 10:29 – EM was informed that there will be no work (to be confirm) on Sunday September 08. EM discuss with QM's personnel on current environmental concerns:
    - Exposed area at station F, resulting from grubbing work on September 06, required additional ESC measures such as silt fencing and poly sheeting to prevent potential runoff sediment.
    - EM observed debris accumulation by the silt curtain downstream from station K. Since there would be no excavation or water pumping, EM recommended that silt curtain could be removed and reinstall later when instream works commence.
    - Potential bank erosion where sandbags berm isolation located was brought up by the EM. Recommendation included installing road plates to protect the bank from potential erosion if deemed necessary.
    - All equipment stored on Site required spill tray in place (2 long reach excavators, 1 excavator and 1 loader). Two (2) 6 inches pumps shall be relocated away from the Creek and protected with spill trays.
- 10:50 – QM installed additional ESC measures at station F.
- 11:44 – QM cleaned up Site, removing used materials and trashes such as used poly sheeting, silt fencing etc. Pumps were relocated away from the creek and spill tray was installed.
- 11:45 – Sandbags placement work completed.
- 12:25 – EM received confirmation work will be canceled on September 08, 2024.
- 12:30 – QM crew, EAs and EM visited CR17 Site.
- 13:15 – End of Day. EM debriefed with PM and left Site shortly after.

- Water Quality Sampling Results:

Location	Time	Turbidity (NTU)
BG (The Bridge)	07:42	3.55
Downstream from G	08:17	2.87
Downstream from G	09:18	3.25
Downstream from G	10:52	5.06
Downstream from L	12:10	1.68

Site Photos




United Rentals
September 07, 2024 12:13 p.m.


September 07, 2024 11:47 a.m.


September 07, 2024 8:41 a.m.


September 07, 2024 12:07 p.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	9
Project:	Legace Creek	**Page:**	1 of 6
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 9, 2024
Contract No.:		**Temperature:**	High: 20 Low: 14
Weather:	Overcast/Drizzle		

September 9, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Mel), Jim, 2 operator, 2 labourers
Keystone Environmental: EM (John) (Kang)
Flaggers: 2

Contractor's Equipment:

-Equipment in Use

- CAT Excavator 324E
- Zaxis Excavator EX0689
- Zaxis excavator 2720
- Deer Loader 1466
- Pumping equipment: generator, 2 – 6" pumps.

Report, if any, Contact with Occupants:

10:30AM

- Discussion with land owner (Bob), AE (Jordan, Vinizza), Leq'a:mel (Melissa) –
- Bob owns land south of blueberry farm parcel (Jahoolie?). Land Bob owns is outside of construction zone.
- Bob expressed great concern with Jahoolie placing an electrical cord in the creek.
- AE (Jordan) – explained if it is outside of our construction zone, it is out of our control.
- Bob said electrical cord is south of SRS L.
- Leq'a:mel (Melissa) – only concern from today was drip tray not under and excavator that was parked.

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

10:20AM
- Discussion with Keystone (Kang) – lot of fish caught at SRS F, going to do more passes with electro-fisher.

4:30PM
- Discussion with Keystone (John) – SRS F is fish salvaged. Placed traps in for overnight, will check in morning but should be ready for excavation.

Discussions with Contractor:

7:00AM
- Toolbox QM (Mel) – Repairing bags at SRS K.
- Moving bags from K to F.
- Still need to excavate at K.
- EM's to inspect fallen bag at SRS K, station still need to be electro-fished.

7:10AM
- Discussion with QM (Jim) – bag from SRS K fell in yesterday when no one was on site.
- Going to re-install silt curtain D/S from SRS K.

9:50AM
- Discussion with QM (Jim) – need confirmation from DFO before beginning excavation today.
- Currently E-fishing at SRS F.
- Going to be filling additional sand bags at SRS E.
- Setting up silt fence opposite side of creek from SRS D.

10:30AM
- Discussion with QM (Jim) – AE (Jordan) expressed concern working in stream from opposite side of creek, excavator not operating on lock blocks.
- Jim – no excavation will take place from this side of creek, only sand bag placing.
- Jim – QM and Mert are aware of and bank failure will be on QM. Is confident the bank will hold and is monitoring it during bag placement.

Report:

7:00AM
- AE (Jordan, Vinizza) on site.
- Observation – a lot of clearing at SRS I. Keep in mind of work is being completed not directly on lock blocks.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

7:15AM
- Installing silt curtain D/S from SRS K.

8:00AM
- Site inspectors call at SCR 15/16 – AE (Jordan, Vinizza, Duncan, Cynthia, Jordon R).

9:45AM
- AE (Jordan) – back on site SCR 14.
- Electro-fishing at SRS F ongoing.

9:50AM
- Leq'a:mel (Melissa) on site.

10:50AM
- Filling sand bags at SRS E.
- Today's count 12, all flagged.

11:30AM
- Aggregate dump for temporary access road.
- 4 Truck loads today.

12:00PM
- AE (Jordan, Vinizza) – re-measure trimming in pruning at SRS stations.
- Station trimming and pruning have been expanded since measuring initially.
- Additional trimming due to sand bag placement from opposite side of creek, and for more area for excavator to move back and forth on lock blocks parallel to creek. (Both concerns have been flagged to QM by AE (Jordan)).
- SRS F – 18x32m
- SRS F Access – 7x40m
- Opposite side of creek SRS F – 9x14m
- SRS I – 22x8m
- SRS J and K combined – 12x37m
- SRS L – 24x4m.

12:30PM
- Clearing at SRS D
- Placing gravel on geotextile on knotweed that has been trimmed.
- Knotweed in area on either side of SRS.
- EM monitoring clearing.
- Trimming knotweed on sides of SRS, placing stems/leaves in empty metre bags.
- Keystone (John) – removal required so excavator can operate without hitting knotweed with bucket.
- John inspecting cleared areas.

2:00-4:00PM

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

- AE (Jordan) on site SCR 15/16.

4:30PM

- All groups leaving site.

Testing:

- None today.

Safety Concerns:

- None today.

Traffic Control:

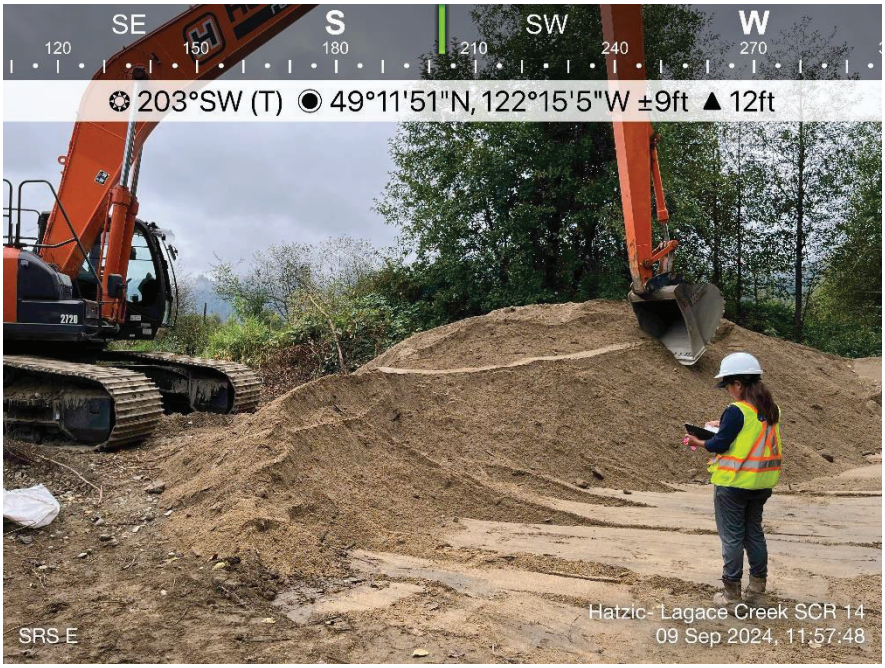
- Flaggers on Dale Road.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Photos:





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

DAILY CONSTRUCTION REPORT

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	13
Project:	Legace Creek	**Page:**	1 of 6
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 9, 2024
Contract No.:		**Temperature:**	High: 21°C Low: 14°C
Weather:	Sunny, Wind: 4 KM/H, Gusts: 13 KM/H		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Labour Force:

Quantum Murray (QM): 2 Site Superintendents (Mel & Jem), 3 Operators (Sandy, Glenn & Greg), 2 Labourers (Dallas & Rick)
Keystone Environmental/Environmental Monitors (KE/EM): Khang and John
Associated Engineering (AE): Jordan Fiske, Vinizza Pingos

Contractor's Equipment: Equipment in use

- Excavator 324E
- Excavator EXO689
- Excavator 2720
- Loader 1466
- 2 - 6" Vacuum Assisted Pumps

Report, if, any, Contact with Occupants:

N/A

Contact with Owner:

N/A

Safety Concerns:

N/A

Testing:

N/A

Traffic Control:

Green Valley Traffic Control provided traffic management along Dale Road near the bridge.

Report:

7:00 AM
- AE (Jordan and Vinizza) arrived on site.
- Traffic management was established on site.
- Hauling of sandbags from Station I to Station F continued.

7:15 AM
- Sign-in and toolbox.
- QM (Jem) reported that sandbags had fallen off at Station K. Today's work plan includes filling and hauling sandbags to Station F, awaiting the arrival of the DFO representative, and conducting fish salvage at both Station K and Station F.

7:19 AM
- Keystone (Khang & John) arrived on site.
- Station K:
    - AE inspectors observed that approximately 3-4 sandbags had fallen on the east side of the creek, in the same location as last week.
- Reinstalled turbidity curtains between Station L and Station K, and one downstream of Station L.

7:55 AM
- Attended daily construction meeting at Site 15.

8:30 AM
- AE (Vinizza) returned to site.

8:35 AM
- Station F:

Ongoing placement of sandbags.
- Station I:
    - 1 bag remaining.
- Station K:
    - 3 bags remaining.

8:38 AM
- Station K:
    - Keystone began electrofishing.

8:50 AM
- Station C2:
    - QM trimmed the area. AE inspector observed that a root had been pulled from the excavator.

9:28 AM

- Station F:
  - AE inspector observed that 1 bag (SE) had fallen off and sand had spilled. Additionally, 3 bags (center side) were not properly sealed and were exposed to water.

9:35 AM

- Station F:
  - Keystone began electrofishing.

9:50 AM

- Station F:
  - AE inspector informed QM about the fallen bottom bag and the exposed, improperly sealed bags. QM laborer responded that they would leave it as is, as it would be similar if removed.

9:56 AM

- Jem indicated that 10-12 bags would be built at Station E to be hauled to Station F and that a silt fence would be placed on the opposite side of Station D.

10:20 AM

- Station D (opposite side, without SRS):
  - QM installed a silt fence.

10:57 AM

- Station E:
  - Began filling and hauling sandbags from Station E to Station F.

11:30 AM

- Completed filling sandbags. 3 bags were hauled to Station F, and 9 bags remained at Station E.

11:57 AM

- Stations E & F:
  - AE inspectors flagged all filled and hauled bags.

12:00 PM

- Stations L, K, J, I, F:
  - AE inspectors measured the trimmed areas.
    Station F (opposite side): 9m x 14m
    Station F: 18m x 32m
    Station E to Station F (access road): 7m x 40m
    Station I: 8m x 22m
    Station J&K: 12m X 37m
    Station L: 4m x 24m

12:50 PM

- Station D:
    - QM trimmed knotweed and disposed of it in the bags.

1:30 PM

- QM Project Manager (Greg) arrived on site.

2:40 PM

- Traffic management left the site.

3:45 PM

- Keystone began fish trapping.
    - John reported that the second pass for electrofishing had been completed and that the fish trap would be left overnight.

3:57 PM

- Keystone released the fish at Station E.

4:40 PM

- QM left the site.
- Keystone left the site.

4:50 PM

- AE (Jordan & Vinizza) left the site.

Photos:


NE E SE S S
60 90 120 150 180 210
130°SE (T) 10 N 554434 5449673 ±4m 11m
Station F - silt fencing
HATZIC - Legace Creek SCR 14
09 Sep 2024, 09:23:32


SE S SW W
120 150 180 210 240 270 30
206°SW (T) 10 N 554459 5449670 ±10m 6m
Station F - electrofishing
HATZIC - Legace Creek SCR 14
09 Sep 2024, 09:52:23


NW N NE E S
330 0 30 60 90 120
41°NE (T) 10 N 554564 5449692 ±4m 5m
Station D: Trimming the knotweed
HATZIC - Legace Creek SCR 14
09 Sep 2024, 12:53:37


NW N NE E
300 330 0 30 60 90
14°N (T) 10 N 554588 5449784 ±4m 9m
Temp access road
HATZIC - Legace Creek SCR 14
09 Sep 2024, 16:38:15

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17

Environmental Monitoring Report

Date: September 9, 2024
Weather: Low 15°C, High 20°C. Cloudy throughout the day and clear skies in the afternoon.

- 07:10 - Environmental Monitors (EMs) arrived on site. A section of the sandbag dam at station K had collapsed, and water breached the area. Additional fish salvage was warranted.
- 07:30 - QM crew installed a silt curtain downstream of station K.
- A green frog was captured by the EM and euthanized following the methods and protocols as per the BC Animal Care Form and Wildlife Permit SU24-886757.
- 07:55 - QM crew started to reinstate the sandbags at station K.
- 08:10 - The EMs started electrofishing following the isolation repair at K.
- A total of 1 (one) pass of electrofishing was completed - 746 seconds on the e-fisher. Results:
    - One (1) Pacific Lamprey
    - Five (5) Prickly Sculpin
- 09:45 - The EMs conducted fish salvage at station F.
- 2 passes of electrofishing
- Station F has more suitable habitat for salmonids with characteristics such as woody debris, aquatic vegetation, and overhanging riparian vegetation.
- 1478 seconds in total
- Results are as follows:
- First pass:
    - 2 largemouth bass
    - 26 prickly sculpins
    - 1 rainbow trout
    - 3 coho salmon
    - 1 Chinook salmon
    - 2 pumpkinseed sunfish
- Second pass:
    - 7 coho salmon
    - 2 Chinook salmon
    - 1 largemouth bass
    - 7 prickly sculpin
- 10 traps were set in station F.
- 12:00 - The EMs assessed the Japanese Knotweed at Station D
- Geotextile and rock were laid on the surface where the excavator will be situated.
- The knotweed was removed to avoid accidental spreading when the excavator's counterweight swings. The EMs monitored the cutting work
- 14:00 – The EMs monitored knotweed cutting work at Station B.
- 15:30 – The EMs retrieved traps set at Sation F.

- Results are as follows:
    - 1 Chinook Salmon
    - 1 pumpkinseed sunfish
    - 10 prickly sculpin
- The traps were then reset and will be retrieved on the following day.
- 16:30 – the EMs departed from site.

Site Photos




2024-09-09 7:17 a.m.


September 09, 2024 10:09 a.m.


2024-09-09 12:37 p.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	10
Project:	Legace Creek	**Page:**	1 of 5
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 10, 2024
Contract No.:		**Temperature:**	High: 22 Low: 12
Weather:	Overcast		

September 10, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Mel), Jim, 2 operator, 2 labourers
Keystone Environmental: EM (Jeff) (Loc)

Contractor's Equipment:

-Equipment in Use

- CAT Excavator 324E
- Zaxis Excavator EX0689
- Zaxis excavator 2720
- Deer Loader 1466
- Pumping equipment: generator, 2 – 6" pumps.

Report, if any, Contact with Occupants:

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

8:40AM

- Discussion with Keystone (Loc) – knotweed at SRS B2, has been trimmed, may be burned during excavation, said that is common practice.
- Will have to verify with landfill how they want it removed from site.

5:10PM
- Discussion with Keystone (Loc) - Salvaged at SCR 17 today, caught lots of fish, set traps. Should be ready for excavation by Friday.

Discussions with Contractor:

7:00AM
- Toolbox Talk QM (Mel) – same plan as yesterday, sand bags are in place, waiting for DFO to begin excavating.

8:30AM
- Discusion with QM (Mel) – unloading lock blocks only work today.
- Unsure as of now how they are going to construct proposed SRS.
- Site walk to SCR 17 with Keystone today, unsure how they are going to clear site and remove sediment in large area.

10:50AM
- Discussion with QM (Mel) after SCR 17 walk with Keystone (Jeff) –
- Planning to start at small section when they begin at SCR 17.
- Unsure how they are going to clear the larger section.
- Going to receive a bin today so they can clean up site, not expecting any other work.

3:00PM
- Discussion with QM (Mel, Jim) –
- Unsure what vegetation is to be removed north and south of Dale road bridge – referring to dashed line (remove and dispose of existing vegetation) on drawing 2623-03-C-3102, dashed line not present south of bridge.
- Also unsure of SRS locations with vegetation in front/how far to reach.
- AE (Jordan) to confirm vegetation removal with Ryan.

3:30PM
- Discussion with QM (Mel, Jim) – following discussion with Ryan, AE (Jordan) informed QM all vegetation in dashed area is to be removed, and south of bridge whatever is necessary for excavation purposes.
- Trees in between Doug PL and creek to be removed as well.
- Jordan showing approximate areas of proposed SRS', Jim taking photos.

3:30PM
- RFI 12 – Excavation extents meeting with AE (Jordan, Jordon, Alyson), QM (Mert, Jim, Nicholas).
- Discussion regarding layout of SRS stations, what vegetation to be removed.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

- AE (Jordan, Vinizza) to layout top of bank for SRS lock blocks.
- Excavation extent to be excavator reach.
- Removal of trees at C2 to facilitate excavation.
- QM thinks clear and grub required for Site 17 – no line item in contract.

4:45PM
- Discussion with QM (Jim) – starting at 6AM tomorrow.
- Moving things around, continuing to clear proposed SRS C2 tomorrow.
- Will be clearing trees and arborist on site.
- Begin excavating for lock blocks.
- Going to move temp access road closer to property line.
- Asking AE (Jordan) to layout SCR 17, larger area.
- Jordan – referred them to drawing and stationing on drawing.
- Jordan – explained up to supervisor if they want me doing the layout, will check with Ryan.

5:30PM
- Discussion with QM (Mel, Operator) –
- AE (Jordan, Vinizza) confirmed trees and stumps in front of SRS C2 should be removed.

Report:

8:00AM
- Leq'a:mel (Melissa) on site.

8:30AM
- Lock block delivery.
- 0.75x0.75x1.5m.

1:50PM
- Disposal bin delivery.

4:00PM
- AE (Jordan, Vinizza) – layout top of bank for proposed SRS.
- Try to connect bridge abutment (Dale road) to existing SRS B.

5:15PM
- Clearing at SRS C2.

5:40PM
- Removing knotweed at SRS B.

6:10PM
- All groups leaving site.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Testing:

- None today.

Safety Concerns:

- None today.

Traffic Control:

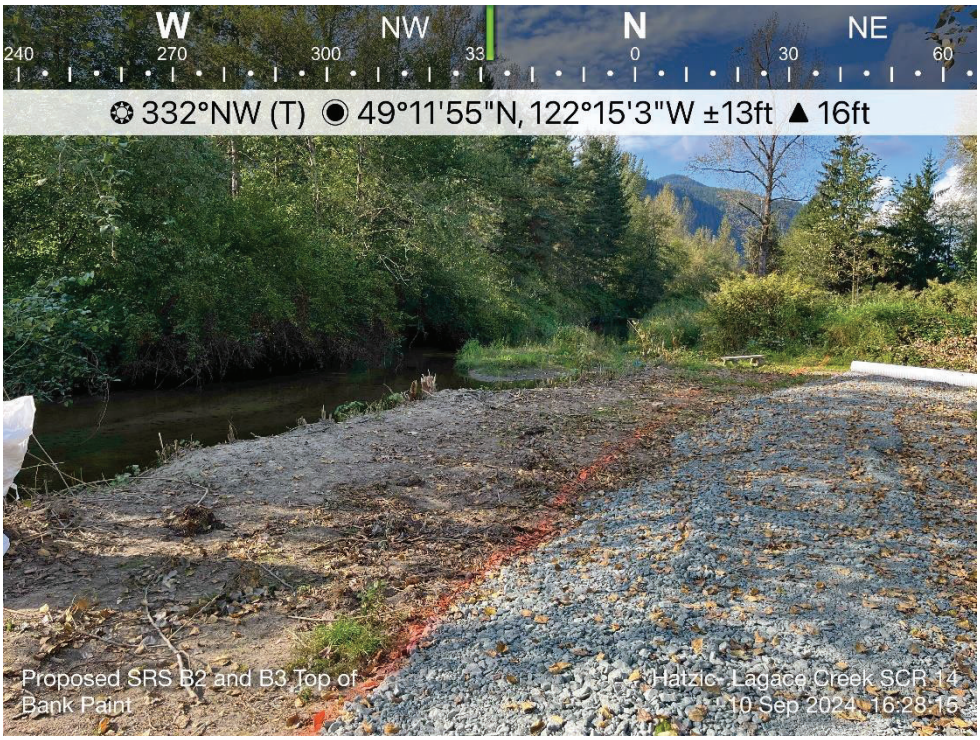
- None today.

Photos:



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: September 10, 2024
Weather: Low 14°C, High 22°C. Mix of cloud and clear skies throughout the day.

- 07:20 - Environmental Monitors (EMs) arrived on site.
- 08:00 – EMs pulled 10 traps from station F.
- Results:
    - 2 Chinook Salmons
    - 29 Prickly Sculpins
    - 1 Crawfish
    - 3 Threespine stickleback (TSS)
- 09:30 – EMs visited CR17 Site with the Site superintendent and was informed that work will occur once the CEMP is approved. Potential work day Thursday or Friday September 12&13.
- 10:46: EMs left site to pick up equipment required for fish isolations for CR17 – South.
- 12:22 – EMs commenced fish isolation work at CR17-South.
- 13:30 – Upstream and downstream fish isolations were completed.
- 13:45 – EMs conducted 4 passes of Electrofishing within the isolated area.
- Results are as follows:
- First pass – 326 seconds:
    - 15 coho salmon
    - 5 TSS
- Second pass – 136 seconds:
    - 5 coho salmon
    - 1 Rainbow trout
    - 1 Cutthroat trout
    - 1 TSS
- Third pass – 97 seconds:
    - 15 coho salmon
- Fourth pass – 335 seconds:
    - 1 chinook salmon
    - 3 TSS
    - 31 coho salmon
- 8 traps were set in CR17-South to get the remaining fishes out.
- 16:45 – EMs returned to CR14 Site and were informed that terrestrial works including grubbing of approximately 3000m2 of vegetation area at station C-2, B-2,B-3, and B will be commenced. Removal of infested knotweed soil was discuss with Jeff Prowse on Site.
- 17:00 – QM's crew pruned down the knotweed plants at station B2,B3 and B. Pruned stems and leaves were stored in the sandbags and will be hauled to designated facility.
- 15:15 – QM's operator commenced grubbing work at station C-2 with EM on Site.
- 18:15 – EMs left Site

Site Photos






September 10, 2024 5:58 p.m.


September 10, 2024 6:17 p.m.


September 10, 2024 2:48 p.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	11
Project:	Legace Creek	**Page:**	1 of
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 11, 2024
Contract No.:		**Temperature:**	High: 18 Low: 12
Weather:	Rainy		

September 11, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Mel), Jim, PM (Mert), 3 operator, 2 labourers
Keystone Environmental: EM (Vincent) (Loc)

Contractor's Equipment:

-Equipment in Use

- CAT Excavator 324E
- Zaxis Excavator EX0689
- Zaxis excavator 2720
- Deer Loader 1466
- Pumping equipment: generator, 2 – 6" pumps.

Report, if any, Contact with Occupants:

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

7:50AM

- Discussion with Keystone (Loc) – Will E-fish SRS K again today.

- Checking for frogs / knotweed at SRS B today as well.

Discussions with Contractor:

7:00AM

- Discussion with QM (Jim) – Trying to pump at SRS K this morning. If QM can get water down/out they are going to try to excavate.
- Water level in creek has come down slightly.
- QM (Jim) and Keystone (Loc) – material testing from SRS C, E, L material was clean.
- All other existing and proposed SRS are high in salt.
- SCR 17 high metallic content.

8:05AM

- Discussion with QM (Mert, Mel, Jim) –
- Mel – Not excavating for proposed SRS today. Arborist on site, will do more clearing.
- Mert – SCR 17 drawing, who do we go to for written approval for required vegetation clearing/removal as stated in drawings? AE (Jordan) – this would be submitted to Ryan or Alyson, I cannot be the one to approve that.
- Jim – asked about Jordan doing layout at SCR 17. AE (Jordan) – per the contract layout is the contractors responsibility, I won't be doing any layout at 17 unless instructed by PM's, that would be something QM would need to discuss with AE PM's.
- Jordan – QM is to determine layout/what sediment is to be removed, Mert – unsure how to determine that.
- Mert – Quantities on drawing 2632-03-C-3103 do not add to 8250 m^3. Jordan – payment will be based on the quantities removed in the field, not what is specified on drawings.
- QM (Mert) – wants to start clearing SCR 17 this week.

10:15AM

- Discussion with QM (Mel, operator) – Mel confirmed they are planning to get a surveyor out to do layout.
- AE (Jordan) – asked Mel to get surveyor to do O.G. topo of areas where proposed SRS are going to be constructed.
- AE (Jordan) – existing vegetation is to remain on existing SRS locations. Proposed SRS locations will be cleared and coconut matting installed.

12:40PM

- Discussion with QM (Jim) – QM is planning to excavate C2 without lock blocks, and build lock blocks after.
- Going to build up existing deposited sediment to drive excavator onto, and then pull the material as the excavator moves back on slope.
- Going to place sand bags and tie into existing island, thinks will be able to do this excavation in dry.
- Jim iterated QM is willing to take risk for this location.

12:45PM

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

- Discussion with QM (Mel) – Area of bush north of Dale road is smaller than appears on drawings.
- AE (Jordan) – iterated purpose is to prevent people from accessing creek. Want to open up creek best as possible.

2:40PM
- AE (Jordan) confirming discussion with QM (Jim) about excavating at SRS C2.
- AE (Jordan) made QM (Jim) aware the risks and potential consequences if an excavator ends up in the creek.
- QM is willing to take risk, thinks this is an opportunity to get a lot of material out of this section and be able to complete it in the dry.
- Only proposed location QM is planning to do this at.
- QM unsure where they will put the material after excavating.
- Planning to start excavating tomorrow.

Report:

6:30AM
- AE (Jordan) – on site.

7:00AM
- Pumping at SRS K – 2 – 6" pumps in operation. Pumping past SRS L into trees again.
- Lost sandbag – excavator back over and ripped bag.

7:35AM
- Excavating stopped – bags failing on left side of dam.

8:00AM
- Arborists on site – clearing SRS C2.

8:30AM
- Fixing bags at SRS K have been repaired.

9:20AM
- Diversion dam at SRS K has been repaired.
- Keystone starting E-fish.

10:20AM
- Pumping at SRS K.
- Right side not bad isolation, small amount of water leaking into creek.
- Left side poor isolation, lots of water coming through diversion, pump can't successfully clear area.
- AE (Jordan) – determined too wet for excavation.

10:30AM
- Moving sand bags to J – going to try pumping here today.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

12:00PM

- Trying to fix sand bag water diversion on SRS K.

1:20

- AE (Jordan, Vinizza) measuring additional clearing areas –
- B3 access road to Doug's property: 9x9m
- SRS B2 to B3 clearing along bank edge: 32x4m
- Across from SRS D: 14x5m.
- SRS D: 17x9m.

2:30PM

- Still fixing sand bags at SRS K.
- Moving filled sand bags from SRS E to SRS C2.

4:15PM

- Silt curtain delivery.

4:45PM

- E-Fish at SRS J complete.

5:00PM

- Pumping at SRS J.
- Unsuccessful – unable to divert water to dry area.

Testing:

- None today.

Safety Concerns:

- None today.

Traffic Control:

- Traffic control on Dale road.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Photos:

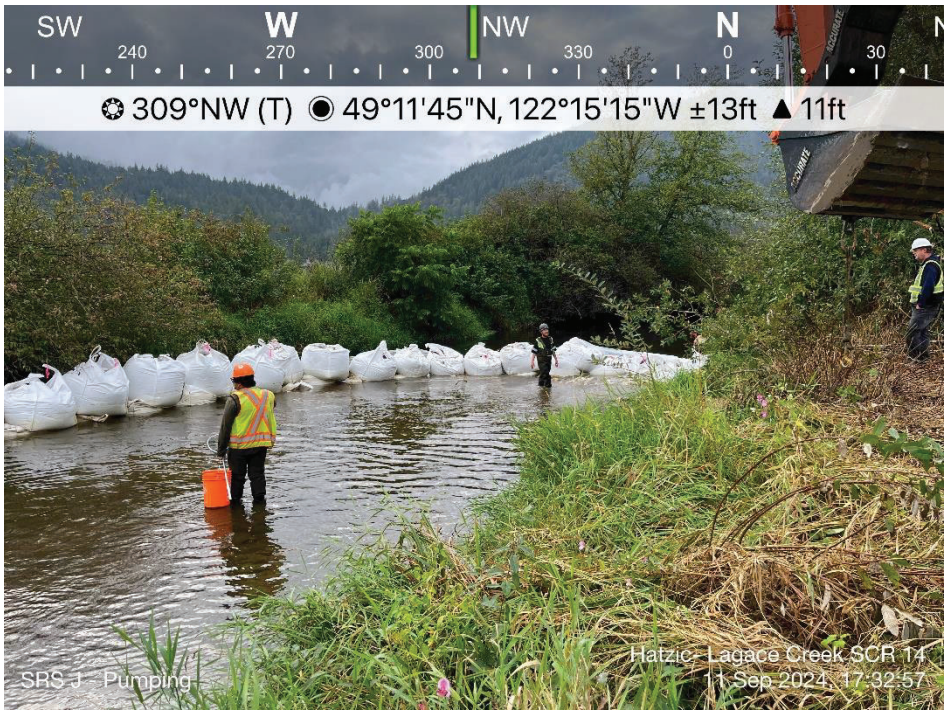




(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17

Environmental Monitoring Report

Date: September 11, 2024
Weather: Low 13°C, High 18°C. Rain in the morning and overcast throughout the day.

- 06:10 - EM arrived on site.
- 06:37 – QM operator grubbed small area to appropriately placed spill tray underneath.
- 07:25 – Pumping started at station K.
- 08:52 – QM started repair sandbag berm at station K.
- 09:16 – EM conducted 2 passes of Electrofishing at station K.
- Results: Pass 1 = 325s
    - 1 coho, 1 lamprey, 4 TSS
- Pass 2 = 416s
    - 4 lampreys
    - 1 largemouth bass
    - 1 coho
    - 4 sculpins
    - 1 TSS
- 11:00 – Grubbing work at Station C-2 and knotweed removal at station B2 and B3 commenced. EM conducted amphibian sweep prior to work commence for both Sites and did not observe any amphibian present.
- 11:41 – EMs pulled 8 traps located at CR14-South.
    - Results: 27 coho, 3 TSS, 1 chinook, 3 rainbow trout.
- 12:40 – EM completed reset all 8 traps back in CR17 – South in attempt to salvage any remaining fish in the isolated work area.
- 14:58 – EMs conducted 2 passes of Electrofishing within the isolated area.
- Results are as follows:
    - First pass – 402 seconds:
        - 5 coho salmon
        - 1 chinook salmon
        - 1 largemouth bass
        - 2 TSS
        - 5 sculpins
    - Second pass – 303 seconds:
        - 1 chinook salmon
        - 1 TSS
        - 1 Crayfish
- 15:30 – Grubbing work and sandbag hauling completed at station C-2.
- 16:58 – Completed Electrofishing at station K
- 17:32 – Started pumping at station J
- 18:06 – Dewatering work stopped. QM was not able to properly dewater station J, as well as K.
- 18:22 – QM installed poly tarp to cover newly exposed area at station C-2 to prevent potential sediment runoff to Lagace Creek.
- 18:30 – End of Workday. EMs debriefed with KEL's PM

- 18:45 – EMs left Site

Site Photos






Sep 11, 2024 2:37:19 p.m.
49.1983637N 122.25077933W
174° S


September 11, 2024 6:43 p.m.


N
W
E
S
Sep 11, 2024 11:43:17 a.m.
49.23578095N 122.21843009W
0° N


September 11, 2024 5:38 p.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	12
Project:	Legace Creek	**Page:**	1 of 7
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 11, 2024
Contract No.:		**Temperature:**	High: 21 Low: 12
Weather:	Overcast		

September 12, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Mel), Jim, 3 operator, 4 labourers
Keystone Environmental: EM (John) (Loc), +1

Contractor's Equipment:

-Equipment in Use

- CAT Excavator 324E
- Zaxis Excavator EX0689
- Zaxis excavator 2720
- Deer Loader 1466
- Pumping equipment: generator, 2 – 6" pumps.

Report, if any, Contact with Occupants:

5:40PM

- Discussion with Landowner (Doug) – AE (Jordan) – explaining QM's diversion plan using existing berm sitting in creek, shared it was part of quantity we want removed.
- Doug – wants the island removed, says it can cause debris build up and could implicate the downstream bridge with material.

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

10:15AM

- Discussion with Keystone group and QM operator – clearing knotweed at SRS B3, remaining cleared area has been deemed clean by keystone – can be disposed at regular facility.

5:00PM

- Discussion with Keystone (Loc) - insisted per the CEMP that the excavation extents of the creek area in front of SRS B is within 20m distance and 2m depth of the knotweed infested bank, therefore implying that all material excavated from this creek section is deemed contaminated.
- Equipment used for this excavation will need to stay at this location until properly cleaned.

Discussions with Contractor:

6:30AM

- Toolbox QM (James (Jim)) – going to set up sandbags at C-2, not sure when going to excavate as they do not have a place to place the excavated material without blocking the access road or double handling.
- Keystone (Loc) – wants to know when they plan to do north part of SCR 17. May take 1-2 days to fish salvage.
- QM cleaning up pumps and hoses at SRS J and K.
- AE (Jorda) – releasing field memo regarding discussing of operating excavator off of SRS blocks.

8:45AM

- Discussion with QM (Mel) and Keystone –
- SRS B knotweed has been trimmed and removed, cloth and gravel placed on time of cut plant.
- QM has determined extent/location of lock blocks for SRS B.

12:00PM

- Discussion with QM (James), AE Enviro (Dave), AE (Jordan) –
- QM – SRS B has lots of knotweed, entire excavation will need to be treated as contaminated. Knotweed on island in middle of creek.
- QM unsure if material placed under temporary access road to B3, B2, B is combi grid.
- AE (Jordan) – confirm combi grid is to be placed under access road and at SRS, should be same material.

2:00PM

- Discussion with QM (James) – hauling contaminated material from SRS B tomorrow. Will load right into truck from creek. 4-5hr round trip.
- 4 trucks coming hold about 8m3 each.

4:30PM

- Discusison with QM (Jim) –
- AE (Jordan) – made Jim aware the berm they tied their sand bags into for water diversion is part of the quantity we want to remove.
- Jim – the excavator can not reach any further.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

5:20PM
- QM (James) confirming AE is aware of there plan for excavation and hauling to contaminated site.
- AE (Jordan) – going to talk to Ryan.

Report:

7:30AM
- Placing sand bags at C-2.
- Complete at 8:30AM.

9:00AM
- Cleaning pumps and hoses at SRS K and J

10:00AM
- Surveyor on site, shooting control points along access road.

10:00AM
- Excavator smoothing access road near SRS L.

11:30PM
- Placing sandbags at SRS B.

12:00PM
- AE Enviro (Dave) on site.
- Shifting SRS B3 access road closer to property line.

1:00PM
- Electo-fish at SRS B
- Small sand bags filled at E

2:00PM
- Filling sand bags at SRS E
- 10 Filled – hauled to SRS B

3:10PM
- Loading clearing and grubbing bin.

3:30PM
- Start pumping at SRS B
- 2 – 6" pumps.

4:30PM
- Excavating:

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

- Water diversion at SRS B was done using sandbags that tied into the existing berm in the middle of the creek. Bags were placed on the upstream and downstream ends of the diversion.
- AE (Jordan) made QM (James) aware the berm is part of the quantity we want to remove; James insisted the excavator could not reach the outskirts of the berm.
- Pumping with 2 – 6" pumps out of the isolation. Overall, the isolation managed to lower the water level. Small amounts of water were seeping under the sand.
- Began excavating to the left of SRS B, initially were excavating this material and using it to reinforce the berm on the right side, QM (James) said this material would be removed at the end of excavation.
- 5:40PM - The excavated side of the isolation began to fill up, it was expected to be lower than the ground water level, shut the pumps off and continued to move material from the left side of the isolation and stockpile it on the right side of the isolation.
- James current plan is to have this pile (currently sitting in the isolated work area) surveyed tomorrow morning before they plan to haul it off to a contaminated site.
- The disposal facility is 2 hours away (4 hour round trip) and they have 4 trucks (8m^3 in volume) coming to haul.

6:00PM

- Done excavating - shutting down for day.

Testing:

- None today.

Safety Concerns:

- None today.

Traffic Control:

- None today.

Photos:

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

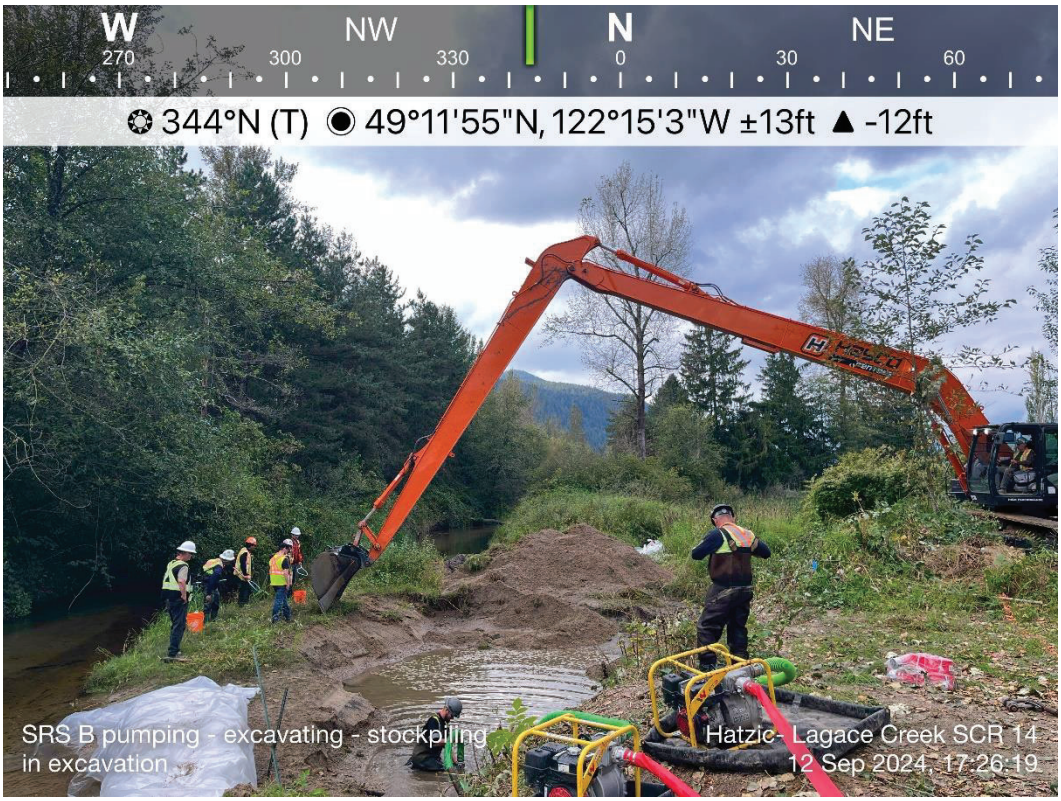
ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

TECHNICAL MEMORANDUM

Issue Date:	September 13, 2024	**File:**	Audit No. 3
To:	**Thyren Jacobs, Flood Debris Management Secretariat**	**Previous Issue Date:**	
From:	Dave Muhlert, R.B.Tech. and Naomi Sands, R.P.Bio.		
Client:	Ministry of Environment and Climate Change Strategy		
Project Name:	Lagace Creek Bank Protection and Sediment Removal - SCR14	**Project No.:**	2022-2632-03
Subject:	Environmental Compliance Audit		
Monitoring Period:	September 6, – September 12, 2024		
Contractor:	QM Environmental		
Environmental Monitor:	Keystone Environmental		

1 INTRODUCTION

Associated Environmental Consultants Inc, (Associated) is pleased to provide this environmental audit report summarizing observations of site conditions, environmental protection measures, regulatory compliance, and corrective actions as part of erosion protection works on Lagace Creek, south of Durieu, BC in the Hatzic Valley (the Project, the Site) during the monitoring period September 6 to September 12, 2024. The results presented in this audit report are based on conditions observed at the time of the audit inspection(s) and represent a snapshot of the workday. Items identified as non-compliant may have been addressed before the report(s) are submitted. The audit report(s) are submitted to the owner, their agent (Associated Engineering), the Contractor, and their environmental monitor (EM) and are not intended for further distribution.

2 ROLES AND RESPONSIBILITIES

The prime contractor for the Project is QM Environmental (the Contractor), and works are being monitored for environmental compliance by Keystone Environmental (Keystone) and audited by Associated. As the EM, Keystone is to work with the Contractor to develop measures to protect the environment and to respond to environmental incidents as they occur. Keystone is also responsible for fish and wildlife salvages prior to instream works. Leq'á:mel First Nation (LFN) is the cultural monitor for the Site. The responsibility of the auditor is to ensure on behalf of the owner, who is ultimately the permit holder, that the EM, LFN, and the Contractor adhere to the requirements of the Construction Environmental Monitoring Plan (CEMP)[1], environmental permit conditions and any applicable regulations.

3 SITE INSPECTION

A summary of site conditions as observed during the audit inspection completed during the monitoring period is provided in Table 3-1. Monitoring reports have been submitted for the auditing period.

[1] AquaTerra Environmental Ltd. 2024. Hatzic Emergency Program, South Herford Creek Project, Construction Environmental Management Plan (Rev. 1). Prepared for Mission Contractors Ltd. 65 p.

Table 3-1 Site Conditions During Audit Inspection

Date / Time	Auditor (Associated)	Weather	Construction Activities
September 12, 2024 11:00	Dave Muhlert	Sunny. 18°C. No precipitation.	Contractors were installing sandbag isolation at station B2 (north of Dale Road).

4 INSPECTION RESULTS

A checklist of required environmental protection measures and mitigative strategies for the Project is presented in Table 4-1. The checklist has been developed in accordance with terms and conditions of the environmental permits and approvals issued for the Project, environmental protection specifications and requirements as part of the construction contract for the Project, the Contractor's Construction Environmental Management Plan and environmental best management practices and guidelines.

Table 4-1 Summary of Environmental Protection Measures Reviewed and Results of the Inspection

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
	Environmental Monitoring					
1	The EM will attend key site meetings where environmental mitigations and issues may be discussed.	☒Compliant ☐Non-Compliant ☐N/A	EM has been on site daily to attend site meetings.	As instream works progress outside the least risk fish window, EM reports should document consideration of increased risk and if enhanced mitigation is required.	CEMP Section 2.4	
2	The EM shall supervise all instream works. If temporary diversion installed, EM is onsite daily to check pumps and flow bypasses.	☒Compliant ☐Non-Compliant ☐N/A	EM was onsite to conduct salvage and oversee dewatering attempts.		WSA (h)2.ii, (j)5.i CEMP Section 2.4	
3	The EM will submit daily and bi-weekly monitoring reports to the Contractor for distribution to MoECCS.	☒Compliant ☐Non-Compliant ☐N/A	Monitoring reports are submitted daily, or the following morning.		CEMP Section 5.1	
4	The EM will complete and submit an Environmental Incident Report (EIR) for non-compliances with the CEMP, reportable spills or other environmental incident.	☐Compliant ☐Non-Compliant ☒N/A	No reportable environmental incidents have been documented to date.		CEMP Section 4	
5	EM is granted authority to stop the work if necessary	☒Compliant ☐Non-Compliant ☐N/A	EM has not exercised stop work to-date.		WSA (i) 7 CEMP Section 2.4	
	Erosion and Sediment Control					
6	Appropriate site isolation is installed as required, including silt fencing prior to instream works. Silt fences are installed properly, intact, adequate, clear of accumulated sediment and are functioning.	☐Compliant ☒Non-Compliant ☐N/A	Installation of sandbag isolation underway; no excavation. Water levels in the creek have dropped and dry conditions have been achieved at some stations to permit excavation. EM reported some attempts at dewatering have failed, and excavation wasn't able to proceed.	DFO and WLRS permit amendments, to allow dredging in the wet, are pending. In there interim, instream works must adhere to existing permit conditions.	WSA (o), (q) CEMP Section 3.5	
7	Riprap or any other engineering material place in channel is clean of any substances deleterious to aquatic life.	☐Compliant ☐Non-Compliant ☒N/A	No riprap or other material was being placed during the audit.		WSA (x) CEMP Section 3.5	
8	Stockpiling and storage areas are located 15 m from the watercourse TOB.	☒Compliant ☐Non-Compliant ☐N/A	Sediment stockpiles are located >15 m from the watercourse.		DFO FAA WSA (t) CEMP Section 3.5	
9	Emergency ESC material onsite (e.g., 100 feet of silt fencing, 5 dry bales, and 100sq.m of ECBs/ Coconut matting, or polyethylene sheets)	☒Compliant ☐Non-Compliant ☐N/A	ESC materials were stockpiled at the site laydown.		CEMP Section 3.5	Photo 1
10	Sediment removed from the Site will be disposed of appropriately at a location approved by the EM and MoECCS.	☐Compliant ☐Non-Compliant ☒N/A	Excavated sediment is currently being stockpiled onsite.	Identify sediment disposal location(s) in the CEMP and/or the environmental monitoring reports.	CEMP Section 5.5	
11	Sediment removal boundaries must be clearly delineated prior to commencement of work.	☐Compliant ☐Non-Compliant ☒N/A	No sediment removal occurring at time of inspection.		WSA (opening)	
	Invasive Plant Management					

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
12	Ensure that machinery is free of invasive plant material that could potentially be transported throughout or between sites.	☐Compliant ☐Non-Compliant ☒N/A	No machinery observed leaving site during inspection.		WSA (opening) CEMP Section 3.4	
13	Ensure that invasive species removed from site are disposed of appropriately at an approved facility	☐Compliant ☒Non-Compliant ☐N/A	Japanese knotweed was bagged onsite awaiting offsite disposal. It appears that knotweed has been cut to ground, but not yet treated with herbicide. Knotweed management protocols are not clearly understood nor documented in monitoring reports.	Ensure knotweed management adheres to approved BMPs and contract, and document methodology.	WSA (opening) CEMP Section 3.4.1	
14	The Project site shall be regularly monitored by the EM for invasive plant infestations and these infestations will be mapped and managed according to applicable species-specific BMPs.	☐Compliant ☒Non-Compliant ☐N/A	EM appears to be overseeing invasive species management; however, knotweed is not being managed according to the BMPs and approved methods. Patches of knotweed adjacent to access roads and work areas were not delineated; there is signs of accidental encroachment on these patches.	If alternative approaches to knotweed management are proposed, once approved, CEMP should be updated. Patches of knotweed adjacent to access and work areas should be delineated and monitored to prevent accidental encroachment and spread.	CEMP Section 3.4.1	
16	Knotweed stems are cut close to the ground and contained on poly sheeting away from the immediate work area. Cut knotweed is covered with woven geotextile fabric and crushed rock prior to machine access. Knotweed stems are injected with an appropriate herbicide before being covered.	☐Compliant ☒Non-Compliant ☐N/A	Cut knotweed was bagged awaiting offsite disposal. Herbicide injection was not being done during the audit visit.	Confirm if stem injections are occurring as required. Confirm disposal site.	CEMP Section 3.4.1 Addendum 1 to the Contract Documents for the Hatzic Emergency Works Program - Lagace Creek – Sites S-CR-14/17	
	Waste Management					
17	Dispose of all anthropogenic debris removed at an appropriate waste management facility.	☒Compliant ☐Non-Compliant ☐N/A	No anthropogenic debris was observed on site.		WSA (opening) CEMP Section 5.5	
18	Non-hazardous waste stored appropriately and removed offsite daily.	☒Compliant ☐Non-Compliant ☐N/A	No non-hazardous waste was observed during the audit.		CEMP Section 5.5	
19	Hazardous waste stored > 30 m of watercourses.	☒Compliant ☐Non-Compliant ☐N/A	Two portable toilets are located at the site laydown, more than 30 m away from watercourses.		CEMP Section 5.5	
20	Secondary containment used for all stored hazardous waste.	☐Compliant ☒Non-Compliant ☐N/A	Portable toilets were not in secondary containment.	Add secondary containment to portable toilets.	CEMP Section 3.6	Photo 2
	Spill Control and Emergency Response					
21	Machinery operating in channel is equipped with environmentally friendly oil	☒Compliant ☐Non-Compliant ☐N/A	Excavator on site has a sticker confirming that it contains Environ™ biodegradable, non-toxic hydraulic fluid.		WSA (p) 4 CEMP Section 3.6	

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
22	Equipment and machinery are free of leaks	☒Compliant ☐Non-Compliant ☐N/A	No leaks were observed during the audit. Equipment appeared to be clean.		WSA (p) 1 CEMP Section 3.6	Photo 3
23	Drip trays are available and used during refueling and equipment maintenance	☒Compliant ☐Non-Compliant ☐N/A	Equipment was actively working during the audit. Spill trays were observed around site. Parked excavator had a spill tray under the engine.		CEMP Section 3.6	
24	Fuel is stored > 30 m from Lagace Creeks and any connected drainages	☒Compliant ☐Non-Compliant ☐N/A			WSA (p) 3 CEMP Section 3.6	
25	Machinery and vehicles operating onsite are equipped with spill kit.	☒Compliant ☐Non-Compliant ☐N/A	Stocked spill kits were available near active work areas.		WSA (p) 2 CEMP Section 3.6	
26	Should suspected contaminated material be encountered (i.e., soil emitting olfactory cues indicative of hydrocarbon fuel), works should temporarily halt for investigation.	☒Compliant ☐Non-Compliant ☐N/A	EM collected sediment samples from each of the sand recovery stations and submitted to ALS Environmental for chemistry analysis. EM reported high concentrations of sodium and some other metals and additional analysis and reporting are pending.		CEMP Section 2.5	
27	Refuelling of machinery is conducted on level ground over a spill tray.	☒Compliant ☐Non-Compliant ☐N/A	No refuelling was observed during the audit.		CEMP Section 3.6	
	Riparian Area Management					
28	Stockpile LWD and root wads removed from channel for use in site restoration	☐Compliant ☐Non-Compliant ☒N/A	No LWD or root wads stockpiled onsite.		CEMP Section 3.3	
29	Construct access points and approaches perpendicular to the watercourse;	☒Compliant ☐Non-Compliant ☐N/A			DFO FAA CEMP Section 3.2	
	Instream Works					
30	The EM shall ensure that instream works are isolated from flow and that measures are in place to protect fish and fish habitat, and to mitigate the migration of sediment downstream.	☒Compliant ☐Non-Compliant ☐N/A	Installation of sediment isolation underway; no excavation. EM reported that work was stopped when site isolation failed on September 9 and 11.	Improve instream isolation to prevent a failure during instream works.	WSA (j) CEMP Section 3.1	Photo 4
31	Pumps and flow bypasses are in proper working condition	☐Compliant ☐Non-Compliant ☒N/A	Pumps were not operating during the audit visit.		WSA (j) 5 CEMP Section 3.1	
32	Instream works conducted in the dry / isolation of flow	☒Compliant ☐Non-Compliant ☐N/A	Instream works (other than placing sandbags for isolation) were not in progress during the audit visit. EM reported that work was stopped on September 11 when Station J and K could not be fully dewatered.	Procure and install appropriate equipment for isolation and dewatering.	WSA (o) CEMP Section 3.1.1	Photo 4
	Water Quality					
33	Water quality is routinely monitored upstream and downstream of the work area, every day that instream works are occurring Instream water quality is compliant with provincial criteria[2]:	☒Compliant ☐Non-Compliant ☐N/A	EM is routinely monitoring water quality, and halting instream works where short-term exceedances are noted. Sediment curtains have been installed downstream of instream works.	The contractor must exercise due care when handling sandbags instream and the EM to provide appropriate guidance to mitigate any	WSA (s) CEMP Section 3.1.2	

[2] British Columbia Ministry of Environment and Climate Change Strategy. 2024. British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture - Guideline Summary – August 2024. Water Quality Guideline Series, WQG-20. Prov. B.C., Victoria B.C. Available at: https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-guidelines/approved-wqgs/wqg_summary_aquaticlife_wildlife_agri.pdf. Accessed August 2024.

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
	Turbidity: - <8 NTU from background at any one time for a duration of 24 h in clear waters; - < 5 NTU from background when background is 8 – 50 NTU; - <10% from background when background is > 50 NTU. **pH:** 6.5-9.0		Excavated sediment is being used to fill the sandbags that are installed for instream isolation. Occasionally the sandbags tip over or rip when being relocated, resulting in localized turbidity.	potential risk to fish and fish habitat.		
	Fish and Wildlife Protection					
34	Full time monitoring for fish during instream works is occurring.	☒Compliant ☐Non-Compliant ☐N/A	EM is onsite full time		WSA (j) 6 CEMP Section 2.4	
35	Fish salvages are conducted in advance of instream works where required.	☒Compliant ☐Non-Compliant ☐N/A	EM is conducting salvages in advance of sediment excavation.		CEMP Section 3.1 WSA (j) 6	
36	Salvaged fish are relocated back to the same watercourse in a nearby area that is not impacted by construction or removal works or its zone of influence	☒Compliant ☐Non-Compliant ☐N/A	EM is relocating fish outside the isolated work zone.		DFO FAA Section 2.2.4	
37	Pump intakes are screened for fish and aquatic species in accordance with the "Interim code of practice: End-of-pipe fish protection screens for small water intakes in freshwater"	☒Compliant ☐Non-Compliant ☐N/A	Conditionally compliant – Pumps were not operating during the audit visit. Pump intakes shown in EM reports were placed within a mesh box. Contractor was installing an additional mesh screen over a pump intake during the audit.		WSA (j) 5.ii DFO FAA Section 2.4.9 CEMP Section 3.1.1	Photo 5
38	Obtain required permits prior to salvage(s).	☒Compliant ☐Non-Compliant ☐N/A	EM has obtained salvage permits.		WSA (Opening) CEMP Section 3.1	
39	EM is on site during disturbance to riparian vegetation and conducting pre-clearing breeding bird surveys prior to clearing.	☒Compliant ☐Non-Compliant ☐N/A	EM is conducting nest surveys at stations as required.		CEMP Section 3.2	
40	Instream works are conducted so as not to lead to fish stranding or other impacts to fish. The works shall not result in depressions that have the ability to trap fish and other aquatic life. Fish passage is maintained where practicable and in accordance with applicable permits.	☒Compliant ☐Non-Compliant ☐N/A	Instream works have been designed to maintain fish passage after completion. Upstream fish passage is impeded due to turbidity curtain installed across the channel.	EM must be monitoring for fish full-time and should have a plan for moving adult fish upstream around the work area, if observed staging below the work zone.	WSA (j) 6 (iii) WSA (u) DFO FAA Section 2.4.2 CEMP Section 3.1.1	
	Restoration Requirements					
41	Restoration plans prepared by EM for disturbed area and implemented with EM oversight	☐Compliant ☐Non-Compliant ☒N/A	Restoration plans have not been prepared yet.		WSA (w) CEMP Section 3	
42	All temporary works shall be removed on completion of the project, and the stream	☐Compliant ☐Non-Compliant ☒N/A	Work is still in progress.		WSA (v) CEMP Section 3	

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
	channel restored to its natural condition					

5 DISCUSSION

5.1 Non-Compliant Items

Knotweed management

Addendum 1 to the Contract Documents for the Hatzic Emergency Works Program - Lagace Creek – SITES S-CR-14/17 requires that trimmed knotweed stems are injected with an appropriate herbicide.

Recommended action: Provide documentation of knotweed management and ensure it adheres to approved BMPs. Confirm if knotweed stems have been injected with appropriate herbicide. If this is not practical, suggest alternative approach with rationale, and update documentation (e.g., CEMP).

Portable toilets without secondary containment

Two portable toilets located at the site laydown adjacent to Dale Road did not have secondary containment. Although the toilets were more than 30 m away from the watercourse, secondary containment would prevent any potential spills from spreading beyond the immediate area.

Recommended action: Add secondary containment to portable toilets.

5.2 Conditionally Compliant Items

EM reporting to document risk and mitigation

As instream works progress beyond the least risk fish window, the EM must provide guidance and advice to the contractor regarding any changes in risk associated with working past the window and required mitigation.

Recommended action: EM reports should document their consideration of any increased risk with working past the least risk and identify if enhanced mitigation is required. EM should continue to document implementation of mitigation measures, evaluate changing conditions, and report any incidents or near-misses.

Site isolation failing during instream works

The emergency *Fisheries Act* authorization requires that instream works are conducted in the dry. EM reports from September 9 and September 11 state that isolation measures have failed during instream works. Although the EM reported that dredging was stopped during these failures, isolation measures should be improved to prevent failure during works.

Recommended action: Permit amendment applications are pending; contractor must adhere to the conditions of existing environmental permits until approved. Isolation measures should be sufficient to maintain isolation for the duration of the work.

6 SUMMARY

A list of environmental issues outstanding to date is provided in Table 6-1, below.

Table 6-1 Tracking Table of Environmental Issues Outstanding to-Date (project commencement August 12, 2024)

Item #(s)	Issue	Date(s) Observed	Recommended Corrective Action(s)	Responsible Party
2	Knotweed material outside poly sheet containment, no herbicide treatment	August 29, 2024 September 5, 2024	Ensure that all knotweed cuttings are confined to poly sheeting. Apply herbicide to remaining stems, as appropriate. Document methodology and ensure it adheres to approved BMPs.	Contractor/EM
3	Portable toilets without secondary containment	August 29, 2024	Add secondary containment to portable toilets.	Contractor
4	Inadequate instream isolation and failed dewatering attempts resulting in instream works conducted in the wet.	August 31, 2024 September 1, 2024 September 2, 2024 September 11, 2024 (EM reports)	Need to provide adequate isolation and dewatering to maintain dry work area OR obtain permission to dredge in the wet	Contractor

Note: Items marked with an asterisk (*) were reported by the EM.

7 CLOSURE

We trust that the information in this memo is sufficient for your present needs. Should you have questions, please do not hesitate to contact the undersigned.

Prepared by:

for Dave Muhlert, R.B.Tech.
Environmental Technologist

DM/NS

Reviewed by:

Naomi Sands, R.P.Bio.
Environmental Scientist

Attachments:
- Site Photographs

Attachment 1: Site photographs taken during audit visit on September 12, 2024.

Photo 1: ESC materials stockpiled at the site laydown 		**Photo 2: Portable toilet at laydown without secondary containment** 
Photo 3: Front end loader working on site appeared to be clean and free of leaks 		**Photo 4: Sandbag isolation was not sufficient to keep water out of the work area** 
Photo 5: Metal mesh fish screen being installed on pump intake 		

Table A2: Tracking Table of Resolved Non-Compliance Issues

Item #(s)	Issue	Date(s) Observed	Date Corrected	Corrective Action(s)	Responsible Party
1	Environmental monitoring reports not received daily	August 29, 2024	September 5, 2024	Monitoring reports received daily, or following morning.	EM
2	Inappropriate fish screen on pump intake	September 5, 2024	September 12, 2024	EM reports show pump intakes in mesh screen boxes. Wire mesh screen was being fitted to an additional pump intake during the audit visit.	Contractor

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: September 12, 2024
Environmental Monitors: John Choi, Loc Ngo, Corbin Manson.
Weather: Low 13°C, High 20°C. Overcast in the morning with sunny breaks in the afternoon.

- 06:40 AM: Environmental Monitors (EMs) arrived on-site.
- 06:45 AM: EMs attended a toolbox meeting with QM personnel.
- 07:05 AM: QM personnel removed the two (2) silt curtains located downstream from Stations J and K.
- 07:20 AM: QM personnel began installing sandbag exclusion at Station C-2. EMs periodically checked downstream water quality to confirm elevated turbidity levels associated with the installation. (Please refer to the water quality table for results.)
- 07:41 AM: Two (2) EMs traveled to Station CR-17 South to retrieve eight (8) traps deployed the previous day. One (1) EM remained at Station C-2 to monitor the sandbag exclusion work.
- Results of trap retrieval:
    - 1 Chinook salmon
    - 1 Three-spined stickleback
    - 8 Coho salmon
    - 2 Rainbow trout
- Ten (10) traps were redeployed to soak overnight and are scheduled for retrieval the following morning.
- Salvaged fish were measured and released downstream.
- 08:22 AM: Sandbag exclusion placement at Station C-2 was completed.
- 09:36 AM: Grubbing work and the placement of an access pad covered with gravel were completed at Station B to minimize the spread of Japanese knotweed during instream work. EMs monitored the work and did not observe any excavator contact with adjacent knotweed growth.
- 11:00 AM: QM initiated isolation prep work at Station B.
- 11:20 AM: Riteway Tree Service Ltd., contracted by BC Hydro, was observed felling trees along Dale Road, adjacent to the Japanese knotweed growth for the blueberry farm access point.
- 11:30 AM: The first sandbag was placed instream at Station B. EMs periodically checked downstream water quality to monitor turbidity levels during the exclusion installation.
- 12:31 PM: An AE inspector inquired about the disposal of Japanese knotweed on-site. The QM Site Superintendent confirmed that knotweed would be hauled off-site and incinerated at the end of the project.
- 12:35 PM: Sandbag exclusion installation at Station B was completed.
- 12:46 PM: EMs conducted electrofishing (e-fishing) at the now-isolated Station B.

- Results of Pass 1 (600s):
    - 3 Coho salmon
    - 1 Rainbow trout
    - 1 Cutthroat trout
    - 70 Prickly sculpins
    - 3 Signal crayfish
    - 1 Largemouth bass
- 15:05 PM: EMs performed a second e-fishing pass at Station B.
- Results of Pass 2 (590s):
    - 3 Signal crayfish
    - 10 Prickly sculpins
    - 1 Pacific lamprey
    - 2 Coho salmon
    - 1 Rainbow trout
- 15:29 PM: A silt curtain was installed downstream from Station B. Due to the strong current in Legace Creek, the curtain could not be fully sunk but was still expected to act as a partial barrier. EMs closely monitored downstream water quality.
- 15:35 PM: Two (2) 3-inch dewatering pumps were installed at Station B, with the discharge outlet placed downstream of the silt curtain. A silt bag was installed at the outlet and set on a poly-sheeted waterway to minimize erosion. Fish protection baskets were confirmed on both inlets.
- 15:42 PM: The two (2) dewatering pumps began operation, and EMs periodically checked downstream water quality for turbidity.
- 15:45 PM: EMs performed active fish salvage during the dewatering process.
- Results:
    - 11 Coho salmon
    - 40 Prickly sculpins
    - 41 Pacific lampreys
    - 14 Signal crayfish
    - 1 Rainbow trout
    - 2 Three-spined sticklebacks
    - 1 Pumpkinseed sunfish
    - 1 Northern red-legged frog
    - 21 American bullfrogs (various stages of development)
- 16:05 PM: A section of vegetation on the sandbank at Station B was grubbed to accommodate sediment stockpiles.
- 17:05 PM: The isolated Station B was nearly dry, though some water continued to seep through the sandbag exclusions and from the surrounding water table. The AE inspector approved the salvaging and dewatering process, allowing excavation to begin.
- 17:10 PM: Sediment from Station B was stockpiled on the cleared sandbank to dry overnight. It will be hauled off-site for appropriate disposal, classified as Class B under the Provincial Knotweed Guidelines (Appendix D).

- 18:10 PM: Sediment excavation work at Station B was completed for the day.
- 18:12 PM: QM personnel refueled the dewatering pumps at Station B. EMs confirmed that the pump was moved away from the bank and placed on a spill tray during refueling. No spillage or leakage was observed.
- 18:25 PM: EMs euthanized various invasive species (i.e., bullfrog, Largemouth bass, Pumpkinseed sunfish) salvaged throughout the workday.
- 18:35 PM: Spill trays were placed under various machinery to prevent potential hydrocarbon leakage into the stream.
- 18:40 PM: EMs observed poly-sheeting placed on the grubbed Station C-2 to minimize potential sediment erosion into the stream.
- 18:45 PM: EMs debriefed with the KEL Project Manager.
- 18:55 PM: EMs departed from the site.
- Water Quality Sampling Results:

Location	Time	Turbidity (NTU)
Station B (Background for Station C-2)	7:20	1.64
Station D (downstream from Station C-2)	7:25	4.96
Upstream from Station B	11:24	2.12
Downstream from Station B	11:38	5.23
Downstream from Station B	15:38	2.67
Downstream from Station B	15:42	7.32
Downstream from Station B	16:02	5.69
Downstream from Station B	16:14	4.34
Downstream from Station B	16:34	5.05
Downstream from Station B	17:40	3.40

Site Photos


ABC Recycling
604.522.9727
September 12, 2024 3:54 p.m.


September 12, 2024 9:37 a.m.


September 12, 2024 5:04 p.m.


September 12, 2024 9:32 a.m.


September 12, 2024 11:30 a.m.


September 12, 2024 3:29 p.m.


September 12, 2024 5:34 p.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	12
Project:	Legace Creek	**Page:**	1 of 7
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 13, 2024
Contract No.:		**Temperature:**	High: 18 Low: 13
Weather:	Rainy		

September 13, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Mel), Jim, 3 operator, 4 labourers
Keystone Environmental: EM (John) (Loc) (Corbin)
2 flaggers

Contractor's Equipment:

-Equipment in Use

- CAT Excavator 324E
- Zaxis Excavator EX0689
- Zaxis excavator 2720
- Deer Loader 1466
- Pumping equipment: generator, 4 – 3" pumps.

Report, if any, Contact with Occupants:

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

Discussions with Contractor:

6:30AM
- Toolbox (James) – Lots of water entered excavation over night, going to get 2 more 3" pumps (4 total).
- Planning on 1 truck coming initially. 4 trucks ended up coming each with a wagon.

6:45AM
- Discussion with Enviro Green (Hauling company) – Doing hauling today, have 4 trucks. All trucks will be tarped.

10:00AM
- Discussion QM (James) – final hauling truck. Will continue excavating in isolation area and stockpiling.
- Plan to build SRS this weekend.

11:00AM
- Discussion with QM (James, Mel) – Planning to give brush clearing to farmer Charlie (Jahoolie). Confirming if that is acceptable.
- AE (Jordan) – ensure no knotweed is in it if its going to the farmer. As far as Jordan is aware QM is to decide where the material leaving site is going.
- Current clearing is going to disposal facility in Abbotsford.

11:15AM
- Discussion with QM (James) – going to keep excavating and stockpiling at SRS B.
- Trucks are coming back at 4:00 to be pre-loaded for tomorrow. Planning to keep hauling this weekend.
- AE (Jordan) asked if remaining stockpile location with be surveyed for this mornings haul, prior to filling it up with excavated material again.
- QM (James) – Mert said that is not required, the morning survey is sufficient.

2:00PM
- Discussion with QM (James) – AE (Jordan) asked to get survey back prior to loading out 2nd stockpile this afternoon, survey crew has done O.G. in B2, B3, B area.
- James said survey crew is unavailable. Will load out anyway.

1:45PM
- Discussion with QM (James, labourer) – after labourer seen refueling pumps on berm in creek.
- AE (Jordan) – reminded group CEMP outlines refueling equipment is to be done 30m from creek.

Report:

6:30AM
- AE (Jordan) – on site.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

6:45AM
- Surveyor on stockpile in SRS B isolation area doing topo. Surveying pile to water level.

7:00AM
- 2 – 3" pumps on at SRS B.

7:50 – 10:45AM
- Loading and Hauling trucks.
- 4 trucks, all with wagons.
- Loading from excavated pile in isolated area to the right of SRS B.
- Each truck about 21m3 for truck + wagon together, roughly 80m3 hauled
- Survey was completed for this stockpile only prior to loading out.
- Material was excavated and loaded into trucks wet.

8:30AM
- Disposal truck for C and G hauling bin off site.

11:15AM
- Removing excavation in isolated zone, reinforcing water diversion on right side of isolation. 2 – 3" pumps in operation.

12:50PM
- All 4 – 6" pumps in operation.

2:15PM
- Gravel delivery at B2

1:30 - 3:00PM
- Excavating remainder of SRS B isolation and placing material on access road next to B.
- Stockpile looks to be roughly 250m^3

3:15PM
- At end of excavation, berm used to divert water began to fail, pumps were placed on top of berm.
- Pumps were quickly removed, in doing so were violently swinging as moving off of creek.
- 1 pump had clear liquid spill out of it while on top of creek, the smell of gas followed.
- In process 1 sand bag was lost.

3:30PM
- Electo-fishing at C2.

3:45PM – 6:00PM
- Afternoon truck loading.
- 4 trucks, all with wagons. Estimated volume per truck and wagon 21m3, 80m3 total.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

- Loading excavated material placed on access road beside B.
- Excavation was wet at time of loading, also raining.
- No survey completed prior to material being loaded.
- Trucks are keeping material over weekend and dumping on Monday at contaminated site.

4:30PM

- Clearing at C2.

6:00PM

- Leaving site, QM awaiting pump delivery.

Testing:

- None today.

Safety Concerns:

- None today.

Traffic Control:

- Traffic control on Dale road.

Photos:

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: September 13, 2024
Environmental Monitors: Loc Ngo, Khang Diep, Corbin Manson.
Weather: Low 13°C, High 18°C. Overcast in the morning and rain in the afternoon.

- 06:30 AM: Environmental Monitor – Corbin, arrived on-site.
- 07:00 AM: Dewater at Station B commenced with EM on Site. EM was actively salvaging fishes during the dewatering.
- 07:30 AM: Loc Ngo and Khang Diep arrived on Site.
- 07:47 AM: Knotweed loadout commenced (hauling off site using dump trucks).
- 08:19 AM: QM's excavator inspected for knotweed directed QM to brush excavator bucket.
- 08:30 AM: Sediment bag at the discharge hose blew out. However, exceedance of turbidity was not observed (See WQ table).
- 08:45 AM: QM repaired the sediment bag and continued dewatering Station B.
- Active salvage results:
    - 7 prickly sculpins
    - 7 Lampreys
    - 2 Signal Crayfish
- 09:47 AM: Loc Ngo and Corbin Manson traveled to Station CR-17 South to retrieve ten (10) traps deployed the previous day. Khang Diep remained at Station B to monitor the dewatering and sediment excavation work.
- Results of trap retrieval:
    - 30 coho salmon
    - 1 chinook salmon
- Ten (10) traps were redeployed to soak and are scheduled for retrieval the following morning.
- Salvaged fish were measured and released downstream.
- 11:12 AM: EMs swept the area within the isolated area at Station B for amphibians prior to excavation. Amphibians were not observed by EMs and excavation work commenced shortly after.
- 11:38 AM: EMs noticed sediment plume and proceeded to take a WQ downstream from B (behind the silt curtain). Turbidity reading was compliant at the time but also indicated potential exceedance if the plume persisted. EM notified QM immediately and recommendations were discussed:
- Reinstall the sediment bag at the discharge station to mitigate sediment plume.
- Reinstate the silt curtain to capture sediment plume.
- 11:45 AM: Pumps were temporarily off. QM initiated sediment bag repair to mitigate sediment plume.
- Active salvage results:
    - 6 Lampreys
    - 1 Signal Crayfish
    - 1 coho (mort)

- 12:11 PM: Sediment bag replacement work completed. QM initiated the pumps again and EM collected WQ downstream from B. Reading was compliant.
- 13:37 PM: Stockpiling contaminated sediments upland to dry confirmed only knotweed contaminated excavator working in the area.
- 13:45 PM: Loc Ngo and Khang Diep left CR14 Site and went to CR17-South Site to enhance the fish isolations prior to rain event. 10 minnow traps were also pulled for fish salvage work in C-2. Corbin Manson remained on CR14 – Station B to active salvage during excavating work.
- Minnow trap results:
    - 9 coho salmon
    - 1 rainbow trout
    - Active salvage results:
    - 1 coho salmon
    - 9 prickly sculpin
    - 2 lamprey
    - 2 signal crayfish
    - 1 bullfrog tadpole (humanly euthanized).
- 14:41 PM: Crushed rocks arrived on Site.
- 15:05 PM: Dewatering working at station B completed.
- 15:10 PM: Station B's upstream isolation failed due to sediment excavating and flow was reintroduced to the isolated area. However, water seemed to slowly fill in the excavated area and turbid water remained isolated from the creek by the downstream sandbag berm. EM conducted WQ at the downstream location from B. Exceedance was not observed.
- 15:23 PM: EMs conducted electrofishing (e-fishing) at the isolated Station C-2.
- Results of Pass 1 (261s):
    - 3 Prickly sculpins
- 15:15 PM: electrofishing completed for safety concern when it rained. 10 minnow traps were deployed at station C-2 and to be retrieved prior to work commence on September 14, 2024. EMs will conduct another electrofishing pass if weather condition improves.
- 16:13 PM: EM completed minnow traps
- 17:00 PM: Contractor completed the sump excavation (in dry) in preparation for excavation work at C-2 Station for tomorrow.
- 17:21 PM: EM checked in with QM to ensure all exposed area will be protected with poly tarp to prevent potential sediment runoff from the rain.
- 17:40 PM: Last hauling trucks were observed
- 18:00 PM: EM debrief with KEL's PM.
- 18:45 PM: EM inspected the Site at the end of workday. Stockpile and exposed area were properly protected with poly tarps. Spill trays were also observed in place.
- 18:50 PM: EM left Site.
- Water Quality Sampling Results:

Location	Time	Turbidity (NTU)
BG – Upstream from Station B	7:48	4.61
~ 50m Downstream rom Station B	7:58	7.00
BG – Upstream from Station B	9:24	2.39
~ 50m Downstream rom Station B	9:25	2.68
BG – Upstream from Station B	11:23	2.15
~ 50m Downstream rom Station B	11:28	9.78
~ 70m Downstream rom Station B	11:38	10:15
~ 70m Downstream rom Station B	12:15	8.08
BG – Upstream from Station B	13:17	3.24
~ 50m Downstream rom Station B	13:20	6.28
BG – Upstream from Station B	14:21	2.46
~ 50m Downstream rom Station B	14:26	5.96
BG – Upstream from Station B	16:27	5.19
~ 50m Downstream rom Station B	16:31	6.05

Site Photos


SPILL KIT
September 13, 2024 6:42 p.m.


LaMotte
T7
Turbidity WB (NT
8.08 NTU
Scan Blank
Scan Sample
11:13:58 009/500+
2020i TURBIDIMETER
September 13, 2024 12:11 p.m.


September 13, 2024 7:50 a.m.


September 13, 2024 6:40 p.m.


September 13, 2024 11:52 a.m.


September 13, 2024 6:42 p.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	13
Project:	Legace Creek	**Page:**	1 of 7
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 14, 2024
Contract No.:		**Temperature:**	High: 17 Low: 12
Weather:	Rainy		

September 14, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Mel), Jim, 3 operator, 4 labourers
Keystone Environmental: EM (John) (Kang)

Contractor's Equipment:

-Equipment in Use

- CAT Excavator 324E
- Zaxis Excavator EX0689
- Zaxis excavator 2720
- Deer Loader 1466
- Pumping equipment: generator, 1 – 6" pumps.

Report, if any, Contact with Occupants:

2:45PM

- Discussion with Doug property owner – Explaining how creek flows into yard behind SRS B during winter months and periods of high rain. Disappointed QM didn't remove berm in front of station and remove more material to the right of station, there is a beaver creek U/S causes flow issues.
- Creek crested into property 3 times last year.

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

4:45PM

- Discussion with Keystone (John) – turbidity was high D/S during pumping today, had to keep stopping pumping.

Discussions with Contractor:

6:30AM

- Toolbox QM (James) – Removing bags at SRS B.
- Planning to start SRS B2 today.
- Also will be excavating at C2.
- Survey at C2 stockpile where there is Y in road – using LiDAR drones.
- AE (Jordan) – expressed concern this area isn't flat, asked if it will be flattened. James thought was flat.

8:00AM

- Discussion with QM (James, labourer) – discussing SRS B2 and B3 plan.
- QM planning to place geotextile 1.5 – 2m in length.
- Have tamper on site for compaction.
- Have general idea for locations – trying to line up with SRS B and Dale road bridge abutment.
- Will excavate back behind slope first and place lock blocks before opening up to creek. Pumping ground water will be required.
- All material from section B3 to B will be contaminated. James mentioned there was discussion of a change order amongst the PM's, won't be removing more than 500m3 before that is released.
- AE (Jordan) – expressing concerns of yesterdays quantity tracking with survey. No O.G. of stockpile locations or survey of stockpile before 2nd load out.
- James – QM going to get bathymetry of SRS B. Thinks between bathymetry, pile survey in isolation, and truck counting should be able to get quantity.
- Jordan also expressed concern of material being fairly wet.
- James – going forward will be easier, surveying whole site with LiDAR drone today.

11:00AM

- Discussion AE (Duncan) and Lucas Geomatics survey group –
- Lucas Geo thinks they are coming for final survey at end of project but have not been finalized.
- Did topo pass and 6 LiDAR passes – should be accurate to material in area.
- Didn't tie into points on bridge, had own reference points near SRS C2 stockpile.

1:30PM

- Discussion with QM (Mel) – not opening up SRS B2 excavation due to rain today. Will prepare area for tomorrow morning.
- Discussion with QM Operator (Craig) – doing layout for SRS B2.
- AE (Jordan) – directed to line SRS B2 with B, top of bank will curve around B3 towards Dale road bridge abutment.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Report:

7:00AM
- Removing sand bags at SRS B

7:25AM
- 2 – 6" pumps delivered on site.

8:30AM
- Moving SRS B contaminated stockpile from SRS B access road to SRS B3 location.

9:00AM
- Moving sandbags from SRS B to C2.

10:00AM
- Clearing area at C2
- Clearing/topsoil removal – rock truck used to transport material from SRS C2 to laydown – down access road outlines by Mert.

10:40AM
- Clearing at B3

11:00AM
- Setting up access for pumps and pumps.
- Pumping 20m downstream into trees.

12:00PM
- Moving lock blocks to B2

1:00PM
- Installing silt curtain D/S C2
- Excavating sump for C2.

1:40PM
- Began pumping at SRS C2, isolation initially unsuccessful.

2:15PM
- Excavator unstable on C2 slope, fell forward, caught itself with bucket.

2:45PM
- 10 Small sandbags filled at SRS E and moved to SRS C2 for isolation.

4:30PM

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

- Placing bags and hoses for isolation at C2 tomorrow.
- 2nd 6" pump delivered to site.

5:10PM
- Left site.

Testing:

- None today.

Safety Concerns:

- None today.

Traffic Control:

- None today.

Photos:

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17

Environmental Monitoring Report

Date: September 14, 2024
Weather: Low 13°C, High 18°C. Overcast in the morning and rain in the afternoon.

- 06:30: The Environmental Monitors arrived on-site.
- 06:45: Retrieved 10 minnow traps. Fish salvage results:
    - 2 Coho salmon
    - 20 prickly sculpin
    - 1 Chinook salmon
    - 2 pumpkinseed sunfish (euthanized)
    - 2 green frogs (euthanized)
- 07:00 – 07:50: QM crew removed sandbags isolation at Station B.
- 07:15: Two 6-inch dewatering pumps arrived on site.
- 08:20: QM crew began setup at Station C-2.
- Removed poly sheeting.Installed additional sandbags.
- Positioned and set up dewatering pumps.
- 08:45: Began hauling sediment material from C-2 that is not instream, stockpiling near the blueberry farm.
- 10:30: QM crew began installing and preparing for discharge outlets. Selected discharge location was vegetated. Poly sheeting was laid to protect the surface from erosion. Discharge hose was placed inside sediment filter bag to divert water energy, and the bag was placed on top of the poly and positioned between the flood plain of the riparian area and the stream.
- 12:10: Transported lock blocks from the laydown area to station B-2 for construction of recovery sand station.
- 12:50: Excavated a deeper sump to have sufficient volume of water for the fish protection cage and pump intakes.
- 13:12: Silt curtain was installed downstream of C-2 and the discharge point. Only one curtain was available for the time being.
- 13:15: Dewatering pump was activated. Only 1 pump was functional. The other pump was missing parts / having defective parts.
- 13:36: Notable turbidity plume was observed downstream of the silt curtain. The EM recommended stopping the pumps and adjusting the silt curtain and discharge outlet.The EMs conducted active fish salvage at Station C-2 during dewatering.
- 15:00: Discharge overwhelmed and flooded the bank, and water began to flow back into site. The pump was stopped, discharge outlet and silt curtain were adjusted once more.
- 16:00: Instream works including dewatering were ceased for the day. QM crew continued to set up the second pump and prepared the site for dewatering the following day.
- 16:10: The EMs released fish to upstream of Station B.

- Active salvage results:
  - 1 Chinook salmon
  - 1 Coho salmon
  - 16 prickly sculpins
  - 12 lampreys
  - 2 signal crayfish
- 16:35: Additional sandbags were installed at Station C-2.
- 17:00: Poly sheeting was installed for exposed surface at Bs and C-2.
- 18:25: The EMs arrived at SCR 17 to inspect the fish isolation, and it remained intact and functional.
- 18:30: EMs departed from site.

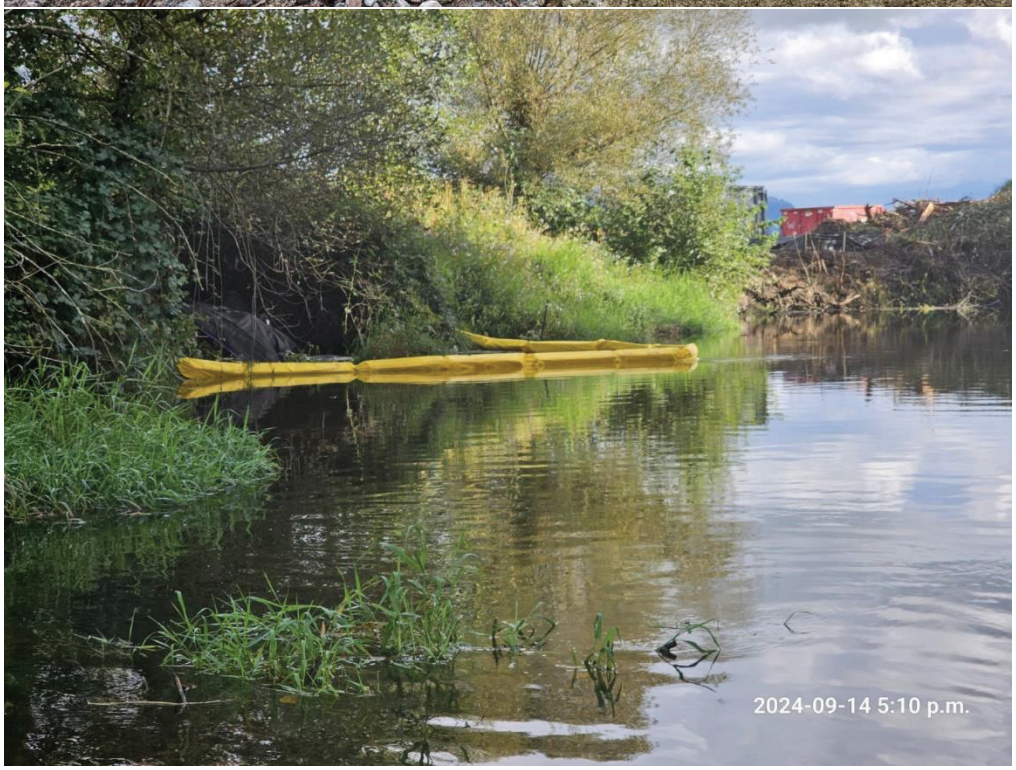
Site Photos




September 14, 2024 1:15 p.m.


September 14, 2024 5:08 p.m.


September 14, 2024 6:24 p.m.


2024-09-14 5:10 p.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	14
Project:	Legace Creek	**Page:**	1 of 4
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 15, 2024
Contract No.:		**Temperature:**	High: 22 Low: 12
Weather:	Sunny		

September 15, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Jim), 2 operator, 2 labourers
Keystone Environmental: EM (John) (Loc)

Contractor's Equipment:

-Equipment in Use

- CAT Excavator 324E
- Zaxis Excavator EX0689
- Zaxis excavator 2720
- Deer Loader 1466
- Pumping equipment: generator, 4 – 3" pumps.

Report, if any, Contact with Occupants:

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Discussions with Contractor:

6:45AM
- Toolbox (James) – Adding another silt curtain at C2 due to high turbidity yesterday using only 1 pump.
- Starting excavation for lock blocks at B2 today.
- Extension from WSA till 30th, nothing from DFO.
- Sand bags at J and K still holding up.

7:00AM
- Discussion with QM (Jim, Craig) – lock block layout.
- Entire bank to be regraded at 2.5:1 from SRS B to bridge abutment (anywhere coco-matting is going). AE (Jordan) confirmed with Ryan.
- AE (Jordan) – referred to RFI 12 while doing layout, drawings show B more north than actual location is. Want B in line with B2 and parallel to creek. Top of bank will curve back towards bridge abutment.

9:00AM
- Discussion on site regarding excavated material from SRS B2 and where it is included in price.
- AE (Jordan) – instructed group to keep separate from excavated pile from SRS B, both are considered contaminated but unsure if proposed SRS excavations are included in price of disposal.
- Mert was under assumption material excavated for SRS lock blocks is included in disposal quantity.
- Jordan discussed with Ryan and he is to confirm. For the time being on site we are going to keep the stockpiles separate and track the volumes separate, the PM's cab decide how the quantity is paid.
- Jordan discussed with Ryan and confirmed with QM (Jim, Craig) – combigrid at the bottom of the SRS excavation is acceptable followed by the base layer wrapped in geotextile. Advised QM not to place gravel in between combigrid and base layer.
- Small tamper on site (lawn mower size) confirmed to be sufficient for SRS install by Ryan.

1:00PM
- Discussion with QM (James) – need to get more base for other proposed SRS. Ordered 9m3 and used all of it on SRS B2. Lots used to get 1:5 slope, clay material too difficult to grade.
- Pumps off at C2, will try diverting pumps to 2 different locations, try to keep turbidity down.

3:00PM
- Discussion with QM (James) – going to be late day. Need to backfill SRS B2 excavation prior to tomorrow because they are hauling material sitting in B3 area, need the space.

6:00PM
- Discussion with QM (Jim) – getting survey tomorrow for stockpiles from B, B2 excavation and C2 topsoil being stockpiled in Jahoolie field.

Report:

7:30AM
- Pumping at C2.
- Preparing SRS B2 lock block area.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

8:20AM
- Excavating at B2 and stockpiling.

9:20AM
- Moving excavated stockpiles SRS B and SRS B2 lock block material and clearing in B3 area to make space for more material being excavated. Keeping SRS B and B2 lock block excavation separate.

1:00PM
- Pumping at C2 off.

12:00PM –
- Placing lock blocks in SRS B2 excavation.
- Outside blocks combigrid and gravel placed between filter and base.
- 3:00PM 5 south most blocks placed and began tamping.
- 4:00 Placing 6th block on first layer, north most.
- Ongoing tamping in lifts during placement of gravel.
- 5:00 Combi grid on top of 1st layer.
- 6:20PM 2nd lock block layer installed. 7 -8 degree slope on blocks.

7:30PM
- Left site.

Testing:

- None today.

Safety Concerns:

12:00PM
- Slope on excavation at south end of SRS B2 excavation for lock blocks, excavator parked at top, running water into excavation
- Slope flattened shortly after.

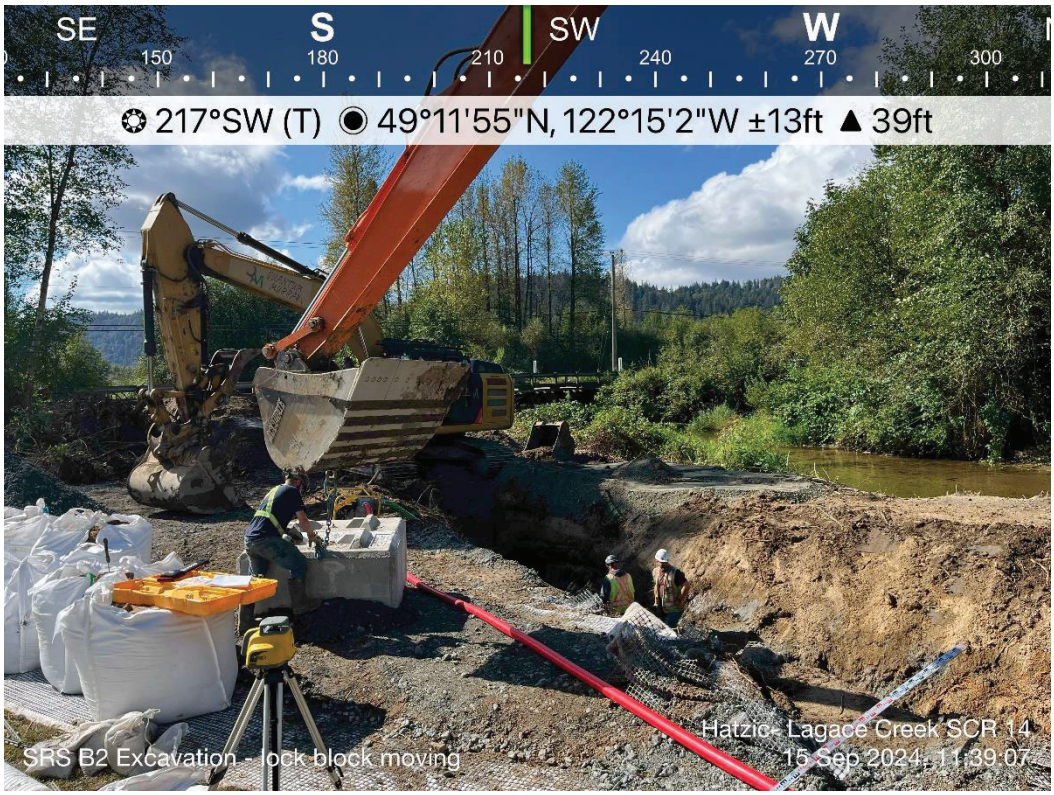
Traffic Control:

- None today.

Photos:

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: September 15, 2024
Environmental Monitors: John Choi, Loc Ngo, Corbin Manson
Weather: Low of 10°C, High of 19°C. Sunny throughout the day.

- 06:30 AM: EMs arrived on-site at CR14.
- 07:10 AM: EMs retrieved ten (10) minnow traps deployed the previous day.
- Results of trap retrieval:
    - 1 Signal crayfish
    - 7 Coho salmon
    - 14 Three-spine sticklebacks
    - 15 Prickly sculpins
    - 2 Pumpkinseed sunfish
- One (1) minnow trap was observed crushed.
- Salvaged fish were measured and released downstream.
- Two (2) invasive Pumpkinseed sunfish were euthanized.
- 07:30 AM: Dewatering at Station C2 was initiated using one (1) 6-inch pump. The discharge hose was directed towards the poly-sheeting waterway installed about 40m downstream. A silt bag was installed on the discharge outlet, and a fish protection basket was observed on the intake hose.
- 07:40 AM: EM observed a notable turbidity bloom traveling downstream from the discharge point. The dewatering pump was temporarily shut down. (Please refer to the water quality result table.)
- 07:45 AM: EMs discussed mitigation strategies with QM to address the turbidity exceedance downstream of Station C2.
- QM noted that the pressure from the discharge was too strong, pushing the turbidity bloom past the silt curtain.
- 08:31 AM: The silt curtain was repositioned across the stream to better accommodate the pressure from the dewatering pump discharge.
- 08:32 AM: The dewatering pump at Station C2 was restarted under the supervision of the EM.
- 08:49 AM: Turbidity bloom persisted near the discharge outlet. (Please see the water quality result table.) EMs informed QM personnel, and the pump was shut down.
- EMs recommended installing poly-sheeting under the silt bag to minimize sediment disturbance on the stream floor during discharge.
- 09:40 AM: The dewatering pump at Station C2 was restarted. EM actively monitored downstream water quality.
- 10:29 AM: Excavator arrived at Stations B2, and excavation work for the SR5 lock-blocks installation began.
- 10:57 AM: The poly-sheeting under the silt bag appeared effective, as turbidity downstream of Station C2 stabilized. (Please refer to the water quality results table.)

- 11:35 AM: Only one (1) dewatering pump was used at Station C2. EMs raised concerns about potential turbidity issues if two (2) dewatering pumps discharge at the same location. QM will set up a second poly-sheeting waterway for the second 6-inch dewatering pump.
- 12:47 PM: QM confirmed no further work at Station C2 for the day, and the dewatering pump was shut down.
- 13:01 PM: EMs deployed nine (9) minnow traps at Station C2 to soak overnight for retrieval the following morning.
- 13:10 PM: Intermittent groundwater discharge from SR5 excavation at Station B2 was observed. Two (2) 3-inch dewatering pumps were used, with discharge directed towards the vegetated bank upstream of Station B. EMs noted that discharged water did not enter the stream.
- 14:15 PM: EMs drove to Station CR17 and noted that the fish isolation barriers were in good condition.
- 16:20 PM: EM Corbin Manson arrived on-site to relieve John and Loc.
- 16:25 PM: EMs (John and Loc) left the site.
- 16:30 PM: SR5 lock-blocks installation continued at Stations B2.
- 17:33 PM: Refueling of the excavator was observed at Stations B2.
- 18:28 PM: The site was shut down for the day.
- 18:35 PM: EM (Corbin) left the site.
- Water Quality Sampling Results:

Location	Time	Turbidity (NTU)
Station B (Background for Station C-2)	7:30	3.05
Station D (~ 50 m downstream from Station C-2)	7:45	**19.06**
Station B (Background for Station C-2)	8:41	3.11
Station D (~ 50 m downstream from Station C-2)	8:49	10.15
Station D (~ 70 m downstream from Station C-2, behind silt curtain)	10:01	10.49
Station D (~ 50 m downstream from Station C-2)	10:08	**15.60**
Station D (~ 50 m downstream from Station C-2)	10:57	5.10
Station D (~ 70 m downstream from Station C-2, behind silt curtain)	12:33	9.67
Upstream from Station B (Background)	15:44	3.09
Downstream from Station B	15:52	7.63

Site Photos






2024-09-15 9:42 a.m.


2024-09-15 9:59 a.m.


2024-09-15 2:26 p.m.


2024-09-15 7:41 a.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	15
Project:	Legace Creek	**Page:**	1 of
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 16, 2024
Contract No.:		**Temperature:**	High: 22 Low: 9
Weather:	Overcast		

September 16, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Jim), 3 operator, 4 labourers
Keystone Environmental: EM (John) (Loc)
Lucas geomatics – survey crew
2 Flaggers

Contractor's Equipment:

-Equipment in Use

- CAT Excavator 324E
- Zaxis Excavator EX0689
- Zaxis excavator 2720
- Deer Loader 1466
- Pumping equipment: generator, 2 – 6" pumps.

Report, if any, Contact with Occupants:

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

3:40PM

- Discussion with QM (Corbin) – AE (Jordan) asking about knotweed management related to in stream works.
- Corbin – was not present when they excavated at B.
- The 20m radius 2m depth is not based on the biology of the plant. Would not expect knotweed to be growing under the creek.
- BC Government flood mitigation manual for invasive species is where the EM's reference the radius and depth buffer. It is more used as a safety / risk mitigation because the knotweed is so predominant on the slope from B to B3. More of a liability aspect in case a seed or stem ends up in the excavated material and it gets hauled to a clean disposal.

Discussions with Contractor:

6:30AM

- Discussion with QM (James) – Haul out material from B and B2 SRS excavation today.
- Survey here this morning will shoot stock piles.
- Leaving B2 lock blocks for now, will try to isolate C2 today.

8:30AM

- Discussion with QM (James, Craig) – AE (Jordan) following discussion with Ryan and Jordon, proposed SRS B2 combigrid and aggregate was improperly installed yesterday.
- The combigrid and aggregate must extent the entire length of the station (excavator distance), it cannot be stepped.
- Must excavate area again and properly install.
- QM – the design drawings do not show a length for how far back the combi grid and aggregate is to extent.
- Jordan asked James to provide submittal for combigrid to AE.

11:00AM

- Discussion with QM (James) – length of combi grid and aggregate for SRS is to be length of excavator.
- QM proposed their excavator is 8m, AE (Jordan) confirmed with AE (Jordon) length is acceptable.
- James got combi grid spec to AE.

1:00PM

- Discussion with QM (James) – James and AE (Jordan) in agreeance isolation at C2 is looking good.
- QM will continue to manage/monitor water and pump during excavation.
- Will be excavating into truck and hauling to stockpile at Jahoolie's, same as topsoil from this location.

1:05PM

- Extension of SRS combi grid and aggregate may reach doug's property for back slope to make excavation safe.
- James to confirm with Doug.
- Jordan confirmed from AE (Jordon) combi grid should have minimum 1m overlap.
- Going to prep B2 area to do it tomorrow.

1:10PM

- Discussion with QM (James) – estimated about 200m3 taken when they excavated C. Will get a lot of material from C2. Won't be finishing today.
- James not concerned with excavator on slope.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

1:30PM
- Discussion with QM (James, Craig) and property owner (Doug) – Doug confirming he is okay with back slope onto edge of his property.

4:15PM
- Discussion with Foreman (Craig) – 5m length for extent of combi grid and aggregate for SRS B2 is what Ryan and Mert agreed upon. Field memo to be released.

Report:

7:15AM
- Stockpiling B2 lock block excavated material near C2.

7:30AM
- Flaggers on site.

7:40AM
- Pumps on at C2
- LiDAR drone active.

8:30AM
- Removing topsoil at C2 and hauling to stockpile on Charlies land (Jahoolie).

9:00AM
- AE (Nicola and Braeden) on site

9:30AM
- Lock block delivery

9:40AM – 10:40AM
- Hauling contaminated material from SRS B2 lock block excavation
- 4 trucks with wagons – same trucks around 21m3 total per truck.

12:00PM
- Removing gravel and combi grid from SRS B2.

1:00PM
- Ongoing pumping and surface excavation at C2.

1:50PM
- Stopped excavation to adjust pump.

4:00PM
- Ongoing excavation at C2

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

- Preparing B2 area for lock blocks tomorrow.
- No longer pumping with cage.

5:45PM

- Left site

Testing:

- None today.

Safety Concerns:

- None today

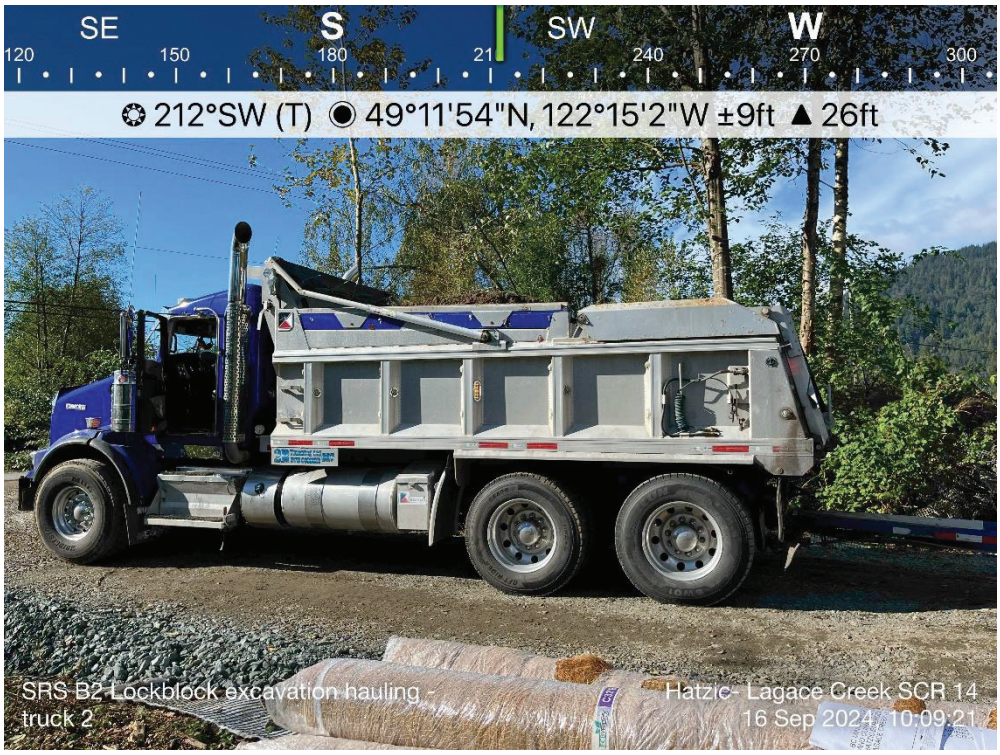
Traffic Control:

- Traffic control on Dale road.

Photos:

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: September 16, 2024
Weather: Low of 10°C, High of 21°C. Partly cloudy throughout the day.

- 0630: EMs arrived on site at CR14.
- 0713: EMs retrieved nine (9) minnow traps deployed the previous day.
    - Trapping Results
        - 2 coho salmon
        - 15 prickly sculpin
        - 28 Three-spine stickleback
- 0735: New dewatering discharge point installed downstream of C2. Original discharge point is now discharge 1, new discharge point is discharge 2.
- 0741: Dewatering at Station C2 was initiated using one (1) 6-inch pump fitted with a screened intake basket. The discharge hose was directed towards a poly sheeting waterway and silt bag combination located about 40m downstream from the intake.
- 0810: Additional 6-inch pump fitted with a screened intake basket started at Station C2. This pump discharged to discharge 2 which was fitted with a poly sheeting waterway and silt bag combination.
- 0830: Active fish salvage commenced at Station C2.
- 0840: Discharge 2 silt bag observed to have failed.
- 0848: The 6-inch pump discharging to discharge 2 was deactivated, as no new silt bags were available to replace the failed one.
- 1040: Dewatering at Station C2 halted due to imminent isolation barrier failure. Placement of sand bags and reinforcement commenced.
- 1129: Excavation and removal of material from Station C2 observed.
- 1158: Ongoing placement of isolation barrier reinforcements observed.
- 1226: Removal of geogrid material was observed near Station B3. Site staff communicated that 6 m of additional gravel behind the lock block walls was required, so excavation and dewatering of the area is expected tomorrow, September 17. Geogrid material was being transported across the road and stored in metal containers. The EM evaluated the risk of the front loader spreading Japanese knotweed when moving across the road to be negligible, due to the vehicle only operating on the crushed rock road base.
- 1237: Dewatering recommenced using a single 6-inch pump fitted with a screened intake basket, discharging to a poly sheeting waterway and silt bag combination.
- 1300: Active fish salvage complete.
    - Active Salvage Results
        - 2 chinook salmon
        - 34 Pacific lamprey
        - 16 prickly sculpin

  - 25 Three-spined stickleback
  - 2 coho salmon
  - 5 signal crayfish
  - 5 green frogs (humanely euthanized)
- 1700: Dewatering at C2 was ceased.
- 1800: Works stopped, isolation at Station C2 was observed to be intact. 5 fish traps were deployed in case of the failure of the isolation barrier. EM offsite.
- Water Quality Sampling Results:

Location	**Time**	**Turbidity (NTU)**
Bridge (Background for Station C2)	0707	5.77
Bridge	0830	8.37
50 m Downstream of Station C2	0836	15.9
Bridge	1030	11.8
50 m Downstream of Station C2	1035	13.6
Bridge	1247	8.31
50 m Downstream of Station C2	1253	**22.17**
100 m Downstream of Station C2	1307	9.31
Bridge	1435	7.12
50 m Downstream of Station C2	1440	**21.8**
100 m Downstream of Station C2	1452	14.0
Bridge	1542	10.31
50 m Downstream of Station C2	1547	11.27
Bridge	1639	4.36
50 m Downstream of Station C2	1645	**16.9**
100 m Downstream of Station C2	1657	13.6

Site Photos









RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: September 16, 2024
Weather: Low of 10°C, High of 21°C. Partly cloudy throughout the day.

- ***Works are being conducted outside of the least-risk window for in-stream works under the supervision and guidance of the Environmental Monitor.***
- 0630: EMs arrived on site at CR14.
- 0713: EMs retrieved nine (9) minnow traps deployed the previous day.
    - Trapping Results
        - 2 coho salmon
        - 15 prickly sculpin
        - 28 Three-spine stickleback
- 0735: New dewatering discharge point installed downstream of C2. Original discharge point is now discharge 1, new discharge point is discharge 2.
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    - Active Salvage Results
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  - 5 signal crayfish
  - 5 green frogs (humanely euthanized)
- 1700: Dewatering at C2 was ceased.
- 1800: Works stopped, isolation at Station C2 was observed to be intact. 5 fish traps were deployed in case of the failure of the isolation barrier. EM offsite.
- Water Quality Sampling Results:

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Bridge	1030	11.8
50 m Downstream of Station C2	1035	13.6
Bridge	1247	8.31
50 m Downstream of Station C2	1253	**22.17**
100 m Downstream of Station C2	1307	9.31
Bridge	1435	7.12
50 m Downstream of Station C2	1440	**21.8**
100 m Downstream of Station C2	1452	14.0
Bridge	1542	10.31
50 m Downstream of Station C2	1547	11.27
Bridge	1639	4.36
50 m Downstream of Station C2	1645	**16.9**
100 m Downstream of Station C2	1657	13.6

Site Photos









Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	16
Project:	Legace Creek	**Page:**	1 of 5
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 17, 2024
Contract No.:		**Temperature:**	High: 17 Low: 10
Weather:	Overcast		

September 17, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Jim), 2 operator, 5 labourers
Keystone Environmental: EM (Corbin)

Contractor's Equipment:

-Equipment in Use

- CAT Excavator 324E
- Zaxis Excavator EX0689
- Zaxis excavator 2720
- Deer Loader 1466
- Pumping equipment: generator, 2 – 6" pumps.

Report, if any, Contact with Occupants:

Contact with Owner:

None Today.

Discussions with Keystone Environmental:
None today.

Discussions with Contractor:

6:45AM

- Toolbox QM (James) – Asked if SRS B2 will be extra work.
- AE (Jordan) – Mert and Ryan decided together yesterday that 5m length of edge of lock block is acceptable. AE PM's will decide if it is extra work, as for today we will note work being conducted in case it is deemed extra.
- Mark up on FM 7 extends past the excavation, this is incorrect, the excavation is to be 5m from lock block edge.

10:15AM

- Discussion with QM (James) and Keystone (Corbin) – AE and QM in agreeance during excavation at SRS B Keystone deemed entire excavation contaminated.
- James asking Corbin to provide AE documentation where the 20m radius and 2m depth comes from for contamination.
- James wants combigrid in bottom of SRS B2 excavation, wants Ryan aware this will be extra charge, wants Jordan to confirm this with Ryan.

11:15AM

- Discussion with QM (James) – Around 500m3 of material he is expecting from SRS C2 excavation.

2:45PM

- Discussion with QM (James) – almost done at C2.
- Measured current slope at C2 around 25 degrees with smart level. (2.5:1 = 22 degrees)

Report:

7:00AM – PM
SRS B2 Lock block installation:
7:10AM – Setting up / layout for SRS B2.
7:20AM – 2 labourers setting up pumps.
7:25AM – 1 excavator starts digging
7:40AM – 2nd excavator starts digging with excavator 1.
7:50AM – 1 – 3" Pump turned on.
8:00AM – 2 operators and 3 labourers
8:30AM – Removing 2nd layer lock blocks.
9:10AM – Removing previous combi grid from top of layer 1.
9:30AM – 2 Labourers and 2 operators
9:45 – 10:25 – Stopped work
10:25AM – Putting combigrid on bottom layer.
10:30AM – Excavator backfilling 1st layer with aggregate
11:30AM – 2 excavators in operation on SRS B2 build – laying aggregate

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

11:50AM – Tamping 3rd time on aggregate layer 1
12:30PM – 2 Operators, 1 labourer
12:30PM – Tamping 4th lift for aggregate layer 1
12:40PM – Laying final lift of gravel
1:00PM – tamping final lift on aggregate layer 1
1:10PM – Fitting lock blocks on bottom layer
2:20 – 2nd layer lock blocks installed
2:20-2:45 – Stopped work
2:45 – 1st aggregate lift, 2nd layer
3:20PM – 2nd layer, 1st lift tamped – 2 operators, 1 labourer
3:45PM – Tamping 2nd lift, 2nd layer
4:45PM – Tamping lift 4, layer 2

7:30AM

- Excavation and pumping at C2.

1:30PM

- Environmental monitor from BC on government for permits.

1:50PM

- Ongoing excavation and hauling to Jahoolie laydown on C2.

3:00PM

- Filled small sand bags at E, around 10.

3:30PM

- Removing pumps at C2, hauling truck to Jahoolie finished.

Testing:

- None today.

Safety Concerns:

- None today

Traffic Control:

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

- None today.

Photos:



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

DAILY CONSTRUCTION REPORT

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	15
Project:	Legace Creek	**Page:**	1 of 7
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 17, 2024
Contract No.:		**Temperature:**	High: 18°C Low: 11°C
Weather:	Partly Cloudy, Wind: 3 KM/H, Gusts: 5 KM/H		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Labour Force:

Quantum Murray (QM): 1 Site Superintendent (Jem), 3 Operators, 4 Labourers
Keystone Environmental/Environmental Monitors (KE/EM): Curbin
Associated Engineering (AE): Jordan Fiske, Vinizza Pingos

Contractor's Equipment: Equipment in use

- Excavator 324E
- Excavator EXO689
- Excavator 2720
- Loader 1466
- 2 – 3" water pump
- 2 - 6" Vacuum Assisted Pumps

Report, if, any, Contact with Occupants:

N/A

Contact with Owner:

N/A

Safety Concerns:

N/A

Testing:

N/A

Traffic Control:

No traffic management on site.

Report:

6:55 AM
- AE (Vinizza) arrived on site.

7:00 AM
- Sign in.

At Station B2: 2 Excavator Operators & 3 Laborers.
7:15 AM
- 2 x 3" water pumps delivered to Station B2.

7:25 AM
- Ongoing excavation of the proposed SRS (Excavator 324E).

7:35 AM
- Ongoing excavation of the proposed SRS (Excavator 2720).
- Water started seeping in.

7:48 AM
- Began pumping the water with the 3" water pumps.

8:00 AM
- Online meeting with Jordon.

8:28 AM
- Ongoing removal of the blocks from the previous installation (2nd layer).

8:35 AM
- Station C:
- Ongoing setup of the 6" water pump.

At Station B2:
8:40 AM
- Finished removing the lock blocks from the previous installation (2nd layer).

9:08 AM
- Removing the combigrid from the previous lock blocks installation.

9:45 AM

- Break.
- Ongoing water pumping.

At Station B2; 1st layer of lock block (bottom):
10:27 AM

- Began laying the combigrid (approximately 9m x 5m with 1m overlap).

10:33 AM

- Laying gravel.

10:54 AM

- Completed the 1st layer of gravel.

10:56 AM

- Began compacting the 1st layer.

11:04 AM

- Finished compacting the 1st layer.

11:06 AM

- Ongoing laying of gravel (2nd layer).

11:18 AM

- Began compacting the 2nd layer.

11:28 AM

- Finished compacting the 2nd layer.

11:30 AM

- Ongoing laying of gravel (3rd layer).

11:48 AM

- Began compacting the 3rd layer.

12:00 PM

- Ongoing laying of gravel (4th layer).

At Station B2; 1st layer of lock block (bottom); 2 Excavator Operators, 1 Loader Operator, 1 Laborer:
12:18 PM

- Began compacting the 4th layer.

12:30 PM
- Finished compacting the 4th layer.

12:42 PM
- Ongoing laying of gravel (5th layer).

12:55 PM
- Began compacting the 5th layer.

1:05 PM
- Finished compacting the 5th layer.

1:18 PM
- Began laying the combigrid (3 sheets approximately 4m x 6m with 1m overlap).
- Began installing the lock blocks (2nd layer).

2:20 PM
- Finished installing the lock blocks (2nd layer).

2:45 PM
- Measuring the slope at Station C2; approximately 25˚.

At Station B2; 2nd layer of lock block (middle); 2 Excavator Operators, 1 Loader Operator, 2 Laborers:
2:49 PM
- Began laying the gravel (1st layer).

3:05 PM
- Finished laying the gravel (1st layer).

3:09 PM
- Began compacting the 1st layer.

3:28 PM
- Laying gravel (2nd layer/lift).

3:44 PM
- Compacting the 2nd layer/lift.

3:54 PM
- Finished compacting the 2nd layer/lift.

3:55 PM
- Laying gravel (3rd layer/lift).

4:14 PM

- Compacting the 3rd layer/lift.

4:22 PM

- Finished compacting the 3rd layer/lift.

4:28 PM

- Laying gravel (4th layer/lift).

4:48 PM

- Compacting the 4th layer/lift.

5:00 PM

- Finished compacting the 4th layer/lift.

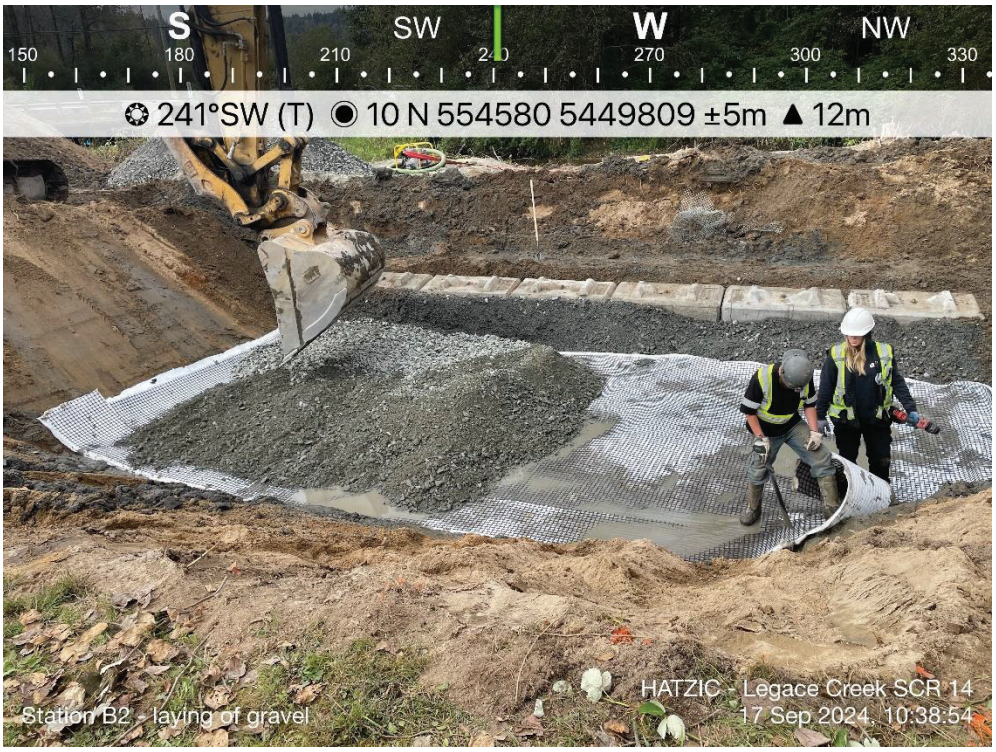
5:40 PM

- QM left the site.

5:50 PM

- AE (Vinizza) left the site.

Photos:


S SW W NW
150 180 210 240 270 300 330
241°SW (T) 10 N 554580 5449809 ±5m 12m
Station B2 - laying of gravel
HATZIC - Legace Creek SCR 14
17 Sep 2024, 10:38:54


SW W NW N
210 240 270 300 330 0
284°W (T) 10 N 554584 5449812 ±3m 1m
Station B2 - 2nd layer of lock block: began laying the gravel
HATZIC - Legace Creek SCR 14
17 Sep 2024, 14:50:54


SW 210 240 W 270 NW 300 330 N 0
285°W (T) 10 N 554585 5449816 ±3m -5m
Station B2: 2nd layer lock block-compacted 4th layer/lift
HATZIC - Legace Creek SCR 14
17 Sep 2024, 17:37:44


E 90 120 SE 150 S 180 210 SW 240
159°S (T) 10 N 554566 5449775 ±4m 0m
Station C2: EOD
HATZIC - Legace Creek SCR 14
17 Sep 2024, 17:40:15

RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: September 17, 2024
Weather: Cloudy with 30% chance of showers. High 18°C, Low 10°C.

- ***Works are being conducted outside of the least-risk window for in-stream works under the supervision and guidance of the Environmental Monitor.***
- ***KEL undertook the following additional measures to reduce the risk of impacts to fish and fish habitat during works conducted outside the instream works least-risk window:***
    - *Overnight trapping of Station C2. Based on the intact isolation and repeated sampling of the work area with no fish caught, we normally would not require additional salvage at Station C2. However, out of an abundance of caution, trapping was conducted overnight. No fish were detected.*
    - *Water quality management. The EM closely monitored downstream water quality and adjusted sediment control measures as neccessary. On September 17th, reinforcements were made to the C2 isolation barrier, and the silt sack at Discharge 1 was replaced when it was observed to be burst.*

- 0630: EM arrived on site at CR14. Isolation at Station C2 appeared intact.
- 0644: EMs retrieved five (5) minnow traps deployed the previous day.
    - Trapping Results
        - No fish captured
    - Based on the trapping results, KEL advised that dewatering could proceed. One 6-inch pump fitted with a screened intake basket was started, and discharge was directed through a silt sack and poly waterway combination at Discharge 1.
- 0722: Placement of two (2) 3-inch trash pumps fitted with spill trays was observed at Station B lock block installation area.
- 0811: Discharge from the 3-inch trash pumps was observed to be directed to a vegetated area upstream of station B.
- 0839: Dewatering was observed to be halted at Station C2 while one 6-inch pump was swapped with the backup pump.
- 0848: Dewatering at Station C2 observed to be resumed.
- 0858: Dewatering at Station B observed to be halted.
- 0925: Discharge at Station B observed to be restarted.
- 1219: Isolation barrier at Station C2 was observed to be deteriorating. Sandbag reinforcements were observed being installed.
- 1355: Staff from the BC Ministry of Water, Land, and Resource Stewardship were on-Site. Per KEL discussion with WLRS, the Ministry will allow excavation in an isolated-but-leaking Station C2. WLRS requested KEL EM be diligent and strict with water quality guidelines.
- 1355: Silt sack at Discharge 1 observed to be replaced.
- 1457: Downstream water quality observed to be improved following installation of new silt sack.

- 1520: Dewatering at Station C2 was observed to be halted.
- 1723: Works observed to be halted for the day.
- 1729: Poly being placed on Japanese knotweed stockpiles based on risk of rain.
- Water Quality Sampling Results:

Location	Time	Turbidity (NTU)
20 m Upstream of Station B	0707	6.39
20 m Upstream of Station B	0808	7.54
Bridge	0801	11.03
50 m Downstream of Station C2	0754	6.58
20 m Upstream of Station B	0901	9.71
Bridge	0910	10.77
50 m Downstream of Station C2	0917	**24.8**
100 m Downstream of Station C2	0922	14.7
20 m Upstream of Station B	1029	5.17
Bridge	1037	5.07
50 m Downstream of Station C2	1041	8.72
20 m Upstream of Station B	1131	4.15
Bridge	1137	3.18
50 m Downstream of Station C2	1143	**14.8**
100 m Downstream of Station C2	1151	11.8
20 m Upstream of Station B	1240	5.00
Bridge	1245	5.29
50 m Downstream of Station C2	1251	12.6
20 m Upstream of Station B	1335	5.26
Bridge	1341	11.9
50 m Downstream of Station C2	1347	15.1
20 m Upstream of Station B	1446	4.96
Bridge	1451	6.31
50 m Downstream of Station C2	1456	9.55

Site Photos











Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	17
Project:	Legace Creek	**Page:**	1 of 5
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 18, 2024
Contract No.:		**Temperature:**	High: 20 Low: 17
Weather:	Overcast		

September 18, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Jim), 3 operator, 4 labourers
Keystone Environmental: EM (Corbin, Vincent)

Contractor's Equipment:

-Equipment in Use

- CAT Excavator 324E
- Zaxis Excavator EX0689
- Zaxis excavator 2720
- Deer Loader 1466
- Pumping equipment: generator, 2 – 6" pumps.

Report, if any, Contact with Occupants:

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

Discussion with Contractor:

7:00AM

- Toolbox talk with QM (James) – plan to finish B2 lock block structure today.
- Removing bags from C2
- Start excavation for C2 lock blocks
- Hauling contaminated material from B and B2 lock block excavation
- Survey on site for C2 stockpiles in Jahoolie yard
- Not planning on change order SRS B2 re-excavation, not a lot of work. Wants to keep everyone happy now that we are on the same page with the contaminated material.

9:25AM

- Discussion with QM (James) – after finishing removing bags at C2 then will start excavating there.
- Also planning to start removing material from B3, once there is space for stockpile.
- Surveyor shooting stockpiles from C2 in Jahoolie field today, also shot contaminated piles.

11:10AM

- Discussion with foreman (Craig) – no width of the access road is specified in the drawings.
- Jordan – refer to PL on drawings and work off that.

11:30AM

- Discussion with QM (Jim, Craig) – asking about extent of combigrid from road surface into SRS.
- AE (Jordan, Vinizza) – want to tie in that combigrid from the road structure on the top layer to the back of the lock blocks, 1m overlap still applies.

2:05PM

- Discussion with QM Foreman (Craig) – left section of combigrid under filter fabric next to SRS B2, will be able to lift this layer up to tie into road with 1m overlap for combigrid.

5:00PM

- Discussion with QM (James) – DFO permit is now in place, waiting on a few comments to be addressed form AE, then will be able to excavate in the wet likely tomorrow.
- Will be ramping up, likely 3 crews by end of week to excavate/build stations.
- Waiting on some permits before giving excavated material from C2 to Jahoolie, Jahoolie pushing because they want to plant crops this week.

5:30PM

- Wondering how far back to extend the access road to SRS B. Gap shown on drawings. Jordan to confirm with AE (Jordon).

Report:

7:15AM

- Hauling contaminated material from B2 lock block excavation and SRS B excavation.

8:00AM

- Surveyor on site, using total station.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

8:15AM
- Removing sand bags and clean up from SRS C2
- Lost 2 bags

8:40AM
- Ongoing aggregate deliveries today.

9:15AM
- SRS B2 excavation
- Final lift on layer 2 – 2 operators 2 laborers

10:10AM
- Combigrid on 2nd layer of SRS B2

11:00AM
- Lucas geomatics – LiDAR survey – on site

11:10AM
- 1st layer lift on top layer SRS B2 – 2 labourers, 2 operators

12:40PM
- 3rd contaminated hauling truck on site – Vinizza tracking trucks today.
- Tarping on Farms road.

2:05PM
- Laying final layer of combigrid (road surface)

3:00PM
- 4th contaminated hauling truck.

4:00PM
- SRS B2 lock block structure complete, back filling surrounding area with stockpile that was surveyed today.

4:00PM
- Fixing bags at SRS J and K

Testing:

- None today.

Safety Concerns:

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

- None today

Traffic Control:

- None today.

Photos:



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

DAILY CONSTRUCTION REPORT

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	16
Project:	Legace Creek	**Page:**	1 of 6
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 18, 2024
Contract No.:		**Temperature:**	High: 19°C Low: 12°C
Weather:	Partly Cloudy, Wind: 3 KM/H, Gusts: 5 KM/H		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Labour Force:

Quantum Murray (QM): 1 Site Superintendent (Jem), 3 Operators, 4 Labourers
Keystone Environmental/Environmental Monitors (KE/EM): 2 staff
Associated Engineering (AE): Jordan Fiske, Vinizza Pingos

Contractor's Equipment:

s
Equipment in use

- Excavator 324E
- Excavator EXO689
- Excavator 2720
- Loader 1466
- 2 – 3" water pump
- 2 - 6" Vacuum Assisted Pumps

Report, if, any, Contact with Occupants:

N/A

Contact with Owner:

N/A

Safety Concerns:

N/A

Testing:

N/A

Traffic Control:

Traffic management control, consisting of one flagman, arrived on site at 9:29 AM and left at 2:45 PM.

Report:

6:40 AM
- AE (Jordan & Vinizza) on site.

6:45 AM
- Sign-in completed. Toolbox talk conducted with QM and Keystone.
- Jem outlined today's tasks: hauling excavated materials from Station B, surveying the excavated materials, and continuing the SRS at Station B2.

7:18 AM
- Commenced hauling excavated materials from Station B.

7:57 AM
- Hauled excavated materials using two trucks with wagons.

8:00 AM
- Online meeting with Jordon.

8:13 AM
- Surveyor arrived

Station C with one operator and three laborers.
8:25 AM
- Began removing sandbags from Station C2.

8:50 AM
- Ongoing delivery of gravel to Station B2.

8:55 AM
- Ongoing survey of excavated materials

At Station B2 with one operator and two laborers. Continuation of the proposed SRS and installation of the second layer of lock blocks.
9:10 AM
- Started laying gravel (5th lift).

9:26 AM
- Compacted the gravel (5th lift).

9:29 AM
- Left site 14; traffic management in place on site.

9:35 AM
- Arrived at site 17.

10:08 AM
- Returned to site 14.

10:10 AM
- Laying combigrid and installing lock blocks (3rd layer).

10:11 AM
- Left site 14.

10:16 AM
- Arrived at site 17.

10:20 AM
- Flagged the north side area for sediment removal.

11:03 AM
- Returned to site 14.

At Station B2: installed the 3rd layer of lock blocks with two operators and two laborers.
11:04 AM
- Completed installation of the 3rd layer of lock blocks.
- Ongoing laying of gravel (1st lift).

11:34 AM
- Ongoing compaction of the 1st lift.

11:50 AM
- Completed compaction of the 1st lift.

12:00 PM
- Online meeting with Jordan.

12:52 PM
- Hauling excavated materials at Station B2 using the 3rd truck with a wagon.

1:15 PM
- At Station C2: transferring sandbags from Station C2 to Station D (opposite side).

1:25 PM
- Laying combigrid and nonwoven cloth on both sides.

1:45 PM
- Laying gravel on the combigrid.

2:14 PM
- Compacting the gravel (1st lift).

2:28 PM
- Laying gravel for the 2nd lift.

2:42 PM
- Ongoing delivery of gravel to Station B2.

2:45 PM
- Traffic management personnel left the site.

2:56 PM
- 4th truck for hauling excavated materials arrived on site.

3:15 PM
- 5th truck for hauling excavated materials arrived on site.

3:32 PM
- 6th truck for hauling excavated materials arrived on site.

3:35 PM
- Surveyed excavated materials were utilized for the proposed SRS at B2.

Station J:
4:15 PM
- Loader transported sandbags from Station D to Station J and placed them at Station J.

4:30 PM
- Installation of lock blocks at Station B2 has been completed.
- Hauled the excavated materials from B2 using 6 trucks + wagon (approximately 21 m^3 $each\ truck$)

4:55 PM
- AE (Vinizza) left the site.

Photos:


E 90 SE 120 150 S 180 SW 210 240
170°S (T) 10 N 554576 5449778 ±4m 6m
Station C2 - removing sandbags
HATZIC - Legace Creek SCR 14
18 Sep 2024, 08:43:55


SW 210 240 W 270 300 NW 330 N 0
284°W (T) 10 N 554585 5449813 ±3m 0m
Station B2
HATZIC - Legace Creek SCR 14
18 Sep 2024, 13:29:28


SW W NW N
210 240 270 300 330 0 30
299°NW (T) 10 N 554583 5449813 ±3m 2m
Station B2
HATZIC - Legace Creek SCR 14
18 Sep 2024, 16:41:31


SE S SW W NW
150 180 210 240 270 300
223°SW (T) 10 N 554583 5449805 ±7m 5m
Station B2- 6th truck
HATZIC - Legace Creek SCR 14
18 Sep 2024, 15:35:55

RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: September 18, 2024
Weather: Partly cloudy. High 17°C, Low 10°C.

- ***Works are being conducted outside of the least-risk window for in-stream works under the supervision and guidance of the Environmental Monitor.***
- ***Keystone Environmental undertook the following additional measures to reduce the risk of impacts to fish and fish habitat during works conducted outside the instream works least-risk window:***
    - *Overnight trapping of Station F. Based on the intact isolation and sampling of the Station F with no fish caught, we normally would not require additional salvage at Station F prior to excavation. However, out of an abundance of caution, four (4) baited minnow traps were deployed at Station F.*
    - *Isolation barrier maintenance, overnight trapping, and intensive dip netting of Station K. The isolation barrier at Station K was observed to have failed with one (1) sandbag having slumped and allowed streamflow to overtop the barrier. The barrier was repaired, and five (5) baited minnow traps were set overnight. The EM undertook intensive systematic dip netting of the area for 44 minutes, yielding no catch. The EM will evaluate the status of Station K following a trap check in the morning.*
    - *Water quality management. The EM closely monitored downstream water quality and adjusted sediment control measures as necessary. On September 18th, the Station C2 isolation barrier was disassembled following confirmation that the turbidity within the isolated area had declined to an acceptable level. No downstream water quality issues were observed. The isolation barrier at Station F was inspected and found to be intact. The isolation barriers at Stations J and K were inspected and both found to have failed at a single point. The EM observed repairs being made to the isolation barriers. The EM also observed a silt curtain being staged upland at Station K in preparation for installation downstream to reduce the release of sediments during excavation. Exposed soils were observed to be covered with poly sheets prior to the end of work today.*

- **0630:** EM arrived on site at CR14. Isolation at Station C2 appeared intact.
- **0652**: QM advised that they intended to walk an excavator from a knotweed contaminated area to an uncontaminated area. The EM advised that the excavator would have to be visibly free from soil and plant parts including high contact areas such as the bucket, treads, and floor of the cab. QM expressed concerns about being unable to remove hardened dirt efficiently. The EM advised that a 5:1 dilution of ammonia bleach with water, sprayed onto difficult to clean areas until wet but not running off, will mitigate knotweed risks associated with hardened dirt.
- **0720:** Loadout of knotweed soil from Station B observed. Transport trucks observed to be covered when leaving the Site.
- **0752:** Japanese knotweed clone observed at the sandbar near Station B2, supporting the idea that stream sediments are knotweed contaminated. Yellow flag iris was also observed to be present.

- **0800:** The isolation barrier at Station C2 was observed to be removed.
- **0806:** First water quality sample collected.
- **0917:** Second water quality sample collected.
- **1009:** Third water quality sample collected.
- **1044:** Excavator observed removing remaining isolation barrier materials.
- **1110:** Fourth water quality sample collected
- **1130:** Final isolation barrier materials observed to be removed by hand. Turbidity within the Station C2 basin observed to be draining slowly into the channel.
- **1227:** Fifth and final water quality sample collected.
- **1250:** Tracking of sediments from south side of Dale Road observed as knotweed transport trucks reverse into loading area. Directed QM to sweep the road and scrape the mud at the north side of the Site to reduce tracking. Knotweed contamination was not suspected in the tracked soils.
- **1309:** Sweeping of Dale Road observed.
- **1427:** Dissolved Oxygen data collected. QM advised that excavation was planned for Stations F and K the following day.
- **1449:** Four (4) baited minnow traps set at Station F. Isolation barrier inspected and found to be intact.
- **1514:** Five (5) baited minnow traps set at Station K. Isolation barrier inspected and found to be breached at a single point. QM notified of breach.
- **1552:** Japanese knotweed soil loadout observed to be ongoing. Transport truck observed to be using rubber tarps to secure load.
- **1610:** Isolation at Station K appears repaired. Active fish salvage via dip netting commenced.
- **1629:** Isolation repaired at Station J. Two (2) systematic dip net passes of Station K completed with no catch.
- **1654**: Five (5) total systematic dip net passes at Station K completed with no catch.
- **1658:** QM asked if there were any CEMP or permit restrictions in relation to moving the stockpiled soils around the neighbour's property to facilitate blueberry planting. Keystone Environmental advised that erosion and sediment control measures would be required if the risk of runoff to Lagace Creek or another watercourse was noted.
- **1735:** Poly sheets observed to be installed at Station C2 to cover exposed soils.
- **1741:** Excavation underway at B3. Trench appears dry and isolated.
- **1813:** Works observed to be halted for the day. Keystone Environmental off Site.
- Water Quality Sampling Results:

Location	Time	Turbidity (NTU)
Bridge	0807	4.72
50 m Downstream of Station C2	0811	5.20
50 m Downstream of Station C2	0917	2.67
Bridge	1009	6.08
50 m Downstream of Station C2	1009	5.53
Bridge	1110	10.27
50 m Downstream of Station C2	1110	9.06
Bridge	1227	6.60
50 m Downstream of Station C2	1231	4.05

Site Photos









Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	18
Project:	Legace Creek	**Page:**	1 of 5
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 19, 2024
Contract No.:		**Temperature:**	High: 19 Low: 10
Weather:	Overcast		

September 19, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Jim), 3 operator, 7 labourers
Keystone Environmental: EM (Corbin, Vincent)

Contractor's Equipment:

-Equipment in Use

- CAT Excavator 324E
- Zaxis Excavator EX0689
- Zaxis excavator 2720
- Deer Loader 1466
- Pumping equipment: generator, 2 – 6" pumps.

Report, if any, Contact with Occupants:

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

Discussion with Contractor:

7:00AM
- Toolbox talk QM (James) –
- Permit from DFO is in place, need amendment to WAS permit because the extension did not include working in the wet.
- Going to extend access to SRS B.
- Hauling contaminated this morning.
- Aggregate deliveries today.
- Finish SRS B2 + road area.
- Starting to excavate at B3 – this is material they are hauling.
- Layout at C2 – unsure if there is space to stockpile excavation for the lock block structure.
- Plan to give Charlie (Jahoolie) material once he signs off for it – stockpile has been surveyed.

7:10AM
- Discussion with QM (James) – discussing where we want B3 SRS.
- James – planning to leave large berm in creek next to bridge in order to excavate in dry, as well based on where original SRS B3 layout was in relation to bridge abutment.
- AE (Jordan) to confirm with Jordon Rozon.

8:00AM
- Discussion with QM (James, Mert), AE (Jordan Vinizza) –
- AE wants berm at B3 removed, explained this is most important section of project. QM wants to use berm for isolation, based on their excavator extent from original lock block layout it is as far as they can reach.
- QM – AE should have addressed moving blocks sooner, has contaminated trucks coming today to move this material, does not want to cancel trucks.
- Extending this area will increase contaminated quantity cost.
- Plan is to currently remove 80 – 90 % of this berm so they can still load out trucks.
- Jordan and Vinizza will help layout where SRS blocks should be.

9:20AM
- Discussion with QM (James) –
- AE (Jordan) and QM measured length of long arm excavator for lock block reference.
- QM will isolate this section and remove the berm. Still gives them ability to load out material today and get the rest after.

11:15AM
- Discussion with QM (James, Craig) – Jahoolie will not sign off on permit to accept material, process can take up to 60 days for agricultural use.
- James and Mert to talk to Doug about material.

11:20AM
- Discussion with QM (James) –
- AE (Jordan) confirming this will be pulling back slope from B to bridge with cocomatting, QM planning to do this after B3 excavation.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

3:15PM

- Discussion with QM (James) – Jordan (AE) asked James to get the edge of the sediment where sand bags are being tied in at. James wants to get BC first out to locate watermain running under bridge before digging any closer to the bridge.

4:15PM

- Discussion with QM (James) –
- After investigating a line locate was already complete at the beginning of this project. Because of the wet location they were unable to determine exactly where the line runs under the bridge because it is a PVC pipe.
- James was advised to stay 5m off the north side of the bridge, but is concerned in the sediment they will be losing.
- Jordan (AE) after talking to Jordon Rozon (AE) is going to provide QM with as-built drawings from Fraser Valley for the 250mm PVC water main running under bridge.

Report:

7:00AM

- AE (Jordan, Vinizza) – measure C2 clearing
- 17m x 22m

7:05AM

- Doing layout at C2 SRS.

8:00AM

- Lock block delivery.

9:30 – 10:15AM

- Hauling trucks all with wagons.
- Same trucks.
- 4 trucks with wagons total.
- Around 21 m3 each.

10:50AM

- Began excavated SRS C2 for lock blocks.

11:00AM

- Placing sand bags at B3 for isolation.

11:20AM

- Placing access road from B2 to B.

12:00PM

- AE Enviro (Naomi) on site.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

12:30PM
- Moving material excavated from SRS C2 lock block to SRS L laydown area.

5:00PM
- Left site

Testing:

- None today.

Safety Concerns:

- None today

Traffic Control:

- None today.

Photos:

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

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DAILY CONSTRUCTION REPORT

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	17
Project:	Legace Creek	**Page:**	1 of 5
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 19, 2024
Contract No.:		**Temperature:**	High: 18°C Low: 10°C
Weather:	Partly Cloudy, Wind: 3 KM/H, Gusts: 5 KM/H		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Labour Force:

Quantum Murray (QM): 1 Site Superintendent (Jem), 3 Operators, 7 Labourers
Keystone Environmental/Environmental Monitors (KE/EM): 2 staff
Associated Engineering (AE): Jordan Fiske, Vinizza Pingos

Contractor's Equipment: Equipment in use

- Excavator 324E
- Excavator EXO689
- Excavator 2720
- Loader 1466
- 2 – 3" water pump
- 2 - 6" Vacuum Assisted Pumps

Report, if, any, Contact with Occupants:

N/A

Contact with Owner:

N/A

Safety Concerns:

N/A

Testing:

N/A

Traffic Control:

Traffic management control, consisting of two flagmen, arrived on site at 6:40 AM and left at 3:20 PM.

Report:

6:35 AM
- AE (Jordan & Vinizza) arrived on site.

6:40 AM
- Sign-in. Toolbox with QM (11) & Keystone (1).
- Jem discussed the day's work plan, which includes:
  - Layout of Station C2 for the SRS
  - Continuing gravel placement to Station B for the access road
  - Spreading excavated material onto Charlie's land
  - Hauling excavated materials
  - Delivering gravel
- Traffic management control established on site (2 flagmen).

7:02 AM
- AE measured the Station B3 (17m x 22m).
- QM laid out Station C2 for the proposed SRS.

7:05 AM
- Cleared the area for the access road to Station B.

8:21 AM
- Lock block delivery arrived.

9:40 AM
- Ongoing excavation at Station B3 (inland sediments).

9:44 AM
- Second truck + wagon arrived for hauling excavated materials from Station B3.

9:50 AM
- Third truck + wagon arrived for hauling excavated materials from Station B3.

10:10 AM
- Fourth truck +wagon arrived for hauling excavated materials from Station B3.

10:50 AM
- Excavator 27290 transferred to Station B3.

11:05 AM
- At Station B3:
  - Setting up the isolation area and placing poly sheet.

11:14 AM
- At Station B3:
  - Placing sandbags.

11:30 AM
- Laying gravel on the access road to Station B.

12:10 PM
- AE Naomi arrived on site.

12:45 PM
- Hauling excavated materials from Station C2 to Station L.
- Transferring sandbags from Station D (opposite side) to Station B3.

1:06 PM
- AE Naomi left the site.

1:30 PM
- Continuing to lay gravel on the access road to Station B.

1:36 PM
- Ongoing excavation of inland sediments at Station C2 in preparation for the proposed SRS installation.
- Ongoing hauling of excavated materials from C2 to L.

2:03 PM
- Transferred the 6” water pump to Station B3.

2:20 PM
- Setting up the 6” water pump at Station B3.

3:00 PM
- Ongoing placement of bags.

3:20 PM
- Traffic management control left the site.

4:30 PM
- At Station B3:
    - Sandbags and polysheet in place.

5:10 PM
- QM left the site.

5:15 PM
- AE (Vinizza) left the site.

Photos:


E SE S SW
90 120 150 180 210 240
170°S (T) 10 N 554579 5449779 ±3m ▲7m
Station C2-hauling excavated materials from C2 to L
HATZIC - Legace Creek SCR 14
19 Sep 2024, 13:35:47


SW W NW N
210 240 270 300 330 0
293°NW (T) 10 N 554590 5449758 ±4m ▲1m
Station C2-in preparation for the SRS installation
HATZIC - Legace Creek SCR 14
19 Sep 2024, 16:56:20


N NE E SE
0 30 60 90 120 150
73°E (T) 10 N 554546 5449783 ±4m 1m
Station B3-isolated area
HATZIC - Legace Creek SCR 14
19 Sep 2024, 16:53:40


W NW N NE
270 300 330 0 30 60
338°N (T) 10 N 554577 5449811 ±4m 0m
Station B2- SRS & access road to Sta. B
HATZIC - Legace Creek SCR 14
19 Sep 2024, 16:50:38

TECHNICAL MEMORANDUM

Issue Date:	September 24, 2024	**File:**	Audit No. 4
To:	**Thyren Jacobs, Flood Debris Management Secretariat**	**Previous Issue Date:**	
From:	Naomi Sands, R.P.Bio.		
Client:	Ministry of Environment and Climate Change Strategy		
Project Name:	Lagace Creek Bank Protection and Sediment Removal - SCR14	**Project No.:**	2022-2632.03
Subject:	Environmental Compliance Audit		
Monitoring Period:	September 13 – September 19, 2024		
Contractor:	QM Environmental		
Environmental Monitor:	Keystone Environmental		

1 INTRODUCTION

Associated Environmental Consultants Inc, (Associated) is pleased to provide this environmental audit report summarizing observations of site conditions, environmental protection measures, regulatory compliance, and corrective actions as part of erosion protection works on Lagace Creek, south of Durieu, BC in the Hatzic Valley (the Project, the Site) during the monitoring period September 13 to September 19, 2024. The results presented in this audit report are based on conditions observed at the time of the audit inspection(s) and represent a snapshot of the workday. Items identified as non-compliant may have been addressed before the report(s) are submitted. The audit report(s) are submitted to the owner, their agent (Associated Engineering), the Contractor, and their environmental monitor (EM) and are not intended for further distribution.

2 ROLES AND RESPONSIBILITIES

The prime contractor for the Project is QM Environmental (the Contractor), and works are being monitored for environmental compliance by Keystone Environmental (Keystone) and audited by Associated. As the EM, Keystone is to work with the Contractor to develop measures to protect the environment and to respond to environmental incidents as they occur. Keystone is also responsible for fish and wildlife salvages prior to instream works. Leq'á:mel First Nation (LFN) is the cultural monitor for the Site. The responsibility of the auditor is to ensure on behalf of the owner, who is ultimately the permit holder, that the EM, LFN, and the Contractor adhere to the requirements of the Construction Environmental Monitoring Plan (CEMP)[1], environmental permit conditions and any applicable regulations.

3 SITE INSPECTION

A summary of site conditions as observed during the audit inspection completed during the monitoring period is provided in Table 3-1. Monitoring reports have been submitted for the auditing period.

[1] AquaTerra Environmental Ltd. 2024. Hatzic Emergency Program, South Herford Creek Project, Construction Environmental Management Plan (Rev. 1). Prepared for Mission Contractors Ltd. 65 p.

Table 3-1 Site Conditions During Audit Inspection

Date / Time	Auditor (Associated)	Weather	Construction Activities
September 19, 2024 12:00	Naomi Sands	Sun & cloud. 17°C. No precipitation.	Contractors were excavating new sand stations C2 and B3, above wetted channel.

4 INSPECTION RESULTS

A checklist of required environmental protection measures and mitigative strategies for the Project is presented in Table 4-1. The checklist has been developed in accordance with terms and conditions of the environmental permits and approvals issued for the Project, environmental protection specifications and requirements as part of the construction contract for the Project, the Contractor's Construction Environmental Management Plan and environmental best management practices and guidelines.

Table 4-1 Summary of Environmental Protection Measures Reviewed and Results of the Inspection

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
	Environmental Monitoring					
1	The EM will attend key site meetings where environmental mitigations and issues may be discussed.	☒Compliant ☐Non-Compliant ☐N/A	EM has been on site daily to attend site meetings.	As instream works continue outside the least risk fish window, EM reports should continue to document consideration of increased risk and if enhanced mitigation is required.	CEMP Section 2.4	
2	The EM shall supervise all instream works. If temporary diversion installed, EM is onsite daily to check pumps and flow bypasses.	☒Compliant ☐Non-Compliant ☐N/A	EM was onsite to oversee works in and about the channel.		WSA (h)2.ii, (j)5.i CEMP Section 2.4	
3	The EM will submit daily and bi-weekly monitoring reports to the Contractor for distribution to MoECCS.	☒Compliant ☐Non-Compliant ☐N/A	Monitoring reports are submitted daily, or the following morning.		CEMP Section 5.1	
4	The EM will complete and submit an Environmental Incident Report (EIR) for non-compliances with the CEMP, reportable spills or other environmental incident.	☐Compliant ☐Non-Compliant ☒N/A	No reportable environmental incidents have been documented to date.		CEMP Section 4	
5	EM is granted authority to stop the work if necessary	☒Compliant ☐Non-Compliant ☐N/A	EM has not exercised stop work to-date.		WSA (i) 7 CEMP Section 2.4	
	Erosion and Sediment Control					
6	Appropriate site isolation is installed as required, including silt fencing prior to instream works. Silt fences are installed properly, intact, adequate, clear of accumulated sediment and are functioning.	☒Compliant ☐Non-Compliant ☐N/A	Sandbag isolation installed at stations J, K. Waiting approval to proceed in the wet. Current excavation is above the wetted channel. Silt fences installed around sediment stockpiles.	WLRS permit amendment, to allow dredging in the wet, is still pending. In the interim, instream works must adhere to existing permit conditions.	WSA (o), (q) CEMP Section 3.5	Photo 1 Photo 2
7	Riprap or any other engineering material place in channel is clean of any substances deleterious to aquatic life.	☐Compliant ☐Non-Compliant ☒N/A	No riprap or other material was being placed during the audit.		WSA (x) CEMP Section 3.5	
8	Stockpiling and storage areas are located 15 m from the watercourse TOB.	☒Compliant ☐Non-Compliant ☐N/A	Sediment stockpiles are located >15 m from the watercourse OR surrounded by silt fencing.		DFO FAA WSA (t) CEMP Section 3.5	Photo 3
9	Emergency ESC material onsite (e.g., 100 feet of silt fencing, 5 dry bales, and 100sq.m of ECBs/ Coconut matting, or polyethylene sheets)	☒Compliant ☐Non-Compliant ☐N/A	ESC materials were stockpiled at the site laydown. Lots of exposed sediment onsite.	With forecast rain, EM should ensure site is stabilized.	CEMP Section 3.5	
10	Sediment removed from the Site will be disposed of appropriately at a location approved by the EM and MoECCS.	☐Compliant ☐Non-Compliant ☒N/A	Excavated sediment is currently being stockpiled onsite. Offsite disposal location still to be determined.	Identify sediment disposal location(s) in the CEMP and/or the environmental monitoring reports.	CEMP Section 5.5	
11	Sediment removal boundaries must be clearly delineated prior to commencement of work.	☒Compliant ☐Non-Compliant ☐N/A	Sediment boundaries determined in consultation with AE inspector.		WSA (opening)	
	Invasive Plant Management					

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
12	Ensure that machinery is free of invasive plant material that could potentially be transported throughout or between sites.	☐Compliant ☐Non-Compliant ☒N/A	No machinery observed leaving site during inspection.		WSA (opening) CEMP Section 3.4	
13	Ensure that invasive species removed from site are disposed of appropriately at an approved facility	☐Compliant ☒Non-Compliant ☐N/A	Japanese knotweed removal is ongoing, however, management protocols in CEMP still do not align with approach in field.	Ensure knotweed management adheres to approved BMPs and contract, and document methodology.	WSA (opening) CEMP Section 3.4.1	
14	The Project site shall be regularly monitored by the EM for invasive plant infestations and these infestations will be mapped and managed according to applicable species-specific BMPs.	☐Compliant ☒Non-Compliant ☐N/A	Patches of knotweed adjacent to work areas have been flagged but still no barrier to prevent accidental encroachment on these patches.	Continually monitor works adjacent to knotweed patches to ensure no accidental encroachment.	CEMP Section 3.4.1	Photo 4
16	Knotweed stems are cut close to the ground and contained on poly sheeting away from the immediate work area. Cut knotweed is covered with woven geotextile fabric and crushed rock prior to machine access. Knotweed stems are injected with an appropriate herbicide before being covered.	☐Compliant ☒Non-Compliant ☐N/A	Knotweed management still not adequately documented.	Update CEMP to document revised knotweed approach.	CEMP Section 3.4.1 Addendum 1 to the Contract Documents for the Hatzic Emergency Works Program - Lagace Creek – Sites S-CR-14/17	
	Waste Management					
17	Dispose of all anthropogenic debris removed at an appropriate waste management facility.	☒Compliant ☐Non-Compliant ☐N/A	No anthropogenic debris was observed on site.		WSA (opening) CEMP Section 5.5	
18	Non-hazardous waste stored appropriately and removed offsite daily.	☒Compliant ☐Non-Compliant ☐N/A	No non-hazardous waste was observed during the audit.		CEMP Section 5.5	
19	Hazardous waste stored > 30 m of watercourses.	☒Compliant ☐Non-Compliant ☐N/A	Two portable toilets are located at the site laydown, more than 30 m away from watercourses.		CEMP Section 5.5	
20	Secondary containment used for all stored hazardous waste.	☐Compliant ☒Non-Compliant ☐N/A	Portable toilets were not in secondary containment.	Add secondary containment to portable toilets.	CEMP Section 3.6	
	Spill Control and Emergency Response					
21	Machinery operating in channel is equipped with environmentally friendly oil	☒Compliant ☐Non-Compliant ☐N/A	Excavator on site has a sticker confirming that it contains Environ™ biodegradable, non-toxic hydraulic fluid.		WSA (p) 4 CEMP Section 3.6	
22	Equipment and machinery are free of leaks	☒Compliant ☐Non-Compliant ☐N/A	No leaks were observed during the audit. Equipment appeared to be clean.		WSA (p) 1 CEMP Section 3.6	
23	Drip trays are available and used during refueling and equipment maintenance	☒Compliant ☐Non-Compliant ☐N/A	Equipment was actively working during the audit. Spill trays were observed around site. Parked excavator had a spill tray under the engine.		CEMP Section 3.6	

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
24	Fuel is stored > 30 m from Lagace Creeks and any connected drainages	☒Compliant ☐Non-Compliant ☐N/A			WSA (p) 3 CEMP Section 3.6	
25	Machinery and vehicles operating onsite are equipped with spill kit.	☒Compliant ☐Non-Compliant ☐N/A	Stocked spill kits were available near active work areas.		WSA (p) 2 CEMP Section 3.6	
26	Should suspected contaminated material be encountered (i.e., soil emitting olfactory cues indicative of hydrocarbon fuel), works should temporarily halt for investigation.	☒Compliant ☐Non-Compliant ☐N/A	EM reported high concentrations of sodium and some other metals and additional analysis and reporting are pending.		CEMP Section 2.5	
27	Refuelling of machinery is conducted on level ground over a spill tray.	☒Compliant ☐Non-Compliant ☐N/A	No refuelling was observed during the audit.		CEMP Section 3.6	
	Riparian Area Management					
28	Stockpile LWD and root wads removed from channel for use in site restoration	☐Compliant ☐Non-Compliant ☒N/A	No LWD or root wads stockpiled onsite. Vegetation clearing should be limited to stations and access points only. Any riparian disturbance must be restored post-construction.		CEMP Section 3.3	Photo 5
29	Construct access points and approaches perpendicular to the watercourse;	☒Compliant ☐Non-Compliant ☐N/A			DFO FAA CEMP Section 3.2	
	Instream Works					
30	The EM shall ensure that instream works are isolated from flow and that measures are in place to protect fish and fish habitat, and to mitigate the migration of sediment downstream.	☒Compliant ☐Non-Compliant ☐N/A	Sediment curtains installed in channel. Excavation was restricted to above wetted channel.	Improve instream isolation to prevent a failure during instream works.	WSA (j) CEMP Section 3.1	Photo 6
31	Pumps and flow bypasses are in proper working condition	☐Compliant ☐Non-Compliant ☒N/A	Pumps were not operating during the audit visit.		WSA (j) 5 CEMP Section 3.1	
32	Instream works conducted in the dry / isolation of flow	☒Compliant ☐Non-Compliant ☐N/A	Instream works (other than placing sandbags for isolation) were not in progress during the audit visit. Excavation was restricted to above wetted channel.	Procure and install appropriate equipment for isolation and dewatering.	WSA (o) CEMP Section 3.1.1	Photo 6
	Water Quality					
33	Water quality is routinely monitored upstream and downstream of the work area, every day that instream works are occurring Instream water quality is compliant with provincial criteria[2]: **Turbidity**: - <8 NTU from background at any one time for a duration of 24 h in clear waters; - < 5 NTU from background when background is 8 – 50 NTU;	☒Compliant ☐Non-Compliant ☐N/A	EM is routinely monitoring water quality, and halting instream works where short-term exceedances are noted. Sediment curtains have been installed downstream of instream works. Excavated sediment is being used to fill the sandbags that are installed for instream isolation. Occasionally the sandbags tip over or rip when being relocated, resulting in localized turbidity.	The contractor must exercise due care when handling sandbags instream and the EM to provide appropriate guidance to mitigate any potential risk to fish and fish habitat.	WSA (s) CEMP Section 3.1.2	

[2] British Columbia Ministry of Environment and Climate Change Strategy. 2024. British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture - Guideline Summary – August 2024. Water Quality Guideline Series, WQG-20. Prov. B.C., Victoria B.C. Available at: https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-guidelines/approved-wqgs/wqg_summary_aquaticlife_wildlife_agri.pdf. Accessed August 2024.

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
	- <10% from background when background is > 50 NTU. **pH:** 6.5-9.0					
	Fish and Wildlife Protection					
34	Full time monitoring for fish during instream works is occurring.	☒Compliant ☐Non-Compliant ☐N/A	EM is onsite full time		WSA (j) 6 CEMP Section 2.4	
35	Fish salvages are conducted in advance of instream works where required.	☒Compliant ☐Non-Compliant ☐N/A	EM is conducting salvages in advance of sediment excavation.		CEMP Section 3.1 WSA (j) 6	
36	Salvaged fish are relocated back to the same watercourse in a nearby area that is not impacted by construction or removal works or its zone of influence	☒Compliant ☐Non-Compliant ☐N/A	EM is relocating fish outside the isolated work zone.		DFO FAA Section 2.2.4	
37	Pump intakes are screened for fish and aquatic species in accordance with the "Interim code of practice: End-of-pipe fish protection screens for small water intakes in freshwater"	☐Compliant ☐Non-Compliant ☒N/A	Pumps were not operating during the audit visit.		WSA (j) 5.ii DFO FAA Section 2.4.9 CEMP Section 3.1.1	Photo 5
38	Obtain required permits prior to salvage(s).	☒Compliant ☐Non-Compliant ☐N/A	EM has obtained salvage permits.		WSA (Opening) CEMP Section 3.1	
39	EM is on site during disturbance to riparian vegetation and conducting pre-clearing breeding bird surveys prior to clearing.	☒Compliant ☐Non-Compliant ☐N/A	EM is conducting nest surveys at stations as required.		CEMP Section 3.2	
40	Instream works are conducted so as not to lead to fish stranding or other impacts to fish. The works shall not result in depressions that have the ability to trap fish and other aquatic life. Fish passage is maintained where practicable and in accordance with applicable permits.	☒Compliant ☐Non-Compliant ☐N/A	Instream works have been designed to maintain fish passage after completion. Upstream fish passage is impeded due to turbidity curtain installed across the channel.	EM must be monitoring for fish full-time and should have a plan for moving adult fish upstream around the work area, if observed staging below the work zone. This plan should be documented in routine monitoring reports.	WSA (j) 6 (iii) WSA (u) DFO FAA Section 2.4.2 CEMP Section 3.1.1	
	Restoration Requirements					
41	Restoration plans prepared by EM for disturbed area and implemented with EM oversight	☐Compliant ☐Non-Compliant ☒N/A	Restoration plans have not been prepared yet.		WSA (w) CEMP Section 3	
42	All temporary works shall be removed on completion of the project, and the stream channel restored to its natural condition	☐Compliant ☐Non-Compliant ☒N/A	Work is still in progress.		WSA (v) CEMP Section 3	

5 DISCUSSION

5.1 Non-Compliant Items

Knotweed management

Knotweed removal onsite is ongoing however the CEMP has not been updated with revised approach.

Recommended action: Provide documentation of knotweed management and ensure it adheres to approved BMPs. Provide details on alternative approach with rationale, and update documentation (e.g., CEMP).

Portable toilets without secondary containment

Two portable toilets located at the site laydown adjacent to Dale Road did not have secondary containment. Although the toilets were more than 30 m away from the watercourse, secondary containment would prevent any potential spills from spreading beyond the immediate area.

Recommended action: Add secondary containment to portable toilets.

5.2 Conditionally Compliant Items

EM reporting to document risk and mitigation

As instream works progress beyond the least risk fish window, the EM must provide guidance and advice to the contractor regarding any changes in risk associated with working past the window and required mitigation.

Recommended action: EM reports should document their consideration of any increased risk with working past the least risk and identify if enhanced mitigation is required. EM should continue to document implementation of mitigation measures, evaluate changing conditions, and report any incidents or near-misses.

6 SUMMARY

A list of environmental issues outstanding to date is provided in Table 6-1, below.

Table 6-1 Tracking Table of Environmental Issues Outstanding to-Date (project commencement August 12, 2024)

Item #(s)	Issue	Date(s) Observed	Recommended Corrective Action(s)	Responsible Party
2	Knotweed material outside poly sheet containment, no herbicide treatment	August 29, 2024 September 5, 2024	Ensure that all knotweed cuttings are confined to poly sheeting. Apply herbicide to remaining stems, as appropriate. Document methodology and ensure it adheres to approved BMPs.	Contractor/EM
3	Portable toilets without secondary containment	August 29, 2024	Add secondary containment to portable toilets.	Contractor
4	Inadequate instream isolation and failed dewatering attempts resulting in instream works conducted in the wet.	August 31, 2024 September 1, 2024 September 2, 2024 September 11, 2024 (EM reports)	Need to provide adequate isolation and dewatering to maintain dry work area OR obtain permission to dredge in the wet	Contractor

Note: Items marked with an asterisk (*) were reported by the EM.

7 CLOSURE

We trust that the information in this memo is sufficient for your present needs. Should you have questions, please do not hesitate to contact the undersigned.

Prepared by:

Naomi Sands, R.P.Bio.
Environmental Scientist

Reviewed by:

Jennifer Privé, R.P.Bio.
Manager, Environmental Sciences

NS/JP

Attachments:
- Site Photographs

Attachment 1: Site photographs taken during audit visit on September 19, 2024.

Photo 1: Instream isolation at Station J and K 		**Photo 2: Silt fence installed onsite around cleared stations** 
Photo 3: Silt fence installed around soil stockpiles 		**Photo 4: Knotweed patches adjacent to work areas must be monitored closely during operations** 
Photo 5: Vegetation clearing should be restricted to minimum required for access and riparian habitat must be restored post-construction. 		**Photo 6: Excavation restricted to above wetted channel; sediment curtain installed across channel as back-up.** 

Table A2: Tracking Table of Resolved Non-Compliance Issues

Item #(s)	Issue	Date(s) Observed	Date Corrected	Corrective Action(s)	Responsible Party
1	Environmental monitoring reports not received daily	August 29, 2024	September 5, 2024	Monitoring reports received daily, or following morning.	EM
2	Inappropriate fish screen on pump intake	September 5, 2024	September 12, 2024	EM reports show pump intakes in mesh screen boxes. Wire mesh screen was being fitted to an additional pump intake during the audit visit.	Contractor

RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: September 19, 2024
Weather: Partly cloudy. High 15°C, Low 7°C.

- ***Works are being conducted outside of the least-risk window for in-stream works under the supervision and guidance of the Environmental Monitor.***
- ***Keystone Environmental undertook the following additional measures to reduce the risk of impacts to fish and fish habitat during works conducted outside the instream works least-risk window:***
    - *Overnight trapping of Station F. After observing fish in the minnow traps at Station F, a decision was made to continue trapping within the isolation barrier until a decline in catch per unit effort. Four baited minnow traps were redeployed at station F.*
    - *Overnight trapping of Station J. Following the repair of the isolation barriers on Wednesday, September 18th at Stations J and K, Keystone Environmental undertook additional overnight trapping at Station K. Following the decision to conclude salvage activities at Station K, five baited minnow traps were moved to Station J and left overnight.*
- 0630: EMs on site. Station B3 excavation observed to be filled with water.
- 0715: 4 baited minnow traps checked and reset at station F.
    - Fish Salvage Results:
        - 1 Coho salmon
        - 9 prickly sculpin
    - All fish were released unharmed in similar habitat nearby within the same stream.
- 0734: Poly sheet waterway and silt sack being removed at Discharge 1 downstream of station C2. Poly and silt sack observed to be already removed at Discharge 2.
- 0804: 5 baited minnow traps removed at Station K.
    - Fish Salvage Results:
        - 1 Three-spined stickleback
    - All fish were released unharmed in similar habitat nearby within the same stream.
    - Following repeated salvages, the repair of the isolation barrier, and the low trap yield, we evaluated the risk of negative effects on fish during excavation at station K to be sufficiently mitigated.
- 0815: Reset 5 baited minnow traps at Station J.
- 0928: Japanese knotweed haul truck observed arriving at site.
- 0943: Japanese knotweed haul truck observed leaving site. Load observed to be covered.
- 1008: Silt curtain installation downstream of Station B3 observed.
- 1037: Lock block trench at Station C observed to be open.
- 1141: Isolation barrier observed being installed at Station B3.
- 1203: Contractor inquired if tarps and filter fabric stored on disturbed soil at Station B3 were considered knotweed contaminated. Keystone Environmental advised that the material should be disposed of with the Japanese knotweed stems.

- 1347: Excavation was observed to be ongoing at Station C2. Isolation barrier installation was observed to be ongoing at B3.
- 1415: 6-inch pump installation observed at Station B3.
- 1608: Contractor communicated that a water main was suspected to be below grade immediately north of the bridge and close to the B3 excavation. Due to the material of the pipe, a utility locate is not possible.
- 1629: Intake hose with mesh intake screen fitted to 6-inch pump at Station B3.
- 1645: EM off site.
- No water quality data was collected, as no in-stream works or dewatering discharge was observed.

Site Photos









Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	19
Project:	Legace Creek	**Page:**	1 of
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 20, 2024
Contract No.:		**Temperature:**	High: 18 Low: 10
Weather:	Overcast		

September 20, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Jim), 3 operator, 5 labourers
Keystone Environmental: EM (Corbin, Liz)

Contractor's Equipment:

-Equipment in Use

- CAT Excavator 324E
- Zaxis Excavator EX0689
- Zaxis excavator 2720
- Deer Loader 1466
- Pumping equipment: generator, 2 – 6" pumps.

Report, if any, Contact with Occupants:

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

Discussion with Contractor:

6:45AM
- Toolbox QM (Jim) – loading out material from Jahoolie field today
- Disposing at a site, 3hr round trip, 7 trucks.
- Hopefully starting excavation at B3, want to probe for watermain first.

1:05PM
- Discussion with QM Foreman (Craig) –
- Ready to start excavating at B3.
- Going to work around the berm and excavate depth first, planning to pull in berm after.

Report:

7:00AM
- Hauling clean material from Jahoolie field.
- This is material from C2 lock block excavation – has been surveyed
- Vinizza counting trucks.

7:30AM
- Probing for watermain at SRS B3.

8:30AM-1:00PM
- AE (Jordan) on site 15/16

1:00PM
- Beginning excavation at SRS B3.
- 1 – 6" pump and 1 - 3" pump

1:15PM
- Hauling trucks round 3.

3:20PM
- Excavation at SRS B3 stopped.

3:30PM
- Moving remaining material that was not hauled out of Jahoolie field to area next to SRS L stockpile.
- This material has been surveyed
- Topsoil stockpile from this area is being moved to lay down.
- This has also been surveyed.
- Current stockpile at SRS L is from SRS C2 lock block excavation. This material has not been surveyed. Ensured the stockpiles are not mixed.

4:30PM
- AE (Jordan, Vinizza) leaving site
- Crew finishing moving material from Jahoolie field to SRS L stockpile area

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Testing:

- None today.

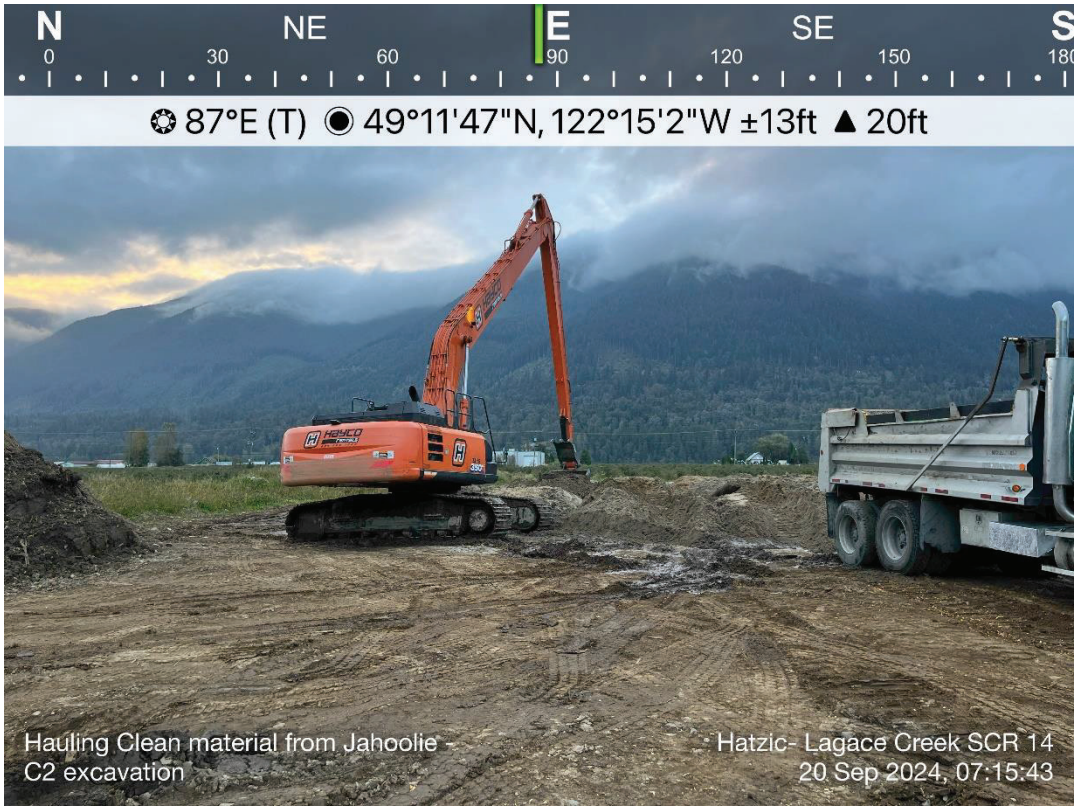
Safety Concerns:

- None today

Traffic Control:

- None today.

Photos:



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

DAILY CONSTRUCTION REPORT

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	18
Project:	Legace Creek	**Page:**	1 of 5
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 20, 2024
Contract No.:		**Temperature:**	High: 18°C Low: 10°C
Weather:	Mostly Cloudy, Wind: 6 KM/H, Gusts: 16 KM/H		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Labour Force:

Quantum Murray (QM): 1 Site Superintendent, 3 Operators, 5 Labourers
Keystone Environmental/Environmental Monitors (KE/EM): Corbin and Liz
Associated Engineering (AE): Jordan Fiske, Vinizza Pingos

Contractor's Equipment: Equipment in uses

- Excavator 324E
- Excavator EXO689
- Excavator 2720
- Loader 1466
- 1 – 3" water pump
- 1 - 6" Vacuum Assisted Pumps

Report, if, any, Contact with Occupants:

N/A

Contact with Owner:

N/A

Safety Concerns:

N/A

Testing:

N/A

Traffic Control:

No traffic management control.

Report:

6:35 AM
- AE (Vinizza & Jordan) arrived on site.

6:40 AM
- Signed in and toolbox talk.
- Jem discussed today's work plan:
  - Seven trucks scheduled for a 3-hour round trip to haul excavated materials from Charlie's field/stockpile area.
  - Locating the existing water main line near the Dale Bridge and Station B3.
- No traffic management control on site.

7:06 AM
- Arrival of the first batch of seven trucks to haul clean excavated materials from Charlie's field to the disposal area.

7:44 AM
- Completed the first batch of hauling clean excavated materials from C2 in Charlie's field/stockpile to the disposal area (3-hour round trip).

7:50 AM
- Continued locating the existing water main line near the Dale Bridge.

8:00 AM
- Online meeting with Jordan.

8:30 AM
- Transferring lock blocks from C2 to B.

9:20 AM
- Ongoing pumping of water using a 6-inch water pump (without silt protection) while locating the existing water main line.

10:18 AM
- Arrival of the second batch of seven trucks to haul clean excavated materials from Charlie's parcel.

10:49 AM
- Completed the second batch of hauling clean excavated materials from Charlie's field/stockpile area to the disposal area (3-hour round trip).

11:15 AM
- At Station B3: switched to a 3-inch water pump due to the 6-inch pump malfunctioning.

12:20 PM

- Conversation with Jem:
    - Jem inquired about the height of the pier of the bridge. AE Vinizza responded that no record drawing is available.

1:30 PM

- Continued excavation of existing inland sediments at Station B3.

1:32 PM

- Arrival of the third batch of trucks to haul clean excavated materials from Charlie's parcel.

1:54 PM

- Completed the third batch of hauling clean excavated materials from Charlie's field/stockpile to the disposal area with 4 trucks.

2:00 PM

- Ongoing hauling of clean excavated materials to the laydown area near Station L on Charlie's land with 3 trucks.

4:00 PM

- QM (half of the laborers) left the site, while the remaining operators continued moving materials from Charlie's field to the Station L stockpile area.

4:40 PM

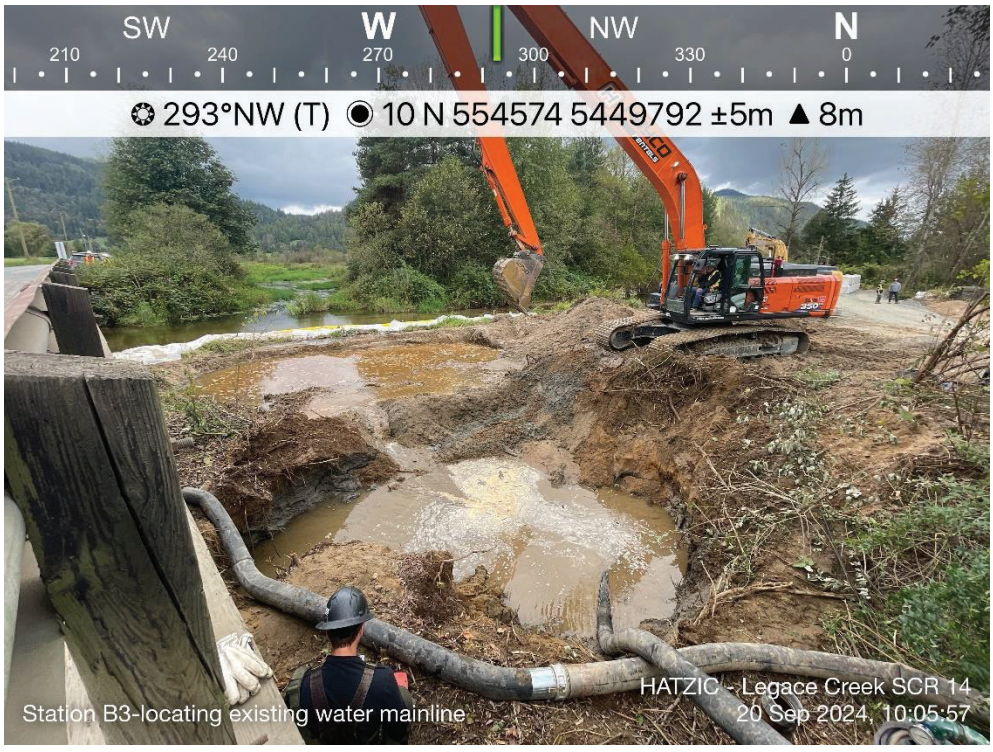
- AE (Vinizza & Jordan) left the site.

Photos:


NW N NE E
00 330 0 30 60 90 120
34°NE (T) 10 N 554599 5449556 ±4m 4m
1st truck-hauling clean materials
HATZIC - Legace Creek SCR 14
20 Sep 2024, 07:09:22


NE E SE S
30 60 90 120 150 180 210
121°SE (T) 10 N 554592 5449574 ±12m -6m
Stockpile
HATZIC - Legace Creek SCR 14
20 Sep 2024, 14:11:07


NW N NE E
300 330 0 30 60 90 120
30°NE (T) 10 N 554555 5449781 ±4m 11m
Station B3-
HATZIC - Legace Creek SCR 14
20 Sep 2024, 10:56:25


SW W NW N
210 240 270 300 330 0
293°NW (T) 10 N 554574 5449792 ±5m 8m
Station B3-locating existing water mainline
HATZIC - Legace Creek SCR 14
20 Sep 2024, 10:05:57

RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: September 20, 2024
Weather: Foggy in the morning, partly cloudy throughout the day. High 19°C, Low 10°C.

- ***Works are being conducted outside of the least-risk window for in-stream works under the supervision and guidance of the Environmental Monitor.***
- ***Keystone Environmental undertook the following additional measures to reduce the risk of impacts to fish and fish habitat during works conducted outside the instream works least-risk window:***
    - *Overnight trapping of Station F. After observing fish in the minnow traps at Station F, a decision was made to continue trapping within the isolation barrier until a decline in catch per unit effort. Four baited minnow traps were redeployed at station F.*
    - *Overnight trapping of Station J. Following the capture of fish within Station J, five baited minnow traps were left overnight within the isolation area.*
    - *Water quality management. The EM closely monitored downstream water quality and adjusted sediment control measures as necessary. On September 20th, dewatering discharge of the excavation at Station B3 was passed through a silt sack on a poly sheet waterway into the channel, where it was further intercepted by a silt curtain. Downstream water quality was observed to be compliant while this system was functioning. A single exceedance was observed when the silt sack burst. Discharge was promptly ceased, and the outlet hose fitted with a new silt sack. Dewatering was delayed, allowing the sediment plume to travel downstream before work was restarted.*

- 0630: EMs on site. Excavation at Station B3 and soil hauling to occur today.
- 0737: 4 baited minnow traps checked and reset at Station F.
    - Fish Salvage Results:
        - 2 prickly sculpin
- 0744: All fish captured at Station F were released unharmed in similar habitat nearby within the same stream.
- 0814: 5 baited minnow traps removed at Station J
    - Fish Salvage Results:
        - 3 prickly sculpin
- 0817: All fish captured at Station J were released unharmed in similar habitat nearby within the same stream.
- 0845: Dewatering commenced at Station B3 excavation with a 6-inch pump fitted with a mesh intake filter and discharging through a silt sack on a poly sheet waterway.
- 1035: Dewatering discharged from Station B3 excavation halted. 6-inch pump swapped for 3-inch trash pump due to high downstream turbidity. The new pumping system yielded compliant readings for the remainder of the day.
- 1253: The internal barrier within the B3 isolation area was knocked down, allowing all water within that excavation to mix. Dewatering continued at this Station.

- 1321: 4 baited minnow traps set at F.
- 1325: A second 3-inch trash pump was installed at Station B3.
- 1453: The EM observed a knotweed decontamination of one of the excavators working within the knotweed contaminated area. Brooms and shovels were observed being used to dislodge visible soil, while a dilute bleach solution was sprayed on to hardened or caked material.
- 1459: Decontaminated excavator crossed road to the south side.
- 1602: Soil loadout activities observed to be ongoing at the blueberry farm north of Dale Road. No dewatering or instream works observed. EM off site.
- Water Quality Sampling Results:

Location	Time	Turbidity	Dissolved Oxygen
Upstream of B3	0915	4.81	84.5% / 9.2 mg/L
50 Downstream of C2	0929	3.97	89.2% / 9.68 mg/L
Upstream of B3	1025	3.47	X
50 Downstream of C2	1040	13.03	X
Upstream of B3	1133	5.18	X
50 Downstream of C2	1142	5.18	X
Upstream of B3	1235	5.58	X
50 Downstream of C2	1245	3.99	X
Upstream of B3	1407	3.86	X
50 Downstream of C2	1416	3.58	X

Site Photos









Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

DAILY CONSTRUCTION REPORT

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	19
Project:	Legace Creek	**Page:**	1 of 6
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 21, 2024
Contract No.:		**Temperature:**	High: 18°C Low: 10°C
Weather:	Partly Cloudy, Wind: 3 KM/H, Gusts: 5 KM/H		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Labour Force:

Quantum Murray (QM): 2 Site Superintendent (Jem & Mel), 3 Operators, 7 Labourers
Keystone Environmental/Environmental Monitors (KE/EM): Loc
Associated Engineering (AE): Jordan Fiske, Vinizza Pingos

Contractor's Equipment: Equipment in use

- Excavator 324E
- Excavator EXO689
- Excavator 2720
- Loader 1466
- 2 – 3" water pump
- 2 - 6" Vacuum Assisted Pumps

Report, if, any, Contact with Occupants:

N/A

Contact with Owner:

N/A

Safety Concerns:

N/A

Testing:

N/A

Traffic Control:

No traffic management control. QM assigned laborers as flagmen in the morning while hauling the excavated materials.

Report:

6:40 AM
- AE (Vinizza & Jordan) arrived on site.

6:45 AM
- Signed in and conducted a toolbox talk.
- Jem discussed today's work plan:
  - Four trucks to haul excavated materials at Station B3.
  - Complete moving topsoil from Charlie's land.
  - At Station B3: continue water pumping and remove additional materials to dry for Monday.
  - At Station C2: layout preparation.
- No traffic management control on site.
- Moving stockpile from Charlie's field to the end of the laydown section.

7:10 AM
- At Station L: Stockpiled materials from C2 excavation were hauled to Charlie's parcel and then rehauled to Station L.

7:28 AM
- Transferred the 6" water pump from Station C2 to Station B3, replacing the pump used yesterday due to sediment clogging.

7:45 AM
- Two laborers acted as flagmen on site.
- The first truck and wagon arrived to haul excavated materials from B3.

8:00 AM
- Meeting with Jordan.
- The second truck and wagon arrived on site.

8:32 AM
- Completed hauling with three trucks and wagons.

9:00 AM
- At Charlie's land/stockpile area:
  - Transferred excavated materials (topsoil from B2) to the corner section near Station D (opposite side).

9:10 AM
- At Station B3:
  - Ongoing water pumping.
  - The fourth truck and wagon arrived on site.

9:37 AM

- Keystone conducted a turbidity test at Station C2 (discharge area from B3).
- Suggested shutting down the water pump to allow turbidity levels to settle.
- QM fixed the cloth bag and added a poly sheet at the discharge area.

9:45 AM

- QM began layout work at Station C2 SRS.

10:43 AM

- At Station C2: laying down granular base.
- Fixed the cloth bag and poly sheet at the discharge area of B3.

10:55 AM

- At Charlie's land/stockpile area:
    - Spread remaining materials within the parcel.

11:02 AM

- Started pumping with both the 3" and 6" water pumps at Station B3.

11:08 AM

- Excavating inland sediments at Station B3.

11:20 AM

- Two discharge cloth bags burst while pumping; water pumps were shut down.

11:31 AM

- Keystone conducted another turbidity test.

11:50 AM

- Noted water seeping in at Station B3.

11:55 AM

- Conversation with Loc and Jem:
    - Loc reported that following the cloth bag bursts, the turbidity level was initially 14.8 (non-compliant) but dropped to 9.49 (compliant) after 10 minutes.
    - Loc also indicated that water at Station B3 was seeping in and needed isolation to prevent fish from entering the area.
    - Jem responded that they would address the isolation and implement an additional turbidity curtain.

12:22 PM

- Installed a turbidity curtain at Station B3.

12:00 PM

- At Station C2: prepared lock block base and slope.

12:50 PM

- At Station C2: ongoing installation of the first layer of lock blocks with non-woven fabric underneath.

1:00 PM

- Completed work at Station C3 until conditions allowed for digging in wet areas. Removed water pump from Station B3.

1:15 PM

- Finished installing the first layer of lock blocks at Station C2.

2:15 PM

- Laid poly sheet over the SRS and excavated materials.

2:30 PM

- Two bags fell at Station J.

3:00 PM

- QM left the site.

3:10 PM

- AE (Vinizza) left the site.

Photos:


W NW N NE
240 270 300 330 0 30
326°NW (T) 10 N 554577 5449785 ±4m 8m
Station B3
HATZIC - Legace Creek SCR 14
21 Sep 2024, 07:13:26


SE S SW W NW
150 180 210 240 270 300
229°SW (T) 10 N 554587 5449819 ±4m 8m
Station B3: 1st truck
HATZIC - Legace Creek SCR 14
21 Sep 2024, 07:48:08


W NW N NE
270 300 330 0 30 60
345°N (T) 10 N 554587 5449755 ±3m 18m
Station C2: installing lock blocks
HATZIC - Legace Creek SCR 14
21 Sep 2024, 12:51:12


W NW N NE
240 270 300 330 0 30
326°NW (T) 10 N 554592 5449763 ±4m 7m
Station C2-1st layer of lock block
SRS installed
HATZIC - Legace Creek SCR 14
21 Sep 2024, 14:34:20

RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: September 21, 2024
Weather: Partly Cloudy. High 14°C, Low 7°C.

- ***Works are being conducted outside of the least-risk window for in-stream works under the supervision and guidance of the Environmental Monitor.***
- ***Keystone Environmental undertook the following additional measures to reduce the risk of impacts to fish and fish habitat during works conducted outside the instream works least-risk window:***
    - *Erosion Sediment Control (ESC):*
        - *Rain is forecasted on Sunday, September 22, 2024. Hence, all exposed areas adjacent to Lagace Creek, including sediment stockpile, are protected with poly tarp to prevent potential sediment runoff into Lagace Creek.*
    - *Water quality management:*
        - *The EM closely monitored downstream water quality and adjusted sediment control measures as necessary. On September 21st, dewatering discharge of the excavation at Station B3 was passed through a silt sack on a poly sheet waterway into the channel, where it was further intercepted by a silt curtain. Downstream water quality was observed to be compliant while this system was functioning. A single exceedance was observed when the silt sack burst. Discharge was promptly ceased, allowing the turbidity to settle. WQ returned to acceptable range within 30 minutes.*
    - *Spill Response and Mitigation:*
        - *Spill trays were put under heavy machines to prevent potential spill over the weekend. Spill kits were also located nearby and fully filled with spill pads, booms, and absorbent materials.*
- 0645: EM on site.
- 0650: EM attended toolbox meeting with contractors.
- 0739: 5 baited minnow traps at Station J were retrieved.
    - Fish Salvage Results:
        - 3 Three-spine sticklebacks (TSS)
- 0744: All fish captured at Station J were released unharmed in similar habitat nearby within the same stream.
- 0751: Soil hauling commenced at station B3.
- 0758: EM noticed sheens on the water surface in B3 isolated work area and proceeded to investigate. Confirmed it was bacteria sheen as it broke into small platelets when disturbed and did not quickly reform as per petroleum sheen characteristic.

- 0759 4 baited minnow traps retrieved at Station F
    - Fish Salvage Results:
        - 1 Rainbow trout
        - 3 Prickly sculpins
        - All fish captured at Station J were released unharmed in similar habitat nearby within the same stream.
- 0800: Fish cage was installed in Station B3. A 6inches and 3 inches pump were used for dewatering. Silt sacks were implemented at the discharge location downstream from B3 to mitigate disturbance.
- 0915: Dewatering commenced. Initial sediment plume was observed as expected. EM continued monitoring WQ closely.
- 0942: EM observed the sediment plume was flowing DS and did not improve after 30mins. EM identified the source was from the 6inches discharge hose since water was flowing out of the silt sack and hit the creek bed, which disturbed the sediment below it. Mitigation method implemented by QM was installing poly tarp under the silt sack to mitigate disturbance from creek bed when discharging.
- 1003: EM conducted WQ and confirmed turbidity returned to acceptable range. QM continued silt sack reinforcement.
- 1024: Dewatering commenced. However, water observed to backflow into C2 area without protection from silt curtain nor silt sack. Pumps were shut down to readjust the discharge hose.
- 1100: Lock block installation at Station C2 commenced
- 1112: Dewatering resumed. EM conducted WQ 30m DS from discharge location. Result yielded compliant. Another sample was taken at Station D (Approximately 55m DS from C2), which yielded compliant reading as well.
- 1125: Shortly after EM conducted compliant WQ, both silt sacks burst, resulted in 1 exceedance.
- 1130-1140: EM discussed with Keystone's Project Manager. QM and KEL's EM were actively monitored WQ, and the burst event was unavoidable. In addition, QM reacted immediately by turning off the pumps to prevent further disturbance. The exceedance noted at 11:33AM and turbidity returned to acceptable range at 11:40AM (10 minutes). Therefore, the Site was deemed compliant.
- 1154: EM noticed a section of sandbag isolation at station B3 sunk and slowly discharged sediment-laden water. QM personnel was notified and reinforcement using additional silt curtain and sandbags was implemented immediately.
- 1245: Reinforcement work completed. EM did not observe any leakage from B3 isolation.
- 1300: Pumps were removed from B3.
- 1338: EM left CR14 and went to CR17 to check on fish isolation fences on the South side.
- 1349: Fish isolations located at CR17 remained in place with no damaged.
- 1415-1430: QM covered exposed areas and stockpile with poly tarp prior to the rain event on Sunday, September 22, 2024.
- 1440: EM performed last inspection before leaving Site.
- 1500: End of workday. EM left Site.

- Water Quality Sampling Results:

Location	Time	Turbidity	Dissolved Oxygen
BG – US of B3	1000	3.16	88.3% / 9.92 mg/L
30m DS of B3	1003	8.24	X
30m DS of B3	1112	9.80	X
~55m DS of B3 – Station D	1120	7.72	X
30m DS of B3	1133	14.8	X
30m DS of B3	1140	9.49	X

Site Photos



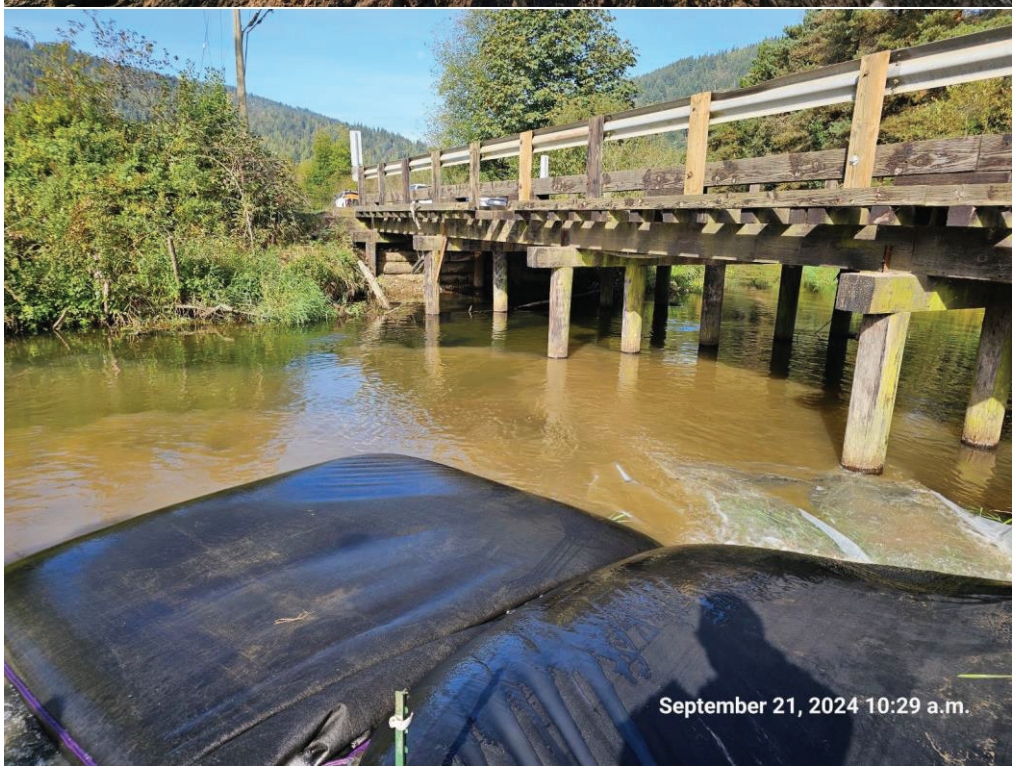

September 21, 2024 2:36 p.m.


September 21, 2024 11:48 a.m.


September 21, 2024 7:52 a.m.


September 21, 2024 2:39 p.m.


September 21, 2024 2:36 p.m.


September 21, 2024 10:29 a.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	20
Project:	Legace Creek	**Page:**	1 of 5
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 23, 2024
Contract No.:		**Temperature:**	High: 19 Low: 13
Weather:	Rainy		

September 23, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Jim), 3 operator, 4 labourers
Keystone Environmental: EM (Loc, Kang)
2 Flaggers

Contractor's Equipment:

-Equipment in Use

- CAT Excavator 324E
- Zaxis Excavator EX0689
- Zaxis excavator 2720
- Deer Loader 1466
- Pumping equipment: generator, 2 – 3" pumps.

Report, if any, Contact with Occupants:

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

12:30PM

- Discussion with Keystone (Loc, Kang) – everything north of Dale road bridge is considered contaminated including what is in the water. Everything south of bridge is considered clean except for SRS D and H will be considered contaminated since knotweed is growing on stations.

Discussion with Contractor:

6:45AM
- Toolbox (James) –
- Continue building C2 lock blocks today
- Hauling contaminated material from B3 creek excavation
- Filling sand bags at E for B2 isolation
- SCR 17 south still a go, planning to vac-truck it.
- Beginning SRS B3 lock block structure excavation

10:30AM
- Discussion with QM (Mel) asking about extent of top of bank
- AE (Jordan) – the top of bank is to be pulled back to line up with the SRS stations being installed and station B. Cocomatting installed here

10:40AM
- Discussion with QM (Jim and Craig) – B3 layout, will be closer to B2 than 20m due to B2 moving down due to Doug's well.
- Facing the creek on bend, will get as tight to existing vegetation as possible. Moved up pasted bridge abutment due to excess material.

1:00PM
- Discussion with QM (James) –
- Have currently removed and hauled almost 1200 tons of contaminated material.
- CO included up to 1700 tons but is afraid we will surpass that now.
- Still have to excavate SRS B3 lock blocks, SRS B2 creek and pull back the slope for the cocomatting from B to the bridge.
- James is estimating now around 3000 tons of contaminated material.
- AE (Jordan) to make AE (Jordon Rozon) aware.

1:10PM
- Discussion with QM (James) –
- AE (Jordan) – put forward a formal change order to our team regarding the change in quantity. Do not surpass the 1700 tons until confirmed with AE.

1:30PM
- Discussion with QM (James) –
- Filter fabric and geogrid came separate for remaining lock block installs. Asking if filter fabric needs to extend into lock blocks.
- AE (Jordan) and James decided that's what the detail shows and both the filter fabric and geogrid need to extend into the lock blocks for SRS C2 install.

3:20PM

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

- Discussion with QM (James) – James confirmed with EM's stations D and H will be considered contaminated removals.

3:30PM
- Discussion with QM (James, Craig) – filter fabric to be below geogrid for SRS C2, same as SRS B2 station.

Report:

7:00AM
- Surveyor on site
- Doing B3 contaminated stockpile (already partly hauled and hauling today)
- Doing clean sediment at E (been moved / loaded into sand bags)
- Jahoolie field after all sediment has been removed.
- SRS L laydown from SRS C2 lock block excavation (potentially surveyed before stockpiling was complete.

7:15AM
- Excavator flattening access road to L / laying gravel on road for accessibility
- Ongoing aggregate deliveries today.

9:00AM
- Filling sand bags at E
- 38 bags filled today

10:30AM
- 3 contaminated hauling trucks today from SRS B3 excavation

10:40AM
- Excavating C2 lock block structure (clean material) and hauling to SRS L laydown.

11:20AM
- Excavating SRS B3 lock block structure

5:15PM
- AE (Jordan) left site.
- AE (Vinizza) on site till end of day

Testing:

- None today.

Safety Concerns:

- None today

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Traffic Control:

- 2 flaggers on Dale road bridge

Photos:



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

DAILY CONSTRUCTION REPORT

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	20
Project:	Legace Creek	**Page:**	1 of 7
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 23, 2024
Contract No.:		**Temperature:**	High: 19°C Low: 14°C
Weather:	Rainy,		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Labour Force:

Quantum Murray (QM): 2 Site Superintendent (Jem & Mel), 3 Operators, 4 Labourers
Keystone Environmental/Environmental Monitors (KE/EM): Loc & Khang
Associated Engineering (AE): Jordan Fiske, Vinizza Pingos

Contractor's Equipment: Equipment in use

- Excavator 324E
- Excavator EXO689
- Excavator 2720
- Loader 1466
- 2 – 3" water pump
- 2 - 6" Vacuum Assisted Pumps

Report, if, any, Contact with Occupants:

N/A

Contact with Owner:

N/A

Safety Concerns:

N/A

Testing:

N/A

Traffic Control:

Traffic management control arrived at 7:10 am and left the site at 3:30 pm.

Report:

6:40 AM
- AE (Vinizza & Jordan) arrived on site.

6:45 AM
- Signed in and conducted a toolbox meeting.
- Jem discussed the work plan for the day:
  - Filling bags at Station E for B2 isolation.
  - Fixing sandbags at Stations F, J, and K.
  - Repairing the isolated area of B3 and starting lock block installation.
  - Hauling excavated materials from B3.
  - Surveying excavated materials.
  - Continuing lock block installation at Station C2.

6:50 AM
- Surveyor arrived on site.

7:10 AM
- Traffic management control personnel arrived on site.

8:00 AM
- Online meeting with Jordon.

8:30 AM
- Surveyed Station E.

8:40 AM
- Delivery trucks of gravel arrived on site.

8:55 AM
- Laid gravel on the access road near Station H to address muddy and uneven surfaces.
- Lequamel arrived on site.

9:00 AM
- Continued filling bags at Station E.

9:30 AM
- Trucks arrived to haul excavated materials from B3.

10:27 AM
- Completed hauling of three trucks and a wagon from the excavated materials at B3.

10:40 AM
- Ongoing hauling of bags from Station E to B2.

10:42 AM
- At Station C2, continued excavating the lock block structure and hauling materials to Station L.

11:00 AM
- At Station B3, moved stockpile to B2 in preparation for lock block structure excavation.

11:20 AM
- Began excavation at Station B3 in preparation for lock block installation.

12:15 PM
- Hauled sandbags from Station E to Station B3.

12:25 PM
- At Station C2, began digging 5m from the lock block.

12:30 PM
- Conversation with Keystone:
    - Loc mentioned that the northern part of Dale Road Station Bs and the southern parts of Stations D & H are considered contaminated, including the instream areas.

12:34 PM
- At Station B3 (SRS/lock block): Started pumping using a 3” water pump.

1:00 PM
- Placed silt fence around the excavated materials at B3.

1:20 PM
- At Station C2, first layer of lock block:
    - Laid gravel for the first layer/lift.

1:48 PM
- At Station C2, compacted gravel for the first layer/lift.

2:02 PM
- At Station C2, began laying gravel for the second layer/lift.

2:25 PM
- Compacted gravel for the second layer/lift at Station C2.

3:18 PM
- Ongoing water pumping at Station B3 using 2-3” water pumps.

3:30 PM
- Traffic management control personnel left the site.

4:05 PM
- AE flagged the sandbags from Station E; 38 sandbags were filled today.

5:10 PM
- At Station C2, the second layer of lock block was installed.

5:20 PM
- Laid gravel for the first layer/lift at Station C2.

5:32 PM
- Compacted gravel for the first layer/lift at Station C2.

5:42 PM
- Laid gravel for the second layer/lift at Station C2.

5:56 PM
- Compacted gravel for the second layer/lift at Station C2.

6:25 PM
- QM left the site.

6:30 PM
- AE (Vinizza) left the site.

Photos:


SE S SW W
20 150 180 210 240 270 300
214°SW (T) 10 N 554601 5449777 ±3m 6m
Surveyor on site.
HATZIC - Legace Creek SCR 14
23 Sep 2024, 07:00:44


SE S SW W
150 180 210 240 270 300
221°SW (T) 10 N 554585 5449821 ±3m 12m
Station B3- 3rd truck: hauling of excavated materials
HATZIC - Legace Creek SCR 14
23 Sep 2024, 10:17:25


S SW W NW N
180 210 240 270 300 330 0
271°W (T) 10 N 554587 5449807 ±13m 28m
Station B3-digging in preparation for lock block installation
HATZIC - Legace Creek SCR 14
23 Sep 2024, 12:10:45


SW W NW N
210 240 270 300 330 0
286°W (T) 10 N 554585 5449800 ±3m 8m
Station B3-excavated lock block area
HATZIC - Legace Creek SCR 14
23 Sep 2024, 18:09:31


SE S SW W N
150 180 210 240 270 300
219°SW (T) 10 N 557662 5449361 ±5240m 10m
Station C2-digging 5 meters from the lockblock
HATZIC - Legace Creek SCR 14
23 Sep 2024, 12:23:43


S SW W NW
150 180 210 240 270 300
231°SW (T) 10 N 554595 5449765 ±4m 4m
Station C2: 2nd layer lock block installed
HATZIC - Legace Creek SCR 14
23 Sep 2024, 18:22:50

RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: September 23, 2024
Weather: Scattered Showers. High 18°C, Low 13°C.

- ***Works are being conducted outside of the least-risk window for in-stream works under the supervision and guidance of the Environmental Monitor.***
- ***Keystone Environmental undertook the following additional measures to reduce the risk of impacts to fish and fish habitat during works conducted outside the instream works least-risk window:***
- ***Erosion Sediment Control (ESC):***
    - *Exposed areas adjacent to Lagace Creek, including sediment stockpiles, are protected with poly tarp to prevent potential sediment runoff into Lagace Creek.*
- ***Water quality management:***
    - *Discharge of groundwater from Station B-3 was closely monitored throughout the day and water quality remained compliant. Any elevated turbidity measurement was notified to the contractor and corrective action was carried out promptly.*
- ***Spill Response and Mitigation:***
    - *Spill trays were placed under heavy machinery to prevent any spill or leakage. Spill kits were also located nearby and fully stocked with spill pads, booms, and absorbent materials.*
- 0630: EMs arrived on site.
- 0645: EMs attended toolbox meeting with the contractor and engineers.
- 0700: QM crew cleaned and brushed the excavator bucket and loader in the north area of the site where the Japanese knotweed issue was present to remove any plant material. Machinery was then moved to the south side for other tasks.
- 0822: Dump trucks carrying 3" crushed rock arrived on site. The material was used to build a sand recovery station and for road repair.
- 0830: Lock block installation commenced at Station C-2. The work was completed above the high water mark, and no concerns were noted.
- 0911: Additional sandbags were installed at Station E.
- 0915: Access road on the south side (blueberry farm) was repaired using the 3" crushed material.

- 0926: Envirogreen truck arrived on site to haul out contaminated material from the stockpile at Station B-3.
- 0928: EMs confirmed with AE engineers that materials on the north side, including Station B-2, were considered contaminated with knotweed material.
- 0930: Oil sheens were observed on the road surface at the site access. The issue was communicated to the site superintendent and promptly cleaned up.
- 1030: EMs expressed concern regarding the upcoming significant rainfall event and recommended that QM crew install silt fencing and poly tarp proactively to prevent potential sediment and erosion issues.
- 1115: Sand recovery station work at Station B-3 commenced. Dewatering was required, with the discharge directed to vegetated area. The discharge was monitored throughout the day for turbidity-related issues.
- 1245: EMs confirmed to AE and QM that the material at Stations D and H was considered contaminated and required treatment and disposal at an approved facility.
- 1453: EM observed sediment plume at the discharge location for groundwater pumped from Station B-3. The issue was notified to QM crew, and pumping was promptly halted to determine a better discharge point.
- 1506: Turbidity measured downstream of the plume was 10.90 NTU, still within compliance. QM crew adjusted the discharge location.
- 1521: Discharge was redirected to the vegetated area, on the side of the property, with approval from the landowner. The water pumped was groundwater and not stream water, which subsequently return to the same source.
- 1600: Lock block installation work continued at Station C-2.
- 1715: Exposed soil and stockpiles at Station B-3 were protected using silt fences and poly tarp.
- 1750: In-stream work, including pumping, was wrapped up for the day.
- 1825: End of workday. EMs departed from site.

Water Quality Sampling Results:

Location	Time	Turbidity	pH	Dissolved Oxygen
BG – US of B3	07:15	2.01	7.58	75.8% / 8.01 mg/L
BG - US of B	14:55	4.48	-	-
DS of discharge location	15:06	10.90	-	-
DS of B3 isolation	16:15	3.17	-	-
BG – US of B3	17:21	3.22	7.35	-
DS of B3	17:25	7.77	-	92.2%, 9.83 mg/L

Site Photos




September 23, 2024 2:37 p.m.


September 23, 2024 3:31 p.m.


September 23, 2024 4:32 p.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	21
Project:	Legace Creek	**Page:**	1 of 5
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 24, 2024
Contract No.:		**Temperature:**	High: 25 Low: 14
Weather:	Sunny		

September 24, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Jim) (Mel), 3 operator, 5 labourers
Keystone Environmental: EM (Loc, Kang)
2 flaggers

Contractor's Equipment:

-Equipment in Use

- CAT Excavator 324E
- Zaxis Excavator EX0689
- Zaxis excavator 2720
- Deer Loader 1466
- Pumping equipment: generator, 2 – 3" pumps.

Report, if any, Contact with Occupants:

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Discussion with Contractor:

6:45AM
- Toolbox QM (James) – continue with SRS B3 and C2 lock block excavation/installation.
- 4 Hauling trucks moving contaminated material from SRS B3 lock block excavation today.
- Mert sent CCN 4 last night.

10:45AM
- Discussion with QM (James) – 4 trucks hauling currently.
- Not planning to get into creek other than stations that are already in place, still waiting on WSA permit before proceeding with those.
- James thinks there is difficulty in excavating SRS B2 even if creek material is deemed clean after discussions between both groups PM's this week.

1:00PM
- Discussion with QM (Craig) – will be backfilling SRS C2 lock blocks front slope with material removed from the excavation.
- This material was removed and hauled to SRS L laydown. Not surveyed as far as aware.
- Hauling from SRS L back to SRS C2.

Report:

7:00AM
- Single large salmon spotted swimming upstream near SRS B3 isolation.
- Keystone will now monitor closely going forward.

7:00AM
- Pumping at SRS B3 lock block excavation
- Continuing building SRS C2 lock blocks.

9:00AM
- QM AE Construction meeting.

10:00AM
- Hauling trucks moving contaminated material from SRS B3 lock block excavation.
- 4 trucks with wagons.
- Truck 4: 23 buckets total.

11:40AM
- Base layer for SRS B3 placed.
- Unable to pack layer with tamper due to fact layer is in ground water after attempt to do so. Ongoing pumping taking place. Going to try packing layer with bucket instead.
- AE (Jordan) – told James we do not want the blocks to settle as you begin stacking them.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

12:30PM
- Demobilizing 6" pumps.

1:00PM
- AE (Jordan, Vinizza) observed sand bag faliures at SRS J.

2:30PM
- Backfilling SRS C2 front slope.

5:00PM
- Leaving site
- SRS C2 lock block structure complete.
- SRS B3 lock block structure 1st set of lock blocks placed.

Testing:
- None today.

Safety Concerns:
- None today

Traffic Control:
- 2 flaggers on Dale road bridge

Photos:

(If necessary, continue report on another sheet.)

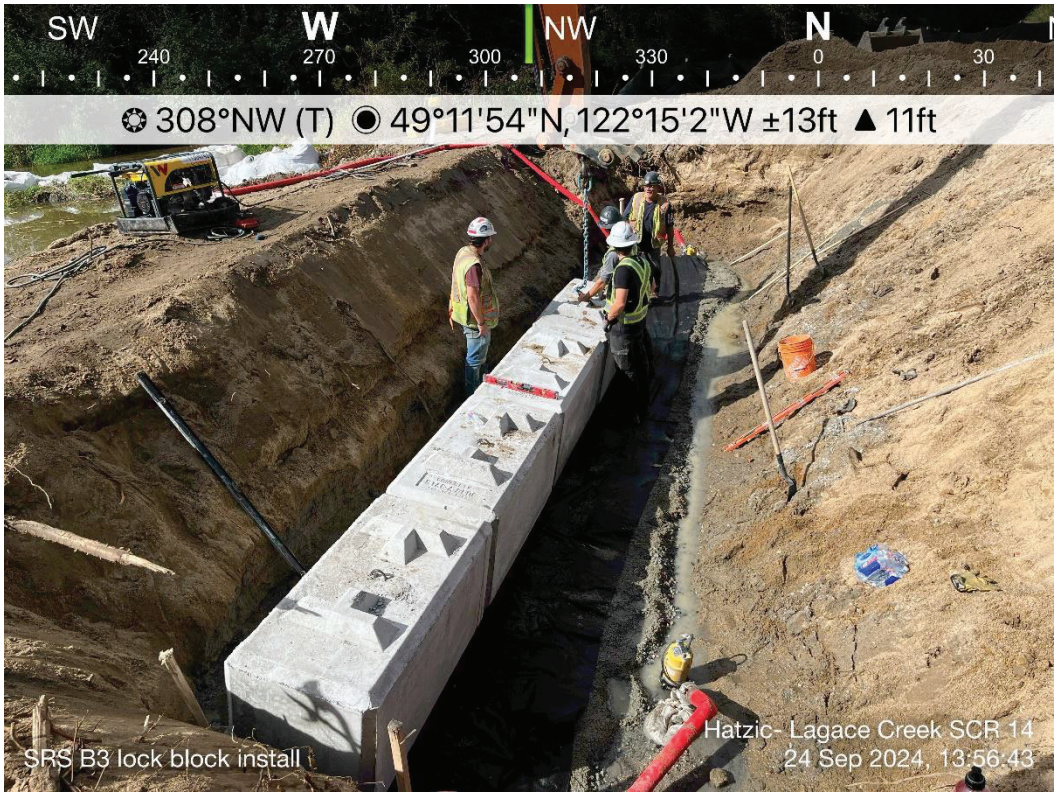
ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

DAILY CONSTRUCTION REPORT

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	21
Project:	Legace Creek	**Page:**	1 of 5
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 23, 2024
Contract No.:		**Temperature:**	High: 25°C Low: 14°C
Weather:	Sunny, Wind 5 KM/H, Gusts 8 KM/H		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Labour Force:

Quantum Murray (QM): 2 Site Superintendent (Jem & Mel), 3 Operators, 5 Labourers
Keystone Environmental/Environmental Monitors (KE/EM): Loc & Khang
Associated Engineering (AE): Jordan Fiske, Vinizza Pingos

Contractor's Equipment: Equipment in use

- Excavator 324E
- Excavator EXO689
- Excavator 2720
- Loader 1466
- 2 – 3" water pump
- 2 - 6" Vacuum Assisted Pumps

Report, if, any, Contact with Occupants:

N/A

Contact with Owner:

N/A

Safety Concerns:

N/A

Testing:

N/A

Traffic Control:

Traffic management control arrived at 7:10 am and left the site at 3:10 pm.

Report:

6:40 AM
- AE (Vinizza & Jordan) arrived on site.

6:45 AM
- Signed in and conducted a toolbox meeting.
- Jem discussed today's work plan:
    - To finish lock block installation at Station C2.
    - To continue working at Station B3: water pumping using a submersible pump and lock block installation.
    - Hauling materials to the disposal area at Station B3.

7:00 AM
- AE spotted a salmon swimming upstream near the isolated area of Station B3.

7:10 AM
- Set up two submersible pumps at Station B3.

7:20 AM
- Ongoing water pumping using the two submersible pumps.

8:00 AM
- Online meeting with Jordan.

8:23 AM
- Ongoing delivery of gravel for the SRS at Station C2.

8:35 AM
- At Station C2, began laying and compacting the second layer of lock block gravel.

9:00 - 10:30 AM
- AE QM construction meeting.

10:32 AM
- A representative from Lequamel arrived on site.
- Installed the third layer of lock block at Station C2.
- Continued water pumping at Station B3; unable to compact the layer with the tamper due to groundwater seeping in.

11:57 AM
- Completed hauling excavated materials from Station B3 using four trucks and a wagon.

12:00 PM
- Ongoing placement of geogrid and nonwoven fabric at Station C2; AE noted a one-meter overlap requirement.

12:15 PM
- At Station B3, placed the base layer and continued layout for the lock block slope.

12:43 PM
- Demobilized two 6-inch water pumps on site.

12:57 PM
- Conducted a site walkthrough to L. QM had not fixed the sandbags; an additional bag had fallen, bringing the total to three bags at that station.
- At Station L/stockpile: additional excavated materials were noted in that area.

1:37 PM
- At Station B3, placed non-woven fabric on the base and began laying the first layer of the lock block.

1:50 PM
- At Station C2, ongoing backfilling of the SRS for the front slope.

2:05 PM
- Installed the first layer of lock block at Station B3.

2:38 PM
- Ongoing laying and compaction of gravel at Station B3.

3:10 PM
- Traffic management control personnel left the site.

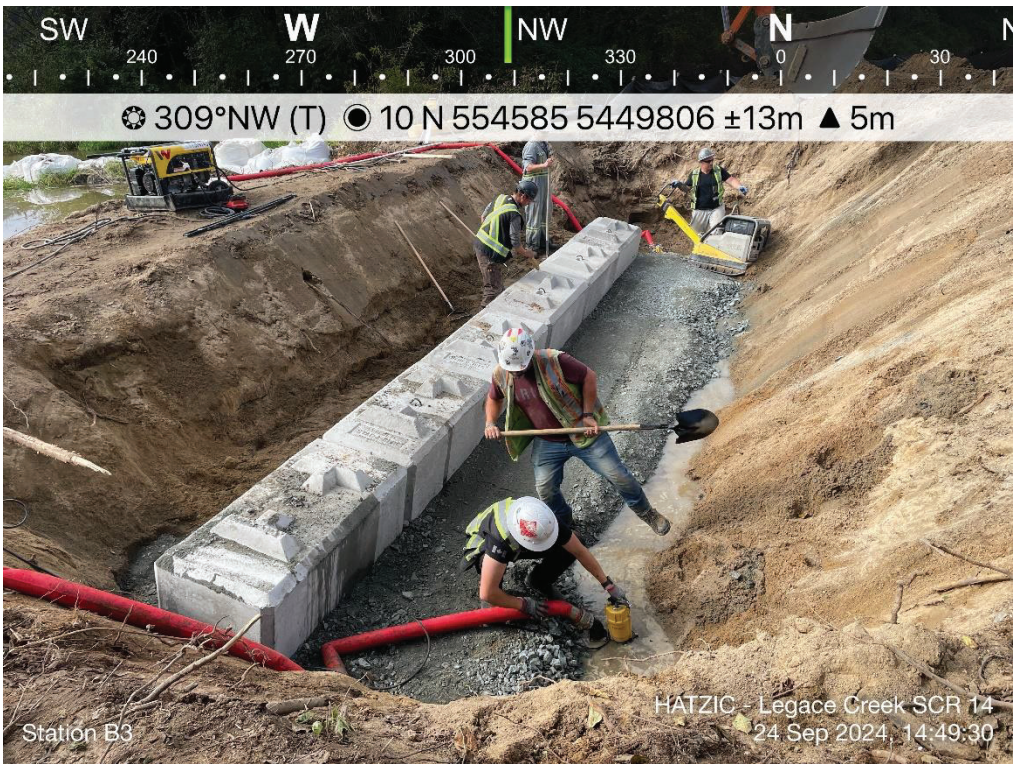
3:45 PM
- Removed the submersible pump from Station B3; completed laying and compacting the gravel in the first layer of lock block (approximately 2 meters from the lock block).

4:00 PM
- Covered the laydown area at Station B3 and the front slope at Station C2 with a poly sheet.

5:00 PM
- AE left the site.

Photos:


S SW W NW N
180 210 240 270 300 330 0
269°W (T) 10 N 554582 5449806 ±4m ▲ 6m
Station B3-set up submersible pump
HATZIC - Legace Creek SCR 14
24 Sep 2024, 07:13:10


SW W NW N
240 270 300 330 0 30
309°NW (T) 10 N 554585 5449806 ±13m ▲ 5m
Station B3
HATZIC - Legace Creek SCR 14
24 Sep 2024, 14:49:30


NE
E
SE
S
60
90
120
150
180
210
131°SE (T) 10 N 554571 5449776 ±4m ▲ 3m
Station C2:3rd layer lock block-ongoing compaction
HATZIC - Legace Creek SCR 14
24 Sep 2024, 11:09:02


NE
E
SE
S
30
60
90
150
180
210
121°SE (T) 10 N 554563 5449777 ±3m ▲ 6m
Station C2
HATZIC - Legace Creek SCR 14
24 Sep 2024, 16:25:26

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: September 24, 2024
Weather: Scattered Showers. High 24°C, Low 14°C.

- ***Works are being conducted outside of the least-risk window for in-stream works under the supervision and guidance of the Environmental Monitor.***
- ***Keystone Environmental undertook the following additional measures to reduce the risk of impacts to fish and fish habitat during works conducted outside the instream works least-risk window:***

- ***Erosion Sediment Control (ESC):***
    - *Exposed areas adjacent to Lagace Creek, including sediment stockpiles, are protected with poly tarp to prevent potential sediment runoff into Lagace Creek prior to the upcoming rain event.*
    - *Additional silt fences were implemented at Station B2 to prevent potential sediment-laden water from entering Lagace Creek.*
- ***Water quality management:***
    - *Discharge of groundwater from Station B-3 was closely monitored and water quality remained compliant. Elevated turbidity was not observed throughout the day.*
    - *Western B3's isolation berm (silt curtain layer) was reinforced prior to the forecasted rain event.*
- ***Spill Response and Mitigation:***
    - *Spill trays were placed under heavy machinery to prevent any spill or leakage. Spill kits were also located nearby and fully stocked with spill pads, booms, and absorbent materials.*
    - *All spill trays were cleaned using spill pads to ensure remaining sheens were removed prior to forecasted rain event. Contaminated spill pads were stored in a separated plastic bag and disposed off site.*
- 0630: EMs arrived on site.
- 0635: EMs attended toolbox meeting with the contractor and engineers.
- 0655: AE observed one (1) spawner near station B3. KEL's EM confirmed present of spawner (Chum salmon) in proximity to station B3. The spawner was observed swimming upstream Lagace Creek shortly after.
- 0700: EMs notified KEL's PM and QM regarding the observed spawner.
- 0715: dewatering of groundwater at station B3 commenced. Water was pumped into the isolated B3 cell, and turbid water was contained within the cell. EM was actively monitored the WQ and no elevated turbidity was observed.
- 0800: Truck delivery of crushed rocks observed arriving on Site.
- 0934: Envirogreen truck arrived on site to haul out contaminated material from the stockpile at Station B-3.
- 1054: Lock block installation at station C2 continued.

- 1128: EMs observed turbid water entered Lagace Creek at the confluence. Additional WQ sample was taken from the slough. See WQ Table.
- 1245: contaminated soil hauling work completed.
- 1300: 6 inches rental pumps were returned.
- 1354: Lock block installation work at C2 completed. Backfill using excavated materials from C2 station was observed. The bank was sloped to 2:1 ratio.
- 1546: Lock blocks at station B3 were now above water table. Dewatering work was ceased.
- 1612: EMs conducted last WQ check since no instream work or dewatering occurred on Site. See WQ table.
- 1624: EMs discussed additional measurements to implement prior to rain event as stated in the additional measures section. QM was observed implementing all additional measurement to protect Lagace Creek from potential runoff from active work site.
- 1650: EMs conducted final inspection at the end of workday.
- 1715: EMs left site.
- Water Quality Sampling Results:

Location	Time	Turbidity	pH	Dissolved Oxygen
BG-US of B3	0653	3.84	7.33	8.93 mg/L;82.1 DO%
DS from B3	0707	5.35	-	-
DS from B3	0746	4.93	-	-
BG-US of B3	0810	3.68	-	-
DS from B3	0820	7.38	-	-
BG-US of B3	0909	4.21	-	-
DS from B3	0918	6.61	-	-
BG-US of B3	1027	4.49	-	-
DS from B3	1034	5.38	-	-
DS from B3	1124	7.96	-	-
Adjacent slough confluence	1132	6.36	-	-
Sample from the slough	1145	10.50	-	-
BG-US of B3	1256	4.45	-	-
DS from B3	1306	6.73	-	-
DS from B3	1418	6.00	-	-
BG-US of B3	1516	4.28	-	-
DS from B3	1524	9.26	-	-
DS from B3	1612	4.04	-	-

Site Photos






September 24, 2024 4:33 p.m.


September 24, 2024 8:17 a.m.


September 24, 2024 4:38 p.m.


September 24, 2024 4:39 p.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	22
Project:	Legace Creek	**Page:**	1 of 4
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 25, 2024
Contract No.:		**Temperature:**	High: 18 Low: 12
Weather:	Raining		

September 25, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Jim) (Mel), 3 operator, 6 labourers
Keystone Environmental: EM (Loc, Nicole)

Contractor's Equipment:

-Equipment in Use

- CAT Excavator 324E
- Zaxis Excavator EX0689
- Zaxis excavator 2720
- Deer Loader 1466
- Pumping equipment: generator, 2 – 3" pumps.

Report, if any, Contact with Occupants:

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

9:30AM

carbon neutral since2009

BEST MANAGED COMPANIES Platinum member

- Discussion with Keystone (Loc) – high levels of turbidity U/S from worksite. Won't be able to measure turbidity on our site if excavation takes place.
- Loc informed Tina (Leqa':mel) of turbidity levels in stream.

11:40AM
- Discussion with Keystone (Loc) – re-salvaged SRS J.
- Keystone will make judgement call in field when salmon start spawning if construction is allowed to continue.

Discussion with Contractor:

6:45AM
- Toolbox QM (James) – going to continue with SRS B3 lock block installation.
- Planning to isolate B2 depending on meeting between AE and QM and what they decide with the contaminated material.
- Going to fix bags at SRS J today.
- No hauling from site today.

11:15AM
- Discussion with QM (Jim) – WSAL permit approved.
- Going to be fixing sand bags at J and K.
- Planning to stockpile excavation from J and K excavation near SRS L.
- SRS L laydown includes sediment from C2 creek excavation (surveyed) and SRS C2 lock block excavation (not surveyed) will keep piles separate and survey accordingly.
- Around 16mm of rain currently, keystone monitoring. Won't be excavating if it gets to 25mm.

2:45PM
- Discussion with QM (James) – QM planning to start at 4:30AM tomorrow.
- AE (Jordan) – need to submit RFI as this is out of specified working hours per the contract / noise by laws ect.

Report:

6:45AM
- AE (Jordan, Vinizza) on site

7:15AM
- Starting 2nd layer lock blocks at SRS

10:45AM
- Going to fix bags at SRS J isolation.
- SRS B3 2nd layer lock blocks ongoing.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

2:45PM

- Done setting up SRS J and K + turbidity curtain for excavation tomorrow.
- Currently finish final lift on SRS B3 and will tie into access road.

3:30PM

- AE (Dave) on site.

5:15PM

- Leaving site
- SRS B3 lock blocks almost complete

Testing:

- None today.

Safety Concerns:

- None today

Traffic Control:

- None today

Photos:

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

DAILY CONSTRUCTION REPORT

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	22
Project:	Legace Creek	**Page:**	1 of 6
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 25, 2024
Contract No.:		**Temperature:**	High: 18°C Low: 12°C
Weather:	Rainy, Wind 3 KM/H, Gusts 9 KM/H		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Labour Force:

Quantum Murray (QM): 2 Site Superintendent (Jem & Mel), 3 Operators, 6 Labourers
Keystone Environmental/Environmental Monitors (KE/EM): Loc & Nicole
Associated Engineering (AE): Jordan Fiske, Vinizza Pingos

Contractor's Equipment: Equipment in use

- Excavator 324ES
- Excavator EXO689
- Excavator 2720
- Loader 1466
- 2 – 3" submersible water pump
- 2 - 6" Vacuum Assisted Pumps

Report, if, any, Contact with Occupants:

N/A

Contact with Owner:

N/A

Safety Concerns:

N/A

Testing:

Turbidity test

Traffic Control:

No traffic control on site.

Report:

6:40 AM
- AE (Vinizza & Jordan) arrived on site.

6:45 AM
- Conducted sign-in and toolbox.
- Jem discussed the work plan for the day:
  - Fixing sandbags at Station J.
  - Continuing work on SRS B3.

6:50 AM
- Keystone conducted a turbidity test at B2 (background measurement). The result was 7.62 NTU.

7:10 AM
- At Station B3:
  - Water pumping with a 1-3" submersible pump.
  - Laying the second layer of lock blocks and combigrid.

7:20 AM
- Continued at Station B3:
  - Installed the second set of geogrid and non-woven fabric. While laying the materials, the AE observed that the laborers were installing them incorrectly and advised a 1-meter overlap.

8:00 AM
- Online meeting with Jordan.

8:20 AM
- Ongoing work at Station B3:
  - Gravel delivery in progress.
  - Second layer of lock blocks installed.
  - Continued water pumping for the SRS structure while excavating 5 meters from the lock block.

8:39 AM
- Keystone conducted a turbidity test downstream at B3. The result was 12.87 NTU.

9:00 AM
- AE & Keystone observed turbidity in the creek water from upstream and downstream of the B stations. A turbidity test at B3 downstream yielded a result of 21.4 NTU.

9:15 AM
- At Station B3:
  - Laying granular base for the remaining distance from the lock block.

9:36 AM
- Compaction of gravels ongoing at Station B3.

9:40 AM
- Additional turbidity tests conducted by Keystone:
  - Downstream of B3: 93.4 NTU
  - Upstream of B3: 89.1 NTU
  - Loc explained that the elevated turbidity levels were not caused by Site 14 construction activities but were due to conditions upstream.

10:10 AM
- Conversation with QM & Keystone:
  - Loc explained that instream sediment removal works would be suspended during periods of significant rainfall, particularly with forecasted rainfall of 25 mm. Nicole reported 16.8 mm recorded in Abbotsford by this hour.
  - QM emphasized the need to fix the sandbags at Station J.
  - Keystone to set up fish traps at K & J since electrofishing cannot be conducted during rain.

10:20 AM
- Placing combigrid at Station B3.

10:22 AM
- Completed building of the second layer of lock blocks.

11:00 AM
- Discussion with Jem:
  - To lay down excavated material from Station K to Station L in a separate pile from C2 materials.
  - Plan to dig at Station K if rain subsides.
  - Fix the isolated area at Station J.
  - Surveyor to conduct a topographic survey tomorrow at the Station L laydown area.
  - Begin moving sandbags from D (opposite side) to J.

11:16 AM
- Began fixing Station J.

12:40 PM
- At Station K:
  - Keystone began fish salvage using dip netting (1st pass).

1:00 PM
- Station J: Completed fixing sandbags and set up turbidity curtains around them.

1:10 PM
- Keystone released approximately 70 fish caught at Station L downstream.

1:47 PM
- Keystone reminded QM that 23 mm of rain had been recorded from the Abbotsford data.

1:55 PM
- Station J: Keystone completed fish salvage (2nd pass) and released the fish at Station L downstream.

2:03 PM
- At Station K: Keystone setting up a minnow trap.

2:14 PM
- At Station J: Keystone setting up a minnow trap.

2:17 PM
- QM mobilized light plant in preparation for the 4:30 AM call time tomorrow.

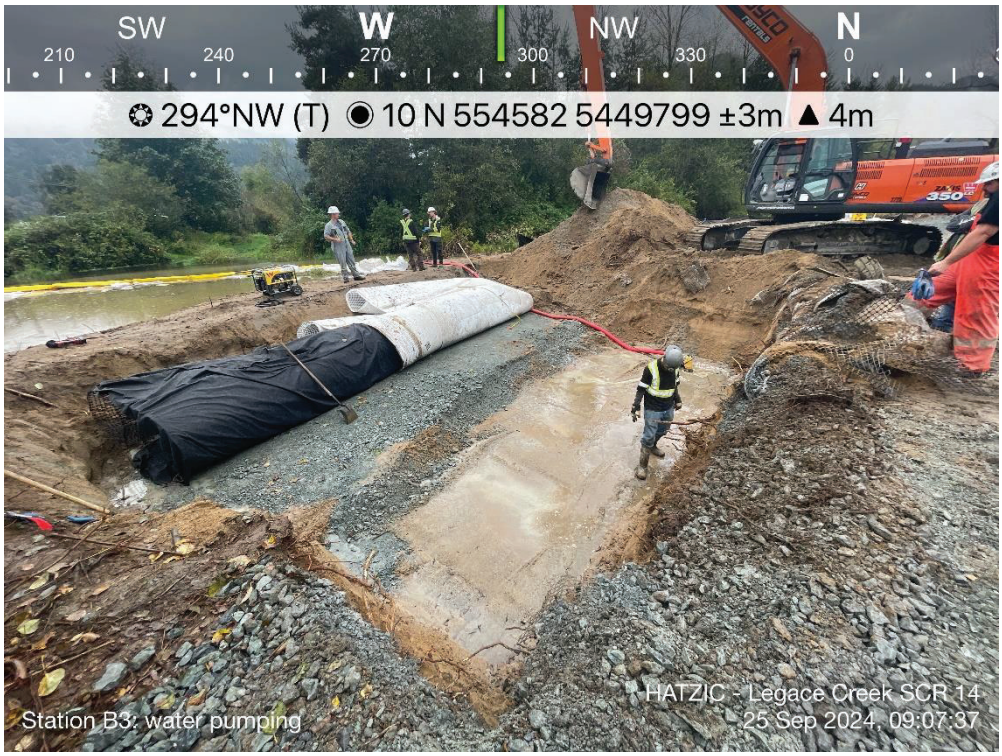
2:30 PM
- At Station B3: Third layer of lock blocks installed, with ongoing laying and compaction of gravel.

3:30 PM
- AE Dave arrived on site.

4:00 PM
- Ongoing gravel laying, adding combigrid to tie into the access road.

5:15 PM
- AE (Jordan and Vinizza) left the site.

Photos:


SW W NW N
210 240 270 300 330 0
294°NW (T) 10 N 554582 5449799 ±3m ▲4m
Station B3: water pumping
HATZIC - Legace Creek SCR 14
25 Sep 2024, 09:07:37


SW W NW N
240 270 300 330 0 30
307°NW (T) 10 N 554583 5449800 ±3m ▲4m
Station B3: 2nd layer lock block installed, placing of geogrid & non woven fabric
HATZIC - Legace Creek SCR 14
25 Sep 2024, 12:26:26


S
SW
W
NW
N
210
240
300
330
0
273°W (T) 31 N 166021 0 0m
Station B3-laying of nonwoven fabric & geogrid
HATZIC - Legace Creek SCR 14
25 Sep 2024, 16:50:31


SE
S
SW
W
120
150
180
210
240
270
195°S (T) 10 N 554353 5449489 ±3m 2m
Station K: placing turbidity curtains
HATZIC - Legace Creek SCR 14
25 Sep 2024, 13:28:09

TECHNICAL MEMORANDUM

Issue Date:	October 1, 2024	**File:**	Audit No. 5
To:	**Thyren Jacobs, Flood Debris Management Secretariat**	**Previous Issue Date:**	
From:	Dave Muhlert, R.B.Tech. and Naomi Sands, R.P.Bio.		
Client:	Ministry of Environment and Climate Change Strategy		
Project Name:	Lagace Creek Bank Protection and Sediment Removal - SCR14	**Project No.:**	2022-2632-03
Subject:	Environmental Compliance Audit		
Monitoring Period:	September 20 – September 25, 2024		
Contractor:	QM Environmental		
Environmental Monitor:	Keystone Environmental		

1 INTRODUCTION

Associated Environmental Consultants Inc, (Associated) is pleased to provide this environmental audit report summarizing observations of site conditions, environmental protection measures, regulatory compliance, and corrective actions as part of erosion protection works on Lagace Creek, south of Durieu, BC in the Hatzic Valley (the Project, the Site) during the monitoring period September 20 to September 25, 2024. The results presented in this audit report are based on conditions observed at the time of the audit inspection(s) and represent a snapshot of the workday. Items identified as non-compliant may have been addressed before the report(s) are submitted. The audit report(s) are submitted to the owner, their agent (Associated Engineering), the Contractor, and their environmental monitor (EM) and are not intended for further distribution.

2 ROLES AND RESPONSIBILITIES

The prime contractor for the Project is QM Environmental (the Contractor), and works are being monitored for environmental compliance by Keystone Environmental (Keystone) and audited by Associated. As the EM, Keystone is to work with the Contractor to develop measures to protect the environment and to respond to environmental incidents as they occur. Keystone is also responsible for fish and wildlife salvages prior to instream works. Leq'á:mel First Nation (LFN) is the cultural monitor for the Site. The responsibility of the auditor is to ensure on behalf of the owner, who is ultimately the permit holder, that the EM, LFN, and the Contractor adhere to the requirements of the Construction Environmental Monitoring Plan (CEMP)[1], environmental permit conditions and any applicable regulations.

3 SITE INSPECTION

A summary of site conditions as observed during the audit inspection completed during the monitoring period is provided in Table 3-1. Monitoring reports have been submitted for the auditing period.

[1] AquaTerra Environmental Ltd. 2024. Hatzic Emergency Program, South Herford Creek Project, Construction Environmental Management Plan (Rev. 1). Prepared for Mission Contractors Ltd. 65 p.

Table 3-1 Site Conditions During Audit Inspection

Date / Time	Auditor (Associated)	Weather	Construction Activities
September 25, 2024 15:30	Dave Muhlert	Overcast. 14°C. Moderate rain[2].	Contractors were working above top of bank / in the dry to construct sand recovery station B3. No instream work was in progress during the audit.

4 INSPECTION RESULTS

A checklist of required environmental protection measures and mitigative strategies for the Project is presented in Table 4-1. The checklist has been developed in accordance with terms and conditions of the environmental permits and approvals issued for the Project, environmental protection specifications and requirements as part of the construction contract for the Project, the Contractor's Construction Environmental Management Plan and environmental best management practices and guidelines.

[2] Government of Canada. 2024. Historical Data (Abbotsford Airport station). Available at: https://climate.weather.gc.ca/historical_data/search_historic_data_e.html. Accessed September 2024.

Table 4-1 Summary of Environmental Protection Measures Reviewed and Results of the Inspection

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
	Environmental Monitoring					
1	The EM will attend key site meetings where environmental mitigations and issues may be discussed.	☒Compliant ☐Non-Compliant ☐N/A	EM has been on site daily to attend site meetings.	As instream works continue outside the least risk fish window, EM reports should continue to document consideration of increased risk and if enhanced mitigation is required.	CEMP Section 2.4	
2	The EM shall supervise all instream works. If temporary diversion installed, EM is onsite daily to check pumps and flow bypasses.	☒Compliant ☐Non-Compliant ☐N/A	EM was onsite to oversee works in and about the channel.		WSA (h)2.ii, (j)5.i CEMP Section 2.4	
3	The EM will submit daily and bi-weekly monitoring reports to the Contractor for distribution to MoECCS.	☒Compliant ☐Non-Compliant ☐N/A	Monitoring reports are submitted daily, or the following morning.		CEMP Section 5.1	
4	The EM will complete and submit an Environmental Incident Report (EIR) for non-compliances with the CEMP, reportable spills or other environmental incident.	☐Compliant ☐Non-Compliant ☒N/A	No reportable environmental incidents have been documented to date.		CEMP Section 4	
5	EM is granted authority to stop the work if necessary	☒Compliant ☐Non-Compliant ☐N/A	EM reported that instream work was stopped on September 25 due to the significant rain event.		WSA (i) 7 CEMP Section 2.4	
	Erosion and Sediment Control					
6	Appropriate site isolation is installed as required, including silt fencing prior to instream works. Silt fences are installed properly, intact, adequate, clear of accumulated sediment and are functioning.	☒Compliant ☐Non-Compliant ☐N/A	Conditionally compliant. Silt fencing was installed around one sediment stockpile but were in need of maintenance as some sections had gaps at the bottom or had partially collapsed. Exposed slopes are covered with poly sheets but some sediment has accumulated on top of the poly. Sandbag isolation is being overtopped by creek flows, leaving the silt curtain as the only fish isolation.	WLRS approval to allow dredging in the wet (with fish isolation) was received on September 24. Sandbag isolation should be high enough to keep instream work areas isolated from fish passage during periods of higher flow.	WSA (o), (q) CEMP Section 3.5	Photo 1, Photo 2, Photo 3
7	Riprap or any other engineering material place in channel is clean of any substances deleterious to aquatic life.	☐Compliant ☐Non-Compliant ☒N/A	No riprap or other material was being placed during the audit.		WSA (x) CEMP Section 3.5	
8	Stockpiling and storage areas are located 15 m from the watercourse TOB.	☒Compliant ☐Non-Compliant ☐N/A	Sediment stockpiles are located >15 m from the watercourse OR surrounded by silt fencing.		DFO FAA WSA (t) CEMP Section 3.5	Photo 2
9	Emergency ESC material onsite (e.g., 100 feet of silt fencing, 5 dry bales, and 100sq.m of ECBs/ Coconut matting, or polyethylene sheets)	☒Compliant ☐Non-Compliant ☐N/A	ESC materials were stockpiled at the site laydown. Lots of exposed sediment onsite.	Utilize emergency ESC during significant rain events as required.	CEMP Section 3.5	
10	Sediment removed from the Site will be disposed of appropriately at a location	☐Compliant ☐Non-Compliant ☒N/A	Excavated sediment is currently being stockpiled onsite.	Identify sediment disposal location(s) in the CEMP and/or the	CEMP Section 5.5	

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
	approved by the EM and MoECCS.		Offsite disposal location still to be determined.	environmental monitoring reports.		
11	Sediment removal boundaries must be clearly delineated prior to commencement of work.	☒Compliant ☐Non-Compliant ☐N/A	Sediment boundaries determined in consultation with AE inspector.		WSA (opening)	
	Invasive Plant Management					
12	Ensure that machinery is free of invasive plant material that could potentially be transported throughout or between sites.	☐Compliant ☐Non-Compliant ☒N/A	No machinery observed leaving site during inspection.		WSA (opening) CEMP Section 3.4	
13	Ensure that invasive species removed from site are disposed of appropriately at an approved facility	☐Compliant ☒Non-Compliant ☐N/A	Japanese knotweed removal is ongoing, however, management protocols in CEMP still do not align with approach in field.	Ensure knotweed management adheres to approved BMPs and contract, and document methodology including rationale for any changes in approach.	WSA (opening) CEMP Section 3.4.1	
14	The Project site shall be regularly monitored by the EM for invasive plant infestations and these infestations will be mapped and managed according to applicable species-specific BMPs.	☐Compliant ☒Non-Compliant ☐N/A	Patches of knotweed at the entrance to the site laydown have not been delineated to prevent encroachment.	Delineate knotweed adjacent to access and work areas, and continually monitor works adjacent to knotweed patches to ensure no accidental encroachment.	CEMP Section 3.4.1	Photo 4
16	Knotweed stems are cut close to the ground and contained on poly sheeting away from the immediate work area. Cut knotweed is covered with woven geotextile fabric and crushed rock prior to machine access. Knotweed stems are injected with an appropriate herbicide before being covered.	☐Compliant ☒Non-Compliant ☐N/A	Knotweed management still not adequately documented.	Update CEMP to document revised knotweed approach.	CEMP Section 3.4.1 Addendum 1 to the Contract Documents for the Hatzic Emergency Works Program - Lagace Creek – Sites S-CR-14/17	
	Waste Management					
17	Dispose of all anthropogenic debris removed at an appropriate waste management facility.	☒Compliant ☐Non-Compliant ☐N/A	Some small pieces of anthropogenic debris were observed during the audit. The site supervisor reported that the crew would do a cleanup at the end of the day.		WSA (opening) CEMP Section 5.5	
18	Non-hazardous waste stored appropriately and removed offsite daily.	☒Compliant ☐Non-Compliant ☐N/A	No non-hazardous waste was observed during the audit.		CEMP Section 5.5	
19	Hazardous waste stored > 30 m of watercourses.	☒Compliant ☐Non-Compliant ☐N/A	Two portable toilets are located at the site laydown, more than 30 m away from watercourses.		CEMP Section 5.5	
20	Secondary containment used for all stored hazardous waste.	☐Compliant ☒Non-Compliant ☐N/A	Portable toilets were not in secondary containment.	Add secondary containment to portable toilets.	CEMP Section 3.6	Photo 4
	Spill Control and Emergency Response					
21	Machinery operating in channel is equipped with environmentally friendly oil	☒Compliant ☐Non-Compliant ☐N/A	Excavator on site has a sticker confirming that it contains Environ™		WSA (p) 4 CEMP Section 3.6	

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
			biodegradable, non-toxic hydraulic fluid.			
22	Equipment and machinery are free of leaks	☒Compliant ☐Non-Compliant ☐N/A	No leaks were observed during the audit. Equipment appeared to be clean.		WSA (p) 1 CEMP Section 3.6	
23	Drip trays are available and used during refueling and equipment maintenance	☒Compliant ☐Non-Compliant ☐N/A	Equipment was actively working during the audit. Spill trays were observed around site and present under stationary equipment.		CEMP Section 3.6	Photo 5
24	Fuel is stored > 30 m from Lagace Creeks and any connected drainages	☒Compliant ☐Non-Compliant ☐N/A			WSA (p) 3 CEMP Section 3.6	
25	Machinery and vehicles operating onsite are equipped with spill kit.	☒Compliant ☐Non-Compliant ☐N/A	Stocked spill kits were available near active work areas.		WSA (p) 2 CEMP Section 3.6	
26	Should suspected contaminated material be encountered (i.e., soil emitting olfactory cues indicative of hydrocarbon fuel), works should temporarily halt for investigation.	☒Compliant ☐Non-Compliant ☐N/A	EM reported high concentrations of sodium and some other metals and additional analysis and reporting are pending.		CEMP Section 2.5	
27	Refuelling of machinery is conducted on level ground over a spill tray.	☒Compliant ☐Non-Compliant ☐N/A	No refuelling was observed during the audit.		CEMP Section 3.6	
	Riparian Area Management					
28	Stockpile LWD and root wads removed from channel for use in site restoration	☒Compliant ☐Non-Compliant ☐N/A	LWD is being stockpiled on site. Vegetation clearing should be limited to stations and access points only. Any riparian disturbance must be restored post-construction.		CEMP Section 3.3	Photo 6
29	Construct access points and approaches perpendicular to the watercourse;	☒Compliant ☐Non-Compliant ☐N/A			DFO FAA CEMP Section 3.2	
	Instream Works					
30	The EM shall ensure that instream works are isolated from flow and that measures are in place to protect fish and fish habitat, and to mitigate the migration of sediment downstream.	☒Compliant ☐Non-Compliant ☐N/A	A silt curtain was installed surrounding station B3 where instream work had been conducted earlier in the day before the stoppage due to rain.	Improve instream isolation to prevent a failure during instream works.	WSA (j) CEMP Section 3.1	
31	Pumps and flow bypasses are in proper working condition	☐Compliant ☐Non-Compliant ☒N/A	Pumps were not operating during the audit visit.		WSA (j) 5 CEMP Section 3.1	
32	Instream works conducted in the dry / isolation of flow	☒Compliant ☐Non-Compliant ☐N/A	Instream works were not in progress during the audit visit. Excavation was restricted to above wetted channel.	Procure and install appropriate equipment for isolation and dewatering as required.	WSA (o) CEMP Section 3.1.1	
	Water Quality					
33	Water quality is routinely monitored upstream and downstream of the work area, every day that instream works are occurring	☒Compliant ☐Non-Compliant ☐N/A	EM is routinely monitoring water quality, and halting or adjusting instream works where short-term exceedances are noted. Sediment curtains have been installed downstream of instream works.	The contractor must exercise due care when handling sandbags instream and the EM to provide appropriate guidance to mitigate any	WSA (s) CEMP Section 3.1.2	

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
	Instream water quality is compliant with provincial criteria[3]: **Turbidity**: - <8 NTU from background at any one time for a duration of 24 h in clear waters; - < 5 NTU from background when background is 8 – 50 NTU; - <10% from background when background is > 50 NTU. **pH:** 6.5-9.0		Excavated sediment is being used to fill the sandbags that are installed for instream isolation. Occasionally the sandbags tip over or rip when being relocated, resulting in localized turbidity.	potential risk to fish and fish habitat.		
	Fish and Wildlife Protection					
34	Full time monitoring for fish during instream works is occurring.	☒Compliant ☐Non-Compliant ☐N/A	EM is onsite full time		WSA (j) 6 CEMP Section 2.4	
35	Fish salvages are conducted in advance of instream works where required.	☒Compliant ☐Non-Compliant ☐N/A	EM is conducting salvages in advance of sediment excavation.		CEMP Section 3.1 WSA (j) 6	
36	Salvaged fish are relocated back to the same watercourse in a nearby area that is not impacted by construction or removal works or its zone of influence	☒Compliant ☐Non-Compliant ☐N/A	EM is relocating fish outside the isolated work zone.		DFO FAA Section 2.2.4	
37	Pump intakes are screened for fish and aquatic species in accordance with the "Interim code of practice: End-of-pipe fish protection screens for small water intakes in freshwater"	☐Compliant ☐Non-Compliant ☒N/A	Pumps were not operating during the audit visit.		WSA (j) 5.ii DFO FAA Section 2.4.9 CEMP Section 3.1.1	Photo 5
38	Obtain required permits prior to salvage(s).	☒Compliant ☐Non-Compliant ☐N/A	EM has obtained salvage permits.		WSA (Opening) CEMP Section 3.1	
39	EM is on site during disturbance to riparian vegetation and conducting pre-clearing breeding bird surveys prior to clearing.	☒Compliant ☐Non-Compliant ☐N/A	EM is conducting nest surveys at stations as required.		CEMP Section 3.2	
40	Instream works are conducted so as not to lead to fish stranding or other impacts to fish. The works shall not result in depressions that have the ability to trap fish and other aquatic life. Fish passage is maintained where practicable and in accordance with applicable permits.	☒Compliant ☐Non-Compliant ☐N/A	Instream works have been designed to maintain fish passage after completion. Instream works are now being conducted outside the least risk window and excavation is occurring in the wet. Contractor's QEP has prepared a detailed memo outlining their updated approach to instream works with enhanced mitigation.	EM must be monitoring for fish full-time and should have a plan for maintaining upstream fish passage around the work area. This plan should be documented in routine monitoring reports. EMs onsite must be aware of the QEP memo and ensure that enhanced mitigation is implemented as outlined in the memo.	WSA (j) 6 (iii) WSA (u) DFO FAA Section 2.4.2 CEMP Section 3.1.1	

[3] British Columbia Ministry of Environment and Climate Change Strategy. 2024. British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture - Guideline Summary – August 2024. Water Quality Guideline Series, WQG-20. Prov. B.C., Victoria B.C. Available at: https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-guidelines/approved-wqgs/wqg_summary_aquaticlife_wildlife_agri.pdf. Accessed August 2024.

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
	Restoration Requirements					
41	Restoration plans prepared by EM for disturbed area and implemented with EM oversight	☐Compliant ☐Non-Compliant ☒N/A	Restoration plans have not been prepared yet.		WSA (w) CEMP Section 3	
42	All temporary works shall be removed on completion of the project, and the stream channel restored to its natural condition	☐Compliant ☐Non-Compliant ☒N/A	Work is still in progress.		WSA (v) CEMP Section 3	

5 DISCUSSION

5.1 Non-Compliant Items

Knotweed management

Knotweed removal onsite is ongoing however the CEMP has not been updated with revised approach. Knotweed adjacent to works areas is not delineated to prevent accidental encroachment and spread.

Recommended action: Provide documentation of knotweed management and ensure it adheres to approved BMPs. Provide details on alternative approach with rationale, and update documentation (e.g., CEMP). Delineate knotweed patches adjacent to access and work areas and monitor machinery to prevent accidental intrusion.

Portable toilets without secondary containment

Two portable toilets located at the site laydown adjacent to Dale Road did not have secondary containment. Although the toilets were more than 30 m away from the watercourse, secondary containment would prevent any potential spills from spreading beyond the immediate area.

Recommended action: Add secondary containment to portable toilets.

5.2 Conditionally Compliant Items

Site isolation and erosion and sediment control

Sandbag isolation around site B3 was almost completely submerged, leaving the silt fence as the only effective fish isolation. Sandbag isolation should be high enough to adequately isolate the instream work area during high flow events. Erosion and sediment control measures (e.g., silt fencing, poly sheeting) were in place but require maintenance to ensure that they continue to function effectively.

EM reporting to document risk and mitigation

As instream works progress beyond the least risk fish window, the EM must provide guidance and advice to the contractor regarding any changes in risk associated with working past the window and required mitigation.

Recommended action: EM reports should document their consideration of any increased risk with working past the least risk and identify if enhanced mitigation is required. EM should continue to document implementation of mitigation measures, evaluate changing conditions, and report any incidents or near-misses.

6 SUMMARY

A list of environmental issues outstanding to date is provided in Table 6-1, below.

Table 6-1 Tracking Table of Environmental Issues Outstanding to-Date (project commencement August 12, 2024)

Item #(s)	Issue	Date(s) Observed	Recommended Corrective Action(s)	Responsible Party
2	Knotweed management	August 29, 2024 September 5, 2024 September 13, 2024 September 29, 2024 September 25, 2024	Ensure that all knotweed cuttings are confined to poly sheeting. Apply herbicide to remaining stems, as appropriate. Document methodology and ensure it adheres to approved BMPs.	Contractor/EM
3	Portable toilets without secondary containment	August 29, 2024 September 5, 2024 September 13, 2024 September 29, 2024 September 25, 2024	Add secondary containment to portable toilets.	Contractor
4	Inadequate instream isolation and failed dewatering attempts resulting in instream works conducted in the wet.	August 31, 2024 September 1, 2024 September 2, 2024 September 11, 2024 (EM reports)	Need to provide adequate isolation and dewatering to maintain dry work area OR obtain permission to dredge in the wet	Contractor

Note: Items marked with an asterisk (*) were reported by the EM.

7 CLOSURE

We trust that the information in this memo is sufficient for your present needs. Should you have questions, please do not hesitate to contact the undersigned.

Prepared by:

D. Muhlert

Dave Muhlert, R.B.Tech.
Environmental Technologist
DM/NS

Reviewed by:

N Sands

Naomi Sands, R.P.Bio.
Environmental Scientist

Attachments:
- Site Photographs

Attachment 1: Site photographs taken during audit visit on September 19, 2024.

Photo 1: Instream isolation at station B3 		**Photo 2: Silt fence installed onsite around stockpile** 
Photo 3: Sediment accumulated on top of poly sheeting 		**Photo 4: Knotweed patches adjacent to work areas and site laydowns must be delineated to prevent accidental encroachment** 
Photo 5: Spill tray under stationary equipment 		**Photo 6: Large woody debris stockpiled on site** 

Table A2: Tracking Table of Resolved Non-Compliance Issues

Item #(s)	Issue	Date(s) Observed	Date Corrected	Corrective Action(s)	Responsible Party
1	Environmental monitoring reports not received daily	August 29, 2024	September 5, 2024	Monitoring reports received daily, or following morning.	EM
2	Inappropriate fish screen on pump intake	September 5, 2024	September 12, 2024	EM reports show pump intakes in mesh screen boxes. Wire mesh screen was being fitted to an additional pump intake during the audit visit.	Contractor

RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: September 25, 2024
Weather: Considerable cloudiness with heavy rain showers. High 14°C, Low 9°C.

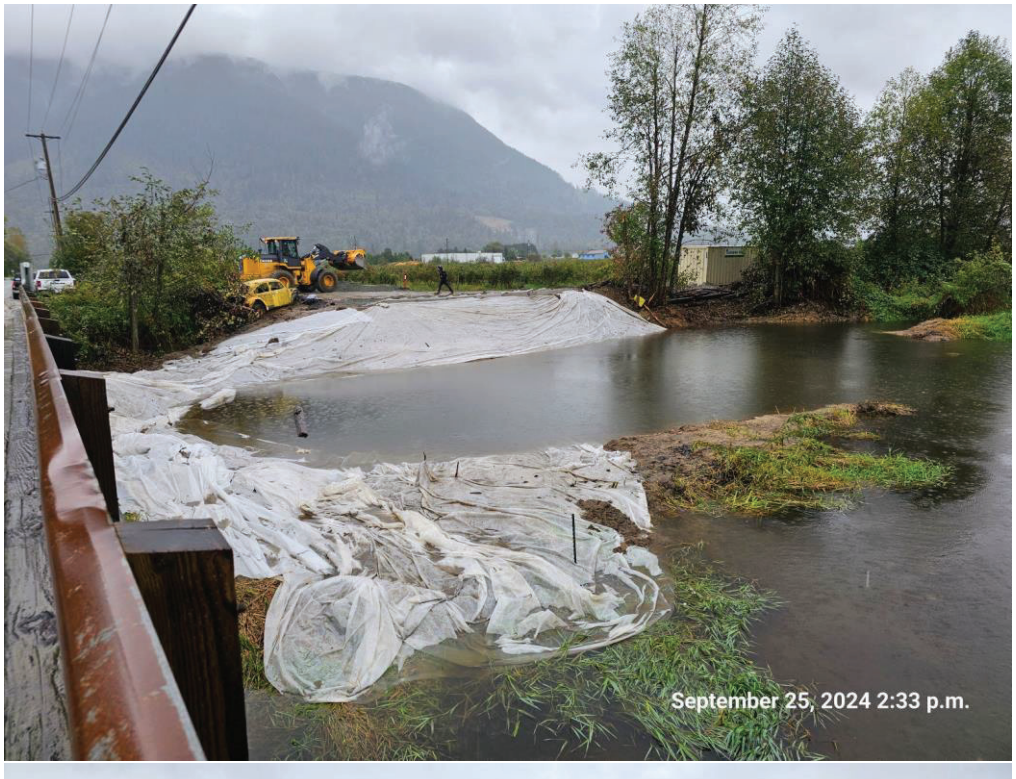
- ***Works are being conducted outside of the least-risk window for in-stream works under the supervision and guidance of the Environmental Monitor.***
- ***Keystone Environmental undertook the following additional measures to reduce the risk of impacts to fish and fish habitat during works conducted outside the instream works least-risk window:***

- ***Erosion Sediment Control (ESC):***
  - *Exposed areas adjacent to Lagace Creek are protected with poly tarp to prevent potential sediment runoff into Lagace Creek prior to the upcoming rain event.*
- ***Water quality management:***
  - *Keystone's EM closely monitors WQ throughout the workday. Elevated turbidity was not observed.*
- ***Spill Response and Mitigation:***
  - *Spill trays were placed under heavy machinery to prevent any spill or leakage. Spill kits were also located nearby and fully stocked with spill pads, booms, and absorbent materials.*
  - *All spill trays were cleaned using spill pads to ensure remaining sheens were removed prior to forecasted rain event.*
- ***Significant Rain Event (SRE):***
  - *As per Water Sustainability Act Extension Memo, and later was approved today:*
    - *Work (instream work) will not occur during periods of significant rainfall or forecasted rain events of 25mm or more within a 24-hour period.*
    - *All instream works were ceased as Abbotsford's flowwork (the closet one since Mission does not have it own) reported over 25mm of rainfalls.*
- 0630: EMs arrived on site.
- 0808: B3 groundwater dewatering work was observed.
- 0858: Turbidity plume observed in channel traveled from upstream of Lagace Creek. KEL EM notified QM personnel, Keystone Project Manager and Leqamel's EM (via phone and email). Additional WQ data was collected by EM.
- 1015: EM received confirmation from QM personnel that excavation in the wetted area was approved. However, SRE was forecasted and EM clearly discussed with QM on the conditions: Work (instream work) will not occur during periods of significant rainfall or forecasted rain events of 25mm or more within a 24-hour period. KEL EM would notify QM when SRE triggered.
- 1020: QM proceeded to repair station J.
- 1149: Turbidity in Lagace Creek at station K observed to be turbid from the turbidity plume observed in the upstream at 0858.

- 1241: EM commenced dipnetting at station K.
    - Salvage Result:
        - Pass 1: 67 TSS, 3 Prickly Sculpin, 1 Coho Salmon
        - Pass 2: 12 TSS
- 1415: 25mm of rainfall was recorded (Abbotsford's flow work), EM notified QM, and all instream works were ceased.
- 1420: Lock block installation at station B3 continued.
- 1730: End of workday.
- 1735: EMs left site.
- Water Quality Sampling Results:

Location	Time	Turbidity	pH	Dissolved Oxygen
BG-US of B3	0650	7.62	-	7.89 mg/L;75.7 DO%
DS from B3	0736	12.1	-	-
DS from B3	0839	12.87	-	-
DS from B3	0905	**21.4**	7.18	-
DS from B3	0940	**93.4**	7.32	-
BG-US of B3	0955	**89.1**	-	-
DS - Station K	1057	**59.6**	-	-
BG-US of B3	1205	14.2	-	-
DS - Station L	1149	30.9	-	-
DS - Station J	1409	10.02	-	-
BG-US of B3	1438	11.35	-	-

Site Photos






September 25, 2024 1:20 p.m.


September 25, 2024 2:38 p.m.


September 25, 2024 9:13 a.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	23
Project:	Legace Creek	**Page:**	1 of 5
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 26, 2024
Contract No.:		**Temperature:**	High: 18 Low: 12
Weather:	Raining/Overcast		

September 26, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Jim) (Mel), 4 operator, 7 labourers
Keystone Environmental: EM (Loc, Nicole +1)

Contractor's Equipment:

-Equipment in Use

- CAT Excavator 324E
- Zaxis Excavator EX0689
- Zaxis excavator 2720
- Deer Loader 1466
- Pumping equipment: generator, 2 – 3" pumps.

Report, if any, Contact with Occupants:

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

10:30AM

- Discussion Keystone (Loc) – Wants turbidity curtain around isolation sand bags instead of across creek.

- Curtain across creek causes fish barrier for potential spawning fish.
- Taking turbidity samples U/S of SRS K at SRS I

Discussion with Contractor:

6:45AM
- Toolbox QM (James) – water level high today – SRS B3, J and K might be overflowing, will have to evaluate and fix if necessary.
- Digging at SRS J and K today.
- Finishing SRS B3 and excavation at B3.

8:30AM
- Discussion with QM (James) – survey:
- SRS C2 lock block excavation pile at SRS L – surveyed today
- SRS C2 creek excavation stockpile next to SRS L – surveyed prior to placing here. Surveyed again today will be titled 'C2 balance'.

10:20AM
- Discussion QM (James) – going to fill sand bags from SRS K excavation for SRS I isolation.

11:00AM
- Discussion with QM (Craig, operator) – near max depth at B3, and near our contaminated quantity.
- Jordan – no more excavation, QM will tidy slopes in area.

11:40AM
- Discussion QM (James), Keystone (Loc) – going to start filling sand bags at SRS K
- Keystone to fish salvage SRS F around 1:00PM, prior to excavation, bags in place.
- Expected to have around 200m3 excavated from SRS K today
- Working though long weekend. Have to be complete and out of water by Oct 1.
- Keystone set this date and are to decide risk window for spawning fish.

2:40PM
- Discussion with QM (James) – taking silt curtain off of SRS J and moving it to F for that isolation.
- Keystone's request, comfortable with turbidity and will be removing sand bags from SRS K tomorrow.

5:15PM
- Discussion with QM (James) – planning to start tomorrow at 4:30AM
- Will be hauling 4 contaminated trucks from SRS B3 and B3 lock block excavation
- Moving bags from I to B2, will be excavating this station as contaminated.

Report:

7:00AM
- Surveyor on site – surveying SRS L laydown stockpile from SRS C2 lock block excavation. Using total station.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

7:20AM
- Keystone checking traps at SRS K.

8:00AM
- Excavating at SRS K
- Moving pile from this excavation next to SRS L laydown.
- Existing stockpiles at this location from SRS C2 creek excavation and SRS C2 lock block excavation.
- Silt curtains placed around isolations instead of across stream.

8:15AM
- Potential spill at SRS K
- EM's not sure if organic material or not
- QM hazmat spraying with spill control – 'spray nine'

8:40AM
- Keystone measuring turbidity D/S from K – good.

8:50AM
- Leq'a:mel CM on site.

10:20AM
- SRS K excavation complete.

11:00AM
- Begin excavation at SRS J
- EM's monitoring turbidity D/S

11:30AM
- EM's satisfied with turbidity D/S from SRS J excavation.

12:30PM
- Filling sand bags from SRS J
- Sand bags filled: 22 – not flagged.

1:00PM
- EM's monitoring turbidity D/S from SRS J – good

2:40PM
- Taking silt curtain off of SRS K isolation – moving to F
- 1 of 2 silt curtains broke when moving.

5:10PM
- Excavation at J complete.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Testing:

- None today.

Safety Concerns:

- None today

Traffic Control:

- None today

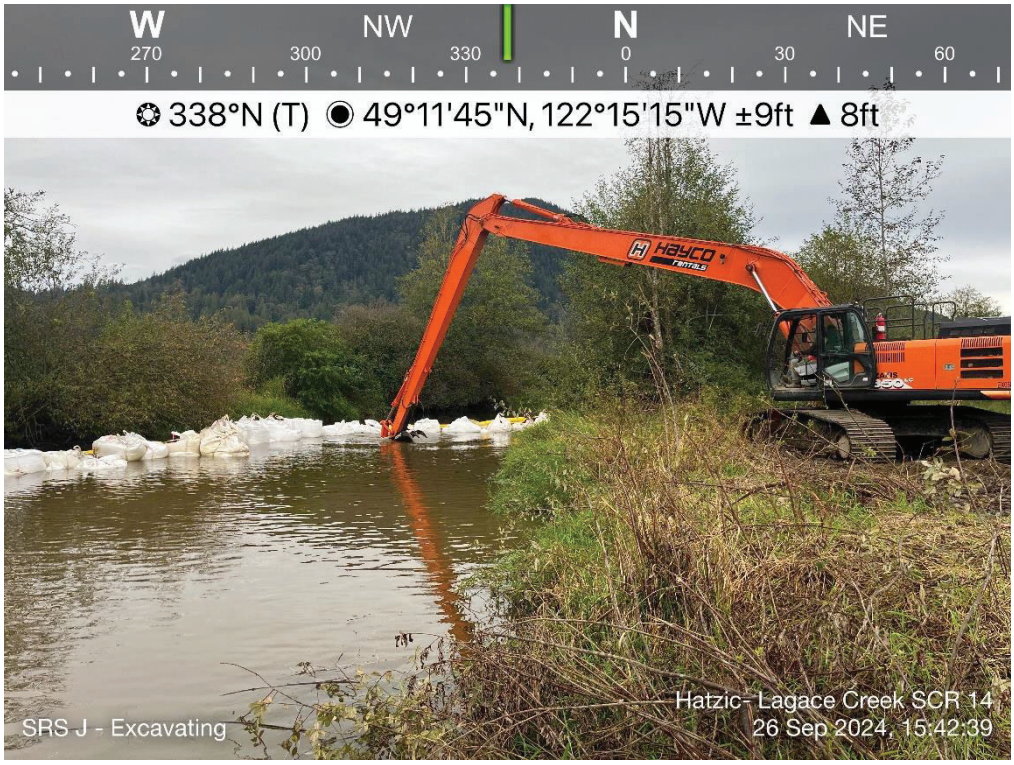
Photos:



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

DAILY CONSTRUCTION REPORT

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	23
Project:	Legace Creek	**Page:**	1 of 5
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 26, 2024
Contract No.:		**Temperature:**	High: 16°C Low: 10°C
Weather:	Cloudy, Wind 8 KM/H, Gusts 18 KM/H		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Labour Force:

Quantum Murray (QM): 2 Site Superintendent (Jim & Mel), 4 Operators, 7 Labourers
Keystone Environmental/Environmental Monitors (KE/EM): Loc, Nicole + 1 field biologist
Associated Engineering (AE): Jordan Fiske, Vinizza Pingos, Duncan McCormick

ss

Contractor's Equipment: Equipment in use

- Excavator 324ES
- Excavator EXO689
- Excavator 2720
- Loader 1466
- 2 – 3" submersible water pump
- 2 - 6" Vacuum Assisted Pumps

Report, if, any, Contact with Occupants:

N/A

Contact with Owner:

N/A

Safety Concerns:

N/A

Testing:

Turbidity test

Traffic Control:

No traffic control on site.

Report:

6:40 AM
- AE (Vinizza & Jordan) arrived on site.

6:45 AM
- Signed in and toolbox.
- Jem discussed the work plan for the day, which included
  - Fish salvage at Stations J and K, followed by excavation.
  - Completion on SRS B3 and excavation at B3.

6:57 AM
- Keystone conducted a turbidity test at Station B2 for background measurements.

7:02 AM
- Surveyor arrived on site.

7:10 AM
- Keystone removed minnow traps at Stations K and J, capturing 13 fish at Station J.

7:30 AM
- Station J: Placed turbidity curtains around the sandbags.

7:40 AM
- Station J: Keystone conducted fish salvage using dip netting.

7:45 AM
- Station K: Excavation commenced.

8:25 AM
- Station K: Excavator EXO689 excavated sediments from the creek, while excavator 324 E hauled and transferred sediments to the laydown area at Station L.

8:35 AM
- Keystone conducted a turbidity test at Station L, downstream of K.

9:10 AM
- Remaining bags at Stations D and E were recorded as 19 and 5, respectively.

9:30 AM
- Station B3: Laid gravel on the SRS and access road. Keystone flagged knotweed at the entrance of Charlie's farm.

9:40 AM
- Station B3: Began excavating the creek. AE Vinizza informed Keystone Nicole about the isolation area where sandbags had fallen. Keystone confirmed it was acceptable to dig as long as the turbidity curtains around the sandbags remained intact.

9:50 AM
- Transferred sandbags from Station D to B2.

10:00 AM
- Jem reported that they had already hauled 1,300. No further isolation was needed at Stations D and H. They planned to excavate materials from the creek to achieve the required slope for the SRS and had no plans to survey the excavated materials from B3 today. Excavation and slope building at B3 continued.

10:10 AM
- QM laborers served as flagmen.

11:50 AM
- Completed excavation at B3. QM began cleaning the equipment.

12:25 PM
- Mobilized excavator 2720 from B3 to F.

12:44 PM
- Station F: AE Vinizza observed approximately 6 bags had fallen from the isolated area.

1:11 PM
- Station B3: AE Vinizza measured the slope of the SRS, estimating the volume of excavated materials.
  - SRS slope: approximately 20.5°
  - Estimated volume: 100 m^3
- Station C2: Slope measured at 20-26° from different sides.

2:00 PM
- Transferred sandbags from Stations D and E to Station F.

3:00 PM
- Station F: Continued fixing sandbags. Transferred turbidity curtains from K to F.

3:14 PM
- Station F: Completed fixing the sandbags.

3:20 PM
- Station F: Keystone began conducting electrofishing.

3:50 PM
- Keystone (Nicole) reported difficulties in electrofishing due to water depth; they decided to set up minnow traps instead.

3:55 PM
- Station F: QM set up turbidity curtains around the sandbags.

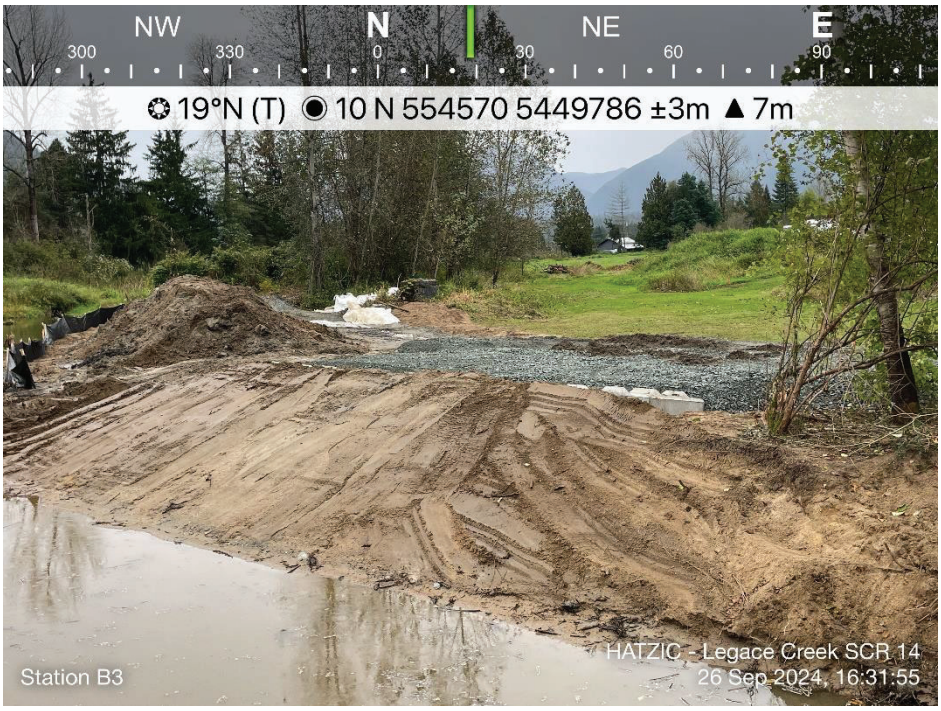
4:00 PM
- Station F: Keystone began setting up minnow traps to be checked tomorrow.

4:30 PM
- AE (Vinizza) left the site.

Photos:


S SW W NW N
180 210 240 270 300 330
266°W (T) 10 N 554332 5449516 ±3m 2m
Station J: placing turbidity curtains & fish salvage
HATZIC - Legace Creek SCR 14
26 Sep 2024, 07:44:46


E SE S SW
90 120 150 180 210 240
165°S (T) 10 N 554596 5449787 ±3m 11m
Flagged the knotweed
HATZIC - Legace Creek SCR 14
26 Sep 2024, 09:27:01


NW N NE E
300 330 0 30 60 90
19°N (T) 10 N 554570 5449786 ±3m 7m
Station B3
HATZIC - Legace Creek SCR 14
26 Sep 2024, 16:31:55


SE S SW W
120 150 180 210 240 270
193°S (T) 10 N 554463 5449673 ±3m 0m
Station F: placing minnow traps
HATZIC - Legace Creek SCR 14
26 Sep 2024, 16:01:44

RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: September 26, 2024
Weather: Rainy. High 15°C, Low 9°C.

- ***Works are being conducted outside of the least-risk window for in-stream works under the supervision and guidance of the Environmental Monitor.***
- ***Keystone Environmental undertook the following additional measures to reduce the risk of impacts to fish and fish habitat during works conducted outside the instream works least-risk window:***

- ***Erosion Sediment Control (ESC):***
  - *Exposed areas adjacent to Lagace Creek are protected with poly tarp and/or silt fences to prevent potential sediment runoff into Lagace Creek prior to the upcoming rain event.*
- ***Water quality management:***
  - *Keystone's EM closely monitors WQ throughout the workday. Elevated turbidity was not observed.*
- ***Spill Response and Mitigation:***
  - *Spill trays were placed under heavy machinery to prevent any spill or leakage. Spill kits were also located nearby and fully stocked with spill pads, booms, and absorbent materials.*

- 0630: EMs arrived on site.
- 0708: EMs arrived at Station K and J. 9 traps were pulled:
  - Result:
    - 5 TSS
    - 7 Prickly Sculpins
    - 1 Coho Salmon
- 0730: EMs conducted dip netting fish salvage at Station J.
  - Results: 5 Lampreys, 3 TSS
- 0740: Silt curtain installation observed at station J
- 0800: Dredging at station K commenced.
- 0815: Runoff sheens observed on the ground within the active work area. Source could potential be runoff from the SRE event. QM was notified and workers were dispatched to clean up the sheens using spill pads and spray nine heavy-duty cleaner.
- 0830: QM observed trimming the knotweed in proximity to the site entrance. Trimmed knotweed was stored in the sandbag. Area along the Site entrance was covered under geo-fabric to mitigate potential truck track-out from hauling activity. EM flagged the invasive knotweed with flagging tape (pink).
- 0840: Truck delivery of crush gravel was observed.
- 0930: Dredging at station B3 commenced.

- 0939: Active salvage result:
    - 10 Lamprey species
- 1020: Small amount of turbid water observed coming out of the silt curtain.
- 1030: Turbid water entered the creek channel and dissipated quickly – no significant increase in turbidity in the DS end.
- 1045: Dredging at K completed. Isolation remained in place to allow turbid water to settle down.
- 1106: Dredging at station J commenced.
- 1115: Dredging work completed for B3. Crew was instructed to sanitize the excavator before moving to the southern section.
- 1120: Gap in silt curtain fixed but small amount of turbid water continued to escape. EM monitored the turbidity closely while investigated the source of it.
- 1230: Source of leakage was identified. QM was notified and a crew was dispatched to resolve the issue.
- 1300: Issue was resolved, and turbidity returned to normal. EM was actively monitoring the turbidity while issue was being investigated. In addition, the final turbidity test at the end of workday indicated WQ was compliant compared to the BG. Therefore, it was deemed compliant.
- 1330: Station F reinforcement commenced.
- 1437: QM utilized the silt curtain at station K to isolate station F. EM was actively monitor the WQ at the DS end. Elevated turbidity was not noted.
- 1600: Station F isolation reinforcement work completed. 9 minnow traps were deployed as it was too deep for EMs to electrofishing or dip netting.
- 1716: Dredging at station J completed.
    - Dredged materials were stored on the bank in proximity to station J and K, where isolations remained in place. Hence, any runoff would be captured within the isolated area.
- 1720: Loader observed hauling sandbags from station I to station B2. EM clearly communicated and discussed with QM site superintendent on keeping the gravel access road clean and free of sediment from dredging or hauling of sediment to prevent potential spreading of knotweed.
- 1815: End of workday.
- 1830: EMs left site.
- Water Quality Sampling Results:

Location	Time	Turbidity	pH	Dissolved Oxygen
BG – US (B2 Station)	0657	7.48	7.59	61.6%, 6.35 mg/L
DS of B3	0805	11.82	7.35	-
BG-Station I	1110	7.05	-	-
30m DS of J	1123	8.97	-	-
BG- Station I	1247	10.03	-	-
30m DS of J	1255	12.33	-	-
30m DS of J	1410	11.81	-	-
BG- Station I	1504	11.10	-	-
Inside of Station K	1510	**52.9**	-	-
50m DS of J	1514	15.2	-	-
50m DS of J	1645	12.73	7.47	-
50m DS of J	1716	7.18	-	-
BG-B2	1732	7.61	7.22	-
Bridge – DS from B3	1740	11.9	-	-

Site Photos






September 26, 2024 9:06 a.m.


September 26, 2024 8:17 a.m.


September 26, 2024 11:18 a.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	24
Project:	Legace Creek	**Page:**	1 of 5
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 27, 2024
Contract No.:		**Temperature:**	High: 20 Low: 9
Weather:	Overcast		

September 27, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Jim) (Mel), 4 operator, 7 labourers
Keystone Environmental: EM (Loc, Nicole, Corbin)

Contractor's Equipment:

-Equipment in Use

- CAT Excavator 324E
- Zaxis Excavator EX0689
- Zaxis excavator 2720
- Deer Loader 1466
- Pumping equipment: generator, 2 – 3" pumps.

Report, if any, Contact with Occupants:

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

3:15PM

- Discussion with Keystone (Corbin)

- AE (Jordan) – asked Corbin to check turbidity D/S from SRS B2 isolation, could see silt leaking from isolated area.
- Corbin took sample 50m D/S – good with result.

3:40PM
- Discussion with Keystone (Corbin), AE (Jordon R) – 50m D/S sample for turbidity is typical. Corbin not concerned with readings.
- AE (Jordon) – brought up fact B2 isolation is not 2 bags wide as stated in WSAL permit.

Discussion with Contractor:

11:50AM
- Discussion with QM (James) – going to load trucks hauling later today with material from B2 area that has been dried.
- Pulling back slopes, will see contaminated quantity at end of day.

4:00PM
- Discussion with QM (James) – AE (Jordan) – asked James to pull slope back where slopes from B2 and B3 connect. Want flow to move around without eroding bank.
- James also is going to check with Keystone if there is any part of SRS H they can remove as clean material.

5:30PM
- Discussion with QM (Mel), Keystone (Loc)
- Potential bags still in creek at SRS J and K.
- QM will need to remove when space is available.
- Keystone – Silt curtain will need to be placed across the creek for a short duration while removing these.

6:00PM
- Discussion with QM (James), Keystone (Loc) – going to place silt curtain across creek for remaining sand bags they missed at SRS J and K (3 bags).
- Going to set up F tomorrow.
- Setting up wilt fence on SRS J and K.

6:30PM
- Discussion with QM (James, Craig) – need to pull back slope still near B.
- Stockpile for B2 is currently in the way, unsure how to access.
- Next hauling trucks for contaminated material coming Tuesday.

Report:

11:00AM
- AE (Jordan) on site.

11:00AM
- Turn over from AE (Duncan) morning-

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

- AE (Paul) on site, told QM they need silt curtain in water if they are removing sand bags from creek.
- QM currently waiting on silt curtain delivery as some have ripped.
- 4 trucks this morning hauling contaminated material from SRS B3 creek excavation.
- 4 more trucks hauling later today.
- Lost 3 bags from SRS K

11:50PM
- Begin excavating at B2, creek and slopes.

12:20PM – 2:20PM
- Hauling material from B2 slopes – contaminated
- 4 trucks with wagons.

2:00PM
- Silt curtain delivery
- Setting up at SRS J for bag removal.

5:15PM
- AE (Duncan, Vinizza) leaving site.

5:30PM
- Bags out of water at SRS J and K
- Been placed in mud at SRS I, will need to be cleaned before putting these bags in the water again.

7:00PM
- Leaving site.

Testing:

- None today.

Safety Concerns:

- None today

Traffic Control:

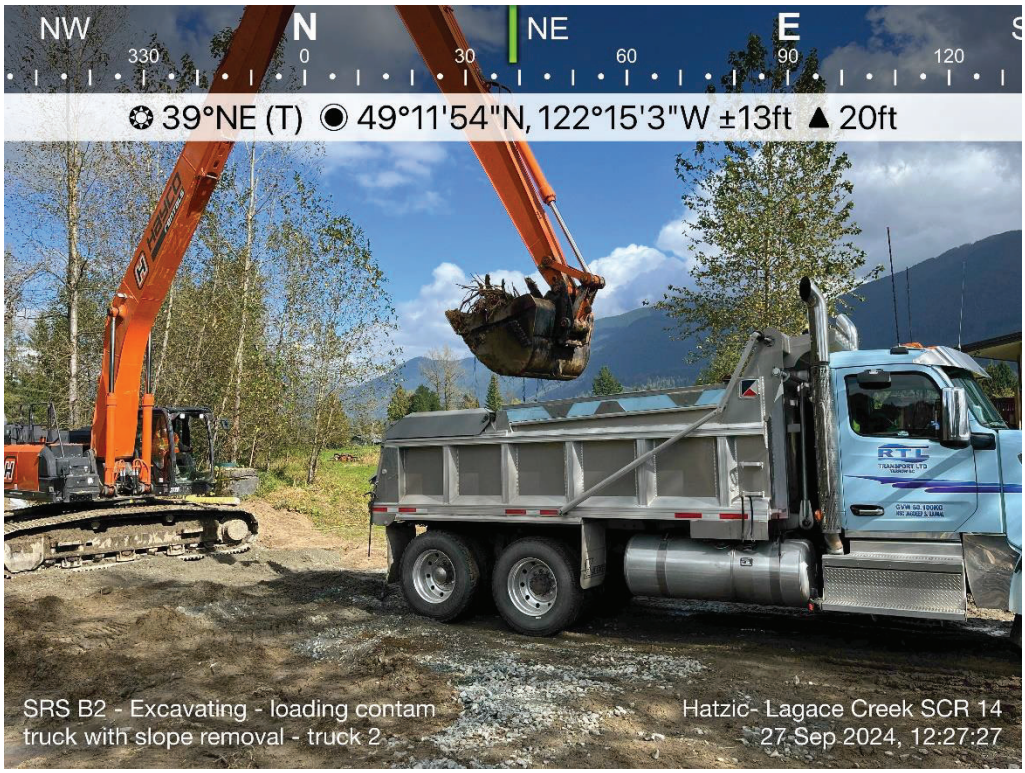
- None today

Photos:

(If necessary, continue report on another sheet.)

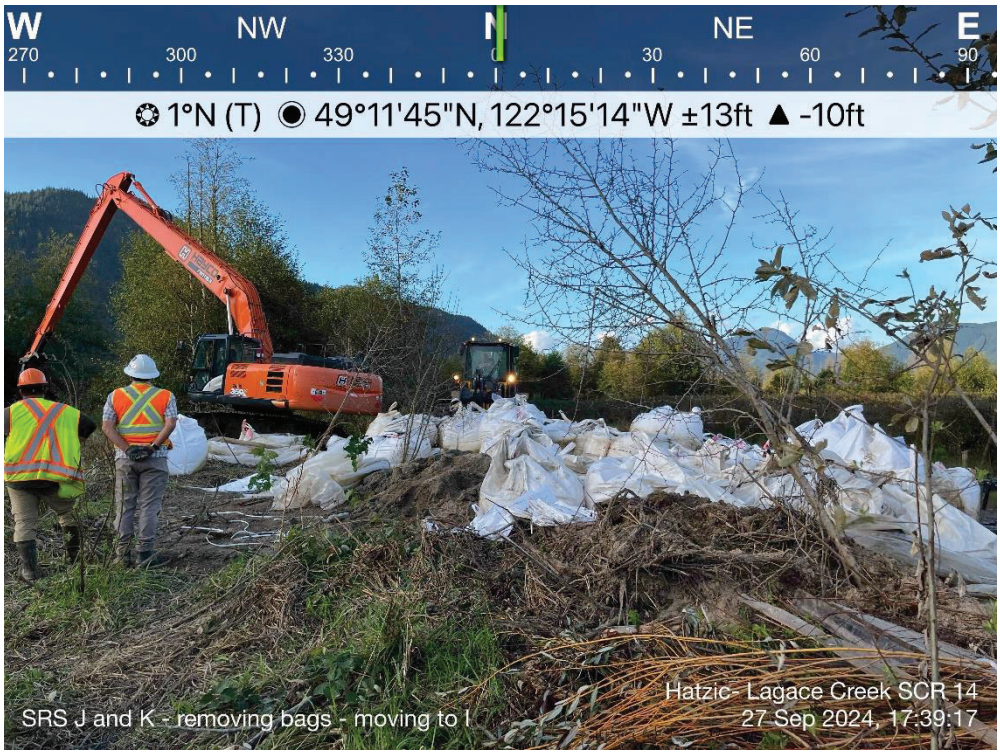
ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

DAILY CONSTRUCTION REPORT

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	24
Project:	Legace Creek	**Page:**	1 of 6
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 27, 2024
Contract No.:		**Temperature:**	High: 18°C Low: 10°C
Weather:	Cloudy, Wind 7 KM/H, Gusts 21 KM/H		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Labour Force:

Quantum Murray (QM): 2 Site Superintendent (Jim & Mel), 4 Operators, 7 Labourers
Keystone Environmental/Environmental Monitors (KE/EM): Loc, Nicole
Associated Engineering (AE): Jordan Fiske, Vinizza Pingos, Duncan McCormick

Contractor's Equipment: ss
Equipment in use

- Excavator 324ES
- Excavator EXO689
- Excavator 2720
- Loader 1466
- 2 – 3" submersible water pump
- 2 - 6" Vacuum Assisted Pumps

Report, if, any, Contact with Occupants:

N/A

Contact with Owner:

N/A

Safety Concerns:

N/A

Testing:

Turbidity test

Traffic Control:

Two flagmen from Green Valley Traffic Control were on site.

Report:

6:55 AM
- AE (Vinizza and Duncan) arrived on site.

7:00 AM
- Signed in.
- Two flagmen from Green Valley Traffic Control were on site.
- Jim mentioned that four trucks and wagons were loaded with excavated materials from B3 this morning. He also outlined today's tasks, which included building an isolation area at B2 and removing sandbags from Stations K and J to transfer to B2 and I.

7:23 AM
- Station K: 1 excavator operator, 1 loader operator, and 4 laborers.
    - AE (Vinizza) observed:
    - The absence of a silt fence around the laydown area at K.
    - No poly sheets were placed on top of the stockpiled excavated materials.
    - Turbidity curtains were removed despite incomplete sandbag removal from the stream.
- Station J:
    - QM removed the turbidity curtains before all sandbags were removed from the creek.

7:42 AM
- Conversation with Keystone (Nicole):
    - AE Vinizza informed Nicole about the situations at Stations J and K, where QM was removing turbidity curtains while sandbags were still in place. This contradicted the Keystone memo stating, “The turbidity curtain will be the final component of the isolation removed.”
    - AE Nicole responded that there would not be an issue as long as turbidity levels were acceptable based on their monitoring.

8:05 AM
- Ongoing placement of sandbags with poly sheets at Station B2.
- Surveyor on site (LIDAR).

8:07 AM
- Transferring sandbags from K to I.

8:50 AM
- Completed the removal of sandbags from K; one sandbag was lost and approximately two were still submerged in the stream.

9:30 AM
- Keystone conducted a turbidity test at Station K and departed after.

9:40 AM
- Station J:
    - Note: Turbidity curtains had been removed, and there was no presence of EM at the station.
    - Began removing sandbags from the stream without turbidity curtains.
    - Loader was transferring sandbags from J to I.

10:10 AM
- AE Paul arrived on site.

10:15 AM
- Conversation with AE, Keystone, and QM:
  - Paul advised the team to review the memo from Keystone.

10:23 AM
- Stations K & L: Setting up silt fences around the laydown areas.

10:32 AM
- Loc confirmed they would instruct QM to install turbidity curtains before removing sandbags.
- Jim advised stopping the removal of sandbags to comply with the memo regarding the placement of turbidity curtains first.

11:05 AM
- Station K & L Laydown Area: Covered excavated materials with poly sheets over the stockpile area.

11:50 AM
- Station B2:
  - Began digging; silt curtains were in place around the sandbags.
  - Excavated materials were laid at B with a poly sheet underneath.

12:18 PM
- Hauling trucks arrived.
- Excavating the bank for slope and loading directly onto the trucks.

1:07 PM
- Jem mentioned there would be eight trucks for today.
- Station B2: Fixing the sandbags.

2:18 PM
- Completed hauling four trucks with wagon; a total of eight trucks for today.

2:30 PM
- Station J: Placed turbidity curtains around the sandbags; noted that two bags had fallen.

3:00 PM
- Station J: Keystone (Nicole), QM: 1 operator, and 4 laborers began removing sandbags.

3:30 PM
- Nicole stated that QM needed to fix F and would re-salvage the area; a few fish were caught this morning.

3:55 PM
- Station J: Removed the poly sheet.

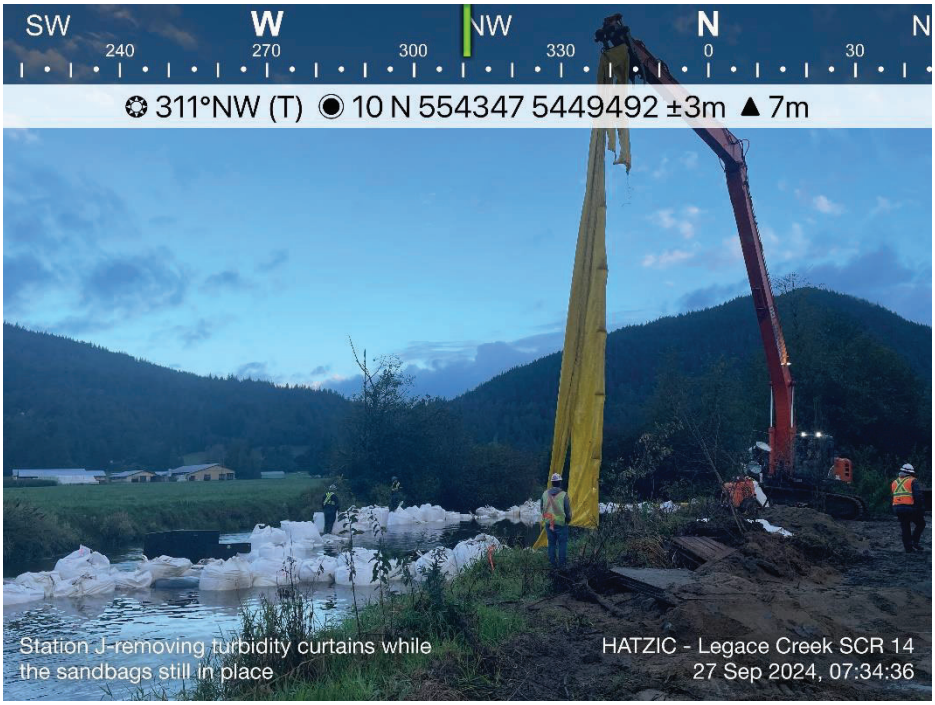
4:13 PM
- Station K: Noted one lost sandbag.

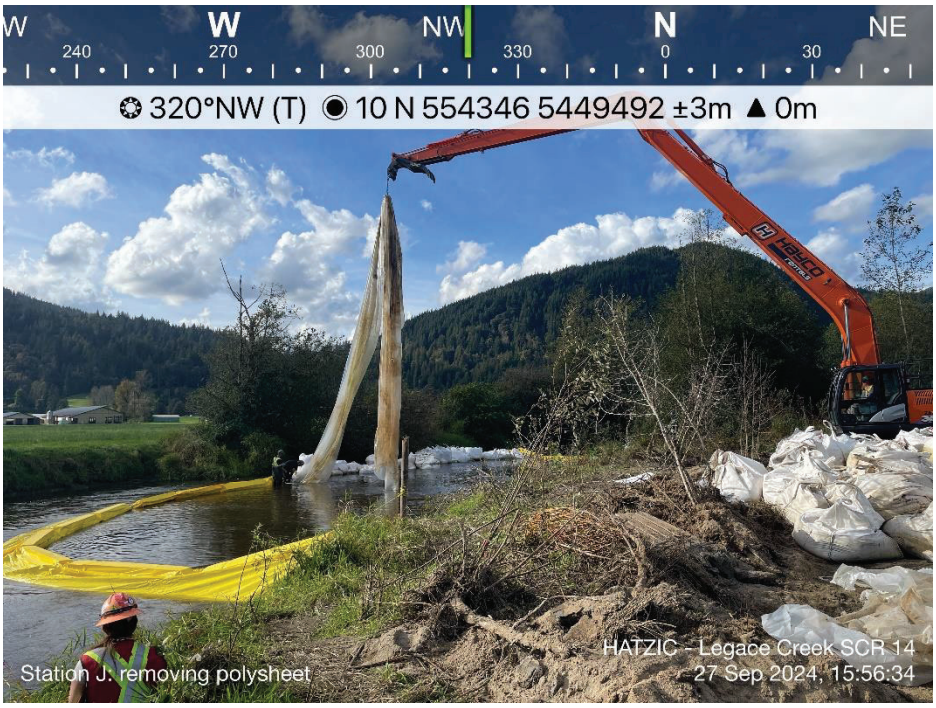
4:30 PM
- Transferring sandbags from J to I.

4:48 PM
- Station J: Moved the turbidity curtain from downstream to get closer to the upstream sandbags. AE (Vinizza) observed poly sheets and sandbags submerged in the downstream area, which were no longer covered by the turbidity curtains since they were being moved upstream.

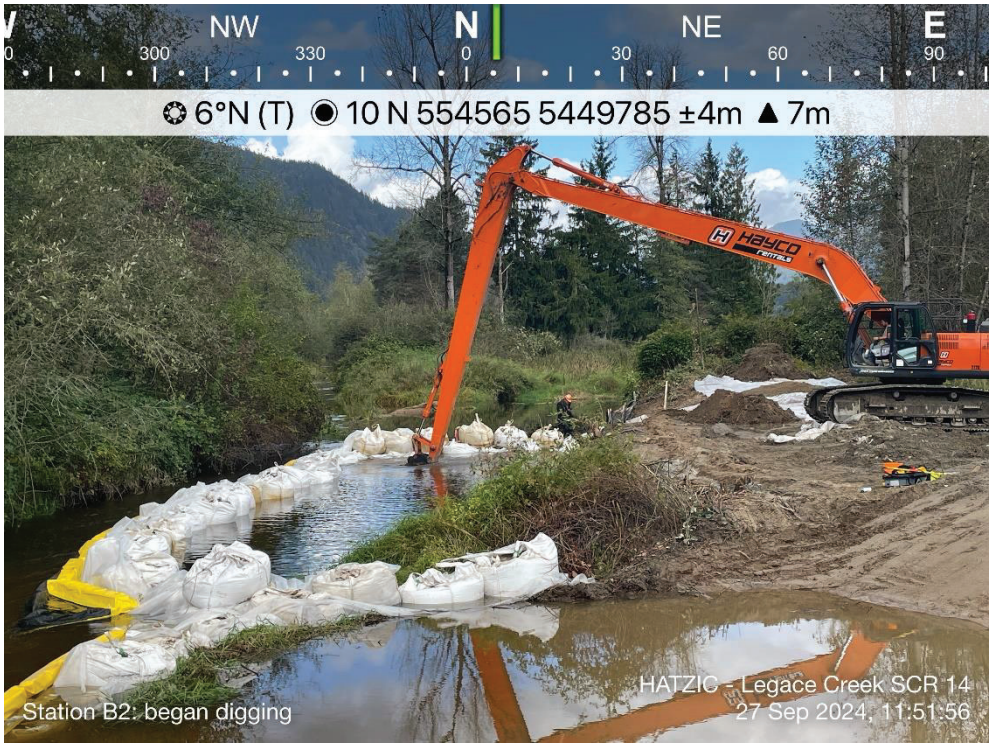
5:10 PM
- AE (Vinizza and Duncan) left the site.

Photos:


SW W NW N N
240 270 300 330 0 30
311°NW (T) 10 N 554347 5449492 ±3m 7m
Station J-removing turbidity curtains while the sandbags still in place
HATZIC - Legace Creek SCR 14
27 Sep 2024, 07:34:36


W W NW N NE
240 270 300 330 0 30
320°NW (T) 10 N 554346 5449492 ±3m 0m
Station J: removing polysheet
HATZIC - Legace Creek SCR 14
27 Sep 2024, 15:56:34


SE S SW W NW
150 180 210 240 270 300
227°SW (T) 10 N 554568 5449829 ±4m 6m
Station B2-placing sandbags
HATZIC - Legace Creek SCR 14
27 Sep 2024, 08:10:53


NW N NE E
300 330 0 30 60 90
6°N (T) 10 N 554565 5449785 ±4m 7m
Station B2: began digging
HATZIC - Legace Creek SCR 14
27 Sep 2024, 11:51:56

RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: September 27, 2024
Weather: Partly cloudy. High 19°C, Low 7°C.

- ***Works are being conducted outside of the least-risk window for in-stream works under the supervision and guidance of the Environmental Monitor.***
- ***Keystone Environmental undertook the following additional measures to reduce the risk of impacts to fish and fish habitat during works conducted outside the instream works least-risk window:***

- ***Erosion Sediment Control (ESC):***
  - *Exposed areas and excavated stockpiles adjacent to Lagace Creek are protected with poly tarp and/or silt fences to prevent potential sediment runoff.*
- ***Water quality management:***
  - *Keystone's EM closely monitors WQ throughout the workday (hourly). Elevated turbidity was not observed.*
- ***Spill Response and Mitigation:***
  - *Spill trays were placed under heavy machinery to prevent any spill or leakage. Spill kits were also located nearby and fully stocked with spill pads, booms, and absorbent materials.*

- 0430: EMs (LN, NL) arrived on site.
- 0435: Contaminated soil removal observed at B3 station.
- 0500: EMs arrived at Station K and J to conduct WQ sample within the isolated cells. Result indicated turbidity of water was within the acceptable range when compared to the BG.
- 0545: QM started pulling sandbags from DS to US.
- 0701: EM noticed elevated background turbidity water at station I. EMs returned to the upstream section to investigate.
- 0715: Turbid water observed flowing down from the US of Lagace Creek.
- 0720: Sandbags placement to build isolation at B2 commenced.
  - QM removed the upper section of B3 isolation under EM supervision to allow freshwater to flow into B3 for faster settlement. DS silt curtain remained in place.
  - As B2 isolation was built, EM noticed the current was getting stronger. EM expressed concern to QM, and they reinstalled the upper section of silt curtain. Elevated turbidity nor sediment plume DS of B3 was not observed.
- 0802: Sediment excavation and sloping in between Station B and B2 commenced under supervision of EM. A silt curtain was deployed to protect potential runoff from work area.
- 0900: EM communicated and discussed with QM to ensure all equipment will be brushed and cleaned properly before leaving the north side (knotweed infested area).

- 1000: AE commented on removing sandbags without silt curtain. Work at station K and J was stopped until QM had more silt curtains on Site.
    - AE commented on instream works required EM presence on Site. Keystone will provide a third EM to accommodate the work.
- 1100: EMs conducted Electrofishing at station B2.
    - Pass 1: 112s= 1 sculpin, 1 river lamprey
    - Pass 2: 303s = 2 sculpins
    - Pass 3: 174s = no fish
    - EM conducted additional salvage using dipnet and yielded 1 TSS.
- ~11:45: B2 isolated was deemed salvaged and instream dredge work could commence.
- 1228: Turbidity plume observed at the DS end of B2 isolation. QM personnel was notified, and workers were dispatch to repair.
- 1145: Dredging at B2 commenced.
- 1230: Third EM (CM) arrived on Site.
- 1315: Fish traps deployed at station F were retrieved.
    - Results:
        - 29 sculpins
        - 3 coho salmons
        - Invasive: 12 pumpkinseeds and a largemouth bass.
        - All invasive species were humanly euthanized using clove oil.
- 1403: Four silt curtains arrived on Site and was transported to station J.
    - 10 Lamprey species
- 1425-1508: Corrective action was implemented. QM installed silt curtain around the sandbags prior to removal work to contain any potential turbidity generate from the work.
- 1540: Bags at B2 noted to be narrower than specified in the permit. AE expressed concern over regulator's perception of same. Issue was communicated to KEL's PM.
- 1600: EM (LN) observed QM removed the isolated sandbags and sediment barrier to connect B2 and B3. This work was not communicated to Keystone EM prior to work commenced. KEL EM expressed concern on potential failure of B3 downstream isolation as water flow and pressure from B2 was introduced. EM notified KEL Project Manager and QM Site superintendent on the concerns.
    - As discussed, EM observed sediment plume escaping B3 isolation cell from the DS section. QM was notified immediately, and workers were dispatched to reinforce the isolation.
    - EM was actively taking WQ. Elevated turbidity was not observed.
    - Moving forward, Keystone recommended any changes in instream work shall be communicated to the EM prior to work commence.
- 1658-1718: Installation of additional silt curtain at the DS end of B3 completed.
- 1744: Following additional silt curtain installation and compliant of WQ reading on the DS end, removal of B2/B3 barrier continued.
- 1800: Sandbags removal at station J completed. Couple bags and plastic sheets observed at station K and will be removed on Saturday, September 28, 2024.
    - QM observed implementing ESC protection along station K and J.
        - Stockpiles were cover under poly tarping.
        - Silt fencing was installed to prevent potential runoff into the Creek.

  - EM expressed concerns on dirty sandbags at station I from the hauling activity. EM recommended all muddy sandbags shall be cleaned and free of mud/sediment prior to instream work.
- 1830: EMs reset 9 minnow traps at station F.
- 1915-1930: EM debrief with KEL's PM and left Site.
- Water Quality Sampling Results:

Location	Time	Turbidity	pH	Dissolved Oxygen
Inside of station K	0456	7.34	7.70	-
Inside of station J	0500	7.27	-	-
BG-Station I	0505	7.87	7.61	-
DS of station L	0515	8.92	-	-
DS of L during removing work	0651	26.2	-	-
BG-Station I	0701	24.5	-	-
BG-US Lagace Creek	0730	21.2	-	-
Bridge- DS from B3	0740	21.7	-	-
Inside B3	0741	37.1	-	-
Bridge- DS of B3 after remove the upper section of silt curtain in B3	0750	19.6	-	-
BG-US of B2	0854	10.43	-	-
DS-Station C	0900	15.0	-	-
BG-Station I	0914	15.3	-	-
DS of station K	0920	25.8	-	-
BG-US B2	1153	11.0	-	-
Bridge-DS of B2	1209	12.48	-	-
BG-Station I	1441	11.11	-	-
DS-Station K	1448	13.5	-	-
DS-Station K	1517	11.71	-	-

BG-US of B2	1646	12.36	-	-
DS of B3- Station C	1648	13.6	-	-
G-Station I	1702	12.09	-	-
DS – Station K	1715	14.5	-	-
BG-Station I	1825	12.72	-	-
BG-US B2	1845	10.12	-	-
DS-Station C	1850	13.8	-	-
BG-US B2	1320	8.71	-	-
DS of B2	1328	12.96	-	-
BG-US B2	1418	12.13	-	-
DS of B2	1424	13.8	-	-
BG-US B2	1533	12.29	-	-
DS of B2	1547	11.56	-	-
BG-US B2	1625	17.4	-	-
DS of B2	1638	12.36	-	-
BG-US B2	1647	13.6	-	-
DS of B2	1737	12.24	-	-
BG-Station I	0914	15.3	-	-
DS-Station K	0920	25.8	-	-
BG-Station I	1030	21.2	-	-
DS-Station K	1036	20.6	-	-
BG-Station I	1608	11.41	-	-
DS-Station K	1616	12.46	-	-

Site Photos






September 27, 2024 5:48 a.m.


September 27, 2024 4:41 a.m.


QUANTUM MURRAY
September 27, 2024 8:03 a.m.


September 27, 2024 3:10 p.m.


September 27, 2024 6:39 p.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	
Project:	Lagace Creek	**Page:**	1 of 5
Location:	Farms – Seux Roads, Fraser Valley, BC 49°13'00" N, 122°14"36" W	**Project No.:**	S-CR-215/16 2022-2632-04
Contractor:	Quantum Murphy	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 28, 2024
Contract No.:		**Temperature:**	High: 17 Low: 11
Weather:	Partly Cloudy		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murphy: Mel and Jim
Keystone: Jeff Prowse and two others

8 Labourers
3 Ops

Contractor's Equipment:
- One Bulldozer
- One Excavator
- Two Long boom excavators

Equipment in use:
- One Bulldozer
- One Excavator
- Two long boom excavators

Report, if any, Contact with Occupants:
None Today

Contact with Owner:
None Today

Report:
5:30 AM
- Duncan McCormick and Vinizza Pingos arrive on site and sign in
- Jim(QM) and Jeff Prowse(Keystone) and two other (QM) staff on site

5:41 AM
- Two more EM's and one more QM staff arrive on site.

6:30 AM
- Duncan, Vinizza, Jeff Prowse (Keystone), and two other QM's walk to L.
- While on walk Duncan notified Keystone staff that QM was refueling excavator within 11m of creek.

- Keystone kept walking to L without doing anything about it.
- Spoke to Jeff Prowse(Keystone). They are aware of the bags in the creek, he wrote the turbidity curtain memo that stated work in the wet needs the curtains, and of the refueling within 30m of creek is not allowed.

7:00 AM

- Removed sandbags that were left in the creek around station L. No turbidity curtain was put in place for removal. 3 Keystone staff monitoring.
- Missing part for excavator Vinizza remained at station L while Duncan moved to laydown to check things out there.

7:30 AM

- Genset lights moved to laydown spill mats placed underneath.

8:00 AM

- Took poysheet covering sediment of of a pile @ E to use as a water barrier in the sand bag barrier at station F wasn't replaced.
- Installed turbidity guards at F

8:25 AM

- Operator almost clipped prop owners irrigation system for their blueberry patch was stopped before it wrecked anything.

9:07 AM

- Finished pulling Keystone finished pulling fish bait traps. Processing fish then going to electro fish.

9:30 AM

- Electro fishing begins

9:40 AM

- Started refueling long boom excavator unit #2720 at site F within **10m** of creek while Keystone were electrofishing.
- Notified Keystone that they were refueling within 30m of creek.
- Jeff Prowse (Keystone) told QM they were refueling a little to close to the creek and asked if they had a drip tray (They did not.)
- Mel (QM) said that they have rags around the pump nozzle so its okay.
- No further action was taken.

10:00 AM

- Electro fishing cont.

10:17 AM

- Electro fishing finishes Keystone give permission to excavate west to east stopping halfway so they can Electrofish the east side again later.

10:21 AM

- Confirmed with Jeff (Keystone) that they did tell Jim(QM) and Mel (QM) that they have to refuel further away from the creek

10:37 AM

- Excavation begins @F

12:26 PM

- Excavation stops having gotten halfway.
- 1 Em on site another on their way from a different station.

12:30 PM

- Em arrives Excavation continues while Em's get ready to electro fish.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Duncan McCormick

1:07 PM
- Electro fishing ends. Em's start sorting through fish.
- Excavation resumes.

2:50 PM
- Duncan and Vinizza leave site. Jordon and Jordan (AE) take over site monitoring.

Testing:
Turbidity testing done by Keystone

Safety Concerns
- Bear safety. Work in pairs, be aware of surroundings.
- Heavy equipment hauling rocks.
- Falling hazard as well as being hit by a vehicle. Easy to avoid by giving operators a wide area to work.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Duncan McCormick

Photos:

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Duncan McCormick

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	25
Project:	Legace Creek	**Page:**	1 of 5
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 28, 2024
Contract No.:		**Temperature:**	High: 19 Low: 9
Weather:	Overcast		

September 28, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Jim) (Mel), 4 operator, 7 labourers
Keystone Environmental: EM (Jeff, Nicole, Corbin)

Contractor's Equipment:

-Equipment in Use

- CAT Excavator 324E
- Zaxis Excavator EX0689
- Zaxis excavator 2720
- Deer Loader 1466
- Pumping equipment: generator, 2 – 3" pumps.

Report, if any, Contact with Occupants:

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

11:45AM
- Discussion with Keystone (Corbin)

- SRS I not currently 2 bags wide, as we discussed yesterday. Not concerned from a turbidity perspective but is aware that is in WSAL memo.
-

Discussion with Contractor:

11:40AM
- Discussion with QM (James) –
- Bags out at SRS J and K – cleaning area.
- Currently excavating F and setting up SRS I
- Too much silt currently to remove bags at SRS B3 and B2, will measure again later today.
- Hoping to set up G today as well.

11:45AM
- Discussion with QM (Craig, James) – going to make SRS I isolation 2 bags wide.
- Keystone also doesn't want the super muddy bags placed in the water.

12:00PM
- Discussion with QM (Mel) – doesn't think topsoil removed from SRS C2 excavation is good material. Unsure if it should be used for live staking.
- AE (Jordan) to check with AE (Jordon R.) when on site.

5:00PM
- Discussion with QM (James) – doesn't think they are going to get to SRS G excavation before Oct 1.
- Planning to set up and excavate SRS G tomorrow, may require shrinking the isolation size.

Report:

11:00AM
- AE (Jordan, Dianna) on site.

11:00AM
- Turnover from Duncan and Vinizza –
- Excavating at F
- Currently setting up SRS I isolation.
- Removed bags from J and K – lost 7 bags total while removing.

12:45AM
- E-fishing other half of SRS F. Excavation paused.
- Keystone wanted to do 1 more pass on left side of SRS F during the excavation process.
- Resume excavation at 1:20PM.
- Jeff wants QM operator to leave fallen tree in water and excavate around it.
- Land owner on site with no PPE walking with a QM

2:00PM
- AE (Duncan, Vinizza) leaving site.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

3:15PM
- Excavation at SRS F complete - around 300m3.

4:00PM
- Removing bags from SRS B3 and B2.
- Lost 2 bags.
- Ongoing turbidity testing by EM's
- 5:45PM - EM made comment of knotweed floating in the area they took the sand bags out from

5:00PM
- Moving bags from SRS B3/B2 to SRS I isolation.
- No traffic control on Dale road, loader frequently crossing street.

5:50PM
- Isolation at SRS I complete.
- Placing fish traps in isolation.
- Placing silt curtain tomorrow.

7:00PM
- Isolation removed from SRS B2 and B3

Testing:
- None today.

Safety Concerns:
- None today

Traffic Control:
- None today

Photos:

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

DAILY CONSTRUCTION REPORT

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	25
Project:	Legace Creek	**Page:**	1 of 5
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 28, 2024
Contract No.:		**Temperature:**	High: 17°C Low: 9°C
Weather:	Cloudy, Wind 8 KM/H, Gusts 10 KM/H		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Labour Force:

Quantum Murray (QM): 2 Site Superintendent (Jim & Mel), 4 Operators, 7 Labourers
Keystone Environmental/Environmental Monitors (KE/EM): Jeff, Nicole and Corbin
Associated Engineering (AE): Jordan Fiske, Vinizza Pingos, Duncan McCormick

Contractor's Equipment: Equipment in use

- Excavator 324ES
- Excavator EXO689
- Excavator 2720
- Loader 1466
- Light Plant
- 2 – 3" submersible water pump
- 2 - 6" Vacuum Assisted Pumps

Report, if, any, Contact with Occupants:

N/A

Contact with Owner:

N/A

Safety Concerns:

N/A

Testing:

Turbidity test

Traffic Control:

Report:

5:25 AM
- AE (Vinizza and Duncan) arrived on site.

5:30 AM
- Signed in and toolbox.
- Jem outlined today's work plan:
  - **Stations J & K:** Remove submerged sandbags from the stream.
  - **Station K:** Fix the isolated area, conduct fish re-salvage, and excavate.
  - **Stations B2 & B3:** Settle water sediments before removing sandbags.
- Keystone conducted turbidity tests at B3, both inside and outside the isolated area.

6:00 AM
- Mobilized excavator EXO689 from C2 to Station J.

6:27 AM
- **Stations J & K:**
  - At the station: QM (Jem, Craig, one operator, and two laborers); Keystone (Jeff, Nicole, and Corbin).
  - AE Vinizza observed that all silt curtains had been removed from the stream. Note: According to QM's work plan for today, they will remove the remaining submerged poly sheets and sandbags from the stream.

6:30 AM
- **Station J:**
  - Began removing remaining submerged sandbags and poly sheets from the stream (w/o turbidity curtains). Two bags and one poly sheet were pulled out. Two bags were lost today, totaling four lost since yesterday.

6:45 AM
- **Station K:**
  - Began removing remaining submerged sandbags and poly sheets from the stream (w/o turbidity curtains). Six bags and two poly sheets were pulled out. Three bags were lost since yesterday, with approximately three bags (30% full) still remaining.

7:40 AM
- Completed the removal of submerged sandbags and poly sheets from the stream.

8:02 AM
- Mobilized excavator 2720 from B2 to F.
- Two laborers served as flagmen.

8:15 AM
- **Station F (opposite side):**
  - Fixing the isolated area by placing sandbags, poly sheets, and silt curtains. Note: The excavator was positioned on the opposite side of Station F, no lock blocks and reinforcement.
  - The excavator hit blueberries along the road while swinging.
  - A wheel loader was moving sandbags from I to the opposite side of F.

9:20 AM
- **Station I:** Keystone (Corbin), QM (Craig), 1 operator, and 5 laborers present.
  - Began isolating the area by placing sandbags and wrapping them with poly sheets.

10:40 AM
- Hauled sandbags from J to G.

11:15 AM
- **Station I:** Fixing sandbags by shifting and repositioning them.

11:26 AM
- Keystone conducted a turbidity test upstream of Station I. The result was 7.26 NTU (background measurement).

11:45 AM
- **Station I:** Corbin reported that the turbidity result downstream was slightly higher but still in compliance, likely due to the movement and shifting of the sandbags.

12:20 PM
- QM took a break.

1:00 PM
- QM returned to work.
- Keystone conducted turbidity tests upstream and downstream. Corbin mentioned that turbidity levels remained good.

1:21 PM
- QM continued placing and fixing sandbags by shifting and moving them, with approximately 40% of the area isolated.

2:00 PM
- AE Vinizza and Duncan left the site.

Photos:


E
SE
S
SW
60
90
120
150
180
210
141°SE (T) 10 N 554340 5449503 ±3m ▲ 5m
Station K
HATZIC - Legace Creek SCR 14
28 Sep 2024, 06:26:31


E
SE
S
SW
W
90
120
150
180
210
240
270
180°S (T) 10 N 554339 5449507 ±3m ▲ 4m
Station J: removing the left sandbags & polysheet from the stream
HATZIC - Legace Creek SCR 14
28 Sep 2024, 06:37:01


W NW N NE
270 300 330 0 30 60
355°N (T) 10 N 554316 5449585 ±4m 8m
Station I: isolating the area, placing bags & poly sheet
HATZIC - Legace Creek SCR 14
28 Sep 2024, 09:29:25


S SW W NW
180 210 240 270 300 330
260°W (T) 10 N 554314 5449610 ±8m 8m
Station I
HATZIC - Legace Creek SCR 14
28 Sep 2024, 13:32:00

RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: September 28, 2024
Weather: Partly cloudy. High 17°C, Low 8°C.

- ***Works are being conducted outside of the least-risk window for in-stream works under the supervision and guidance of the Environmental Monitor.***
- ***Keystone Environmental undertook the following additional measures to reduce the risk of impacts to fish and fish habitat during works conducted outside the instream works least-risk window:***

- ***Erosion and Sediment Control (ESC)***
    - *Exposed areas and excavated stockpiles adjacent to Lagace Creek are protected with poly tarp and/or silt fences to prevent potential sediment runoff.*
- ***Water Quality Management***
    - *Keystone's EM closely monitored WQ throughout the workday, on an hourly basis at minimum. Additional turbidity readings were collected if obvious turbidity plumes or high-risk activities were observed.*
- ***Spill Response and Mitigation***
    - *Spill trays were placed under heavy machinery to prevent any spill or leakage. Spill kits were also located nearby and fully stocked with spill pads, booms, and absorbent materials.*
    - *The EM reiterated the importance of refuelling machinery at least 30 m away from the Top of Bank of Lagace Creek. A safe refuelling area that complies with the 30 m buffer around Lagace Creek was marked out.*

- 0530: KEL staff on site.
- 0630: KEL directed QM to proceed with the removal of the remaining sandbags at Stations J & K.
- 0734: Removal of sandbags and poly sheets from Station K complete.
- 0756: Cleaning and sanitizing of knotweed contaminated excavator at Station B observed.
- 0805: Isolation wall at Station F being reinforced with sandbags and silt curtain.
- 0807: Walking of properly sanitized excavator from Station B to Station F observed.
- 0900: Following installation of the silt curtain at Station F, 9 baited minnow traps were removed.
    - Trapping Results:
        - 9 prickly sculpin (1 mort.)
        - 2 coho
    - Fish were released unharmed downstream into similar habitat.
- 0923: Sandbag placement was commenced at Station I.
- 0930: Commenced e-fishing at Station F.
- 0945: No visible turbidity plume evident during sandbag placement at I.

- 1000: Sandbags coated with mud observed at Station I. EM directed QM to leave those sandbags out of the water to prevent the release of additional turbidity.
- 1015: E-fishing completed at Station F. 542 seconds duration.
    - Trapping Results:
        - 1 rainbow trout
        - 1 lamprey
        - 51 prickly sculpin
        - 1 three-spine stickleback
        - 6 pumpkinseed
        - 1 catfish
    - Non-invasive fish were released unharmed downstream into similar habitat.
- 1048: Invasive fish euthanized with clove oil. Disposed of in forested area.
- ~1100: 5 lampreys captured during excavation at Station F.
- 1129: Downstream turbidity at Station I observed to be elevated but compliant. No obvious source observed.
- 1240: Commenced electrofishing at Station F.
- 1300: Completed electrofishing at station F. 329 seconds duration.
    - Trapping Results:
        - 23 prickly sculpin
        - 1 coho
- ~1300: 135 lamprey salvaged during excavation at Station F.
- 1313: Excavation at Station F complete.
- 1458: Sandbag placement temporarily paused at Station I.
- 1522: Sandbag placement recommenced at Station I.
- 1707: Undermining of isolation at Station I observed. The issue was communicated to QM staff.
- 1757: Installation of isolation barrier at Station I complete.
- 1813: 9 baited minnow traps set at Station I.
- 1838: Last bag at Station B2/B3 removed.
- 1850: Turbidity plume observed following removal of silt curtain at Station B2/B3.
- 1858: Works at Station B2/B3 completed. Water quality monitoring continued until turbidity level is observed to decline below 20 NTU.
- 1720: KEL staff offsite.
- Water Quality Sampling Results

Location	Time	Turbidity (NTU)	Temperature (°C)	Dissolved Oxygen (mG/L)	Dissolved Oxygen (%)
Inside Station B2/B3 Isolation	0542	89	-	-	-
Background at Station B2/B3	0544	7.3	-	-	-
5 m Downstream of Station K	0642	22.2	-	-	-
5 m Downstream of Station K	0700	9.56	-	-	-
5 m Downstream of Station K	0710	10.74	-	-	-
5 m Downstream of Station K	0730	25.2	-	-	-
5 m Downstream of Station K	0740	10.64	-	-	-
5 m Downstream of Station K	0750	9.63	-	-	-
Inside Station F isolation	0820	-	11.5	8.03	73.7
Background at Station I	0918	9.29	-	-	-
50 m Downstream of Station I	0932	9.06	-	-	-
50 m Downstream of Station I	1026	9.60	-	-	-
Background at Station I	1120	7.25	-	-	-
50 m Downstream of Station I	1127	13.0	-	-	-
Station B3	1208	13.7	-	-	-
Station B3	1212	15.2	-	-	-
Background at Station I	1257	6.87	-	-	-
50 m Downstream of Station I	1303	9.77	-	-	-
30 m Downstream of Station I	1333	9.72	-	-	-
50 m Downstream of Station I	1431	9.62	-	-	-
30 m Downstream of Station I	1530	11.4	-	-	-
10 m Downstream of Station B3	1530	8.91	-	-	-
Background at Station I	1535	7.22	-	-	-

Background at Station I	1629	6.57	-	-	-
50 m Downstream of Station I	1634	9.49	-	-	-
10 m Downstream of Station B3	1715	11.15	-	-	-
Background at Station I	1720	8.21	-	-	-
50 m Downstream of Station I	1724	10.48	-	-	-
10 m Downstream of Station B3	1813	13.6	-	-	-
50 m Downstream of Station I	1818	10.80	-	-	-
10 m Downstream of Station B3	1835	26.4	-	-	-
10 m Downstream of Station B3	1845	13.9	-	-	-
10 m Downstream of Station B3	1850	28.2	-	-	-
10 m Downstream of Station B3	1852	60.4	-	-	-
10 m Downstream of Station B3	1855	52.9	-	-	-
10 m Downstream of Station B3	1858	48.6	-	-	-
10 m Downstream of Station B3	1903	26.8	-	-	-
10 m Downstream of Station B3	1906	22.8	-	-	-
10 m Downstream of Station B3	1908	16.7	-	-	-

Site Photos






Hayco
rentals
2024-09-28 10:58 a.m.


2024-09-28 7:01 p.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	
Project:	Lagace Creek	**Page:**	1 of 5
Location:	Farms – Seux Roads, Fraser Valley, BC 49°13'00" N, 122°14"36" W	**Project No.:**	S-CR-215/16 2022-2632-04
Contractor:	Quantum Murphy	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 29, 2024
Contract No.:		**Temperature:**	High: 17 Low: 11
Weather:	Partly Cloudy		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murphy: Mel and Jim
Keystone: Jeff Prowse and two others

8 Labourers
3 Ops

Contractor's Equipment:
- One Bulldozer
- One Excavator
- Two Long boom excavators

Equipment in use:
- One Bulldozer
- One Excavator
- Two long boom excavators

Report, if any, Contact with Occupants:
None Today

Contact with Owner:
None Today

Report:
5:30 AM
- Duncan McCormick and Vinizza Pingos arrive on site and sign in
- Jim(QM) told crews they cannot fuel withing 30m of creek. A red flag has been placed in the field where they can go to fuel
- Trucking not until tuesday

6:10 am
- Back from site 15/16
- Currently moving equipment around at station B

- At B they have
    - Installed turbidity guards
    - Drove across contaminated pile. Station B is all contaminated so they can move around no problem at station B but will have to clean tracks before going to other stations.
    - Long Boom excavator is scrapping the soil between stations at B avoiding touching the water.
    - Jim and Loc(EM) monitoring

6:40 am

- Turbidity test done
- Slope about 2:1 drawings say 2.5:1
- Loaded turbidity curtains onto bulldozer
- Loc(EM) gives okay to remove turbitity curtain

7:00 am

- Removed sandbags from station B
- No turbidity guard while removing sandbags from creek.
- Removing some sandbags by hand
- Loc monitoring
- Cleaned long boom excavator of contaminated soil & bleaching
- Loc monitoring and pointing out areas that require further attention

7:30 am

- Loc give approval that the excavator is clean
- Moved LBExcavator down to different station
- Finished removing most of the sandbags from B
- Started working at station I currently installing turbidity guards

8:00 am

- Em's gave go ahead to dig @ I
- Em's on site
- Electrofishing done
- Turbidity guards in place
- Sandbags in place
- Turbidity testing done

8:50 am

- Walked to station G
- Putting in sandbags at G
- Jim and Loc(EM) monitoring
- No turbid guards installed yet but they are at the station waiting till after the sandbags are in place to install.
- Turbity testing being done upstream and downstream.

11:30 am

- Pulling sandbags from F to I
- Noticed some small sandbags have been left in the water at station B pointed it out to EM
- Turbidity curtain in place @ I
- Em's monitoring

Testing:

Turbidity testing done by Keystone

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Duncan McCormick

Safety Concerns

- Bear safety. Work in pairs, be aware of surroundings.
- Heavy equipment hauling rocks.
- Falling hazard as well as being hit by a vehicle. Easy to avoid by giving operators a wide area to work.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Duncan McCormick

Photos:

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Duncan McCormick

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	26
Project:	Legace Creek	**Page:**	1 of 5
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 29, 2024
Contract No.:		**Temperature:**	High: 15 Low: 7
Weather:	Overcast		

September 29, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Jim) (Mel), 4 operator, 7 labourers
Keystone Environmental: EM (Jeff, Loc, Kang)

Contractor's Equipment:

-Equipment in Use

- CAT Excavator 324E
- Zaxis Excavator EX0689
- Zaxis excavator 2720
- Deer Loader 1466
- Pumping equipment: generator, 2 – 3" pumps.

Report, if any, Contact with Occupants:

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

Discussion with Contractor:

11:30AM
- Discussion with QM (Mert), AE (Jordan, Jordon, Dianna, Duncan) –
- QM expecting G to be final station, not going to get to D or H, no creek work past Oct 1.
- Going to do bio-engineering at B to B3 after, then do sites 1-3 for brush layering.
- QM planning to go back to 5 days 10 hours.
- Jordon – will plan to have biologist from AE on site during initial bio-engineering for guidance.
- Jordon to look into different options for trees on Doug property.

2:00PM
- Discussion with QM (Mert), Keystone (Jeff), AE (Dianna, Jordan F.) –
- AE confirming silt curtain needs to be in place while removing bags. Was seen floating down river during the removal of the final bags.
- Keystone – silt curtain is anchored to bags, when the final bags are removed the curtain will not stay in place. Keystone monitoring D/S turbidity level during time of removal. Around 11NTU at end, Keystone says is acceptable.

2:45PM
- Discussion with QM (Mert, James), AE (Jordan F., Jordan R.) –
- Survey will be here Tues/Wed.
- Going to put 40 bags aside to account for the initial bags filled with material not in the creek. Rest of bags will be stockpiled. All stockpiles will be surveyed.
- Jordon will be able to compare survey data to existing survey and get quantities.

4:30PM
- Discussion with QM (James) – putting silt fence up at SRS J and K.
- Starting tomorrow at 6:30AM, will be removing bags and stockpiling.

Report:

11:00AM
- AE (Jordan) on site.
- Turnover from AE (Jordon R/Duncan)– currently finishing excavation at SRS I.
- Estimated quantity from I around 300 m3
- Setting up isolation at SRS G.
- QM planning to fix and gravel access road on Jahoolie farm.

11:30AM
- Removing bags from isolation at SRS F, taking to G.

12:45PM
- Finished fish salvage at G.

2:45PM

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

- Begin excavating at SRS G.
- Moving stockpile next to SRS K.

3:15PM
- Isolation removal at SRS F complete.

3:45PM
- Excavation at SRS G complete.

5:00PM
- Installing silt fence at SRS J and K.
- Moving sand from G to K still.

5:15PM
- AE (Jordan) leaving site.

Testing:
- None today.

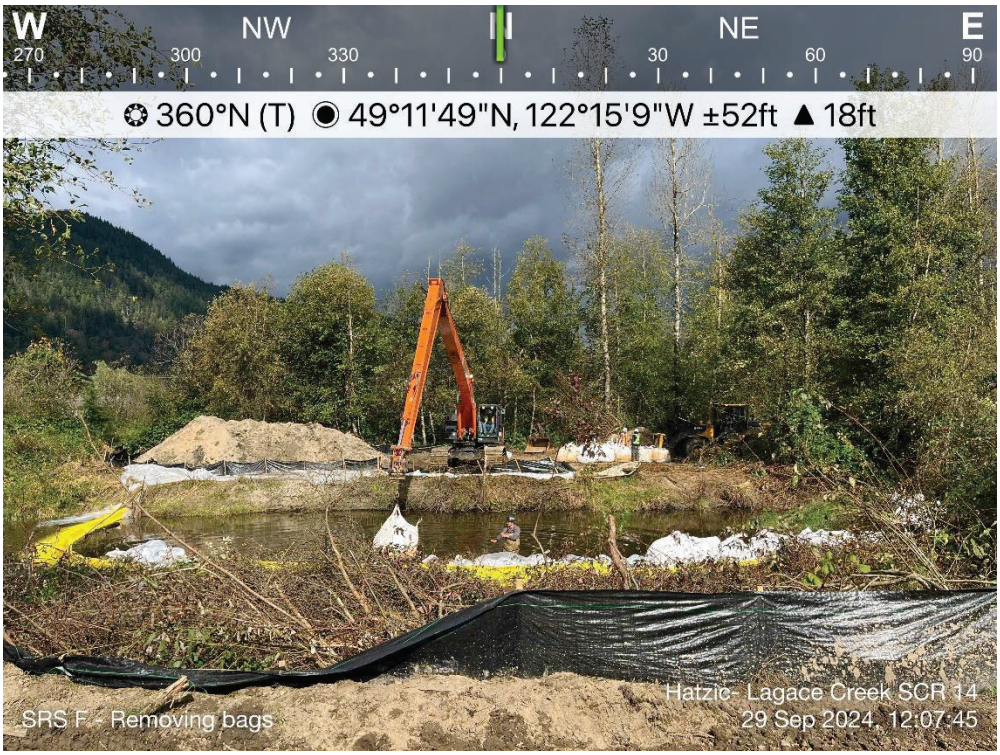
Safety Concerns:
- None today

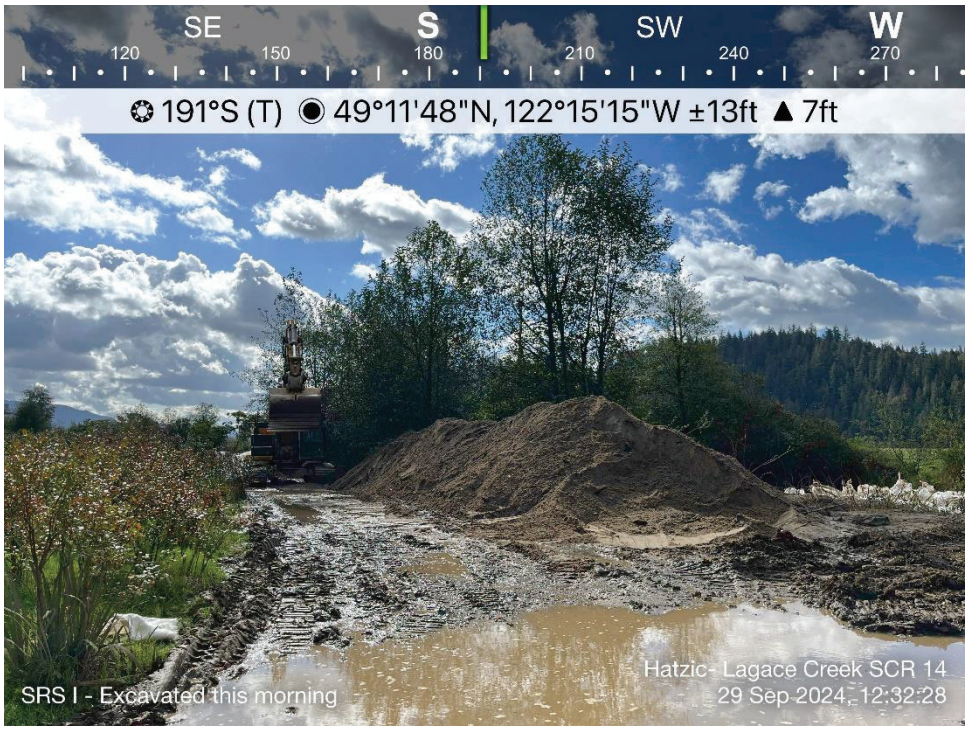
Traffic Control:
- None today

Photos:

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

DAILY CONSTRUCTION REPORT

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	26
Project:	Legace Creek	**Page:**	1 of 5
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 29, 2024
Contract No.:		**Temperature:**	High: 15°C Low: 7°C
Weather:	Cloudy, Wind 9 KM/H, Gusts 28 KM/H		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Labour Force:

Quantum Murray (QM): 2 Site Superintendent (Jim & Mel), 4 Operators, 7 Labourers
Keystone Environmental/Environmental Monitors (KE/EM): Jeff, Khang and Loc
Associated Engineering (AE): Jordan Fiske, Vinizza Pingos, Duncan McCormick, Jordon Rozon

Contractor's Equipment: Equipment in use

- Excavator 324E
- Excavator EXO689s
- Excavator 2720
- Loader 1466
- Light Plant
- 2 – 3" submersible water pump
- 2 - 6" Vacuum Assisted Pumps

Report, if, any, Contact with Occupants:

N/A

Contact with Owner:

N/A

Safety Concerns:

N/A

Testing:

Turbidity test

Traffic Control:

No traffic control on site.

Report:

5:30 AM
- AE (Vinizza and Duncan) arrived on site.

5:35 AM
- Sign-in and toolbox.
- Jim outlined the work plan for the day:
  - Station I: Fish salvage and excavation.
  - Station G: Placing sandbags, fish salvage and excavation.
  - Station B3: Skimming the edge of the creek.
  - Station F: Removing sandbags.
  - No hauling today of the excavated materials; it is scheduled for Tuesday.

6:00 AM
- Station I: Keystone (Jeff and Khang)
  - The isolation area was already completed, except for placing the turbidity curtains around the sandbags.
  - Keystone is currently removing minnow traps.
  - AE Vinizza observed that the excavator and light plant lacked spill trays underneath.
  - The wheel loader is transferring silt curtains to Station I.

7:00 AM
- Station I: Keystone is conducting electrofishing.

7:05 AM
- AE Vinizza informed QM that the light plant lacked a spill tray. The QM placed a spill tray under the light plant.

7:28 AM
- Electrofishing at Station I is complete.

7:30 AM
- Station K: Excavated materials are not covered with a poly sheet.
- Keystone released the fish at Station J.
- Excavator 2720 was mobilized from Station B2 to Station G.

7:40 AM
- Station I: QM: Craig, 1 operator, 2 laborers; Keystone: Jeff & Khang
  - Setting up turbidity curtains around the sandbags.

8:05 AM
- Keystone conducted a turbidity test downstream of Station I.

8:14 AM
- Transferring sandbags from Station I to Station G.

8:18 AM
- Station I: Keystone: Jeff & Khang; QM: Mel, Craig, 1 operator, 2 laborers
  - Excavation began.
  - AE Vinizza inquired about the necessity of setting up a silt fence and poly sheet around the laydown area due to mud accumulation. Keystone confirmed that a silt fence was unnecessary as the area is

distant from the creek, and a poly sheet is not needed as long as the QM excavator operator handles the sediments carefully during loading.

8:30 AM
- Excavation at Station I is ongoing. The QM used dip netting to collect fish from the excavated sediments.

8:54 AM
- Adjusting turbidity curtains on the downstream section at Station I.

8:57 AM
- Keystone conducted a turbidity test downstream of Station I, with a result of 28.7 NTU.

8:59 AM
- Keystone conducted a turbidity test upstream of Station I, yielding a result of 13.4 NTU.
    - Note: Based on these results, this is classified as non-compliant; however, excavation continues.

9:30 AM
- QM Mel noted that the excavated materials from Station I would be provided to Dough for structural purposes.

10:50 AM
- Excavation at Station I is complete.

11:00 AM
- AE Vinizza measured the excavated materials from Station I, estimating the volume at approximately 300 m^3.

11:30 AM
- Station G: QM: Craig, 1 operator, 2 laborers; Keystone: Jeff & Khang
    - Approximately 70% of the area has been isolated with sandbags, which are wrapped in poly sheets.

11:37 AM
- Placing sandbags at Station G.

11:40 AM
- Continuing the transfer of sandbags from Station I to Station G.

12:42 PM
- Station G: Isolation of the area is complete. Keystone is conducting electrofishing.

1:05 PM
- Station G: Electrofishing is complete. Keystone released the fish into Station H.

1:10 PM
- Ongoing hauling of sandbags from Station F to Station I.
- Sandbags are being removed from the opposite side of Station F.
    - Note: The excavator is positioned on the opposite side where there are no lock blocks or reinforcements.

1:30 PM
- AE Vinizza and Duncan left the site.

Photos:


SE S SW W
120 150 180 210 240 270 300
213°SW (T) 10 N 554319 5449600 ±3m 9m
Station I: placing turbidity curtains
HATZIC - Legace Creek SCR 14
29 Sep 2024, 07:43:12


SE S SW W
120 150 180 210 240 270 300
209°SW (T) 10 N 554334 5449601 ±5m 2m
Station I: ongoing excavation
HATZIC - Legace Creek SCR 14
29 Sep 2024, 09:03:05


W NW N NE
270 300 330 0 30 60
341°N (T) 10 N 554388 5449638 ±3m 3m
Station G-electrofishing
HATZIC - Legace Creek SCR 14
29 Sep 2024, 12:44:49


NW N NE E
300 330 0 30 60 90
6°N (T) 10 N 554453 5449636 ±4m 6m
Station F (opposite side): removing of sandbags from Station F
HATZIC - Legace Creek SCR 14
29 Sep 2024, 13:12:36

RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: September 29, 2024
Weather: Partly cloudy. High 15°C, Low 4°C.

- ***Works are being conducted outside of the least-risk window for in-stream works under the supervision and guidance of the Environmental Monitor.***
- ***Keystone Environmental undertook the following additional measures to reduce the risk of impacts to fish and fish habitat during works conducted outside the instream works least-risk window:***

- ***Erosion and Sediment Control (ESC)***
  - *Exposed areas and excavated stockpiles adjacent to Lagace Creek are protected with poly tarp and/or silt fences to prevent potential sediment runoff.*
- ***Water Quality Management***
  - *Keystone's EM closely monitored WQ throughout the workday, on an hourly basis at minimum. Additional turbidity readings were collected if obvious turbidity plumes or high-risk activities were observed.*
- ***Spill Response and Mitigation***
  - *Spill trays were placed under heavy machinery to prevent any spill or leakage. Spill kits were also located nearby and fully stocked with spill pads, booms, and absorbent materials.*
  - *The EM reiterated the importance of refuelling machinery at least 30 m away from the Top of Bank of Lagace Creek. A safe refuelling area that complies with the 30 m buffer around Lagace Creek was marked out.*

- 0530: Environmental Monitors (EMs) arrived on site.
- 0550: Nine traps set the previous night at Station I were retrieved by two EMs.
  Fish Salvage Results:
  - 1 signal crayfish
  - 9 three-spined sticklebacks
  - 1 sculpin
  - 1 lamprey
- 0615: Silt curtain was deployed around a small area between Stations B and B2 for sloping work and the removal of a small above-water island. One EM monitored this work while the other two EMs were on standby for electrofishing and observed QM crew installing sandbags and silt curtain at Station I.
- 0645-0730: Electrofishing at Station I for 925 seconds.
  Fish Salvage Results:
  - 7 lampreys
  - 8 sculpins
  - 1 three-spined stickleback

- 0654: Turbidity within the silt curtain at Station B was comparable to the outside, allowing the curtain to be removed. QM crew proceeded to remove leftover small sandbags from the stream.
- 0705: QM crew began removing and cleaning sediment and vegetation fragments from the long-reach excavator tracks in the knotweed-contaminated area (Stations B, B2, and B3). EM closely monitored the process.
- 0727: The long-reach excavator was approved to be moved to the south side of the site.
- 0820: Sediment removal work commenced at Station I.
- 0825: Sandbag isolation placement began at Station G.
- 0850: Downstream silt curtain was adjusted to a higher slope to prevent potential turbidity leakage.
- 1046: Sediment removal at Station I was completed.
  Active Fish Salvage Results:
  - 33 lampreys
- 1052: Sandbag installation at Station G was temporarily halted due to a shortage of sandbags. The long-reach excavator mobilized to Station F to remove sandbags from the stream, while a second excavator at Station I was moved to continue installation at Station G.
- 1124: Sandbag removal began at Station F.
- 1220: Electrofishing started at Station G following the completion of sandbag installation (417 seconds).
  Fish Salvage Results:
  - 12 sculpins
  - 1 lamprey
- 1310-1400: Meeting with QM project manager and AE engineers.
- 1340: Additional water quality testing was conducted. The silt curtain from Station F was moved to Station G for isolation purposes.
- 1350: The final silt curtain was released from its anchors to remove the remaining sandbags in the creek.
- 1400: Machine was observed refuelling at designated area.
- 1424: Sediment removal work commenced at Station G.
- 1430: KEL EM removed fish isolations at SCR 17.
- 1516: Sandbag removal at Station F was completed, and water quality (WQ) was compliant.
- 1541: Excavation at Station G was completed.
  Active Fish Salvage Results:
  - 9 lampreys
- 1550: Excavator was moved to Station F on the south side to pick up remaining sandbags and poly sheeting in the creek.
- 1608: QM covered contaminated stockpiles with poly sheeting.
- 1615: Road repairs and stockpile transport commenced at Station G.
- 1715: EMs assessed the sediment stockpile area and observed that silt fencing was installed at the reviewed locations.
- 1730: Work completed. The EMs departed from site
- Water Quality Sampling Results

Location	Time	Turbidity (NTU)	Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%)
Inside Station I isolation	06:00	-	11.3	7.8	71.4
Background at Station B2/B3	06:09	2.42	-	-	-
Outside isolation at B2	06:40	9.92			
Inside isolation at B	06:42	13.7			
Inside isolation at B	06:54	7.99			
Background at H	07:48	10.32			
Background at E	08:14	7.27			
5m Downstream at H	08:40	11.5			
5 m Upstream of Station I	08:50	13.4	-	-	-
5 m Downstream of Station I	08:55	28.7	-	-	-
5 m Upstream of Station I	09:15	10.34	-	-	-
5 m Downstream of Station I	09:15	28.7	-	-	-
Background at E	09:21	7.17			
Downstream at H	09:28	11.1			
Inside Station F isolation	09:45	9.13	-	-	-
Background at E	10:18	7.83			
5 m Downstream of Station I	10:24	14.7	-	-	-
Downstream at H	10:26	11.1			
Background at E	12:01	8.41			
Downstream at H	12:06	12.2			
5 m Downstream of F	12:55	9.28			
5 m Downstream of F	13:15	10.16			
Background at E	13:35	8.79			
5 m Downstream of F	13:39	11.1			
Upstream background of Station G	14:10	8.6			
5 m Downstream of F	14:40	11.3			
5 m Downstream at Station G	14:42	6.12	-	-	-
5 m Downstream of Station G	14:55	6.94	-	-	-
Background of Station F	15:16	7.32			
5 m Downstream of Station G	15:18	4.15	-	-	-
5 m Downstream of Station G	15:33	4.79	-	-	-
50 m Downstream of Station G	17:20	6.35	-	-	-

Site Photos






September 29, 2024 5:09 p.m.


September 29, 2024 4:09 p.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	
Project:	Lagace Creek	**Page:**	1 of 5
Location:	Farms – Seux Roads, Fraser Valley, BC 49°13'00" N, 122°14"36" W	**Project No.:**	S-CR-215/16 2022-2632-04
Contractor:	Quantum Murphy	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 30, 2024
Contract No.:		**Temperature:**	High: 17 Low: 11
Weather:	Partly Cloudy		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murphy: Mel and Jim
Keystone: Jeff Prowse and two others

8 Labourers
3 Ops

Contractor's Equipment:
- One Bulldozer
- One Excavator
- Two Long boom excavators

Equipment in use:
- One Bulldozer
- One Excavator
- Two long boom excavators

Report, if any, Contact with Occupants:
None Today

Contact with Owner:
None Today

Report:
7:30 am
- Tested Station G's turbidity. It was high but still within the range
- Tested I turbidity. It was good
- Started pulling sandbags from I working downstream to upstream.

10:30 am
- Monitored bag removal at G
- EM on site testing turbidity
- Turbidity curtains in place

11:10 am
- Continue removing bags

12:00 pm
- Finished removing bags turbidity curtains being removed
- Turbidity curtain torn while removing from creek. Torn over land.

12:30 pm
- Finished started moving sandbags back to stockpile
- Clearning pathway then done for the day

1:15 pm
- Refueling dozer outside of 30m with a driptray underneath
- Checked equipment for driptrays. All equipment has one under it.

1:30 pm
- Left site.

Testing:
Turbidity testing done by Keystone

Safety Concerns
- Bear safety. Work in pairs, be aware of surroundings.
- Heavy equipment hauling rocks.
- Falling hazard as well as being hit by a vehicle. Easy to avoid by giving operators a wide area to work.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Duncan McCormick

Photos:

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Duncan McCormick

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

DAILY CONSTRUCTION REPORT

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	27
Project:	Legace Creek	**Page:**	1 of 5
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 30, 2024
Contract No.:		**Temperature:**	High: 18°C Low: 6°C
Weather:	Cloudy, Wind 5 KM/H, Gusts 9 KM/H		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Labour Force:

Quantum Murray (QM): 1 Site Superintendent (Mel), 3 Operators, 5 Labourers
Keystone Environmental/Environmental Monitors (KE/EM): Khang and Loc
Associated Engineering (AE): Vinizza Pingos, Duncan McCormick, Jordon Rozon

Contractor's Equipment: Equipment in use

- Excavator 324E
- Excavator EXO689s
- Excavator 2720
- Loader 1466
- Light Plant
- 2 – 3" submersible water pump
- 2 - 6" Vacuum Assisted Pumps

Report, if, any, Contact with Occupants:

N/A

Contact with Owner:

N/A

Safety Concerns:

N/A

Testing:

Turbidity test

Traffic Control:

No traffic control on site.

Report:

6:35 AM
- AE Vinizza and Duncan arrived on site.

7:00 AM
- Sign-in and toolbox
- Mel discussed the work plan for the day:
    - At Stations G and I, sandbags will be removed and hauled to the laydown/stockpile area at Station K.
    - QM Glenn observed two salmon swimming under the bridge.

7:33 AM
- Keystone conducted a turbidity test at Station G (inside the isolation area); the result was 9.32 NTU.

7:37 AM
- Keystone conducted a turbidity test at Station H; the result was 2.32 NTU (background measurement for Station I).

7:44 AM
- Keystone conducted a turbidity test at Station I (inside the isolation area); the result was 3.30 NTU.

7:54 AM
- At Station I:
    - Personnel: QM Mel, 1 loader operator, 1 excavator operator, 2 laborers; Keystone: Loc.
    - Began removing sandbags and hauling them to the laydown area at Station K.

8:00 AM
- At Station I: Fixed the turbidity curtains on the downstream side.

8:06 AM
- Keystone conducted a turbidity test downstream at Station I; the result was 6.11 NTU.

8:24 AM
- At Station I: 1 loader operator, 1 excavator operator, 4 laborers resumed work.

9:35 AM
- At Station G: Mobilized excavator 2720 to Station G.
- At Station I: 50% of sandbag removal was completed.

9:43 AM
- At Station G: QM, 1 excavator operator, and 2 laborers began removing sandbags. Keystone personnel: Khang.

10:20 AM
- At Station I: Separated the two turbidity curtains, unhooked them from the sandbags, and secured them to the creek.

11:40 AM
- At Station I: Continued removing submerged sandbags and poly sheets.

11:58 AM
- Hauled bags from Station G to the Station K laydown area.

12:10 PM
- Removed poly sheets at Station I.

12:15 PM
- Completed dismantling the isolation area at Station I.

12:20 PM
- Keystone conducted a turbidity test downstream of Station J.

12:45 PM
- At Station I: Fixed the silt fence around the stockpile of excavated materials.

1:15 PM
- QM left the site.

1:30 PM
- AEs Vinizza and Duncan left the site.

Photos:


E SE S SW
90 120 150 180 210 240
167°S (T) 10 N 554325 5449603 ±3m 12m
Station I: Removing sandbags
HATZIC - Legace Creek SCR 14
30 Sep 2024, 07:58:05


W NW N NE
270 300 330 0 30 60
356°N (T) 10 N 554319 5449578 ±3m 2m
Station G: removing of sandbags
HATZIC - Legace Creek SCR 14
30 Sep 2024, 10:19:30


NW N NE E S
330 0 30 60 90 120
41°NE (T) 10 N 554373 5449634 ±4m 8m
Station G: removing of sandbags
HATZIC - Legace Creek SCR 14
30 Sep 2024 10:09:45


W NW N NE E
270 300 330 0 30 60 90
3°N (T) 10 N 554388 5449644 ±3m -1m
Station G: EOD
HATZIC - Legace Creek SCR 14
30 Sep 2024 13:20:29

RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: September 30, 2024
Weather: Cloudy with occasional showers overnight. High 16°C, Low 9°C.

- ***Works are being conducted outside of the least-risk window for in-stream works under the supervision and guidance of the Environmental Monitor.***
- ***Keystone Environmental undertook the following additional measures to reduce the risk of impacts to fish and fish habitat during works conducted outside the instream works least-risk window:***

- ***Erosion and Sediment Control (ESC)***
  - *Exposed areas and excavated stockpiles adjacent to Lagace Creek are protected with poly tarp and/or silt fences to prevent potential sediment runoff.*
- ***Water Quality Management***
  - *Keystone's EM closely monitored WQ throughout the workday, on an hourly basis at minimum. Additional turbidity readings were collected if obvious turbidity plumes or high-risk activities were observed.*
- ***Spill Response and Mitigation***
  - *Spill trays were placed under heavy machinery to prevent any spill or leakage. Spill kits were also located nearby and fully stocked with spill pads, booms, and absorbent materials.*
  - *The EM reiterated the importance of refuelling machinery at least 30 m away from the Top of Bank of Lagace Creek. A safe refuelling area that complies with the 30 m buffer around Lagace Creek was marked out.*

- 0630: EMs arrived on site. No construction activities were observed.
- 0745: Water quality (WQ) was measured at Station I and found to be within the allowable range compared to background levels.
- 0755: Sandbag removal at Station I commenced. The EMs communicated the ordered procedure for sandbag removal to QM: begin removing bags from the downstream end, keeping a few bags at the end to anchor the silt curtain. Once most of the bags are removed, the anchor bags can then be taken out, starting from the upstream side of the cell.
- 0800: EM expressed concern about maintaining the downstream silt curtain, and a T-post was used to secure it to the bank.
- 0918: A second long-reach excavator was brought to Station G, allowing sandbag removal to occur simultaneously at both stations.
- 0940: Sandbag removal at Station G commenced.
- 1000: Downstream silt curtains at both stations remained intact and functional as intended. Turbidity-related issues were not observed.
- 1200: Silt curtain at Station G was removed.

- 1220: Work at Station I was completed.
- 1225: Work at Station G was completed.
- 1300: Final site preparations before closure: Excavators were parked away from the top of bank, spill trays were equipped for machinery, garbage was collected, and silt fencing was reinstated.
- 1345: EMs departed from the site.
- Water Quality Sampling Results

Location	Time	Turbidity (NTU)	Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%)
Inside Station G isolation	07:30	9.32	-	-	-
Background of Station I (upstream)	07:35	2.32	-	-	-
Inside Station I solation	07:45	3.30	-	-	-
Downstream of Station I	08:06	6.11	-	-	-
Background of Station I	08:57	3.04	-	-	-
Downstream of Station I (at J)	09:11	4.02	-	-	-
Inside Station G isolation	09:40	8.04			
Upstream of Station I	10:00	2.86	-	-	-
Downstream of Station I (at J)	10:01	3.87	-	-	-
Downstream of Station G (at H)	10:13	7.89			
Upstream of Station I	10:58	1.37	-	-	-
Downstream of Station I (at J)	11:01	1.99	-	-	-
Downstream of Station G (at H)	11:33	8.23			
Upstream of work (at the bridge)	12:02	7.37			
Downstream of Station G (at H)	12:23	11.0			
Upstream of Station I	12:23	11.0	-	-	-
Downstream of Station I (at J)	12:27	11.0	-	-	-

Site Photos






September 30, 2024 12:30 p.m.


September 30, 2024 12:55 p.m.


September 30, 2024 11:27 a.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	27
Project:	Legace Creek	**Page:**	1 of 4
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	October 1, 2024
Contract No.:		**Temperature:**	High: 13 Low: 9
Weather:	Overcast		

October 1, 2024

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum Murray: Site Superintendent (Jim) (Mel), 2 operator, 2 labourers
Keystone Environmental: EM (Corbin)
2 flaggers

Contractor's Equipment:

-Equipment in Use

- CAT Excavator 324E
- Zaxis Excavator EX0689
- Zaxis excavator 2720 – demob today
- Deer Loader 1466
- Pumping equipment: generator, 2 – 3" pumps.

Report, if any, Contact with Occupants:

Contact with Owner:

None Today.

Discussions with Keystone Environmental:

Discussion with Contractor:

7:00AM
- Toolbox QM (James) – demobilizing one of the long arm excavators today.
- Going to start opening and stockpiling sand bags today.
- Plan to survey site after all bags are open – maybe tomorrow.
- Loading out contaminated material from B2/B3 around 9:30AM today.
- 45 bags will be opened and stockpiled separate at SRS F.

10:00AM
- Discussion with QM (James) –
- AE (Jordan) after confirming with AE (Jordon R.) – Install cocomatting up to the south end of SRS B. Drawing shows cocomatting extending to the north side of the SRS B.
- Vegetation has been trimmed in front of SRS B, not to be removed.

Report:

7:00 AM
- AE (Jordan, Vinizza) on site.
- Moving bags from SRS G to SRS J
- Opening bags at J and stockpiling them.

8:00AM
- 2 flaggers on site, traffic control on Dale road Bridge.

9:30AM
- Taking sand bags from SRS F to SRS J.
- Leaving 45 bags at F to be stockpiled separate.

9:30AM
- Hauling contaminated material from SRS B2/B3.
- 4 trucks this morning, Vinizza keeping count.
- Potential trucks returning later today.

10:45AM
- Demobilizing Zaxis excavator 2720.

11:15AM
- AE (Jordan) leaving site.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Testing:

- None today.

Safety Concerns:

- None today

Traffic Control:

- 2 flaggers on Dale road bridge.

Photos:



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Jordan Fiske

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

DAILY CONSTRUCTION REPORT

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	28
Project:	Legace Creek	**Page:**	1 of 5
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	October 1, 2024
Contract No.:		**Temperature:**	High: 14°C Low: 9°C
Weather:	Cloudy and Rainy, Wind 4 KM/H, Gusts 8 KM/H		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Labour Force:

Quantum Murray (QM): 1 Site Superintendent (Mel & Jim), 2 Operators, 2 Labourers
Keystone Environmental/Environmental Monitors (KE/EM): Corbin
Associated Engineering (AE): Vinizza Pingos, Jordan Fiske

Contractor's Equipment: Equipment in use

- Excavator 324E
- Excavator EXO689
- Excavator 2720
- Loader 1466
- Light Plant
- 2 – 3" submersible water pump
- 2 - 6" Vacuum Assisted Pumps

Report, if, any, Contact with Occupants:

N/A

Contact with Owner:

N/A

Safety Concerns:

N/A

Testing:

N/A

Traffic Control:
N/A

Report:

6:50 AM
- AE Vinizza and Jordan arrived on site.

7:00 AM
- Jim discussed the work plan for the day, which includes:
  - Station B2: Hauling of contaminated materials scheduled for 9:30 AM.
  - Station K Laydown/Stockpile Area: Dumping of sandbags from Stations G and I.
- Demobilization of one long-boom excavator and 1 light plant.

7:30 AM
- Continued hauling of bags from Station G to Station K.
- Station K Laydown/Stockpile Area: Excavator 324 E is opening and dumping sediments from the sandbags.

8:30 AM
- Traffic control is on site, provided by Green Valley Traffic Control (two flagmen).
- Mobilization of excavator EXO689 to Station B2.

9:00 AM
- At Station B2, measurements of the excavated materials were taken, estimating an approximate volume of 250 m^3.

9:25 AM
- The first truck arrived on site to haul the contaminated excavated materials from Station B2.

10:43 AM
- Demobilization of excavator 2720.

11:30 AM
- At Station B2, hauling of excavated materials was completed with four trucks, leaving approximately 50 m^3 of excavated materials remaining.
- Jim mentioned that the remaining materials will be hauled tomorrow.

11:50 AM
- At Station F, the estimated volumes were measured:
  - Excavated materials: 230 m^3
  - Sandbags in the laydown/stockpile area: 45 bags counted as non-excavated

12:00 PM
- Traffic control left the site.

12:10 PM
- At Station G, hauling of sandbags to Station K was completed.

12:15 PM
- At the Station K laydown/stockpile area, emptying the sandbags is ongoing.

1:15 PM
- Emptying of the sandbags was completed, with the empty sandbags stockpiled at Station J.

- Station K laydown/stock pile area: Measured the excavated materials;
  - From Station K excavated materials: approximately 100 m^3
  - From Station J excavated materials: approximately 430 m^3
  - From Station G excavated materials: approximately 100 m^3
  - Sandbags: approximately 310 m^3

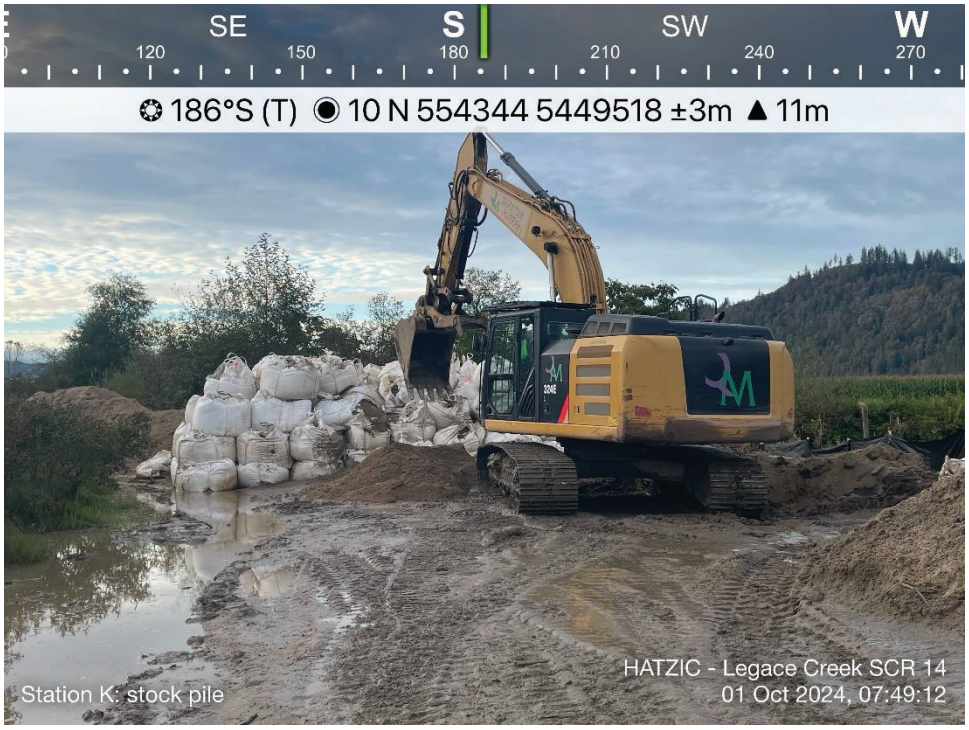
1:40 PM

- At Station I, hauling of turbidity curtains to their storage area.

2:10 PM

- AE Vinizza left the site.

Photos:


SE
S
SW
W
120
150
180
210
240
270
186°S (T) 10 N 554344 5449518 ±3m ▲ 11m
Station K: stock pile
HATZIC - Legace Creek SCR 14
01 Oct 2024, 07:49:12


SE
S
SW
W
120
150
180
210
240
270
190°S (T) 10 N 554341 5449529 ±4m ▲ 5m
Station K: dumping of sandbags
HATZIC - Legace Creek SCR 14
01 Oct 2024, 12:19:43


SW W NW N
210 240 270 300 330 0
288°W (T) 10 N 554597 5449799 ±3m 7m
Station B2: 4th truck + wagon
HATZIC - Legace Creek SCR 14
01 Oct 2024, 11:13:10


SW W NW N
210 240 270 300 330 0
296°NW (T) 10 N 554459 5449682 ±3m 5m
Station F
HATZIC - Legace Creek SCR 14
01 Oct 2024, 11:53:13

RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: October 1, 2024
Weather: Cloudy with occasional showers. High 12°C, Low 8°C.

- ***Works are being conducted outside of the least-risk window for in-stream works under the supervision and guidance of the Environmental Monitor.***
- ***Keystone Environmental undertook the following additional measures to reduce the risk of impacts to fish and fish habitat during works conducted outside the instream works least-risk window:***

- ***Erosion and Sediment Control (ESC)***
  - *Exposed areas and excavated stockpiles adjacent to Lagace Creek are protected with poly tarp and/or silt fences to prevent potential sediment runoff.*
- ***Spill Response and Mitigation***
  - *Spill trays were placed under heavy machinery to prevent any spill or leakage. Spill kits were also located nearby and fully stocked with spill pads, booms, and absorbent materials.*
  - *Refuelling was conducted in a marked refuelling area that complies with the 30 m buffer around Lagace Creek.*

- 0700: KEL EM on site
- 0705: QM communicated their intention to stockpile sand at Station K and load out knotweed soil at Station B.
- 0719: Cleaning of excavator at Station C prior to demobilization observed.
- 0818: Garbage removal and sandbag piling observed at Station J.
- 0925: Loader observed crossing Dale Road bridge to move sandbags from Station F to Station J.
- 0928: Loadout of knotweed contaminated soil observed at Station B.
- 1006: Truck and transfer hauling knotweed contaminated soil observed to be covered when leaving site.
- 1045: Demobilization of "big stick" excavator from Station C to lowboy semi-trailer observed.
- 1050: Truck and transfer loaded with knotweed contaminated soil observed departing Station B. Covers over the soil were observed to be in place.
- 1211: QM indicated that 1 more truck and transfer would be leaving from Station B, then the poly liner and remaining soil would be removed.
- 1246: Sanitizing of cleaned excavator at Station B using diluted bleach solution observed.
- 1255: Cleaned and sanitized excavator observed crossing Dale Road from Station B to Station C.
- 1321: Demobilization and sand stockpiling was observed at Station I.
- 1436: Loading of used bulk bags into waste container was observed.
- 1457: Walking of excavator from I to F across the Dale Road bridge was observed.

- 1617: Piling of soil and poly at Station B was observed.
- 1630: KEL EM off site.

Site Photos






OVERSIZE LOAD


WESCAN



Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

DAILY CONSTRUCTION REPORT

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	29
Project:	Legace Creek	**Page:**	1 of 4
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	October 2, 2024
Contract No.:		**Temperature:**	High: 15°C Low: 9°C
Weather:	Cloudy, Wind 7 KM/H, Gusts 15 KM/H		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Labour Force:

Quantum Murray (QM): 1 Site Superintendent (Mel & Jim), 2 Operators, 2 Labourers
Keystone Environmental/Environmental Monitors (KE/EM): Corbin
Associated Engineering (AE): Vinizza Pingos,

Contractor's Equipment: Equipment in use

- Excavator 324E
- Excavator EXO689
- Excavator 2720
- Loader 1466
- Light Plant
- 2 – 3" submersible water pump
- 2 - 6" Vacuum Assisted Pumps

Report, if, any, Contact with Occupants:

N/A

Contact with Owner:

N/A

Safety Concerns:

N/A

Testing:

N/A

Traffic Control:
N/A

Report:

6:50 AM
- AE Vinizza arrived on site.

7:00 AM
- Jim discussed the work plan for the day.
  - The lidar surveyor is on site.
  - Two trucks will haul the remaining contaminated materials from Station B2.
  - One long boom excavator and light plant will be demobilized.
  - Cleaning up.

7:20 AM
- Station E
  - Scraping sediment in the laydown area.
  - AE Vinizza measured the stockpile, estimating it at approximately 550 m^3.

8:00 AM
- Demobilization of the light plant.

8:45 AM
- Demobilization of excavator EX0689.

8:50 AM
- Station B2
  - AE Vinizza measured the remaining materials, estimating them at approximately 50 m^3.
  - Mel noted that there will be no work from tomorrow through Sunday.

8:57 AM
- The first truck arrived on site to haul the remaining contaminated materials.

10:20 AM
- The second truck arrived on site to haul the remaining contaminated materials.

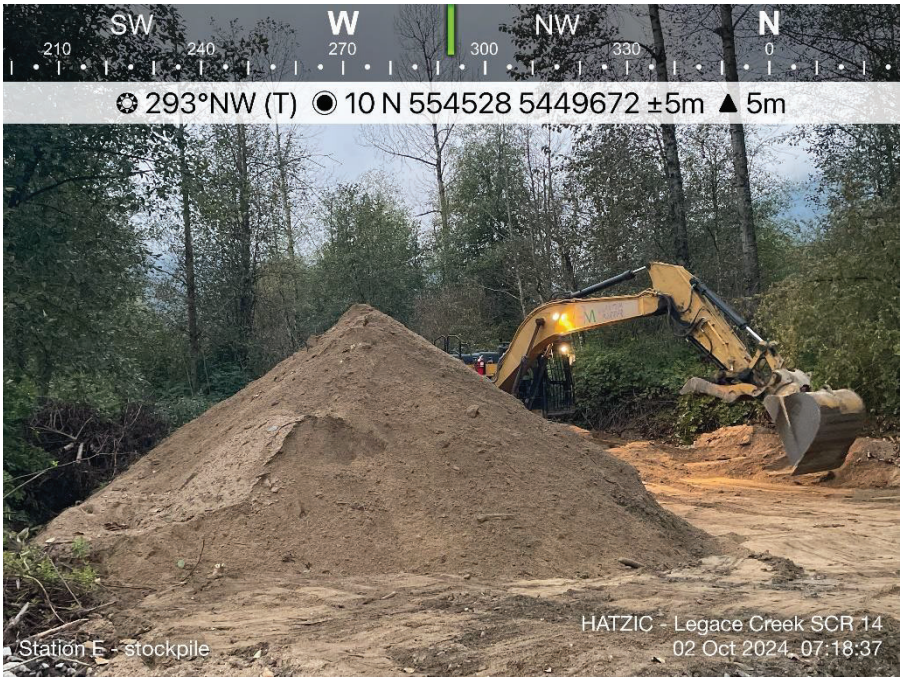
10:45 AM
- Station B2
  - There are approximately two buckets of contaminated materials remaining in the stockpile, which QM used to level the bank's surface.

11:15 AM
- QM left the site.

s

11:30 AM
- AE Vinizza left the site.

Photos:


SW W NW N
210 240 270 300 330 0
293°NW (T) 10 N 554528 5449672 ±5m 5m
Station E - stockpile
HATZIC - Legace Creek SCR 14
02 Oct 2024, 07:18:37


SE S SW W
120 150 180 210 240 270 30
206°SW (T) 10 N 554548 5449766 ±7m 1m
Lidar survey
HATZIC - Legace Creek SCR 14
02 Oct 2024, 07:42:04


SW
W
NW
N
210
240
270
300
330
0
277°W (T) 10 N 554589 5449788 ±10m ▲15m
Station B2: 2nd truck + wagon
HATZIC - Legace Creek SCR 14
02 Oct 2024, 10:44:19


S
SW
W
NW
180
210
240
270
300
330
262°W (T) 10 N 554590 5449807 ±5m ▲6m
324E
Station B2:
HATZIC - Legace Creek SCR 14
02 Oct 2024, 10:55:47

RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: October 2, 2024
Weather: Partly cloudy. High 16°C, Low 6°C.

- ***Works are being conducted outside of the least-risk window for in-stream works under the supervision and guidance of the Environmental Monitor.***
- ***Keystone Environmental undertook the following additional measures to reduce the risk of impacts to fish and fish habitat during works conducted outside the instream works least-risk window:***

- ***Erosion and Sediment Control (ESC)***
  - *Exposed areas and excavated stockpiles adjacent to Lagace Creek are protected with poly tarp and/or silt fences to prevent potential sediment runoff.*
- ***Spill Response and Mitigation***
  - *Spill trays were placed under heavy machinery to prevent any spill or leakage. Spill kits were also located nearby and fully stocked with spill pads, booms, and absorbent materials.*
  - *Refuelling was conducted in a marked refuelling area that complies with the 30 m buffer around Lagace Creek.*

- 0700: KEL EM on site
- 0728: QM communicated their intention to load out knotweed contaminated soil at B and remove erosion and sediment control measures from stations C, E, and F.
- 0741: Stockpiling of sand observed at Station E.
- 0839: Truck and transfer observed to have arrived at Station B.
- 0845: Semi truck with lowboy trailer on site for "big stick" excavator demobilization.
- 0904: Excavator observed to be demobilized from site.
- 0919: Pacific crayfish observed within Station B3 excavation footprint.
- 0921: Truck and transfer, loaded with knotweed contaminated soil and covered, observed leaving Station B.
- 1021: Truck and transfer on site to load out knotweed contaminated soil at Station B.
- 1044: Truck and transfer, loaded with knotweed contaminated soil and covered, observed leaving Station B.
- 1051: KEL directed QM to distribute the remaining knotweed contaminated soil on site within the contaminated area.
- 1100: KEL EM off site.

Site Photos









TECHNICAL MEMORANDUM

Issue Date:	October 9, 2024	**File:**	Audit No. 6
To:	**Thyren Jacobs, Flood Debris Management Secretariat**	**Previous Issue Date:**	
From:	Dave Muhlert, R.B.Tech. and Naomi Sands, R.P.Bio.		
Client:	Ministry of Environment and Climate Change Strategy		
Project Name:	Lagace Creek Bank Protection and Sediment Removal - SCR14	**Project No.:**	2022-2632-03
Subject:	Environmental Compliance Audit		
Monitoring Period:	September 26 – October 4, 2024		
Contractor:	QM Environmental		
Environmental Monitor:	Keystone Environmental		

1 INTRODUCTION

Associated Environmental Consultants Inc, (Associated) is pleased to provide this environmental audit report summarizing observations of site conditions, environmental protection measures, regulatory compliance, and corrective actions as part of erosion protection works on Lagace Creek, south of Durieu, BC in the Hatzic Valley (the Project, the Site) during the monitoring period September 26 to October 4, 2024. The results presented in this audit report are based on conditions observed at the time of the audit inspection(s) and represent a snapshot of the workday. Items identified as non-compliant may have been addressed before the report(s) are submitted. The audit report(s) are submitted to the owner, their agent (Associated Engineering), the Contractor, and their environmental monitor (EM) and are not intended for further distribution.

2 ROLES AND RESPONSIBILITIES

The prime contractor for the Project is QM Environmental (the Contractor), and works are being monitored for environmental compliance by Keystone Environmental (Keystone) and audited by Associated. As the EM, Keystone is to work with the Contractor to develop measures to protect the environment and to respond to environmental incidents as they occur. Keystone is also responsible for fish and wildlife salvages prior to instream works. Leq'á:mel First Nation (LFN) is the cultural monitor for the Site. The responsibility of the auditor is to ensure on behalf of the owner, who is ultimately the permit holder, that the EM, LFN, and the Contractor adhere to the requirements of the Construction Environmental Monitoring Plan (CEMP)[1], environmental permit conditions and any applicable regulations.

3 SITE INSPECTION

A summary of site conditions as observed during the audit inspection completed during the monitoring period is provided in Table 3-1. Monitoring reports have been submitted for the auditing period.

[1] AquaTerra Environmental Ltd. 2024. Hatzic Emergency Program, South Herford Creek Project, Construction Environmental Management Plan (Rev. 1). Prepared for Mission Contractors Ltd. 65 p.

Table 3-1 Site Conditions During Audit Inspection

Date / Time	Auditor (Associated)	Weather	Construction Activities
October 4, 2024 11:55	Dave Muhlert	Overcast. 13°C. Light rain[2].	No work in progress during the audit.

4 INSPECTION RESULTS

A checklist of required environmental protection measures and mitigative strategies for the Project is presented in Table 4-1. The checklist has been developed in accordance with terms and conditions of the environmental permits and approvals issued for the Project, environmental protection specifications and requirements as part of the construction contract for the Project, the Contractor's Construction Environmental Management Plan and environmental best management practices and guidelines.

[2] Government of Canada. 2024. Historical Data (Abbotsford Airport station). Available at: https://climate.weather.gc.ca/historical_data/search_historic_data_e.html. Accessed October 7, 2024.

Table 4-1 Summary of Environmental Protection Measures Reviewed and Results of the Inspection

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
	Environmental Monitoring					
1	The EM will attend key site meetings where environmental mitigations and issues may be discussed.	☒Compliant ☐Non-Compliant ☐N/A	EM has been on site daily during active works to attend site meetings.	As instream works continue outside the least risk fish window, EM reports should continue to document consideration of increased risk and if enhanced mitigation is required.	CEMP Section 2.4	
2	The EM shall supervise all instream works. If temporary diversion installed, EM is onsite daily to check pumps and flow bypasses.	☒Compliant ☐Non-Compliant ☐N/A	Conditionally compliant. The EM reported on September 27 that instream works were occurring at multiple locations on site and there weren't enough EM staff to monitor all of the active work locations; the EM reported that they would provide a third EM so that all instream works could be monitored. Instream sediment removal was completed on September 30, 2024; removal of sandbag isolation is ongoing. No instream work or other work was in progress during the audit inspection.		WSA (h)2.ii, (j)5.i CEMP Section 2.4	
3	The EM will submit daily and bi-weekly monitoring reports to the Contractor for distribution to MoECCS.	☒Compliant ☐Non-Compliant ☐N/A	Monitoring reports are submitted daily, or the following morning.		CEMP Section 5.1	
4	The EM will complete and submit an Environmental Incident Report (EIR) for non-compliances with the CEMP, reportable spills or other environmental incident.	☐Compliant ☐Non-Compliant ☒N/A	No reportable environmental incidents have been documented to date.		CEMP Section 4	
5	EM is granted authority to stop the work if necessary	☒Compliant ☐Non-Compliant ☐N/A	EM has the authority to stop work. No stoppages for environmental reasons were reported during the audit period.		WSA (i) 7 CEMP Section 2.4	
	Erosion and Sediment Control					
6	Appropriate site isolation is installed as required, including silt fencing prior to instream works. Silt fences are installed properly, intact, adequate, clear of accumulated sediment and are functioning.	☒Compliant ☐Non-Compliant ☐N/A	Conditionally compliant. Silt fencing is installed around one sediment stockpile but needs maintenance as some sections have gaps at the bottom or have partially collapsed. Exposed slopes are covered with poly sheets but some sediment has accumulated on top of the poly. Removal of instream sandbag isolation is ongoing.		WSA (o), (q) CEMP Section 3.5	Photo 1, Photo 2
7	Riprap or any other engineering material place in channel is clean of any substances deleterious to aquatic life.	☐Compliant ☐Non-Compliant ☒N/A	No riprap or other material was being placed during the audit.		WSA (x) CEMP Section 3.5	
8	Stockpiling and storage areas are located 15 m from the watercourse TOB.	☒Compliant ☐Non-Compliant ☐N/A	Sediment stockpiles are located >15 m from the watercourse OR are surrounded by silt fencing.		DFO FAA WSA (t) CEMP Section 3.5	Photo 1

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
9	Emergency ESC material onsite (e.g., 100 feet of silt fencing, 5 dry bales, and 100sq.m of ECBs/ Coconut matting, or polyethylene sheets)	☒Compliant ☐Non-Compliant ☐N/A	ESC materials were stockpiled at the site laydown. Access roads on both sides of the creek are very soft/muddy and have lots of standing water.	EM/contractor to monitor the site and install additional ESC measures as/when required Install emergency ESC materials during significant rain events as required.	CEMP Section 3.5	Photo 3
10	Sediment removed from the Site will be disposed of appropriately at a location approved by the EM and MoECCS.	☐Compliant ☐Non-Compliant ☒N/A	Excavated sediment is currently being stockpiled onsite. Offsite disposal location still to be determined.	Identify sediment disposal location(s) in the CEMP and/or the environmental monitoring reports.	CEMP Section 5.5	
11	Sediment removal boundaries must be clearly delineated prior to commencement of work.	☒Compliant ☐Non-Compliant ☐N/A	Sediment boundaries determined in consultation with AE inspector.		WSA (opening)	
	Invasive Plant Management					
12	Ensure that machinery is free of invasive plant material that could potentially be transported throughout or between sites.	☐Compliant ☐Non-Compliant ☒N/A	No machinery operating during inspection.		WSA (opening) CEMP Section 3.4	
13	Ensure that invasive species removed from site are disposed of appropriately at an approved facility	☐Compliant ☒Non-Compliant ☐N/A	Japanese knotweed removal is ongoing, however, management protocols in CEMP still do not align with approach in field.	Ensure knotweed management adheres to approved BMPs and contract, and document methodology including rationale for any changes in approach.	WSA (opening) CEMP Section 3.4.1	
14	The Project site shall be regularly monitored by the EM for invasive plant infestations and these infestations will be mapped and managed according to applicable species-specific BMPs.	☐Compliant ☒Non-Compliant ☐N/A	Patches of knotweed at station B and on the access road west of the creek have not been delineated to prevent encroachment.	Delineate knotweed adjacent to access and work areas, and continually monitor works adjacent to knotweed patches to ensure no accidental encroachment.	CEMP Section 3.4.1	Photo 4
16	Knotweed stems are cut close to the ground and contained on poly sheeting away from the immediate work area. Cut knotweed is covered with woven geotextile fabric and crushed rock prior to machine access. Knotweed stems are injected with an appropriate herbicide before being covered.	☐Compliant ☒Non-Compliant ☐N/A	Knotweed management is still not adequately documented.	Update CEMP to document revised knotweed approach.	CEMP Section 3.4.1 Addendum 1 to the Contract Documents for the Hatzic Emergency Works Program - Lagace Creek – Sites S-CR-14/17	
	Waste Management					
17	Dispose of all anthropogenic debris removed at an appropriate waste management facility.	☒Compliant ☐Non-Compliant ☐N/A	No anthropogenic debris was observed during the audit.		WSA (opening) CEMP Section 5.5	
18	Non-hazardous waste stored appropriately and removed offsite daily.	☒Compliant ☐Non-Compliant ☐N/A	No non-hazardous waste was observed during the audit.		CEMP Section 5.5	

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
19	Hazardous waste stored > 30 m of watercourses.	☒Compliant ☐Non-Compliant ☐N/A	Two portable toilets are located at the site laydown, more than 30 m away from watercourses.		CEMP Section 5.5	
20	Secondary containment used for all stored hazardous waste.	☐Compliant ☒Non-Compliant ☐N/A	Portable toilets were not in secondary containment.	Add secondary containment to portable toilets.	CEMP Section 3.6	
	Spill Control and Emergency Response					
21	Machinery operating in channel is equipped with environmentally friendly oil	☒Compliant ☐Non-Compliant ☐N/A	Excavator on site has a sticker confirming that it contains Environ™ biodegradable, non-toxic hydraulic fluid.		WSA (p) 4 CEMP Section 3.6	
22	Equipment and machinery are free of leaks	☒Compliant ☐Non-Compliant ☐N/A	No leaks were observed during the audit. Equipment appeared to be clean.		WSA (p) 1 CEMP Section 3.6	
23	Drip trays are available and used during refueling and equipment maintenance	☐Compliant ☒Non-Compliant ☐N/A	Drip trays were not present under all stationary equipment. Where drip trays were in place, some were full of water or otherwise non-functional.	Place drip trays under all stationary equipment. Drain water regularly.	CEMP Section 3.6	Photo 5
24	Fuel is stored > 30 m from Lagace Creeks and any connected drainages	☒Compliant ☐Non-Compliant ☐N/A			WSA (p) 3 CEMP Section 3.6	
25	Machinery and vehicles operating onsite are equipped with spill kit.	☒Compliant ☐Non-Compliant ☐N/A	Stocked spill kits were available near active work areas.		WSA (p) 2 CEMP Section 3.6	
26	Should suspected contaminated material be encountered (i.e., soil emitting olfactory cues indicative of hydrocarbon fuel), works should temporarily halt for investigation.	☒Compliant ☐Non-Compliant ☐N/A	EM reported high concentrations of sodium and some other metals and additional analysis and reporting are pending.		CEMP Section 2.5	
27	Refuelling of machinery is conducted on level ground over a spill tray.	☒Compliant ☐Non-Compliant ☐N/A	No refuelling was observed during the audit.		CEMP Section 3.6	
	Riparian Area Management					
28	Stockpile LWD and root wads removed from channel for use in site restoration	☒Compliant ☐Non-Compliant ☐N/A	LWD is being stockpiled on site. Vegetation clearing should be limited to stations and access points only. Any riparian disturbance must be restored post-construction.		CEMP Section 3.3	Photo 6
29	Construct access points and approaches perpendicular to the watercourse;	☒Compliant ☐Non-Compliant ☐N/A			DFO FAA CEMP Section 3.2	
	Instream Works					
30	The EM shall ensure that instream works are isolated from flow and that measures are in place to protect fish and fish habitat, and to mitigate the migration of sediment downstream.	☐Compliant ☒Non-Compliant ☐N/A	No instream works during the audit inspection. EM reported on September 26, 27, and 28 that turbid water was released from inside silt curtains.	Improve instream isolation to prevent the release of turbid water.	WSA (j) CEMP Section 3.1	
31	Pumps and flow bypasses are in proper working condition	☐Compliant ☐Non-Compliant ☒N/A	Pumps were not installed or operating during the audit visit.		WSA (j) 5 CEMP Section 3.1	
32	Instream works conducted in the dry / isolation of flow	☐Compliant ☐Non-Compliant ☒N/A	Instream works were not in progress during the audit visit.		WSA (o) CEMP Section 3.1.1	
	Water Quality					

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
33	Water quality is routinely monitored upstream and downstream of the work area, every day that instream works are occurring Instream water quality is compliant with provincial criteria[3]: **Turbidity**: - <8 NTU from background at any one time for a duration of 24 h in clear waters; - < 5 NTU from background when background is 8 – 50 NTU; - <10% from background when background is > 50 NTU. **pH:** 6.5-9.0	☒Compliant ☐Non-Compliant ☐N/A	EM is routinely monitoring water quality, and halting or adjusting instream works where short-term exceedances are noted. Sediment curtains had been removed at the time of the audit; no instream works were in progress.		WSA (s) CEMP Section 3.1.2	
	Fish and Wildlife Protection					
34	Full time monitoring for fish during instream works is occurring.	☒Compliant ☐Non-Compliant ☐N/A	EM is onsite full time during active works.		WSA (j) 6 CEMP Section 2.4	
35	Fish salvages are conducted in advance of instream works where required.	☒Compliant ☐Non-Compliant ☐N/A	EM is conducting salvages in advance of sediment excavation.		CEMP Section 3.1 WSA (j) 6	
36	Salvaged fish are relocated back to the same watercourse in a nearby area that is not impacted by construction or removal works or its zone of influence	☒Compliant ☐Non-Compliant ☐N/A	EM is relocating fish outside the isolated work zone.		DFO FAA Section 2.2.4	
37	Pump intakes are screened for fish and aquatic species in accordance with the "Interim code of practice: End-of-pipe fish protection screens for small water intakes in freshwater"	☐Compliant ☐Non-Compliant ☒N/A	Pumps were not installed or operating during the audit visit.		WSA (j) 5.ii DFO FAA Section 2.4.9 CEMP Section 3.1.1	
38	Obtain required permits prior to salvage(s).	☒Compliant ☐Non-Compliant ☐N/A	EM has obtained salvage permits.		WSA (Opening) CEMP Section 3.1	
39	EM is on site during disturbance to riparian vegetation and conducting pre-clearing breeding bird surveys prior to clearing.	☒Compliant ☐Non-Compliant ☐N/A	EM is conducting nest surveys at stations as required.		CEMP Section 3.2	
40	Instream works are conducted so as not to lead to fish stranding or other impacts to fish. The works shall not result in depressions that have the ability to trap fish and other aquatic life. Fish passage is maintained where practicable and in accordance with applicable permits.	☒Compliant ☐Non-Compliant ☐N/A	Instream works have been designed to maintain fish passage after completion. Instream dredging/excavation was completed on September 30, 2024. Remaining instream works are limited to removal of sandbags used for site isolation.	EM must be monitoring for fish full-time and should have a plan for maintaining upstream fish passage around the work area. This plan should be documented in routine monitoring reports. EMs onsite must be aware of the QEP	WSA (j) 6 (iii) WSA (u) DFO FAA Section 2.4.2 CEMP Section 3.1.1	

[3] British Columbia Ministry of Environment and Climate Change Strategy. 2024. British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture - Guideline Summary – August 2024. Water Quality Guideline Series, WQG-20. Prov. B.C., Victoria B.C. Available at: https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-guidelines/approved-wqgs/wqg_summary_aquaticlife_wildlife_agri.pdf. Accessed August 2024.

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
				memo and ensure that enhanced mitigation is implemented as outlined in the memo.		
	Restoration Requirements					
41	Restoration plans prepared by EM for disturbed area and implemented with EM oversight	☐Compliant ☐Non-Compliant ☒N/A	Restoration plans have not been prepared yet.		WSA (w) CEMP Section 3	
42	All temporary works shall be removed on completion of the project, and the stream channel restored to its natural condition	☐Compliant ☐Non-Compliant ☒N/A	Work is still in progress.		WSA (v) CEMP Section 3	

5 DISCUSSION

5.1 Non-Compliant Items

Knotweed management

Knotweed removal onsite continued on September 26, and transport of knotweed-contaminated material to offsite disposal is ongoing; the CEMP has not been updated with revised approach or the disposal location(s). Knotweed adjacent to work areas is not delineated to prevent accidental encroachment and spread.

Recommended action: Provide documentation of knotweed management and ensure it adheres to approved BMPs. Provide details on alternative approach with rationale, and update documentation (e.g., CEMP). Delineate knotweed patches adjacent to access and work areas and monitor machinery to prevent accidental intrusion. Identify the specific disposal site(s) in the CEMP.

Stationary equipment without drip trays

Drip trays were not present under all stationary equipment. Where drip trays were in place, some were full of water or otherwise non-functional.

Recommended action: Place drip trays under all stationary equipment. Drain rainwater regularly to avoid the need to dispose of contaminated water if there are any drips or spills.

Inadequate site isolation for instream works

The EM reported on September 26, 27, and 28 that turbid water was released from inside silt curtains used for site isolation.

Recommended action: If any further instream works are required, improve site isolation to prevent the release of turbid water.

Portable toilets without secondary containment

Two portable toilets located at the site laydown adjacent to Dale Road did not have secondary containment. Although the toilets were more than 30 m away from the watercourse, secondary containment would prevent any potential spills from spreading beyond the immediate area.

Recommended action: Add secondary containment to portable toilets.

5.2 Conditionally Compliant Items

EM to supervise all instream works

The EM reported on September 27, 2024 that instream works were being carried out at stations J and K (while concurrent work was in progress at stations B2 and B3) without an EM present to monitor active dredging. The EM also reported that they would provide a third EM to accommodate monitoring all of the instream work on site.

Erosion and sediment control

Erosion and sediment control measures (e.g., silt fencing, poly sheeting) were in place but require maintenance to ensure that they continue to function effectively.

EM reporting to document risk and mitigation

As instream works progress beyond the least risk fish window, the EM must provide guidance and advice to the contractor regarding any changes in risk associated with working past the window and required mitigation. At the time of this memo, instream dredging and excavation work is complete; remaining instream works are limited to demobilization (i.e., removal of sandbags used for site isolation).

Recommended action: EM reports should document their consideration of any increased risk with working past the least risk and identify if enhanced mitigation is required. EM should continue to document implementation of mitigation measures, evaluate changing conditions, and report any incidents or near-misses.

6 SUMMARY

A list of environmental issues outstanding to date is provided in Table 6-1, below.

Table 6-1 Tracking Table of Environmental Issues Outstanding to-Date (project commencement August 12, 2024)

Item #(s)	Issue	Date(s) Observed	Recommended Corrective Action(s)	Responsible Party
2	Knotweed management	August 29, 2024 September 5, 2024 September 13, 2024 September 29, 2024 September 25, 2024	Ensure that all knotweed cuttings are confined to poly sheeting. Apply herbicide to remaining stems, as appropriate. Document methodology and ensure it adheres to approved BMPs.	Contractor/EM
3	Portable toilets without secondary containment	August 29, 2024 September 5, 2024 September 13, 2024 September 29, 2024 September 25, 2024 October 4, 2024	Add secondary containment to portable toilets.	Contractor
4	Inadequate instream isolation and failed dewatering attempts resulting in instream works conducted in the wet.	August 31, 2024 September 1, 2024 September 2, 2024 September 11, 2024 September 27, 2024 (EM reports)	Need to provide adequate isolation and dewatering to maintain dry work area OR obtain permission to dredge in the wet	Contractor
5	Stationary equipment without drip trays, or drip trays full of water	October 4, 2024	Place drip trays under all stationary equipment. Empty rainwater regularly.	Contractor

Note: Items marked with an asterisk (*) were reported by the EM.

7 CLOSURE

We trust that the information in this memo is sufficient for your present needs. Should you have questions, please do not hesitate to contact the undersigned.

Prepared by:

Dave Muhlert, R.B.Tech.
Environmental Technologist
DM/NS

Reviewed by:

Naomi Sands, R.P.Bio.
Environmental Scientist

Attachments:

- Site Photographs
- Table A2: Tracking Table of Resolved Non-Compliance Issues

Attachment 1: Site photographs taken during audit visit on October 4, 2024.

Photo 1: Silt fence installed around stockpile 		**Photo 2: Sediment accumulated on top of poly sheeting** 
Photo 3: Muddy laydown / access road 		**Photo 4: Knotweed patch adjacent to station B** 
Photo 5: Spill tray under stationary equipment full of water and placed at an angle 		**Photo 6: Large woody debris stockpiled on site** 

Table A2: Tracking Table of Resolved Non-Compliance Issues

Item #(s)	Issue	Date(s) Observed	Date Corrected	Corrective Action(s)	Responsible Party
1	Environmental monitoring reports not received daily	August 29, 2024	September 5, 2024	Monitoring reports received daily, or following morning.	EM
2	Inappropriate fish screen on pump intake	September 5, 2024	September 12, 2024	EM reports show pump intakes in mesh screen boxes. Wire mesh screen was being fitted to an additional pump intake during the audit visit.	Contractor

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	
Project:	Lagace Creek	**Page:**	1 of 7
Location:	Farms – Seux Roads, Fraser Valley, BC 49°13'00" N, 122°14"36" W	**Project No.:**	S-CR-215/16 2022-2632-04
Contractor:	Quantum Murphy	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	October 7, 2024
Contract No.:		**Temperature:**	High: 17 Low: 11
Weather:	Partly Cloudy		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum: Mel, 1 Operator, 2 Labourers
Leq'á: mel First Nation: Cultural Monitor rotating between sites
Keystone: Corbin
2 Fence installers

Contractor's Equipment:
- One Excavator

Equipment in use:
- One Excavator

Report, if any, Contact with Occupants:
None Today

Contact with Owner:
None Today

Report:
7:30 am
- AE arrives on site after stopping by 15/16 momentarily.
- Mel (QM), Corbin (Keystone), 1 op, LFN Cultural monitor, and 2 fence installers on site already.

8:00 am
- Two Labourers for QM arrive on site.

8:30 am
- Bush and vegetaiton was removed along property line on site B to make way for fence to be installed. No trees were taken out and the EM monitored it. Aprox a 3m by 5m rectangle of vegetation was removed.
- Fence installation begins once completed.

9:00 am
- Mel spoke to Duncan (AE) about a timewindow on what trees are going to be put in as they only have the excavator there till the end of the week and want to pre dig holes if possible.

9:15 am

- Drone flight around site capturing current conditions since last drone flight as well as some additional areas of interest.

9:50 am
- Began scapping up unused gravel into pile to use on road repair with excavator.

11:00 am
- Loaded up unused 1m bags to take off site.
- Continue installing fence.

11:15 am
- Hole drill for dirt arrived on site

11:30 am
- Fence posts in place need to wait for concrete to dry. Fence installers leave site.

11:40 am
- Moved excavator to remove plastic sheets covering slope as well as taking out some sandbags that were keeping it pinned down.

11:50 am
- Heard there were no live stakes coming this week and that work would be put on hold.

12:00 pm
- Spoke to Joon wanted me to run to 15/16 to get up to date on how things are progressing. Left 14/17 while nothing was happening to walk site there.

1:00 pm
- Returned to 14/17 QM still on lunch break

1:45 pm
- Duncan spoke to Mel asked a few questions.
- When are wood pins coming in for nailing the coconut matting down? Mel said tomorrow morning they are picking them up tonight.
- Plan for rest of week? Mel said coconut matting and pinning station B and C then done.
- When will repairs to the access road be done? Mel said they'll be starting that now.
- Mel asked Duncan to ask about spacing of stakes. Looked over drawings and answered.
- Taking the last of the polywrap out of stations B & C

2:00 pm
- Mel to repair silt fence damage.
- Plan to use unused gravel rocks to fill in areas of the access road that were punched out and ruined.
- Plan to get a flatbed truck to haul turbidity curtains off site
- Mel asked how far in water coconut matting goes. Drawings say to bottom of slope spoke to Jordon Rozon (AE) said about a meter in the water is fine. Just make sure they overlap and are installed with 30cm staples.

3:00 pm
- Slitfence repaired
- Road repair ongoing

3:50 pm
- QM wraps up for day.
- Walked down site to inspect road repair work done by QM. Road still flooded and sunk-in in a few different areas. More restoration work will be required to return road to original condition.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Duncan McCormick

Testing:
Turbidity testing done by Keystone

Safety Concerns

- Bear safety. Work in pairs, be aware of surroundings.
- Heavy equipment hauling rocks.
- Falling hazard as well as being hit by a vehicle. Easy to avoid by giving operators a wide area to work.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Duncan McCormick

Photos:
Bush that needs to be removed to install fence along propline.



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Duncan McCormick

Area now that vegetation has been removed.



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Duncan McCormick

Fence poles installed.



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Duncan McCormick

Road repair progress



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Duncan McCormick

RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: October 7, 2024
Weather: Partly cloudy. High 22°C, Low 12°C.

- ***Works are being conducted outside of the least-risk window for in-stream works under the supervision and guidance of the Environmental Monitor.***
- ***Keystone Environmental undertook the following additional measures to reduce the risk of impacts to fish and fish habitat during works conducted outside the instream works least-risk window:***

- ***Erosion and Sediment Control (ESC)***
  - *Exposed areas and excavated stockpiles adjacent to Lagace Creek are protected with poly tarp and/or silt fences to prevent potential sediment runoff.*
  - *Exposed areas are prepared for the installation of coco matting.*
- ***Spill Response and Mitigation***
  - *Spill trays were placed under heavy machinery to prevent any spill or leakage. Spill kits were also located nearby and fully stocked with spill pads, booms, and absorbent materials.*
  - *Refuelling was conducted in a marked refuelling area that complies with the 30 m buffer around Lagace Creek.*

- 0700: Keystone environmental monitors on site.
- 0715: QM Environmental communicated their intention to remove poly sheets and silt fencing from stations where no sediments are stockpiled.
- 0736: The EM reviewed site conditions following several days off site. The site was observed to be tidy with satisfactory measures to prevent sedimentation of Lagace Creek.
- 0810: QM communicated their intention to remove a small swath of vegetation at Station B adjacent to Dale Road to facilitate the installation of a fence. Keystone implemented the following measures to mitigate the risk of spreading invasive plant propagules during these works: 1) QM to minimize soil disturbance during the works. 2) Any contaminated soil moved during the course of the works is to be kept in place or returned to the vegetation clearing footprint. 3) Do not disturb knotweed stems or leaves during the works.
- 0828: Grubbing was commenced at Station B.
- 0833: Grubbing was observed to be completed at Station B, and the works were observed to proceed according to the guidance provided by the EM. The EM observed the walking of the excavator across Dale Road to dispose of the grubbed material.
- 0838: Cleaning of Dale Road observed.

- 1001: Mixing of cement for fence post observed at Station B. The EM directed the contractors to ensure concrete mixing takes place behind the top of bank for Lagace Creek.
- 1137: Walking of excavator across Dale Road bridge from C to F observed.
- 1153: Poly removal observed at Station E.
- 1207: Poly removal at Station C observed.
- 1344: QM communicated their intention to repair the silt fences at Stations H and F to prevent sloughing of the stockpiles into the stream.
- 1345: Poly removal at Station J observed.
- 1501: Silt fence observed to be repaired at F.
- 1505: Silt fence observed to be repaired at H.
- 1600: Work observed to be completed for the day. QM communicated their intention to remove poly sheets and install coco matting on October 8th.

Site Photos









Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	
Project:	Lagace Creek	**Page:**	1 of 5
Location:	Farms – Seux Roads, Fraser Valley, BC 49°13'00" N, 122°14"36" W	**Project No.:**	S-CR-215/16 2022-2632-04
Contractor:	Quantum Murphy	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	October 8, 2024
Contract No.:		**Temperature:**	High: 15 Low: 10
Weather:	Partly Cloudy		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum: Mel, 1 Operator, Labourers
Leq'á: mel First Nation: Cultural Monitor rotating between sites
Keystone: Corbin
2 Fence installers

Contractor's Equipment:
- One Excavator

Equipment in use:
- One Excavator

Report, if any, Contact with Occupants:
None Today

Contact with Owner:
None Today

Report:
7:00 am
- Arrive on site
- Talk with Mel about plan for today.
- Finish taking plastic off of bank
- Put down coconut matting
- Lay gravel on road for restoration
- Finish gate

7:30 am
- More Labourers arrive

8:00 am
- LFN arrives on site rotating between sites today

8:10 am
- More Labourers arrive on site.

8:30 am
- Coconut matting
- Nails forgotten to be picked up yesterday and needed to be picked up today.

8:45 am
- Call from Jordon
- Halt in work
- Topsoil & seeds needed to go in before coconut matting

9:00 am
- Fence installation crew arrives on site

9:30 am
- QM takes coffee break

10:00 am
- QM back from coffee break

10:30 am
- Run to site 15 to watch install of woody debris.

11:45 am
- Arrived back on site 14
- QM on lunch

12:30 pm
- Loading turbidity guards onto trucks
- Gate finished just needs green privacy curtains installed. Will get the insterts tomorrow.
- Gravel continues being placed in areas where access road was punched out.
- Access road will still need more work.

1:00pm
- Laid out and cut out coconut matting. QM did not nail it down yet.

3:20am
- QM wraps up for the day wont be back till the 10th.
- Duncan walks site to check how road repairs went. Still need more work.

Testing:
Turbidity testing done by Keystone

Safety Concerns
- Bear safety. Work in pairs, be aware of surroundings.
- Heavy equipment hauling rocks.
- Falling hazard as well as being hit by a vehicle. Easy to avoid by giving operators a wide area to work.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Duncan McCormick

Photos:



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Duncan McCormick



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Duncan McCormick



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Duncan McCormick

RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: October 8, 2024
Weather: Rainy. High 15°C, Low 10°C.

- ***Works are being conducted outside of the least-risk window for in-stream works under the supervision and guidance of the Environmental Monitor.***
- ***Keystone Environmental undertook the following additional measures to reduce the risk of impacts to fish and fish habitat during works conducted outside the instream works least-risk window:***

- ***Erosion and Sediment Control (ESC)***
  - *Exposed areas and excavated stockpiles adjacent to Lagace Creek are protected with poly tarp and/or silt fences to prevent potential sediment runoff.*
  - *Exposed areas are prepared for the installation of coco matting.*
- ***Spill Response and Mitigation***
  - *Spill trays were placed under heavy machinery to prevent any spill or leakage. Spill kits were also located nearby and fully stocked with spill pads, booms, and absorbent materials.*
  - *Refuelling was conducted in a marked refuelling area that complies with the 30 m buffer around Lagace Creek.*

- 0700: Keystone environmental monitors on site.
- 0714: The EM discussed the plans for the day with QM. QM communicated that poly removal and coco matting installation would proceed.
- 0720: The EM noted that a correction was required in the October 7th summary email. While the October 7th email stated that no works occured below the top of bank, it is more accurate to state that no works occurred below the high water mark, as poly removal was observed on October 7th.
- 0736: Poly removal was commenced at Station C.
- 0745: A minor turbidity plume was observed during poly sheet removal at C. The EM did not note any environmental concerns.
- 0748: Poly removal was completed at Station C.
- 0800: Poly removal was commenced at Station B.
- 0810: Poly removal at Station B observed to be complete. The EM did not note any environmental concerns.
- 0828: QM communicated their intention to bucket pack areas at Stations B and C where rills are forming. Due to the potential for soil disturbance in a knotweed contaminated area, the EM directed QM to clean and sanitize the excavator prior to leaving Station B.

- 0832: Suspected knotweed regrowth was observed at Station B.
- 0836: Coco matting placement observed at Station C.
- 0851: QM was informed that Associated Engineering required the placement of topsoil and grass seed at Station C prior to coco matting placement.
- 0906: Fence installation observed at Station B.
- 0930: Works observed to be paused. QM site staff were awaiting further directions.
- 1024: QM communicated their desire to use existing soil, excavated from Station C and stockpiled on site, as topsoil at Station C.
- 1104: Placement of crushed rocks opposite Station F as part of ongoing road repairs observed.
- 1122: Silt fence removal and coco matting install observed at Station B.
- 1420: Walking of excavator from Station C to Station B observed. Excavator was removing garbage at Station B.
- 1505: As QM was expecting to leave the site inactive on Wednesday, October 9th, the EM directed QM to leave coco matting in place as a temporary erosion control measure.
- 1515: Works were observed to be concluded for the day.
- 1530: Keystone EM off site.

Site Photos









Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	
Project:	Lagace Creek	**Page:**	1 of 7
Location:	Farms – Seux Roads, Fraser Valley, BC 49°13'00" N, 122°14"36" W	**Project No.:**	S-CR-215/16 2022-2632-04
Contractor:	Quantum Murphy	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	October 7, 2024
Contract No.:		**Temperature:**	High: 17 Low: 11
Weather:	Partly Cloudy		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum: Mel, 1 Operator, 2 Labourers
Leq'á: mel First Nation: Cultural Monitor rotating between sites
Keystone: Corbin
2 Fence installers

Contractor's Equipment:
- One Excavator

Equipment in use:
- One Excavator

Report, if any, Contact with Occupants:
None Today

Contact with Owner:
None Today

Report:
7:30 am
- AE arrives on site after stopping by 15/16 momentarily.
- Mel (QM), Corbin (Keystone), 1 op, LFN Cultural monitor, and 2 fence installers on site already.

8:00 am
- Two Labourers for QM arrive on site.

8:30 am
- Bush and vegetaiton was removed along property line on site B to make way for fence to be installed. No trees were taken out and the EM monitored it. Aprox a 3m by 5m rectangle of vegetation was removed.
- Fence installation begins once completed.

9:00 am
- Mel spoke to Duncan (AE) about a timewindow on what trees are going to be put in as they only have the excavator there till the end of the week and want to pre dig holes if possible.

9:15 am

- Drone flight around site capturing current conditions since last drone flight as well as some additional areas of interest.

9:50 am
- Began scapping up unused gravel into pile to use on road repair with excavator.

11:00 am
- Loaded up unused 1m bags to take off site.
- Continue installing fence.

11:15 am
- Hole drill for dirt arrived on site

11:30 am
- Fence posts in place need to wait for concrete to dry. Fence installers leave site.

11:40 am
- Moved excavator to remove plastic sheets covering slope as well as taking out some sandbags that were keeping it pinned down.

11:50 am
- Heard there were no live stakes coming this week and that work would be put on hold.

12:00 pm
- Spoke to Joon wanted me to run to 15/16 to get up to date on how things are progressing. Left 14/17 while nothing was happening to walk site there.

1:00 pm
- Returned to 14/17 QM still on lunch break

1:45 pm
- Duncan spoke to Mel asked a few questions.
- When are wood pins coming in for nailing the coconut matting down? Mel said tomorrow morning they are picking them up tonight.
- Plan for rest of week? Mel said coconut matting and pinning station B and C then done.
- When will repairs to the access road be done? Mel said they'll be starting that now.
- Mel asked Duncan to ask about spacing of stakes. Looked over drawings and answered.
- Taking the last of the polywrap out of stations B & C

2:00 pm
- Mel to repair silt fence damage.
- Plan to use unused gravel rocks to fill in areas of the access road that were punched out and ruined.
- Plan to get a flatbed truck to haul turbidity curtains off site
- Mel asked how far in water coconut matting goes. Drawings say to bottom of slope spoke to Jordon Rozon (AE) said about a meter in the water is fine. Just make sure they overlap and are installed with 30cm staples.

3:00 pm
- Slitfence repaired
- Road repair ongoing

3:50 pm
- QM wraps up for day.
- Walked down site to inspect road repair work done by QM. Road still flooded and sunk-in in a few different areas. More restoration work will be required to return road to original condition.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Duncan McCormick

Testing:
Turbidity testing done by Keystone

Safety Concerns

- Bear safety. Work in pairs, be aware of surroundings.
- Heavy equipment hauling rocks.
- Falling hazard as well as being hit by a vehicle. Easy to avoid by giving operators a wide area to work.

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Duncan McCormick

Photos:
Bush that needs to be removed to install fence along propline.



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Duncan McCormick

Area now that vegetation has been removed.



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Duncan McCormick

Fence poles installed.



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Duncan McCormick

Road repair progress



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Duncan McCormick

TECHNICAL MEMORANDUM

Issue Date:	October 16, 2024	**File:**	Audit No. 7
To:	**Thyren Jacobs, Flood Debris Management Secretariat**	**Previous Issue Date:**	
From:	Naomi Sands, R.P.Bio.		
Client:	Ministry of Environment and Climate Change Strategy		
Project Name:	Lagace Creek Bank Protection and Sediment Removal - SCR14	**Project No.:**	2022-2632-03
Subject:	Environmental Compliance Audit		
Monitoring Period:	October 4 – 10, 2024		
Contractor:	QM Environmental		
Environmental Monitor:	Keystone Environmental		

1 INTRODUCTION

Associated Environmental Consultants Inc, (Associated) is pleased to provide this environmental audit report summarizing observations of site conditions, environmental protection measures, regulatory compliance, and corrective actions as part of erosion protection works on Lagace Creek, south of Durieu, BC in the Hatzic Valley (the Project, the Site) during the monitoring period October 4 to 10, 2024. The results presented in this audit report are based on conditions observed at the time of the audit inspection(s) and represent a snapshot of the workday. Items identified as non-compliant may have been addressed before the report(s) are submitted. The audit report(s) are submitted to the owner, their agent (Associated Engineering), the Contractor, and their environmental monitor (EM) and are not intended for further distribution.

2 ROLES AND RESPONSIBILITIES

The prime contractor for the Project is QM Environmental (the Contractor), and works are being monitored for environmental compliance by Keystone Environmental (Keystone) and audited by Associated. As the EM, Keystone is to work with the Contractor to develop measures to protect the environment and to respond to environmental incidents as they occur. Keystone is also responsible for fish and wildlife salvages prior to instream works. Leq'á:mel First Nation (LFN) is the cultural monitor for the Site. The responsibility of the auditor is to ensure on behalf of the owner, who is ultimately the permit holder, that the EM, LFN, and the Contractor adhere to the requirements of the Construction Environmental Monitoring Plan (CEMP)[1], environmental permit conditions and any applicable regulations.

3 SITE INSPECTION

A summary of site conditions as observed during the audit inspection completed during the monitoring period is provided in Table 3-1. Monitoring reports have been submitted for the auditing period.

[1] AquaTerra Environmental Ltd. 2024. Hatzic Emergency Program, South Herford Creek Project, Construction Environmental Management Plan (Rev. 1). Prepared for Mission Contractors Ltd. 65 p.

Table 3-1 Site Conditions During Audit Inspection

Date / Time	Auditor (Associated)	Weather	Construction Activities
October 10, 2024 11:05	Naomi Sands	Sun. 11°C.	Spreading topsoil along bank at Station B

4 INSPECTION RESULTS

A checklist of required environmental protection measures and mitigative strategies for the Project is presented in Table 4-1. The checklist has been developed in accordance with terms and conditions of the environmental permits and approvals issued for the Project, environmental protection specifications and requirements as part of the construction contract for the Project, the Contractor's Construction Environmental Management Plan and environmental best management practices and guidelines.

Table 4-1 Summary of Environmental Protection Measures Reviewed and Results of the Inspection

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
	Environmental Monitoring					
1	The EM will attend key site meetings where environmental mitigations and issues may be discussed.	☒Compliant ☐Non-Compliant ☐N/A	EM has been on site daily during active works to attend site meetings.		CEMP Section 2.4	
2	The EM shall supervise all instream works. If temporary diversion installed, EM is onsite daily to check pumps and flow bypasses.	☒Compliant ☐Non-Compliant ☐N/A	EM was onsite monitoring topsoil placement along bank.		WSA (h)2.ii, (j)5.i CEMP Section 2.4	
3	The EM will submit daily and bi-weekly monitoring reports to the Contractor for distribution to MoECCS.	☒Compliant ☐Non-Compliant ☐N/A	Monitoring reports are submitted daily, or the following morning, during active works		CEMP Section 5.1	
4	The EM will complete and submit an Environmental Incident Report (EIR) for non-compliances with the CEMP, reportable spills or other environmental incident.	☐Compliant ☐Non-Compliant ☒N/A	No reportable environmental incidents have been documented to date.		CEMP Section 4	
5	EM is granted authority to stop the work if necessary	☒Compliant ☐Non-Compliant ☐N/A	EM has the authority to stop work. No stoppages for environmental reasons were reported during the audit period.		WSA (i) 7 CEMP Section 2.4	
	Erosion and Sediment Control					
6	Appropriate site isolation is installed as required, including silt fencing prior to instream works. Silt fences are installed properly, intact, adequate, clear of accumulated sediment and are functioning.	☒Compliant ☐Non-Compliant ☐N/A	Conditionally compliant. QEP guidance for topsoil placement (email dated Oct 9) stipulated the placement of silt fence, or suitable alternative, along the toe of slope, prior to topsoil placement, to intercept any soil potentially migrating downslope. No silt fence was installed. Onsite EM advised contractor to make a little berm with the topsoil at the toe and work up the slope. EM was monitoring turbidity and did not observe any issues. Several sediment stockpiles along riparian corridor. Silt fencing has been installed around the stockpiles, but requires extensive maintenance as some sections have gaps at the bottom or have partially collapsed. Exposed slopes should be covered prior to demobilization.		WSA (o), (q) CEMP Section 3.5	Photo 1, Photo 2, Photo 3, Photo 4
7	Riprap or any other engineering material place in channel is clean of any substances deleterious to aquatic life.	☐Compliant ☐Non-Compliant ☒N/A	No riprap or other material was being placed during the audit.		WSA (x) CEMP Section 3.5	
8	Stockpiling and storage areas are located 15 m from the watercourse TOB.	☒Compliant ☐Non-Compliant ☐N/A	Sediment stockpiles are located >15 m from the watercourse OR are surrounded by silt fencing. Conditionally compliant as silt fence requires maintenance.		DFO FAA WSA (t) CEMP Section 3.5	Photo 3, Photo 4
9	Emergency ESC material onsite (e.g., 100 feet of silt fencing, 5 dry bales, and 100sq.m of ECBs/ Coconut	☒Compliant ☐Non-Compliant ☐N/A	ESC materials were stockpiled at the site laydown. Access road is still very soft/muddy.	EM/contractor to conduct a walk-through prior to temporary	CEMP Section 3.5	

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
	matting, or polyethylene sheets)			demobilization to determine if additional ESC measures are required.		
10	Sediment removed from the Site will be disposed of appropriately at a location approved by the EM and MoECCS.	☐Compliant ☐Non-Compliant ☒N/A	Excavated sediment is currently being stockpiled onsite. Offsite disposal location still to be determined.	Identify sediment disposal location(s) in the CEMP and/or the environmental monitoring reports.	CEMP Section 5.5	
11	Sediment removal boundaries must be clearly delineated prior to commencement of work.	☒Compliant ☐Non-Compliant ☒N/A	No sediment removal occurred during audit period.		WSA (opening)	
	Invasive Plant Management					
12	Ensure that machinery is free of invasive plant material that could potentially be transported throughout or between sites.	☐Compliant ☐Non-Compliant ☒N/A	Excavator spreading topsoil at Station B appeared free of plant material. EM oversaw decontamination of machinery between stations.		WSA (opening) CEMP Section 3.4	
13	Ensure that invasive species removed from site are disposed of appropriately at an approved facility	☐Compliant ☒Non-Compliant ☐N/A	Japanese knotweed removal and handling of contaminated soil is ongoing, however, management protocols in CEMP still do not align with approach in field.	Ensure knotweed management adheres to approved BMPs and contract, and document methodology including rationale for any changes in approach.	WSA (opening) CEMP Section 3.4.1	
14	The Project site shall be regularly monitored by the EM for invasive plant infestations and these infestations will be mapped and managed according to applicable species-specific BMPs.	☒Compliant ☐Non-Compliant ☐N/A	EM is oversighting vegetation clearing and movement of contaminated soil at Station B.	Delineate knotweed adjacent to access and work areas, and continually monitor works adjacent to knotweed patches to ensure no accidental encroachment.	CEMP Section 3.4.1	
16	Knotweed stems are cut close to the ground and contained on poly sheeting away from the immediate work area. Cut knotweed is covered with woven geotextile fabric and crushed rock prior to machine access. Knotweed stems are injected with an appropriate herbicide before being covered.	☐Compliant ☒Non-Compliant ☐N/A	Knotweed management is still not adequately documented.	Update CEMP to document revised knotweed approach.	CEMP Section 3.4.1 Addendum 1 to the Contract Documents for the Hatzic Emergency Works Program - Lagace Creek – Sites S-CR-14/17	
	Waste Management					
17	Dispose of all anthropogenic debris removed at an appropriate waste management facility.	☒Compliant ☐Non-Compliant ☐N/A	No anthropogenic debris was observed during the audit.		WSA (opening) CEMP Section 5.5	
18	Non-hazardous waste stored appropriately and removed offsite daily.	☒Compliant ☐Non-Compliant ☐N/A	No non-hazardous waste was observed during the audit.		CEMP Section 5.5	
19	Hazardous waste stored > 30 m of watercourses.	☒Compliant ☐Non-Compliant ☐N/A	Two portable toilets are located at the site laydown, more than 30 m away from watercourses.		CEMP Section 5.5	

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
20	Secondary containment used for all stored hazardous waste.	☐Compliant ☒Non-Compliant ☐N/A	Portable toilets were not in secondary containment.	Add secondary containment to portable toilets.	CEMP Section 3.6	
	Spill Control and Emergency Response					
21	Machinery operating in channel is equipped with environmentally friendly oil	☒Compliant ☐Non-Compliant ☐N/A	Excavator on site has a sticker confirming that it contains Environ™ biodegradable, non-toxic hydraulic fluid.		WSA (p) 4 CEMP Section 3.6	
22	Equipment and machinery are free of leaks	☒Compliant ☐Non-Compliant ☐N/A	No leaks were observed during the audit. Equipment appeared to be clean.		WSA (p) 1 CEMP Section 3.6	
23	Drip trays are available and used during refueling and equipment maintenance	☒Compliant ☐Non-Compliant ☐N/A	Drip trays are available onsite.	Place drip trays under all stationary equipment.	CEMP Section 3.6	
24	Fuel is stored > 30 m from Lagace Creeks and any connected drainages	☒Compliant ☐Non-Compliant ☐N/A			WSA (p) 3 CEMP Section 3.6	
25	Machinery and vehicles operating onsite are equipped with spill kit.	☒Compliant ☐Non-Compliant ☐N/A	Stocked spill kits were available near active work areas.		WSA (p) 2 CEMP Section 3.6	
26	Should suspected contaminated material be encountered (i.e., soil emitting olfactory cues indicative of hydrocarbon fuel), works should temporarily halt for investigation.	☒Compliant ☐Non-Compliant ☐N/A	EM reported high concentrations of sodium and some other metals and additional analysis and reporting are still pending.		CEMP Section 2.5	
27	Refuelling of machinery is conducted on level ground over a spill tray.	☒Compliant ☐Non-Compliant ☐N/A	No refuelling was observed during the audit.		CEMP Section 3.6	
	Riparian Area Management					
28	Stockpile LWD and root wads removed from channel for use in site restoration	☒Compliant ☐Non-Compliant ☐N/A	LWD is being stockpiled on site. Vegetation clearing should be limited to stations and access points only. Any riparian disturbance must be restored post-construction.		CEMP Section 3.3	Photo 6
29	Construct access points and approaches perpendicular to the watercourse;	☒Compliant ☐Non-Compliant ☐N/A			DFO FAA CEMP Section 3.2	
	Instream Works					
30	The EM shall ensure that instream works are isolated from flow and that measures are in place to protect fish and fish habitat, and to mitigate the migration of sediment downstream.	☐Compliant ☐Non-Compliant ☒N/A	No instream works during the audit inspection.		WSA (j) CEMP Section 3.1	
31	Pumps and flow bypasses are in proper working condition	☐Compliant ☐Non-Compliant ☒N/A	Pumps were not installed or operating during the audit inspection.		WSA (j) 5 CEMP Section 3.1	
32	Instream works conducted in the dry / isolation of flow	☒Compliant ☐Non-Compliant ☐N/A	Topsoil placement restricted to above the wetted channel.		WSA (o) CEMP Section 3.1.1	
	Water Quality					
33	Water quality is routinely monitored upstream and downstream of the work area, every day that instream works are occurring	☒Compliant ☐Non-Compliant ☐N/A	EM is routinely monitoring water quality.		WSA (s) CEMP Section 3.1.2	

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
	Instream water quality is compliant with provincial criteria[2]: **Turbidity**: - <8 NTU from background at any one time for a duration of 24 h in clear waters; - < 5 NTU from background when background is 8 – 50 NTU; - <10% from background when background is > 50 NTU. **pH:** 6.5-9.0					
	Fish and Wildlife Protection					
34	Full time monitoring for fish during instream works is occurring.	☒Compliant ☐Non-Compliant ☐N/A	EM is onsite full time during active works.		WSA (j) 6 CEMP Section 2.4	
35	Fish salvages are conducted in advance of instream works where required.	☐Compliant ☐Non-Compliant ☒N/A	No instream works requiring salvage during audit period.		CEMP Section 3.1 WSA (j) 6	
36	Salvaged fish are relocated back to the same watercourse in a nearby area that is not impacted by construction or removal works or its zone of influence	☐Compliant ☐Non-Compliant ☒N/A	No instream works requiring salvage during audit period.		DFO FAA Section 2.2.4	
37	Pump intakes are screened for fish and aquatic species in accordance with the "Interim code of practice: End-of-pipe fish protection screens for small water intakes in freshwater"	☐Compliant ☐Non-Compliant ☒N/A	No pumps operating.		WSA (j) 5.ii DFO FAA Section 2.4.9 CEMP Section 3.1.1	
38	Obtain required permits prior to salvage(s).	☒Compliant ☐Non-Compliant ☐N/A	EM has obtained salvage permits.		WSA (Opening) CEMP Section 3.1	
39	EM is on site during disturbance to riparian vegetation and conducting pre-clearing breeding bird surveys prior to clearing.	☒Compliant ☐Non-Compliant ☐N/A	EM is oversighting vegetation clearing.		CEMP Section 3.2	
40	Instream works are conducted so as not to lead to fish stranding or other impacts to fish. The works shall not result in depressions that have the ability to trap fish and other aquatic life. Fish passage is maintained where practicable and in accordance with applicable permits.	☒Compliant ☐Non-Compliant ☐N/A	Instream works are complete. No barriers to fish passage observed.		WSA (j) 6 (iii) WSA (u) DFO FAA Section 2.4.2 CEMP Section 3.1.1	
	Restoration Requirements					
41	Restoration plans prepared by EM for disturbed area and	☐Compliant ☒Non-Compliant ☐N/A	Site restoration is underway (i.e., seeding of bank at Stations B and C). All riparian vegetation cleared and/or	Submit a restoration plan detailing all riparian areas	WSA (w) CEMP Section 3	Photo 5 Photo 6

[2] British Columbia Ministry of Environment and Climate Change Strategy. 2024. British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture - Guideline Summary – August 2024. Water Quality Guideline Series, WQG-20. Prov. B.C., Victoria B.C. Available at: https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-guidelines/approved-wqgs/wqg_summary_aquaticlife_wildlife_agri.pdf. Accessed August 2024.

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
	implemented with EM oversight		disturbed for access must be restored upon project completion.	disturbed for instream works including access points, and proposed restoration.		
42	All temporary works shall be removed on completion of the project, and the stream channel restored to its natural condition	☒Compliant ☐Non-Compliant ☐N/A	Instream works are complete. Instream isolation has been removed. Site restoration is underway.		WSA (v) CEMP Section 3	

5 DISCUSSION

5.1 Non-Compliant Items

Knotweed management

Knotweed removal and transport of knotweed-contaminated material to offsite disposal is ongoing; the CEMP has not been updated with revised approach or the disposal location(s).

Recommended action: Provide documentation of knotweed management and ensure it adheres to approved BMPs. Provide details on alternative approach with rationale, and update documentation (e.g., CEMP).

Portable toilets without secondary containment

Two portable toilets located at the site laydown adjacent to Dale Road did not have secondary containment. Although the toilets were more than 30 m away from the watercourse, secondary containment would prevent any potential spills from spreading beyond the immediate area.

Recommended action: Add secondary containment to portable toilets.

Provide restoration plan for all disturbed riparian areas

There are several points along the riparian corridor where vegetation has been disturbed to facilitate access. All disturbed areas should be restored upon project completion.

Recommended action: Prepare a restoration plan identifying areas disturbed for instream works, including access points, and propose site-specific restoration measures.

5.2 Conditionally Compliant Items

Erosion and sediment control

Erosion and sediment control measures (e.g., silt fencing, poly sheeting) were in place but require maintenance to ensure that they continue to function effectively.

6 SUMMARY

A list of environmental issues outstanding to date is provided in Table 6-1, below.

Table 6-1 Tracking Table of Environmental Issues Outstanding to-Date (project commencement August 12, 2024)

Item #(s)	Issue	Date(s) Observed	Recommended Corrective Action(s)	Responsible Party
2	Knotweed management	August 29, 2024 September 5, 2024 September 13, 2024 September 29, 2024 September 25, 2024	Ensure that all knotweed cuttings are confined to poly sheeting. Apply herbicide to remaining stems, as appropriate. Document methodology and ensure it adheres to approved BMPs.	Contractor/EM

Item #(s)	Issue	Date(s) Observed	Recommended Corrective Action(s)	Responsible Party
3	Portable toilets without secondary containment	August 29, 2024 September 5, 2024 September 13, 2024 September 29, 2024 September 25, 2024 October 4, 2024 October 10, 2024	Add secondary containment to portable toilets.	Contractor
6	Riparian areas outside the individual sand stations have been disturbed to facilitate access to the creek.	October 10, 2024	Prepare a restoration plan for the entire project footprint (including access points)	Contractor

Note: Items marked with an asterisk (*) were reported by the EM.

7 CLOSURE

We trust that the information in this memo is sufficient for your present needs. Should you have questions, please do not hesitate to contact the undersigned.

Prepared by:

Naomi Sands, R.P.Bio.
Environmental Scientist
NS/JP

Reviewed by:

Jennifer Privé, R.P.Bio.
Manager, Environmental Sciences

Attachments:

- Site Photographs
- Table A2: Tracking Table of Resolved Non-Compliance Issues

Attachment 1: Site photographs taken during audit visit on October 10, 2024.

Photo 1: Topsoil placement at Station B 		**Photo 2: Topsoil stockpiled for placement at Station C** 
Photo 3: Silt fence around soil stockpiles needs to be keyed in properly. 		**Photo 4: Silt fence collapsing, needs maintenance** 
Photo 5: Riparian areas disturbed for access require restoration upon project completion 		**Photo 6: Riparian areas cleared / disturbed for access require restoration upon project completion** 

Table A2: Tracking Table of Resolved Non-Compliance Issues

Item #(s)	Issue	Date(s) Observed	Date Corrected	Corrective Action(s)	Responsible Party
1	Environmental monitoring reports not received daily	August 29, 2024	September 5, 2024	Monitoring reports received daily, or following morning.	EM
2	Inappropriate fish screen on pump intake	September 5, 2024	September 12, 2024	EM reports show pump intakes in mesh screen boxes. Wire mesh screen was being fitted to an additional pump intake during the audit visit.	Contractor
4	Inadequate instream isolation and failed dewatering attempts resulting in instream works conducted in the wet.	August 31, 2024 September 1, 2024 September 2, 2024 September 11, 2024 September 27, 2024 (EM reports)	October 10, 2024	Instream works are now complete	N/A
5	Stationary equipment without drip trays, or drip trays full of water	October 4, 2024	October 10, 2024	Drip trays available onsite.	Contractor

RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: October 10, 2024
Weather: Partly cloudy. High 18°C, Low 4°C.

- ***Works are being conducted outside of the least-risk window for in-stream works under the supervision and guidance of the Environmental Monitor.***
- ***Keystone Environmental undertook the following additional measures to reduce the risk of impacts to fish and fish habitat during works conducted outside the instream works least-risk window:***

- ***Erosion and Sediment Control (ESC)***
    - *A review of silt fencing surrounding exposed stockpiles at Stations E, F, I, J, K, and L was conducted by the EM. EM communicated any deficiencies to QM staff and observed maintenance activities including stapling and hammering.*
    - *During the placement of topsoil on the slopes at Stations B and C, a small earthen berm was constructed at the toe of the slope by an experienced excavator operator under the supervision and direction of the EM. This berm served to protect the water quality at those stations during topsoil placement. No mobilization of sediments downstream was observed by the EM during the topsoil placement.*
- ***Spill Response and Mitigation***
    - *Spill trays were placed under heavy machinery to prevent any spill or leakage. Spill kits were also located nearby and fully stocked with spill pads, booms, and absorbent materials.*
    - *Refuelling was conducted in a marked refuelling area that complies with the 30 m buffer around Lagace Creek.*

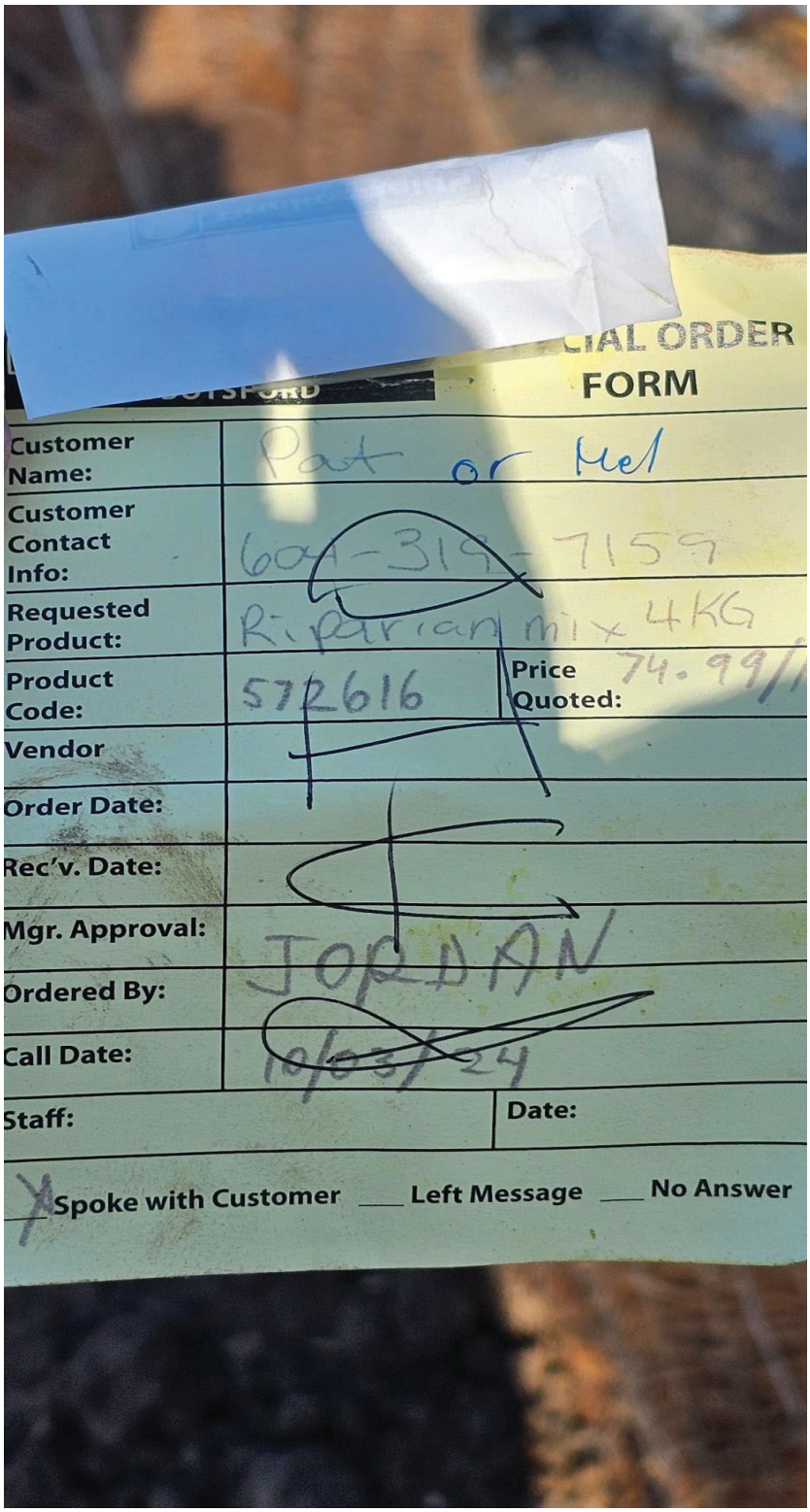
- 0705: Keystone environmental monitor on site. Bear observed approximately 650m west of the site in a farmer's field.
- 0714: Cleaning and sanitizing of excavator observed at Station B.
- 0716: Discussed day's plan with QM. Topsoil and coco mat placement, coco mat staking, seeding.
- 0814: Walking of cleaned and sanitized excavator from Station B to C observed.
- 0836: Observed loading of topsoil near Station D into dump truck.
- 0849: First load of soil delivered at Station B.
- 0902: Second load of soil delivered at Station B.
- 0922: First load of soil observed to be delivered at Station C.
- 0938: Remaining sandbags at Station B observed to be removed.
- 1106: Walking of excavator from Station C to Station B observed.

- 1108: Soil placement on exposed slopes at Station B observed.
- 1118: QM staff observed removing coarse wood from topsoil.
- 1122: Grass seed application observed at Station B.
- 1125: QM observed to be using a 4 kg bag of riparian grass seed mix from Buckerfields.
- 1138: Silt fence review prior to demobilization commenced.
- 1201: Silt fence review complete. Results communicated to QM site staff.
- 1242: Topsoil placement observed to be completed at Station B.
- 1246: Cleaning and sanitizing of excavator observed at Station B.
- 1259: Walking of cleaned and sanitized excavator from Station B to Station C observed.
- 1304: Placement of topsoil at Station C commenced.
- 1349: Placement of soil and grass seed at Station C complete.
- 1404: Preparations for culvert unearthing observed at Station L. Following excavation, culvert appeared blocked with pre-project materials. Work was determined to be out of scoped and halted.
- 1409: Silt fence repairs observed.
- 1442: Coco matting placement observed at Station C.
- 1446: Coco matting installed at Station B appeared to be staked, correctly overlapping, and extending into the water approximately 1 meter.
- 1503: Coco matting installed at Station C appeared to be staked, correctly overlapping, and extending into the water approximately 1 meter.
- 1545: Keystone EM off site.

Site Photos






FORM
Customer Name:
Pat or Mel
Customer Contact Info:
604-319-7159
Requested Product:
Riparian mix 4KG
Product Code:
572616
Price Quoted:
74.99
Vendor
Order Date:
Rec'v. Date:
Mgr. Approval:
JORDAN
Ordered By:
Call Date:
10/03/24
Staff:
Date:
X Spoke with Customer ___ Left Message ___ No Answer





TECHNICAL MEMORANDUM

Issue Date:	October 25, 2024	**File:**	Audit No. 8
To:	**Thyren Jacobs, Flood Debris Management Secretariat**	**Previous Issue Date:**	
From:	Dave Muhlert, R.B.Tech. and Naomi Sands, R.P.Bio.		
Client:	Ministry of Environment and Climate Change Strategy		
Project Name:	Lagace Creek Bank Protection and Sediment Removal - SCR14	**Project No.:**	2022-2632-03
Subject:	Environmental Compliance Audit		
Monitoring Period:	October 11 – 18, 2024		
Contractor:	QM Environmental		
Environmental Monitor:	Keystone Environmental		

1 INTRODUCTION

Associated Environmental Consultants Inc, (Associated) is pleased to provide this environmental audit report summarizing observations of site conditions, environmental protection measures, regulatory compliance, and corrective actions as part of erosion protection works on Lagace Creek, south of Durieu, BC in the Hatzic Valley (the Project, the Site) during the monitoring period October 11 to 18, 2024. The results presented in this audit report are based on conditions observed at the time of the audit inspection(s) and represent a snapshot of the workday. Items identified as non-compliant may have been addressed before the report(s) are submitted. The audit report(s) are submitted to the owner, their agent (Associated Engineering), the Contractor, and their environmental monitor (EM) and are not intended for further distribution.

2 ROLES AND RESPONSIBILITIES

The prime contractor for the Project is QM Environmental (the Contractor), and works are being monitored for environmental compliance by Keystone Environmental (Keystone) and audited by Associated. As the EM, Keystone is to work with the Contractor to develop measures to protect the environment and to respond to environmental incidents as they occur. Keystone is also responsible for fish and wildlife salvages prior to instream works. Leq'á:mel First Nation (LFN) is the cultural monitor for the Site. The responsibility of the auditor is to ensure on behalf of the owner, who is ultimately the permit holder, that the EM, LFN, and the Contractor adhere to the requirements of the Construction Environmental Monitoring Plan (CEMP)[1], environmental permit conditions and any applicable regulations.

3 SITE INSPECTION

A summary of site conditions as observed during the audit inspection completed during the monitoring period is provided in Table 3-1. No monitoring reports have been received for the audit period as there was no work on site since the previous audit.

[1] AquaTerra Environmental Ltd. 2024. Hatzic Emergency Program, South Herford Creek Project, Construction Environmental Management Plan (Rev. 1). Prepared for Mission Contractors Ltd. 65 p.

Table 3-1 Site Conditions During Audit Inspection

Date / Time	Auditor (Associated)	Weather	Construction Activities
October 18, 2024 12:46	Dave Muhlert	Overcast with light rain. 9°C.	No crews on site or work in progress during the audit.

4 INSPECTION RESULTS

A checklist of required environmental protection measures and mitigative strategies for the Project is presented in Table 4-1. The checklist has been developed in accordance with terms and conditions of the environmental permits and approvals issued for the Project, environmental protection specifications and requirements as part of the construction contract for the Project, the Contractor's Construction Environmental Management Plan and environmental best management practices and guidelines.

Table 4-1 Summary of Environmental Protection Measures Reviewed and Results of the Inspection

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
	Environmental Monitoring					
1	The EM will attend key site meetings where environmental mitigations and issues may be discussed.	☐Compliant ☐Non-Compliant ☒N/A	Contractor has completed sediment removal works and has temporarily demobilized from site until restoration.		CEMP Section 2.4	
2	The EM shall supervise all instream works. If temporary diversion installed, EM is onsite daily to check pumps and flow bypasses.	☐Compliant ☐Non-Compliant ☒N/A	Instream works are complete.		WSA (h)2.ii, (j)5.i CEMP Section 2.4	
3	The EM will submit daily and bi-weekly monitoring reports to the Contractor for distribution to MoECCS.	☐Compliant ☐Non-Compliant ☒N/A	Contractor has temporarily demobilized from site.		CEMP Section 5.1	
4	The EM will complete and submit an Environmental Incident Report (EIR) for non-compliances with the CEMP, reportable spills or other environmental incident.	☐Compliant ☐Non-Compliant ☒N/A	No reportable environmental incidents have been documented to date.		CEMP Section 4	
5	EM is granted authority to stop the work if necessary	☒Compliant ☐Non-Compliant ☐N/A	EM has the authority to stop work. No stoppages for environmental reasons were reported during the audit period.		WSA (i) 7 CEMP Section 2.4	
	Erosion and Sediment Control					
6	Appropriate site isolation is installed as required, including silt fencing prior to instream works. Silt fences are installed properly, intact, adequate, clear of accumulated sediment and are functioning.	☐Compliant ☒Non-Compliant ☐N/A	Several sediment stockpiles along riparian corridor. Silt fencing has been installed around the stockpiles but requires extensive maintenance as some sections have gaps at the bottom or have partially collapsed. Exposed slopes were covered with coconut matting.		WSA (o), (q) CEMP Section 3.5	Photo 1, Photo 2, Photo 3, Photo 4
7	Riprap or any other engineering material place in channel is clean of any substances deleterious to aquatic life.	☐Compliant ☐Non-Compliant ☒N/A			WSA (x) CEMP Section 3.5	
8	Stockpiling and storage areas are located 15 m from the watercourse TOB.	☐Compliant ☒Non-Compliant ☐N/A	Sediment stockpiles are located >15 m from the watercourse OR are surrounded by silt fencing. However, silt fence requires extensive maintenance.		DFO FAA WSA (t) CEMP Section 3.5	Photo 3
9	Emergency ESC material onsite (e.g., 100 feet of silt fencing, 5 dry bales, and 100sq.m of ECBs/ Coconut matting, or polyethylene sheets)	☐Compliant ☐Non-Compliant ☒N/A	ESC materials were installed. No ESC materials at site laydown as the site as been mostly demobilized. Access roads are still very soft/muddy.		CEMP Section 3.5	Photo 4
10	Sediment removed from the Site will be disposed of appropriately at a location approved by the EM and MoECCS.	☐Compliant ☐Non-Compliant ☒N/A	Excavated sediment is currently being stockpiled onsite. Offsite disposal location still to be determined. Stockpiled sediment at station J/K/L appears to be acting as a berm and holding a lot of water in the adjacent blueberry field	Identify sediment disposal location(s) in the CEMP and/or the environmental monitoring reports.	CEMP Section 5.5	Photo 5
11	Sediment removal boundaries must be clearly	☐Compliant ☐Non-Compliant ☒N/A	Sediment removal works are now complete.		WSA (opening)	

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
	delineated prior to commencement of work.					
	Invasive Plant Management					
12	Ensure that machinery is free of invasive plant material that could potentially be transported throughout or between sites.	☐Compliant ☐Non-Compliant ☒N/A	No machinery on site during the audit.		WSA (opening) CEMP Section 3.4	
13	Ensure that invasive species removed from site are disposed of appropriately at an approved facility	☐Compliant ☐Non-Compliant ☒N/A	Site restoration is still outstanding.	Document invasive species removal methodology including rationale for any changes in approach.	WSA (opening) CEMP Section 3.4.1	
14	The Project site shall be regularly monitored by the EM for invasive plant infestations and these infestations will be mapped and managed according to applicable species-specific BMPs.	☐Compliant ☐Non-Compliant ☒N/A	Sediment removal works are complete; site is awaiting restoration.		CEMP Section 3.4.1	
16	Knotweed stems are cut close to the ground and contained on poly sheeting away from the immediate work area. Cut knotweed is covered with woven geotextile fabric and crushed rock prior to machine access. Knotweed stems are injected with an appropriate herbicide before being covered.	☐Compliant ☒Non-Compliant ☐N/A	Knotweed management is still not adequately documented.	Update CEMP to document revised knotweed approach.	CEMP Section 3.4.1 Addendum 1 to the Contract Documents for the Hatzic Emergency Works Program - Lagace Creek – Sites S-CR-14/17	
	Waste Management					
17	Dispose of all anthropogenic debris removed at an appropriate waste management facility.	☐Compliant ☒Non-Compliant ☐N/A	Some anthropogenic debris (pallets, discarded poly sheets) was still on site.		WSA (opening) CEMP Section 5.5	Photo 6
18	Non-hazardous waste stored appropriately and removed offsite daily.	☐Compliant ☐Non-Compliant ☒N/A	Contractor has demobilized from site.		CEMP Section 5.5	
19	Hazardous waste stored > 30 m of watercourses.	☒Compliant ☐Non-Compliant ☐N/A			CEMP Section 5.5	
20	Secondary containment used for all stored hazardous waste.	☐Compliant ☐Non-Compliant ☒N/A	No hazardous waste observed during the audit. Portable toilets have been removed from the site.		CEMP Section 3.6	
	Spill Control and Emergency Response					
21	Machinery operating in channel is equipped with environmentally friendly oil	☐Compliant ☐Non-Compliant ☒N/A	No machinery on site during the audit.		WSA (p) 4 CEMP Section 3.6	
22	Equipment and machinery are free of leaks	☐Compliant ☐Non-Compliant ☒N/A	No machinery on site during the audit.		WSA (p) 1 CEMP Section 3.6	
23	Drip trays are available and used during refueling and equipment maintenance	☐Compliant ☐Non-Compliant ☒N/A			CEMP Section 3.6	

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
24	Fuel is stored > 30 m from Lagace Creeks and any connected drainages	☐Compliant ☐Non-Compliant ☒N/A	No fuel currently stored onsite.		WSA (p) 3 CEMP Section 3.6	
25	Machinery and vehicles operating onsite are equipped with spill kit.	☐Compliant ☐Non-Compliant ☒N/A	No machinery or vehicles on site.		WSA (p) 2 CEMP Section 3.6	
26	Should suspected contaminated material be encountered (i.e., soil emitting olfactory cues indicative of hydrocarbon fuel), works should temporarily halt for investigation.	☐Compliant ☐Non-Compliant ☒N/A	Sediment removal works are complete.		CEMP Section 2.5	
27	Refuelling of machinery is conducted on level ground over a spill tray.	☐Compliant ☐Non-Compliant ☒N/A	Machinery has demobilized from the site.		CEMP Section 3.6	
	Riparian Area Management					
28	Stockpile LWD and root wads removed from channel for use in site restoration	☒Compliant ☐Non-Compliant ☐N/A	LWD is being stockpiled on site. Vegetation clearing should be limited to stations and access points only. Any riparian disturbance must be restored post-construction.		CEMP Section 3.3	
29	Construct access points and approaches perpendicular to the watercourse;	☐Compliant ☐Non-Compliant ☒N/A			DFO FAA CEMP Section 3.2	
	Instream Works					
30	The EM shall ensure that instream works are isolated from flow and that measures are in place to protect fish and fish habitat, and to mitigate the migration of sediment downstream.	☐Compliant ☐Non-Compliant ☒N/A	Instream works are complete.		WSA (j) CEMP Section 3.1	
31	Pumps and flow bypasses are in proper working condition	☐Compliant ☐Non-Compliant ☒N/A	Instream works are complete.		WSA (j) 5 CEMP Section 3.1	
32	Instream works conducted in the dry / isolation of flow	☐Compliant ☐Non-Compliant ☒N/A	Instream works are complete.		WSA (o) CEMP Section 3.1.1	
	Water Quality					
33	Water quality is routinely monitored upstream and downstream of the work area, every day that instream works are occurring Instream water quality is compliant with provincial criteria[2]: **Turbidity**: - <8 NTU from background at any one time for a duration of 24 h in clear waters; - < 5 NTU from background when background is 8 – 50 NTU; - <10% from background when background is > 50 NTU. **pH:** 6.5-9.0	☐Compliant ☐Non-Compliant ☒N/A	Instream works are complete.		WSA (s) CEMP Section 3.1.2	

[2] British Columbia Ministry of Environment and Climate Change Strategy. 2024. British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture - Guideline Summary – August 2024. Water Quality Guideline Series, WQG-20. Prov. B.C., Victoria B.C. Available at: https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-guidelines/approved-wqgs/wqg_summary_aquaticlife_wildlife_agri.pdf. Accessed August 2024.

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
	Fish and Wildlife Protection					
34	Full time monitoring for fish during instream works is occurring.	☐Compliant ☐Non-Compliant ☒N/A	Instream works are complete; contractor has demobilized from site.		WSA (j) 6 CEMP Section 2.4	
35	Fish salvages are conducted in advance of instream works where required.	☐Compliant ☐Non-Compliant ☒N/A	Instream works are complete.		CEMP Section 3.1 WSA (j) 6	
36	Salvaged fish are relocated back to the same watercourse in a nearby area that is not impacted by construction or removal works or its zone of influence	☐Compliant ☐Non-Compliant ☒N/A	Instream works are complete.		DFO FAA Section 2.2.4	
37	Pump intakes are screened for fish and aquatic species in accordance with the "Interim code of practice: End-of-pipe fish protection screens for small water intakes in freshwater"	☐Compliant ☐Non-Compliant ☒N/A	Instream works are complete.		WSA (j) 5.ii DFO FAA Section 2.4.9 CEMP Section 3.1.1	
38	Obtain required permits prior to salvage(s).	☐Compliant ☐Non-Compliant ☒N/A			WSA (Opening) CEMP Section 3.1	
39	EM is on site during disturbance to riparian vegetation and conducting pre-clearing breeding bird surveys prior to clearing.	☐Compliant ☐Non-Compliant ☒N/A	Sediment removal works, including associated vegetation clearing, are complete; site is awaiting restoration.		CEMP Section 3.2	
40	Instream works are conducted so as not to lead to fish stranding or other impacts to fish. The works shall not result in depressions that have the ability to trap fish and other aquatic life. Fish passage is maintained where practicable and in accordance with applicable permits.	☒Compliant ☐Non-Compliant ☐N/A	Instream works are complete. No barriers to fish passage observed.		WSA (j) 6 (iii) WSA (u) DFO FAA Section 2.4.2 CEMP Section 3.1.1	
	Restoration Requirements					
41	Restoration plans prepared by EM for disturbed area and implemented with EM oversight	☐Compliant ☒Non-Compliant ☐N/A	Site restoration is underway (i.e., seeding of bank at Stations B and C). All riparian vegetation cleared and/or disturbed for access must be restored upon project completion.	Submit a restoration plan detailing all riparian areas disturbed for instream works including access points, and proposed restoration.	WSA (w) CEMP Section 3	
42	All temporary works shall be removed on completion of the project, and the stream channel restored to its natural condition	☒Compliant ☐Non-Compliant ☐N/A	Instream works are complete. Instream isolation has been removed. Site restoration is underway.		WSA (v) CEMP Section 3	

5 DISCUSSION

5.1 Non-Compliant Items

Erosion and sediment control

Erosion and sediment control measures (e.g., silt fencing, poly sheeting) were in place but require maintenance to ensure that they continue to function effectively.

Knotweed management

Knotweed removal and transport of knotweed-contaminated material to offsite disposal is complete; however, the CEMP has not been updated with revised approach or the disposal location(s).

Recommended action: Provide details on alternative approach with rationale, and update documentation (e.g., CEMP).

Anthropogenic debris left on site

Some anthropogenic debris (e.g., pallets, discarded poly sheets, various other small items) was still on around the laydown and access road areas.

Recommended action: Collect and disposed of leftover construction materials and other debris at an appropriate facility.

Provide restoration plan for all disturbed riparian areas

There are several points along the riparian corridor where vegetation has been disturbed to facilitate access. All disturbed areas should be restored upon project completion.

Recommended action: Prepare a restoration plan identifying areas disturbed for instream works, including access points, and propose site-specific restoration measures.

5.2 Conditionally Compliant Items

6 SUMMARY

A list of environmental issues outstanding to date is provided in Table 6-1, below.

Table 6-1 Tracking Table of Environmental Issues Outstanding to-Date (project commencement August 12, 2024)

Item #(s)	Issue	Date(s) Observed	Recommended Corrective Action(s)	Responsible Party
2	Knotweed management	August 29, 2024 September 5, 2024 September 13, 2024 September 29, 2024 September 25, 2024 October 18, 2024	Document methodology and ensure it adheres to approved BMPs.	Contractor/EM

Item #(s)	Issue	Date(s) Observed	Recommended Corrective Action(s)	Responsible Party
6	Riparian areas outside the individual sand stations have been disturbed to facilitate access to the creek.	October 10, 2024 October 18, 2024	Prepare a restoration plan for the entire project footprint (including access points)	Contractor
7	Anthropogenic debris left on site	October 18, 2024	Collect and disposed of leftover construction materials and other debris at an appropriate facility.	Contractor

Note: Items marked with an asterisk (*) were reported by the EM.

7 CLOSURE

We trust that the information in this memo is sufficient for your present needs. Should you have questions, please do not hesitate to contact the undersigned.

Prepared by:

Dave Muhlert, R.B.Tech.
Environmental Technologist
DM/NS

Reviewed by:

Naomi Sands, R.P.Bio.
Environmental Scientist

Attachments:

- Site Photographs
- Table A2: Tracking Table of Resolved Non-Compliance Issues

Attachment 1: Site photographs taken during audit visit on October 18, 2024.

Photo 1: Coco matting installed at Station B 		**Photo 2: Coco matting installed at Station C** 
Photo 3: Silt fence around soil stockpiles needs to be keyed in properly. 		**Photo 4: Wet/muddy access road** 
Photo 5: Stockpiled sediment holding water in the adjacent field 		**Photo 6: Pallets and discarded poly sheets** 

Table A2: Tracking Table of Resolved Non-Compliance Issues

Item #(s)	Issue	Date(s) Observed	Date Corrected	Corrective Action(s)	Responsible Party
1	Environmental monitoring reports not received daily	August 29, 2024	September 5, 2024	Monitoring reports received daily, or following morning.	EM
2	Inappropriate fish screen on pump intake	September 5, 2024	September 12, 2024	EM reports show pump intakes in mesh screen boxes. Wire mesh screen was being fitted to an additional pump intake during the audit visit.	Contractor
	Portable toilets without secondary containment	August 29, 2024 September 5, 2024 September 13, 2024 September 29, 2024 September 25, 2024 October 4, 2024 October 10, 2024	October 18, 2024	Portable toilets have been removed from the site.	Contractor
4	Inadequate instream isolation and failed dewatering attempts resulting in instream works conducted in the wet.	August 31, 2024 September 1, 2024 September 2, 2024 September 11, 2024 September 27, 2024 (EM reports)	October 10, 2024	Instream works are now complete	N/A
5	Stationary equipment without drip trays, or drip trays full of water	October 4, 2024	October 10, 2024	Drip trays available onsite.	Contractor

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	
Project:	Lagace Creek	**Page:**	1 of 7
Location:	Farms – Seux Roads, Fraser Valley, BC 49°13'00" N, 122°14"36" W	**Project No.:**	S-CR-215/16 2022-2632-04
Contractor:	Quantum Murphy	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	November 12, 2024
Contract No.:		**Temperature:**	High: 9 Low: -3
Weather:	Cloudy with some rain		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum: Mel, Jim, 1 Operator, 4 Labourers
Keystone: Nicole

Contractor's Equipment:
- One Excavator

Equipment in use:
- One Excavator

Report, if any, Contact with Occupants:
None Today

Contact with Owner:
Spoke to North home owner (lives next to station B):
- Asked that the trees remained bagged in case he needs to raise them so they don't die.
- Already has had tresspasers ignoring no trespassing sign.

Charlie was on site saw him speaking to Jim never engaged me.

Report:
7:00 am
- AE arrives on site.
- Mel (QM), an operator, and 4 labourers arrive on site.
- Keystone rep arrives on site.
- Spoke to Mell about live cluster staking

7:30 am
- 324 Excavator arrives on site. Noted it is filled with environmentally friendly oil.

8:00 am
- Put up construction signs on site
- Stakes arrive
- Mapple trees arrive on site
- Put spill mat under outhouses

9:30am
- Stakes soaking in bag
- Scratched stakes and confirmed theyre still alive
- Stratched trees and confirmed theyre still alive

10:00 am
- Spray painted swall outline
- Installed trees still in burlap bag as recommended by nursery

10:30 am
- Marked out cluster staking placement

11:00 am
- Raining heavily so QM took a break

12:30 pm
- Jim arrives on site
- Getting started digging swale. Only going till they hit the matting.
- Workers removing plastic left over from previous work.

1:30 pm
- Pre drilled three test holes
- Checked silt fences
- Checked existing fence post diameter and height for QM to replace

2:30 pm
- Called Peel's Nursery to confirm if the stakes had been soaked for 24hrs they had not been.

3:00 pm
- Fully submerged the stakes in water before leaving site for the day.

3:15 pm
- AE left site.

Testing:
None

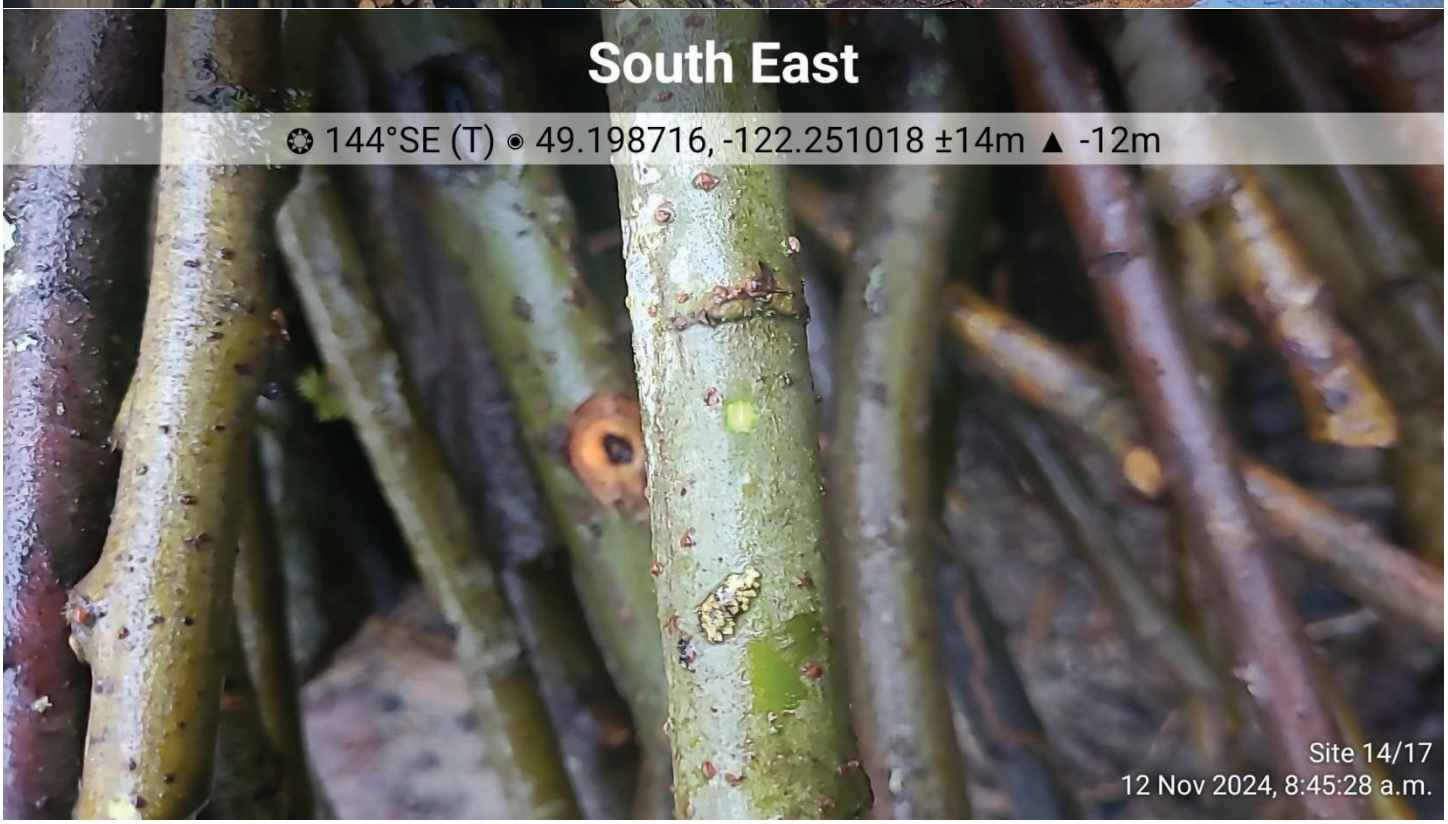
Safety Concerns
- Bear safety. Work in pairs, be aware of surroundings.
- Falling hazard as well as being hit by a vehicle. Easy to avoid by giving operators a wide area to work.

Photos:

(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Duncan McCormick





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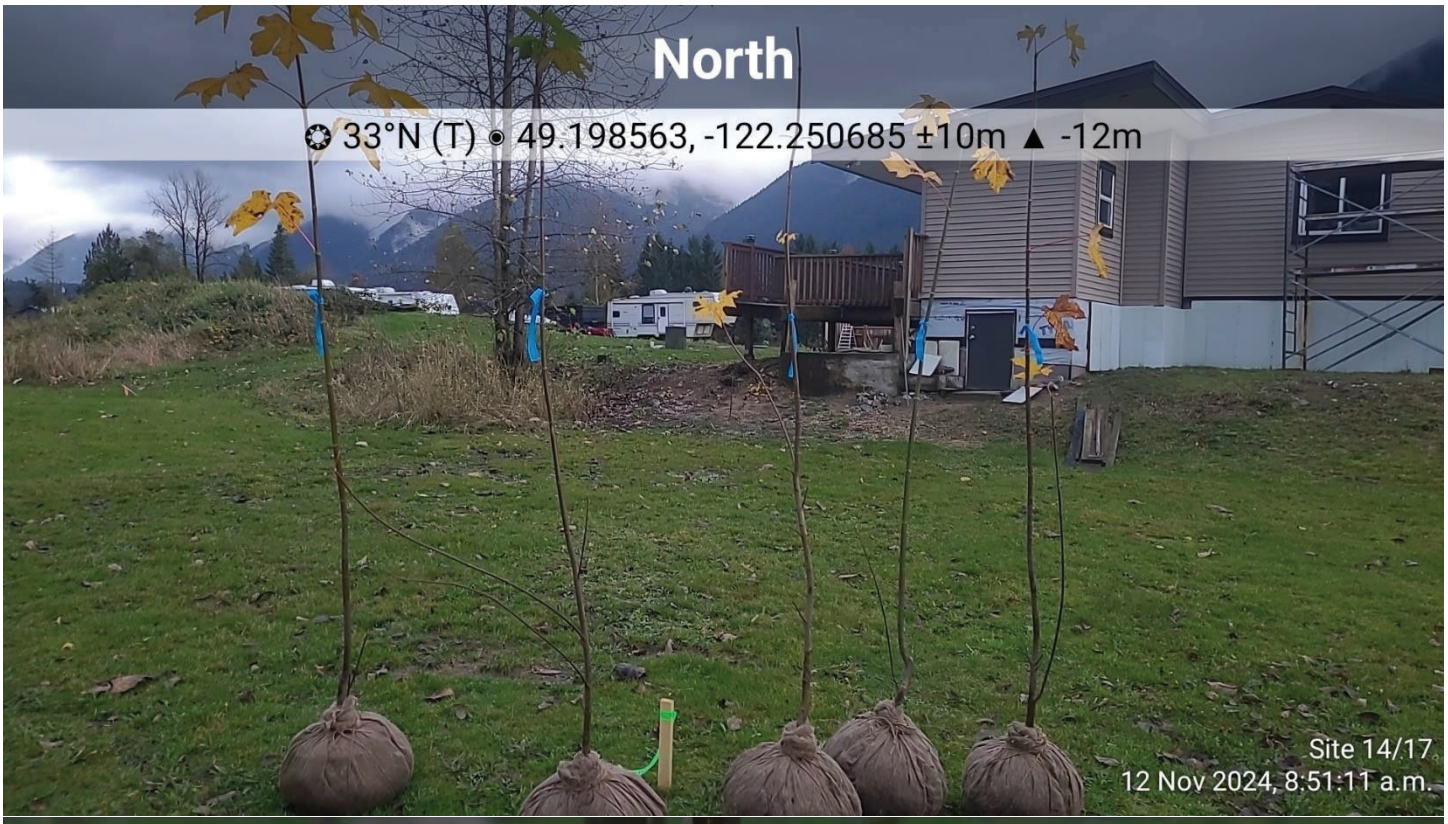
ASSOCIATED ENGINEERING REPRESENTATIVE: Duncan McCormick





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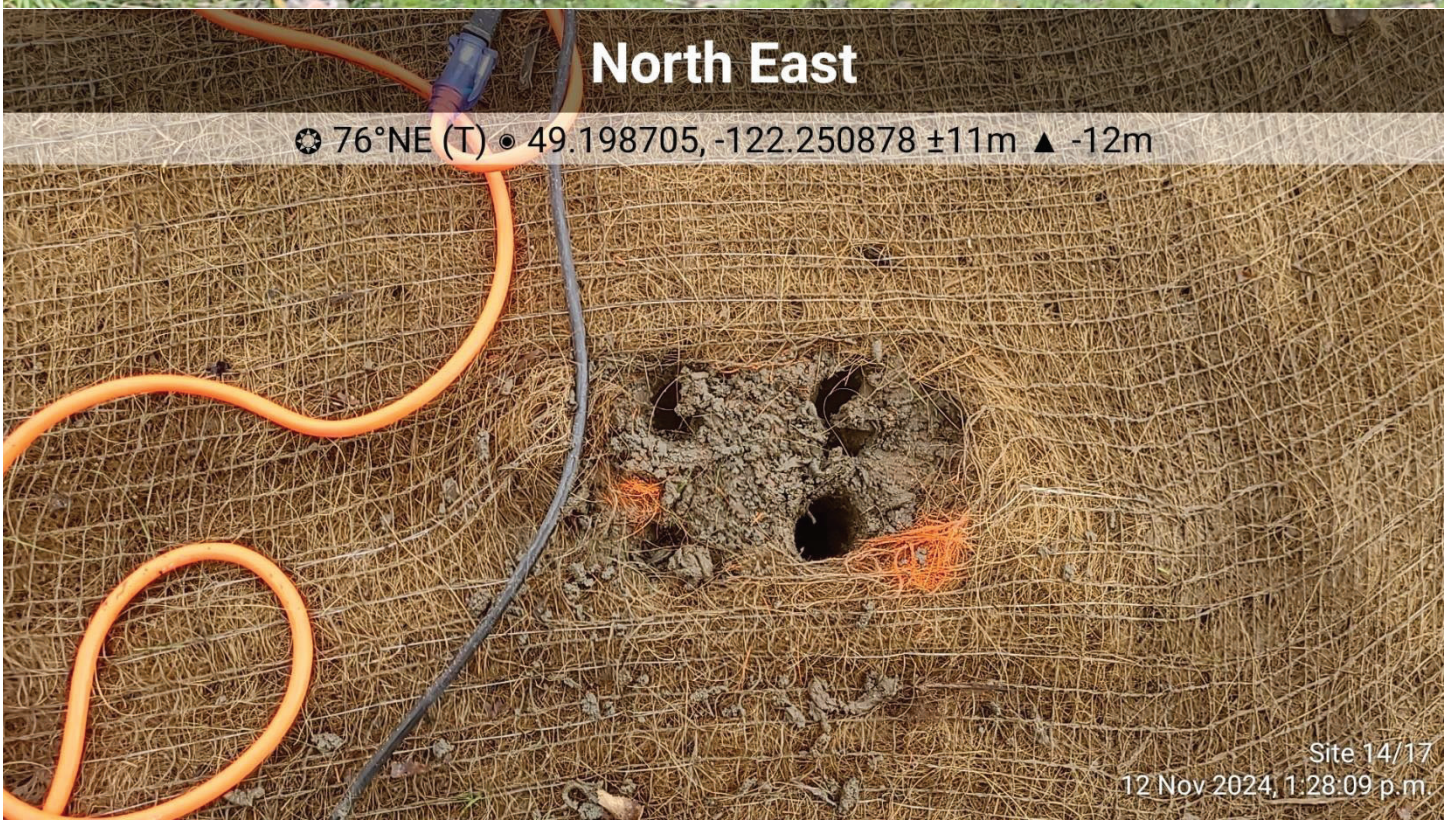
ASSOCIATED ENGINEERING REPRESENTATIVE: Duncan McCormick





(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Duncan McCormick



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Duncan McCormick



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Duncan McCormick

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: November 12, 2024
Weather: Low of 8°C, High of 13°C, overcast with periods of rain.

- 07:30: EM arrive on-Site and signed on to QM FLRA.
- 08:45: Red-osier Dogwood stakes and five big leaf maples arrive on-Site.
    - Species and size were confirmed to meet specifications.
- 09:00: Porta potties were delivered and placed within secondary containment.
- 09:25: Red-osier dogwood stakes were left to soak in Legace Creek at B3.
    - Stakes are to soak for 24 hours prior to planting.
- 09:45: Holes were dug for big leaf maples and the trees were placed inside.
    - Locations were confirmed to be accurate to planting plan.
- 10:40: Locations of red-osier dogwood stake clusters were delineated with spray paint in B and B2.
- 12:35-12:45: Small swale was dug in roadway to aid in drainage.
- 13:00-13:45: Repair damaged and fallen silt fencing near Stations J, K and L.
- 14:00: QM crew and EM leave site for the day.

Site Photos






PIT STOP
2024-11-12 10:50 a.m.


2024-11-12 9:25 a.m.


2024-11-12 12:36 p.m.


2024-11-12 12:49 p.m.


2024-11-12 1:28 p.m.


2024-11-12 10:47 a.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	
Project:	Lagace Creek	**Page:**	1 of 7
Location:	Farms – Seux Roads, Fraser Valley, BC 49°13'00" N, 122°14"36" W	**Project No.:**	S-CR-215/16 2022-2632-04
Contractor:	Quantum Murphy	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	November 13, 2024
Contract No.:		**Temperature:**	High: 9 Low: -3
Weather:	Rain		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum: Mel, Jim, 1 Operator, 4 Labourers
Keystone: Nicole

Contractor's Equipment:
- One Excavator

Equipment in use:
- One Excavator

Report, if any, Contact with Occupants:
None Today

Contact with Owner:
Spoke to Charlie:
- Dirt needs to go so he can bring his sprayer in
- Reiteratied that he would like someone to look into removing the beaver dam as well as clearing up the vegetation in the creek north of dougs property
- Still would like the sediment
- Road needs to be repaired

Doug spoke to contractor over phone:
- Said the swale repair was good enough he plans to raise the entire area up anyways.

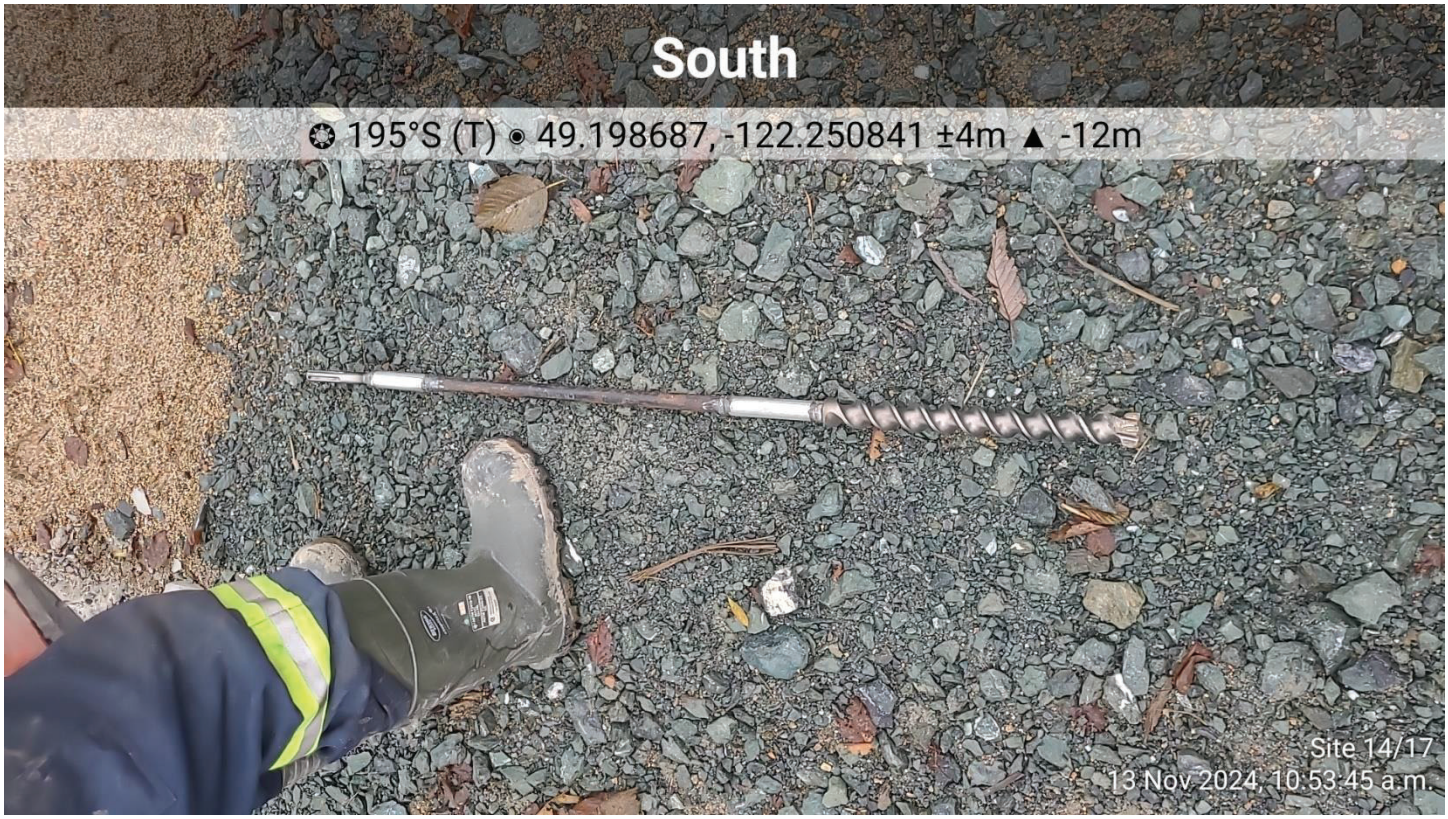
Report:
- QM did around 5 test installs of stakes in the bank before their drill bit broke
- Repaired turbidity gates
- Tried to locate Charlies culvert which was clogged located one end which was jammed couldn't find the other
- Measured fence to repair
- Mapple trees installed by QM are now underwater.

Testing:
Keystone did turbidity tests when water was disturbed.

Safety Concerns

- Bear safety. Work in pairs, be aware of surroundings.
- Falling hazard as well as being hit by a vehicle. Easy to avoid by giving operators a wide area to work.

Photos:



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Duncan McCormick



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Duncan McCormick



(If necessary, continue report on another sheet.)

ASSOCIATED ENGINEERING REPRESENTATIVE: Duncan McCormick

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: November 13, 2024
Weather: Low of 6°C, High of 9°C, with rain throughout the day.

- 07:00 AM: EM arrived on-Site at SCR 14.
    - Standby waiting for QM personnel to arrive.
- 07:40 AM: QM personnel arrived on-Site.
- 07:50 AM: Quick tailgate meeting held to discuss the scope of work and basic Site safety.
- 08:00 AM: EM observed multiple bundles of Dogwood stakes soaking overnight at Station B-3.
    - Only the bottom bundle was available for use, as other stakes had not yet soaked for 24 hours.
    - Excavator parked overnight at Station B-3 was observed with a deployed drip tray, and no notable spillage or leakage.
- 08:05 AM: Coco mattings at Stations B-3, B-2, and C-2 were in good condition, with no visible erosion or runoff despite heavy rainfall the previous night.
- 08:20 AM: Excavator began grading the temporary gravel road on the north side of Station B-2 to reestablish the drainage swale.
    - No notable sediment erosion or runoff was observed.
    - Road grading work was completed by 08:40 AM.
- 09:15 AM: Due to Japanese knotweed growth at Stations B-3 and B-2, excess soil was removed from the excavator before mobilizing to other stations to prevent the potential spread of knotweed. Shovels used to clean the excavator were also cleaned prior to removal from these stations.
- 10:50 AM: Extended drill bit for Dogwood stake installation arrived on-Site.
- 10:55 AM: Sandbags were observed instream by Station B-3, likely left from previous channel maintenance work in September. Due to high water levels, QM personnel could not retrieve the sandbags; they will be removed once water levels subside.
- 11:00 AM: QM personnel began installing Dogwood stakes at Station B-2. EM verified the number and orientation of stakes according to the planting plan.

  - The generator powering the hammer drill was placed on a spill tray to prevent hydrocarbon release into Legace Creek; no spillage or leakage was observed.

- 11:10 AM: Minor turbidity bloom observed at Station B-3 due to QM personnel retrieving the Dogwood stake bundles from soaking. EM collected a background sample at Station B-1 (6.29 NTU) and compared it to downstream Station C (7.01 NTU), confirming compliant turbidity levels and that the removal of Dogwood stakes did not impact downstream water quality.
- 11:50 AM: Extended drill bit broke, halting further planting work for the day.
- 12:10 PM: QM personnel began removing fences across Stations D and E at the property owner's request.
- 12:57 PM: QM personnel attempted to unblock a culvert by Station K to drain the farmer's field. However, debris and sediment build-up prevented full access to the culvert gate.
- 13:45 PM: Multiple sections of silt fencing around sand stockpiles at Stations K, J, and I were observed to be deficient, with the bottom lifted from the ground. EM instructed QM personnel to bury the bottom of the silt fencing to contain sediment runoff within the farm property and prevent discharge into Legace Creek.
- 14:10 PM: Silt curtain left on the farm property was removed from the Site.
- 14:45 PM: Work stopped for the day.
- 15:00 PM: EM left the Site.
- Water Quality Sampling Results:

Location	**Time**	**Turbidity (NTU)**
Station B-1 (Background for Station B-3)	11:05	6.29
Station C (Downstream measurement for Station B-3)	11:15	7.01
Station C (Downstream measurement for Station B-3)	11:25	6.87

Site Photos






2024-11-13 8:03 a.m.


HILTI
United Rentals
2024-11-13 10:55 a.m.


2024-11-13 11:03 a.m.


FINNING
324E
2024-11-13 9:16 a.m.


2024-11-13 1:20 p.m.


2024-11-13 8:25 a.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	
Project:	Lagace Creek	**Page:**	1 of 7
Location:	Farms – Seux Roads, Fraser Valley, BC 49°13'00" N, 122°14"36" W	**Project No.:**	S-CR-215/16 2022-2632-04
Contractor:	Quantum Murphy	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	November 13, 2024
Contract No.:		**Temperature:**	High: 9 Low: -3
Weather:	Rain		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum: Mel, Jim, 1 Operator, 4 Labourers
Keystone: Loc

Contractor's Equipment:
- One Excavator

Equipment in use:
- One Excavator

Report, if any, Contact with Occupants:
None Today

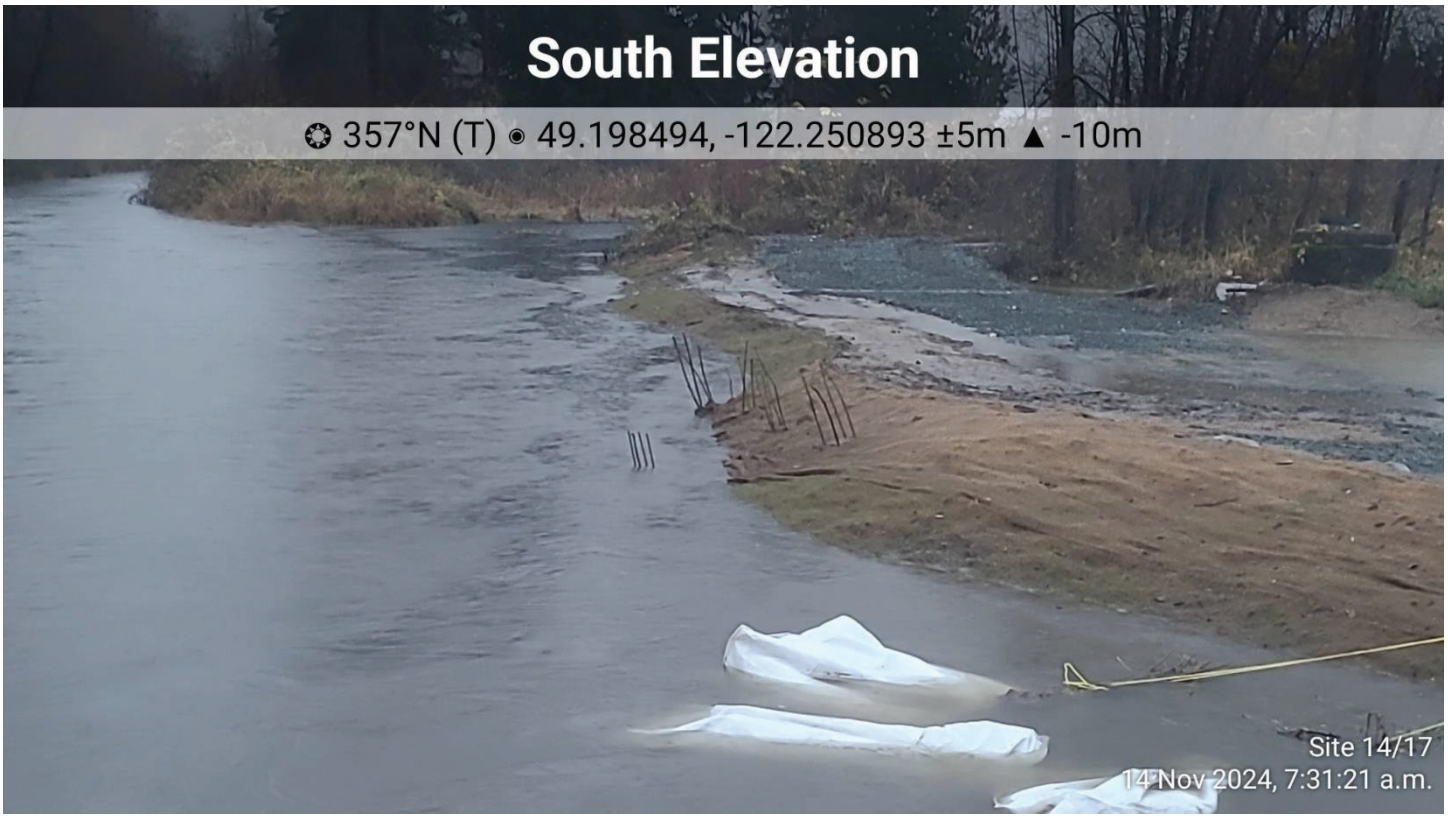
Contact with Owner:
- None

Report:
- Keystone Identified oilspill which was cleaned up with a spill rag
- Fully soaked stakes
- Installed 17 clusters of 4 stakes
- Installed silt curtain around sediment pile which didn't have one.
- Fully submerged stakes again

Testing:

Safety Concerns
- Bear safety. Work in pairs, be aware of surroundings.
- Falling hazard as well as being hit by a vehicle. Easy to avoid by giving operators a wide area to work.

Photos:



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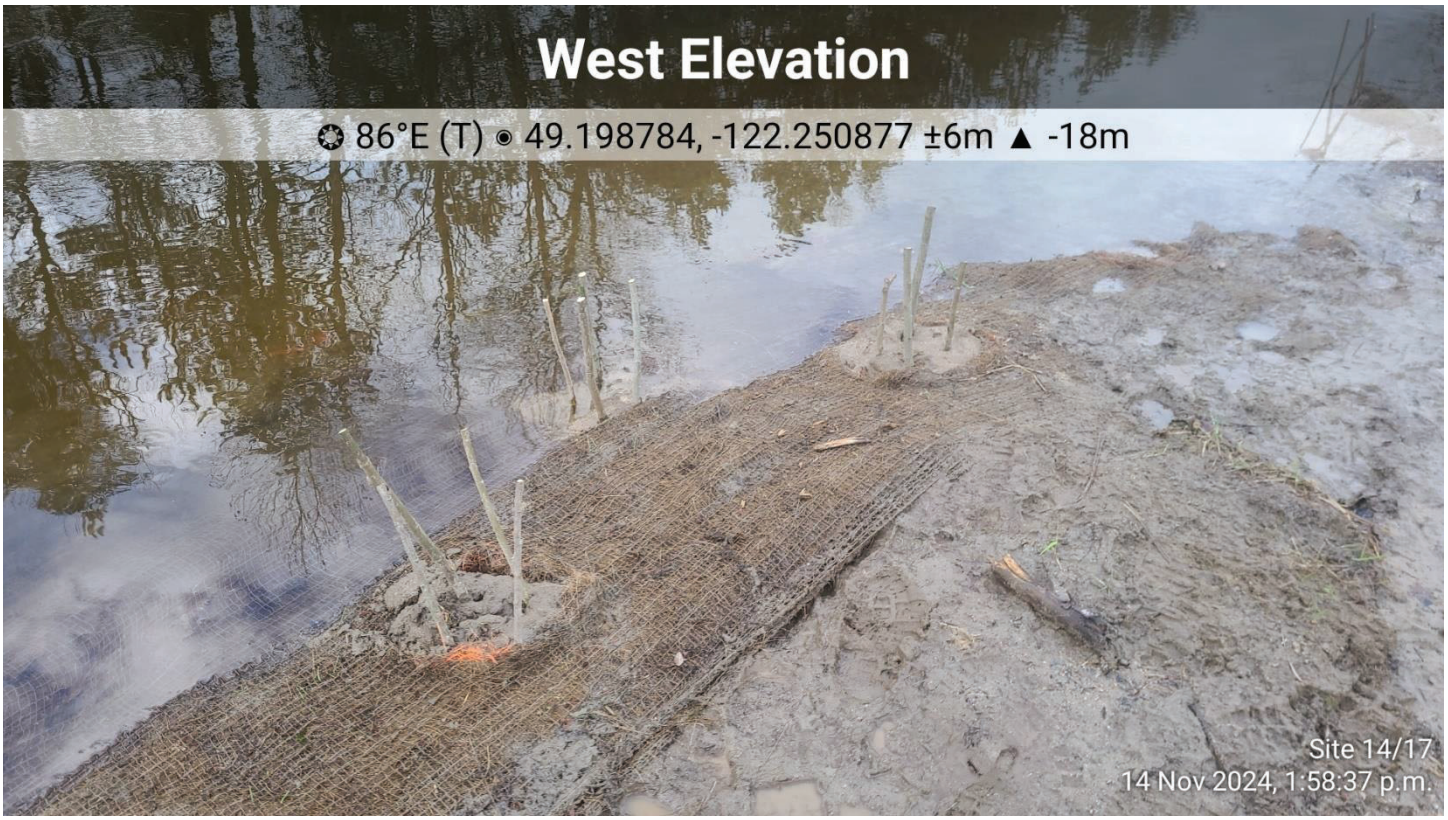
ASSOCIATED ENGINEERING REPRESENTATIVE: Duncan McCormick





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ASSOCIATED ENGINEERING REPRESENTATIVE: Duncan McCormick

RESPOND. RECLAIM. RENEW.

Keystone Environmental
Knowledge-Driven Results

Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14 & 17
Environmental Monitoring Report

Date: November 14, 2024
Weather: Low of 6°C, High of 10°C, with rain in the morning and overcast in the afternoon.

- 07:15 AM: EM arrived on-Site at SCR 14.
    - Standby waiting for QM personnel to arrive.
- 07:20 AM: QM personnel arrived on-Site.
- 07:25 AM: Quick tailgate meeting held to discuss the scope of work and basic Site safety.
- 07:28 AM: Excavator observed without spill tray in place. EM notified QM Site Superintendent. Issue was resolved at 11:34
- 07:40 AM: EM observed multiple bundles of Dogwood stakes soaking overnight at Station B-3.
- 08:20 AM: Coco mattings at Stations B-3, B-2, and C-2 were in good condition, with no visible erosion or runoff. Drilling commenced at station B-2.
- 08:28 AM: Water Quality was conducted. See WQ Table below.
    - Minor plume observed during Dogwood stakes installation. Turbidity readings were taken at station B (Background) and downstream from active work area, confirming compliant turbidity level.
- 09:00 AM: Stakes were installed as per planting plant.
- 09:28 AM: Drill broke down. QM personnel worked on retrieving the broken part from the hole.
- 10:00 AM: Coffee break
- 11:34 AM: Parked excavator observed with spill tray in place.
- 12:22 AM: QM resumed work. Bundles of Dogwood stakes were secured.
- 12:41 AM: Excavator moved the garbage bin to the area in proximity to Station C-2.
- 13:34 PM: QM personnel reinstated silt fences at station E and installed additional ones around the sand stockpile to prevent potential sediment laden runoff into Lagace Creek.
- 13:45 PM: Fuel sheen observed on the road surface at station C-2. EM notified QM immediately. Issue was resolved on Site.
- 14:15 PM: EM conducted final inspection. Excavator observed with spill tray in place.
- 14:41 PM: End of day. EM left Site.

- Water Quality Sampling Results:

Location	Time	Turbidity (NTU)
Station B (Background for Station B-3)	08:21	11.50
Downstream of Station B-3 (Compliant station)	08:30	16.6

Site Photos




November 14, 2024 2:02 p.m.


November 14, 2024 2:28 p.m.


November 14, 2024 1:51 p.m.


November 14, 2024 8:33 a.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	
Project:	Lagace Creek	**Page:**	1 of 7
Location:	Farms – Seux Roads, Fraser Valley, BC 49°13'00" N, 122°14"36" W	**Project No.:**	S-CR-215/16 2022-2632-04
Contractor:	Quantum Murphy	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	November 13, 2024
Contract No.:		**Temperature:**	High: 9 Low: -3
Weather:	Cloudy		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Quantum: Mel, Jim, 3 Labourers
Keystone: Loc

Contractor's Equipment:
- One Excavator

Equipment in use:
- One Excavator

Report, if any, Contact with Occupants:
None Today

Contact with Owner:
- None

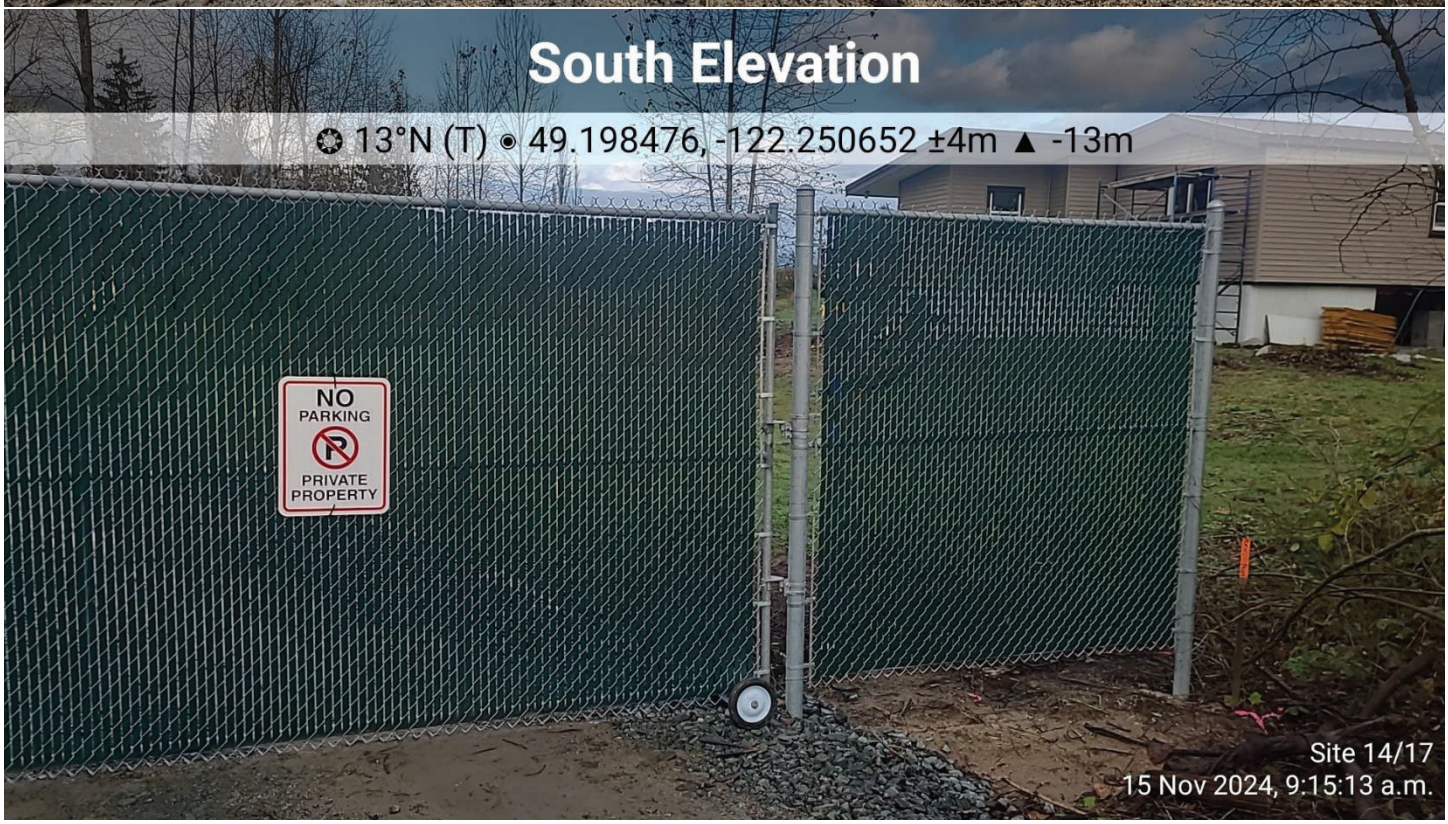
Report:
- Resubmerged stakes
- Repaired silt curtain at station F
- QM said they repaired Blueberry posts upon inspection I didn't find any repaired but found some still damaged
- Installed another joint on fence gates leading to station B
- Removed garbge and turbidity curtain from site
- Left site Mel to monitor water levels for when work can resume

Testing:

Safety Concerns
- Bear safety. Work in pairs, be aware of surroundings.
- Falling hazard as well as being hit by a vehicle. Easy to avoid by giving operators a wide area to work.

Photos:





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ASSOCIATED ENGINEERING REPRESENTATIVE: Duncan McCormick

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment and Climate Change Strategy	**Report No.:**	
Project:	Haztic Flood Mitigation – SCR 14/17	**Page:**	1 of 3
Location:	Farms Road	**Project No.:**	2022-2632-03
Contractor:	Quantum Murphy	**File No.:**	
Contract:		**Date:**	November 22, 2024
Contract No.:		**Temperature:**	High: 6 Low: 3
Weather:	Rain, cloudy		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Labour Force: Mel, Jim, 2 labourers

Contractor's Equipment: 1 Excavator

Report:

Work focused on installing live clusters.

QM inquired if AE would like to install more than the initially planned 25 live clusters on the north side of the Dale Road Bridge. QM explained that the lower water level has revealed additional surface area, which was not accounted for when Duncan determined the number of clusters. Carrie advised that additional live clusters could be installed if the newly exposed surface area allows and if the installation meets design specifications.

After completing the installation of live clusters, the contractor proposed beginning dense live staking at Site 1. However, the Environmental Monitor (EM) reviewed the specifications and noted that the current water level is too high for dense live staking. EM also mentioned that this is his first time reviewing the specifications for dense live staking. He will consult with his supervisor to discuss about dense live staking specifications.

In the meantime, QM plans to be on-site tomorrow to use hydrovac equipment to expose the culvert on the opposite side of Site 2. If the EM determines that dense live staking can proceed tomorrow, the work will commence. Otherwise, it will be rescheduled for Monday.





Photo 1: Hauling stockpiled materials off-site.





Photo 2: Dead salmons





Photo 3: Reinstating fence.

Jordon Rozon

From: Loc Ngo <lngo@keystoneenvironmental.ca>
Sent: November 24, 2024 9:34 PM
To: Nicholas Doucette
Cc: Greg Clease; Mel Murray; Warren Appleton; Jeff Prowse; Corbin Manson; Vinson Yau; John Choi
Subject: RE: 19279 - Lower Lagace Creek SCR 14 Environmental Monitoring Summary - 241122
Attachments: 241122 LN.pdf

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Hello Nick,

After carefully review my field note (see attached field note), I would like to clarify that line as below:

14:40-15:30: EM assessed Site 1,2, 3 for dense staking. Work was temporarily stopped as water level still was relatively high. EM will discuss with KEL PM.

To my understanding, dense staking was temporarily on hold while I conducted the assessment with AE's representative. At that time, I had not discussed with Jeff on the water level nor the dense staking specs so "high water levels" was likely my professional comment. After debriefing with Jeff at the end of workday, we agreed that the water level has decreased by a good amount comparing to last week.

Hope this will answer your question.

Kindly Regards,

Loc Ngo

Loc Ngo
Field Biologist
T: 604-430-0671 | **C:** 604-347-7115 | **E:** lngo@keystoneenvironmental.ca

Keystone Environmental
Knowledge-Driven Results

Great Place To Work. Certified

From: Nicholas Doucette <Nicholas.Doucette@QMenv.com>
Sent: November 24, 2024 6:16 PM

To: Loc Ngo <lngo@keystoneenvironmental.ca>
Cc: Greg Clease <Greg.Clease@QMenv.com>; Mel Murray <Mel.Murray@QMenv.com>; Warren Appleton <wappleton@keystoneenvironmental.ca>; Jeff Prowse <jprowse@keystoneenvironmental.ca>; Corbin Manson <cmanson@keystoneenvironmental.ca>; Vinson Yau <vyau@keystoneenvironmental.ca>; John Choi <jchoi@keystoneenvironmental.ca>
Subject: RE: 19279 - Lower Lagace Creek SCR 14 Environmental Monitoring Summary - 241122

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Hi Loc,

For this report, your note for 15:30 states that that work was stopped due to high water levels, can you please clarify this note which conflicts with your notes below on vegetation and the notes provided by Jeff yesterday.

Thank you,
Nick

Nicholas Doucette | Vice President, Special Projects & New Markets
C: 250.893.8671 | F: 416.253.6699 | Nicholas.Doucette@QMenv.com

QM Environmental
200-5035 South Service Road, Burlington, ON L7L 6M9
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24/7 Emergency Response 1.877.378.7745
Holiday Hours:
FULL SHUT DOWN - December 25, 2024 December 26, 2024 and January 1, 2025
REDUCED OPERATION - December 24, 2024 - January 1, 2025.
Emergency Response Line will remain open 24/7

The information contained in this email message is privileged and confidential, intended for the person to whom it is addressed. If you have received this email in error, please forward it to Information.Technology@QMenv.com and delete the message from your system.

From: Loc Ngo <lngo@keystoneenvironmental.ca>
Sent: November 22, 2024 9:45 PM
To: Nicholas Doucette <Nicholas.Doucette@QMenv.com>
Cc: Greg Clease <Greg.Clease@QMenv.com>; Mel Murray <Mel.Murray@QMenv.com>; Warren Appleton <wappleton@keystoneenvironmental.ca>; Jeff Prowse <jprowse@keystoneenvironmental.ca>; Corbin Manson <cmanson@keystoneenvironmental.ca>; Vinson Yau <vyau@keystoneenvironmental.ca>; John Choi <jchoi@keystoneenvironmental.ca>
Subject: 19279 - Lower Lagace Creek SCR 14 Environmental Monitoring Summary - 241122

Caution: This email originated from outside our organization. Please do not click links or open attachments, unless you recognize the source of this email. When in doubt, please contact Helpdesk.

Hi Nick,

Please find the summary of the Site visit conducted by Keystone Environmental.

Date: November 22, 2024
Environmental Monitor: Loc Ngo
Weather: Low of 5°C, High of 12°C, overcast with periods of rain.

Environmental Monitoring Activities:

- **07:30:** EM arrive on-Site.
- **08:00**: QM crew arrived on-Site.
- **08:34:** AE personnel arrived on Site.
- **10:00:** Access road repair using sediment stockpile at station E commenced. EM inspected the silt fencing on the east side of the stockpile, and it remained intact. Sediment laden water was not observed entering the Creek.
- **10:30:** Access road repair at station E completed.
- **10:40:** QM commenced installing live cluster staking from Station B-B3.
- **10:46:** Farmer met up with QM representative and KEL EM to discuss on the damage irrigation pipeline.
- **11:00:** QM commenced drilling and live staking installation.
- **11:20-11:40:** KEL EM collected (3) soil samples. QM personnel delivered hose samples to CAROS lab in Burnaby. The sample was submitted at ~13:00.
- **13:35:** Live staking (cluster) work completed. A total 32 clusters of Red-osier Dogwood stakes were installed from station B-B3.
- **15:30:** EM visiting Site 1, 2 and 3 for Dense Staking work scope. The Creek's water level was high with limited areas to work with. Hence, dense staking work was stopped temporarily until the Creek's water level goes down.
- **16:00:** EM inspected the Site before end of day.
- **16:30:** EM debriefed with KEL PM.
- **17:00:** EM left Site.

Regarding the **Dense Staking Specs**, KEL comments and rationales are provided below:

3.1.5 - Apply this treatment along the toe of the creek banks slopes, in locations shown on drawing C-3104, where the channel margin is unvegetated. Width of treatment will be selected in the field and depends on site characteristics. Install stakes from the waters edge up the bank to a maximum of 4 m (horizontal) width.
3.1.6. - Do not install cuttings where vegetation is growing.
3.1.14 - Do not disturb or damage existing native wood vegetation growing in treatment area.
3.1.15 - Install live stakes in and around existing native woody vegetation, adjust treatment specifications in the field as necessary to avoid woody vegetation.

Utilizing these specs, the only location on drawing C-3104 that meets these requirements is Site 1. Sites 2 and 3 were not disturbed by the sediment removal works in 2024.

For Water Management:

Do not discharge any water to the watercourse that does not meet BC Water Quality Guidelines. Turbid water that exists on the access road or is generated by restoration works cannot be pumped into the watercourse.

Please let me know if you have any questions or concerns.

Thank you,

Keystone Environmental
Knowledge-Driven Results

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Loc Ngo
Field Biologist
T: 604-430-0671 | **C:** 604-347-7115 |
E: lngo@keystoneenvironmental.ca
320-4400 Dominion Street | Burnaby, BC V5G 4G3

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November 22, 2024 1:35 p.m.


November 22, 2024 3:37 p.m.


November 22, 2024 3:33 p.m.


November 22, 2024 2:42 p.m.


November 22, 2024 3:12 p.m.


November 22, 2024 10:26 a.m.


November 22, 2024 3:32 p.m.


November 22, 2024 10:11 a.m.


November 22, 2024 3:37 p.m.

19279 LagaceGeek EM 241122 LN
In: 0730 6°C; Rainy
Out: 1700

0720 EM arrived on Site.
0804 Site Super intendent - Mel, arrived on Site.
↳ ~~Stand~~ On standby to wait for the team to arrive.

Workplan:
Station E → Sand → Build access
↳ hauling Sand at station F & E to cut.
~~a new stockpile~~ (cause F & E are clean).
other stockpile at Station L → G.
↳ will be hauled to new stockpile location for easy rock truck

Moving sands at station L → G → Access for ~~rock~~ vac truck

Question for Jeff: vaccum material in front of

10:00 am	Jim commenced sand movement of station E to create access to station F.
1030	Access road repair at E completed
1040	QM started laying out Stakes at station B → B_2 → in prep for drilling
1046	Farmer showed up & showed QM & KEL representative the location of the Culvert Inlet. Sheen was observed on the road surface at the aless road by Dale Rd → EM determined the source was from the farmer equipment EM observed leakage from farmer machine.
11:00	QM commenced drilling & stakes installations

R.D. PENHALL LTD. MADE IN VANCOUVER, CANADA
DUKSBAK WATERPROOF

Scanned with CamScanner

11:20	EM collected soil sampling
1137	EM completed sample collecting ↳ QM deliver samples to Caro's Lab in Burnaby.
1200	Lunch Break
1300	Resume work.
1335	A total of 32 cluster (of 4) of Dogwood Stakes were installed from B → B3 bank area.
1440	EM checking Site 2, 1 & 3 for Dense Staking ↳ Discuss with PM., need clarification?
15:05	EM check Site 1, 2, 3.
16:00	EM did a Site inspection & EOD
1700	EM left site.

Jordon Rozon

From: Corbin Manson <cmanson@keystoneenvironmental.ca>
Sent: November 24, 2024 11:36 AM
To: Nicholas Doucette
Cc: Greg Clease; Mel Murray; Warren Appleton; Jeff Prowse; Vinson Yau; John Choi; Loc Ngo
Subject: 19279 - Lower Lagace Creek SCR 14 Environmental Monitoring Summary - 241123
Attachments: 20241123_115151.jpg; 20241123_090514.jpg; 20241123_104638.jpg; 20241123_113232.jpg

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Hi Nick,

Please find the summary of the Site visit conducted by Keystone Environmental.

Date: November 23, 2024
Environmental Monitor: Corbin Manson
Weather: Cloudy, high of 9°C.

Environmental Monitoring Activities:

- **0800:** EM on site, discussed plans for the day with QM.
  - Installing dense stakes at Site 1,
  - Hydroexcavation at the culvert inlet near station K,
  - No planting planned for Sites 2 & 3,
- **0845**: Stake installation at Site 1 commenced under EM supervision. Stakes were laid out to be installed from the water's edge to 4 m back from the water's edge,
- **0930:** Vacuum truck observed arriving on Site, installing wheel chains,
- **1010:** Vacuum truck observed moving to Station J,
- **1023:** The EM directed QM staff to hydroexcavate standing water at the culvert inlet to prevent turbid water from being discharged to the stream,
  - QM proposed to discharge the hydroexcavation water to an area isolated from stream flow and protected to the west with a berm, and north and south with silt fences,
  - The EM inspected the proposed discharge site and found it met the criteria of containing water without discharging it to the stream,
- **1041:** Hydroexcavation commenced,
- **1054:** The EM observed QM staff building up a berm with hand tools to prevent floodwater from entering the unearthed culvert inlet,
- **1114:** Culvert inlet fully exposed, minimal flows observed entering the culvert.
- **1148:** Hydrovac discharge was observed being detained in a pool isolated from streamflow.
- **1152:** Hydrovac discharge ceased. All water observed to be detained in isolation from streamflow.
- **1230:** Most works ceased for the day. QM requested the EM stay on site while QM consulted with the neighboring homeowner.
- **1330:** EM off site.

Thank you for your patience regarding the submission of this daily report. Should you require more information or have any questions, please contact the number listed below.

Best,

Keystone Environmental
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Corbin Manson B.Sc., R.P. Bio, CESCL
Biologist
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E: cmanson@keystoneenvironmental.ca
320-4400 Dominion Street | Burnaby, BC V5G 4G3

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November 23, 2024 9:05 a.m.


November 23, 2024 10:46 a.m.


November 23, 2024 11:32 a.m.


A-97905
November 23, 2024 11:51 a.m.

Jordon Rozon

From: Loc Ngo <lngo@keystoneenvironmental.ca>
Sent: November 25, 2024 9:39 PM
To: Nicholas Doucette
Cc: Greg Clease; Mel Murray; Warren Appleton; Jeff Prowse; Vinson Yau; John Choi; Corbin Manson
Subject: 19279 - Lower Lagace Creek SCR 14 Environmental Monitoring Summary - 241125
Attachments: Silt fence was installed to prevent potential runoff at station C2.jpg; Site 1 - Location 1.jpg; Site 1 - Location 2.jpg; Site 1 - Location 3.jpg; Spill tray was in place at the end of work day.jpg; View of seiment hauling work.jpg; View of silt fence condition at Station L.jpg

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Hi Nick,

Please find the summary of the Site visit conducted by Keystone Environmental.

Date: November 25, 2024

Environmental Monitor: Loc Ngo
Weather: Overcast with periods of light rain, 4 - 8 °C.

Environmental Monitoring Activities:

- **0730:** EM on site, discussed plans for the day with QM.
  - Continue installing dense stakes at Site 1 (Location 1,2 and 3, See attached pictures).
  - Sand hauling using 2 Morookas from station L to the main access road and station C2 in preparation or truck hauling.
  - Dense stakes installation on Site 2 when Site 1 is completed.
- **0800**: EM inspected 2 Morookas. Grease and/or fuel spillage were not observed.
- **0830**: Stake installation at Site 1 commenced under EM supervision.
- **0845:** Sand hauling work commenced. Approximately ~200 m3 of sand materials were hauled to the field main access road.
- **0900:** EM discussed with QM to ensure all refueling activities will be occurring at the designated area, at least 30m away from the watercourse.
- **0945:** Clarification from AE:

    - Willow stakes can be installed in vegetated area, as long as it is not native and under EM supervision.
    - Area of dense staking is from the toe of bank (water level) to the Top of Bank (TOB). It appeared that the current installed stakes at Site 1 – Location 1 was above the TOB. QM will install additional stakes on the accessible and exposed slope area.
- **1014:** EM received comment from AE on the top part of the clusters at station B-B3. The specs indicated the top length should be max at 200mm. Current measurement yielded 400-600mm. EM communicated the issue to QM. QM personnels were dispatched to resolve the issue. The issue was resolved at ~**1120**.
- **1100:** EM received comment on AE on the area of Site 1. The provided location map was not geo referenced. EM discussed with KEL PM and Keystone had sent a request to QM to have AE representative ground-truth the designed work area or providing Keystone and QM with a geo reference pdf file for confirmation.
- **1200:** Lunch break
- **1203:** EM and AE walked to station L to inspect the area. Silt fencing along the creek required reinforcement at some sections. The issue was communicated to QM representative.
- **1230:** Work resume
- **1253:** QM tried drilling in the vegetated area at Site 1 – Location 2 (covered with Reed canary grass). The core got caught up with the vegetation. QM then came back to Site 1- Location 1 to install more stakes along the slope.
- **1255:** EM discussed with KEL PM regarding the request to have a geo reference map ready to confirm QM had covered the work area.
- **1331:** EM discussed with QM representative on giving ~200m3 of sand material to the farmer as AE response was " The materials are not suitable for building road; all remaining sand materials must be hauled off Site". EM discussed with KEL PM and came to the same agreement.
- **1345:** EM clearly communicated both Jeff's and AE's comment on the ~200m3 of sand given to the farmer to QM representative.
- **1353:** Comment from AE:
    - Due to high flow and issue with access in between the toe of slope and the TOB, the design has been adjusted to get as close as the toe as feasible and plant up to the TOB. Once density of objective has been met, extra stakes can be in stalled above the TOB or area cover with invasive species.
    - EM passed on the information to QM representative.
- **1400**: Crew commenced plating at Site 1 – Location 3.
- **1419**: A second drill was brought to Site 1 – Location 3.
- **1430:** EM communicated with QM regarding silt fencing required along the Creek side at the new stockpile.
- **1456:** EM and AE access Site 2. Current condition was communicated to QM.
- **1625:** Planting at Site 1 – Location 3 completed for the day. Work will continue tomorrow. See below for total number of stakes at each location.
- **1640**: QM installed silt fence around the sand stockpile at station C2 to prevent potential runoff into the creek.
- **1645**: EM conducted final inspection. Spill trays observed in place.
- **1650**: EM debriefed with KEL's PM.
- **1705**: EM left Site.

<u>Total Willow stakes:</u>

- Site 1:
    - Location 1: 135
    - Location 2: 100
    - Location 3 ~ 200

Please let me know if you have any questions or concerns.

Kindly Regards,
Loc Ngo

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E: lngo@keystoneenvironmental.ca
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November 25, 2024 4:38 p.m.


November 25, 2024 2:00 p.m.


November 25, 2024 11:29 a.m.


November 25, 2024 2:40 p.m.


MOROOKA
November 25, 2024 4:42 p.m.


November 25, 2024 2:56 p.m.


November 25, 2024 12:00 p.m.

Jordon Rozon

From: John Choi <jchoi@keystoneenvironmental.ca>
Sent: November 27, 2024 12:03 AM
To: Nicholas Doucette
Cc: Greg Clease; Mel Murray; Warren Appleton; Jeff Prowse; Vinson Yau; Loc Ngo; Corbin Manson
Subject: 19279 - Lower Lagace Creek SCR 14 Environmental Monitoring Summary - 241126
Attachments: View of the new sand stockpile by Site 1 access point with silt fencing protection along the bank side..jpg; View of the Reed Canary Grass growth along the bank of Site 3 adjacent to Farm Road..jpg; View of the Site 3 looking downstream from the western extent..jpg; View of the dense stakes planted at Site 1 - Location 3..jpg; View of the dense stakes planting work at Site 1 - Location 3..jpg; View of the flagged Japanese knotweed growth on the blueberry bush by C-2..jpg; View of the new sand stockpile by Site 1 access point with silt fencing protection along the bank side..jpg

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Hi Nick,

Below is a summary of the Site visit conducted by Keystone Environmental.

Date: November 26, 2024
Environmental Monitor: John Choi
Weather: Sunny, temperatures ranging from 1°C to 6°C

Environmental Monitoring Summary

07:00: EM arrived on-Site.

- Machinery parked on Site overnight were protected with spill trays, with no evidence of spillage or leakage.
- Stockpiles near the bank of Legace Creek were observed to be adequately protected with silt fencing.

07:20: EM flagged two areas of Japanese knotweed to prevent accidental contact by machinery.

- By C-2 near the Site 1 access point on Dale Road.
- Adjacent to the blueberry bushes by C-2.

07:30: A quick tailgate meeting was held with QM personnel to outline the day's scope of work:

- Continued planting of dense stakes at Site 1 (Locations 1, 2, and 3).
- Dense stakes planting at Site 2 to commence following the completion of Site 1.

07:45: Dense stakes planting commenced at Site 1 under EM supervision:

- Stakes had been soaked for over 24 hours, per specifications.
- Stakes were installed along the bank at Site 1 – Location 3, extending from the water's edge up to 4m inland.

- Stakes were installed perpendicular to the bank slope, with cuttings protruding approximately 200–250mm above the surface.

08:45: Excavator and tracked dumpers transported sand stockpiles by Stations J,K, and L to the Site 1 access point by C-2 for off-Site disposal.

08:50: A gasoline generator was placed at Site 1 to recharge cordless drill batteries:

- The generator was placed on a spill tray, and no spillage or leakage was observed.

09:07: EM consulted with AE personnel regarding watering requirements for the dense stakes.

- AE advised that watering is not currently required but may be revisited depending on Site conditions.

09:40: Dense stakes planting at Site 1 – Location 3 was completed:

- Approximately 70 additional dense stakes were installed.

10:00: Planting of 20 additional dense stakes was completed at Site 1 – Location 1:

- QM personnel minimized entry into Legace Creek but entered occasionally to facilitate bore holing.

10:20: QM personnel mobilized to Site 2:

- Access was limited to foot traffic through the farmer's field, with materials hand-carried into the area.

10:40: Dense stakes planting began at Site 2:

- The generator for drill batteries was placed on a spill tray.
- The bank at Site 2 featured a narrow, muddy strip at the water's edge with steep slopes vegetated with Reed Canary Grass, posing additional challenges for bore holing.

12:25: Minor turbidity bloom observed in Legace Creek near Site 2:

- The bloom resulted from QM personnel disturbing the exposed bank during bore holing.
- Downstream turbidity was measured approximately 20m from Site 2 at 4.69 NTU, compared to background levels at Dale Road Bridge of 4.62 NTU, indicating minimal downstream impact.

12:40: EM measured the dense stakes planting area at Site 2:

- Dimensions: 15m x 3m ($45m^2$).
- Approximately 450 stakes will be required at a density of 12 stakes per square meter.

13:00: QM, Keystone, and AE personnel scouted Site 3:

- A natural gas pipeline was identified along the eastern extent near Farms Road.
- The bank at Site 3 was primarily vegetated with Reed Canary Grass at the water's edge and trees/bushes near the top of the bank.
- Strips of exposed slopes observed along Site 3 near the water level.
- Site 3 dense stakes planting area was partially measured and flagged.

14:30: Property owner at Site 3 requested AE and Keystone personnel vacate the property:

- QM personnel were notified of the issue.
- Measurements of the dense stake planting area at Site 3 were incomplete.

14:45: AE flagged additional slopes at Site 1 for dense stake planting.

15:10: Dense stake planting at Site 2 was completed for the day:

- Approximately 75 stakes were installed.
- Work is scheduled to continue the following day.

15:30: EM and QM personnel revisited Site 3 to assess Site conditions.

- QM personnel engaged with the property owner to address the earlier conflict.

15:50: Work concluded for the day:

- Machinery was confirmed to be protected with spill trays.
- A new sand stockpile near the Site 1 access point was observed without silt fencing. At the request of EM, QM personnel to install silt fencing to prevent potential sediment runoff into Legace Creek during off-hours.

16:15: EM debriefed with KEL's PM.
16:30: EM departed from the Site.

Please let me know if you have any questions or require further clarification.

Kind regards,
John

Keystone Environmental
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John Choi BC-CESCL
Field Biologist / Construction Monitor
T: 604-430-0671 | **C:** 778-229-5321 | **E:** jchoi@keystoneenvironmental.ca
320-4400 Dominion Street | Burnaby, BC V5G 4G3

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2024-11-26 9:44 a.m.


2024-11-26 8:03 a.m.


2024-11-26 7:17 a.m.


2024-11-26 4:06 p.m.


2024-11-26 1:03 p.m.


2024-11-26 1:09 p.m.

Jordon Rozon

From: Vinson Yau <vyau@keystoneenvironmental.ca>
Sent: November 27, 2024 9:15 PM
To: Nicholas Doucette
Cc: Greg Clease; Mel Murray; Warren Appleton; Jeff Prowse; John Choi; Loc Ngo; Corbin Manson
Subject: 19279 - Lower Lagace Creek SCR 14 Environmental Monitoring Summary - 241127
Attachments: Sediment track-out on the bridge.jpg; Soil stockpiling.jpg; staking at Station 1, near C.jpg; Staking at Station 1, near D.jpg; Staking at Station 2.jpg

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Hi Nick,

Below is a summary of the Site visit conducted by Keystone Environmental.

Date: November 27, 2024
Environmental Monitor: Vinson Yau
Weather: Cloudy/Light rain, temperatures ranging from 2°C to 5°C

Environmental Monitoring Summary

- **0700**: EM arrived on site and conducted a safety hazard assessment
- **0720**: EM met QM to debrief was done so far
    - The area north of the bridge is completed.
    - There would be no work conducted at Site 3 due to a public incident with the landowner
    - Today's work would involve soil demobilization and staking
- **0740**: EM inspected the silt fences around the sand stockpiles at Station C and D. The silt fences were in adequate condition.
- **0800**: EM observed two excavators and two morookas hauling soil at Station 1. Active trucking was occurring where trucks back into the service road from Dale Road.
- **0803**: QM asked about the planting specs on where to plant. EM informed that AE does not want stakes to be installed past the top-of-bank (TOB).
- **0832**: QM was continuing staking at Station 1, near C. Some of the stakes were installed past the TOB. QM informed EM that the stakes were installed prior to AE mapping with the TOB was via pin flags. Subsequent staking occurred below the TOB
- **0925**: QM continued staking near Station D.
- **0951**: EM temporary stopped work as there was vegetation nearby, per planting spec 3.1.6. EM confirmed with Keystone PM that the main emphasis is native and woody vegetation. Adjacent vegetation at D consisted of non-native reed canary grass, and one cluster of native dogwood. EM instructed QM to plant

around the dogwood cluster. Some stakes were planted above the TOB, but SPEC 3.1.15 allowed flexibility in the planting procedures

- **1130**: QM saw that one of the haul trucks accidentally drove over the farmer's irrigation line. QM delineated with flagging tape to avoid future encroachments.
- **1202**: The farmer arrived at Station 1 and was angry with the damaged irrigation line. QM spoke with the farmer, and the farmer demanded that everyone to vacate his property. QM decided that all works at Station 1 will be suspended due to conflict with the farmer. As of the time of this email, QM informed that the farmer would allow QM to remove heavy machinery and other equipment/supplies off the property, but QM would no longer continue at Station 1 to avoid upsetting the farmer. QM had to turn away all subsequent haul trucks that were arriving.
- **1203**: AE arrived on Site
    - AE was informed about the incident at Station 1.
    - AE clarified that 'vegetation' on the SPECS referred to native vegetation only. Other non-native plants such as Himalayan blackberry and reed canary grass are exempted, and hence can be encroached to stake.
    - AE expressed the importance of each stake needs to be installed perpendicular to the bank slope, and slightly angled downwards towards the stream. However, AE also acknowledged that may not always be possible or feasible due to the topography and safety concerns.
- **1220**: EM observed sediment track-out onto the bridge from Station 1 when trucks were making a three-point turn to turnaround. EM notified QM to remove sediment from Dale Road and the bridge.
- **1232**: Planting efforts moved to Station 2
- **1327**: AE mapped a new planting area slightly north of the 1st planting area. EM confirmed that this new area is still part of Station 2.
- **1340**: QM continued staking the 1st area at Station 2.
- **1426**: A second group from AE arrived and confirmed that they will speak with the landowners at Station 3 to regain access to the location. AE did not confirm when confirmation will be received.
- **1500**: Staking at the 1st area of Station 2 was completed. Approximately 450 stakes were installed during today and yesterday. QM plans to continue staking at the new area mapped by AE on the next day.
- **1515**: EM debriefed with the project manager
- **1530**: EM left site.

Let me know if you have any questions,

Vinson

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Vinson Yau B.Sc., B.I.T.
Field Biologist
T: 604-430-0671 | **C:** 778-228-8342 | **E:** vyau@keystoneenvironmental.ca
320-4400 Dominion Street | Burnaby, BC V5G 4G3

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Nov 27, 2024 12:42:28 p.m.
49.19834317N 122.25067174W
279° W


HAYCO
rentals
Nov 27, 2024 7:57:14 a.m.
49.19753585N 122.25064685W
213° SW


S
E
M
N
Nov 27, 2024 12:50:06 p.m.
49.19772883N 122.25080101W
178° S


Nov 27, 2024 9:28:10 a.m.
49.19759207N 122.25077594W
211° SW


N
E
S
W
Nov 27, 2024 2:08:21 p.m.
49.1958937ŠN 122.2544929ŠW
97° E

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment and Climate Change Strategy	**Report No.:**	
Project:	Haztic Flood Mitigation – SCR 14/17	**Page:**	1 of 4
Location:	Farms Road	**Project No.:**	2022-2632-03
Contractor:	Quantum Murphy	**File No.:**	
Contract:		**Date:**	November 28, 2024
Contract No.:		**Temperature:**	High: 7 Low: 3
Weather:	Partly cloudy/sunny		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Labour Force: Jim, Mel, 3 labourers (QM), 2 excavator operators, Vinson (EM from Keystone)

Contractor's Equipment: 2 Excavators

Report:

- Mel's crew: Work focused on live staking at site 2 along with completing the live staking at site 1. Vinson Informed us that the live stakes being used may be dogwood instead of willow which was specified.
- Jim's crew: Work focused on removing sediment from stockpiles near Dale road.
- Jim informed me one of the excavators ran over and damaged one of the landowner's (Charlie) irrigation line. Charlie has now told them they aren't allowed to continue moving sediment with the exception of the large pile just next to Dale road gate.
- Jim mentioned that the Charlie also wants to keep the sand but doesn't want to go through the process of obtaining a permit. Charlie mentioned to him that when sediment removal was done in the creek years ago, he got to keep the sediment.
- Jim said they will be removing 2 disposal bins and leaving one for some additional woody debris.
- Mel said they switched from using a drill with auger to drill the holes for the live stakes to a a handheld metal pole at site 2 as the soild conditions are soft enough for it. The handheld bar has been faster than the mechanical auger drill.
- Andrew Wiens and Dianna Christopoulis arrived on site to talk with landowners. Andrew talked with Charlie and Charlie still does not want contractor to venture any further into his property anymore.
- Andrew informed me that Site 3 live staking has been removed from the scope as the landowner has not granted access.
- Sediment hauling was completed from the west (right bank) side of the creek around 3pm.
- The homeowner on the west (right bank) side of the creek came up and asked to ensure any flagging or twine/wire was removed from his property before construction is complete as it can be dangerous to his livestock.

- Mel told us that Birch trees will be planted on Doug's property on Monday and he will return to site 2 to fill in some bare areas with more live stakes.
- Paul Hague talked with Charlie over the phone and Charlie has now given permission for the contractor to access the stockpiles further back on his property. Jim will now organize more trucks to come tomorrow to haul the material.

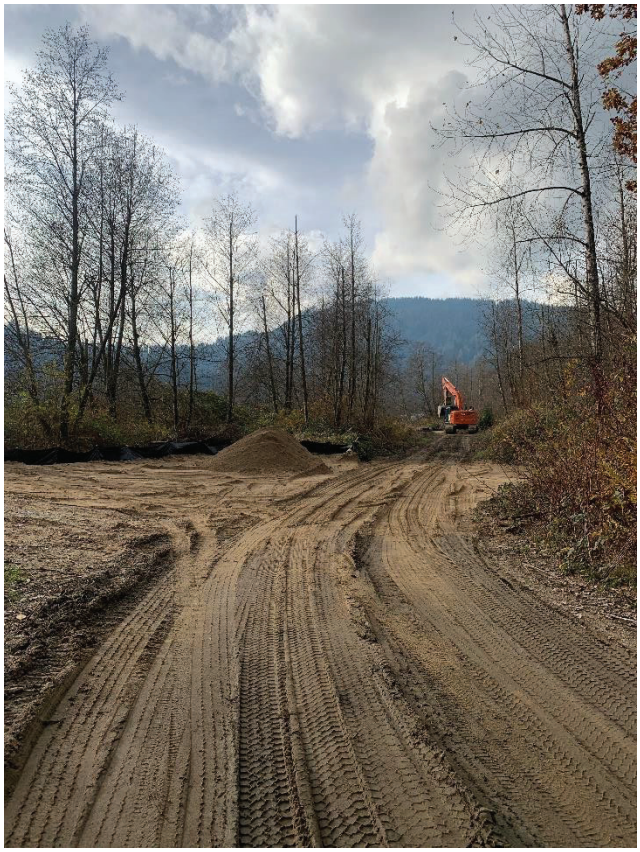

Photo 1: West Bank stockpile



Photo 2: Site 2 live stakes



Photo 3: Site 2 live stakes



Photo 4: Stockpile next to Farms Road on Charlie's property

Jordon Rozon

From: Vinson Yau <vyau@keystoneenvironmental.ca>
Sent: November 28, 2024 7:59 PM
To: Nicholas Doucette
Cc: Greg Clease; Mel Murray; Warren Appleton; Jeff Prowse; John Choi; Loc Ngo; Corbin Manson
Subject: 19279 - Lower Lagace Creek SCR 14 Environmental Monitoring Summary - 241128
Attachments: AE auditing the staking.jpg; An excavtor being demobed.jpg; Site 2 with Stakes.jpg; Soil hauling at Station C.jpg; Soil Hualing at Station F.jpg; QM soaking unused stakes.jpg

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Hi Nick,

Below is a summary of the Site visit conducted by Keystone Environmental.

Date: November 28, 2024
Environmental Monitor: Vinson Yau
Weather: Partly cloudy, temperatures ranging from 1°C to 5°C

- **0710**: EM arrived on site
- **0725**: QM informed that the farmer has allowed soil removal and hauling near Dale Road at Site 1, but nothing else south of that.
    - Active hauling was occurring at Station C and F, both sides of the creek
- **0800**: QM was removing dirt from one of the two excavators at Site 1. The excavator was later demobilized from the site, while one remained to load the haul trucks
- **0900:** QM began moving supplies to Site 2
- **0915**: AE arrived on Site. The AE representative was new to the Site. EM showed AE Site 1 and 2, from across the creek and explained recent incidents with residents at Site 1 and 3.
- **0930**: QM began staking the new area that was flagged by AE yesterday.
- **1050**: QM explained that they aim to finish all stakes today. They will inspect all staked areas tomorrow to confirm that they are placed properly.
- **1210**: Senior AE representatives arrived on Site and spoke with the resident at Site 1 that forced QM off the Site. To the EM's understanding, AE was unable to convince the farmer to regain access back onto the property. As a result, AE will escalate the situation to upper management, or even to the ministry.
- **1352**: AE was auditing the density of the planted stakes, the height, and orientation of the stake and the cuts. All were sufficient.

- **1402**: QM finished staking Site 2. QM informed that they would plant remaining stakes at Site 2 were feasible, and within guidelines to the planting specs. QM also informed that tree planting at Site 1, north of the bridge, will be conducted this coming Monday.
- **1432**: QM was soaking leftover stakes in the creek, per the planting specs.
- **1440**: EM observed that the soil stockpile at Station C was completely removed. Station F was still actively hauling, but the stockpile was mostly gone.
- **1445**: EM debriefed with Keystone project manager.
- **1500**: EM left Site

Let me know if you have questions,

Vinson

Keystone Environmental
Knowledge-Driven Results

Great Place To Work. Certified

Vinson Yau B.Sc., B.I.T.
Field Biologist
T: 604-430-0671 | **C:** 778-228-8342 | **E:** vyau@keystoneenvironmental.ca
320-4400 Dominion Street | Burnaby, BC V5G 4G3

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N
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S
W
Nov 28, 2024 1:52:52 p.m.
49.19601257N 122.25454432W
45° NE


QUANTUM MURRAY
324E
Nov 28, 2024 7:59:51 a.m.
49.19843171N 122.25060643W
99° E


N
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Nov 28, 2024 2:31:49 p.m.
49.19838419N 122.25108096W
31° NE


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Nov 28, 2024 12:30:27 p.m.
49.19599479N 122.25449968W
0° N


S
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CAT
0459
Nov 28, 2024 8:20:07 a.m.
49.19833062N 122.25048699W
208° SW


Nov 28, 2024 7:47:29 a.m.
49.19744217N 122.25236245W
236° SW

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment and Climate Change Strategy	**Report No.:**	
Project:	Haztic Flood Mitigation – SCR 14/17	**Page:**	1 of 4
Location:	Farms Road	**Project No.:**	2022-2632-03
Contractor:	Quantum Murphy	**File No.:**	
Contract:		**Date:**	November 29, 2024
Contract No.:		**Temperature:**	High: 8 Low: -1
Weather:	Cloudy with some light rain showers		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Labour Force: Jim, Mel, 3 labourers (QM), 2 excavator operators, 2 Morooka drivers, Different EM from Keystone

Contractor's Equipment: 2 excavators and 2 Morookas tracked dumpers (For transporting sediment around Charlie's property)

Report:

- Construction activities consisted of removing stockpiled sand and spreading remaining sand out to fix the access road on Charlie's property. Mel's crew is finishing up the live staking at site 2 and then adding a few more live stakes to site 1.
- One excavator is fixing up the access road on the West (right bank) side of the creek. They are spreading some leftover sand and compacting it by driving the excavator over it.
- The Marooka's are hauling sand from the stockpile near Dale road to further back on his property to be spread out on the access road low spots for repair.
- Jim believes they will need almost all of the remaining sand to spread on the access road.
- Charlie again complained that he wanted to keep the sand that was hauled off his property.
- The right bank access road was completed and restored to original conditions. The excavator working on this site returned to Charlies property to spread sand in certain areas here.
- Live staking completed at both sites around 11:15am. Mel began to cleanup after this.
- The EM said they will leave silt fencing up until all sediment is removed from the stockpiles and then remove the silt fencing. Mel removed silt fencing along the right bank as work is completed here.
- Doug (landowner on upstream side of Dale Road) Complained they don't want any more work being done here. Mel informed him they only have tree planting left to do on Monday.
- A new waste bin was delivered and one was removed. 2 waste bins remain on site. There is some woody debris to be placed in the waste bin.
- Jim began spreading some of the dirty sand near the back of Charlies property (End of access road to SRS-L) as this area is a depression and Charlie asked for it to be repaired.

- The remaining dirty sand was brought to the stockpile near Dale road to be hauled off site on Monday.



Photo 1: Dirty sand stockpiled near Dale Road



Photo 2: Stockpiled spread on Access rd.



Photo 3: Large muddy depression in access road



Photo 4: Sand to be spread on access road

Jordon Rozon

From: John Choi <jchoi@keystoneenvironmental.ca>
Sent: November 30, 2024 10:30 AM
To: Nicholas Doucette
Cc: Greg Clease; Mel Murray; Warren Appleton; Jeff Prowse; Vinson Yau; Loc Ngo; Corbin Manson
Subject: 19279 - Lower Lagace Creek SCR 14 Environmental Monitoring Summary - 241129
Attachments: View of the dense stakes planting work at Site 2..jpg; View of the dense stakes planing work at Site 1 - Location 1..jpg; View of the silt fencing removal work at Station I..jpg; View of the soil hauling work at Station L..jpg; View of the dense stakes planting work at Site 1 - Location 3..jpg; View of the farm access road surface regarading and repair work along east side of Legace Creek..jpg

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Hi Nick,

Below is a summary of the site visit conducted by Keystone Environmental:

Date: November 29, 2024
Environmental Monitor: John Choi
Weather: Partly cloudy, with periods of rain (1℃ to 5℃)

Environmental Monitoring Summary:

- **07:15**: The Environmental Monitor (EM) arrived on-site.
    - Machinery parked overnight was observed with spill tray protections, and no notable leakage or spillage was present.
- **07:30**: QM personnel arrived on-site.
    - A quick tailgate meeting was held with QM to discuss site safety and the day's scope of work.
- **07:35**: Soil hauling activities were observed on the east side of Legace Creek along the Site 1 access road.
    - An excavator and Morooka were used to transport soil stockpiles from Stations J, K, and L to Station C (Dale Road) for off-site disposal.
    - The EM reminded operators about flagged Japanese knotweed growth near Station C and emphasized avoiding contact with machinery.
- **07:40**: Sand stockpiles along the west side of Legace Creek (Stations D, E, and F) had been removed.
    - An excavator was observed regrading the road surface to repair damage caused by construction vehicle traffic,
- **08:10**: Dense stakes planting work continued at Site 2.

    - QM personnel entered the water only when necessary for planting.
    - Background water quality (4.72 NTU) was compared to downstream water quality (4.97 NTU), indicating minimal impact.
    - Planting focused on bare slopes, with stakes density at 12–15 stakes per m^2.
    - The EM asked QM to trim stakes to ~250 mm above the soil surface.
- **09:45**: Dense stakes planting at Site 2 was completed.
    - AE personnel inspected the work and noted no deficiencies.
    - Farm owner requested the removal of flagging tapes and twines, which QM addressed, confirmed by the EM.
- **09:50–10:45**: Dense stakes planting continued at Site 1 (Locations 1 and 3).
    - Planting focused on bare soil near water and along slopes.
    - AE personnel inspected both locations and noted no deficiencies.
    - Planting was completed at Sites 1 and 2.
- **11:00**: QM informed the EM that sand stockpiles would be used to repair the farm road along the east side of Legace Creek, as requested by the property owner.
    - Morooka dumped stockpiles along the road, and the excavator leveled them to fill low spots.
    - Washed gravel is scheduled for mobilization next week to armor the road surface.
- **11:15**: EM, QM, and AE discussed silt fencing removal.
    - Silt fencing along the east side of Legace Creek will remain until sand hauling and road repairs are completed.
    - Silt fencing along the west side of Legace Creek was removed after stockpile removal and road repairs.
- **12:00**: QM removed silt fencing and construction waste along the west side of Legace Creek (Stations D, E, and F).
    - New Japanese knotweed growth was observed near Station D.
- **12:45**: Construction materials and waste were removed from Stations B-2 and B-3, except for portable toilets and a wooden pallet.
    - Japanese knotweed growth was noted at Stations B-3 (under Dale Road bridge) and Station B. QM personnel were reminded to avoid contact with machinery.
- **14:10**: QM hauled sand stockpiles from Station L to Station C for off-site disposal.
    - Some of the sand was used to fill low spots between the blueberry bushes, as requested by the farm owner, with regrading completed by the excavator.
- **15:35**: EM confirmed machinery was protected with spill trays and stockpiles were secured with silt fencing when applicable.
- **15:50**: EM debriefed with the Keystone Project Manager.
- **16:00**: EM departed the site.

Please let me know if you have any questions or concerns.

Thank you,

Kind regards,
John

Keystone Environmental
Knowledge-Driven Results

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John Choi BC-CESCL
Field Biologist / Construction Monitor
T: 604-430-0671 | **C:** 778-229-5321 | **E:** jchoi@keystoneenvironmental.ca
320-4400 Dominion Street | Burnaby, BC V5G 4G3

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2024-11-29 12:08 p.m.


2024-11-29 9:53 a.m.


2024-11-29 10:59 a.m.


2024-11-29 8:48 a.m.


2024-11-29 11:00 a.m.


604.526.7260
HAYCO
2024-11-29 2:32 p.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment and Climate Change Strategy	**Report No.:**	
Project:	Haztic Flood Mitigation – SCR 14/17	**Page:**	1 of 5
Location:	Farms Road	**Project No.:**	2022-2632-03
Contractor:	Quantum Murphy	**File No.:**	
Contract:		**Date:**	December 2, 2024
Contract No.:		**Temperature:**	High: 8 Low: -1
Weather:	Sunny		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Labour Force: Jim, Mel, 3 labourers (QM), 2 excavator operators, 2 Morooka drivers, Loc (EM from Keystone)

Contractor's Equipment: 2 excavators and 2 Morooka tracked dumpers (For transporting sediment around Charlie's property)

Report:

- Excavator continues to spread and compact sand on access road while the Morookas take dirty sand up to stockpile near Dale Road.
- Mel removed the remaining sandbags that were visible in the creek on the upstream side of the bridge but there still may be a few sandbags remaining that are now buried.
- 5 birch trees delivered to site at 9am
- Loc (EM) flagged some knotweed on Charlies property near Dale road for the contractor to avoid. He says there is no evidence the contractor is touching/disturbing it so they are fine to continue.
- Mel began re-installing fence along the creek that was removed in some sections on Charlies property.
- 5 smaller maple trees have already been planted along Doug's property line. Mel planted the 5 birch trees about 1 foot above existing ground as per Doug's request as the area floods and he believes the wont survive if placed at existing grade. Mel also removed the smaller maple trees already planted an left them beside their holes to be planted by Doug once he brings more topsoil in from his property
- Access road to SRS-L is completed. The excavator has reinstated the small ditch along the portion of the access road from SRS-L to J.
- Jim said Charlie has agreed to accepting $2000 form QM for the broken irrigation line.
- Jim plans to have trucks bring in 3 inch aggregate tomorrow to be spread on the access roads and then have equipment removed from site at 3pm.





Photos 1 & 2: repaired access road to SRS-L



Photo 3: Dirty sediment being hauled off site



Photo 4: Silt fences being removed


CAT
0459

Photo 5: Birch tree planting

Jordon Rozon

From: Loc Ngo <lngo@keystoneenvironmental.ca>
Sent: December 2, 2024 9:02 PM
To: Nicholas Doucette
Cc: Greg Clease; Mel Murray; Warren Appleton; Jeff Prowse; Vinson Yau; Corbin Manson; John Choi
Subject: 19279 - Lower Lagace Creek SCR 14 Environmental Monitoring Summary - 241202
Attachments: flagged invasive species area by EM in proximity to active hauling activity.jpg; Parked vehicle with spill tray in place.jpg; Road repair near station C-2.jpg; sediment hauling near station C-2.jpg; View of completed tree planting.jpg; View of station J and K at the end of workday.jpg

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Hi Nick,

Below is a summary of the site visit conducted by Keystone Environmental:

Date: December 02, 2024
Environmental Monitor: Loc Ngo
Weather: Clear skies(1℃ to 5℃)

Environmental Monitoring Summary:

- **0730**: The Environmental Monitor (EM) arrived on-site.
    - A quick tailgate meeting was held with QM to discuss site safety and the day's scope of work.
- **0800**: Sediment hauling commenced near station C-2. QM completed sediment hauling from station L to station C-2 using Morookas. Road repair and reinforcement started from station L commenced shortly after.
    - Knotweed area was flagged.
    - Silt fences around the stockpile were in good condition.
    - WQ was collected.BG = 5.12 NTU and DS from work area (Station L) = 5.06 NTU → Erosion and sediment runoff was not observed by EM.
- **0915**: Five (5) river birch trees (*Betula sp.*) arrived on-Site.
- **0947**: AE commented on deficiency regarding sandbags remained in Lagace Creek, north of Dale Road. EM brought up the comment to QM personnel and KEL PM.
    - It is understood that three (3) sandbags were observed and noted in Lagace Creek on October 15, 2024. QM could not get those out due to high water level at the time.

    - EM accessed the noted sandbags area → Sandbags in Lagace Creek, north of Dale Road, were not visibly observed from the bridge. They are potentially lost or buried under the sediment. Any effort to find it will cause turbidity concern without proper isolation in place.

- **1003**: EM flagged area of invasive species in proximity to the current sand stockpile at station C-2. EM clearly communicated to the operator not to disturb the flagged area to prevent potential spread of invasive plants.
    - QM personnel entered the water only when necessary for planting.
    - Background water quality (4.72 NTU) was compared to downstream water quality (4.97 NTU), indicating minimal impact.
    - Planting focused on bare slopes, with stakes density at 12–15 stakes per m^2.
    - The EM asked QM to trim stakes to ~250 mm above the soil surface.
- **1352**: Tree planting commenced north of Dale Road.
- **1445**: Sediment hauling completed.
- **1500**: Road repair and reinforcement from station L – G was completed. EM inspected the area. Deficiency was not noted.
    - Road repair and reinforcement near station C-2 commenced using remaining sediment.
- **1544**: Tree planting completed.
- **1610:** EM inspected parked machines. Spill trays were in place.
- **1630**: EM debriefed with KEL PM and left Site shortly.

Please let me know if you have any questions or concerns.

Thank you,

Kind regards,

Keystone Environmental
Knowledge-Driven Results

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Loc Ngo
Field Biologist
T: 604-430-0671 | **C:** 604-347-7115 |
E: lngo@keystoneenvironmental.ca
320-4400 Dominion Street | Burnaby, BC V5G 4G3

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December 02, 2024 3:11 p.m.


Hayco
rentals
604.526.7260
December 02, 2024 10:06 a.m.


604.526.7260
604.526.7260
December 02, 2024 4:11 p.m.


0459
December 02, 2024 3:52 p.m.


December 02, 2024 8:56 a.m.


December 02, 2024 3:40 p.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment and Climate Change Strategy	**Report No.:**	
Project:	Haztic Flood Mitigation – SCR 14/17	**Page:**	1 of 4
Location:	Farms Road	**Project No.:**	2022-2632-03
Contractor:	Quantum Murphy	**File No.:**	
Contract:		**Date:**	December 3, 2024
Contract No.:		**Temperature:**	High: 9 Low: -1
Weather:	Sunny		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Labour Force: Jim, Mel, 2 labourers (QM), 2 excavator operators, 2 Morooka drivers, Loc (EM from Keystone)

Contractor's Equipment: 2 excavators and 2 Morookas tracked dumpers (For transporting sediment around Charlie's property)

Report:

- Mel confirmed the leaning fence on Charlies property was already there before they begun construction.
- The excavators are still spreading the remaining sand on the central access road through Charlie's blueberry field as there is a large muddy depression in the road with pooled water.
- Aggregate trucks began delivering aggregate for the access roads around 9am and piling the material on Charlies property near Dale road. Excavator began loading Morookas with aggregate to be taken down the access roads and dumped for spreading along the road.
- Paul asked to check if there was any agreement made between QM and Doug regarding responsibility for the trees on his property line. I talked with Mel and Doug and he stated he will be placing more soil in the area and requested them to raise the trees above grade. He mentioned this area is a low point and the trees will likely not survive if placed this low. He has taken responsibility for tree health going forward. Doug mentioned he talked about this with Ryan and Jordan previously and that they can contact him if any issues going forward.
- The excavator removed the gravel back fill and culvert under the access road to Doug's property in the afternoon. The culvert and any gravel backfill used was placed at the end of the access road leading into Doug's property area.
- Silt fencing was removed from the access road to SRS-L by Mel and crew. Mel left site around 1:30pm
- 18 total truckloads of aggregate was brough in. The excavators have spread most of it on the access roads on Charlies property but some pile remain that will have to be spread tomorrow. No aggregate stockpile remains near Dale road on Charlies property.
- Jim said the Morookas will be removed from site tomorrow morning while the excavator spreads out and compacts any remaining piles.

- Combigrid protruding from under access road on Doug's property was trimmed and removed by labourer as per Ryan's request.
- Fences on Charlies property bordering the creek have been re-installed where QM removed.



Photo 1: Fence re-installation on Charlie's property



Photo 2: Silt fences removed



Photo 3: Aggregate delivered and piled



Photo 4: Aggregate spread on access road

Jordon Rozon

From: Loc Ngo <lngo@keystoneenvironmental.ca>
Sent: December 3, 2024 9:11 PM
To: Nicholas Doucette
Cc: Greg Clease; Mel Murray; Warren Appleton; Jeff Prowse; Vinson Yau; Corbin Manson; John Choi
Subject: 19279 - Lower Lagace Creek SCR 14 Environmental Monitoring Summary - 241203
Attachments: Fences installation at station C-2.jpg; Material stockpiles at station B from the decomission work.jpg; Parked equipment with proper spill tray in place.jpg; Road repair and reinforcement work.jpg; View of c;leaned equipment at the end of work day.jpg; View of the access road decomission work, north of Dale Road.jpg

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Hi Nick,

Below is a summary of the site visit conducted by Keystone Environmental:

Date: December 03, 2024
Environmental Monitor: Loc Ngo
Weather: Clear skies (1℃ to 5℃)

Environmental Monitoring Summary:

- **0730**: The Environmental Monitor (EM) arrived on-site.
    - A quick tailgate meeting was held with QM to discuss site safety and the day's scope of work.
- **0800**: QM continued road repair and reinforcement east of Lagace Creek.
    - QM installed fences at station C-2.
    - Silt fences removal was completed.
- **0900**: QM and AE representatives spoke with the property owner north of Dale Road regarding the tree planting work and confirmed that five (5) river birch trees were planted as per the property owner’s reference.
- **0920**: First round of gravel trucks arrived. A total of 18 loads were expected.
- **0930**: Portable toilets (Pit Stop) were hauled off-Site.
- **1024**: Road repair using gravels commenced.
- **1102**: Access road north of Dale Road decommission commenced.
    - Materials and the culvert removed from the decommission were given to the property owner and stockpiled at station B. EM inspected and confirmed the machine stayed on the gravel pad and invasive species contamination risk was low.

- **1200-1245**: EM went on lunch break
- **1300**: Access road decommission work completed.
- **1305:** QM personnel swept the road surface to remove sediment track-out.
- **1505**: Road repair using gravels continued.
- **1530-1630**: QM personnel observed cleaning and removing dirt from equipment (Morookas, excavator etc.)
- **1650**: EM inspected parked equipment
- **1715**: EM left Site.

Please let me know if you have any questions or concerns.

Thank you,

Kind regards,

Keystone Environmental
Knowledge-Driven Results

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Loc Ngo
Field Biologist
T: 604-430-0671 | **C:** 604-347-7115 |
E: lngo@keystoneenvironmental.ca
320-4400 Dominion Street | Burnaby, BC V5G 4G3

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December 03, 2024 1:00 p.m.


December 03, 2024 9:17 a.m.


December 03, 2024 1:52 p.m.


604.526.7260
December 03, 2024 4:46 p.m.


December 03, 2024 4:15 p.m.


HAYCO
RENTALS
604.526.7260
604.526.7260
HAYCO
RENTALS
MST 1500VDR
December 03, 2024 3:41 p.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Owner:	Ministry of Environment and Climate Change Strategy	**Report No.:**	
Project:	Haztic Flood Mitigation – SCR 14/17	**Page:**	1 of 3
Location:	Farms Road	**Project No.:**	2022-2632-03
Contractor:	Quantum Murphy	**File No.:**	
Contract:		**Date:**	December 4, 2024
Contract No.:		**Temperature:**	High: 9 Low: -1
Weather:	Sunny		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Labour Force: Jim, 1 labourer (QM), 1 excavator operators, Loc (EM from Keystone), AE environmental representative

Contractor's Equipment: 2 excavators and 2 Morookas tracked dumpers (For transporting sediment around Charlie's property)

Report:

- 2 Morookas and one excavator removed from site around 7:15am
- One excavator operator now just spreading remaining aggregate piles on the access roads. Access roads completed around 11am.
- Jim exchanged phone number and email with Charlie for sending of written agreement for payment for broken irrigation line. Charlie expressed to Jim he is happy with the repairs to the access road and fences.
- Aggregate doesn't extend all the way down access roads but this is what Charlie requested.
- One remaining excavator will be removed from site at some point in the afternoon.
- The excavator couldn't pick up fallen fence post on Charlies property due to knotweed here. This post may have been knocked over previous to construction



Photo 1: Completed access road junction on Charlie's propert



Photo 2: Re-instated ditch next to Doug's property



Photo 3: Aggregate extents on SRS-L access road



Photo 4: Aggregate extents on central access road

TECHNICAL MEMORANDUM

Issue Date:	December 17, 2024	**File:**	Audit No. 9
To:	**Thyren Jacobs, Flood Debris Management Secretariat**	**Previous Issue Date:**	
From:	Dave Muhlert, R.B.Tech. and Naomi Sands, R.P.Bio.		
Client:	Ministry of Environment and Climate Change Strategy		
Project Name:	Lagace Creek Bank Protection and Sediment Removal - SCR14	**Project No.:**	2022-2632-03
Subject:	Environmental Compliance Audit		
Monitoring Period:	November 12 - December 4, 2024		
Contractor:	QM Environmental		
Environmental Monitor:	Keystone Environmental		

1 INTRODUCTION

Associated Environmental Consultants Inc, (Associated) is pleased to provide this environmental audit report summarizing observations of site conditions, environmental protection measures, regulatory compliance, and corrective actions as part of erosion protection works on Lagace Creek, south of Durieu, BC in the Hatzic Valley (the Project, the Site) during the monitoring period November 12 to December 4, 2024. The results presented in this audit report are based on conditions observed at the time of the audit inspection(s) and represent a snapshot of the workday. Items identified as non-compliant may have been addressed before the report(s) are submitted. The audit report(s) are submitted to the owner, their agent (Associated Engineering), the Contractor, and their environmental monitor (EM) and are not intended for further distribution.

2 ROLES AND RESPONSIBILITIES

The prime contractor for the Project is QM Environmental (the Contractor), and works are being monitored for environmental compliance by Keystone Environmental (Keystone) and audited by Associated. As the EM, Keystone is to work with the Contractor to develop measures to protect the environment and to respond to environmental incidents as they occur. Keystone is also responsible for fish and wildlife salvages prior to instream works. Leq'á:mel First Nation (LFN) is the cultural monitor for the Site. The responsibility of the auditor is to ensure on behalf of the owner, who is ultimately the permit holder, that the EM, LFN, and the Contractor adhere to the requirements of the Construction Environmental Monitoring Plan (CEMP), environmental permit conditions and any applicable regulations.

3 SITE INSPECTION

A summary of site conditions as observed during the audit inspection completed during the monitoring period is provided in Table 3-1. Works within the monitoring period comprised bioengineering, planting, soil disposal and site clean up.

Table 3-1 Site Conditions During Audit Inspection

Date / Time	Auditor (Associated)	Weather	Construction Activities
December 4, 2024 10:08	Dave Muhlert	Air temperature 5°C. Clear sky with no precipitation[1].	One excavator and crew on site working to restore the access road and clean up the site.

4 INSPECTION RESULTS

A checklist of required environmental protection measures and mitigative strategies for the Project is presented in Table 4-1. The checklist has been developed in accordance with terms and conditions of the environmental permits and approvals issued for the Project, environmental protection specifications and requirements as part of the construction contract for the Project, the Contractor's Construction Environmental Management Plan and environmental best management practices and guidelines.

[1] Government of Canada. 2024. Historical Climate Data. Available at: https://climate.weather.gc.ca/historical_data/search_historic_data_e.html. Accessed December 5, 2024.

Table 4-1 Summary of Environmental Protection Measures Reviewed and Results of the Inspection

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
	Environmental Monitoring					
1	The EM will attend key site meetings where environmental mitigations and issues may be discussed.	☒Compliant ☐Non-Compliant ☐N/A	EM was on site during the audit visit.		CEMP Section 2.4	
2	The EM shall supervise all instream works. If temporary diversion installed, EM is onsite daily to check pumps and flow bypasses.	☐Compliant ☐Non-Compliant ☒N/A	Instream works are complete.		WSA (h)2.ii, (j)5.i CEMP Section 2.4	
3	The EM will submit daily and bi-weekly monitoring reports to the Contractor for distribution to MoECCS.	☒Compliant ☐Non-Compliant ☐N/A	Daily EM reports have been received throughout the audit period.		CEMP Section 5.1	
4	The EM will complete and submit an Environmental Incident Report (EIR) for non-compliances with the CEMP, reportable spills or other environmental incident.	☐Compliant ☐Non-Compliant ☒N/A	No reportable environmental incidents have been documented during the monitoring period.		CEMP Section 4	
5	EM is granted authority to stop the work if necessary	☒Compliant ☐Non-Compliant ☐N/A	EM has the authority to stop work. No stoppages for environmental reasons were reported during the audit period.		WSA (i) 7 CEMP Section 2.4	
	Erosion and Sediment Control					
6	Appropriate site isolation is installed as required, including silt fencing prior to instream works. Silt fences are installed properly, intact, adequate, clear of accumulated sediment and are functioning.	☒Compliant ☐Non-Compliant ☐N/A	Exposed slopes were covered with coco matting. Sediment stockpiles have been removed from the site. Previous locations of stockpiles have been levelled. Site appears to have been stabilized for decommissioning.		WSA (o), (q) CEMP Section 3.5	Photo 1 Photo 2 Photo 3
7	Riprap or any other engineering material place in channel is clean of any substances deleterious to aquatic life.	☐Compliant ☐Non-Compliant ☒N/A			WSA (x) CEMP Section 3.5	
8	Stockpiling and storage areas are located 15 m from the watercourse TOB.	☐Compliant ☐Non-Compliant ☒N/A	Sediment stockpiles have been removed from the site.		DFO FAA WSA (t) CEMP Section 3.5	
9	Emergency ESC material onsite (e.g., 100 feet of silt fencing, 5 dry bales, and 100sq.m of ECBs/ Coconut matting, or polyethylene sheets)	☐Compliant ☐Non-Compliant ☒N/A	No ESC materials stockpiled at site laydown as the site has been demobilized. Access road on east side of creek has been levelled with crushed rock.		CEMP Section 3.5	Photo 4 Photo 5
10	Sediment removed from the Site will be disposed of appropriately at a location approved by the EM and MoECCS.	☒Compliant ☐Non-Compliant ☐N/A	Conditionally compliant. Some of the creek sediment was used on site to restore and re-grade the access road and fill in low spots in the adjacent blueberry field, as per the property owner's request. Offsite disposal location has not been reported by the EM.	Identify sediment disposal location(s) in the CEMP and/or the environmental monitoring reports.	CEMP Section 5.5	
11	Sediment removal boundaries must be clearly delineated prior to commencement of work.	☐Compliant ☐Non-Compliant ☒N/A	Sediment removal works are now complete.		WSA (opening)	

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
	Invasive Plant Management					
12	Ensure that machinery is free of invasive plant material that could potentially be transported throughout or between sites.	☒Compliant ☐Non-Compliant ☐N/A	Excavator on site appeared to be free of plant material. EM reported that equipment was being		WSA (opening) CEMP Section 3.4	
13	Ensure that invasive species removed from site are disposed of appropriately at an approved facility	☐Compliant ☐Non-Compliant ☒N/A	Invasive species have been removed from the site.	Document invasive species removal methodology including rationale for any changes in approach.	WSA (opening) CEMP Section 3.4.1	
14	The Project site shall be regularly monitored by the EM for invasive plant infestations and these infestations will be mapped and managed according to applicable species-specific BMPs.	☐Compliant ☐Non-Compliant ☒N/A	Sediment removal works are complete. Riparian grass seeding and live staking has been completed.		CEMP Section 3.4.1	Photo 1 Photo 6 Photo 7
16	Knotweed stems are cut close to the ground and contained on poly sheeting away from the immediate work area. Cut knotweed is covered with woven geotextile fabric and crushed rock prior to machine access. Knotweed stems are injected with an appropriate herbicide before being covered.	☐Compliant ☒Non-Compliant ☐N/A	No knotweed material was being handled or disturbed during the audit. Knotweed management is still not adequately documented. EM summary report does not include justification for the methods used.	Update CEMP to document revised knotweed approach.	CEMP Section 3.4.1 Addendum 1 to the Contract Documents for the Hatzic Emergency Works Program - Lagace Creek – Sites S-CR-14/17	
	Waste Management					
17	Dispose of all anthropogenic debris removed at an appropriate waste management facility.	☒Compliant ☐Non-Compliant ☐N/A	Pallet, poly sheets, woody debris piles, and other debris has been removed from the site.		WSA (opening) CEMP Section 5.5	Photo 8
18	Non-hazardous waste stored appropriately and removed offsite daily.	☐Compliant ☐Non-Compliant ☒N/A	Contractor has demobilized from site.		CEMP Section 5.5	
19	Hazardous waste stored > 30 m of watercourses.	☐Compliant ☐Non-Compliant ☒N/A	No hazardous waste observed during the audit. EM reports show portable toilets in secondary containment, >30 m away from watercourses.		CEMP Section 5.5	
20	Secondary containment used for all stored hazardous waste.	☐Compliant ☐Non-Compliant ☒N/A	No hazardous waste observed during the audit. EM reports show portable toilets in secondary containment. Portable toilets were already removed from the site at the time of the audit visit.		CEMP Section 3.6	
	Spill Control and Emergency Response					
21	Machinery operating in channel is equipped with environmentally friendly oil	☐Compliant ☐Non-Compliant ☒N/A	No instream works were in progress during the audit. Excavator was working on the access road.		WSA (p) 4 CEMP Section 3.6	
22	Equipment and machinery are free of leaks	☒Compliant ☐Non-Compliant ☐N/A	No leaks were observed during the audit.		WSA (p) 1 CEMP Section 3.6	Photo 9
23	Drip trays are available and used during refueling and equipment maintenance	☐Compliant ☐Non-Compliant ☒N/A	No refueling or equipment maintenance during the audit. EM		CEMP Section 3.6	

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
			reported that drip trays were in use under stationary equipment.			
24	Fuel is stored > 30 m from Lagace Creeks and any connected drainages	☐Compliant ☐Non-Compliant ☒N/A	No fuel stored on site during the audit.		WSA (p) 3 CEMP Section 3.6	
25	Machinery and vehicles operating onsite are equipped with spill kit.	☒Compliant ☐Non-Compliant ☐N/A	No spill kit was observed during the audit; however, the Contractor reported that the excavator would be demobilized in the afternoon of December 4.		WSA (p) 2 CEMP Section 3.6	
26	Should suspected contaminated material be encountered (i.e., soil emitting olfactory cues indicative of hydrocarbon fuel), works should temporarily halt for investigation.	☐Compliant ☐Non-Compliant ☒N/A	Sediment removal works are complete.		CEMP Section 2.5	
27	Refuelling of machinery is conducted on level ground over a spill tray.	☐Compliant ☐Non-Compliant ☒N/A	No refueling observed during the audit.		CEMP Section 3.6	
	Riparian Area Management					
28	Stockpile LWD and root wads removed from channel for use in site restoration	☐Compliant ☐Non-Compliant ☒N/A	No LWD or root wads stockpiled on site.		CEMP Section 3.3	
29	Construct access points and approaches perpendicular to the watercourse;	☐Compliant ☐Non-Compliant ☒N/A			DFO FAA CEMP Section 3.2	
	Instream Works					
30	The EM shall ensure that instream works are isolated from flow and that measures are in place to protect fish and fish habitat, and to mitigate the migration of sediment downstream.	☐Compliant ☐Non-Compliant ☒N/A	Instream works are complete.		WSA (j) CEMP Section 3.1	
31	Pumps and flow bypasses are in proper working condition	☐Compliant ☐Non-Compliant ☒N/A	Instream works are complete.		WSA (j) 5 CEMP Section 3.1	
32	Instream works conducted in the dry / isolation of flow	☐Compliant ☐Non-Compliant ☒N/A	Instream works are complete.		WSA (o) CEMP Section 3.1.1	
	Water Quality					
33	Water quality is routinely monitored upstream and downstream of the work area, every day that instream works are occurring Instream water quality is compliant with provincial criteria[2]: **Turbidity**: - <8 NTU from background at any one time for a duration of 24 h in clear waters; - < 5 NTU from background when background is 8 – 50 NTU; - <10% from background when background is > 50 NTU.	☐Compliant ☐Non-Compliant ☒N/A	Instream works are complete. EM observed turbidity plumes during riparian restoration work but reported that water quality was compliant with the provincial criteria.		WSA (s) CEMP Section 3.1.2	

[2] British Columbia Ministry of Environment and Climate Change Strategy. 2024. British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture - Guideline Summary – August 2024. Water Quality Guideline Series, WQG-20. Prov. B.C., Victoria B.C. Available at: https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-guidelines/approved-wqgs/wqg_summary_aquaticlife_wildlife_agri.pdf. Accessed August 2024.

Item #	Item or Location	Compliance	Comments	Corrective actions	Reference Documents	Photos
	pH: 6.5-9.0					
	Fish and Wildlife Protection					
34	Full time monitoring for fish during instream works is occurring.	☐Compliant ☐Non-Compliant ☒N/A	Instream works are complete.		WSA (j) 6 CEMP Section 2.4	
35	Fish salvages are conducted in advance of instream works where required.	☐Compliant ☐Non-Compliant ☒N/A	Instream works are complete.		CEMP Section 3.1 WSA (j) 6	
36	Salvaged fish are relocated back to the same watercourse in a nearby area that is not impacted by construction or removal works or its zone of influence	☐Compliant ☐Non-Compliant ☒N/A	Instream works are complete.		DFO FAA Section 2.2.4	
37	Pump intakes are screened for fish and aquatic species in accordance with the "Interim code of practice: End-of-pipe fish protection screens for small water intakes in freshwater"	☐Compliant ☐Non-Compliant ☒N/A	Instream works are complete.		WSA (j) 5.ii DFO FAA Section 2.4.9 CEMP Section 3.1.1	
38	Obtain required permits prior to salvage(s).	☐Compliant ☐Non-Compliant ☒N/A			WSA (Opening) CEMP Section 3.1	
39	EM is on site during disturbance to riparian vegetation and conducting pre-clearing breeding bird surveys prior to clearing.	☐Compliant ☐Non-Compliant ☒N/A	Sediment removal works, including associated vegetation clearing, are complete.		CEMP Section 3.2	
40	Instream works are conducted so as not to lead to fish stranding or other impacts to fish. The works shall not result in depressions that have the ability to trap fish and other aquatic life. Fish passage is maintained where practicable and in accordance with applicable permits.	☒Compliant ☐Non-Compliant ☐N/A	Instream works are complete. No barriers to fish passage observed.		WSA (j) 6 (iii) WSA (u) DFO FAA Section 2.4.2 CEMP Section 3.1.1	
	Restoration Requirements					
41	Restoration plans prepared by EM for disturbed area and implemented with EM oversight	☒Compliant ☐Non-Compliant ☐N/A	Site restoration is complete as per the engineering drawings. Coco matting and live stakes have been installed on exposed slopes. New grass appeared to be growing on the coco matting. Some trees have been planted at Station B/B-2/B-3. Smaller trees were placed (above ground) at Station B/B-2/B-3, with root balls wrapped in burlap sacks.		WSA (w) CEMP Section 3	
42	All temporary works shall be removed on completion of the project, and the stream channel restored to its natural condition	☒Compliant ☐Non-Compliant ☐N/A	Instream works are complete. Instream isolation has been removed. Site restoration is complete.		WSA (v) CEMP Section 3	

5 DISCUSSION

5.1 Non-Compliant Items

Knotweed management

Knotweed removal and transport of knotweed-contaminated material to offsite disposal is complete; however, the CEMP has not been updated with revised approach or the disposal location(s).

Recommended action: Provide details on alternative approach with rationale, and update documentation (e.g., CEMP).

6 SUMMARY

A list of environmental issues outstanding to date is provided in Table 6-1, below.

Table 6-1 Tracking Table of Environmental Issues Outstanding to-Date (project commencement August 12, 2024)

Issue #	Issue	Date(s) Observed	Recommended Corrective Action(s)	Responsible Party
2	Knotweed management	August 29, 2024 September 5, 2024 September 13, 2024 September 29, 2024 September 25, 2024 October 18, 2024 December 4, 2024	Document methodology and ensure it adheres to approved BMPs.	Contractor/EM

Note: Items marked with an asterisk (*) were reported by the EM.

7 CLOSURE

We trust that the information in this memo is sufficient for your present needs. Should you have questions, please do not hesitate to contact the undersigned.

Prepared by:

Dave Muhlert, R.B.Tech.
Environmental Technologist
DM/NS

Reviewed by:

Naomi Sands, R.P.Bio.
Environmental Scientist

Attachments:

- Site Photographs
- Table A2: Tracking Table of Resolved Non-Compliance Issues

Attachment 1: Site photographs taken during audit visit on December 4, 2024.

Photo 1: Coco matting, live stakes, and planted trees at Station B 		**Photo 2: Location of sediment stockpile at Station L** 
Photo 3: Location of sediment stockpile at Station F 		**Photo 4: Crushed rock placed on access road** 
Photo 5: End of crushed rock on access road, near Station G 		**Photo 6: Coco matting and grass seeding at Station C-2** 

Photo 7: Live staking on the right (west) bank, across from Station J 		**Photo 8: Site laydown at station C-2** 
Photo 9: Excavator on site appeared to be clean and free of leaks 		

Table A2: Tracking Table of Resolved Non-Compliance Issues

Item #(s)	Issue	Date(s) Observed	Date Corrected	Corrective Action(s)	Responsible Party
1	Environmental monitoring reports not received daily	August 29, 2024	September 5, 2024	Monitoring reports received daily, or following morning.	EM
2	Inappropriate fish screen on pump intake	September 5, 2024	September 12, 2024	EM reports show pump intakes in mesh screen boxes. Wire mesh screen was being fitted to an additional pump intake during the audit visit.	Contractor
3	Portable toilets without secondary containment	August 29, 2024 September 5, 2024 September 13, 2024 September 29, 2024 September 25, 2024 October 4, 2024 October 10, 2024	October 18, 2024	Portable toilets have been removed from the site.	Contractor
4	Inadequate instream isolation and failed dewatering attempts resulting in instream works conducted in the wet.	August 31, 2024 September 1, 2024 September 2, 2024 September 11, 2024 September 27, 2024 (EM reports)	October 10, 2024	Instream works are now complete	N/A
5	Stationary equipment without drip trays, or drip trays full of water	October 4, 2024	October 10, 2024	Drip trays available onsite.	Contractor
6	Riparian areas outside the individual sand stations have been disturbed to facilitate access to the creek.	October 10, 2024 October 18, 2024	December 4, 2024	Associated has not received a restoration plan at the time of this memo. However, coco matting, live stakes, and new trees have been installed in disturbed riparian areas.	Contractor/EM
7	Anthropogenic debris left on site	October 18, 2024	December 4, 2024	Contractor removed majority of debris and was removing the last few pieces on December 4.	Contractor

Jordon Rozon

From: Loc Ngo <lngo@keystoneenvironmental.ca>
Sent: December 4, 2024 6:51 PM
To: Nicholas Doucette; Jeff Prowse
Cc: Greg Clease; Mel Murray; Warren Appleton; Vinson Yau; Corbin Manson; John Choi; james hirst
Subject: 19279 - Lower Lagace Creek SCR 14 Environmental Monitoring Summary - 241204
Attachments: ditch bank reinforcement north of Dale Rd..jpg; Garbage was collected and disposed off-Site.jpg; North view of the access road.jpg; QM personnel cleaned the excavator to remove tracked sediment and dirt.jpg; View east of the access road at the end of the work day.jpg

Caution: This email originated from outside our organization. Please do not click links or open attachments, unless you recognize the source of this email. When in doubt, please contact Helpdesk.

Hi Nick,

Below is a summary of the site visit conducted by Keystone Environmental:

Date: December 04, 2024
Environmental Monitor: Loc Ngo
Weather: Clear skies (0℃ to 5℃)

Environmental Monitoring Summary:

- **0700**: The Environmental Monitor (EM) arrived on-site.
    - A quick tailgate meeting was held with QM to discuss site safety and the day's scope of work.
- **0717**: EM inspected 2 Morookas prior to Site departure. Deficiency was not noted.
- **0720**: Machinery tow truck arrived on Site. 2 Morookas were transported off-Site.
- **0725**: Road repair and reinforcement commenced.
- **0835**: Machinery tow truck arrived on Site. One excavator was transported off-Site.
- **1035**: Road repair completed.
    - QM personnel observed cleaning up the machine.
- **1049**: QM collected and removed remaining garbage on Site.
- **1115**: QM commenced ditch bank reinforcement north of Dale Road.
- **1130**: One of the entrance poles was damaged. However, the pole located close to the present knotweed areas and the risk of invasive knotweed contamination was high if the bucket contacted with the knotweed. Hence, QM called off the repair.
- **1145:** End of project. EM inspected the Site and deficiencies were not noted.

- **1150**: EM left Site.

Please let me know if you have any questions or concerns.

Thank you,

Kind regards,

Keystone Environmental
Knowledge-Driven Results

Great Place To Work. Certified

Loc Ngo
Field Biologist
T: 604-430-0671 | **C:** 604-347-7115 |
E: lngo@keystoneenvironmental.ca
320-4400 Dominion Street | Burnaby, BC V5G 4G3

Indigenous Territory Acknowledgement | We acknowledge our Burnaby office is located on the traditional territory of the Coast Salish Peoples, including the səlilwətaɬ (Tsleil-Waututh), Sḵwx̱wú7mesh Úxwumixw (Squamish) and xʷməθkʷəy̓əm (Musqueam) Nations. We are grateful for this privilege and accept our responsibility to improve relationships and respect land rights in the spirit of reconciliation.

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December 04, 2024 10:42 a.m.


NO
PARKING
PRIVATE
PROPERTY
December 04, 2024 11:20 a.m.


HAYCO
rentals
ZAXIS
245USB
December 04, 2024 10:56 a.m.


December 04, 2024 9:32 a.m.


Hayco
rentals
4403
December 04, 2024 10:49 a.m.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

DAILY CONSTRUCTION REPORT

Owner:	Ministry of Environment & Climate Change Strategy-Hatzic Emergency Works	**Report No.:**	14
Project:	Legace Creek	**Page:**	1 of 4
Location:	35225 Dale Road, Mission, BC (Dale Road Bridge)	**Project No.:**	S-CR-214/17 2022-2632-03
Contractor:	Quantum Murray	**File No.:**	Sharepoint / AERIS
Contract:		**Date:**	September 10, 2024
Contract No.:		**Temperature:**	High: 22°C Low: 1°C
Weather:	Sunny, Wind: 4 KM/H, Gusts: 13 KM/H		

List the LABOUR FORCE (by trade) and the CONTRACTOR'S EQUIPMENT, followed by the REPORT.

Labour Force:

Quantum Murray (QM): 2 Site Superintendents (Mel & Jem), 3 Operators (Sandy, Glenn & Greg), 2 Labourers (Dallas & Rick)
Keystone Environmental/Environmental Monitors (KE/EM): Loc and Jeff
Associated Engineering (AE): Jordan Fiske, Vinizza Pingos

Contractor's Equipment: Equipment in use

- Excavator 324Es
- Excavator EXO689
- Excavator 2720
- Loader 1466
- 2 - 6" Vacuum Assisted Pumps

Report, if, any, Contact with Occupants:

N/A

Contact with Owner:

N/A

Safety Concerns:

N/A

Testing:

N/A

Traffic Control:

No traffic management on site.

Report:

7:00 AM
- AE (Vinizza) arrived on site.
- No traffic management in place.

7:12 AM
- Signed in.
- Mel indicated that today's tasks would be the same as yesterday's, pending DFO's response.

8:00 AM
- Leq'amel (Melissa) arrived on site.
- Held a meeting with Jordon.

8:33 AM
- 21 lock blocks (0.75m x 0.75m x 1.52m) delivered to the site.

10:00 AM
- Online meeting with Ryan.

12:00 PM
- United Rentals delivered a replacement 6" water pump to Station K.

1:50 PM
- Garbage bin delivered.

3:30 PM
- Online meeting with Jordon, Alyson, and QM to discuss the layout of the proposed SRS.

4:30 PM
- AE laid out the approximate top of the bank for the proposed SRS.
- Wheel loader transferred coconut matting and poly sheeting to the temporary access road.

4:50 PM
- Hauled gravel from Station C2 to the opposite site.
- Keystone (Loc) reported catching approximately 100 fish at Site 17 and setting traps again.

5:15 PM
- QM continued clearing at Station C.

5:30 PM
- Knotweed removal at Station B.

6:10 PM
- QM and AE left the site.

Photos:


SE
S
SW
W
120
150
180
210
240
270
193°S (T) 10 N 554596 5449753 ±3m 8m
Lock block delivery
HATZIC - Legace Creek SCR 14
10 Sep 2024, 08:46:16


NW
N
NE
E
300
330
0
30
60
90
5°N (T) 10 N 554570 5449819 ±4m 7m
Station B2 & B3
HATZIC - Legace Creek SCR 14
10 Sep 2024, 16:27:27


SE S SW W
150 180 210 240 270 300
221°SW (T) 10 N 554593 5449760 ±3m 7m
Station C2 - trimming
HATZIC - Legace Creek SCR 14
10 Sep 2024, 17:14:06


W NW N NE
270 300 330 0 30 60
350°N (T) 10 N 554572 5449812 ±3m 3m
Station B & B2 - knotweed removal
HATZIC - Legace Creek SCR 14
10 Sep 2024, 17:39:07

APPENDIX H – CONSTRUCTION COMMUNICATIONS

RESPOND. RECLAIM. RENEW.

Associated Engineering

Project Name: Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14-17

Project I.D.:	218635	**Date Submitted:**	August 20, 2024
Submitted By:	Mert Gezgin	**Date Response Needed:**	August 22, 2024
Project Name:	**Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14-17**		
RFI Number:	**RFI-0005**		
RFI Subject:	**Confirmation for Wet Excavation**		
DOCUMENTS AFFECTED BY THIS RFI:			
Spec Section, Para:	N/A		
Drawing #:	N/A		
Other:	N/A		
Schedule Effect:	Yes	TBD	
Cost Effect:	Yes	TBD	
QC Scope Change:	No	N/A	

Requested Information

According to the notes found on Schedule G – Drawings; the contractor must isolate instream work areas for the duration of construction to prevent the migration of sediment downstream while maintaining the natural flow of the creek via temporary diversion or appropriate filter fabric (e.g. silt curtain). Upstream fish passage must be maintained for the duration of construction.

QM is requesting confirmation of whether there are any areas where the wet excavation is acceptable.

RESPOND. RECLAIM. RENEW.

Associated Engineering

Project Name: Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14-17

Response

DFO Emergency Authorization does require that all works are conducted in the dry.

> 2.4.9 Works must be conducted in the dry. Follow DFO's interim Standard for In-Water Site Isolation: (https://www.dfo-mpo.gc.ca/pnw-ppe/codes/interim-provisoire/site-isolation-confinement-aire-travail-eng.html); DFO's interim Code of Practice for End-of-Pipe Fish Protection Screens for Small Water Intakes in Freshwater: (https://www.dfo-mpo.gc.ca/pnw-ppe/codes/screen-ecran-eng.html); and follow DFO's Code of Practice for Temporary Fords: (https://www.dfo-mpo.gc.ca/pnw-ppe/codes/temporary-fords-traversees-temporaires-eng.html)[4]. If works cannot be conducted in the dry due to high flow conditions, the work area must be decommissioned and fish passage reinitiated until conditions allow for site isolation.

Distribution	Organization
Andrew Wiens	AE
Paul Hague	AE
Alyson Meyers	AE
Dianna Christopoulos	AE
Ryan Karsgaard	AE
Naomi Sands	AE
Thyren Jacobs	ENV
Nicholas Doucette	QM
Michael Bailey	QM
Greg Clease	QM
Mert Gezgin	QM
Mel Murray	QM

Originator: Mert Gezgin, Project Manager

Date: August 22, 2024

Contract Administrator (AE):

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

TO	**Contractor:**	QM LP, dba QM Environmental	**Date:**	September 3, 2024
RE	**Project:**	Hatzic Emergency Works Program – Lagace Creek – S-CR-14/17	**Memo No.:**	FM-01
	Owner:	Ministry of Environment and Climate Change Strategy	**Page:**	1 of 2
	Location:	Farms Rd, Hatzic, BC	**File No.:**	
			Project No.:	2022-2632-03

Contractor Question or Discussion:
Email Received from QM's Environmental Monitor (Jeff Prowse, Keystone Environmental)
Email Date and Time: September 3, 2024, 12:10 pm
Details:

Regarding the excavations on Lagace Creek:

- The DFO Authorization states in section 2.4.9 that "Works must be conducted in the dry". As you are likely aware, each excavation area is actually being isolated from flow by a sandbag berm placed on poly sheeting, which wraps around the outside of the berm to minimize the chance of sediment or fish passage between any non-flush areas of the sandbag berm.
- The WSA Approval states (b) 2. "Isolate the instream work zones by diverting flow around the isolated areas via pumps or temporary diversion channels, or by installing silt curtains".

Functionally, the sandbag berm is acting as a diversion channel (flow is diverted around the excavation area) and prevents turbid water from leaving the excavation during instream works. This isolated area is salvaged for fish by minnow trapping (if time allows) and multiple passes of electrofishing.

The DFO Authorization was first issued in October 2022, and the WSA Approval in August 2024 and is the most recent document. It is our strong recommendation that the Proponent should contact DFO to confirm whether the instream works need to be completed in the dry, or if the isolation is sufficient and works can continue. In order to dewater each excavation area, the sandbag berm would likely have to be considerably larger in width and height to withstand the pressure differential, which would shrink excavation areas. In addition, multiple pumps of at least 6 inches in hose diameter would need to be sourced to drain the excavation area within a reasonable time frame to start excavation.

It should be noted that excavation areas salvaged and excavated so far has resulted in the capture and relocation of 10 or less fish in each area, with none seen during the excavation process in distress (i.e. no fish observed swimming at the surface on their side, or incapacitated).

All of the isolation and salvage works completed on Lagace Creek to date are within normal instream works procedures for streams within the lower mainland. However, the requirement within the DFO Authorization needs to be confirmed or amended by DFO to determine how the works continue.

Associated Engineering Response:

- Section 2.4.9 of the DFO Emergency Authorization states "*Works must be conducted in the dry…*". In accordance with DFO's interim standard for in-water site isolation, if a dry working environment is required within the isolation area, the materials used will need to be able to create a water-tight seal and water from within the isolation area is pumped outside of the isolation area. In addition, dewatering will require appropriately sized pumps for the flows and seepage anticipated during construction, and dewatering will need to continue for the duration of in-water works or for as long as water continues to enter the isolation area. Based on the monitoring reports and feedback from QM, it appears that the equipment currently being used is not sized appropriately and therefore ineffective for the existing instream isolation. Excavating sediment in the wet (i.e., not pumping down the water in the isolation area, nor maintaining post-fish salvage) is a contravention of the existing DFO Emergency Fisheries Act Authorization.
- While saturated sediment and some seepage is expected, the bulk of the water should be pumped down while salvaging and before excavation occurs. To conduct instream works, QM must follow the existing DFO Emergency Authorization and associated guidelines.
- Keystone Environmental, as QM's Qualified Professional and Environmental Monitor, is responsible for ensuring the Contractor adheres to the CEMP and the EMP and remains in compliance with applicable permits and authorizations.
- The WSA Section 11 Approval and DFO Emergency Authorization are issued by two separate regulators and the conditions of each are distinct.
- Prior to applying for any amendments to the DFO Emergency Authorization, QM needs to demonstrate that working in the dry is in fact not reasonably achievable.
- No further instream excavation can take place until all permit conditions and CEMP and EMP measures and requirements are met.

If, as a result of this memo, the Contractor intends to make a claim for extra payment, such claim or notice of intention to submit a claim, shall be submitted to the Engineer, in writing, within 10 days after the date of issue of this memo and prior to the commencement of the described work.

Receipt acknowledged by:	Issued by: Alyson Meyers
Contractor Representative	Associated Engineering Representative
Date Acknowledged:	Date Issued: September 3, 2024

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

TO	**Contractor:**	QM LP, dba QM Environmental	**Date:**	September 6, 2024
RE	**Project:**	Hatzic Emergency Works Program – Lagace Creek – S-CR-14/17	**Memo No.:**	FM-03
	Owner:	Ministry of Environment and Climate Change Strategy	**Page:**	1 of 2
	Location:	Farms Rd, Hatzic, BC	**File No.:**	
			Project No.:	2022-2632-03

Contractor Question or Discussion:

Letter sent to Paul Hague (AE) from Jeff Prowse (Keystone Environmental) on September 5, 2024
Details:
Re: Lagace Creek Sediment Removal Works
Fisheries Act Authorization Works Isolation
File No.: 19279

QM Environmental was retained to remove sediment from two reaches of Lagace Creek in the Hatzic Area of Mission, BC. QM Environmental retained Keystone Environmental to provide environmental services for the sediment removal program, including environmental monitoring and fish salvage works.

The *Fisheries Act* Authorization 22-HPAC-01308 states that the instream works must be conducted in the dry (paragraph 2.4.9). To date, QM Environmental has attempted to isolate and dewater excavation areas, however achieving dry work areas has not been possible (see Attachment I: site photos). Isolation at excavation sites has included:

- Installation of cubic meter sandbags around the work area, placed on poly sheeting; the poly sheeting is then wrapped around the outside of the sandbag berm.
- Installation of steel road plates in areas of seepage between bags.
- Turbidity curtain placed downstream of the works area across the channel.
- Electofishing of the isolated area to remove any fish.
- Installation of a fish screened cage around pump intakes, and placement into the isolated area.
- Use of two six-inch dewatering pumps to attempt to dewater the area.

In general, sandbag berms around the isolation sites are two bags wide at the downstream and upstream ends, and one bag wide where flow is parallel to the stream. Depending on the depth of the stream bed each isolation areas, the berm is either one or two bags high.

The two six-inch pumps have not been able to completely dewater the isolated area, with a water level drop of approximately 30 cm out of an average depth of 60 cm. Permeable streambed and interstitial gaps within the sandbag berm wall allow enough water to pass into the excavated area to prevent further reduction of the water level.

As this work is taking place within the instream works window, a relaxing of the "in the dry" requirement for the sediment removal is sought. Mitigations for working instream would still include the sandbag berm isolation of each excavation site with the poly sheeting barrier, in addition to the turbidity curtain remaining downstream. Turbidity curtains could also be used to form part of the isolation barrier in lieu of sandbags in areas of low force (i.e., parallel to flow). Fish salvages would still occur prior to any excavation works within the isolated area. Excavation would take place in isolation of flow, and the area would remain isolated until turbidity with the excavation meets is below the 8 NTU threshold above stream background. Once the turbidity threshold is reached, sandbags will be removed from the downstream to upstream direction.

If you have any questions, please feel free to contact the undersigned.

Associated Engineering Response:

Date of Response: September 6, 2024

Details:

AE engaged with Duncan Lanoville from DFO on September 4,2024, noting the challenges the Contractor was having meeting the Fisheries Act Emergency Authorisation (FAA) condition 2.4.9 which requires that works are conducted in the dry. DFO response was they wanted to see additional efforts to meet the condition before considering a FAA amendment to allow dredging in the wet. AE met with Duncan on September 6,2024, and outlined the efforts that the Contractor has taken to-date, and their continued inability to meet the FAA condition, which is increasing the duration of instream works. Duncan suggested that an application to amend the FAA be submitted outlining the rationale and suggested mitigative measures to permit excavation to occur in the wet.

AE will submit the FAA amendment application to allow for the sediment excavation to be carried out in the wet. In the interim, all instream works must continue to be carried out in accordance with the existing emergency authorization.

If, as a result of this memo, the Contractor intends to make a claim for extra payment, such claim or notice of intention to submit a claim, shall be submitted to the Engineer, in writing, within 10 days after the date of issue of this memo and prior to the commencement of the described work.

Receipt acknowledged by:	Issued by: Alyson Meyers
Contractor Representative	Associated Engineering Representative
Date Acknowledged:	Date Issued: September 6, 2024

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

TO	**Contractor:**	QM LP, dba QM Environmental	**Date:**	September 11, 2024
RE	**Project:**	Hatzic Emergency Works Program – Lagace Creek – S-CR-14/17	**Memo No.:**	FM-05
	Owner:	Ministry of Environment and Climate Change Strategy	**Page:**	1 of 2
	Location:	Farms Rd, Hatzic, BC	**File No.:**	
			Project No.:	2022-2632-03

RE: Knotweed Management

Addendum 1 noted how Knotweed was to be addressed:

> *Knotweed is to be addressed per the EMP (Environmental Management Plan) and in consideration of best management practices. Where sediment is being excavated from the creek bank and the construction of sand stations, the material will be disposed of and tracked per item 4.05 - Lagace Creek S-CR-14 table in the proposal response form. Soil within 20 m circumference and 2 m depth of surface knotweed is considered contaminated (i.e., may contain seeds, root material) and should not be used for site reclamation. Where knotweed is being pruned and trimmed back, those plants need to have the appropriate herbicide injected into the stalk. This cost shall be associated with the restoration of the sand stations as per line item 4.01 - Lagace Creek S-CR-14 table. The CEMP (Contractors Environmental Management Plan) shall address knotweed management. Where knotweed is encountered in relation to trimming, pruning, clearing, grubbing and disposal, those costs should be included in item 2.01 - Lagace Creek S-CR-14 table.*

Associated Environmental conducted an Environmental Compliance Audit on Thursday, August 29, 2024, and identified the following concerns via email sent on Thursday, August 29, 2024, and further detailed in Environmental Compliance Audit No. 1 dated August 30, 2024:

> *One issue of concern noted during the inspection was related to knotweed management.*
>
> - *The EM was on site directing knotweed management. The Contractor was cutting the stems close to the ground and stacking on poly for later disposal. The disposal site has not yet been determined, but will be added to the monitoring reports once identified.*
> - *They are placing geotextile over the cut stems for machinery to drive over for access to the creek bank.*
> - *The auditor noticed that some of the knotweed stems were lying on top of the sandbags that will be going into the creek for site isolation, and even one that had fallen on the excavator track. Just a reminder to make sure all cuttings are confined to the poly as even the smallest stem or root fragment can reproduce.*
> - *Knotweed cut/trimmed on site should also be treated with stem injections. This is in accordance with Addendum 1 to the Contract Documents for the Hatzic Emergency Works Program - Lagace Creek – SITES S-CR-14/17 (Question/Answer 2), "Where knotweed is being pruned and trimmed back, those plants need to have the appropriate herbicide injected into the stalk".*

It has been observed on-site and noted in the Environmental Compliance Audit that knotweed is not being treated with stem injection. Further, this has been discussed with your EM.

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Sediment excavated from knotweed-infested areas that are directly related to the construction of Sand Recovery Stations B-2, B-3, and C-2 will be paid for through Item 4.05 – Lagace Creek S-CR-14 table.

QM needs to manage the knotweed as per the contract requirements and as described in the EMP and the CEMP. QM needs to treat knotweed with stem injections or provide an alternate solution before proceeding with any further work involving knotweed management. Knotweed within 1 m of the HWM must be treated with the appropriate aquatic herbicide. Herbicide application typically requires a Pesticide Use Permit. The pesticide applicator is responsible for selecting the most appropriate product and treatment methods for a site, following the pesticide label instructions and restrictions, and adhering to relevant provincial and federal regulations.

We request that QM document their knotweed management approach and send to AE for review. Please reference the B.C. Ministry of Forest, Invasive Plant Program, Flood Mitigation – Invasive Plant Guidelines.

If, as a result of this memo, the Contractor intends to make a claim for extra payment, such claim or notice of intention to submit a claim, shall be submitted to the Engineer, in writing, within 10 days after the date of issue of this memo and prior to the commencement of the described work.

Receipt acknowledged by:	Issued by:
	Alyson Meyers
Contractor Representative	Associated Engineering Representative
Date Acknowledged:	Date Issued: September 11, 2024

RESPOND. RECLAIM. RENEW.

Associated Engineering

Project Name: Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14-17

Project I.D.:	218635	**Date Submitted:**	September 6, 2024
Submitted By:	Mert Gezgin	**Date Response Needed:**	September 6, 2024
Project Name:	**Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14-17**		
RFI Number:	**RFI-0012**		
RFI Subject:	**Clarification on the Extents of Excavation Areas CR-14 B-2, B-3, C-2 & CR-17 Excavation Areas**		
DOCUMENTS AFFECTED BY THIS RFI:			
Spec Section, Para:	N/A		
Drawing #:	2632-03-C-3102, 2632-03-C-3103, 2632-03-C-3105, 2632-03-C-3106		
Other:	N/A		
Schedule Effect:	No	N/A	
Cost Effect:	No	N/A	
QC Scope Change:	No	N/A	

Requested Information

QM Environmental field crew requires a clear layout of the work area extents for Stations B-2, B-3 and C-2 at Lower Lagace Site (CR-14), and Excavation Area North at Upper Lagace Saporano Site (CR-17), between the parcels 008-799-121 and 000-439-665. This request was communicated with the AE site representative(s) on-site.

QM is unable to identify the excavation limits as there is no distance provided between the excavation extents and the creek's bank in the drawings for the stations B-2, B-3 and C-2. That may result in a collapse in the excavated area due to groundwater pressure and loose material if QM starts excavation too close to the bank. In order for QM to perform the excavation, a safe distance for the excavation limit needs to be specified and marked with paint or stakes/ribbons by the AE field team according to the design.

The extents of the excavation areas located on the Upper Lagace Saporano Site need to be marked as well in order for QM to perform excavation. QM is unable to locate the extents without any given dimensions or markings.

An urgent action on this matter will be highly appreciated.

RESPOND. RECLAIM. RENEW.

Associated Engineering

Project Name: Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14-17

Response

The Contractor is responsible to layout the work per the MWC, Article 22.

The attached markup provides further clarity for S-CR-14 to aid in this effort. A few notes:
- As discussed during the Supplier Site Meeting, the intention is to remove sediment accumulation around Seux Road bridge to increase the flow capacity. To this end, the top of bank is being relocated. Associated will establish the proposed top of bank to assist with further layout by QM.
- Per Detail 1 on Drawing C-3502, the edge of the SRS shall be located at the top of bank while the approximate location of each station is identified on Drawing C-3101.
- Further, SRS will be located 2-3 m off of the ROW property line extensions (green lines on the attached) and generally in line with the bridge abutment.
- Refer to Note 1 on the attached.

For S-CR-17, Drawing C-3106 notes the extent of excavation. A few notes:
- The 50 m^3 excavation starts at the downstream end of the existing culverts in the south ditch of Sylvester Road. Using the stationing as a guide, the work extends approximately 50 m upstream. Given the quantity and length, the expectation is that the Contractor will excavate 1 m^3 of sediment per lineal meter of ditch length.
- The 250 m^3 excavation starts at Station 3+990 and extends approximately 45 m upstream. The exact location of the sediment deposition can be visually located in the creek.
- Refer to Note 1 on the drawing.

Distribution	Organization
Andrew Wiens	AE
Paul Hague	AE
Alyson Meyers	AE
Dianna Christopoulos	AE
Ryan Karsgaard	AE
Naomi Sands	AE
Thyren Jacobs	ENV
Nicholas Doucette	QM
Michael Bailey	QM
Greg Clease	QM
Mert Gezgin	QM
Mel Murray	QM

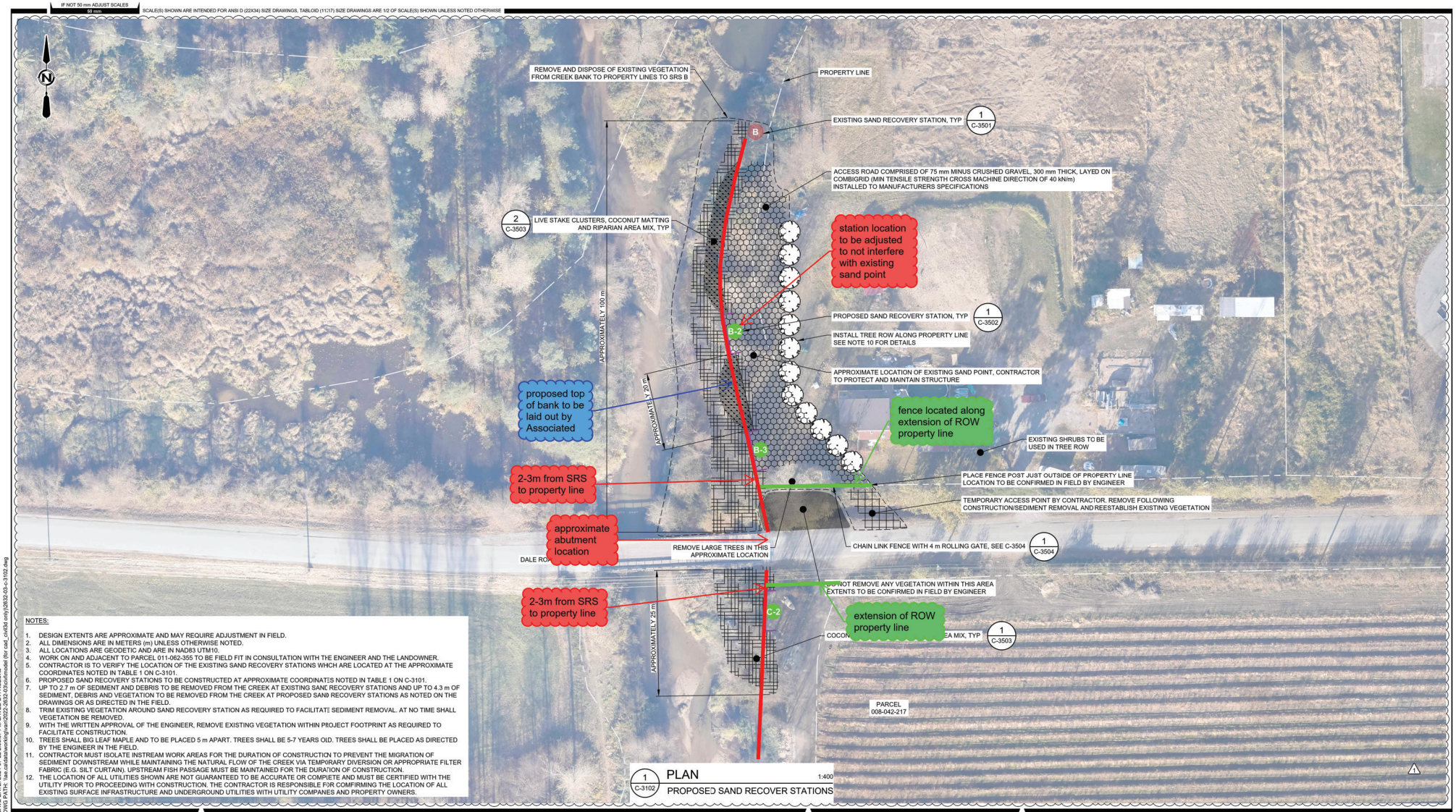
Originator: Mert Gezgin, Project Manager

Date: September 10, 2024

Contract Administrator (AE):

IF NOT 50 mm ADJUST SCALES
50 mm

SCALE(S) SHOWN ARE INTENDED FOR ANSI D (22X34) SIZE DRAWINGS, TABLOID (11X17) SIZE DRAWINGS ARE 1/2 OF SCALE(S) SHOWN UNLESS NOTED OTHERWISE



1 C-3102 PLAN 1:400
PROPOSED SAND RECOVER STATIONS

NOTES:

1. DESIGN EXTENTS ARE APPROXIMATE AND MAY REQUIRE ADJUSTMENT IN FIELD.
2. ALL DIMENSIONS ARE IN METERS (m) UNLESS OTHERWISE NOTED.
3. ALL LOCATIONS ARE GEODETIC AND ARE IN NAD83 UTM10.
4. WORK ON AND ADJACENT TO PARCEL 011-062-355 TO BE FIELD FIT IN CONSULTATION WITH THE ENGINEER AND THE LANDOWNER.
5. CONTRACTOR IS TO VERIFY THE LOCATION OF THE EXISTING SAND RECOVERY STATIONS WHCH ARE LOCATED AT THE APPROXIMATE COORDINATES NOTED IN TABLE 1 ON C-3101.
6. PROPOSED SAND RECOVERY STATIONS TO BE CONSTRUCTED AT APPROXIMATE COORDINATES NOTED IN TABLE 1 ON C-3101.
7. UP TO 2.7 m OF SEDIMENT AND DEBRIS TO BE REMOVED FROM THE CREEK AT EXISTING SAND RECOVERY STATIONS AND UP TO 4.3 m OF SEDIMENT, DEBRIS AND VEGETATION TO BE REMOVED FROM THE CREEK AT PROPOSED SAND RECOVERY STATIONS AS NOTED ON THE DRAWINGS OR AS DIRECTED IN THE FIELD.
8. TRIM EXISTING VEGETATION AROUND SAND RECOVERY STATION AS REQUIRED TO FACILITATE SEDIMENT REMOVAL. AT NO TIME SHALL VEGETATION BE REMOVED.
9. WITH THE WRITTEN APPROVAL OF THE ENGINEER, REMOVE EXISTING VEGETATION WITHIN PROJECT FOOTPRINT AS REQUIRED TO FACILITATE CONSTRUCTION.
10. TREES SHALL BIG LEAF MAPLE AND TO BE PLACED 5 m APART. TREES SHALL BE 5-7 YEARS OLD. TREES SHALL BE PLACED AS DIRECTED BY THE ENGINEER IN THE FIELD.
11. CONTRACTOR MUST ISOLATE INSTREAM WORK AREAS FOR THE DURATION OF CONSTRUCTION TO PREVENT THE MIGRATION OF SEDIMENT DOWNSTREAM WHILE MAINTAINING THE NATURAL FLOW OF THE CREEK VIA TEMPORARY DIVERSION OR APPROPRIATE FILTER FABRIC (E.G. SILT CURTAIN). UPSTREAM FISH PASSAGE MUST BE MAINTAINED FOR THE DURATION OF CONSTRUCTION.
12. THE LOCATION OF ALL UTILITIES SHOWN ARE NOT GUARANTEED TO BE ACCURATE OR COMPLETE AND MUST BE CERTIFIED WITH THE UTILITY PRIOR TO PROCEEDING WITH CONSTRUCTION. THE CONTRACTOR IS RESPONSIBLE FOR COMFIRMING THE LOCATION OF ALL EXISTING SURFACE INFRASTRUCTURE AND UNDERGROUND UTILITIES WITH UTILITY COMPANES AND PROPERTY OWNERS.

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Associated Engineering

Platinum member

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
R. T. KARSGAARD
58091
2024-07-25
FOR CIVIL

COLLEGE OF APPLIED BIOLOGISTS
Carrie-Lynn Nadeau
RPBio
2026
CAB
2024/Jul/26
FOR BIOENGINEERING

PERMIT TO PRACTICE
ASSOCIATED ENGINEERING (B.C.) LTD.
PERMIT NUMBER: 1000163
Engineers & Geoscientists BC

REV	DATE	DESIGN	DRAWN	DESCRIPTION
1	2024/JUL22	R. KARGAARD	J. ROZON	ISSUED FOR RFP AND PERMITTING
0	2024/JUN14	R. KARSGAARD	J. ROZON	ISSUED FOR RFP

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: AS SHOWN

BRITISH COLUMBIA

CIVIL
PLAN
S-CR-14 PROPOSED SAND RECOVERY STATIONS

DRAWING	REVISION	SHEET
2632-03-C-3102	1	4

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TO	**Contractor:**	QM LP, dba QM Environmental	**Date:**	September 10, 2024
RE	**Project:**	Hatzic Emergency Works Program – Lagace Creek – S-CR-14/17	**Memo No.:**	FM-04
	Owner:	Ministry of Environment and Climate Change Strategy	**Page:**	1 of 1
	Location:	Farms Rd, Hatzic, BC	**File No.:**	
			Project No.:	2022-2632-03

Contractor Question or Discussion:

Phone call from Mert Gezgin (QM) to Alyson Meyers (AE) on September 6, 2024, at 9:00 am:
Details:
QM requested clarification on specification for the 200 mm granular base material in the Typical Detail for Lock Block Structure.

Associated Engineering Response:

Date of Response: September 10, 2024
Details:
Granular Base: MOTI 25 mm Intermediate-Graded Base (IGB)

If, as a result of this memo, the Contractor intends to make a claim for extra payment, such claim or notice of intention to submit a claim, shall be submitted to the Engineer, in writing, within 10 days after the date of issue of this memo and prior to the commencement of the described work.

Receipt acknowledged by:	Issued by:
	Alyson Meyers
Contractor Representative	Associated Engineering Representative
Date Acknowledged:	Date Issued: September 10, 2024

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TO	**Contractor:**	QM LP, dba QM Environmental	**Date:**	September 16, 2024
RE	**Project:**	Hatzic Emergency Works Program – Lagace Creek – S-CR-14/17	**Memo No.:**	FM-07
	Owner:	Ministry of Environment and Climate Change Strategy	**Page:**	1 of 1
	Location:	Farms Rd, Hatzic, BC	**File No.:**	
			Project No.:	2022-2632-03

Contractor Question or Discussion:

Site Discussion Date & Time: September 16, 2024, at 8:30AM

Details: Quantum Murray (QM) (James Hirst) and Associated Engineering (Associated) (Jordan Fiske) discussed the excavation extents and length of the Combigrid and 75mm minus crushed gravel for the proposed Sand Recovery Stations (SRS). The Combigrid and 75mm minus crushed gravel is to extend 5m from the back of the lock blocks for the proposed SRS per Detail 1 on drawing 2632-03-C-3502.

Email Received from Contractor: No

Email Date & Time: N/A

Attachments: Drawing 2632-03-C-3502.

If, as a result of this memo, the Contractor intends to make a claim for extra payment, such claim or notice of intention to submit a claim, shall be submitted to the Engineer, in writing, within 10 days after the date of issue of this memo and prior to the commencement of the described work.

Receipt acknowledged by:	Issued by:
	Jordan Fiske
Contractor Representative	Associated Engineering Representative
Date Acknowledged:	Date Issued: September 16, 2024

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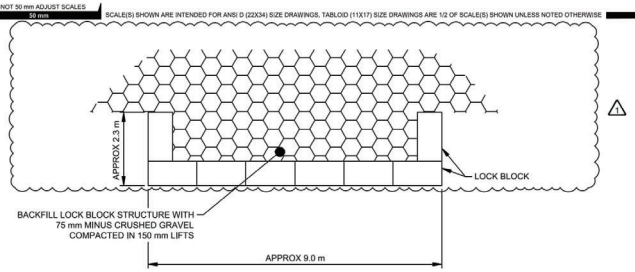
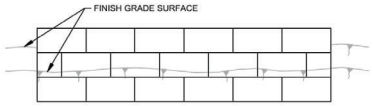
IF NOT 50 mm ADJUST SCALES
50 mm
SCALE(S) SHOWN ARE INTENDED FOR ANSI D (22X34) SIZE DRAWINGS, TABLOID (11X17) SIZE DRAWINGS ARE 1/2 OF SCALE(S) SHOWN UNLESS NOTED OTHERWISE



PLAN



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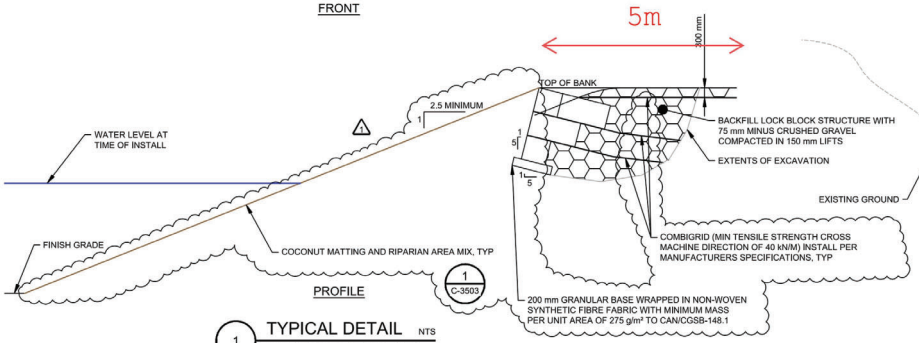
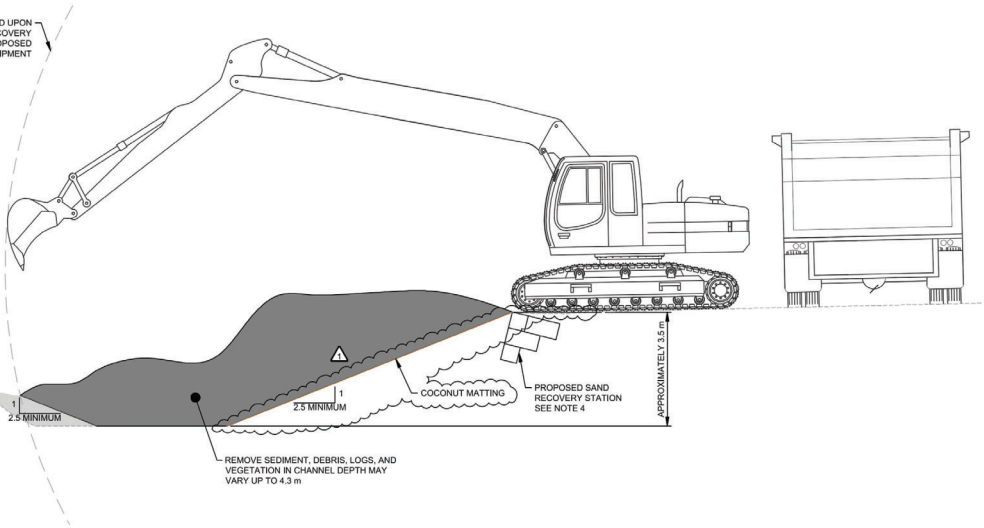


1 TYPICAL DETAIL NTS
LOCK BLOCK STRUCTURE



2 TYPICAL DETAIL NTS
PROPOSED SAND RECOVERY STATION EXCAVATION

NOTES:

1. DESIGN EXTENTS ARE APPROXIMATE AND MAY REQUIRE ADJUSTMENT IN FIELD.
2. ALL DIMENSIONS ARE IN METERS (m) UNLESS OTHERWISE NOTED.
3. ALL LOCATIONS ARE GEODETIC AND ARE IN NAD83 UTM10.
4. CONTRACTOR IS TO VERIFY THE LOCATION OF THE EXISTING SAND RECOVERY STATIONS WHICH ARE LOCATED AT THE APPROXIMATE COORDINATES NOTED IN TABLE 1 ON C-3101.
5. PROPOSED SAND RECOVERY STATIONS TO BE CONSTRUCTED AT APPROXIMATE COORDINATES NOTED IN TABLE 1 ON C-3101.
6. UP TO 2.7 m OF SEDIMENT AND DEBRIS TO BE REMOVED FROM THE CREEK AT EXISTING SAND RECOVERY STATIONS AND UP TO 4.3 m OF SEDIMENT, DEBRIS AND VEGETATION TO BE REMOVED FROM THE CREEK AT PROPOSED SAND RECOVERY STATIONS AS NOTED ON THE DRAWINGS OR AS DIRECTED IN THE FIELD.
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Associated Engineering
Platinum member

PERMIT TO PRACTICE
ASSOCIATED ENGINEERING (B.C.) LTD.
PERMIT NUMBER: 1000163
Engineers & Geoscientists BC

REV	DATE	DESIGN	DRAWN	DESCRIPTION
1	2024/JUL22	R. KARGAARD	J. ROZON	ISSUED FOR RFP AND PERMITTING
0	2024/JUN14	R. KARSGAARD	J. ROZON	ISSUED FOR RFP

BC MINISTRY OF ENVIRONMENT
AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY
WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: AS SHOWN

BRITISH COLUMBIA

CIVIL
DETAIL 2 OF 6
PROPOSED SAND RECOVERY STATION

DRAWING	REVISION	SHEET
2632-03-C-3502	1	10

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

TO	**Contractor:**	QM LP, dba QM Environmental	**Date:**	September 12, 2024
RE	**Project:**	Hatzic Emergency Works Program – Lagace Creek – S-CR-14/17	**Memo No.:**	FM-06
	Owner:	Ministry of Environment and Climate Change Strategy	**Page:**	1 of 1
	Location:	Farms Rd, Hatzic, BC	**File No.:**	
			Project No.:	2022-2632-03

Contractor Question or Discussion:

Site Discussion Date & Time: September 11, 2024, at 2:40 PM

Details: Quantum Murray (QM) (James Hirst) and Associated Engineering (Associated) (Jordan Fiske) discussed creek work with an excavator not situated on the existing or proposed Sand Recovery Stations (SRS). Associated (Jordan and Jack Dai Tang) have made QM aware multiple times that all excavator work (sandbag placement and excavation of material) along the creek bank should be done from within the lock block structure of the SRS.

QM is proposing to excavate location C-2 without installing the proposed SRS first. QM believes it can achieve a higher quantity and have a better opportunity of working in the dry by excavating this location before the SRS is constructed. Construction of the SRS will then follow once excavation is complete.

Associated (Jordan) has made QM (James) aware of the potential risks and consequences of completing this work without the proposed SRS C-2 constructed, including fines and penalties should the creek bank fail, and/or the excavator fall into the creek. QM (James) has acknowledged and is willing to take on the associated risks.

Email Received from Contractor: No

Email Date & Time: N/A

If, as a result of this memo, the Contractor intends to make a claim for extra payment, such claim or notice of intention to submit a claim, shall be submitted to the Engineer, in writing, within 10 days after the date of issue of this memo and prior to the commencement of the described work.

Receipt acknowledged by:	Issued by:
	Jordan Fiske
Contractor Representative	Associated Engineering Representative
Date Acknowledged:	Date Issued: September 12, 2024

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RESPOND. RECLAIM. RENEW.

Associated Engineering

Project Name: Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14-17

Project I.D.:	218635	**Date Submitted:**	September 5, 2024
Submitted By:	Mert Gezgin	**Date Response Needed:**	September 10, 2024
Project Name:	**Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14-17**		
RFI Number:	**RFI-0011**		
RFI Subject:	**Usage of Clean Sediment As A Replacement for Topsoil**		
DOCUMENTS AFFECTED BY THIS RFI:			
Spec Section, Para:	N/A		
Drawing #:	2632-03-C-3503, Vegetated Riprap Specifications 2.1.5		
Other:	N/A		
Schedule Effect:	No	N/A	
Cost Effect:	No	N/A	
QC Scope Change:	No	N/A	

Requested Information

As stated on the drawing # 2632-03-C-3503, Vegetated Riprap Specifications 2.1.5; imported topsoil will be required to use in soil pockets for the live staking.

QM is requesting a confirmation for the usage of the clean sediment as a replacement for topsoil if the soil sampling results to be found satisfactory.

RESPOND. RECLAIM. RENEW.

Associated Engineering

Project Name: Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14-17

Response

Topsoil is required to support live staking for the vegetated rip rap (coconut matting) and provide an appropriate growing medium for plant growth. Excavated sediment is not considered an appropriate growing medium for riparian/terrestrial vegetation and therefore cannot be used in this capacity.

Distribution	Organization
Andrew Wiens	AE
Paul Hague	AE
Alyson Meyers	AE
Dianna Christopoulos	AE
Ryan Karsgaard	AE
Naomi Sands	AE
Thyren Jacobs	ENV
Nicholas Doucette	QM
Michael Bailey	QM
Greg Clease	QM
Mert Gezgin	QM
Mel Murray	QM

Originator: Mert Gezgin, Project Manager

Date: September 10, 2024

Contract Administrator (AE):

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

TO	**Contractor:**	QM LP, dba QM Environmental	**Date:**	October 9, 2024
RE	**Project:**	Hatzic Emergency Works Program – Lagace Creek – S-CR-14/17	**Memo No.:**	FM-09 Rev1
	Owner:	Ministry of Environment and Climate Change Strategy	**Page:**	1 of 2
	Location:	Farms Rd, Hatzic, BC	**File No.:**	
			Project No.:	2022-2632-03

Contractor Discussion:
Site Discussion Date & Time: October 8, 2024, at 10:00 AM between Duncan McCormick (Associated Engineering) and Mel Murray (QM)
Details:
Per Drawing C-3102, QM is placing coconut matting on the excavated slopes; however, topsoil and seed are not being used. The need for topsoil was brought to QM's attention. QM is concerned that the drawing set does not explicitly note the need for topsoil.

Should topsoil be required, QM is requesting to use the existing material excavated from Sand Recovery Station C-2 or imported topsoil. RFI-011 refers to not being allowed to use the excavated topsoil from C-2 for this purpose; however, QM is requesting that we reconsider this position.

Associated Engineering Response:
Date of Response: October 8, 2024
Details:
The drawing set notes the requirement to install coconut matting and riparian area mix on the excavated slopes (see Drawing C-3102 and callouts to Drawing C-3502 and C-3503). The need for topsoil is not explicitly labelled; however, the hatch is intended to be topsoil – an appropriate growing medium for the riparian area mix to be placed on. Further, the order materials are drawn in the details on Drawing C-3503 are incorrect; the topsoil and seed shall be placed under the coconut matting as per the manufacturer's specifications (attached).

The material excavated from C-2 is not considered suitable growing material per RFI-011.

Date of Revision 1 Response: October 9, 2024
Contractor Discussion:
QM sent an email on October 9, 2024, that stated the following:

> Please see the comment from Keystone below as per our proposal of using the topsoil removed from C-2 under the coconut matting:
>
> *"Hi Mert,*

Under the guidance of the QEP for this project, we believe that the stockpiled soil, removed from Station C2, is suitable for use as topsoil at Stations B and C. As the soil is currently considered free of knotweed contamination, it may be moved freely from its current location to Stations B and C.

Please note that any topsoil moved into the area of Station B is to be considered contaminated with knotweed and must remain at Station B area unless directed otherwise by the QEP.

As QM proceeds with the placement of the topsoil, Keystone Environmental recommends the following mitigation measures be implemented to prevent deposition of sediments into Legace Creek and to prevent the spread of knotweed propagules:

1. *Silt fencing (or a suitable alternative as determined by the environmental monitor) shall be placed above the toe of the slope prior to topsoil placement to catch any mobilized soils before they reach the stream.*
2. *Avoid placing excess soil at Station B, as once the soil is brought to Station B, it cannot be removed (see above). Consider moving soil to Station B on an as-needed basis to avoid the placement of excessive soil at Station B.*
3. *Should the quantity of available soil on site be insufficient for slope stabilization preparations, we recommend sourcing certified weed-free soil from a reputable local supplier. If possible, receive the soil in a knotweed-free area so it may be used in knotweed-free and knotweed infested areas.*

Please advise us if you require more information.

Best,"

If we will need to place min. 50 mm thick topsoil layer under the coconut matting, the required volume is approx. 57 m^3. According to the survey results, we have 79 m^3 of topsoil removed from Station C-2 which is sufficient. If we can get the go-ahead for the topsoil today, we will be able to send our crew tomorrow to do this work. Your prompt response will be much appreciated on this matter.

Associated Engineering Response:

Date of Response: October 9, 2024

Details:

Based on the information received from QM's Environmental Monitor regarding the stockpiled material from Station C2, QM can proceed with using this material as topsoil under the coconut matting, provided they follow Keystone Environmental's recommended mitigation measures for placing the topsoil.

If, as a result of this memo, the Contractor intends to make a claim for extra payment, such claim or notice of intention to submit a claim, shall be submitted to the Engineer, in writing, within 10 days after the date of issue of this memo and prior to the commencement of the described work.

Receipt acknowledged by:

Contractor Representative

Date Acknowledged:

Issued by: Alyson Meyers

Associated Engineering Representative

Date Issued: October 9, 2024

Canada's leader of complete geosynthetic solutions



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Coir Mats

Coir Mats are made from 100% natural biodegradable coconut fibre and are naturally resistant to rot and moulds. They are excellent for controlling soil erosion by holding the soil in place and dissipating the force of heavy rains and run-off water.

With a longevity of 36 to 72 months, Coir Mats will provide good soil support while allowing natural vegetation to become established. They will also promote growth of new vegetation by absorbing water and preventing the topsoil from drying out, creating an ideal micro-climate for seed germination.

Coir Mats are available in 3 varieties, being Coir Mat 400, Coir Mat 700 & Coir Mat 900, with the number corresponding to the density in g/m2 for that particular mat.



Coir Mat Installation

Site Preparation: Grade and shape the area of installation. If applicable, prepare seed-bed by loosening 5 cm to 8 cm of topsoil.

Seeding: Seed the area before the installation of Coir Mat. For best results, a veneer of soil should be raked over the broadcast seeded surface. All check slots and other areas disturbed during the installation must be re-seeded.

Anchoring: U-shaped wire staples (11 gauge minimum 15 cm to 30 cm long) or wooden stakes can be used to anchor the matting to the ground.







Installation on Slopes

- Begin at the top of the slope and anchor Coir Mat in a 30 cm deep initial anchor trench. Backfill trench and tamp earth firmly.
- Unroll matting down slope.
- Overlap edges of adjacent parallel rolls 15 cm and anchor with staple at 30 cm centres.
- When Coir Mat must be spliced, place end over end (shingle style) with 30 cm overlap and anchor using two staggered rows of staples at 15 cm centres.
- Lay mat loosely and anchor sufficiently to maintain direct contact with the soil.
- For slopes 2:1 and steeper use a minimum of 2 staples per square metre and for slopes flatter than 2:1 use a minimum of 1 staple per square metre.
- Anchor, fill and compact end of the matting in 30 cm x 15 cm terminal anchor trench.

Installation in Channels

- Dig 30 cm x 20 cm initial channel anchor trench across the channel at the upstream end.
- Excavate intermittent 15 cm x 15 cm check slots across the channel at 7.6 m to 15 m intervals along the channel depending on the slope gradient.
- Cut 15 cm x 15 cm longitudinal channel anchor slots along each side of the installation to bury the edges of Coir Mat.
- Begin the initial anchor trench installation in the channel centre. Secure initial ends of Coir Mat using anchors at 30 cm centres, backfill and compact soil.
- In the same manner, position adjacent rolls in the initial anchor trench overlapping the preceding roll a minimum of 15 cm.
- Unroll centre strip downstream.
- Unroll adjacent mats downstream in similar fashion, maintaining 15 cm wide overlap. Anchor through the overlapped area at 30 cm intervals.
- Secure the edges of Coir Mat along the longitudinal trench using anchors at 30 cm centres.
- Fold and secure the matting snugly into all transverse check slots. Lay the matting in the bottom of the slot and then fold back against itself. Anchor through both layers of matting at 30 cm intervals then backfill and compact soil. For non-critical installations, place two staggered rows of anchors at 15 cm centres in lieu of check slots.
- When Coir Mat must be spliced, place upstream matting over the downstream matting (shingle style) and anchor using two staggered rows of staples at 15 cm centres.
- Anchor, fill and compact downstream end of the matting in terminal anchor trench.



Coir Mat Specifications



Technical Specifications for Coir Mat 400, 700 & 900

PROPERTY	TEST METHOD	UNITS	COIR MAT 400	COIR MAT 700	COIR MAT 900
Material	n/a	n/a	Woven matting of coir yard made from high strength coconut fibre		
Color	n/a	n/a	Natural/Earth tone		
Thickness	ASTM D 5199	mm	8.9	8.9	8.9
Mass per unit area (min)	ASTM D 5261	g/m^2	400	700	900
Wide width tensile strength - Dry MD X CD	ASTM D 4595	kN/m	7.37 x 7.01	22.10 x 15.08	28.76 x 20.69
Maximum Elongation Dry MD X CD	ASTM D 4595	%	33 x 31	40 x 33	46 x 34
Wide width tensile strength - Wet MD X CD	ASTM D 4595	kN/m	6.66 x 5.26	13.50 x 10.00	18.41 x 11.22
Maximum Elongation - Wet MD X CD	ASTM D 4595	%	36 x 31	69 x 34	43 x 36
Flexural Rigidity (Stiffness) - MD X CD	ASTM D 1388	mg-cm	4,070 x 3,923	12,896 x 8,132	14,019 x 9,329
Shear Stress (Recommended)	Flume Tests	kPa	22.06	31.03	41.37
Water Velocity	Flume Tests	m/sec	2.44	3.66	4.88
Water Absorption	ASTM D 1117	%	163	146	132
Open Area	Measured	%	65	50	39

*Standard Roll Size 2m x 50m (6.5' x 164')

Coir Logs

Coir Logs are made out of 100% natural biodegradable coconut fibers and the product composition is divided into two categories, the outer netting and inner core material. The outer netting is made with high tensile machine spun bristle coir twine coconut fiber. The high tensile bristle coconut coir fiber netting is made up to an open area of 25.4mm x 25.4mm opening. The inner core is filled up with hydraulically compacted with coconut fiber and coir logs are available in two different densities. This product is highly recommended for bank Stabilization and Shore land restoration, where the banks are subjected to sever erosion. The coir logs will act as a barrier and cut down the high water waves hitting the bank and at the same time will facilitate the vegetation establishment to grow and naturally protect the bank erosion



The coconut coir log has a functional longevity of approximately 36 to 48 months. The functional longevity period will depend on the micro climate, where the coir log is laid and also on the external environmental conditions the log is exposed to. The functional longevity is enhanced by the strong spun bristle coir twine along with the high compaction of coconut fiber while supporting the vegetation. Coconut fiber is natural product from the Coconut Palm tree (Cocos nuceifera) and **100% bio-degradable product without any external additives (chemicals or any other colourings).**

Coir Log Installation

To insure successful installation of Coir Logs, it is important that proper staking procedures are followed to prevent logs from being displaced from the shoreline.

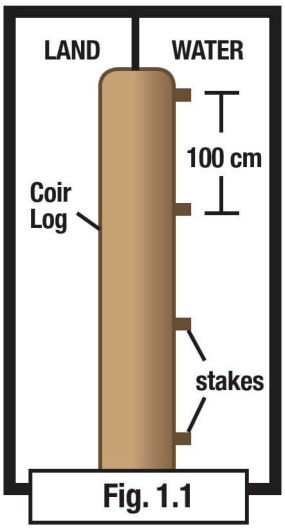

Fig. 1.1

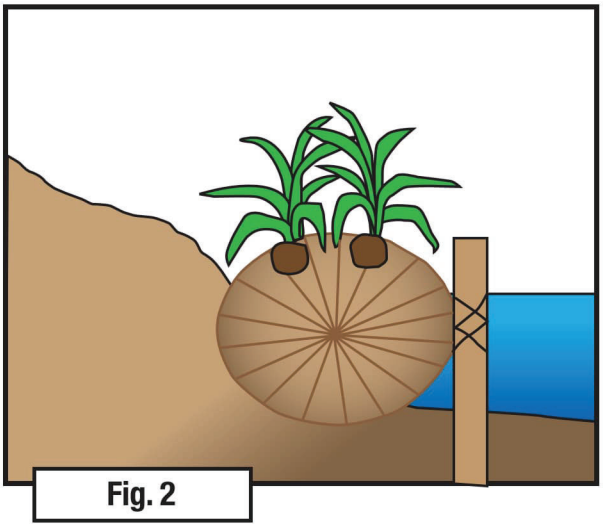
Fig. 2

For sites such as small ponds, or where water flow is slow moving, as few as 4 stakes per 2.28 meter log can be used (Fig. 1.1) The wood stakes should be placed along the water side of the Coir Log and the stake should be placed through the netting (Fig. 2).

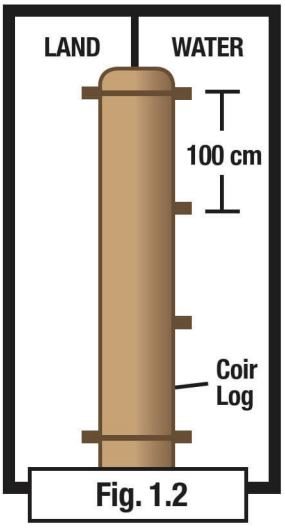

Fig. 1.2

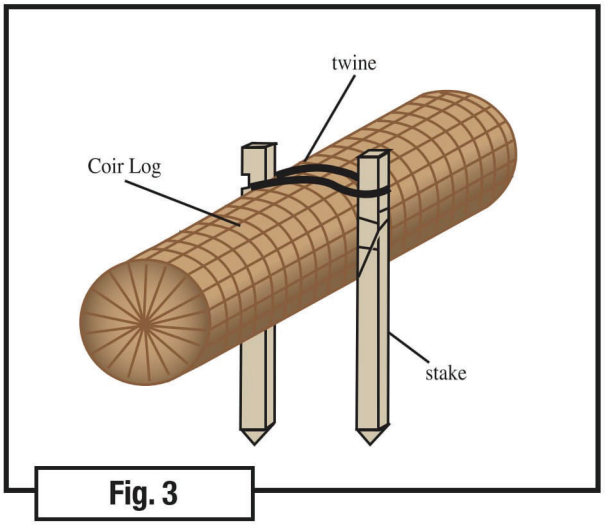

Fig. 3

On medium water flow sites, at least 6 stakes should be used per 2.28 meter log (Fig.1.2).
If there is a potential for water flow or ice to lift the log from position, the log should be held in place using twine (Fig. 3).

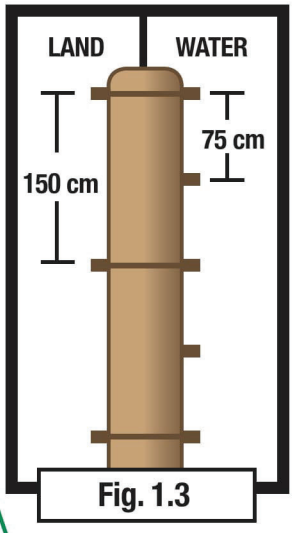

Fig. 1.3

On high water flow sites, such as lakes or in fast moving currents, a minimum of 8 stakes should be used on a 2.28 meter log. (Fig.1.3).

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Coir Logs Specifications

Technical Specifications for Coir Log	
PROPERTY	**COIR LOG 12**
Netting	Coir
Diameter	30 cm
Length	2.28 m
Weight per 7.5 ft (2.28m)	18 kg
Tensile Strength	356N
Inner Core Density	112 kg/cu.m











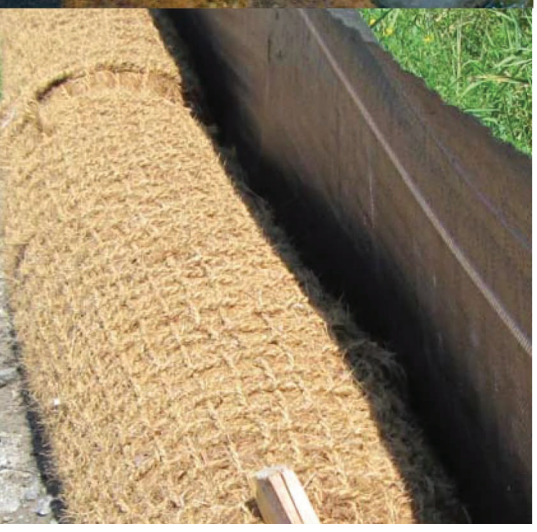

Erosion Control - A Natural Solution

Terrafix® Coir Mats and Coir Logs are made of pure coconut husk fibre - 100% natural and biodegradable. Coir fibre is durable and strong, with the right properties for being spun and woven into a high strength mat.

Features

- Coir Mat erosion control mattings are made from coir fiber which is 100% natural, organic, biodegradable and safe to wildlife
- More flexible than mattings made from bristle coir fibre. This characteristic allows Coir Mat to interface with the soil surface
- High tensile strength and durability makes it suitable for the most severe erosion control problems
- Easy to install
- 36 to 72 months longevity to allow for full vegetation establishment
- Absorbs water and acts as a mulch on the surface as well as a wick in the soil mantle. This creates an ideal micro-climate for the germination of seeds
- Open mesh construction provides an excellent opportunity for the growth of vegetation
- Adds fertility to the soil after biodegradation
- Accelerates the development of aquatic and riparian habitat
- Accepts hydraulically applied products
- Traps sediments and encourages deposition
- Environmentally and aesthetically pleasing
- Provides effective erosion control of steep slopes and high velocity flow channels
- Provides economic and environmentally sound stabilization of stream banks & shorelines
- Ideal for most landscaping and bioengineering applications

Applications

- Slope and channel stabilization
- Stream and river bank stabilization
- Wetland construction
- Golf courses
- Erodible sea shore
- Dams
- Tidal marshes
- Detention ponds
- Highway and rail embankments
- Mining operations and landfills
- Intermittent flow channels
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- High altitude planting
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June 2015

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

TO	**Contractor:**	QM LP, dba QM Environmental	**Date:**	November 8, 2024
RE	**Project:**	Hatzic Emergency Works Program – Lagace Creek – S-CR-14/17	**Memo No.:**	FM-11
	Owner:	Ministry of Environment and Climate Change Strategy	**Page:**	1 of 2
	Location:	Farms Rd, Hatzic, BC	**File No.:**	
			Project No.:	2022-2632-03

The purpose of this Field Memo is to **request an Implementation Plan from the Contractor for the application of bioengineering treatments, before the start of installation,** at Lagace Creek - Site S-CR-14, near Hatzic, B.C. These treatments refer to drawings 2632-03-G-3001, 3002 to 2632-03-C-3101 to 3505.

Two bioengineering treatment types are prescribed in the design package:

1) Live Stake Clusters (C-3102, C-3503)
2) Dense Live Staking (C-3104, C-3505)

Installation of bioengineering requires the correct application of the bioengineering specifications outlined in the design drawings as the materials are alive. Incorrect handling, preparation, storage, and installation of the live stakes can significantly impact the success of the treatments. For installation, using crews who are experienced in soil bioengineering is preferred and the presence of the Environmental Monitor is recommended.

As per the bioengineering specifications outlined in the design drawings, before the start of installation, **the following information is requested in an Implementation Plan, for each treatment** (if different):

1) Schedule
    a. Provide a schedule: delivery, storage, preparation, and installation
2) Source and Stake Details
    a. Where are the stakes coming from, supplier and specific harvest location (as per specs 1.1-1.3 C-3503 and 1.3.1 C-3505)
    b. Confirm lengths
    c. Confirm the species
    d. Confirm numbers ordered for each treatment type
3) Transportation and Storage Onsite
    a. How will the stakes be transported and stored during transport
    b. Where will they be delivered onsite
    c. How they will be stored while onsite
4) Stake Preparation
    a. Provide the preparation plans (where/how they will be prepared)

5) Stake Installation Methods
    a. List planned installation methods for each treatment. Installation methods listed in C-3503 and C-3505 state installation methods.
        i. The recommended method for stake installation for both treatments is using a planting bar (1.5 m long straight heavy iron bar with a pointed end) and create the pilot hole to a depth of 1.0 m.
        ii. Do not use live stakes to create the pilot holes as this will damage their bark and compromise the viability of the stake.
        iii. Pilot holes can also be created with a hand drill auger, but live stakes must be planted to a minimum depth of 0.8 m, and air pockets must not be left in the pilot holes around the stakes. Using an auger can also cause increased sedimentation in the creek as the auger lifts soil up and out of the pilot hole. Erosion and sedimentation mitigation measures (as per the CEMP) must be implemented.

Live Stakes Clusters (C-3503) remove the following specifications as they no longer apply:

- 2.1.5. ADDING TOPSOIL TO THE SOIL POCKET TO IMPROVE SOIL QUALITY AND FERTILITY. IMPORTING WEED-FREE TOPSOIL.
- 2.1.7. CUT COCONUT MATTING TO A LENGTH THAT WILL ENTIRELY WRAP AROUND THE SOIL POCKET ONCE BUILT (0.3 M DIAMETER), APPROXIMATELY 1 TO 2 M.
- 2.1.8. ONCE RIPRAP IS INSTALLED TO THE CORRECT ELEVATION, CUT COCONUT MATTING IS TO BE LAID FLAT ON THE RIPRAP BELOW THE PREPARED SOIL POCKET EXCAVATION AREA.
- 2.1.9. FOLLOWING TYPICAL DETAIL 2 ON C-3503, SOIL WILL BE PLACED ON THE COCONUT MATTING TO A DIAMETER OF 30 CM UP TO THE DEPTH OF THE RIPRAP. THE COCONUT MATTING ENDS ARE TO BE LEFT FREE TO BE WRAPPED AROUND THE SOIL POCKET.

Live Stakes Clusters (C-3503) revise the following specification as the application has changed:

- 2.1.10. PLACE FOUR STAKES IN THE SOIL, AT 10 CM DISTANCE APART

If, as a result of this memo, the Contractor intends to make a claim for extra payment, such claim or notice of intention to submit a claim, shall be submitted to the Engineer, in writing, within 10 days after the date of issue of this memo and prior to the commencement of the described work.

Receipt acknowledged by:	Issued by:
Contractor Representative	Associated Engineering Representative
Date Acknowledged:	Date Issued: November 8, 2024

Alyson Meyers

From: Alyson Meyers
Sent: November 28, 2024 12:10 PM
To: Nicholas Doucette; Mel Murray; Loc Ngo; John Choi
Cc: Ryan Karsgaard; Dianna Christopoulos; Naomi Sands; Andrew Wiens; Greg Clease; james hirst; Babacan Yildiz; Jeff Prowse; Corbin Manson; Paul Hague
Subject: RE: 218635 - Hatzic - RFI - No. of Dense Live Stakes / Area - 2024 11 26

Hi Nicholas,

Site 3 will be removed from the scope of work because of site access issues.

If you have any questions or would like to discuss further, please let me know.

Thank you,

Alyson Meyers, P.Eng.
Project Engineer
Associated Engineering (Sask.) Ltd.
Saskatoon, SK
Tel: 306.653.4969

From: Nicholas Doucette <Nicholas.Doucette@QMenv.com>
Sent: November 27, 2024 10:10 AM
To: Alyson Meyers <meyersa@ae.ca>; Mel Murray <Mel.Murray@QMenv.com>; Loc Ngo <lngo@keystoneenvironmental.ca>; John Choi <jchoi@keystoneenvironmental.ca>
Cc: Ryan Karsgaard <karsgaardr@ae.ca>; Dianna Christopoulos <christopoulosd@ae.ca>; Naomi Sands <sandsn@ae.ca>; Andrew Wiens <wiensa@ae.ca>; Greg Clease <Greg.Clease@QMenv.com>; james hirst <jameshirst@telus.net>; Babacan Yildiz <Babacan.Yildiz@QMenv.com>; Jeff Prowse <jprowse@keystoneenvironmental.ca>; Corbin Manson <cmanson@keystoneenvironmental.ca>
Subject: RE: 218635 - Hatzic - RFI - No. of Dense Live Stakes / Area - 2024 11 26

Hi Paul,

As discussed, sites 1 and 2 appear to be half the area than the contract. As of yesterday afternoon there is now an access issue to site 3. We need direction today on what work is expected for live staking scope, specifically if site 3 will proceed or not.

Thank you,
Nick

Nicholas Doucette I Vice President, Special Projects & New Markets
C: 250.893.8671 I F: 416.253.6699 I Nicholas.Doucette@QMenv.com

QM Environmental
200-5035 South Service Road, Burlington, ON L7L 6M9
www.QMenv.com I LinkedIn
24/7 Emergency Response 1.877.378.7745

Holiday Hours:
FULL SHUT DOWN - December 25, 2024 December 26, 2024 and January 1, 2025
REDUCED OPERATION - December 24, 2024 - January 1, 2025.
Emergency Response Line will remain open 24/7

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From: Nicholas Doucette
Sent: November 26, 2024 12:10 PM
To: Alyson Meyers <meyersa@ae.ca>; Mel Murray <Mel.Murray@QMenv.com>; Loc Ngo <lngo@keystoneenvironmental.ca>; John Choi <jchoi@keystoneenvironmental.ca>
Cc: Ryan Karsgaard <karsgaardr@ae.ca>; Dianna Christopoulos <christopoulosd@ae.ca>; Naomi Sands <sandsn@ae.ca>; Andrew Wiens <wiensa@ae.ca>; Greg Clease <Greg.Clease@QMenv.com>; james hirst <jameshirst@telus.net>; Babacan Yildiz <Babacan.Yildiz@QMenv.com>; Jeff Prowse <jprowse@keystoneenvironmental.ca>; Corbin Manson <cmanson@keystoneenvironmental.ca>
Subject: 218635 - Hatzic - RFI - No. of Dense Live Stakes / Area - 2024 11 26

Hi Alyson,

As discussed, there is some visual observations occurring in the past few days on-site that the area for dense live staking at sites 1, 2, and 3 appears to be less than as indicated on the drawings (similar to the live clusters).

Based on table 4 (which is less than the drawing surface area but match the SoV of 720 m2), it should be:
Site 1 – 1440 stakes
Site 2 – 1200 stakes
Site 3 – 6000 stakes

We're almost complete site 1, moving to site 2, with less than 750 stakes. We suspect the real number of stakes could be less than half based on some initial observations.

Can both teams today go look at these sites and try to measure off the available stake area? @Mel Murray @Alyson Meyers @John Choi

We need to determine this quickly as it impacts schedule and the existing stake order. In theory base scope should have been about 5 weeks with current crew (we were going to double up and go down to 3, which hasn't happened yet). Half the amount of stakes could see us complete by end of next week.

Also, we need to look at doing some line trimming of the grasses at site 3 so that the drilling approach will work.

Thank you,
Nick

TABLE 4: DENSE LIVE STAKING TREATMENT SUMMARY

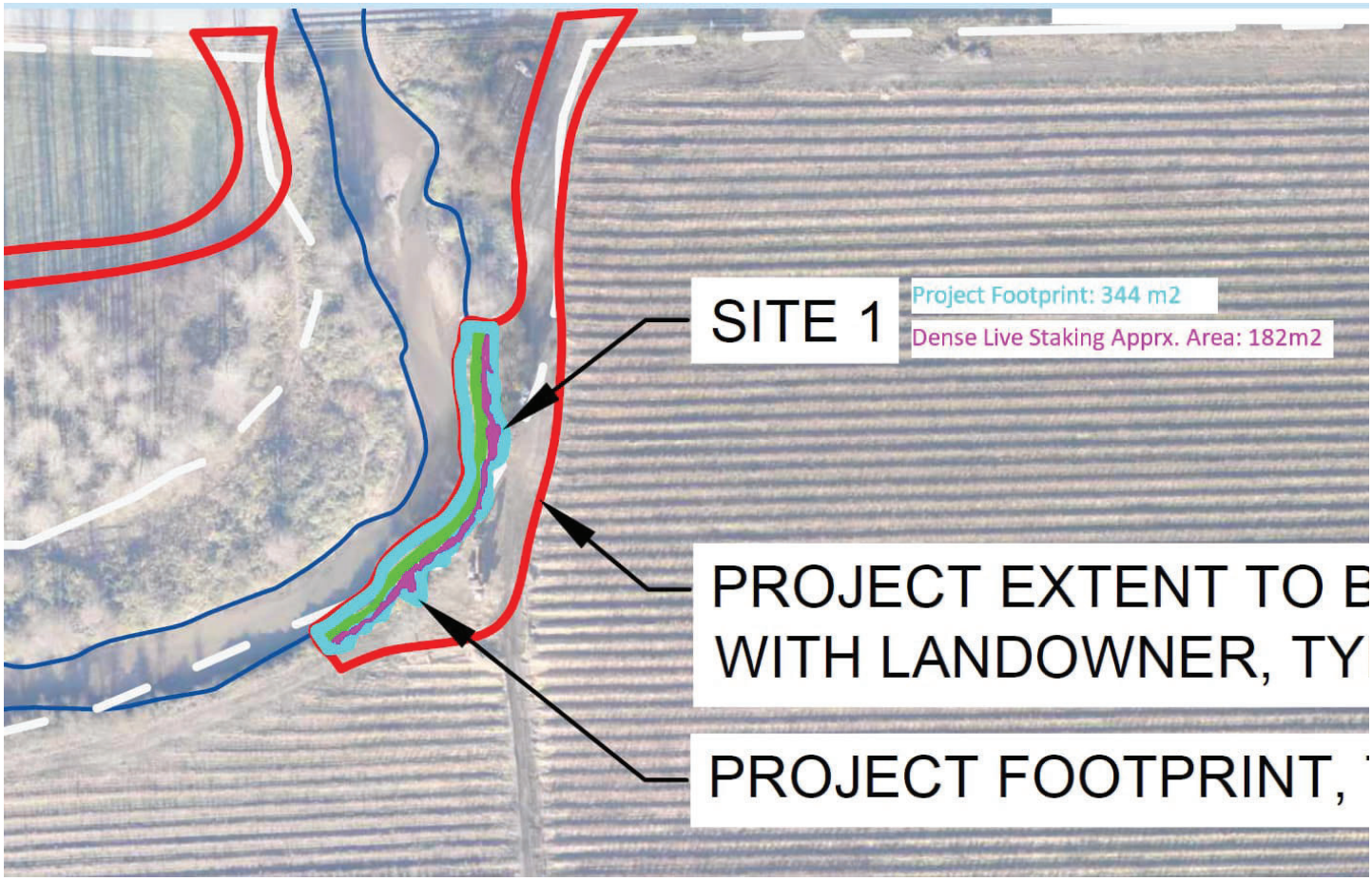
LOCATION	APPROXIMATE AREA	APPROXIMATE LINEAR METERS	AVERAGE DENSITY
SITE 1	120 m²	80 m	12 PER m²
SITE 2	100 m²	50 m	
SITE 3	500 m²	240 m	

NOTE:
CONTRACTOR IS SOLELY RESPONSIBLE FOR CONFIRMING THE NUMBER OF STEMS REQUIRED

From: Babacan Yildiz <Babacan.Yildiz@QMenv.com>
Sent: November 26, 2024 7:57 AM
To: Nicholas Doucette <Nicholas.Doucette@QMenv.com>; Jeff Prowse <jprowse@keystoneenvironmental.ca>
Cc: Mel Murray <Mel.Murray@QMenv.com>
Subject: RE: 218635 - Hatzic - Drawings - CAD line work for Dense Lives Stakes

Hi Nick,
In the 2632-03-C-3104 drawings, we are given only the project footprint (cyan) and dense live staking line (green), not the area, however if we assume that green line is the water level, when I calculate the area from dense live staking line to the project footprint, the area values (magenta) are as follows. Also, please not that there is the statement *"DENSE LIVE STAKING LOCATIONS TO BE CONFIRMED BY ENGINEER IN THE FIELD. REFER TO TABLE 4 ON C-3505 FOR TREATMENT SUMMARY"* in the drawing notes. (See Table-4 below)

Site-1:



Site-2:


SITE 2
Project footprint: 221m2
Dense Live Staking Apprx. Area: 93m2

Site-3:

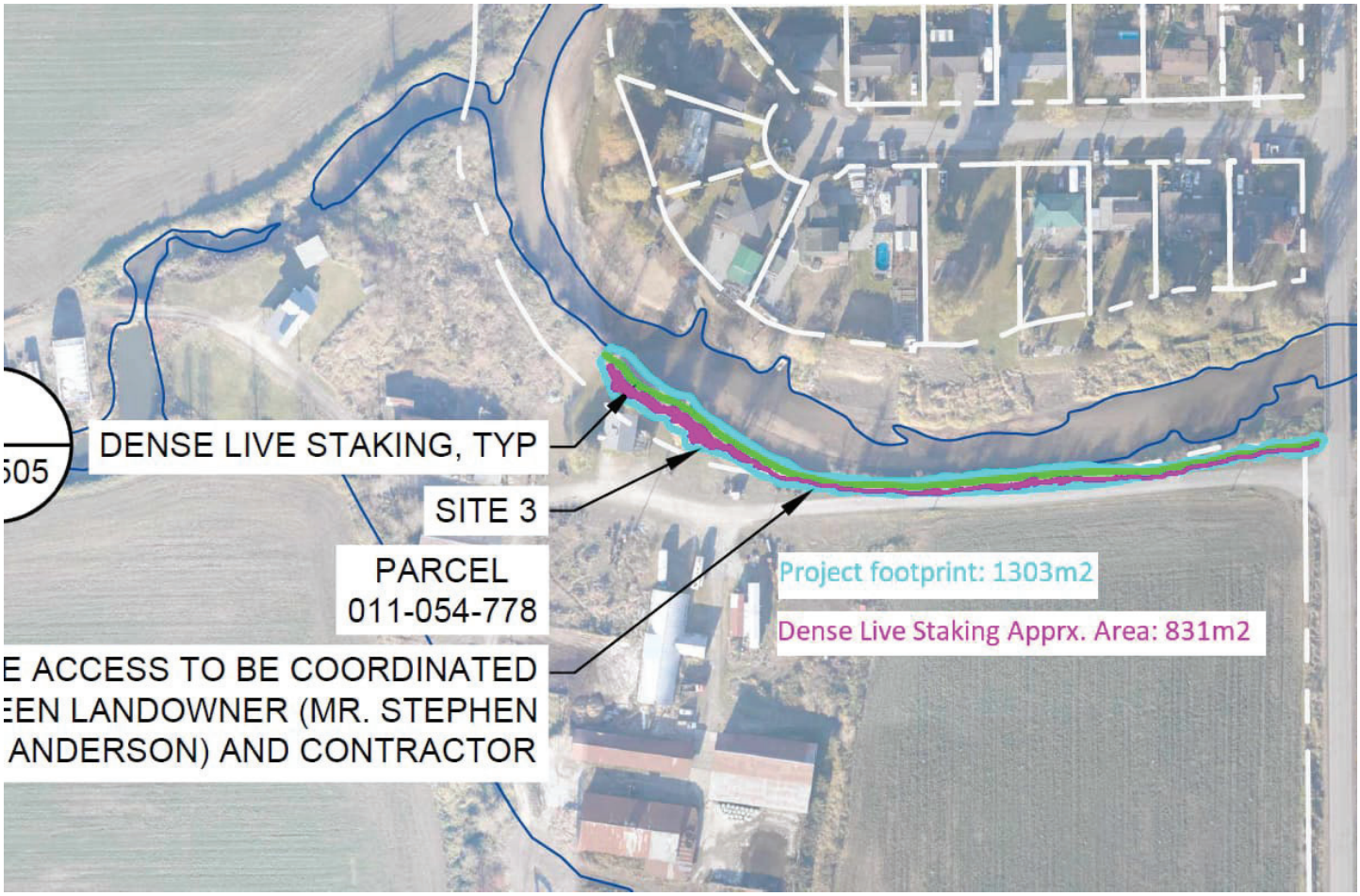


Table-4:

TABLE 4: DENSE LIVE STAKING TREATMENT SUMMARY			
LOCATION	APPROXIMATE AREA	APPROXIMATE LINEAR METERS	AVERAGE DENSITY
SITE 1	120 m²	80 m	12 PER m²
SITE 2	100 m²	50 m	
SITE 3	500 m²	240 m	

NOTE:
CONTRACTOR IS SOLELY RESPONSIBLE FOR CONFIRMING THE NUMBER OF STEMS REQUIRED

If you need further information, please let me know.
Best regards,

Babacan Yildiz | Site Surveyor
C: 416.899.9914 | Babacan.Yildiz@QMenv.com

QM Environmental
200-5035 South Service Road, Burlington, ON L7L 6M9
www.QMenv.com | LinkedIn
24/7 Emergency Response 1.877.378.7745

Holiday Hours:
FULL SHUT DOWN - December 25, 2024 December 26, 2024 and January 1, 2025
REDUCED OPERATION - December 24, 2024 - January 1, 2025.
Emergency Response Line will remain open 24/7

The information contained in this email message is privileged and confidential, intended for the person to whom it is addressed. If you have received this email in error, please forward it to Information.Technology@QMenv.com and delete the message from your system.

RESPOND. RECLAIM. RENEW.

Associated Engineering

Project Name: Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14-17

Project I.D.:	218635	**Date Submitted:**	September 5, 2024
Submitted By:	Mert Gezgin	**Date Response Needed:**	September 10, 2024
Project Name:	**Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14-17**		
RFI Number:	**RFI-0010**		
RFI Subject:	**Change of Trees to Be Supplied for Installation of Tree Row Line Item**		
DOCUMENTS AFFECTED BY THIS RFI:			
Spec Section, Para:	SECTION 2, 2.02, d (i)		
Drawing #:	2632-03-C-3102, Note #10		
Other:	N/A		
Schedule Effect:	No	N/A	
Cost Effect:	Yes	Additional charges on material	
QC Scope Change:	No	N/A	

Requested Information

As stated in Section 2, Sub-section 2.02 Incidental and Miscellaneous, Paragraph d Supply and Installation of Tree Row per Drawing C-3102, (i) General; *"The category of Supply and Installation of Tree Row shall include supply and installation of Big Leaf Maple trees (5-7 years old) and post installation watering, and all work incidental thereto."*

After QM's research, none of the nurseries have those ages of Big Leaf Maple Trees. The closest ones that was found were 3-4 year-old 4-5 ft-tall. After a discussion with the landowner Doug Hancock, his request for taller trees was received. QM asked the agreed nursery (Peel's Nurseries) if they have any taller trees in stock and found Acer rubrum 'Bowhall' (Bowhall Red Maple) and Acer x freemanii Autumn Fantasy (Autumn Fantasy) available in 12 - 14 ft-tall with 2" Caliper. The landowner requested whether Autumn Fantasy to be planted or not.

If this request is accepted, QM can supply the trees according to the landowner's preference but this will increase the material supply cost which result in an additional $1,700 increase in *"Supply and Installation of Tree Row per Drawing C-3102"* line item.

QM requests a confirmation for the supply of above mentioned trees.

RESPOND. RECLAIM. RENEW.

Associated Engineering

Project Name: Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14-17

Response

The replacement trees should be native species. The trees proposed above (Bowhall Red Maple and Autumn Fantasy) are not native species. QM's Environmental Monitor should consult with the landowner and propose a native species that is likely to thrive at the site.

Please re-submit with appropriate species for the site.

Distribution	Organization
Andrew Wiens	AE
Paul Hague	AE
Alyson Meyers	AE
Dianna Christopoulos	AE
Ryan Karsgaard	AE
Naomi Sands	AE
Thyren Jacobs	ENV
Nicholas Doucette	QM
Michael Bailey	QM
Greg Clease	QM
Mert Gezgin	QM
Mel Murray	QM

Originator: Mert Gezgin, Project Manager

Date: September 10, 2024

Contract Administrator (AE):

RESPOND. RECLAIM. RENEW.

Associated Engineering

Project Name: Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14-17

Project I.D.:	218635	**Date Submitted:**	October 2, 2024
Submitted By:	Mert Gezgin	**Date Response Needed:**	October 7, 2024
Project Name:	**Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14-17**		
RFI Number:	**RFI-0018**		
RFI Subject:	**Clarification on Tree Species to Be Supplied**		
DOCUMENTS AFFECTED BY THIS RFI:			
Spec Section, Para:	SECTION 2, 2.02, d (i)		
Drawing #:	2632-03-C-3102, Note #10		
Other:	RFI - 0010		
Schedule Effect:	No	N/A	
Cost Effect:	Yes	TBD	
QC Scope Change:	No	N/A	

Requested Information

As discussed in the October 1st weekly progress meeting, QM informed AE that the "Supply and Installation of Tree Row" line item has still been under consideration.

Background:
QM originally based the budget of this line item on the supply of Big Leaf Maple Trees which were only 3-4 ft-tall. After the discussions with Doug Hancock, QM started looking for taller species and found Bowhall Red Maple and Autumn Fantasy in 12-14 ft height upon his request. Doug Hancock chose the Autumn Fantasy and an RFI (RFI-0010) was sent to see if these species and the cost differences were allowed. The response from AE was negative as these species were not native. Then QM consulted with Keystone to identify native species and was informed that Cottonwood, Paper Birch and Red Alder trees could be planted as they are native. QM was able to locate Red Alder trees that were 7-8 feet tall without any cost differences. But Doug Hancock stated they were also too short.

QM requests AE to have an agreement with the landowner on the species that need to be supplied by QM and advise on cost differences.

RESPOND. RECLAIM. RENEW.

Associated Engineering

Project Name: Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14-17

Response

The Issued for Construction drawings state "the trees shall be Big Leaf Maple, 5-7 years old, and be installed 5 m apart". Big Leaf Maple trees that are 5 -7 years old are approximately 1.5 m to 4.3 m tall with a wider canopy. The intent of what was specified is to replace what was removed with a native tree species of a size that did not require a tree spade for installation.

Our investigation found that trees meeting the design intent can be sourced at Specimen Trees Wholesale Nurseries Ltd., 18598 Advent Road in Pitt Meadows - their phone number is 604.465.7122 and their website address is https://specimentrees.com/

Construction at stations B, B-2, and B-3 has not extended as far north as anticipated during design, therefore reducing the available space to plant new trees. To this extent, we have modified the design as follows:

- Reduce the number of Big Leaf Maple trees from 12 to 5.
- Add 5 Paper Birch trees.

Please see the revised planting sketch attached to this response. Associated will be on site on October 28, 2024, to layout the planting plan.

To clarify, the Big Leaf Maple trees shall be 4 cm caliper (as tall as possible), and the Paper Birch trees shall be 10 cm caliper (as tall as possible).

Distribution	Organization
Andrew Wiens	AE
Paul Hague	AE
Alyson Meyers	AE
Dianna Christopoulos	AE
Ryan Karsgaard	AE
Naomi Sands	AE
Thyren Jacobs	ENV
Nicholas Doucette	QM
Michael Bailey	QM
Greg Clease	QM
Mert Gezgin	QM
Mel Murray	QM

Originator: Mert Gezgin, Project Manager

Date: October 28, 2024

Contract Administrator (AE):


PAPER BIRCH
- 3 m FROM EXISTING TREES
- 5 m OR MORE FROM MAPLES
BIG LEAF MAPLE
- BETWEEN WELL AND EXISTING TREES
PAPER BIRCH
- 4.5 m FROM WELL
- 5 m OR MORE FROM MAPLES
EXISTING WELL
PAPER BIRCH, TYP
- 3.5 m FROM PROPERTY LINE
- 5 m FROM MAPLES
BIG LEAF MAPLE, TYP
- 2 m OFF PROPERTY LINE
-9.8 m SPACING BETWEEN MAPLES
PROPERTY LINE

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TO	**Contractor:**	QM LP, dba QM Environmental	**Date:**	December 6, 2024
RE	**Project:**	Hatzic Emergency Works Program – Lagace Creek – S-CR-14/17	**Memo No.:**	FM-13
	Owner:	Ministry of Environment and Climate Change Strategy	**Page:**	1 of 1
	Location:	Farms Rd, Hatzic, BC	**File No.:**	
			Project No.:	2022-2632-03

Contractor Discussion:

Site Discussion Date & Time: December 2, 2024, between Doug Hancock (landowner) and Mel Murray (QM)

Details:

Mr. Hancock requested that the River Birch trees be planted high on his parcel as he intends on filling in the area in the near future as he currently has an application into the FVRD (Fraser Valley Regional District) for Placement of Fill within the ALR (Agricultural Land Reserve). Therefore, QM planted the trees in the locations staked by Associated Engineering (Associated) ~1 ft high to satisfy Mr. Hancock's request. Mr. Hancock also requested that the five Big Leaf Maple trees, which had already been planted by QM, be dug up so that Mr. Hancock can re-plant them higher once he has filled in the area. QM dug up the Big Leaf Maple trees, wrapped them in burlap, and left them on site for Mr. Hancock to re-plant. This was communicated to Associated's Field Representative, Braeden Sykes, after the work was carried out.

Associated Engineering Response:

Doug Hancock has agreed to re-plant the Big Leaf Maple trees as soon as possible and understands that he is responsible for maintaining them to improve their likelihood of survival.

If, as a result of this memo, the Contractor intends to make a claim for extra payment, such claim or notice of intention to submit a claim, shall be submitted to the Engineer, in writing, within 10 days after the date of issue of this memo and prior to the commencement of the described work.

Receipt acknowledged by:

Issued by: Alyson Meyers

Contractor Representative

Associated Engineering Representative

Date Acknowledged:

Date Issued: December 6, 2024

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RESPOND. RECLAIM. RENEW.

Associated Engineering

Project Name: Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14-17

Project I.D.:	218635	**Date Submitted:**	August 20, 2024
Submitted By:	Mert Gezgin	**Date Response Needed:**	August 22, 2024
Project Name:	**Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14-17**		
RFI Number:	**RFI-0003**		
RFI Subject:	**Request for Benchmarks, Coordinate system & CAD Drawings**		
DOCUMENTS AFFECTED BY THIS RFI:			
Spec Section, Para:	N/A		
Drawing #:	N/A		
Other:	N/A		
Schedule Effect:	Yes	TBD	
Cost Effect:	Yes	TBD	
QC Scope Change:	No	N/A	

Requested Information

QM is planning to complete the pre-construction survey before the actual works commence. In order to complete the pre-construction survey QM's survey team requires the following:

- Benchmarks and Survey Control Points
- Coordinate System
- Vertical Datum Information
- CAD Drawings

Every phase of the surveys including As-Built surveys will be based on these documents and information.

RESPOND. RECLAIM. RENEW.

Associated Engineering

Project Name: Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14-17

Response

Coordinate system details follow. Benchmark details are attached. CAD files will not be supplied as the works are predominantly field fit.

- Horizontal datum: NAD83 (CSRS)
- Projection: UTM Zone 10.
- Vertical Datum: CGVD2013
- Geoid Model: CGG2013

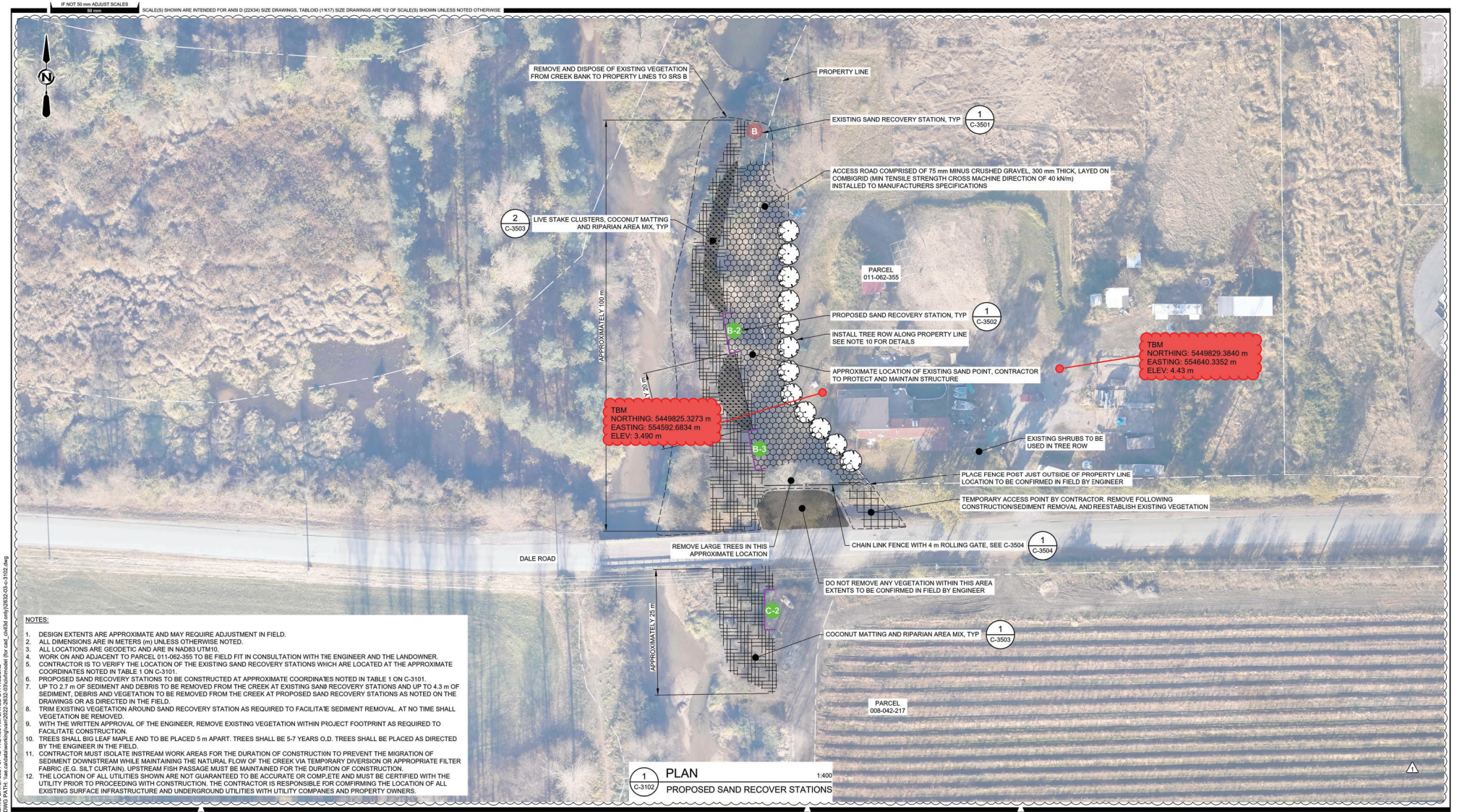
Distribution	Organization
Andrew Wiens	AE
Paul Hague	AE
Alyson Meyers	AE
Dianna Christopoulos	AE
Ryan Karsgaard	AE
Naomi Sands	AE
Thyren Jacobs	ENV
Nicholas Doucette	QM
Michael Bailey	QM
Greg Clease	QM
Mert Gezgin	QM
Mel Murray	QM

Originator: Mert Gezgin, Project Manager

Date: August 22, 2024

Contract Administrator (AE):

IF NOT 50 mm ADJUST SCALES
50 mm
SCALE(S) SHOWN ARE INTENDED FOR ANSI D (22X34) SIZE DRAWINGS, TABLOID (11X17) SIZE DRAWINGS ARE 1/2 OF SCALE(S) SHOWN UNLESS NOTED OTHERWISE



1 C-3102 PLAN 1:400
PROPOSED SAND RECOVER STATIONS

NOTES:

1. DESIGN EXTENTS ARE APPROXIMATE AND MAY REQUIRE ADJUSTMENT IN FIELD.
2. ALL DIMENSIONS ARE IN METERS (m) UNLESS OTHERWISE NOTED.
3. ALL LOCATIONS ARE GEODETIC AND ARE IN NAD83 UTM10.
4. WORK ON AND ADJACENT TO PARCEL 011-062-355 TO BE FIELD FIT IN CONSULTATION WITH THE ENGINEER AND THE LANDOWNER.
5. CONTRACTOR IS TO VERIFY THE LOCATION OF THE EXISTING SAND RECOVERY STATIONS WHICH ARE LOCATED AT THE APPROXIMATE COORDINATES NOTED IN TABLE 1 ON C-3101.
6. PROPOSED SAND RECOVERY STATIONS TO BE CONSTRUCTED AT APPROXIMATE COORDINATES NOTED IN TABLE 1 ON C-3101.
7. UP TO 2.7 m OF SEDIMENT AND DEBRIS TO BE REMOVED FROM THE CREEK AT EXISTING SAND RECOVERY STATIONS AND UP TO 4.3 m OF SEDIMENT, DEBRIS AND VEGETATION TO BE REMOVED FROM THE CREEK AT PROPOSED SAND RECOVERY STATIONS AS NOTED ON THE DRAWINGS OR AS DIRECTED IN THE FIELD.
8. TRIM EXISTING VEGETATION AROUND SAND RECOVERY STATION AS REQUIRED TO FACILITATE SEDIMENT REMOVAL. AT NO TIME SHALL VEGETATION BE REMOVED.
9. WITH THE WRITTEN APPROVAL OF THE ENGINEER, REMOVE EXISTING VEGETATION WITHIN PROJECT FOOTPRINT AS REQUIRED TO FACILITATE CONSTRUCTION.
10. TREES SHALL BIG LEAF MAPLE AND TO BE PLACED 5 m APART. TREES SHALL BE 5-7 YEARS O.D. TREES SHALL BE PLACED AS DIRECTED BY THE ENGINEER IN THE FIELD.
11. CONTRACTOR MUST ISOLATE INSTREAM WORK AREAS FOR THE DURATION OF CONSTRUCTION TO PREVENT THE MIGRATION OF SEDIMENT DOWNSTREAM WHILE MAINTAINING THE NATURAL FLOW OF THE CREEK VIA TEMPORARY DIVERSION OR APPROPRIATE FILTER FABRIC (E.G. SILT CURTAIN). UPSTREAM FISH PASSAGE MUST BE MAINTAINED FOR THE DURATION OF CONSTRUCTION.
12. THE LOCATION OF ALL UTILITIES SHOWN ARE NOT GUARANTEED TO BE ACCURATE OR COMPLETE AND MUST BE CERTIFIED WITH THE UTILITY PRIOR TO PROCEEDING WITH CONSTRUCTION. THE CONTRACTOR IS RESPONSIBLE FOR COMFIRMING THE LOCATION OF ALL EXISTING SURFACE INFRASTRUCTURE AND UNDERGROUND UTILITIES WITH UTILITY COMPANIES AND PROPERTY OWNERS.

PLOT DATE: 2024-07-22 2:09:28 PM
SAVE DATE: 2024-07-12 11:24:33 AM SAVED BY: ROZONJ
DWG PATH: \\as.ca\data\work\gvan\2022-2632-03\civil\model (for cad_cad3d only)\2632-03-c-3102.dwg

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PERMIT TO PRACTICE
ASSOCIATED ENGINEERING (B.C.) LTD.
PERMIT NUMBER: 1000163
Engineers & Geoscientists BC

FOR CIVIL FOR BDENGINEERING

REV	DATE	DESIGN	DRAWN	DESCRIPTION
1	2024JUL22	R. KARSGAARD	J. ROZON	ISSUED FOR RFP AND PERMITTING
0	2024JUN14	R. KARSGAARD	J. ROZON	ISSUED FOR RFP

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: AS SHOWN

BRITISH COLUMBIA

CIVIL
PLAN
S-CR-14 PROPOSED SAND RECOVERY STATIONS

DRAWING	REVISION	SHEET
2632-03-C-3102	1	4

Ryan Karsgaard

From: Jordon Rozon
Sent: August 31, 2023 12:19 PM
To: Ryan Karsgaard
Subject: S-CR-15/16 - SURVEY CONTROL INFORMATION
Attachments: IMG_20221213_134916.jpg; IMG_20230106_094343.jpg; IMG_20230106_094314.jpg; IMG_20230106_094325.jpg

Hi Ryan, here is the information for survey control Terra provided.

Datums

Horizontal Datum: NAD83 (CSRS 2002)
Projection: UTM 10N
Vertical Datum: CGVD2013
Geoid: CGG2013

Check Control

NAME: 84HAE014
EASTING: 555599.917 m
NORTHING: 5451874.136 m
ELEVATION: 24.767 m
NOTES: A brass cap on Seux Road Bridge

Placed Control

NAME: TRSI1
EASTING: 554807.258 m
NORTHING: 5451834.884 m
ELEVATION: 9.618 m
NOTES: A nail on a gravel pad to the NE of Farms Road Bridge

Additionally there is a website here (https://maps.gov.bc.ca/ess/hm/mascot/) that has some BC survey markers that could be used once the contractor's survey is tied into Terra Remote's pin shots.

Jordon Rozon, B.Sc.
Technician, Infrastructure
Associated Engineering (Sask.) Ltd.
1 - 2225 Northridge Drive, Saskatoon, SK S7L 6X6
Cell: 306.281.5667

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014
84

3719 TRS1-1
Trimble





RESPOND. RECLAIM. RENEW.

Associated Engineering

Project Name: Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14-17

Project I.D.:	218635	**Date Submitted:**	September 11, 2024
Submitted By:	Mert Gezgin	**Date Response Needed:**	September 16, 2024
Project Name:	**Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14-17**		
RFI Number:	**RFI-0015**		
RFI Subject:	**Clarification on the Sediment Volumes**		
DOCUMENTS AFFECTED BY THIS RFI:			
Spec Section, Para:	N/A		
Drawing #:	2632-03-C-3103		
Other:	N/A		
Schedule Effect:	No	N/A	
Cost Effect:	Yes	TBD	
QC Scope Change:	No	N/A	

Requested Information

In drawing #2632-03-C-3103 Table-3 shows the calculated volumes of the stations on the CR-14 Site. QM realized a math error on the total volume. When all the volumes are summed up, the total is 6,300 m^3. QM is requesting clarification on how these sediment volumes are calculated to get a total volume of 8,250 m^3.

TABLE 3: APPROXIMATE VOLUME REMOVAL

SITE	CUBIC METERS
B	250
B-2 AND B-3	950
C AND C-2	650
D	450
E	450
F	500
G	450
H	500
I	400
J	600
K	700
L	400
TOTAL	8250

RESPOND. RECLAIM. RENEW.

Associated Engineering

Project Name: Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14-17

Response

The Approximate Volume Removal for each Site in Table 3 is correct. The Total in Table 3 is incorrect. The Total should be 6,300 m^3. The total quantity for Item 4.04 Excavation and Off-site Disposal of Sediment in the Schedule of Quantities and Prices should be 6,300 m^3.

Each of the volumes estimated in Table 3 are non-contaminated sediment volumes.

Item 4.05 Excavation of Off-site Disposal of Contaminated Sediment (estimated total quantity of 500 m^3) was based on estimated contaminated sediment volumes from the excavation of B-2 and B-3 and the trimming of the creek bank.

Distribution	Organization
Andrew Wiens	AE
Paul Hague	AE
Alyson Meyers	AE
Dianna Christopoulos	AE
Ryan Karsgaard	AE
Naomi Sands	AE
Thyren Jacobs	ENV
Nicholas Doucette	QM
Michael Bailey	QM
Greg Clease	QM
Mert Gezgin	QM
Mel Murray	QM

Originator: Mert Gezgin, Project Manager

Date: September 17, 2024

Contract Administrator (AE):

RESPOND. RECLAIM. RENEW.

Associated Engineering

Project Name: Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14-17

Project I.D.:	218635	**Date Submitted:**	September 25, 2024
Submitted By:	Mert Gezgin	**Date Response Needed:**	September 25, 2024
Project Name:	**Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14-17**		
RFI Number:	**RFI-0016**		
RFI Subject:	**Change of Work Hours**		
DOCUMENTS AFFECTED BY THIS RFI:			
Spec Section, Para:	Schedule D – Special Provisions, Section 1 General, 1.09 Hours of Work		
Drawing #:	N/A		
Other:	N/A		
Schedule Effect:	Yes	N/A	
Cost Effect:	Yes	TBD	
QC Scope Change:	No	N/A	

Requested Information

In Major Works Contract Schedule D – Special Provisions, Section 1. General, 1.09 Hours of Work, a) Working Restrictions; it is stated that the Contractor shall confine the work to the following time periods, unless otherwise approved in writing by the Ministry Representative:

(i) Between 7:30am and 6:30pm from Monday through Saturday
(ii) No work is to occur on Sunday or Statutory Holidays.

(b) Variances to Hours of Work
No Work will be carried out at times outside

QM is requesting a written approval for working between 4:00 am and 10:00 pm for the next 5 days, September 26th, 27th, 28th, 29th and 30th in order to complete the in-stream works. This request requires an urgent response due to the given time constraints.

RESPOND. RECLAIM. RENEW.

Associated Engineering

Project Name: Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14-17

Response

Associated initially responded to QM's with the following via email sent on September 25, 2024:
Thank you for your RFI. Before proceeding with the revised hours several considerations need to be addressed as follows:

1. *Has QM received approval from the Fraser Valley Regional District to work from 4:00 am until 10:00 pm – this could be a bylaw concern that needs to be addressed with them directly. Please advise.*
2. *Has QM received approval from the landowners where work will be undertaken to confirm they are accepting of the revised hours? At this time, we cannot afford to disturb any landowners. Please advise.*
3. *Pursuant to the MWC, Associated will present your request to ENV for consideration. Please note that a contract amendment may be required. We will advise as soon as possible.*
4. *Associated cannot support the increased hours tomorrow (September 26th). We will internally review our capacity going forward and will advise accordingly.*

QM provided an email from the Fraser Valley Regional District approving the extended work hours from 4:00 am to 10:00 pm for September 27 to September 30 (email attached). QM also indicated they contacted the landowners to confirm their acceptance of the extended work hours. QM submitted their proposed schedule for September 27 to September 30 with work hours being 4:30 am to 8:00 pm (email attached). QM has confirmed that their Environmental Monitor, Keystone, will be onsite full time during these extended hours. QM shall ensure that trucking/hauling is limited to between the hours of 7:00 am and 7:00 pm.

QM may proceed with the extended hours, from 4:30 am to 8:00 pm for September 27, 2024 to September 30, 2024, inclusive.

Distribution	Organization
Andrew Wiens	AE
Paul Hague	AE
Alyson Meyers	AE
Dianna Christopoulos	AE
Ryan Karsgaard	AE
Naomi Sands	AE
Thyren Jacobs	ENV
Nicholas Doucette	QM
Michael Bailey	QM
Greg Clease	QM
Mert Gezgin	QM
Mel Murray	QM

Originator: Mert Gezgin, Project Manager

Date: September 30, 2024

Contract Administrator (AE):

Alyson Meyers

From: Bylaw Enforcement <enforcement@fvrd.ca>
Sent: September 26, 2024 10:03 AM
To: M. Mert Gezgin
Subject: RE: Change on Hours of Work - Hatzic Emergency Works Program, Lagace Creek Site-CR-14

Caution: This email originated from outside our organization. Please do not click links or open attachments, unless you recognize the source of this email. When in doubt, please contact Helpdesk.

Good morning Mert,

In response to your email below, we do not have any issue with regard to the extension of work hours in the time frame outlined below from 4:00 am to 10:00 pm (September 27 – 30th) to conduct the mitigation works within the required timeline.

I hope this email satisfies your requirement from the Regional District.

Louise Hinton, BA
Bylaw Compliance & Enforcement Officer
Fraser Valley Regional District

P 604-702-5015
1-45950 Cheam Ave, Chilliwack, B.C. V2P 1N6
fvrd.ca | haveyoursay.fvrd.ca

Fraser Valley Regional District

From: noreply@fvrd.ca <noreply@fvrd.ca>
Sent: September 25, 2024 5:28 PM
To: Bylaw Enforcement <enforcement@fvrd.ca>
Subject: Change on Hours of Work - Hatzic Emergency Works Program, Lagace Creek Site-CR-14

Recipient	Bylaw Enforcement
Topic	Change on Hours of Work - Hatzic Emergency Works Program, Lagace Creek Site-CR-14
Name	Mert Gezgin
E-mail Address	mert.gezgin@qmenv.com
Phone Number	6729633490

Message

Hello,

We are currently working on a project on Lagace Creek for flood mitigation and remediation works, a part of the Hatzic Emergency Works Program. According to the bylaws, we have been working between 7:30 am and 6:30 pm from Monday through Saturday.

We want to extend these work hours from 4:00 am to 10:00 pm until October 1st due to our permit restrictions. These works are conducted under "Water Sustainability Act Section 11(1) Changes In and About a Stream Approval" and the DFO permit allows us to complete the in-stream works by September 30th.

Due to the tight work window and time constraints, QM Environmental is required to work longer hours only for these 4 days (Sep 27-30). The landowners in the area have already been contacted by our field team for the long hours of work.

We require FVRD's response to amend our contract with the BC Ministry of Environment and Climate Change Strategy.

Your prompt response on this urgent matter will be highly appreciated.

Thank you.

Alyson Meyers

From: M. Mert Gezgin <Mert.Gezgin@QMenv.com>
Sent: September 26, 2024 7:15 PM
To: Alyson Meyers
Cc: Dianna Christopoulos; Paul Hague; Ryan Karsgaard; Naomi Sands; Andrew Wiens; Thyren.Jacobs@gov.bc.ca; Nicholas Doucette; Greg Clease; Michael Bailey; Mel Murray; James Hirst; Jordon Rozon
Subject: RE: Urgent Response Required - Hatzic Lagace Creek Project - QM Environmental RFI Submission - 0016 - 20240925

Hello everyone,

Please see below for the schedule for the next 4 days with new work hours. Please send us a written approval for working in the extended hours at your earliest convenience.

Work Hours: 4:30 am to 8:00 pm
Stations where the excavation is completed: B, C, E, J (today), K (today), L
Built new stations: B-2 (knotweed soil to excavate in-stream), B-3 (knotweed soil to load-out), C-2
Remaining stations: D, F, G, H, I

September 27, 2024 – Friday

- Load out 4 trucks (quads) with the material removed from Station B-3. ~ 150 mT, current total: 1,302.99 mT
- Remove isolations from Stations J & K
- Start installing bags and isolation at Station B-2
- Start fish salvaging at Station B-2
- Start excavation at Station B-2 (knotweed soil)
- Start fish salvaging at Station F
- Start excavation at Station F (clean soil)
- Complete excavation at Station F
- Start installing bags and isolation at Station I

September 28, 2024 – Saturday

- Start fish salvaging at Station I
- Start excavation at Station I (clean soil)
- Complete excavation at Station B-2
- Complete excavation at Station I
- Start installing bags and isolation at Station G or H
- Start fish salvaging at Station G or H
- Start excavation either at Station G (clean soil) or H (knotweed soil)
- Complete excavation at Station G or H

September 29, 2024 – Sunday

- Complete excavation G or H
- Start installing bags and isolation at Station G or H
- Start fish salvaging at Station G or H
- Remove isolation from Station B-2

- Remove isolation from Station I
- Start excavation either at G (clean soil) or Station H (knotweed soil)
- Complete excavation at Station G or H

September 30, 2024 – Monday

- No excavation activities
- Let the water settle
- Remove all the isolations from Stations G and H

Thanks,

M. Mert Gezgin | Project Manager
C: 672.963.3490 | Mert.Gezgin@QMenv.com

QM Environmental
1707 Cliveden Avenue, Delta, BC V3M 6W5
www.QMenv.com | LinkedIn
24/7 Emergency Response 1.877.378.7745

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From: M. Mert Gezgin
Sent: Thursday, September 26, 2024 9:15 AM
To: Alyson Meyers <meyersa@ae.ca>
Cc: Dianna Christopoulos <christopoulosd@ae.ca>; Paul Hague <haguep@ae.ca>; Ryan Karsgaard <karsgaardr@ae.ca>; Naomi Sands <sandsn@ae.ca>; Andrew Wiens <wiensa@ae.ca>; Thyren.Jacobs@gov.bc.ca; Nicholas Doucette <Nicholas.Doucette@QMenv.com>; Greg Clease <Greg.Clease@QMenv.com>; Michael Bailey <Michael.Bailey@QMenv.com>; Mel Murray <Mel.Murray@QMenv.com>; James Hirst <James.Hirst@QMenv.com>; Jordon Rozon <rozonj@ae.ca>
Subject: RE: Urgent Response Required - Hatzic Lagace Creek Project - QM Environmental RFI Submission - 0016 - 20240925

Good morning Alyson,

Please see attached the response from FVRD. Also, our team has already contacted the landowners and they are ok with the long hours of work.

Thanks,

From: Alyson Meyers <meyersa@ae.ca>
Sent: Wednesday, September 25, 2024 4:58 PM
To: M. Mert Gezgin <Mert.Gezgin@QMenv.com>
Cc: Dianna Christopoulos <christopoulosd@ae.ca>; Paul Hague <haguep@ae.ca>; Ryan Karsgaard <karsgaardr@ae.ca>; Naomi Sands <sandsn@ae.ca>; Andrew Wiens <wiensa@ae.ca>; Thyren.Jacobs@gov.bc.ca; Nicholas Doucette <Nicholas.Doucette@QMenv.com>; Greg Clease <Greg.Clease@QMenv.com>; Michael Bailey <Michael.Bailey@QMenv.com>; Mel Murray <Mel.Murray@QMenv.com>; James Hirst <James.Hirst@QMenv.com>; Jordon Rozon <rozonj@ae.ca>

Subject: Re: Urgent Response Required - Hatzic Lagace Creek Project - QM Environmental RFI Submission - 0016 - 20240925

Caution: This email originated from outside our organization. Please do not click links or open attachments, unless you recognize the source of this email. When in doubt, please contact Helpdesk.

Good Afternoon Mert,

Thank you for your RFI. Before proceeding with the revised hours several considerations need to be addressed as follows:

1. Has QM received approval from the Fraser Valley Regional District to work from 4:00 am until 10:00 pm – this could be a bylaw concern that needs to be addressed with them directly. Please advise.
2. Has QM received approval from the landowners where work will be undertaken to confirm they are accepting of the revised hours? At this time, we cannot afford to disturb any landowners. Please advise.
3. Pursuant to the MWC, Associated will present your request to ENV for consideration. Please note that a contract amendment may be required. We will advise as soon as possible.
4. Associated cannot support the increased hours tomorrow (September 26*th*). We will internally review our capacity going forward and will advise accordingly.

Pending the feedback on the above considerations, Associated will provide a formal response to the RFI as soon as possible.

Thank you,

Alyson Meyers

Sent from my iPhone

On Sep 25, 2024, at 4:46 PM, M. Mert Gezgin <Mert.Gezgin@qmenv.com> wrote:

Hello AE Team,

Please see attached the RFI regarding the change of work hours for the next 5 days.

Your prompt response on this will be highly appreciated as we are planning to start early in the morning tomorrow.

SP Link: 218635 - Hatzic - RFI-0016 - Change of Work Hours.pdf

Thank you,

M. Mert Gezgin | Project Manager
C: 672.963.3490 | Mert.Gezgin@QMenv.com
QM Environmental
1707 Cliveden Avenue, Delta, BC V3M 6W5
www.QMenv.com | LinkedIn
24/7 Emergency Response 1.877.378.7745

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RESPOND. RECLAIM. RENEW.

Associated Engineering

Project Name: Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14-17

Project I.D.:	218635	**Date Submitted:**	October 2, 2024
Submitted By:	Mert Gezgin	**Date Response Needed:**	October 7, 2024
Project Name:	**Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14-17**		
RFI Number:	**RFI-0017**		
RFI Subject:	**Clean Sediment Relocation**		
DOCUMENTS AFFECTED BY THIS RFI:			
Spec Section, Para:	N/A		
Drawing #:	N/A		
Other:	N/A		
Schedule Effect:	No	N/A	
Cost Effect:	No	N/A	
QC Scope Change:	No	N/A	

Requested Information

As discussed in the October 1st weekly progress meeting, QM informed AE that there are landowners (specifically Doug Hancock and Robert Dale) who have intents to use the clean sediment for structural purposes. QM would like to use that option. After consulting with Keystone, it was made clear that the lands surrounding the excavation areas are in the vicinity within the Provincial Agricultural Land Reserve. Interested landowners may submit a Notice of Intent with the Agriculture Land Commission to obtain and utilize the sediment.

QM requires a clarification for the use of the clean sediment and technical and administrative support for the local landowners.

Attachments:
- Soil Sampling Results
- Saturated Paste Test for Sodium Ion
- Sediment Sampling Memo by Keystone Environmental

RESPOND. RECLAIM. RENEW.

Associated Engineering

Project Name: Hatzic Emergency Works Program Lagace Creek – Sites S-CR-14-17

Response

Correct, landowners would like to retain the excavated sediment where possible. To that extent, Associated can only speak to the work we are conducting for Doug Hancock (we are not aware of any work that Robert Dale or Kam Jhulley may be undertaking in the same regard). Doug is in the process of submitting an application for Soil Use for Placement of Fill or Removal of Soil. At this time, no timeline exists for when approval will be received. We can provide further details as they become available.

Distribution	Organization
Andrew Wiens	AE
Paul Hague	AE
Alyson Meyers	AE
Dianna Christopoulos	AE
Ryan Karsgaard	AE
Naomi Sands	AE
Thyren Jacobs	ENV
Nicholas Doucette	QM
Michael Bailey	QM
Greg Clease	QM
Mert Gezgin	QM
Mel Murray	QM

Originator: Mert Gezgin, Project Manager

Date: October 4, 2024

Contract Administrator (AE):

APPENDIX I – SITE PHOTOGRAPHS

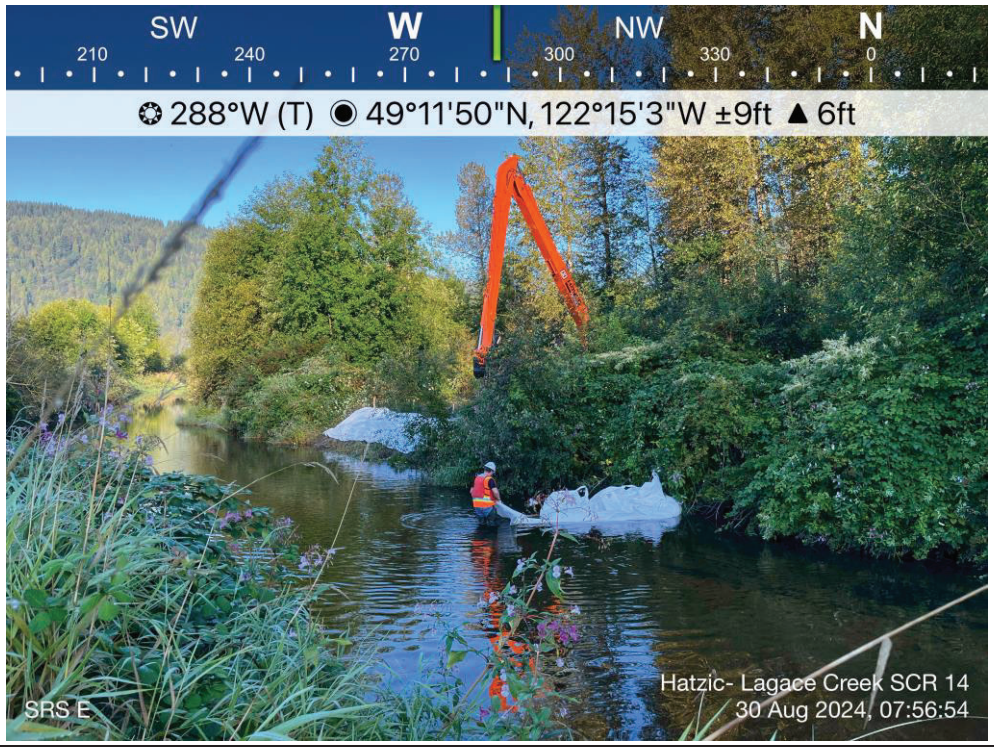
Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Hatzic Site: S-CR-14 Record: 1 Date: August 27,2024 Description: Associated Engineering located and flag sand recovery stations.	
Hatzic Site: S-CR-14 Record: 2 Date: August 28, 2024 Description: QM begins filling sandbags for creek isolation.	

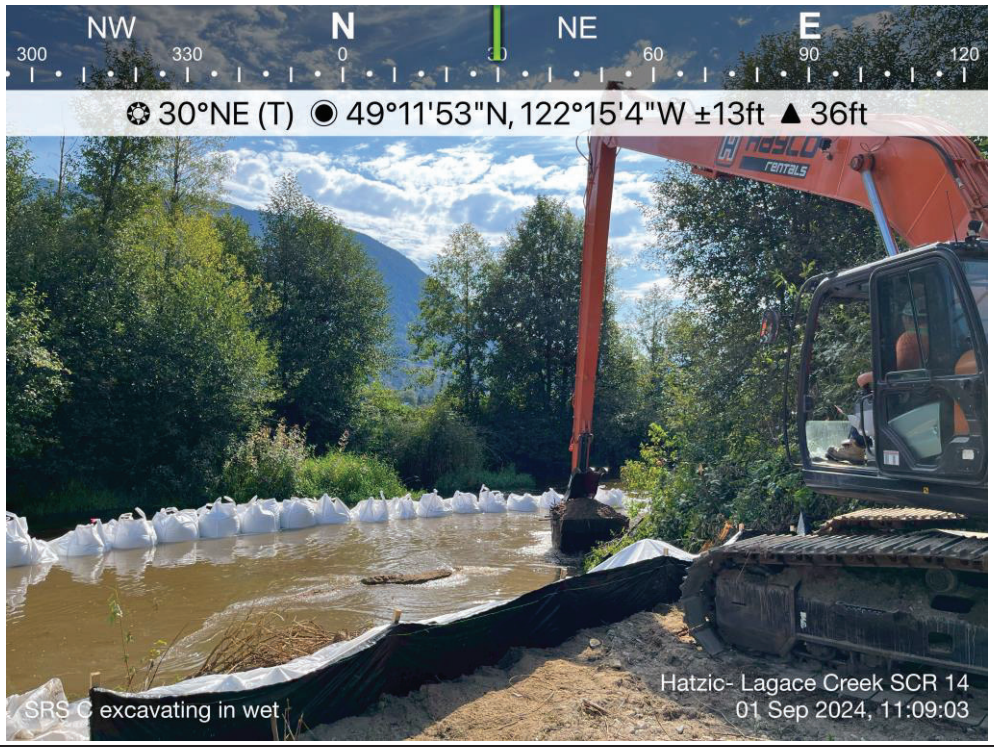
Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

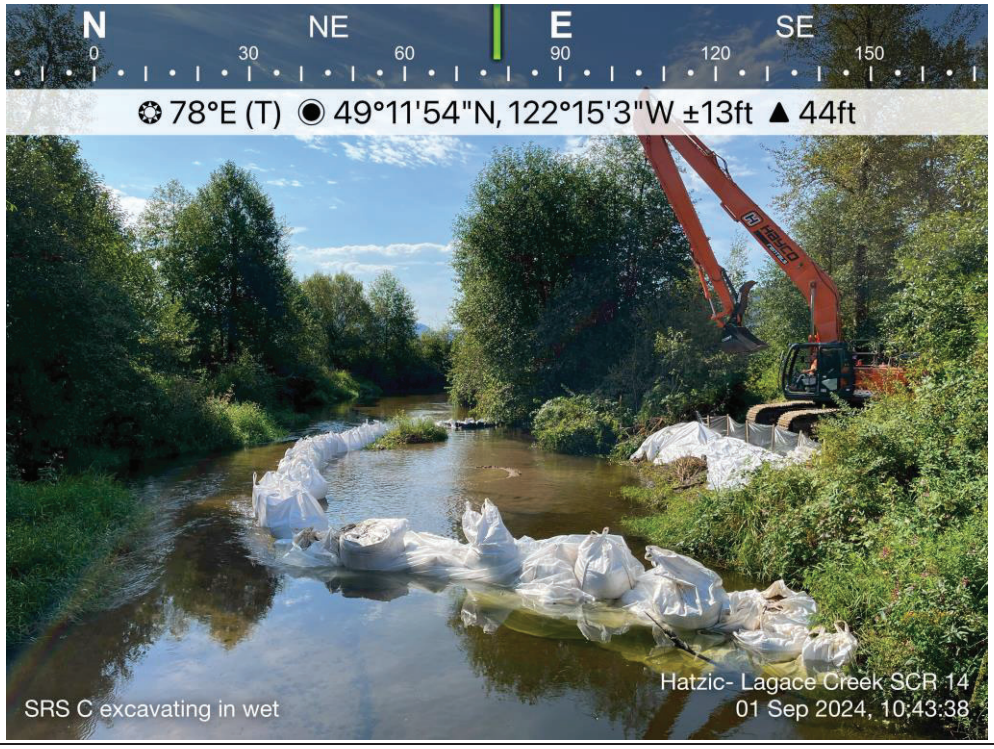
Hatzic Site: S-CR-14 Record: 3 Date: August 29, 2024 Description: First drone photo of the site.	
Hatzic Site: S-CR-14 Record: 4 Date: August 29, 2024 Description: QM begins clearing access to sites.	

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Hatzic Site: S-CR-14 Record: 5 Date: August 29,2024 Description: Knotweed removal.	
Hatzic Site: S-CR-14 Record: 6 Date: August 30, 2024 Description: Sandbag water isolation set up begins.	

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

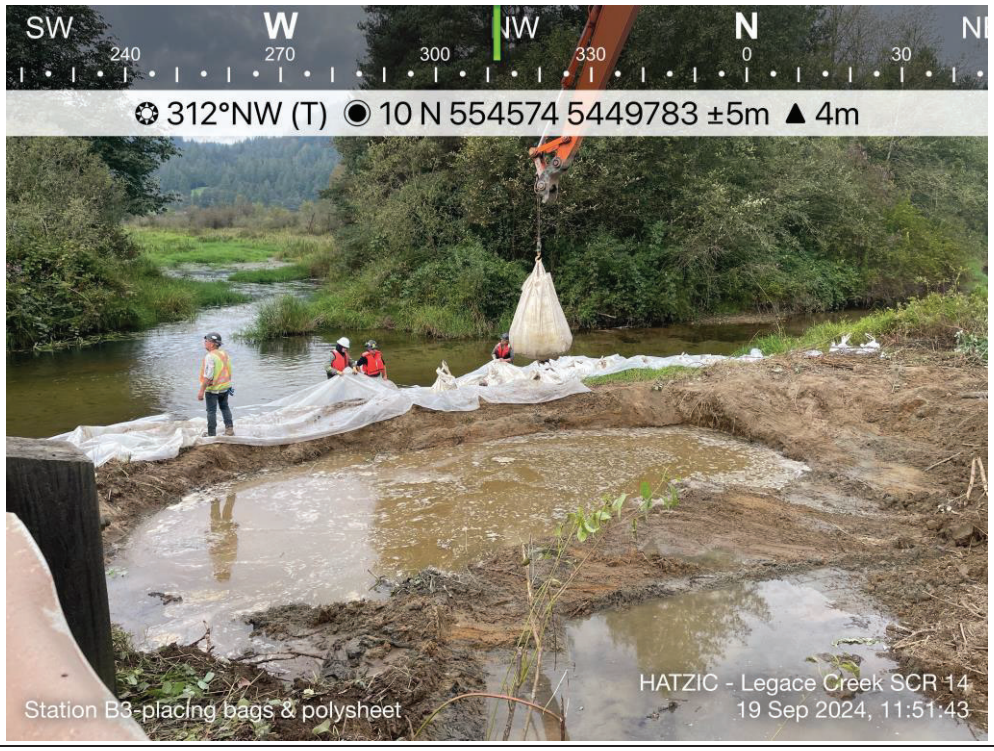
Hatzic Site: S-CR-14 Record: 7 Date: August 31, 2024 Description: Site E isolation and excavation complete.	
Hatzic Site: S-CR-14 Record: 8 Date: September 1, 2024 Description: Site C isolation and excavation complete.	

Hatzic Site: S-CR-14 Record: 9 Date: September 1, 2024 Description: Site C isolation and excavation complete.	
Hatzic Site: S-CR-14 Record: 10 Date: September 2, 2024 Description: Site L isolation and excavation complete.	

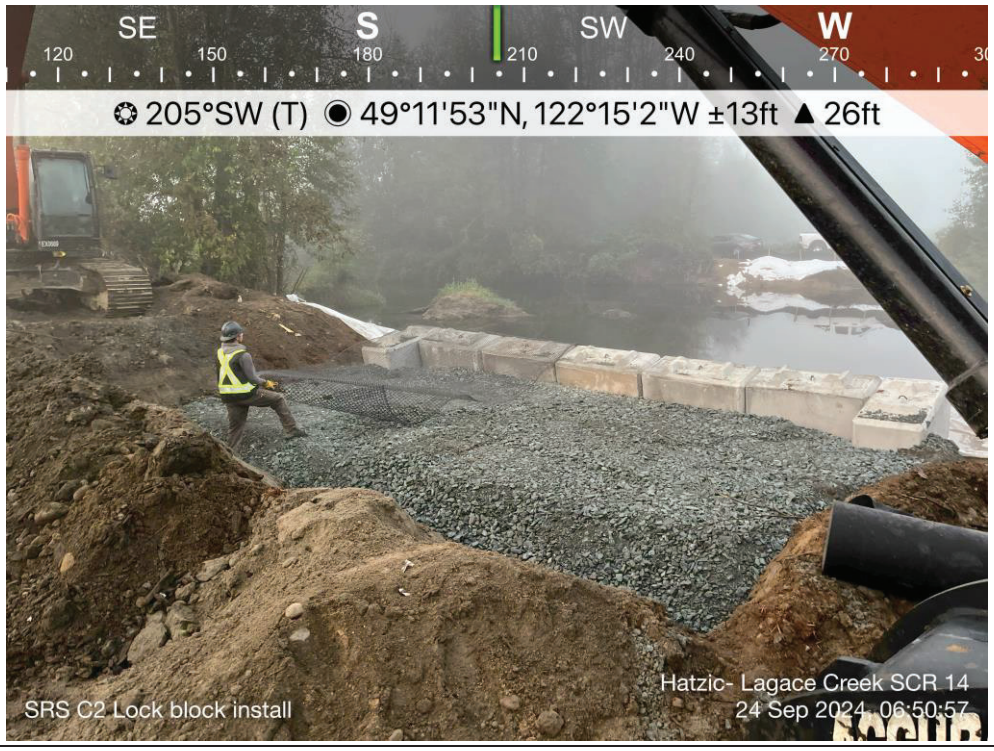
Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Hatzic Site: S-CR-14 Record: 11 Date: September 11, 2024 Description: Aerial photo of isolation.	
Hatzic Site: S-CR-14 Record: 12 Date: September 13, 2024 Description: Site B isolation and excavation complete.	

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Hatzic Site: S-CR-14 Record: 13 Date: September 13, 2024 Description: Site C2 isolation and excavation complete.	
Hatzic Site: S-CR-14 Record: 14 Date: September 19, 2024 Description: Site B3 isolation and excavation complete.	

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Hatzic Site: S-CR-14 Record: 15 Date: September 20, 2024 Description: Drone photo of progress.	
Hatzic Site: S-CR-14 Record: 16 Date: September 24, 2024 Description: recovery station installation progress	

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Hatzic Site: S-CR-14 Record: 17 Date: September 26, 2024 Description: Site J isolation and excavation complete.	
Hatzic Site: S-CR-14 Record: 18 Date: September 26, 2024 Description: Site K isolation and excavation complete.	

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Hatzic Site: S-CR-14 Record: 19 Date: September 27, 2024 Description: Aerial photo of isolation	
Hatzic Site: S-CR-14 Record: 20 Date: September 27, 2024 Description: Site B2 isolation and excavation complete.	

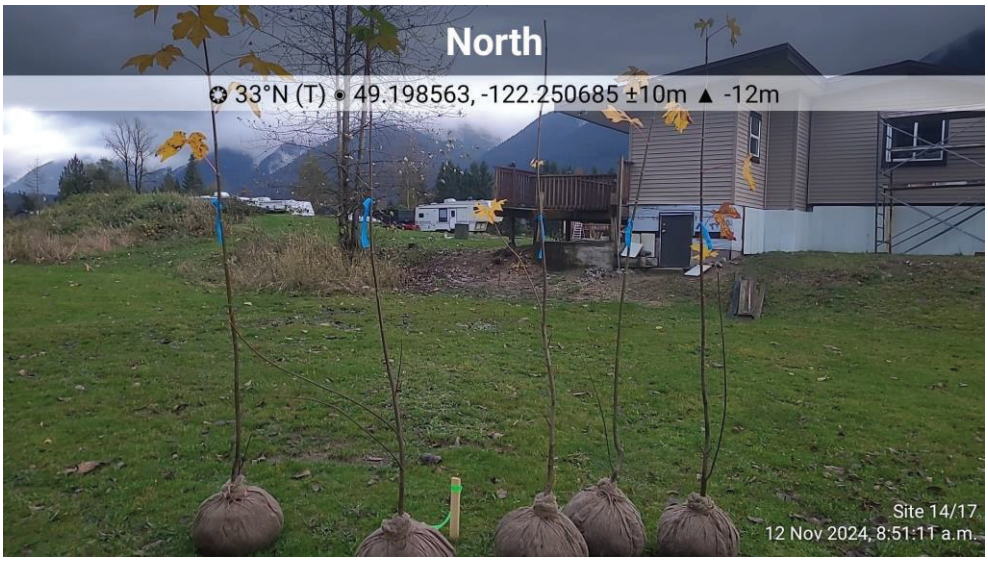
Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Hatzic Site: S-CR-14 Record: 21 Date: September 28, 2024 Description: Site F isolation and excavation complete.	
Hatzic Site: S-CR-14 Record: 22 Date: September 29, 2024 Description: Site G isolation and excavation complete	

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Hatzic Site: S-CR-14 Record: 23 Date: September 29, 2024 Description: Site I isolation and excavation complete.	
Hatzic Site: S-CR-14 Record: 24 Date: October 1, 2024 Description: Contractors final day working in creek removing bags and emptying contents.	

Hatzic Site: S-CR-14 Record: 25 Date: October 7, 2024 Description: Drone photo of progress	
Hatzic Site: S-CR-14 Record: 26 Date: October 20, 2024 Description: Drone photo of flooding.	

Hatzic Site: S-CR-14 Record: 27 Date: November 12, 2024 Description: Live stakes arrive on site.	
Hatzic Site: S-CR-14 Record: 28 Date: November 12, 2024 Description: Trees arrive on site.	

Hatzic Site: S-CR-14 Record: 29 Date: November 29, 2024 Description: Live Staking completed.	
Hatzic Site: S-CR-14 Record: 30 Date: December 4, 2024 Description: QM demobilizes from the site.	

APPENDIX J – ENVIRONMENTAL MONITORING REPORT

Ministry of Water, Land and Resource Stewardship

PERMIT

78470-25

WILDLIFE ACT

PERMIT SU24-886757

PERMIT HOLDER	**KEYSTONE ENVIRONMENTAL LTD.** 320-4400 DOMINION ST. BURNABY, BC V5G 4G3 ATTENTION: (604) 430 - 0671 PHONE: ELIZABETH FAIRHURST

IS AUTHORIZED UNDER s. 2(c)(i), 2(j), 2(k)(i), 2(m), and 2(o) of the Permit Regulation, B.C. Reg. 253/2000,

TO	**Live capture, temporarily possess, transport and release to a nearby suitable habitat , and dispose of dead invasive species.** Pond-breeding amphibians: - northwestern salamander (*Ambystoma gracile*) - long-toed salamander (*Ambystoma macrodactylum*) - western toad (*Anaxyrus boreas*) - American bullfrog (*Lithobates catesbeianus*) - green frog (*Lithobates clamitans*) - Pacific treefrog (*Pseudacris regilla*) - northern red-legged frog (*Rana aurora*) - Oregon spotted frog (*Rana pretiosa*) - roughskin newt (*Taricha granulosa*) Terrestrial amphibians: - ensatina (*Ensatina eschscholtzii*) - western red-backed salamander (*Plethodon vehiculum*) Reptiles: - northern alligator lizard (*Elgaria coerulea*) - western skink (*Plestiodon skiltonianus*) - terrestrial gartersnake (*Thamnophis elegans*) - northwestern gartersnake (*Thamnophis ordinoides*) - common gartersnake (*Thamnophis sirtalis*) Small mammals: - Pacific water shrew (*Sorex bendirii*) **In specific areas: Hatzic Lake Watershed, Mission** **- Site 14 (Lower Hatzic Slough, alias Lagace Creek; approx. midpoint UTM Zone 10, 554623 m E, 5449271 m N)** **- Site 17 (Lagace Creek and unnamed stream alias Saporano Creek; approx. midpoint UTM Zone 10, 556899 m E, 5453945 m N)**

SUBJECT TO THE FOLLOWING:

TERMS OF PERMIT	The permit holder must follow the attached British Columbia **Interim Hygiene Protocols for Amphibian field staff and researchers**. The permit holder must comply with the terms in Appendix A.

COMPLIANCE ADVISORY	Failure to comply with any term of this permit is an offence under the *Wildlife Act*, and may result in any or all of prosecution, suspension of the permit, cancellation of the permit, ineligibility for future permits, and denial of future permit requests.	
PERIOD OF PERMIT	This permit is only valid from September 5, 2024 to August 22, 2025.	
DATE OF ISSUE	September 5, 2024	
 **SIGNATURE OF ISSUER**	Elizabeth Shebib, Wildlife Biologist A person authorized by the Regional Manager Recreational Fisheries & Wildlife Programs South Coast Region	**PERMIT FEE** $100.00 **HCTF SURCHARGE** $10.00

BRITISH COLUMBIA

APPENDIX A
TERMS OF PERMIT

PERMIT SU24-886757

REPORTING REQUIREMENTS:

1. The permit holder must maintain an accurate up to date record of the wildlife hunted, trapped or killed under the permit that includes the following information:

    a) common name of the wildlife;
    b) location* where the wildlife was taken,
    c) the date the wildlife was hunted, trapped or killed;
    d) the sex and age class of the wildlife taken;
    e) the bands or tags on the wildlife; and
    f) a description of all nests, dams or other structures destroyed or removed.

    *includes a UTM grid location in NAD83 to + or – 100m accuracy (zone 2 digits, easting 6 digits, northing 7 digits)

    NOTE: A blank reporting form (Appendix C) is attached to the end of this permit for your convenience

2. The permit holder must submit the original copy of this record to FrontCounter BC, Ministry of Water, Land and Resource Stewardship **within 21 days** of the permit's expiry.

3. The permit holder must produce a copy of the record referred to in paragraph 1 on the demand of an officer.

4. If a species at risk (red or blue) is captured – the above information needs to be submitted within **7 days** of the capture and notification must be submitted without delay to Ministry of Water, Land and Resource Stewardship (FrontCounterBC.Surrey@gov.bc.ca). Please include a description of the wildlife, the above information and a photo documenting identifying characteristics.

ADDITIONAL REPORTING REQUIREMENTS:

1. The permit holder must within 90 days of the expiry of this permit submit data and a written report of activities related to this permit. The data and written report must be submitted on-line to https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/wildlife/wildlife-data-information/submit-wildlife-data-information.

    This website contains the data templates, report specifications and describes which data is mandatory to submit. Interim reports may also be required and must be submitted as required by Regional Biologists.

GENERAL CONDITIONS:

1. The permit holder must comply with all laws applicable to the activities carried out under this permit.

2. This permit extends to the permit holder's employees or contractors only when they are engaged in the direct performance of their duties on behalf of the permit holder.

3. All work is to be undertaken by trained professionals with experience in capturing and handling amphibians, reptiles and small mammals.

4. Regardless of period of permit dates, salvage of amphibians shall not occur once the amphibians enter their overwintering phase between: October 31 – March 1; salvage of reptiles shall not occur once the reptiles enter their overwintering phase between: October 15 – March 15.

5. The permit holder must take all reasonably necessary steps to ensure that public safety is not jeopardized, and fish or wildlife habitat is not damaged by any action taken under authority of this permit.

6. Capture and handling of specimens to be in accordance with the Standards for Live Animal Capture and Handling Guidelines established by the Ministry of Environment.

   https://www2.gov.bc.ca/gov/content/environment/natural-resource-stewardship/laws-policies-standards-guidance/inventory-standards/terrestrial-ecosystems-biodiversity

   Further guidelines can be obtained on the Canadian Council on Animal Care website at https://www.ccac.ca/en/standards/guidelines/types-of-animals.html

7. The permit holder must ensure that the wildlife are treated in a humane manner and are not subjected to any unnecessary harm or suffering.

8. No intentional mortality of red or blue listed species is to occur. All reasonable steps must be taken to ensure accidental mortality does not occur.

9. If Oregon Spotted Frog are identified on site, the permit holder must contact Oregon Spotted Frog Recover Team Lead, Briar Hunter at Briar.hunter@gov.bc.ca and SCFishandAquaticWildlife@gov.bc.ca immediately.

10. All activities completed under this permit will follow methods described in the most recent Application and Animal Care Application (ACA) and General Wildlife Permit Application associated documents. Salvage and handling of amphibians shall follow the methodology outlined in Best Management Practices for Amphibian and Reptile Salvages in British Columbia, 2016, by British Columbia Ministry of Water, Land and Resource Stewardship.

11. Snakes must not be relocated further than 500m from any capture site, unless there are no suitable areas within 500m that support the microhabitat characteristics preferred by each species. All release sites must contain similar microhabitat characteristics as the capture location, such as refuge features (i.e. rocks/talus, shrubs, coarse woody debris, small mammal burrows, etc.) and thermal characteristics (i.e. aspect) and should be located a minimum of 100m from any road or trail.

12. Lizards must not be relocated further than 60m distance from capture sites, unless there are no suitable areas within 60m. Lizards must be moved to a location containing natural habitat features that may provide refuge (i.e. talus, rock outcrop, etc.) and away from any roads and trails.

13. In the case of needing to salvage and translocate reptiles from a den site, the permit holder must contact FrontCounter BC, Ministry of Water, Land and Resource Stewardship upon discovery of the den site. Post-salvage monitoring plans must be developed in conjunction with Regional Biologists and species experts. The permit holder must ensure implementation of the monitoring plan.

14. All other small mammals and other organisms incidentally captured must be released unharmed; except wildlife species listed under *Wildlife Act Designation and Exemption Regulation (BC Reg 168/90),* Schedule “C” which must be humanely euthanized.

15. Be advised that these works are occurring in potential Pacific Water Shrew habitat, therefore works must be consistent with the most current Draft Best Management Practices for Pacific Water Shrew in Urban and Rural Areas, September 2010, by Craig, Vennesland and Kym

Welstead. It is the responsibility of the contractor/permit holder to obtain the most current version.

16. All traps, including those used in any associated fish salvage works, must be checked regularly to ensure that shrews are not killed. From March 1 to November 1, traps should be checked every 8 hours (minimum). From November 1 to March 1, traps should be checked every 6 hours (minimum). Please note that this trap checking frequency is specific to Pacific Water Shrew and may not be frequent enough to avoid mortality of other organisms. Due care should be exercised in this regard to ensure unnecessary mortality of other organisms does not occur.

17. The following mitigation measures are to be adhered to for all aquatic traps.
    - Traps must be equipped with a Styrofoam platform (placed inside) of approximately 7 cm diameter and 2 cm depth, for shrews to rest on out of the water.
    - A 2.5 cm air gap must be left above the Styrofoam so shrews can sit out of the water
    - A large amount of bait must be placed in nylon netting/pantyhose in the trap to provide food for shrews, that is not accessible to fish from outside the trap.
18. No trapping works shall occur in Pacific Water Shrew habitat during periods of inclement weather, i.e, flooding, heavy rain or freezing temperatures (< 3 °C).

19. In addition to reporting condition requirements in this permit (i.e. reporting all captured wildlife within 21 days of permit expiry date), the permit holder must provide upon conclusion of this year's project, a copy of the final project report to Front Counter BC, Ministry of Water, Land and Resource Stewardship. The final project report must include an inventory of all wildlife species listed under *Wildlife Act Designation and Exemption Regulation (BC Reg 168/90),* Schedule "C" that were captured and euthanized.

BRITISH COLUMBIA

APPENDIX B
ADVISORY

PERMIT SU24-886757

GENERAL

- It is the permit holder's responsibility to be aware of all applicable laws and the limits of this permit. For example, this permit does not give the permit holder authority to access or travel though any private land without permission from the landowner.
- The Province is not liable for any illness contracted through wildlife handling. It is the responsibility of the permit holder to inform themselves of possible health hazards, and to ensure that all reasonably necessary safety measures are undertaken.
- If applicable, the permit holder is responsible for renewing this permit. The issuer is not obliged to send a reminder notice.

LEGISLATION

Below is a non-exhaustive list of provisions under the *Wildlife Act* and regulations that are relevant to this permit. It is the permit holder's responsibility to be aware of any provisions under the *Wildlife Act* or regulations that may apply to this permit.

Wildlife Act

Property in Wildlife

2 (1) Ownership in all wildlife in British Columbia is vested in the government.

(4) If a person by accident or for the protection of life or property kills wildlife, that wildlife, despite subsection (3), remains the property of the government.

(5) Despite anything in this Act, no right of action lies, and no right of compensation exists, against the government for death, personal injury or property damage caused by

(a) wildlife, or

(b) an animal that escapes or is released from captivity or is abandoned

in British Columbia

Trafficking in wildlife

22 A person who traffics live wildlife or wildlife meat, except as authorized by regulation or a permit, commits an offence.

Documents not transferable

81 Except as authorized by regulation or as otherwise provided under this Act, a licence, permit or limited entry hunting authorization is not transferable, and a person commits an offence if the person

(a) allows his or her licence, permit or limited entry hunting authorization to be used by another person, or

(b) uses another person's licence, permit or limited entry hunting authorization.

Failure to pay fine

85 (1) This section applies if a person

(a) fails to pay, within the time required by law, a fine imposed as a result of the person's conviction for an offence under this Act or the *Firearm Act*, and

(b) has been served with notice of this section.

(2) In the circumstances referred to in subsection (1),

(a) the person's right to apply for or obtain a licence, permit or limited entry hunting authorization under this Act is suspended immediately and automatically on the failure to pay the fine,

(b) all licences, permits and limited entry hunting authorizations issued to that person under this Act are cancelled immediately and automatically on the failure to pay the fine,

(b.1) the person must not apply for employment as an assistant guide,

(b.2) the person must not guide as an assistant guide, and

(c) the person commits an offence if, before that fine is paid, the person

(i) applies for, or in any way obtains, a licence, permit or limited entry hunting authorization under this Act,

(ii) does anything for which a licence, permit or limited entry hunting authorization under this Act is required,

(iii) applies for employment as an assistant guide, or

(iv) guides as an assistant guide.

Proof of identity and authorization

97 (1) In this section, **"authorization"** means a licence, permit or limited entry hunting authorization issued under this Act.

(2) Subject to subsection (5), a person who is required to hold an authorization must, on the request of an officer,

(a) state the person's name and address,

(b) produce prescribed photo identification, and

(c) demonstrate in accordance with subsection (3) that the person holds the authorization.

(3) A person may demonstrate that the person holds an authorization by

(a) producing the authorization, or

(b) unless the regulations require that the original authorization be produced,

(i) producing a legible copy of the authorization, or

(ii) if authorized by the regulations, stating a number assigned to the person by the director as an identification number for the person.

(4) Subject to subsection (5), a person who would be required to hold a licence or permit issued under this Act were the person not exempt under section 11 (9) or 12 (b) must, on the request of an officer,

(a) state the person's name and address, and

(b) produce prescribed photo identification.

(5) Subsections (2) (b) and (4) (b) do not apply to a person in a prescribed class of persons.

(6) A person who contravenes subsection (2) or (4) commits an offence.

Permit Regulation

General offence – failure to comply with permit

8 A person who holds a permit under the Act or this regulation commits an offence if the person fails to comply with a term of the permit.

Wildlife Act General Regulation

Proof of identity

21.01 (1) For the purposes of section 97 (2)(b) and (4)(b) of the Act, the following photo identification is prescribed:

(a) valid photo identification issued to a person by any of the following:

(i) the government of Canada;

(ii) the government of a province or territory, or an agent of the government of a province or territory, in which the person has a current address;

(iii) the Nisga'a Nation, if the person is a Nisga'a citizen;

(iv) a treaty first nation, if the person is a treaty first nation member of the treaty first nation;

(b) in the case of a person who is a non-resident alien,

(i) valid photo identification in the form of

(A) a passport, or

(B) a driver's licence issued to the person by a foreign jurisdiction in which the person has a current address, or

(ii) a copy of a photo identification referred to in subparagraph (i) that has been certified as a true copy by

(A) a lawyer, or

(B) a notary who is a member in good standing under the *Notaries Act;*

(c) in any case, a valid NEXUS card.

(2) For the purposes of section 97 (5) of the Act, persons under 16 years of age are prescribed as exempt from the requirement to produce photo identification.

BRITISH COLUMBIA

STANDARD OPERATING PROCEDURES:
HYGIENE PROTOCOLS FOR AMPHIBIAN FIELDWORK - 2008

ECOSYSTEMS BRANCH, MINISTRY OF ENVIRONMENT, BRITISH COLUMBIA

Interim Hygiene Protocols for Amphibian field staff and researchers

PURPOSE

To describe hygiene protocols to be used by amphibian field staff and researchers to reduce risk of disease transmission among sites and among animals within a site.

DESCRIPTION

Over the past few decades emerging infectious diseases such as the amphibian chytrid fungus (*Batrachochytrium dendrobatidis*) and ranavirus have been implicated in the decline of amphibian populations from many sites around the world. It is thought that field staff could act as potential vectors of transmission introducing these diseases into new sites and to naïve species. The risk of this mode of transmission is not fully understood compared to other modes of transmission, for example by vectors such as waterfowl and other wildlife. However, to reduce the risk, it is essential that all field workers incorporate the hygiene protocol into their research plans as Standard Operating Procedure (SOP).

To encourage compliance, the SOP below aims to strike a balance between reducing risk of disease transmission and increasing ease of protocol implementation under field conditions.

The protocols below address two levels of disease transmission: 1) the risk of disease transmission between sites; and 2) the risk of disease transmission among individuals within a site.

RESPONSIBILITY

This protocol applies to all field staff working in aquatic habitats sampling amphibians in freshwater lentic and lotic wetlands.

MATERIALS

- Plastic tote or box to store field equipment.
- Buckets and totes for mixing bleach solution and soaking equipment
- Spray bottle for bleach solution
- Scraper, brushes, hand-brushes
- Rubber dishwashing gloves, rubber apron
- Clean plastic containers and bags for temporarily holding animals
- Household bleach (contains active ingredient 5-6.5% sodium hypochlorite solution)
- Vinyl or nitrile gloves for handling amphibians
- Sterilizing solutions (ethanol) and alcohol burner/lighter for disinfecting instruments if toe-clipping or marking animals.
- Container for waste disposal

STANDARD OPERATING PROCEDURES (SOP)

I. SOP when moving between sites

Definition of site

At geographic scales of tens of kilometres, watersheds and major geographical barriers should be used to designate separate sites.

Each tributary of a river should be considered a separate site. Wetlands, ponds and lakes separated by dry land should be considered separate sites.

Site designation is particularly difficult at smaller geographic scales and with small isolated water bodies. At scales less than 500 m, if the water bodies remain separate under high water/flood conditions then they should be considered separate sites. Within a stream (at distances less than 500 m) sampling should occur in a downstream direction where possible. Each stream and each upstream location should be considered separate sites.

Equipment treatment

Equipment such as wetsuits, waders, footwear, nets, buckets, and traps may act as vectors of disease spread. In this SOP we recommend household bleach for disinfection because it is widely available, and it is easy to dispose under field conditions if the precautions below are followed. However, there are a number of other disinfectants that have been tested (Table 1) that offer a variety of other advantages. The SOP can be used with these chemical disinfectants instead of bleach, but manufacturer's recommendations and Material Safety Data Sheet requirements for use and disposal must be followed. It is important to ensure that disinfectants do not leave a residue on equipment, as the residue can be harmful to amphibians.

1. Before leaving a site, field workers must scrub using a hand brush and rinse using the pond/stream water to remove mud, algae, plants, snails and other invertebrates from all equipment. Disinfection procedures work best on cleaned equipment, free of debris.
2. A bleach solution with 0.2 % sodium hypochlorite and exposure time of 10 minutes has been shown to be effective against *Bd* (Johnson et al 2003). Commercial household bleach sold in North America often contains 6.15% sodium hypochlorite, but concentrations can vary. To prepare the disinfectant solution, add 32 ml of household bleach to 1 litre of water. This translates to approximately 3.5 cups (0.85 litre) of bleach to one tall bucket or tote (~ 25 litres) of water. In the absence of municipal/well water supply, water from the pond or stream can be used.
3. All equipment must be soaked in the bleach solution for a minimum of 15 minutes. Small items such as dipnets, and sample containers can be immersed in the bleach solution in a bucket or plastic tote. Larger items such as chest waders, paddles, boats, canoes, meter sticks and other survey equipment should be thoroughly soaked with the bleach solution using a spray bottle.
4. The bleach solution can be rinsed off after 15 minutes with clean water from a well or municipal supply. However, if clean treated water is not available, the items can be hung out to dry, preferably in sunlight, so that the bleach evaporates completely from the equipment.
5. The bleach solution can damage exposed skin and clothing. Dishwashing gloves and rubber aprons should be worn to protect clothing and skin from exposure to the bleach solution.
6. The SOP is most easily carried out back at the laboratory or field station. All equipment should be stored in a waterproof box or tote during transportation to prevent contaminating the vehicle and preventing the vehicles from acting as secondary sources of cross contamination.
7. If the equipment needs to be used immediately at another site prior to returning to the laboratory or field station, the SOP should be carried out on a road or other impermeable surface away from the waterbody, so that no bleach contaminated water enters surface water bodies. If time permits, all equipment should be dried completely between sites. This is facilitated by having two sets of gear, one of which is drying while the other is in use. If the equipment needs to be used immediately at another site, residual bleach from nets and other equipment should be rinsed off using water from the second site, again working away from the waterbody. Even trace amounts of residual bleach can adversely affect amphibians on contact.
8. In the field, the bleach solution is best disposed far from the waterbody by pouring over an asphalt, hard roadbed or concrete surface where it breaks down in sunlight and evaporates. Ensure no bleach water enters surface waters directly.
9. Washing road vehicles at a carwash between watersheds is desirable. All off-road vehicles, boats, canoes, and other floatation devices should be subject to the same SOP as sampling equipment. Large equipment, such as boats and seine nets, are most easily handled by spraying with or soaking in the bleach solution and then rinsing off at a carwash using high pressure hot water rinses.

Special Sites

The above SOP should be sufficient to reduce the risk of disease transmission under most circumstances. However, at sites where there have been known disease outbreaks or sites with highly endangered amphibian populations extra precautions are necessary. The simplest solution would be to have dedicated field gear that is used only at that site.

II. SOP under Special Circumstances

The above SOP should be implemented under all normal operating conditions. However, if for unforeseen and unplanned reasons it is not possible to adhere strictly to the above SOP the following precautions can be taken to reduce the risk of disease transmission.

1. At a minimum, all equipment should be scrubbed and rinsed thoroughly to remove debris, algae, invertebrates and mud.
2. Complete drying between sites can reduce the risk of transmission of chytrid fungus (*Bd*) but is not effective against ranavirus.
3. If it is possible to heat water, equipment should be soaked in water > 60°C for 30 minutes. This method may be practical for small equipment such as dipnets that come in direct contact with the animals.

III. SOP for handling amphibians within a site

It is important to assume that not all animals from a site are infected and that handling multiple animals without adequate caution will significantly increase the risk of between animal disease transmissions. The following SOP should be followed to ensure that handling by field staff does not increase the risk of an animal being exposed to a pathogen.

1. All field staff must ensure that their hands are well cleaned and free of residual chemicals such as sunscreen and insecticides at the start of the survey.
2. All field staff must wear disposable gloves when capturing amphibians. Non- powdered vinyl and nitrile gloves are preferred, as latex has been shown to have toxicity towards frog embryos and tadpoles.
3. Gloves should be changed between animal captures. If under unforeseeable circumstances access to gloves is limited, it is better to capture animals with bare hands and wash hands thoroughly in water to which the animals are habitually exposed, rather than to use the same pair of gloves to handle multiple animals.
4. Captured animals must be housed in separate disinfected containers or disposable bags such as plastic Ziploc bags.
5. The duration of restraint should be as short as possible. The greatest stress and risk of disease transmission between animals is during restraint. Every effort should be made to process animals at the site of capture and avoid captivity. Containers used to house individuals should not be reused unless the containers have been treated using 4% bleach solution as described in SOP #1 above.
6. Fresh disposable gloves must be worn when measuring, swabbing or marking the animal.
   Surgical instruments such as scissors used for toe clipping should be dipped in 70% ethanol and flamed briefly between uses. A *bic* lighter is useful and effective for flaming surgical instruments in the field. Wiping down with ethanol alone kills the pathogens but does not completely destroy the pathogen DNA. This may increase the number of false positives if the animals are being sampled for disease prevalence

7. Instruments used for inserting PIT tags and other tags should also be sterilized between animals. Fresh disposable syringes should be used for each animal.
8. The tuberculin syringes used for fluorescent elastomer paint injections present a special problem. The needles can neither be changed between animals nor is it practical to use a fresh syringe for each marked animal. At this time the recommendation is that the needles should be sterilized with appropriate viricide/bactericide (or dipped in 70% ethanol) and rinsed with distilled water between making animals. The efficacy of this method in preventing between animal disease transmission needs to be assessed.

FURTHER INFORMATION

When in doubt, field staff should use the precautionary principle and use the highest standards of cleanliness possible. An additional half hour spent following the most stringent SOP is well worth the effort. A number of other protocols, using a variety of disinfection agents are listed below.

RELEVANT LITERATURE

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Johnson M, Berger L, Philips L, Speare R**.** 2003. Fungicidal effects of chemical disinfectants, UV light, dessication and heat on the amphibian chytrid, *Batrachochytrium dendrobatidis.* Diseases of Aquatic Organisms 57:255-260.

Speare, R., L. Berger, L. F. Skerratt, R. A. Alford, D. Mendez, S. Cashins, N. Kenyon, K. Hauselberger, and J. J. L. Rowley. 2004. Hygiene protocol for handling amphibians in field studies. Amphibian Disease Group, James Cook University, Townsville 4811, Australia. http://www.jcu.edu.au/school/phtm/PHTM/frogs/field-hygiene.pdf

US Forest Service Intermountain Region. Technical Chemical Information for Disinfecting Aquatic Invasive Species (excellent resource for calculating disinfectant dilutions) http://www.fs.fed.us/r4/resources/aquatic/guidelines/chemical_tech_final.xls

Webb, R., D. Mendez, L. Berger, and R. Speare. 2007. Additional disinfectants effective against the amphibian chytrid fungus Batrachochytrium dendrobatidis. Diseases of Aquatic Organisms 74:13-16.

Wellington, R. and R. Haering. 2001. Hygiene protocol for the control of diseases in frogs. New South Wales National Parks and Wildlife Service Threatened Species Management Information Circular No 6, Hurstville, Australia. www.npws.gov.au/wildlife/licence/frog.html

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Table 1

Summary of disinfectant concentrations and exposure times found to be effective against *Bd*. Table reproduced with modification from Speare et al (2004) with additional information from Johnson et al (2003) and Webb et al (2007).

DISINFECTANT	CONCENTRATION	TIME	REFERENCE
Disinfecting surgical equipment and scales			
Ethanol	70%	1 min	Speare et al 2004 Webb et al 2007
Virkon	1mg/ml	1 min	Speare et al 2004
Benzalkonium chloride	1 mg/ml	1 min	Speare et al 2004
Disinfecting collection equipment, containers, footwear, waders, boats, nets and other field gear			
Household bleach (sodium hypochlorite 4% to 6%)	4% to 1% (0.2 to 0.01% Sodium hypochlorite)	10 min to 30 sec	Speare et al 2004 Johnson et al 2003 Webb et al 2007
Didecyl dimethyl ammonium chloride	1 to 1000 dilution	30 sec	Speare et al 2004
Quaternary ammonium compound 128	Full strength to $1x10^{-3}$	5 mins to 30 sec	Johnson et al 2003
Virkon	1 mg/ml 2 g/litre	5 min, 20 sec 1 min	Johnson et al 2003 Webb et al 2007
F10 Super Concentrate Disinfectant	0.7 ml/litre	1 min	Webb et al 2007
TriGene Viricidal Surface Disinfectant Cleaner	0.2 ml/litre	1 min	Webb et al 2007
DDAC	2 ml/litre	1 min	Webb et al 2007
Sodium chloride	10%	5 min, 2 min	Johnson et al 2003
Potassium permanganate	2%	10 min, 5 min	Johnson et al 2003
Hot wash for cloth bags and clothing	60 °C or greater	15 mins	Speare et al 2004
Heat	60 °C	30 minutes	Speare et al 2004 Webb et al 2007
Complete drying (footwear only)	Effective against *Bd* but not ranavirus	3 hrs or greater	Speare et al 2004
Sterilising UV light ($1000\ mW\ m^{-2}$ wavelength 254 nm)	Effective against ranavirus but not *Bd*	1 min	Speare et al 2004 Johnson et al 2003

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APPENDIX C
RECORD OF WILDLIFE HUNTED, TRAPPED OR KILLED
PERMIT SU24-886757

- The permit holder **MUST** maintain an accurate up-to-date record.
- The permit holder **MUST** submit the original copy of this record to FrontCounter BC, Ministry of Water, Land and Resource Stewardship **within 21 days** of the permit's expiry or annually as indicated in "Appendix A – Terms of Permit – Reporting Requirements" of this permit.
- The permit holder must produce a copy of this record on the demand of an officer

*If more room is required, please use a sheet of blank paper

Common name of wildlife	Location where wildlife was taken	Date wildlife was hunted, trapped or killed	Sex and age class of wildlife	Bands or tags on wildlife	Description of all nests, dams or other structures destroyed or removed

BRITISH COLUMBIA

_____ _____

Signature of Permit Holder Date

FrontCounter BC
Ministry of Water, Land and Resource Stewardship
Locations: https://portal.nrs.gov.bc.ca/web/client/locations

Fisheries and Oceans Canada | Pêches et Océans Canada

Licence Number: XHAB 494 2024 - Amendment 1
Valid From: 26-Aug-2024
Expiry Date: 22-Aug-2025

This licence and/or permit is issued under the authority of SECTION 52 OF THE FISHERY (GENERAL) REGULATIONS.

This licence and/or permit authorizes the person(s) listed below, subject to the following terms and conditions, to collect the species and quantity of fish identified below for: Scientific purposes. Non-compliance with any condition of this licence and/or permit may result in the cancellation of this licence and/or permit.

Licence/Permit Activity Description:
A fish salvage is required in advance of emergency flood restoration works in Hatzic, BC.

This licence authorizes fishing for the purpose of fish salvage in the waterbodies listed in this licence. Fish salvage is required to remove fish using non-lethal methods from construction areas.

No fish may be retained under the authority of this licence.

Licence Holder:
FIN: 121981

320-4400 DOMINION ST.
BURNABY BC V5G 4G3

KEYSTONE ENVIRONMENTAL LTD.

Contact Number: 604-430-0671
Fax Number: 604-430-0672

Contact Party:
FIN: 129997 FAIRHURST, ELIZABETH

Contact Number: 604-430-0671

Individuals or groups assisting with the authorized activity:

Employees of Keystone Environmental Ltd. are authorized to fish under this licence.

Species, Quantity of Fish, Area(s) and Gear:

Species:	CHINOOK SALMON (Oncorhynchus tshawytscha); CHUM SALMON (Oncorhynchus keta); COHO SALMON (Oncorhynchus kisutch); PINK SALMON (Oncorhynchus gorbuscha); SOCKEYE SALMON (Oncorhynchus nerka); PRICKLY SCULPIN (Cottus apser); THREESPINE STICKLEBACK (Gasterosteus aculeatus);
Life Stage:	Juvenile
Gear:	Dip Net Electroshocker Seine Net Trap, Gee/Minnow
Licence Area:	Lagace Creek Watershed - See below for more detail
To be Retained:	0

Additional Descriptions: **Areas:**

Site 14: Lower Hatzic Slough; Site 17: Lagace Creek and Saporano Creek

See appendix for map

Life stage(s):

Salmon species: juvenile

Stickleback species - juvenile; adult

Sculpin species: juvenile; adult

Reporting Requirements:

XHAB 494 2024 **Due Date** 30-Sep-2025
Submit report to: DFO.FIALicense-LicenseSFI.MPO@dfo-mpo.gc.ca

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Terms and Conditions:

Licence authority: This licence authorizes fishing activities and sample collections to be undertaken by the Licence Holder and members, employees, volunteers and students of the Licence Holder and designated iindividuals or groups assisting the Licence Holder provided that all persons (other than minors who are engaged in activities under the authority of this licence) are carrying suitable photo identification to be produced upon request of a Fishery Officer or Fishery Guardian.

The Licence Holder/Operator must carry a copy of the licence while conducting fishing activities and while in possession of fish caught or fishing gear used for fishing under the authority of this licence and must produce this licence upon request by a Fishery Officer or Fishery Guardian.

Species permitted to be fished: This licence authorizes fishing for Sockeye salmon (Oncorhynchus nerka), Chinook salmon (Oncorhynchus tshawytscha), Chum salmon (Oncorhynchus keta), Pink salmon (Oncorhynchus gorbuscha), Coho salmon (Oncorhynchus kisutch), Prickly Sculpin (Cottus apser)
and Threespine Stickleback (Gasterosteus aculeatus)

This licence does not authorize fishing for non-anadromous (freshwater) species or Steelhead trout or Cutthroat trout. Approval to fish for these species must be obtained from the Province of British Columbia (BC) prior to the commencement of fishing.

Species at Risk: The Licence Holder/Operator is prohibited from fishing for species at risk or engaging in an activity affecting a species that is listed as “endangered” or “threatened” under Schedule 1 of the *Species at Risk Act* (SARA), including those identified anywhere in the Species, Quantity of Fish, Area(s) and Gear part of this licence, unless authorized under a separate permit issued in accordance with the *Species at Risk Act*.

Nothing in this licence shall be construed as authority to contravene Sections 32 (1), 32 (2), 33 or 58 of the *Species at Risk Act*, with respect to any species listed under SARA as extirpated, endangered, or threatened. If the activity may affect a listed wildlife species, any part of its critical habitat or its residences, a Section 73 SARA permit may be required in addition to this licence. For more information on SARA Section 73 permits, please visit: https://www.dfo-mpo.gc.ca/species-especes/sara-lep/permits-permis/index-eng.html or contact

DFO.PACSAR-LEPPAC.MPO@dfo-mpo.gc.ca. A list of SARA protected species can be found at: https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html.

Notification prior to fishing: The Licence Holder/Operator must call, and if not answered, leave a message at the Conservation and Protection Detachment closest to the fishing area, as specified in the Species, Quantity of Fish, Area(s) and Gear part of this licence. Notification must take place at least 24 hours prior to the licenced activities taking place and include the details and locations of fishing.

See below for a list of Conservation and Protection Detachments and their respective contact numbers:
Chilliwack: (604) 824-3300
Delta: (604) 666-8266
Langley: (604) 607-4150
Squamish: (604) 892-3230
Steveston: (604) 664-9250
Vancouver: (604) 666-0384

Area(s) permitted to be fished: Fishing for the purposes of fish salvage shall only take place in isolated in-water work areas, within the Licence Area(s) and the locations specified in this licence.

Fish and fish habitat: Projects in or near water must avoid causing 'serious harm' to fish unless authorized by the Minister of Fisheries & Oceans Canada (Applications for a Fisheries Act Authorization (normal or emergency) may be found at the following link: www.dfo-mpo.gc.ca/pnw-ppe/reviews-revues/authorization-autorisation-eng.html). This applies to any work being conducted in or near waterbodies that support fish that are a part of a commercial, recreational, or Aboriginal fishery, or to fish that support such a fishery.

Any person who causes or contributes to the death of fish, or causes any permanent alteration or destruction of fish habitat, that is not authorized, is required to report the occurrence to DFO. As well, that person must counteract, mitigate, or remedy the adverse effects that resulted from the occurrence, or that might have reasonably been expected to result from it.

Fishing gear: Notwithstanding s. 27 of the Fishery (General) Regulation, SOR/93-53, the Licence Holder/Operator must ensure that unattended gear is clearly marked with either the Vessel Registration Number, the Licence Number, or the name and phone number of the person who owns the gear. All gear left unattended must not interfere with the public right of navigation.

The Licence Holder/Operator is prohibited from discarding in Canadian fisheries waters any item that may be harmful to fish or fish habitat including but not limited to plastics, ropes, fishing gear, garbage bags, fuel, oil, rags, glass, bottles, metal, extruded polystyrene foam (e.g. Styrofoam), and tires.

While fishing under the authority of this licence, the Licence Holder/Operator is prohibited from interfering with lawful fishing activities by tampering with traps, nets, bait or any other thing used for fishing, and is prohibited from otherwise interfering with the conduct of the fishing activities by another person.

Manner in which fishing gear is permitted to be used: It is the responsibility of the Licence Holder/Operator to

ensure that the authorized persons fishing under this licence are experienced and competent in the fish collection methods and gear authorized in this licence.

The Licence Holder/Operator must ensure that when setting non-tended gear (i.e., minnow traps) permitted under this licence, that non-tended gear must be tended at least once every 24 hours. If mortalities are observed the Licence Holder/Operator must reduce the set interval of the non-tended gear.

"Electrofishing" means using an electric current to attract and temporarily immobilize a fish to allow capture.

If electrofishing is to be used:

(a) A person trained and certified in the use of electrofishers must be a part of the electrofishing crew.

(b) Electrofishing must not be conducted in the vicinity of spawning gravel, redds or spawning fish, or around gravels which are capable of supporting eggs or developing embryos of any species of salmonid at a time of year when such eggs or embryos may be present.

(c) Electrofishing is only permitted after extensive use of other gear during sampling activity indicates no presence of juvenile salmonids. This condition does not apply in those areas and water conditions where the use of other gear may cause more harm to fish then electrofishing.

(d) No electrofishing is permitted to take place in waters having a temperature less than 5 degrees Celsius (°C) or greater than 20 °C.

Fish sampling: The Licence Holder/Operator must ensure that sampling is completed by persons trained in proper fish handling techniques. The Licence Holder/Operator must ensure measurements of body condition, such as weight and length, which involve hands-on manipulation, are conducted quickly and in a manner that is minimally stressful.

No biological sampling (e.g., length or weight measurements) of salmon shall take place in waters having a temperature greater than 20 °C at the surface.

Release of fish: The Licence Holder/Operator must ensure that all species captured are released into the water body or course from which they originated, and as near as possible to the location from which they were sampled. Fish must be released in a manner that causes the least harm.

Aquatic Invasive Species (AIS): Nothing in this licence shall be construed as authority to import, possess, transport, release or introduce into a particular region or body of water frequented by fish where it is not indigenous, any aquatic invasive species listed in Parts 2 and 3 of the Schedule of the Aquatic Invasive Species Regulations (SOR/2015-121). The Aquatic Invasive Species Regulations can be found online at: https://laws-lois.justice.gc.ca/eng/regulations/SOR-2015-121/FullText.html.

Clean, drain, dry and decontaminate: The Licence Holder/Operator must clean, disinfect and decontaminate all gear and equipment including waders, nets, electrofishing cathodes and anodes and buckets, boats and trailers that were used in any freshwater and coastal waters before transferring to another body of water.

Additional precautionary measures that may be taken to avoid the introduction and/or transportation of aquatic invasive species (AIS) into other waters:

1. Inspect and clean plants, animals, mud, and sediment from all equipment used below the high watermark.
2. Drain all water from equipment used below the high watermark.
3. Dry all parts of equipment completely before leaving the site.
4. All organic matter and wash water generated during cleaning must be disposed of on land.

For further information, please visit:

https://www.dfo-mpo.gc.ca/species-especes/ais-eae/index-eng.html

https://www.dfo-mpo.gc.ca/species-especes/ais-eae/prevention/index-eng.html

Introductions and transfers: Other than releasing live fish immediately into waters in which they were caught, the Licence Holder/Operator is prohibited from releasing live fish into fish habitat and/or transferring live fish to any fish rearing facility unless in possession of a licence issued pursuant to Section 56 of the Fishery (General) Regulations.

If the fishing activity, permitted in this licence, requires the release of live fish into fish habitat (other than releasing live fish immediately into waters in which they were caught) or the transfer of live fish into a fish rearing facility, the Licence Holder/Operator must contact the Introductions and Transfers Committee of the province representing the aquatic organisms' final destination to discuss whether an Introductions and Transfers Licence may be required. For more information regarding the review process for the movement of live fish, visit: https://www.dfo-mpo.gc.ca/aquaculture/management-gestion/it-code-eng.htm, or you may also contact:

- British Columbia Introductions and Transfers Committee by email at: DFO.BCITC-CITCB.MPO@dfo-mpo.gc.ca or DFO.salmonITC-CITsaumon.MPO@dfo-mpo.gc.ca

Reporting upon expiry of the licence: The Licence Holder/Operator must submit a final report to the Department. The report shall be emailed to DFO.FIALicense-LicenseSFI.MPO@dfo-mpo.gc.ca within 30 days of the expiry date printed on this licence.

The report must contain at minimum:
1. License number;
2. Sampling date(s), time(s), crew, stream name, watershed name;
3. GPS position of site(s);
4. Number of captured aquatic organisms by species;
5. If conducted, bio-sampling data (lengths, weights); and
6. Any mortalities associated with sampling activities.

In the event that the licence holder does not fish under the authority of this licence, the licence holder is responsible for submitting a nil report. A nil report shall consist of the licence number and a statement indicating that no fishing took place.

Licence validity: The use of the licence(s) is subject to any conditions which are issued by Fisheries and Oceans Canada. The issuance of this licence implies no commitment by the Minister of Fisheries and Oceans Canada (DFO) to reissue the licence in subsequent years. This licence may be amended or revoked by DFO prior to the expiry date if deemed necessary.

Compliance with the *Fisheries Act*: Pursuant to subsection 22(6) of the Fishery (General) Regulations, compliance

with the *Fisheries Act* and the regulations made under the Act is a condition of this licence.

By signing on this document, the person(s) listed below, agree to be bound by the terms and conditions that pertain to each person as an individual and to the group as a whole.

121981

FIN	Licence Holder - Print Name	Signature	Date

Replaced due to For Licence Amendment Purposes Only

Licence Issued: 26 August 2024

Licence Printed: 26 August 2024
Licence Issued By: THOMAS POWELL, Fisheries and Oceans Canada

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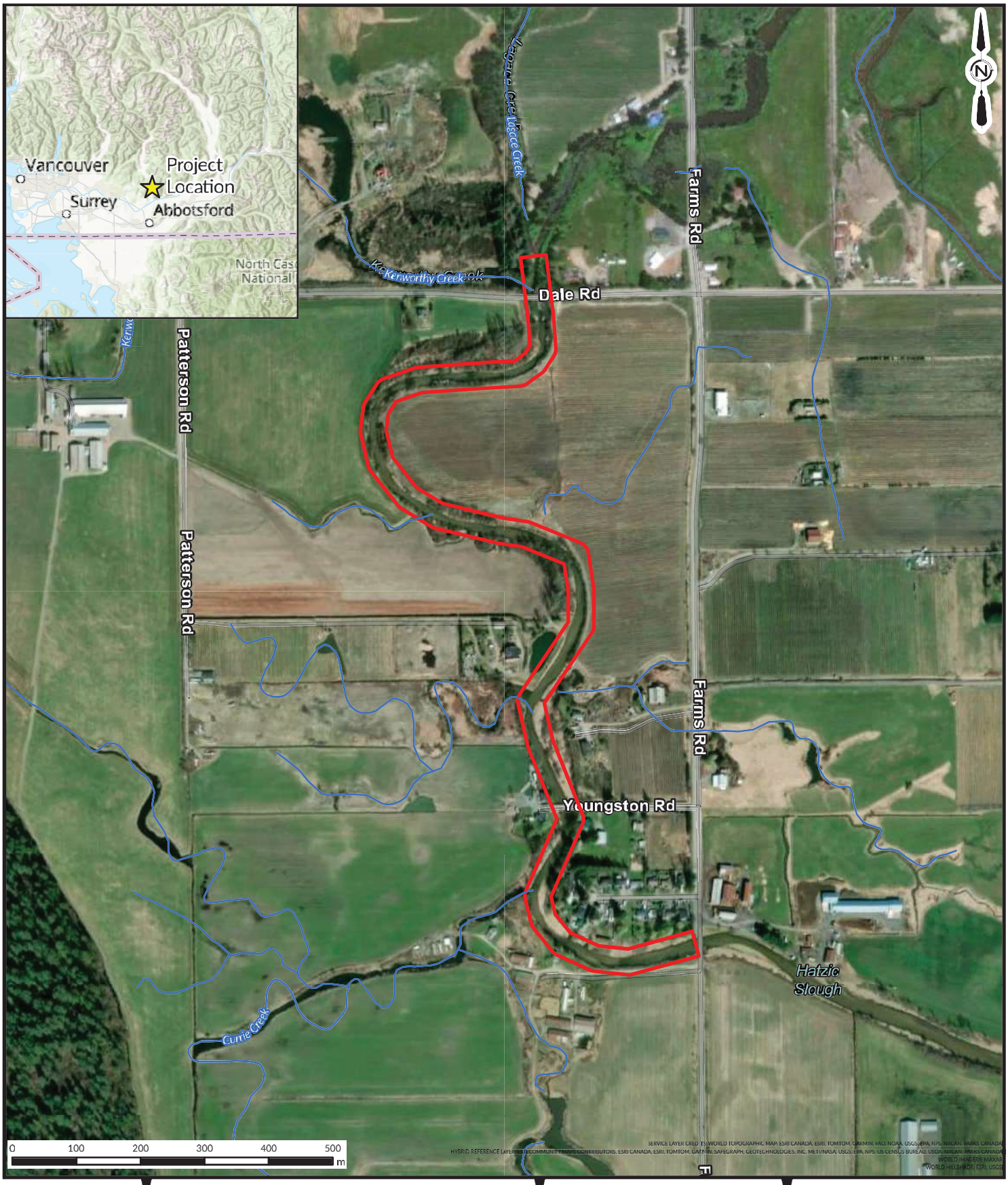

C:\USERS\CHENGS\ONEDRIVE - ASSOCIATED ENGINEERING GROUP LTD\DESKTOP\GIS\2022-2632\NEW_ARC\2022-2632-060.APRX

LEGEND
Site 14

Associated Environmental

BRITISH COLUMBIA Ministry of Environment and Climate Change Strategy

AE PROJECT NO.	2022-2632
SCALE	1:8,000
COORD. SYSTEM	NAD 1983 UTM ZONE 10N
DATE	2024-04-26
REV	00
DRAWN BY	SC
CHECKED BY	NS

FIGURE 1-1
PROJECT LOCATION

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
SCR14 LAGACE CREEK

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\\AE.CA\DATA\WORKING\WAN\2022-2632-06\GIS_ARC\2022-2632-060.APRX
IMAGERY: ESRI, DIGITALGLOBE, GEOEYE, I-CUBED, USDA FSA, USGS, AEX, GETMAPPING, ROAD AND HYDROGRAPHY: GOVERNMENT OF CANADA, 2019.

Associated Environmental

Ministry of Environment and Climate Change Strategy

LEGEND

Project Location

Base Data

Watercourse

N

0 50 100 150 200 250 m

AE PROJECT NO.	2022-2632
SCALE	1:9,000
COORD. SYSTEM	NAD 1983 UTM ZONE 10N
DATE	2024-07-30
REV	01
DRAWN BY	SC
CHECKED BY	NS

FIGURE 1-1
PROJECT LOCATION

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
SCR17 LAGACE CREEK

FISH COLLECTION PERMIT
FISH SALVAGE

File: 34770-20

Permit No.: **SU24-887358**

Permit Holder: **Keystone Environmental Ltd.** – Elizabeth Fairhurst
320-4400 Dominion St.
Burnaby, BC V5G 4G3

Authorized Persons: Alicia Andersen, Warren Appleton, Caitlin Belz, Katherine Carbeck, John Choi, Duncan Clark, Khang Diep, Elizabeth Fairhurst, Azadeh Gheibi, Mitchell Hewitt, Matt Husband, Nicole Lamarche, Dave Langill, Adomas Lukas, Corbin Manson, Dylan Matheson, Libor Michalak, Xuan (Loc) Ngo, Jeremy Nilson, Afshin Parsamanesh, Craig Patterson, Katie Piper, Jeff Prowse, Varsha Rani, Amy Wilson, Nolan White, Vinson Yau

Pursuant to section 18 of the Angling and Scientific Collection Regulation, B.C. Reg. 125/90, the above-named persons are authorized to collect fish for scientific purposes (from non-tidal waters) subject to the terms set forth in this Permit:

Permitted Sampling Period: August 29, 2024 – August 22, 2025
Permitted Waterbodies: Lower Hatzic Slough - Lagace Creek (100-058500), Lagace Creek (100-058500-84700), Unnamed - Saporano Creek (100-058500-84700-72100); See Appendix C
Permitted Sampling Techniques: DN, EF, MT, SN (subject to permit terms)
Potential Species: BCB, BNH, CP, BL, PCC, CAS, PMB, RB, ST, TSB, CCT (subject to permit terms)
Provincial Terms: (Permit holder and authorized persons must be aware of all terms):
See Appendix A.
Region Specific Terms:
See Appendix A.

Authorized by:

Elizabeth Shebib, Wildlife Biologist
A person authorized by the Regional Manager
Recreational Fisheries & Wildlife Programs
South Coast Region

Date: August 29, 2024

Permit Fee: $25.00

APPENDIX A
FISH COLLECTION PERMIT TERMS

Any Variation of the following terms will require explicit authorization by the appropriate regional Fish & Wildlife Section Head.

PROVINCIAL TERMS

1. This collecting permit is **only** valid for species listed as threatened, endangered, or extirpated under the *Species at Risk Act* (SARA) **in conjunction with a permit issued under Section 73 of SARA from Fisheries and Oceans Canada.**

   NOTE: Contact the Department of Fisheries and Oceans for fish collecting permits for salmon or eulachon https://www.pac.dfo-mpo.gc.ca/fm-gp/licence-permis/forms/licence-sci-permis-eng.pdf or for SARA listed species https://www.dfo-mpo.gc.ca/species-especes/sara-lep/permits-permis/index-eng.html#apply.

2. Any specimen's surplus to scientific requirements and any species not authorized for collection in this permit must be immediately and carefully released at the point of capture.

3. Fish collected under authority of this permit must not be used for food or any purpose other than the objectives set out in this permit. Dead fish must be disposed of in a manner that will not constitute a health hazard, nuisance, or a threat to wildlife.

4. No fish collected under authority of this permit must be transplanted unless separately authorized by the Federal/Provincial Introductions and Transfers Committee.

5. The permit holder must, within 90 days (120 days for the Kootenay/Boundary region and Peace region) of the expiry of this permit, submit a report of fish collection activities. Interim reports may also be required and must be submitted as required by the permit issuer. All submissions must be filed electronically to: https://www2.gov.bc.ca/fish-data-submission-process.

   Reporting specifications, information and templates are available from this website and outline the mandatory information requirements. Prior notification of submission or questions regarding data report standards can be made to: fishdatasub@gov.bc.ca

6. The permit holder must comply with all Workers' Compensation Board requirements and other regulatory requirements. The permit holder is responsible for ensuring authorized persons listed on the permit are properly certified for specific sampling methods or activities (e.g., electroshocking).

7. Any workers not listed on the permit must be supervised by the permit holder or one of the authorized persons named on the permit.

8. All sampling equipment that has been previously used outside of B.C. must be cleaned of mud and dirt and disinfected with 100mg/L chlorine bleach before using in any water course to prevent the spread of fish pathogens (e.g., whirling disease) and/or invasive plant species. Any washed off dirt or mud must be disposed of in a manner such that it cannot enter a watercourse untreated.

9. No electrofishing is to take place in waters having a temperature less than five degrees C.

10. No sampling of fish in waters having a temperature greater than twenty degrees C.

11. Electrofishing must not be conducted in the vicinity of spawning gravel, redds, or spawning fish, or around gravels which are capable of supporting eggs or developing embryos of any species of salmonid at a time of year when such eggs or embryos may be present.

12. When work requires de-watering or isolation of the worksite in the stream, a permit for the salvage of fish and wildlife (Scientific Fish Collection permit) must be obtained prior to commencing work. All required salvage permits must be obtained from FrontCounter BC: https://portal.nrs.gov.bc.ca/web/client/home.

PROVINCIAL TERMS CONTINUED

13. Any fish or wildlife salvage must be carried out by a qualified environmental professional registered with a professional association (such as an RPBio). The qualified professional conducting salvage work must adhere to the conditions below in addition to those required in the Scientific Fish Collection permit.

- Salvage activities must be conducted to the Provincial Resource Information Standards Committee (RISC) standards for capture, data collection, handling, and release:

STREAM ISOLATION

- The QP must follow the standards and practices outlined in the Work Area Isolation Appendix found in the Standards and Best Practices for Instream Works. http://www.env.gov.bc.ca/wld/documents/bmp/iswstdsbpsmarch2004.pdf
- A QP must ensure that the worksite has be substantively isolated to prevent any fishes from entering the work area and efforts must be made to exclude fish from entrapment during installation of isolation works. (See section 14.2 of the Standards and Best Practices for Instream Works (MWLAP 2004).
- Dewatering must not result in HADD to fish habitat or the death of fish unless authorized by Fisheries and Oceans Canada.
- While dewatering the work site and dewatering during fish capture, all pump intakes are required to meet the federal COP for fish intake screening guidelines https://www.dfo-mpo.gc.ca/pnw-ppe/codes/screen-ecran-eng.html.

FISH CAPTURE

- Qualified professionals must determine appropriate sampling methods from the RISC standards based on water body type and habitat conditions https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/nr-laws-policy/risc/fishml04.pdf.
- Qualified professionals must use a risk hierarchy of passive to active and low risk to higher risk in collection methods (e.g., minnow traps, fyke nets, beach pole seines, electroshocking, angling).
- Qualified professional must conduct a **minimum of three** non-lethal collection methods in all fish salvages.
- For active collection methods a minimum of two consecutive passes of each method that produces a zero catch must be completed as per total population removal methodology (at a minimum 95% fish removal must be achieved). (https://www.wildsalmoncenter.org/resources/field-protocols-best-monitoring-practices/).
- Where work site isolation cannot be fully achieved (e.g., fast flowing streams, imperfect seal due to substrate) additional efforts are needed to prevent harm to fish. At the end of each workday, a passive form of fish capture (e.g., baited minnow traps) are to be placed in the isolation site. If fish are captured overnight, you must restart isolation procedures at the start of the workday.
- If species at risk are captured, work must stop until proper permits are obtained.

DATA COLLECTION

- Sampling/data collection is a requirement of the Scientific Collection Permit. Sample size requirements are listed in the table below.
- Scientific Fish Collection Permits require a Fish Data Submission Template to be completed. Step 4 (Stream Site Data) of the Fish Data Submission Template must be filled out for the location where fish are salvaged from. https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/fish/fish-and-fish-habitat-data-information/fish-data-submission/submit-fish-data.

FISH RELEASE

- Fish must be released following RISC standards.
- All species are to be released in the same watercourse downstream of the work areas or a sufficient distance upstream (5 channel widths to a maximum of 100 meters) into waters of equivalent baseline quality and habitat type (pool, riffle, run).

Minimum Standards During Salvage for Fish Collection Sampling Effort*

Fish Species	Age Class	Size range	Minimum Sampling Size for lengths	Sample column required (from Individual Fish Data form)	Notes
Salmonids, including RB, CT(CCT), DV, BT, GR, LT, KO	fry	20 to 80 mm	up to 30 after 30 count	J (if possible), K	
	juvenile	81 mm-250 mm	Measure all fish caught	J, K, L	
	adult	greater than 250 mm	Measure all fish caught	J, K, L, M, N	
Coarse Fish (cyprinids, stickleback, dace, shiner, carp, pikeminnow)		under 200 mm	up to 30 after 30 count	J, K	
	Adult	over 200 mm	All	J, K, L, M	
Sport other (bass, perch, sunfish, walleye, northern pike)		all	up to 30 after 30 count	J, K, L	
Sculpin sp.		0-150mm (total length)	up to 30 after 30 count	J, K	
		Over 150mm	All	J, K, L	
Burbot, Lamprey		0-150 mm (total length)	All	J, K, L, N	
Listed Species (salish sucker, sturgeon, etc.)		All	All		Refer to SAR permit for conditions
All fishes not listed above		All	minimum 10 of each then count only	J, K, L	

Abbreviations for salmonids

RB-Rainbow
CT(CCT)-Cutthroat
DV-Dolly Varden
BT- Bull Trout
GR- Arctic Grayling
LT- Lake Trout
KO- Kokanee

BRITISH COLUMBIA

REGION SPECIFIC TERMS

South Coast Region

1. All streams sampled, for which a watershed code does not presently exist, will require a map showing the location of the stream and sampling location with the map scale identified at time of reporting.

2. Electrofishing and minnow trapping can harm or kill non-target species of management concern such as the endangered Coastal Giant Salamander (within the Chilliwack River drainage system), Oregon Spotted Frog, and Pacific Water Shrew (within the lower Fraser River Valley). Any incidental captures (alive or dead) of any red-listed or blue-listed wildlife species must be reported to the Ministry of Water, Land, and Resource Stewardship, South Coast Region. For further information on these species or to report incidental captures, please contact the Fish and Wildlife Branch by e-mail at SCFishandAquaticWildlife@gov.bc.ca.

3. All non-native fish species captured under this permit are to be humanely euthanized and disposed of appropriately. Within 48 hours of capture, a record of the species, capture location, date, waterbody, number, size range (mm) and digital imagery must be submitted to the Fish and Wildlife Branch by email at SCFishandAquaticWildlife@gov.bc.ca. Non-native fish species include but are not limited to: American Shad; Black Catfish; Black Crappie; Brown Catfish; Carp; Goldfish; Largemouth or Smallmouth Bass; Pumpkinseed Sunfish; and Weather-fish.

4. Please refer to the following website for the least risk in-stream work windows: https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-licensing-rights/working-around-water/regional-terms-conditions-timing-windows. Where possible, collection should be conducted during the least risk word windows identified. The exception is seasonal or ephemeral streams where sampling may not be possible during the prescribed window due to flow conditions.

5. The permit holder must refer to the following when sampling Salish Sucker, Nooksack Dace, and Stickleback species.

   Salish sucker sampling guidelines - https://portal.nrs.gov.bc.ca/documents/10184/0/SalishSuckerCollectionGuidelines2015.pdf/5893755c-1c3f-b85b-419c-a4ce50ffac71

   Nooksack dace sampling guidelines – https://portal.nrs.gov.bc.ca/documents/10184/0/NooksackDaceCollectionGuidelines2015.pdf/339d65e0-23b5-10bb-b33f-a7dbf74d5d39

   Stickleback species pairs sampling guidelines - http://www.dfo-mpo.gc.ca/species-especes/publications/sara-lep/stickleback-epinoches/index-eng.html

6. Be advised that these works are occurring in Pacific Water Shrew habitat, thus there is potential for incidental capture of shrews in gee/minnow traps. The following mitigation measures to ensure protection of this species must be adhered to.
   - Gee/minnow traps must be equipped with a Styrofoam platform (placed inside) of approximately 7 cm diameter and 2 cm depth, for shrews to rest on.
   - A 2.5 cm air gap must be left above the Styrofoam so shrews can sit out of the water
   - A large amount of bait must be placed in nylon netting/pantyhose in the trap to provide food for shrews, that is not accessible to fish from outside the trap.
   - Gee/minnow traps must be checked regularly to ensure that shrews are not killed. From March 1 to November 1, traps should be checked every 8 hours (minimum). From November 1 to March 1, traps should be checked every 6 hours (minimum). Please note that this trap checking frequency is specific to Pacific Water Shrew and may not be frequent enough to avoid mortality of other organisms. Due care should be exercised in this regard to ensure unnecessary mortality of other organisms does not occur
   - Sampling must be suspended during periods of inclement weather, i.e, flooding, heavy rain or freezing temperatures (< 3 °C).

APPENDIX B
ADVISORY

GENERAL

- It is the permit holder's responsibility to be aware of all applicable laws and the limits of this permit.
  For example,
  - This permit **does not** authorize the collection of fish in national or provincial parks.
  - This permit does not authorize the collection of fish in tidal waters.
  - This permit does not authorize the collection of eulachon or for salmon, other than kokanee.
  - This permit is NOT authority to angle for fish without a valid angling licence.

  It is the responsibility of the permit holder to obtain proper authorization.
- The Province is not liable for any illness contracted through fish handling. It is the responsibility of the permit holder to inform themselves of possible health hazards, and to ensure that all reasonably necessary safety measures are undertaken.
- If applicable, the permit holder is responsible for renewing this permit. The issuer is not obliged to send a reminder notice.

LEGISLATION

Below is a non-exhaustive list of provisions under the *Wildlife Act* and regulations that are relevant to this permit. It is the permit holder's responsibility to be aware of any provisions under the *Wildlife Act* or regulations that may apply to this permit.

Wildlife Act

Suspension and cancellation of permits

25 (1) A regional manager, for any cause he or she considers sufficient, and after providing an opportunity for the person to be heard, may suspend or cancel a permit held by a person, may order that the person is ineligible to obtain or renew a permit for a period and, if he or she does make an order, must inform the person of the period of ineligibility.

(2) An officer may, without the necessity of holding a hearing, exercise the powers of a regional manager under this section to suspend a permit and, if a permit is suspended by an officer, the matter must be referred to the regional manager, who may confirm, reduce, extend or terminate the suspension.

Documents not transferable

81 Except as authorized by regulation or as otherwise provided under this Act, a licence, permit or limited entry hunting authorization is not transferable, and a person commits an offence if the person

(a) allows his or her licence, permit or limited entry hunting authorization to be used by another person, or

(b) uses another person's licence, permit or limited entry hunting authorization.

Failure to pay fine

85 (1) This section applies if a person

(a) fails to pay, within the time required by law, a fine imposed as a result of the person's conviction for an offence under this Act or the *Firearm Act*, and

(b) has been served with notice of this section.

(2) In the circumstances referred to in subsection (1),

(a) the person's right to apply for or obtain a licence, permit or limited entry hunting authorization under this Act is suspended immediately and automatically on the failure to pay the fine,

(b) all licences, permits and limited entry hunting authorizations issued to that person under this Act are cancelled immediately and automatically on the failure to pay the fine,

(b.1) the person must not apply for employment as an assistant guide,

(b.2) the person must not guide as an assistant guide, and

(c) the person commits an offence if, before that fine is paid, the person

(i) applies for, or in any way obtains, a licence, permit or limited entry hunting authorization under this Act,

(ii) does anything for which a licence, permit or limited entry hunting authorization under this Act is required,

(iii) applies for employment as an assistant guide, or

(iv) guides as an assistant guide.

Proof of identity and authorization

97 (1) In this section, **"authorization"** means a licence, permit or limited entry hunting authorization issued under this Act.

(2) Subject to subsection (5), a person who is required to hold an authorization must, on the request of an officer,

(a) state the person's name and address,

(b) produce prescribed photo identification, and

(c) demonstrate in accordance with subsection (3) that the person holds the authorization.

(3) A person may demonstrate that the person holds an authorization by

(a) producing the authorization, or

(b) unless the regulations require that the original authorization be produced,

(i) producing a legible copy of the authorization, or

(ii) if authorized by the regulations, stating a number assigned to the person by the director as an identification number for the person.

(4) Subject to subsection (5), a person who would be required to hold a licence or permit issued under this Act were the person not exempt under section 11 (9) or 12 (b) must, on the request of an officer,

(a) state the person's name and address, and

(b) produce prescribed photo identification.

(5) Subsections (2) (b) and (4) (b) do not apply to a person in a prescribed class of persons.

(6) A person who contravenes subsection (2) or (4) commits an offence.

Wildlife Act General Regulation

Proof of identity

21.01 (1) For the purposes of section 97 (2)(b) and (4)(b) of the Act, the following photo identification is prescribed:

(a) valid photo identification issued to a person by any of the following:

(i) the government of Canada;

(ii) the government of a province or territory, or an agent of the government of a province or territory, in which the person has a current address;

(iii) the Nisga'a Nation, if the person is a Nisga'a citizen;

(iv) a treaty first nation, if the person is a treaty first nation member of the treaty first nation;

(b) in the case of a person who is a non-resident alien,

(i) valid photo identification in the form of

(A) a passport, or

(B) a driver's licence issued to the person by a foreign jurisdiction in which the person has a current address, or

(ii) a copy of a photo identification referred to in subparagraph (i) that has been certified as a true copy by

(A) a lawyer, or

(B) a notary who is a member in good standing under the *Notaries Act*

(c) in any case, a valid NEXUS card.

(2) For the purposes of section 97 (5) of the Act, persons under 16 years of age are prescribed as exempt from the requirement to produce photo identification.

Freshwater Fish Regulation

Offences

2 A person commits an offence where the person

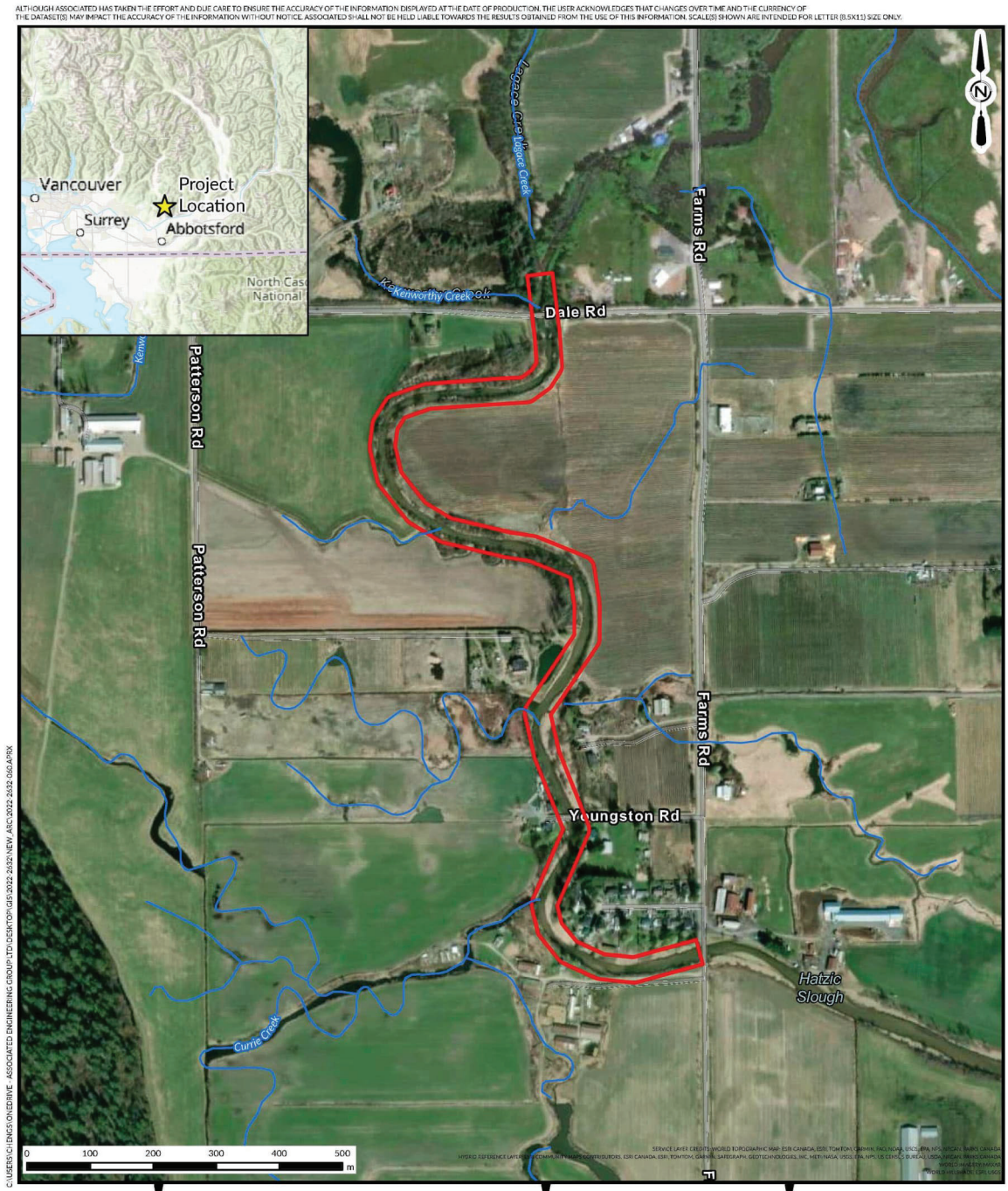
(a) has in possession,

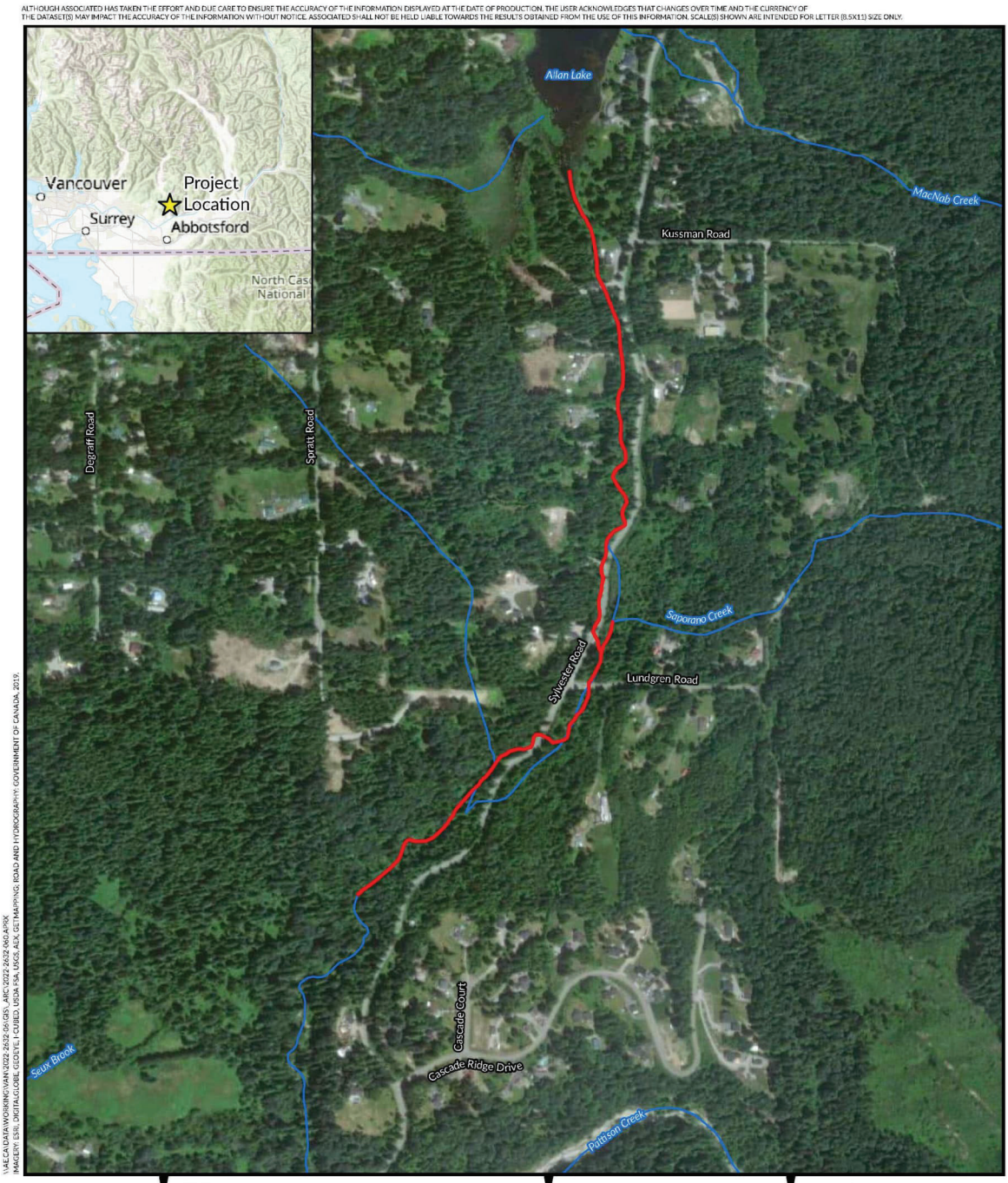
(b) transports, or

(c) traffics in

live fish unless authorized by a permit or a licence.

APPENDIX C
PERMITTED WATERBODIES

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Vancouver
Surrey
Project Location
Abbotsford
North Cas National
Allan Lake
MacNab Creek
Kussman Road
Degraff Road
Spratt Road
Saporano Creek
Sylvester Road
Lundgren Road
Cascade Court
Cascade Ridge Drive
Seux Brook
Pattison Creek
\\AE\DATA\WORKING\VAN\2022 2632 06\GIS_ARC\2022 2632 060.APRX
IMAGERY: ESRI, DIGITALGLOBE, GEOEYE, I-CUBED, USGS FSA, USGS, AGX, GEI MAPPING, ROAD AND HYDROGRAPHY: GOVERNMENT OF CANADA, 2019.
LEGEND
Project Location
Base Data
Watercourse
Associated Environmental
Ministry of Environment and Climate Change Strategy
0 50 100 150 200 250 m
AE PROJECT NO. 2022-2632
SCALE 1:9,000
COORD. SYSTEM NAD 1983 UTM ZONE 10N
DATE 2024-07-30
REV 01
DRAWN BY SC
CHECKED BY NS
FIGURE 1-1
PROJECT LOCATION
BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY
HATZIC EMERGENCY WORKS PROGRAM
SCR17 LAGACE CREEK

Keystone Environmental
Knowledge-Driven Results

December 4, 2024

QM Environmental
1707 Cliveden Avenue
Delta BC V3M 6S6

Attn: Nicholas Doucette

Re: Lagace Creek Sediment Removal Post Construction Monitoring Report
CR14 and CR17 Sites, Lower Lagace Creek Emergency Flood Restoration
Mission, BC
Project No. 19279

We have enclosed the report titled *Lagace Creek Sediment Removal Post Construction Monitoring Report*. We are pleased to submit this report to QM Environmental fulfilling the requirement for a detailed post-construction report outlined in *Water Sustainability Act* Change Approvals 2011310 and 2011242. We appreciate the opportunity to provide services for this project.

If you have any questions, please do not hesitate to contact us.

Sincerely,

Keystone Environmental Ltd.

Jeff Prowse, R.P.Bio.
Project Manager

I:\19200-19299\19279\Reporting\WSA Approval Report\19279 241204 Lagace Creek WSA Approval PCR.docx

Encl.

Suite 320-4400 Dominion Street
Burnaby, BC V5G 4G3 | Canada
Ph: 604.430.0671
Fax: 604.430.0672
Email: KeyInfo@KeystoneEnvironmental.ca
Web: KeystoneEnvironmental.ca



Keystone Environmental
Knowledge-Driven Results

LAGACE CREEK SEDIMENT REMOVAL
POST CONSTRUCTION MONITORING REPORT

CR14 and CR17 Sites, Lower Lagace Creek Emergency Flood Restoration
Mission, BC

Prepared For: QM Environmental Ltd

Project No: 19279
December 2024

EXECUTIVE SUMMARY

This detailed post-construction report regarding instream works conducted at Lagace Creek in Mission, BC, is presented as required by the *Water Sustainability Act* Approvals. The works described in this report were performed subject to *Water Sustainability Act* Change Approvals 2011310 and 2011242, and *Fisheries Act* Authorization 22-HPAC-01308. This report describes work performed at two sites: CR14 located near 10491 Farms Road, Mission and CR17 near 36409 Lundgren Road, Mission. The works at CR14 included three new sand recovery stations, sediment removal from 13 locations, and bank stabilization. Works at CR17 were confined to preliminary fish isolation and salvage – no excavation works occurred at CR17.

In-stream works at CR14 included work area isolation using temporary barriers, work area dewatering or isolation, and sediment excavation. During the in-stream works, the BC Approved Water Quality Guidelines were used to determine thresholds required to slow or stop works. Following site isolation, fish and amphibians were salvaged from the work areas and released downstream of the work area within similar habitat.

Prior to September 12, dewatering of sediment removal areas at CR14 was delayed due to high stream flow volumes resulting in isolation barrier infiltration and streambed percolation. Excavation was originally proposed to be completed in the dry; however, an amendment to the *Fisheries Act* Authorization for the project was granted allowing for works in the wet following site isolation. As the delays required work to continue past September 15, Keystone Environmental also submitted a memo to MOECCS detailing the rationale for in-stream works continuing outside the reduced risk window in conformance with the Change Approval issued for CR14.

The directly affected in-stream area for the Project was 2,800 m^2 (0.28 ha). The total quantity of sediments removed was 2,930 m^3. This volume is comprised of clean sediments, knotweed contaminated sediments, and sediments utilized in bulk bags used to create isolation barriers.

During the works, an existing Japanese knotweed (*Reynoutria japonica*) infestation north of Dale Road was cleared to access a key sediment removal location. Multiple mitigation measures were implemented to prevent the spread of Japanese knotweed propagules during the project, including the transport of contaminated soils and sediments in covered trucks to an approved knotweed soil disposal facility. Sediment removal at station H did not occur due to knotweed presence resulting in the entire station area to be considered contaminated. Due to additional costs associated with approved disposal of this material, station H was removed from the program.

The project design included erosion and sediment control measures on all disturbed areas. The environmental monitor routinely inspected erosion and sediment control measures and communicated any deficiencies to the contractor. Following the work period, exposed slopes were covered, and live stakes were installed as a slope stabilization measure. Ongoing monitoring and maintenance of planted areas is required for three years following the completion of the works.

The environmental monitor coordinated works to avoid or mitigate non-compliance issues promptly. No environmental or non-compliance incidents were observed at CR17 during the works, as no excavation occurred. At CR14, the environmental monitor was occasionally required to halt or modify works. The works were conducted in a manner generally compliant with all terms and conditions applicable to the project. The environmental monitor was able to resolve issues directly with the contractor on the same day they were observed, and no ongoing compliance issues were noted.

This Executive Summary is subject to the same general limitations as contained in the report and must be read in conjunction with the entire report.

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LIST OF ACRONYMS

CEMP	Construction Environmental Management Plan
CR14	The work area near 10491 Farms Road, Mission
CR17	The work area near 36409 Lundgren Road, Mission
DFO	Fisheries and Oceans Canada
EM	Environmental Monitor
ESC	Erosion and Sediment Control
FAA	*Fisheries Act* Authorization
HDPE	High Density Polyethylene
MOECCS	Ministry of Environment and Climate Change Strategy
PPE	Personal Protective Equipment
ToB	Top of Bank
WSA	*Water Sustainability Act*
WQ	Water Quality

1. INTRODUCTION

Subject to the terms and conditions of *Water Sustainability Act* (WSA) Change Approval 2011310, WSA Change Approval 2011242, and *Fisheries Act* Authorization 22-HPAC-01308 (FAA 22-HPAC-01308), this detailed post-construction report summarizes relevant details about the in-stream works conducted at Lower Lagace Creek in the general area of 10491 Farms Road, Mission, BC (CR14) as well as preparatory works conducted at Upper Lagace Creek and Saporano Creek in the general area of 36409 Lundgren Road, Mission, BC (CR17). A detailed location description of CR14 and CR17 is provided below in Table 1.

Table 1 General Site Information Summary

Legal Description for CR14	LAGACE CREEK WITHIN LOT 2 EXCEPT PARCEL A (REFERENCE PLAN 6603), PARCEL B (REFERENCE PLAN 7565) & PARCEL A (EXPLANATORY PLAN 17194), PLAN 3529, 3942 & 11344, LOT 3, LOT 5, LOT 6, LOT 7, LOT 8 & LOT 27, SECTION 2, SECTION 11, TOWNSHIP 18, NEW WESTMINSTER DISTRICT & UNSURVEYED CROWN FORESHORE OR LAND COVERED BY WATER BEING PART OF THE BED OF LAGACE CREEK HELD UNDER PERMIT #29886
Street Address for CR14	10491 Farms Road, Mission, BC
UTM Coordinates for CR14	10U 554600E 5449776N
Legal Description for CR17	LAGACE CREEK WITHIN PARCEL A, EXPLANATORY PLAN 25357, EXCEPT PLAN SUBDIVIDED BY PLAN 37358, PLAN 34325, 38134, 20437, AND 39696 OF LOT 2, LOT 7, LOT 13, LOT 15 SOUTH WEST, SECTION 30, NORTH WEST QUARTER SECTION 19, TOWNSHIP 21, NEW WESTMINSTER DISTRICT & UNSURVEYED CROWN FORESHORE OR LAND COVERED BY WATER BEING PART OF THE BED OF LAGACE CREEK HELD UNDER PERMIT #29877
Street Address for CR17	36409 Lundgren Road, Mission, BC
UTM Coordinates for CR17	10U 556898E 5453962N

Drainage of the Lagace Creek floodplain was impaired following the November 2021 atmospheric river event. This extraordinary rainfall event resulted in widespread flooding and sediment deposition, including in Lagace Creek and the downstream Hatzic Slough. The works described in this report are associated with the Ministry of Environment and Climate Change Strategy (MOECCS) emergency flood restoration in Lagace Creek, including the locations referred to as "CR14" and "CR17". The restoration works at CR14 proposed the creation of three new sand recovery stations, removal of sediment from 14 locations, and bank stabilization/erosion protection, while proposed works at CR17 included sediment removal in two locations (the Project). Keystone Environmental Ltd. (Keystone Environmental) provided Environmental Monitoring (EM) services for QM Environmental (the Contractor) during the Project.

This report is submitted in fulfillment of section (bb) of WSA Change Approval 2011310 and section (aa) of WSA Change Approval 2011242. Specifically, this report summarizes the in-stream works undertaken, documents any environmental or non-compliance incidents, and provides supporting documentation including surveys and site photographs.

2. CONSTRUCTION WORKS SUMMARY

The Project involved sediment removal from the bed of Lagace Creek at CR14 (Photos 1 & 2) to enhance drainage capacity and mitigate flood risk in the surrounding area. A fish salvage was conducted at CR17 in preparation for excavation there, but no excavation was conducted (Photo 3). A summary of the in-stream works completed, the associated terrestrial and riparian works completed, the timing of all works, the footprint of the in-stream works, and the volume of sediment removed (referred to as "gravel" in the WSA Change Approvals) is presented below. The EM documented the works undertaken by the Contractor with photographs, water quality (WQ) measurements, discussions with contractor staff, and field notes.

During the in-stream works, upstream and downstream WQ was monitored with daily dissolved oxygen measurements and hourly turbidity measurements. Turbidity measurements were carried out more frequently during critical periods, such as decommissioning of isolation barriers, to allow for rapid response in the event of an exceedance. The BC Approved Water Quality Guidelines for the Protection of Aquatic Life standards were used to determine thresholds required to slow or stop works if increased turbidity was observed downstream of the work area.

This section refers to lettered stations (*e.g.,* Station F) to provide additional geographical context, where necessary. The attached site figure (Appendix A – Site Figure) was used by the EM to record activities on a station-by-station basis and can be reviewed in conjunction with this report to provide additional perspective.

2.1 In-Stream Works Conducted

In-stream works conducted include:

- Work area isolation and dewatering,
- Fish salvage, and
- Sediment removal and disposal.

2.1.1 Work Area Isolation and Dewatering

During work area isolation and dewatering, upstream and downstream WQ was monitored with daily dissolved oxygen measurements and hourly turbidity measurements. Dewatering was accomplished with three and six-inch pumps fitted with end-of-pipe protections (*i.e.,* inlet screens) to prevent the intake of fish (Photo 4). Dewatering discharge was directed through mesh filter sacks placed in vegetated areas to minimize the amount of sediment reaching the stream (Photo 5).

Sandbag placement commenced on August 30, 2024, at Station E (Photo 6), and isolation sandbag removal was completed at the final area within Lagace Creek on September 30, 2024. Prior to September 12, isolation barrier maintenance and work area dewatering were complicated by high-flow conditions. Within the isolation barriers, substantial infiltration of water through the sandbag berms and stream bed was observed. Additionally, the isolation barriers were designed and built to maintain fish passage (i.e., the channel was not blocked off). This resulted in flow constrictions, increasing the local velocity adjacent to excavation areas in Lagace Creek, increasing pressure against the isolation berms and increasing bedload mobilization in the

localized area. Additional mitigations such as silt curtains, increasing berm height and width and utilizing poly sheeting to prevent fish and flow passage between sandbags assisted in mitigating this issue. However, ongoing streambed percolation and high infiltration either increased the time required for dewatering or made dewatering impossible.

2.1.2 Fish and Amphibian Salvage

Prior to and during dewatering at CR14, fish and amphibians were salvaged from the work areas using an electrofisher, pole seines, dip nets, and baited minnow traps (Photo 7 & 8). Fish and amphibian salvages at CR14 and CR17 were authorized and carried out subject to the terms and conditions of Fish Collection Permit SU24-887358 and *Wildlife Act* Permit SU24-886757. Fish and amphibians were temporarily held in buckets containing cool stream water for identification, measurement, and photography. Captured individuals were released downstream of the work area within similar habitat. Native fish salvaged within the works areas included coho (*Oncorhynchus kistuch*), chinook (*O. tshawytscha*), coastal cutthroat trout (*O. clarkii clarkii*), threespine stickleback (*Gasterosteus aculeatus*), and prickly sculpin (*Cottus asper*).

Invasive species caught during the salvage were held separately, humanely euthanized, and disposed of appropriately; invasive species primarily consisted of pumpkinseed (*Lepomis gibbosus*) and tadpoles of bull frog (*Lithobates catesbeianus*).

A fish salvage was conducted at CR17 starting on September 10, 2024, with the installation of isolation barriers upstream and downstream of the work area and the placement of baited minnow traps. Minnow traps were generally set overnight and removed the following morning, followed by several electrofishing passes until the catch declined substantially, at which point the area was prepared for dewatering (if possible) and incidental salvage using dipnets as necessary. The sandbag isolation barriers remained around active work areas until September 29. On September 29, the final sandbag isolation barrier was removed with no additional work completed at CR17. Excavation did not occur at CR17 as the works would have had to occur outside the instream works window, and it was the opinion of the QEP that the environmental risk was too great to initiate the works outside the instream works window.

During excavations at CR14, numerous river lampreys (*Lampetra ayresii*) were uncovered. For this species, the larval forms burrow in stream sediments until maturity, and thus salvage using the above methods was only effective in removing mature lampreys. For immature river lampreys, all Contractor staff were trained to recognize this species, and the EM collaborated with contractor staff to salvage and release all uncovered immature lampreys during sediment excavation.

Occasional isolation barrier failures occurred at CR14. If a work area isolation barrier was breached, the EM would direct the Contractor to halt works until the isolation barrier was repaired and the area could be re-salvaged. Once an initial re-salvage was complete, the EM would direct the Contractor to recommence excavation works.

2.1.3 Sediment Removal and Soil Disposal

During sediment removal and soil disposal, upstream and downstream WQ was monitored with daily dissolved oxygen measurements and hourly turbidity measurements. Sediment removal occurred only within areas isolated from streamflow to prevent the mobilization of sediments and excessive turbidity.

Excavation was originally undertaken in the dry (Photo 9), but stream conditions and the practical isolation method substantially increased the amount of time required for dewatering, or dewatering was not possible. Keystone Environmental requested DFO provide an A*uthorization Amendment* to allow for works in the wet (i.e., without dewatering the isolation areas; Photo 10).

Sediment removal was originally scheduled to occur within the least-risk window for trout and salmon species in the south coast region (*i.e.,* August 1 to September 15). However, due to the delays encountered from the works being awarded near the end of August, in addition to attempts at excavation in the dry, Keystone Environmental submitted a memo entitled *Lagace Creek Instream Works – Works After September 15, 2024* to MOECCS detailing the rationale for allowing works to continue outside the reduced risk in-stream work window and outlining additional prevention and mitigation measures for these works. This process was detailed in section (h) 2 (i-iv) of the Approval; the memo is presented in Appendix F.

Removed sediments were generally stockpiled near each removal area or moved by front end loader to be stockpiled at other excavation areas within CR14 with more space. In addition, excavated sediment was utilized for filling the cubic meter "super sacks" used for area isolation. The exception to this is soils and sediments contaminated with Japanese knotweed, which were either stockpiled within the knotweed contaminated area prior to being loaded into covered trucks for transport to an approved knotweed soil disposal facility or loaded into trucks directly.

2.2 Terrestrial and Riparian Works Conducted

Terrestrial and Riparian works conducted include:

- Vegetation removal and sand recovery station construction,
- Knotweed and knotweed soil removal, and
- Slope stabilization and erosion management.

These works are described in detail below.

2.2.1 Vegetation Removal/Sand Recovery Station Construction

Vegetation removal commenced on August 29, 2024, with clearing and grubbing of several stations at CR14 (Photo 11). Most vegetation removal was completed by September 11, 2024. Prior to vegetation removal, wildlife surveys were completed. To assess the presence of protected species or their nests within the vegetation clearing footprint, wildlife surveys targeted nesting birds, amphibians, reptiles, and small mammals. Wildlife surveys were repeated daily as Keystone Environmental EMs were on site full time during vegetation removal.

2.2.2 Knotweed and Knotweed Soil Removal

An existing Japanese knotweed (*Reynoutria japonica*) infestation was observed at CR14 prior to the commencement of works. Japanese knotweed is a regulated noxious weed under the BC *Weed Control Act*, imposing a duty on the landowner or occupier to control this infestation. For Japanese knotweed, eliminating work in infested areas is preferred, as mechanical removal is unreliable and introduces an increased risk of spread through contaminated machinery, tools, and personal protective equipment (PPE).

The area north of Dale Road, identified as Stations B, B-2, and B-3, was heavily impacted by this infestation. However, sediment removal works north of the Dale Road bridge over Lagace Creek were deemed necessary to protect the bridge and return the creek to a more stable alignment. Therefore, multiple mitigation measures were implemented to prevent the spread of Japanese knotweed propagules during the Project. For example, above ground knotweed stems were cut down by hand and disposed of separately prior to machine access; an access road with plastic-reinforced geotextile fabric under a crushed rock surface was installed, and tools/equipment used in the contaminated area were thoroughly cleaned under EM supervision. Additionally, soils and sediments excavated from this area were loaded into covered trucks and transported to an approved knotweed soil disposal facility (Photo 12).

2.2.3 Slope Stabilization and Erosion Management

The Construction Environmental Management Plan (CEMP) for the Project required erosion and sediment control (ESC) measures on all disturbed areas, including banks and access routes (Photo 13). For the purposes of preventing bank erosion and sedimentation of streams, silt fencing was installed along all access routes and downslope of exposed stockpiles. Additionally, the mobilization or transport of sediments during in-stream works was managed according to multiple conditions in the CEMP, including operating heavy equipment from behind the top of bank (ToB) of Lagace Creek and the installation of sediment curtains around the work area. During the work period, erosion and sediment control measures were inspected daily and deficiencies were communicated to the Contractor for resolution.

Following the work period, exposed slopes at stations B to C2 were covered with coco matting and live stakes were installed (Photo 14). The coco matting will provide erosion protection during the overwintering period, and the live stakes are expected to establish a root network to stabilize the slope during the following year. Live stakes were also planted in disturbed areas of station D (Site 1) and the bank across from stations J, K, and L (Site 2). Survivorship monitoring of planting areas at CR14 will be required as part of the Three-Year Effectiveness Monitoring plan described under WSA Approval 2011310 section (aa).

2.3 Timing of Works

The works described in this post-construction report were generally completed between August 27, 2024, and November 29, 2024. As this report describes work at two sites, CR14 and CR17, the specific timing of the works for those sites is described below.

2.3.1 CR14

An initial site visit at CR14 was conducted on August 27, 2024. Clearing and grubbing commenced at CR14 on August 29, 2024. Work area isolation and fish salvage commenced on August 30, 2024. Sediment removal commenced on August 31 and was completed by September 30, 2024. Slope stabilization and site decommissioning was generally completed on October 10, 2024, while the final replanting in Sites 1 and 2 was completed on November 29. The Site 3 replanting area was not attempted as the landowner did not allow access to install the live stakes.

Pursuant to FAA 22-HPAC-01308, works were initially planned to be conducted in the absence of water within the excavation footprint (*i.e.,* in the dry). However, during the reduced risk in-stream work window for the Project (August 1 to September 15), water levels were frequently too high in Lagace Creek for the contractor to effectively dewater the work areas, even after isolation from streamflow and extensive dewatering effort (i.e., multiple six-inch pumps). This impeded progress until September 12, at which point water levels decreased allowing some areas to be dewatered efficiently.

On September 5, 2024, Keystone Environmental submitted a memo entitled *Lagace Creek Sediment Removal Works, Fisheries Act Authorization Works Isolation* to Fisheries and Oceans Canada (DFO) requesting a relaxation of the requirement to work in the dry and outlining the avoidance and mitigation measures in place to protect fish and fish habitat during the Project. In addition, on September 13, 2024, Keystone Environmental submitted a memo to MOECCS detailing the rationale for in-stream works outside the reduced risk window and outlining additional protective measures.

On September 17, 2024, Keystone Environmental received an *Authorization Amendment* from DFO allowing sediment removal in the wet if all other measures and conditions outlined in the amendment and amendment request were applied. As WSA Change Approval 2011310 section (h) subsection 2 allows work outside of the reduced risk in-stream work window subject to additional terms and conditions, and the receipt of the DFO letter allowed for work in the wet, Project works proceeded according to the new requirements.

2.3.2 CR17

Preparatory works commenced at CR17 on September 10, 2024. Initially, fish isolation barriers were installed upstream and downstream of the work area, and baited minnow traps were placed within the isolation area. Minnow traps were set overnight and removed the following morning, followed by electrofishing. This process continued for several days until salvage results indicated the isolation area was prepared for dewatering and final salvage. No additional works were conducted at CR17 between September 14 and September 28, 2024. The isolation barrier was removed on September 29, 2024. Excavation did not occur at CR17 as the works would have had to occur outside the instream works window, and it was the opinion of the QEP that the environmental risk was too great to initiate the works outside the instream works window.

2.4 Quantity of Sediment Removed and Directly Affected In-stream Area

The directly affected in-stream area for the Project was 2,800 m^2 (0.28 ha). The total quantity of sediments removed was 2,930 m^3. This volume is comprised of clean sediments, knotweed contaminated sediments, and sediments for the bulk bags used to create isolation barriers. A breakdown of the directly affected in-stream area and the quantity of sediment removed is provided below in Table 2. Data were drawn from the Contractor's progress survey, attached as Appendix D. No excavation occurred at Station H due to presence of knotweed, which resulted in the majority of that area to be considered contaminated and requiring special disposal, which was not accounted for during project scoping.

Table 2 Volume of Sediments Removed and In-Stream Footprint by Station at CR14

CR14 Station	Clean Sediment Removed (m^2)	Knotweed Contaminated Sediment Removed (m^2)	Sediment Removed for Bulk Bags (m^2)	Total Volume (m^3)	In-Stream Footprint (m^2)
B to B-3	0	1,091	0	1,091	700
C	86†	0	0	86	230
C-2	764	0	0	764	310
E	85†	0	0	85	200
F	117	0	26	143	290
G	85	0	0	85	120
I	150	0	0	150	220
J	171	0	84†	255	320
K	94	0	84†	178	240
L	93	0	0	93	170
Total	1,645	1,091	194	**2,930**	**2,800**

† Sediments were stockpiled together, and the volume has been split between the relevant stations.

3. ENVIRONMENTAL AND NON-COMPLIANCE INCIDENTS

During the Project, the EM monitored works at CR14 on a full-time basis for 50 days between August 27, 2024, and November 30, 2024. Final site clean up works are occurring in early December with full-time monitoring ongoing. During the monitoring period, the EM coordinated works on site with the Contractor to avoid or mitigate non-compliance issues promptly. The EM also conducted stream isolation and fish salvage activities at CR17 to prepare for possible excavation works between September 10 and 15, 2024.

The works at CR14 and preparatory works at CR17 were conducted in a manner generally compliant with all terms and conditions laid out in the Project authorizations, approvals, amendments, and CEMPs. No environmental or non-compliance incidents were observed at CR17 throughout the duration of the works. With all excavation works occurring at CR14, the EM was occasionally required to halt or modify works based on professional judgement or WQ monitoring results. Those occasions and the associated mitigations implemented to prevent recurrence are documented below.

3.1 CR14 – August 31

During sediment removal at Station E, the isolation barrier failed. Turbid water was released downstream, resulting in an exceedance (Photo 15). The turbidity plume persisted within the stream for no longer than 46 minutes. Following the collapse, the EM directed the Contractor to maintain a 1 m buffer from the isolation barrier when excavating. The EM also directed the Contractor to install a silt curtain downstream of the excavation.

3.2 CR14 – September 1

During the removal of a sandbag isolation barrier, turbid water from within the excavation footprint was released into the stream (Photo 16). Downstream WQ met the exceedance threshold for no more than 58 minutes. The EM directed the Contractor to allow turbidity within isolation areas to settle overnight before removing the isolation barrier.

3.3 CR14 – September 3

During the removal of an isolation barrier, material was spilled from sandbags into the stream (Photo 17). The sandbags were filled with local material excavated from the creek and were not expected to pose a risk of contamination outside elevated turbidity. Turbidity exceeded the threshold for less than eight minutes. The EM directed the contractor to handle sandbags carefully to prevent breakage.

3.4 CR14 – September 5

Turbidity was compliant on this day; however, this was the beginning of a period of high flows interfering with complete work area dewatering.

3.5 CR14 – September 6

During vegetation removal activities, grubbing of a Japanese knotweed contaminated area at Station H was observed. The EM directed the Contractor to halt works and clean the excavator before leaving the contaminated area (Photo 18). The EM installed flagging tape around the perimeter of the contaminated area to prevent inadvertent entry.

3.6 CR14 – September 15

During dewatering with a six-inch pump, the force of the discharge eroded a portion of the stream bank and pushed sediment past the downstream silt curtain, resulting in an exceedance. Discharge was halted, and the discharge point was protected with poly sheeting. Following the initial mitigation, dewatering was restarted. After observing a subsequent exceedance, the EM directed the Contractor to halt discharge and adjust the downstream silt curtain position. Following the adjustment of the downstream silt curtain and commencement of dewatering, WQ was observed to be compliant (Photo 19). Three and a half hours elapsed between the initial exceedance and a subsequent compliant reading. Discharge was limited during this time.

3.7 CR14 – September 16, 17, 21

During dewatering with a six-inch pump, multiple sandbag super sack failures were observed (Photo 20). When super sack failures were noted by the EM, they were promptly communicated to the Contractor and discharge was ceased until a new silt sack could be installed. Three exceedances, each lasting less than one hour, were observed.

3.8 CR14 – September 27

During sandbag removal at stations J and K, a downstream exceedance was observed. However, the EM also observed the background turbidity increasing upstream of the Project area, suggesting that the turbidity was originating offsite (Photo 21). A second exceedance was noted to occur for approximately 60 minutes, but it was unclear if the works were causing this, or the background turbidity was fluctuating. On a precautionary basis, the EM recommended the installation of silt curtains on the downstream end of active work areas to contain turbid water.

3.9 CR14 – September 29

During sediment removal activities at station I, work was being conducted in the wet, resulting in elevated turbidity within the work area. The turbid water was observed to be exfiltrating through the isolation barrier, and downstream exceedances were observed for no more than 90 minutes (Photo 22). The EM directed the Contractor to adjust the sediment curtain downstream of the work area to better contain the sediments.

3.10 CR14 – October 15

Three small sandbags were noted within the stream north of the Dale Road bridge, remnants from the isolation berm during excavation of locations B-2 and B-3. These sandbags likely rolled down slope into the excavation area during berm dismantling. Due to water levels and lack of area isolation, these sandbags were not able to be retrieved. Subsequent inspections for the sandbags during lower flows were unsuccessful; it is likely the sandbags have been buried by shifting stream sediments.

4. SUMMARY AND CONCLUSION

This detailed post-construction report summarizes in-stream works conducted at Lagace Creek sites CR14 and CR17, as part of the MOECCS emergency flood restoration project at Lagace Creek. The report describes the works conducted, the timing of those works, the affected in-stream area, and the quantity of sediment removed. The works at CR14 included the creation of three new sand recovery stations, removal of sediment from 12 locations, and bank stabilization/erosion protection. Due to knotweed presence, excavation at Station H did not occur. Works at CR17 were confined to fish isolation and salvage, as no excavation works occurred at CR17. This report is based on the photographs, WQ measurements, contractor communications, and field notes collected by the EM.

Timing of Works

The Project was generally completed between August 27, 2024, and November 29, 2024, with some final clean up works occurring in early December (i.e., material hauling and demobilization). Works commenced at CR14 on August 27, while salvage works at CR17 were initiated on September 10, 2024. The fish salvage continued at CR17 until September 13, 2024, and the fish isolation barrier was removed from CR17 on September 29, 2024.

On September 17, 2024, Keystone Environmental received an *Authorization Amendment* from DFO allowing sediment removal in the wet subject to terms and conditions. In-stream works were concluded on September 30, 2024. Slope stabilization and site decommissioning was generally completed on October 10, 2024, while the final replanting was completed between November 12 and 29, 2024.

Water Quality and Dewatering

During the in-stream works, the EM monitored WQ routinely, with intensive turbidity monitoring during critical periods. The BC Approved Water Quality Guidelines for the Protection of Aquatic Life standards were used to determine thresholds required to slow or stop works.

Within areas isolated from streamflow, dewatering was accomplished with three and six-inch pumps fitted with end-of-pipe protections to prevent the intake of fish. Dewatering discharge was directed through mesh filter sacks placed in vegetated areas to reduce the amount of sediment reaching the stream.

Fish and Amphibian Salvages

Prior to and during dewatering, fish and amphibians were salvaged from the work areas and released downstream of the work area within similar habitat. Any invasive species caught during the salvage were humanely euthanized. During excavation, numerous river lampreys were uncovered; the EM collaborated with contractor staff to salvage and release all uncovered immature lampreys.

Quantity of Sediment Removed and Directly Affected In-Stream Area

The directly affected in-stream area for the Project was 2,800 m^2 (0.28 ha). The total quantity of stream sediments removed was 2,044 m^3. This volume is comprised of clean sediments, knotweed contaminated sediments, and sediments for the bulk bags used to create isolation barriers.

DFO Authorization Amendment and Work Outside the Least-Risk Window

Prior to September 12, isolation barrier maintenance and work area dewatering at CR14 were complicated by high-flow conditions. Occasional streambed percolation combined with high infiltration rates either increased the time required to dewater the area or made dewatering impossible.

Excavation was originally to be completed in the dry. However, upon request from Keystone Environmental, a DFO A*uthorization Amendment* was granted allowing for works in the wet under the supervision and direction of the EM. Keystone Environmental also submitted a memo to MOECCS detailing the rationale for in-stream works outside the reduced risk window. As WSA Change Approval 2011310 allows work outside of the reduced risk in-stream work window subject to additional terms and conditions, and the receipt of the DFO letter allowed for work in the wet, Project works proceeded according to the new requirements.

Vegetation Clearing

During the Project period, an existing infestation of regulated Japanese knotweed north of Dale Road was mechanically cleared to access a key sediment removal location. Multiple mitigation measures were implemented to prevent the spread of Japanese knotweed propagules during the Project, including the transport of contaminated soils and sediments in covered trucks to an approved knotweed soil disposal facility.

Erosion and Sediment Control

The CEMP for the Project required ESC measures on all disturbed areas. During the work period, the EM inspected ESC measures and communicated any deficiencies to the Contractor. Following the work period, exposed slopes were covered with coco matting prior to the installation of live stakes. Survivorship monitoring of planting areas at CR14 will be required as part of the Three-Year Effectiveness Monitoring plan.

Environmental and Non-Compliance Incidents

During the monitoring period, the EM coordinated works on site with the Contractor to avoid or mitigate non-compliance issues promptly. The works at CR14 and preparatory salvage works at CR17 were conducted in a manner generally compliant with all terms and conditions laid out in the Project authorizations, approvals, amendments, and CEMPs. No environmental or non-compliance incidents were observed at CR17 throughout the duration of the works. With all excavation work occurring at CR14, the EM was occasionally required to halt or modify works there based on professional judgement or WQ monitoring results.

Conclusions

The works at CR14 and preparatory works at CR17 were conducted in a manner generally compliant with all terms and conditions laid out in the Project authorizations, approvals, amendments, and CEMPs. The EM was able to resolve environmental and non-compliance issues directly with the Contractor on the same day they were observed, and no ongoing compliance issues were noted. Per the project CEMP, ongoing monitoring and maintenance of planted areas is required for three years following the completion of the works.

5. PROFESSIONAL STATEMENT

Keystone Environmental Ltd. confirms that this report titled *Lagace Creek Sediment Removal Post Construction Monitoring Report*, has been prepared in general conformance with the *Water Sustainability Act* and the terms and conditions of *Water Sustainability Act* Section 11(1) Change Approvals 2011310 and 2011242, as well other legislation, approvals, amendments, and plans identified above. Report author Corbin Manson and Project Manager Jeff Prowse have demonstrable experience in the development and implementation of Construction Environmental Management Plans for in-stream works and Environmental Monitoring of the same. The report is subject to the General Terms and Conditions appended at the end of the report.

If you have questions regarding the information contained in this report, please contact Jeff Prowse at 236-330-7914.

December 4, 2024
Date

Keystone Environmental Ltd.

Reviewed by:



Jeff Prowse, R.P.Bio.
Project Manager

Written by:



Corbin Manson, B.Sc., R.P.Bio.
Biologist

ATTACHMENTS

- Appendix A – Site Figure
- Appendix B – Site Photographs
- Appendix C – Water Quality Data
- Appendix D – Contractor Progress Surveys
- Appendix E – WSA and DFO Documents
- Appendix F – WSA Work Extension Memo

APPENDIX A

SITE FIGURE

IF NOT 50 mm ADJUST SCALES
50 mm

SCALE(S) SHOWN ARE INTENDED FOR ANSI D (22X34) SIZE DRAWINGS, TABLOID (11X17) SIZE DRAWINGS ARE 1/2 OF SCALE(S) SHOWN UNLESS NOTED OTHERWISE



TABLE 2: DEPTH RANGE			
#		MIN.	MAX.
1		-2.8 m	-2.1 m
2		-2.1 m	-2.0 m
3		-2.0 m	-1.9 m
4		-1.9 m	-1.6 m
5		-1.6 m	-1.2 m
6		-1.2 m	-0.8 m
7		-0.8 m	-0.4 m
8		-0.4 m	-0.2 m
9		-0.2 m	0.8 m

TABLE 3: APPROXIMATE VOLUME REMOVAL	
SITE	CUBIC METERS
B	250
B-2 AND B-3	950
C AND C-2	650
D	450
E	450
F	500
G	450
H	500
I	400
J	600
K	700
L	400
TOTAL	8250

NOTES:

1. DESIGN EXTENTS ARE APPROXIMATE AND MAY REQUIRE ADJUSTMENT IN FIELD.
2. ALL DIMENSIONS ARE IN METERS (m) UNLESS OTHERWISE NOTED.
3. ALL LOCATIONS ARE GEODETIC AND ARE IN NAD83 UTM10.
4. CONTRACTOR IS TO VERIFY THE LOCATION OF THE EXISTING SAND RECOVERY STATIONS WHICH ARE LOCATED AT THE APPROXIMATE COORDINATES NOTED IN TABLE 1 ON C-3101.
5. PROPOSED SAND RECOVERY STATIONS TO BE CONSTRUCTED AT APPROXIMATE COORDINATES NOTED IN TABLE 1 ON C-3101.
6. UP TO 2.7 m OF SEDIMENT AND DEBRIS TO BE REMOVED FROM THE CREEK AT EXISTING SAND RECOVERY STATIONS AND UP TO 4.3 m OF SEDIMENT, DEBRIS AND VEGETATION TO BE REMOVED FROM THE CREEK AT PROPOSED SAND RECOVERY STATIONS AS NOTED ON THE DRAWINGS OR AS DIRECTED IN THE FIELD.
7. TRIM EXISTING VEGETATION AROUND SAND RECOVERY STATION AS REQUIRED TO FACILITATE SEDIMENT REMOVAL. AT NO TIME SHALL VEGETATION BE REMOVED.
8. WITH THE WRITTEN APPROVAL OF THE ENGINEER, REMOVE EXISTING VEGETATION WITHIN PROJECT FOOTPRINT AS REQUIRED TO FACILITATE CONSTRUCTION.
9. CONTRACTOR MUST ISOLATE INSTREAM WORK AREAS FOR THE DURATION OF CONSTRUCTION TO PREVENT THE MIGRATION OF SEDIMENT DOWNSTREAM WHILE MAINTAINING THE NATURAL FLOW OF THE CREEK VIA TEMPORARY DIVERSION OR APPROPRIATE FILTER FABRIC (E.G. SILT CURTAIN). UPSTREAM FISH PASSAGE MUST BE MAINTAINED FOR THE DURATION OF CONSTRUCTION.
10. THE LOCATION OF ALL UTILITIES SHOWN ARE NOT GUARANTEED TO BE ACCURATE OR COMPLETE AND MUST BE CERTIFIED WITH THE UTILITY PRIOR TO PROCEEDING WITH CONSTRUCTION. THE CONTRACTOR IS RESPONSIBLE FOR COMFIRMING THE LOCATION OF ALL EXISTING SURFACE INFRASTRUCTURE AND UNDERGROUND UTILITIES WITH UTILITY COMPANIES AND PROPERTY OWNERS.

PLOT DATE: 2024-07-25 11:53:46 AM
SAVE DATE: 2024-07-22 12:24:52 PM SAVED BY: ROZONJ
DWG PATH: \\ae.calstatsworking\ram\2022-2632-03\civil\model (for cad_civil3d only)\2632-03-c-3103.dwg

Associated Engineering

CANADA BEST MANAGED COMPANIES
Platinum member

PERMIT TO PRACTICE
ASSOCIATED ENGINEERING (B.C.) LTD.
PERMIT NUMBER: 1000163
Engineers & Geoscientists BC

REV	DATE	DESIGN	DRAWN	DESCRIPTION
1	2024JUL22	R. KARGAARD	J. ROZON	ISSUED FOR RFP AND PERMITTING
0	2024JUN14	R. KARSGAARD	J. ROZON	ISSUED FOR RFP

BC MINISTRY OF ENVIRONMENT
AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY
WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: AS SHOWN

BRITISH COLUMBIA

CIVIL
PLAN
S-CR-14 SEDIMENT REMOVAL EXTENTS

DRAWING	REVISION	SHEET
2632-03-C-3103	1	5

APPENDIX B

SITE PHOTOGRAPHS



Photograph 1. The Dale Road bridge as seen from Station C at CR14. Photo facing north.



Photograph 2. Lagace Creek as seen from Station C at CR14. Photo facing south.



Photograph 3. The confluence of Saporano Creek (behind the photographer) and Lagace Creek (center) at CR17. Photo facing northwest and dated August 28, 2024.



Photograph 4. Dewatering at Station E (CR14) was accomplished using a three-inch pump fitted with a screened inlet for fish protection. Photo dated August 30, 2024.



Photograph 5. Dewatering discharge being directed through a silt sack placed on an poly tarp at Station B-2 (CR14) on September 12, 2024. A silt curtain can be seen downstream of the discharge point. Keystone Environmental staff can be seen measuring salvaged fish prior to their downstream release (upper right). Photo facing northwest.



Photograph 6. Placement of sandbags at Station E (CR14) on August 30, 2024. Photo facing northwest.



Photograph 7. Keystone Environmental staff salvaging fish by electrofisher at Station B (CR14) on September 12, 2024. Photo facing northwest



Photograph 8. Minnow traps soaking at CR17. Photo facing northeast.



Photograph 9. Dewatering nearing completion within the isolation barrier at Station J (CR14). Photo facing southeast.



Photograph 10. Excavation at Station C-2 (CR14) on September 17, 2024 following the granting of the *FAA Authorization Amendment* allowing for excavation in the wet. Photo facing southeast.



Photograph 11. Vegetation removal included removal of a select number of mature trees to facilitate access to the sediment removal stations at CR14 north of Dale Road. Photo facing northwest.



Photograph 12. Loading of contaminated knotweed soil into trucks equipped with covers at Station B (CR14). The soil was transported to Envirogreen Technologies Ltd. facility in Princeton, BC. Photo facing east and dated September 13, 2024.



Photograph 13. Prior to the start of construction, an active Japanese knotweed infestation was observed at CR14, including at Station B, shown here. Photo facing north.



Photograph 14. Exposed slopes were covered with coco matting and stabilized with live stakes following the work period. Planted areas will be monitored for three years to ensure survivorship goals are met. Photo facing northwest.



Photograph 15. Repairs underway to the isolation barrier at Station E (CR14). Ongoing improvements were made to isolation barrier construction methods during the Project. Photo facing south.



Photograph 16. Excavation and sandbag removal on the same day caused excessive turbidity downstream. Subsequent removals were scheduled one day after excavation. Photo at Station C (CR14), facing north.



Photograph 17. A sandbag burst while being removed from Station K (CR14). The contractor was directed to handle sandbags with care. Photo facing northwest.



Photograph 18. Following inadvertent entry to a Japanese knotweed area at Station H, the contractor decontaminated their excavator. Flagging tape was installed at the Station to prevent recurrence. Photo facing west.



Photograph 19. Downstream of the Station C-2 (CR14) dewatering discharge point (circled) following the creation of a reinforced spillway and adjustment of the silt curtain. Photo facing east.



Photograph 20. An example of a leaking or failing silt sack leading to excessive turbidity downstream of Station C-2 (CR14) on September 17, 2024.



Photograph 21. Turbid water observed entering the site from upstream of Station B (CR14). Photo facing west.



Photograph 22. Excavation was temporarily halted at Station I when turbid water was observed to be exfiltrating the isolation barrier. A silt curtain was installed downstream of the excavation to contain turbidity.
Photo facing southwest.



Photograph 23: Cluster planting north of Dale Road; viewing north.



Photograph 24: Live staking in planting area Site 1, viewing southwest.



Photograph 25: Live staking in planting area Site 1, viewing south.



Photograph 26: Live staking in planting area Site 2, viewing south.

APPENDIX C

WATER QUALITY DATA

Table C1 Environmental and non-compliance incidents at CR14.

Date	Time	Location	Turbidity (NTU)[†]
August 31, 2024	1137	Dale Road Bridge (background)	*4.28*[††]
	1154	30 m Downstream of Station E	**31.5**
	1240	30 m Downstream of Station E	4.13
September 1, 2024	1208	Dale Road Bridge (background)	*2.78*
	1455	Station D	10.10
	1526	Station D	**12.5**
	1543	Station D	**17.0**
	1553	Station D	8.51
September 3, 2024	0852	Station K (background)	*2.43*
	0930	10 m Downstream of Station L	4.47
	0933	10 m Downstream of Station L	**13.3**
	0938	10 m Downstream of Station L	5.67
September 15, 2024	0730	Station B (background)	*3.05*
	0745	Station D, 50 m Downstream of Station C-2	**19.06**
	0841	Station B (background)	*3.11*
	0849	Station D, 50 m Downstream of Station C-2	10.15
	1001	Station D, 50 m Downstream of Station C-2	10.49
	1008	Station D, 50 m Downstream of Station C-2	**15.60**
	1057	Station D, 50 m Downstream of Station C-2	5.10
September 16, 2024	1639	Dale Road Bridge (background)	*4.36*
	1645	50 m Downstream of Station C-2	**16.9**
	1657	100 m Downstream of Station C-2	**13.6**
	1700	CR14	End of workday
September 17, 2024	1137	Dale Road Bridge (background)	*3.18*
	1143	50 m Downstream of Station C-2	**14.8**
	1151	100 m Downstream of Station C-2	**11.8**
	1245	Dale Road Bridge (background)	*5.29*
	1251	50 m Downstream of Station C-2	12.6

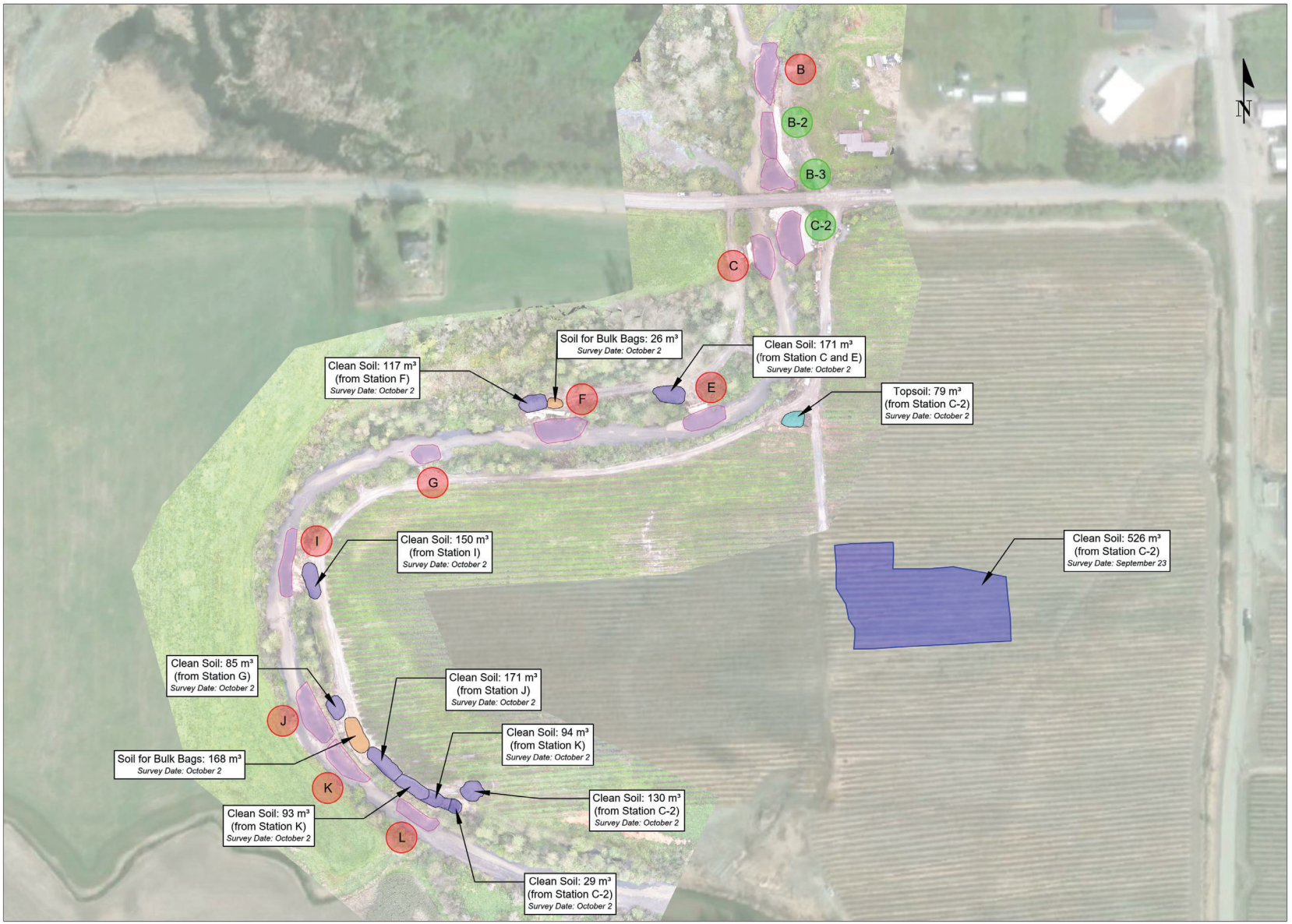
Date	Time	Location	Turbidity (NTU)†
September 21, 2024	1000	Upstream of Station B-3 (background)	*3.16*
	1112	30 m Downstream of Station B-3	7.72
	1133	30 m Downstream of Station B-3	**14.8**
	1140	30 m Downstream of Station B-3	9.49
September 27, 2024	0505	Station I (background)	*7.87*
	0651	Downstream of Station L	**26.2**
	0701	Station I (background)	*24.5*
	0730	10 m upstream of the project (background)	*21.2*
	0914	Station I (background)	*15.3*
	0920	Downstream of Station K	**25.8**
	1030	Station I (background)	*21.2*
	1036	Downstream of Station K	20.6
September 29, 2024	0850	5 m Upstream of Station I (background)	*13.4*
	0855	5 m Downstream of Station I	**28.7**
	0910	5 m Upstream of Station I (background)	*10.34*
	0915	5 m Downstream of Station I	**26.7**
	1018	Station E (background)	*7.83*
	1024	5 m Downstream of Station I	14.7

†: Turbidity readings were collected on a LaMotte 2020we portable turbidity meter following Keystone Environmental standard field procedures.

††: Background turbidity readings are indicated with *italic numerals.* Exceedances of the BC Approved Water Quality Guidelines for Aquatic Life are indicated with **bold numerals.**

APPENDIX D

CONTRACTOR PROGRESS SURVEY



HATZIC EMERGENCY WORKS
PROGRAM LAGACE CREEK
SITE S-CR-14/17

Client :

BRITISH COLUMBIA

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

PROGRESS SURVEY
SITE-CR-14

Total Volumes

Clean Soil: 1566 m³

Soil for Bulk Bags: 194 m³

Topsoil: 79 m³

Legend

- Clean Soil Stockpile Area
- Topsoil Stockpile Area
- Soil Stockpile Area for Bulk Bags
- Sand Recovery Stations
- Existing Sand Recovery Stations
- Proposed Sand Recovery Stations

0 30 60 Meters

RESPOND. RECLAIM. RENEW.

JOB NUMBER: 218635
DATE: Oct 04, 2024
DRAWN BY: BY
CHECKED BY: MG

Drawing #:

QM-P-1378

APPENDIX E

WSA AND DFO DOCUMENTS

August 23, 2024 File Number: 2011310

Ministry of Environment and Climate Change Strategy
PO BOX 9047 STN PROV GOVT
Victoria, BC V8W 9E2

Sent via email: Thyren.Jacobs@gov.bc.ca

Dear Thyren Jacobs,

Re: Application for approval to make changes in Lagace Creek Within, Lot 2, Except: Firstly: Parcel "A" (REFERENCE PLAN 6603) & "B" (Reference Plan 7565) Secondly: Parcel "A" (Explanatory Plan 17194) Plan 3529, 3942 & Plan 11344, Lot 3, Lot 5, Lot 6, Lot 7, Lot 8, Lot 27, Section 2, Section 11, Township 18, New Westminster District Plan 3529, 3942 & Plan 11344 and Unsurveyed Crown foreshore or Land Covered by Water being part of the Bed of Lagace Creek held under permit # 29886.

A Change Approval for the above application has been granted and a *Water Sustainability Act* Section 11(1) Changes In and About a Stream Approval document verifying this is attached.

This Change Approval does not authorize entry onto private or Crown owned land. Permission of the affected landowner must be obtained and should be in writing for your protection.

This Approval does not constitute authority of any other agency. The holder of this Approval shall have the necessary permits from other agencies concerned prior to the commencement of the works authorized herein. The permit holder is required to adhere to all other applicable Provincial and Federal Regulations.

A copy of this Approval (and associated plans/drawings listed on this Approval) must be available for inspection, upon request, at any location where the authorized changes in and about a stream are being undertaken.

The holder of this Approval must advise Water Authorizations at SouthCoastWSAReporting@gov.bc.ca with the Approval number in the subject line, five (5)

Ministry of Water, Land and Resource Stewardship
Mailing Address: 200-10428 153 Street, Surrey BC V3R1E1
Location: 200-10428 153 Street, Surrey BC V3R1E1
Phone: (604) 586-4400
Fax: (604) 586-4444
Web: https://www2.gov.bc.ca/gov/content/environment/air-land-water/water

working days prior to commencement and five (5) working days following completion of the authorized work to facilitate the timing of auditing.

The holder of this Approval must have permits or other written consent from any affected property/right-of-way holders before commencing work that could affect utilities or other structures within the property or rights-of-way.

The holder of this Approval is reminded that the Fraser Valley Regional District Crown Interface Policy's Appendix 1, General policies Section 18 Hatzic Prairie may be applicable to their proposed works.

This Approval requires the oversight of an appropriately Qualified Professional. For the purposes of this authorization, that professional must be registered with one of the five professional regulatory bodies named under the *Professional Governance Act* of British Columbia. They must be in good standing and acting under that professional regulatory body's code of ethics and subject to disciplinary action by that professional regulatory body.

Please ensure that machinery is free of invasive plant material that could potentially be transported throughout or between sites. In addition, ensure that invasive species removed from a site are disposed of appropriately.

For the protection of wildlife species, the Qualified Professional is responsible for planning and implementing fish and wildlife salvages prior to any instream and riparian works. *Wildlife Act* permits must be obtained from the Ministry of Water Land and Resource Stewardship. (https://portal.nrs.gov.bc.ca/web/client/home).

The holder of this Approval shall ensure that any proposed development and/or changes do not impact traditional or special sites in accordance with the *Heritage Conservation Act* or the ability of First Nation community members to participate in traditional activities on the land and water.

Archaeological sites (both recorded and unrecorded) are protected under the *Heritage Conservation Act* and must not be altered or damaged without a permit from the Archaeology Branch. The holder of this Approval must advise everyone who will be involved in ground-disturbance and construction that if archaeological materials are encountered, activities must be halted, and the Archaeology Branch contacted at 250-953-3334 for direction.

Section 105 of the *Water Sustainability Act* gives the recipient of this notice the right to appeal my decision. You may file an appeal within 30 days of the date indicated on this letter. Information on filing an appeal can be found on the Environmental Appeal Board website at http://www.eab.gov.bc.ca/ .

Ministry of Water, Land and Resource Stewardship
Mailing Address: 200-10428 153 Street, Surrey BC V3R1E1
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Fax: (604) 586-4444
Web: https://www2.gov.bc.ca/gov/content/environment/air-land-water/water

If you have any questions or concerns regarding the document issued or the content of this letter, please contact the South Coast Office at WaterActReferrals.LowerMainland@gov.bc.ca.

Sincerely,



Michael Currie
Assistant Water Manager

pc: Naomi Sands, Associated Engineering, Email: sandsn@ae.ca
Pradeep Poudel, Ministry of Water, Land and Resource Stewardship, Email: Pradeep.1.Poudel@gov.bc.ca
Kwantlen First Nation
Leq'á:mel First Nation
Matsqui First Nation
Peters First Nation
PRRO
Semiahmoo First Nation

Ministry of Water, Land and Resource Stewardship
Mailing Address: 200-10428 153 Street, Surrey BC V3R1E1
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Fax: (604) 586-4444
Web: https://www2.gov.bc.ca/gov/content/environment/air-land-water/water

August 23, 2024 File Number: 2011310

APPROVAL

WATER SUSTAINABILITY ACT - Subsection 11(1) and 11(2)
(Changes in and about a stream)

Ministry of Environment and Climate Change Strategy

is hereby authorized to make changes in and about a stream as follows:

(a) The name of the stream is Lagace Creek.

(b) The Changes to be made in and about the stream are:

1. Install temporary erosion and sediment control methods using silt curtain and/or fencing before instream works begin as required.
2. Isolate the instream work zones by diverting flow around the isolated areas via pumps or temporary diversion channels or by installing silt curtains.
3. Riparian vegetation removal over approximately 3000 square metres for access, lay down and installation of sand stations.
4. Construct three new sand recovery stations as outlined in the Environmental Management Plan and engineering drawings.
5. Sediment and debris removal at Lagace Creek over an area of approximately 5100 square metres, up to a maximum of approximately 8750 cubic metres of sediment. Maximum depth of excavation is not to exceed approximately 2.5 metres at the Sand Recovery Stations and 2.8 metres within other areas of the stream channel.
6. Restore the bank around the new sand recovery stations with native vegetation and riparian seed mix.

Within, Lot 2, Except: Firstly: Parcel “A" (REFERENCE PLAN 6603) &
"B" (Reference Plan 7565) Secondly: Parcel "A" (Explanatory Plan 17194) Plan 3529, 3942 & Plan 11344, Lot 3, Lot 5, Lot 6, Lot 7, Lot 8, Lot 27, Section 2, Section 11, Township 18, New Westminster District Plan 3529, 3942 & Plan 11344 and Unsurveyed Crown foreshore or Land Covered by Water being part of the Bed of Lagace Creek held under permit 29886.

(c) The location of the works is at the following coordinates, as provided by the applicant: 49.1956250, -122.2536030.

(d) The works authorized in this Approval shall be completed on or before. December 31, 2024.

(e) The holder of this Approval shall take reasonable care to avoid damaging any land, works, trees or other property and shall make full compensation to the owners for any damage or loss resulting from the exercise of rights granted hereunder.

(f) All works associated with the Effectiveness Monitoring Plan, as outlined in clause (aa) below, shall be completed by December 1, 2027, three years after the works are completed.

(g) As much as is practicable, the construction area(s) and access routes must be marked on-site prior to starting groundwork. Any vegetation removal must be minimized and limited only to the areas required for active construction, with consideration for the timing and scheduling of work.

(h) Work in the stream and stream channel must only occur during the periods outlined below, so that the fisheries interests are protected:

1. Instream work during the reduced risk instream work window must occur during the period of August 1 to September 15; or
2. Based on project justification and risk, instream work outside of the reduced risk instream work window (as stated above) must occur subject to the following:
    i. An appropriately Qualified Professional must provide advice to the holder of this Approval on the timing of the work based on: the nature of the works, environmental values (including fish, amphibians, wildlife, any listed species present), water quality, channel stability, weather conditions, water levels, and any other relevant factors);
    ii. The Qualified Professional must also provide additional construction mitigation advice to prevent adverse environmental impacts, and daily or full-time supervision of all work in or near the stream;
    iii. Work must be timed and planned appropriately, the stream must be completely dry or have marginal flows (naturally or achieved through appropriate isolation and diversion) for the duration of the construction activities; and
    iv. The advice of the Qualified Professional on construction timing (as per (i) above) and mitigation measures (as per (ii) above), as well as the timing of work and the presence of the Qualified Professional, must be documented in writing. This documentation must be submitted as part of the post construction reporting for this project.

(i) All works shall be completed within the designed project footprint and in accordance with the following:

1. Report “Lower Lagace Creek (SCR 14) Sediment Removal and Bank Stabilization Environmental Management Plan” prepared for Ministry of Environment and Climate Change Strategy by Associated Environmental May 2024.
2. Sealed Drawing Issued for RFP and Permitting for Hatzic Emergency Works Program Legace Creek- Sites S-CR-14 2022-2632-03 “ G-3002 General Legend” prepared for Ministry of Environment and Climate Change strategy by Associated Engineering dated July 22, 2024.
3. Sealed Drawing Issued for RFP and Permitting for Hatzic Emergency Works Program Legace Creek- Sites S-CR-14 2022-2632-03 “ C-3101 Civil Plan- S-CR-14 Sediment Removal” prepared for Ministry of Environment and Climate Change strategy by Associated Engineering dated July 22, 2024.
4. Sealed Drawing Issued for RFP and Permitting for Hatzic Emergency Works Program Legace Creek- Sites S-CR-14 2022-2632-03 “ C-3102 Civil Plan- S-CR-14 Proposed Sand Recovery Stations” prepared for Ministry of Environment and Climate Change strategy by Associated Engineering dated July 22, 2024.
5. Sealed Drawing Issued for RFP and Permitting for Hatzic Emergency Works Program Legace Creek- Sites S-CR-14 2022-2632-03 “ C-3103 Civil Plan- S-CR-14 Sediment Removal Extents” prepared for Ministry of Environment and Climate Change strategy by Associated Engineering dated July 22, 2024.
6. Sealed Drawing Issued for RFP and Permitting for Hatzic Emergency Works Program Legace Creek- Sites S-CR-14 2022-2632-03 “C-3104 Civil Plan- S-CR-14 Erosion Protection” prepared for Ministry of Environment and Climate Change strategy by Associated Engineering dated July 22, 2024.
7. Sealed Drawing Issued for RFP and Permitting for Hatzic Emergency Works Program Legace Creek- Sites S-CR-14 2022-2632-03 “C-3501 Civil Detail 1 of 6 Existing Sand Recovery Station ” prepared for Ministry of Environment and Climate Change strategy by Associated Engineering dated July 22, 2024.
8. Sealed Drawing Issued for RFP and Permitting for Hatzic Emergency Works Program Legace Creek- Sites S-CR-14 2022-2632-03 “C-3502 Civil Detail 2 of 6 Proposed Sand Recovery Station ” prepared for Ministry of Environment and Climate Change strategy by Associated Engineering dated July 22, 2024.
9. Sealed Drawing Issued for RFP and Permitting for Hatzic Emergency Works Program Legace Creek- Sites S-CR-14 2022-2632-03 “C-3503 Civil Detail 3 of 6 Bank Protection” prepared for Ministry of Environment and Climate Change strategy by Associated Engineering dated July 22, 2024.
10. Sealed Drawing Issued for RFP and Permitting for Hatzic Emergency Works Program Legace Creek- Sites S-CR-14 2022-2632-03 “C-3504 Civil Detail 4 of 6 Fence and Gate Installation” prepared for Ministry of Environment and Climate Change strategy by Associated Engineering dated July 22, 2024.
11. Sealed Drawing Issued for RFP and Permitting for Hatzic Emergency Works Program Legace Creek- Sites S-CR-14 2022-2632-03 “C-3505 Civil Detail 5 of 6 Dense Live Staking” prepared for Ministry of Environment and Climate Change strategy by Associated Engineering dated July 22, 2024.

(j) The holder of this Approval must hire an appropriately Qualified Professional to conduct Environmental Monitoring on all in-stream works authorized under this Approval. The Qualified Professional is responsible for observing the methods of construction and preparing information and reports on the compliance of the construction activities. The Qualified Professional shall:

1. Ensure all best management practices and mitigation measures are in place to avoid and minimize environmental impact on the land and on fish and fish habitat of the stream.
2. Where applicable, assist in the isolation of the stream prior to the commencement of works.
3. Implement and ensure erosion and sediment control measures are constructed, installed, and maintained appropriately for the full duration of instream works.
4. Supervise all instream works authorized under this Approval.
5. When the works involve temporary diversions to isolate the work site,
    i) Monitor all diversion works daily to ensure pumps & flow bypasses are in proper working condition;
    ii) Ensure diversion works that include pump intakes be screened for fish and aquatic species in accordance with the "Interim code of practice: End-of-pipe fish protection screens for small water intakes in freshwater" (Fisheries and Oceans Canada, 2020); and
    iii) Ensure fish are prevented from entering the works.
6. When the works involve dewatering or isolation of flow and the stream is known or suspected to contain fish and/or amphibians,
    i) Attend the site prior to conducting any instream works to complete fish and wildlife search and salvage(s);
    ii) Obtain any permits needed prior to undertaking the salvage(s); and
    iii) Inspect the extraction area for fish stranding at least once after water levels have declined.
    iv) Protect the species at risk and salvage under the direction of a Qualified Environmental Professional in the event of discovery of species at risk. The works shall not result in harm to species at risk.
7. Be granted authority to stop the work authorized under this Approval if deemed necessary to address risks to the environment. The Qualified Professional or their designate (specified in writing) must be on site during all phases of construction in and around the stream to ensure this component is upheld.
8. In the event of an environmental incident or non-compliance with any of the terms or conditions of this Approval, an appropriately Qualified Professional must immediately mitigate the situation. Within 48 hours, each incident must be reported to the Water Manager at SouthCoastWSAReporting@gov.bc.ca with the approval number in the subject line. The incident report shall describe mitigation measures employed and a rationale as to why works have resumed, or the next steps required before works may resume. The holder of this approval must follow the advice of the appropriately Qualified Professional.
9. Conduct a search and salvage (if required) for wildlife within the proposed clearing footprints before works occur.

(k) All work shall be carried out in accordance with the Provincial "Requirements and Best Management Practices for Making Changes In and About A Stream in British Columbia" (2022). The Provincial guidance document can be found at the following link: https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/working-around-water/wsa-cias-requirements-bmps.pdf .

(l) The holder of this Approval must provide as-built drawings post-construction within 60 days of completion of the works. The drawings shall include all modifications made from the initial drawings during the construction process and include justification for the modifications. The drawings must be labelled with this Approval file number and labelled in the subject line of the email and submitted to SouthCoastWSAReporting@gov.bc.ca.

(m) The holder of this Approval must ensure that a Construction Environmental Management Plan (CEMP) is developed and implemented by an appropriately Qualified Professional. A copy of the plan must be submitted to SouthCoastWSAReporting@gov.bc.ca with this Approval number in the subject line.

(n) Upon commencement of the project, work shall be pursued to completion as quickly as possible.

(o) All proposed works shall be completed in isolation of the stream flows.

(p) All equipment and machinery used in or near the stream channel:

1. Be in good operating condition and free of leaks, excess oil and grease.
2. Have a spill containment kit readily accessible on-site with operators and/or staff on site trained in handling and applying a spill kit appropriately to any spills/incidents.
3. Be refueled a minimum of 30 meters away from all streams.
4. Use environmentally sensitive hydraulic fluids which are non-toxic to aquatic life and which are readily or inherently bio-degradable.
5. Any spill of a substance that is toxic, polluting, or deleterious to aquatic life of reportable quantities must be reported to the Dangerous Goods Incident Report 24-hour phone line at 1-800-663-3456.

(q) Sediment and Erosion Control plans must be developed, designed, implemented and monitored by an appropriately qualified person. The plans, implementation and monitoring must also address stormwater pollution prevention for the duration of construction.

(r) Sediment and Erosion Control measures to prevent the release of silt, sediment or sediment-laden water must be in place before starting works that may result in sediment mobilization. Care shall be exercised during all phases of the work to prevent the release of silt, sediment, sediment-laden water, raw concrete, concrete leachate, or any

deleterious substances. All control measures must meet or surpass the Requirements and Best Management Practices for Making Changes in and About a Stream in British Columbia (2022) and the "Land Development Guidelines for the Protection of Aquatic Habitat" (Fisheries and Oceans Canada and the British Columbia, 1993).

(s) Discharge and runoff water from the site into any watercourse(s) must comply with the BC Approved Water Quality Guidelines for the Protection of Aquatic Life (https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-quality/water-quality-guidelines/approved-water-quality-guidelines) and/or the applicable Local Government Bylaw(s) .

Water quality monitoring must be conducted by an appropriately Qualified Professional or a designate (in writing) Environmental Monitor on every day in which instream works are being conducted. Measurements must be taken upstream of any works taking place and within the extent of the sedimentation downstream of where instream work is actively occurring. Measurements are to be taken immediately prior to works beginning, and then at regular intervals until the works are completed and may require additional frequency during wet weather conditions. Wet weather conditions will be defined as being equal to or greater than 25 millimetres of rainfall within a 24-hour period. All excavated material and debris shall be removed from the site or placed in a stable area above the high-water mark of the stream. Mitigative measures must be applied to protect the excavated material and debris from erosion and reintroduction into the watercourse. These measures may include covering the material with erosion blankets, seeding and planting with native vegetation, or as otherwise directed by a Qualified Professional.

(t) All excavated material and debris shall be removed from the site or placed in a stable area above the high-water mark of the stream. Mitigative measures must be applied to protect the excavated material and debris from erosion and reintroduction into the watercourse.

(u) The holder of this Approval shall ensure that instream works are designed and installed so as not to restrict fish passage and/or lead to fish stranding. The works shall not result in depressions that have the ability to trap fish and other aquatic life.

(v) All temporary works (including a ford, stream crossing, flow bypass, and erosion and sediment control measures) shall be removed on completion of the project, and the stream channel restored to its natural condition.

(w) All disturbed areas of the banks of the stream shall be restored using native vegetation suitable for the site conditions.

(x) All rock used in the works must be clean and free of sediment producing material, durable, non-acid generating and suitably graded. Any other engineering material required for the construction of the works shall be clean of any substances deleterious to aquatic life.

(y) Drought mitigation: Monitor current drought conditions as per the Provincial Drought Level Classification system (Level 0 – 5, Drought information – Province of British Columbia (gov.bc.ca)) during all instream works, undertakings and activities. Instream works shall cease if the Drought Level Classification is at Level 5. The proponent shall contact WLRS under this circumstance to evaluate current on-site conditions and additional avoidance and mitigation measures. Instream works may commence only after receiving written permission from WLRS.

1. If instream works are occurring during a period of drought or the dry summer period when the Drought Level Classification is below Level 5, and works involve the loss of habitat that provides cold water refugia for fish (e.g., deep pools), the QEP must ensure salvaged fish are relocated to an area that provides similar habitat conditions (e.g., well-shaded habitat, habitat with known ground-water upwelling, pools, or undercut banks).

2. Site isolation and fish salvage(s): Instream works, undertakings and activities where there is potential for fish presence shall only be carried out within previously isolated and salvaged areas. Incorporate applicable measures and standards from DFO's Interim standard: in-water site isolation and ensure pumps are screened to prevent entrainment or impingement of fish according to DFO's Interim Code of Practice for End-of-pipe Fish Protection Screens for Small Water Intakes. It is the Proponent's responsibility to obtain the necessary Federal and Provincial fish collection permits for fish salvage and follow the conditions therein. The isolation areas shall be inspected regularly and maintained throughout the project.

(z) The holder(s) of water license C114253, located downstream of the proposed works, and any other potential licensees who will be impacted, are to be advised as soon as practicable prior to commencement of construction. If the proposed works cause or are expected to cause an adverse impact to quality of quantity of water available to the license holders, the license holders are to be provided with an alternate supply of fresh water during the periods when water quality or availability will be adversely affected by the works.

(aa) The holder of this Approval must retain an appropriately Qualified Professional to develop and implement Three Year Effectiveness Monitoring plan that includes:

1. Maintenance and monitoring of plantings (including watering);
2. Replacement of plantings, where necessary, to ensure 100% tree survival and minimum 80% shrub and other vegetation survival rate.
3. Invasive species management;
4. Monitoring water flow and stream channel function with proposed adaptive management strategies to address shortfalls.

Annual reports must be submitted by December 1 of each calendar year following completion of construction to SouthCoastWSAReporting@gov.bc.ca. The reports and subject line of the email must be labelled with this Approval file number.

(bb) The holder of this Approval must provide a detailed post-construction report no later than December 1 of the year works were completed. The report must be submitted by email to SouthCoastWSAReporting@gov.bc.ca with the approval file number listed in the subject line of the email and the title of the report. The report shall include a signed statement from an appropriately Qualified Professional summarizing:

1. The in-stream works undertaken;
2. The timing of those works;
3. The total in-stream area directly affected;
4. The pre-construction and post-construction surveys if undertaken;
5. The quantity of gravel removed;
6. Representative site photographs;
7. Whether or not they observed or were otherwise aware of any non-compliance with the terms and conditions of this Approval; and
8. A description of any environmental incidents, non-compliance or other difficulties, and how these were addressed and reported.

Sincerely,



Michael Currie
Assistant Water Manager

Province of British Columbia
Water Sustainability Act

PERMIT AUTHORIZING THE OCCUPATION OF CROWN LAND

The holder of this permit, Ministry of Environment and Climate Change Strategy (29886), whose Change Approval authorizes changes in and about a stream (Lagace Creek), is hereby authorized to occupy Crown Land by constructing, maintaining and operating the works as authorized in the Change Approval (2011310).

(a) The Crown land which is authorized to be occupied under this permit is a portion of Unsurveyed Crown foreshore or Land Covered by Water being part of the Bed of Lagace Creek, the location of which is shown approximately on the plans associated with said Change Approval.

(b) The approximate dimensions of the Crown Land authorized to be occupied under this permit, are for approximately 0.722 hectares.

(c) Prior to cutting, destroying or clearing of any timber necessary to construct, maintain and operate the said works or the clearing of the said lands which may be flooded, the permittee shall apply for and obtain a licence to cut timber from the Ministry of Forests, District Manager. The amount of stumpage, royalty and/or compensation payable to the Crown in respect of trees, including merchantable or young growth, cut, removed, damaged, or destroyed by the permittee, shall be the sum or sums fixed by the Forest Service of the Province of British Columbia.

(d) This permit is appurtenant to the land, mine, or undertaking to which the aforesaid Change Approval is appurtenant.

(e) This permit shall become void if the Change Approval with respect to which the permit is issued should terminate, be abandoned or cancelled, or amended so as to render this permit unnecessary.

(f) This permit is issued and accepted on the understanding that the permittee shall indemnify and save harmless the Government of the Province of British Columbia for all loss, damage to works, cost or expense suffered by the permittee by reason of the Crown land or any portion thereof being submerged or damaged by erosion or otherwise affected by flooding.

(g) The holder of this permit shall not be entitled to compensation if the Crown grants permits to other persons to occupy the land affected by this permit.

(h) In the event of a dispute at any time with respect to the area or boundaries of the land affected by this permit, the holder shall, at his own expense, have the said land surveyed by a duly authorized surveyor.



Michael Currie
Assistant Water Manager

September 6, 2024 File Number: 2011242

Thyren Jacobs
Ministry of Environment and Climate Change Strategy - Surrey
200-14070 152 St
Surrey, BC V3R 0Y3
Sent via email: Thyren.Jacobs@gov.bc.ca

Dear Thyren Jacobs,

Re: Application for approval to make changes in Lagace Creek Within Parcel A, Explanatory Plan 25357, Except plan subdivided by plan 37358, Plan 34325, 38134, 20437 and 39696 of lot 2, Lot 7, Lot 13, Lot 15 South West, Section 30, North West Quarter Section 19, Township 21, New Westminster District and Unsurveyed Crown foreshore or Land Covered by Water being part of the Bed of Lagace Creek held under permit# 29877.

A Change Approval for the above application has been granted and a *Water Sustainability Act* Section 11(1) Changes In and About a Stream Approval document verifying this is attached.

This Change Approval does not authorize entry onto private or Crown owned land. Permission of the affected landowner must be obtained and should be in writing for your protection.

This Approval does not constitute authority of any other agency. The holder of this Approval must have the necessary permits from other agencies concerned prior to the commencement of the works authorized herein. The permit holder is required to adhere to all other applicable Provincial and Federal Regulations.

A copy of this Approval (and associated plans/drawings listed on this Approval) must be available for inspection, upon request, at any location where the authorized changes in and about a stream are being undertaken.

The holder of this Approval must have permits or other written consent from any affected property/right-of-way holders before commencing work that could affect utilities or other structures within the property or rights-of-way.

This Approval requires the oversight of an appropriately Qualified Professional. For the purposes of this authorization, that professional must be registered with one of the five professional regulatory bodies named under the *Professional Governance Act* of British Columbia. They must

Ministry of Water, Land and Resource Stewardship
Stream Management Authorizations – South Coast
Website: www.gov.bc.ca/water
Suite 200, 10428 - 153 St
Surrey, BC V3R 1E1
Phone: (604) 586-4400
Fax: (604) 586-4444

be in good standing and acting under that professional regulatory body's code of ethics and subject to disciplinary action by that professional regulatory body.

Please ensure that machinery is free of invasive plant material that could potentially be transported throughout or between sites. In addition, ensure that invasive species removed from a site are disposed of appropriately.

When choosing compensation/restoration locations, it is encouraged to avoid areas that are isolated or are discontinuous from existing habitat, to avoid creating habitat sinks, and enable wildlife access.

For the protection of wildlife species, the Qualified Professional is responsible for planning and implementing fish and wildlife salvages prior to any instream and riparian works. *Wildlife Act* permits must be obtained from the Ministry of Water Land and Resource Stewardship. (https://portal.nrs.gov.bc.ca/web/client/home).

The holder of this Approval must ensure that any proposed development and/or changes do not impact traditional or special sites in accordance with the *Heritage Conservation Act* or the ability of First Nation community members to participate in traditional activities on the land and water.

Archaeological sites (both recorded and unrecorded) are protected under the *Heritage Conservation Act* and must not be altered or damaged without a permit from the Archaeology Branch. The holder of this Approval must advise everyone who will be involved in ground-disturbance and construction that if archaeological materials are encountered, activities must be halted, and the Archaeology Branch contacted at 250-953-3334 for direction.

Section 105 of the Water Sustainability Act gives the recipient of this notice the right to appeal my decision. You may file an appeal within 30 days of the date indicated on this letter. Information on filing an appeal can be found on the Environmental Appeal Board website at http://www.eab.gov.bc.ca/ .

If you have any questions or concerns regarding the document issued or the content of this letter, please contact the South Coast Office at WaterActReferrals.LowerMainland@gov.bc.ca.

Sincerely,



Michael Currie
Assistant Water Manager

Cc: Naomi Sands, Associated Environmental, Email: sandsn@ae.ca

Pradeep Poudel, Ministry of Water, Land and Resource Stewardship, Email: Pradeep.1.Poudel@gov.bc.ca
Kwantlen First Nation
Leq'á:mel First Nation
Matsqui First Nation
Peters First Nation
PRRO
Semiahmoo First Nation

September 6, 2024 File Number: 2011242

APPROVAL

WATER SUSTAINABILITY ACT - Subsection 11(1) and 11(2)
(Changes in and about a stream)

Ministry of Environment and Climate Change Strategy

is hereby authorized to make changes in and about a stream as follows:

(a) The names of the stream is Lagace Creek, herein referred to as the stream.

(b) The Changes to be made in and about the stream are:

1. Removal of approximately 400 cubic metres of sediment and debris from the stream channel, impacting an area of approximately 400 square metres over 90 linear metres of the channel.
2. Clearing of riparian vegetation to facilitate laydown and access, impacting an area of approximately 275 square meters.

Within Parcel A, Explanatory Plan 25357, Except plan subdivided by plan 37358, Plan 34325, 38134, 20437 and 39696 of lot 2, Lot 7, Lot 13, Lot 15 South West, Section 30, North West Quarter Section 19, Township 21, New Westminster District and Unsurveyed Crown foreshore or Land Covered by Water being part of the Bed of Lagace Creek held under permit# 29877

(c) The location of the works is at the following coordinates, as provided by the applicant: 49.2410600, -122.2183400.

(d) The works authorized in this Approval must be completed on or before. December 31, 2024.

(e) The holder of this Approval must take reasonable care to avoid damaging any land, works, trees or other property and must make full compensation to the owners for any damage or loss resulting from the exercise of rights granted hereunder.

Ministry of Water, Land and Resource Stewardship
Stream Management Authorizations – South Coast
Website: www.gov.bc.ca/water
Suite 200, 10428 - 153 St
Surrey, BC V3R 1E1
Phone: (604) 586-4400
Fax: (604) 586-4444

(f) All works associated with the Effectiveness Monitoring Plan, as outlined in clause (aa) below, must be completed by December 1, 2027, three years after the works are completed.

(g) As much as is practicable, the construction area(s) and access routes must be marked on-site prior to starting groundwork. Any vegetation removal must be minimized and limited only to the areas required for active construction, with consideration for the timing and scheduling of work.

(h) Work in the stream and stream channel must occur only during the periods outlined below, so that the fisheries interests are protected:

1. Instream work during the reduced risk instream work window must occur during the period of August 1 to September 15; or
2. Based on project justification and risk, instream work outside of the reduced risk instream work window (as stated above), subject to the following:
    i) An appropriately qualified professional must provide advice to the holder of this Approval on the timing of the work based on the nature of the works, environmental values (including fish, amphibians, wildlife, any listed species present), water quality, channel stability, weather conditions, water levels, and any other relevant factors); and
    ii) The Qualified Professional must also provide additional construction mitigation advice to the holder of this Approval, and daily or full-time supervision of all work in or near the stream; and
    iii) Work must be timed and planned appropriately, the stream must be completely dry or have marginal flows for the duration of the construction activities; and
    iv) The advice of the Qualified Professional on construction timing (as per (i) above) and mitigation measures (as per (ii) above), as well as the timing of work and the presence of the Qualified Professional, must be documented in writing. This documentation must be submitted as part of the post construction reporting for this project.

(i) All works must be completed within the designed project footprint and in accordance with the following:

1. Report “Upper Lagace Creek (SCR 17) and Saporano Creek Bank Protection and Sediment Removal Environmental Management Plan ” prepared for Ministry of Environment and Climate Change Strategy by Associated Environmental February 2024.
2. Sealed Drawing Issued for RFP and Permitting Hatzic Emergency Works Program Lagace Creek- Site S-CR 14/17 2022-2632-03 “ Drawing C-3105 Civil Plan- SCR-17 Sediment Removal” prepared for Ministry of Environment and Climate Change Strategy by Associated Engineering dated July 5, 2024.
3. Sealed Drawing Issued for RFP and Permitting Hatzic Emergency Works Program Lagace Creek- Site S-CR 14/17 2022-2632-03 “ Drawing C-3106 Civil

Plan- SCR-17 Sediment Removal" prepared for Ministry of Environment and Climate Change Strategy by Associated Engineering dated July 5, 2024.

4. Sealed Drawing Issued for RFP and Permitting Hatzic Emergency Works Program Lagace Creek- Site S-CR 14/17 2022-2632-03 " Drawing C-3506 Civil Detail Sediment Removal" prepared for Ministry of Environment and Climate Change Strategy by Associated Engineering dated July 5, 2024.

(j) The holder of this Approval must hire an appropriately Qualified Professional to conduct Environmental Monitoring on all in-stream works authorized under this Approval. The Qualified Professional is responsible for observing the methods of construction and preparing information and reports on the compliance of the construction activities. The Qualified Professional must:

1. Ensure all best management practices and mitigation measures are in place to avoid and minimize environmental impact on the land and on fish and fish habitat of the stream.
2. Where applicable, assist in the isolation of the stream prior to the commencement of works.
3. Implement and ensure erosion and sediment control measures are constructed, installed, and maintained appropriately for the full duration of instream works.
4. Supervise all instream works authorized under this Approval.
5. Complete a sweep for wildlife species at risk prior to starting works.
6. When the works involve temporary diversions to isolate the work site,
   i) Monitor all diversion works daily to ensure pumps & flow bypasses are in proper working condition;
   ii) Ensure diversion works that include pump intakes be screened for fish and aquatic species in accordance with the "Interim code of practice: End-of-pipe fish protection screens for small water intakes in freshwater" (Fisheries and Oceans Canada, 2020); and
   iii) Ensure fish are prevented from entering the works.
7. When the works involve dewatering or isolation of flow and the stream is known or suspected to contain fish and/or amphibians,
   i) Attend the site prior to conducting any instream works to complete fish and wildlife search and salvage(s);
   ii) Obtain any permits needed prior to undertaking the salvage(s); and
   iii) Inspect the extraction area for fish stranding at least once after water levels have declined.
   iv) Protect the species at risk and salvage under the direction of a Qualified Environmental Professional in the event of discovery of species at risk. The works must not result in harm to species at risk.
8. Be granted authority to stop the work authorized under this Approval if deemed necessary to address risks to the environment. The Qualified Professional or their designate (specified in writing) must be on site during all phases of construction in and around the stream to ensure this component is upheld.
9. In the event of an environmental incident or non-compliance with any of the terms or conditions of this Approval, an appropriately Qualified Professional

must immediately mitigate the situation. Within 48 hours, each incident must be reported to the Water Manager at SouthCoastWSAReporting@gov.bc.ca with the approval number in the subject line. The incident report must describe mitigation measures employed and a rationale as to why works have resumed, or the next steps required before works may resume. The holder of this approval must follow the advice of the appropriately Qualified Professional.

(k) All work must be carried out in accordance with the Provincial "Requirements and Best Management Practices for Making Changes In and About A Stream in British Columbia" (2022). The Provincial guidance document can be found at the following link: https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/working-around-water/wsa-cias-requirements-bmps.pdf .

(l) The holder of this Approval must provide as-built drawings post-construction within 60 days of completion of the works. The drawings must include all modifications made from the initial drawings during the construction process and include justification for the modifications. The drawings must be labelled with this Approval file number and labelled in the subject line of the email and submitted to SouthCoastWSAReporting@gov.bc.ca.

(m) The holder of the Approval must submit a Construction Environmental Management Plan prepared or approved by an appropriately Qualified Professional to SouthCoastWSAReporting@gov.bc.ca with this Approval file number in the subject line of the email prior to commencing works.

(n) Upon commencement of the project, work must be pursued to completion as quickly as possible.

(o) All proposed works must be completed in isolation of the stream flows.

(p) All equipment and machinery used in or near the stream channel:

1. Be in good operating condition and free of leaks, excess oil and grease.
2. Have a spill containment kit readily accessible on-site with operators and/or staff on site trained in handling and applying a spill kit appropriately to any spills/incidents.
3. Be refueled a minimum of 30 meters away from all streams.
4. Use environmentally sensitive hydraulic fluids which are non-toxic to aquatic life and which are readily or inherently bio-degradable.
5. Any spill of a substance that is toxic, polluting, or deleterious to aquatic life of reportable quantities must be reported to the Dangerous Goods Incident Report 24-hour phone line at 1-800-663-3456.

(q) Sediment and Erosion Control plans must be developed, designed, implemented and monitored by an appropriately qualified person. The plans, implementation and

monitoring must also address stormwater pollution prevention for the duration of construction.

(r) Sediment and Erosion Control measures to prevent the release of silt, sediment or sediment-laden water must be in place before starting works that may result in sediment mobilization. Care must be exercised during all phases of the work to prevent the release of silt, sediment, sediment-laden water, raw concrete, concrete leachate, or any deleterious substances. All control measures must meet or surpass the Requirements and Best Management Practices for Making Changes in and About a Stream in British Columbia (2022) and the "Land Development Guidelines for the Protection of Aquatic Habitat" (Fisheries and Oceans Canada and the British Columbia, 1993).

(s) Discharge and runoff water from the site into any watercourse(s) must comply with the BC Approved Water Quality Guidelines for the Protection of Aquatic Life (https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-quality/water-quality-guidelines/approved-water-quality-guidelines) and/or the applicable Local Government Bylaw(s) .

Water quality monitoring must be conducted by an appropriately Qualified Professional or a designate (in writing) Environmental Monitor on every day in which instream works are being conducted. Measurements must be taken upstream of any works taking place and within the extent of the sedimentation downstream of where instream work is actively occurring. Measurements are to be taken immediately prior to works beginning, and then at regular intervals until the works are completed and may require additional frequency during wet weather conditions. Wet weather conditions will be defined as being equal to or greater than 25 millimetres of rainfall within a 24-hour period. All excavated material and debris must be removed from the site or placed in a stable area above the high water mark of the stream. Mitigative measures must be applied to protect the excavated material and debris from erosion and reintroduction into the watercourse. These measures may include covering the material with erosion blankets, seeding and planting with native vegetation, or as otherwise directed by a Qualified Professional.

(t) All excavated material and debris must be removed from the site or placed in a stable area above the high-water mark of the stream. Mitigative measures must be applied to protect the excavated material and debris from erosion and reintroduction into the watercourse.

(u) The holder of this Approval must ensure that instream works are designed and installed so as not to restrict fish passage and/or lead to fish stranding. The works must not result in depressions that have the ability to trap fish and other aquatic life.

(v) All temporary works (including a ford, stream crossing, flow bypass, and erosion and sediment control measures) must be removed on completion of the project, and the stream channel restored to its natural condition.

(w) All disturbed areas of the banks of the stream must be restored using native vegetation suitable for the site conditions.

(x) Rock used as riprap must be clean of any substances deleterious to aquatic life and must be durable, angular in shape and suitably graded and sized to resist movement by stream flow. Any other engineering material required for the construction of the works must be clean of any substances deleterious to aquatic life.

(y) Drought mitigation: Monitor current drought conditions as per the Provincial Drought Level Classification system (Level 0 – 5, Drought information – Province of British Columbia (gov.bc.ca)) during all instream works, undertakings and activities. Instream works must cease if the Drought Level Classification is at Level 5. The proponent must contact WLRS and DFO under this circumstance to evaluate current on-site conditions and additional avoidance and mitigation measures. Instream works may commence only after receiving written permission from WLRS.

1. If instream works are occurring during a period of drought or the dry summer period when the Drought Level Classification is below Level 5, and works involve the loss of habitat that provides cold water refugia for fish (e.g., deep pools), the QEP must ensure salvaged fish are relocated to an area that provides similar habitat conditions (e.g., well-shaded habitat, habitat with known ground-water upwelling, pools, or undercut banks).

2. Site isolation and fish salvage(s): Instream works, undertakings and activities where there is potential for fish presence must only be carried out within previously isolated and salvaged areas. Incorporate applicable measures and standards from DFO's Interim standard: in-water site isolation and ensure pumps are screened to prevent entrainment or impingement of fish according to DFO's Interim Code of Practice for End-of-pipe Fish Protection Screens for Small Water Intakes. It is the Proponent's responsibility to obtain the necessary Federal and Provincial fish collection permits for fish salvage and follow the conditions therein. The isolation areas must be inspected regularly and maintained throughout the project.

(z) The holder of this Approval must retain an appropriately Qualified Professional to develop and implement a Three-Year Effectiveness Monitoring Plan that includes:

1. Maintenance and monitoring of plantings (including watering);
2. Replacement of plantings, where necessary, to ensure 100% tree survival and minimum 80% shrub and other vegetation survival rate.
3. Invasive species management; and
4. Monitoring water flow and function with proposed adaptive management strategies to address shortfalls.

Annual reports must be submitted by December 1 of each calendar year following completion of construction to SouthCoastWSAReporting@gov.bc.ca. The reports and subject line of the email must be labelled with this Approval file number.

(aa) The holder of this Approval must provide a detailed post-construction report no later than December 1 of the year works were completed. The report must be submitted by email to SouthCoastWSAReporting@gov.bc.ca with the approval file number listed in the subject line of the email and the title of the report. The report must include a signed statement from an appropriately Qualified Professional summarizing:

5. The in-stream works undertaken;
6. The timing of those works;
7. The total in-stream area directly affected;
8. The pre-construction and post-construction surveys if undertaken;
9. The quantity of gravel removed;
10. Representative site photographs;
11. Whether or not they observed or were otherwise aware of any non-compliance with the terms and conditions of this Approval; and
12. A description of any environmental incidents, non-compliance or other difficulties, and how these were addressed and reported.

Sincerely,



Michael Currie
Assistant Water Manager

Province of British Columbia
Water Sustainability Act

PERMIT # 29877 AUTHORIZING THE OCCUPATION OF CROWN LAND

The holder of this permit, Ministry of Environment and Climate Change Strategy - Surrey (29877), whose Change Approval authorizes changes in and about a stream (Lagace Creek), is hereby authorized to occupy Crown Land by constructing, maintaining and operating the works as authorized in the Change Approval (2011242).

(a) The Crown land which is authorized to be occupied under this permit is a portion of Unsurveyed Crown foreshore or Land Covered by Water being part of the Bed of Lagace Creek, the location of which is shown approximately on the plans associated with said Change Approval.

(b) The approximate dimensions of the Crown Land authorized to be occupied under this permit, are for approximately 0.04 hectares.

(c) Prior to cutting, destroying or clearing of any timber necessary to construct, maintain and operate the said works or the clearing of the said lands which may be flooded, the permittee shall apply for and obtain a licence to cut timber from the Ministry of Forests, District Manager. The amount of stumpage, royalty and/or compensation payable to the Crown in respect of trees, including merchantable or young growth, cut, removed, damaged, or destroyed by the permittee, shall be the sum or sums fixed by the Forest Service of the Province of British Columbia.

(d) This permit is appurtenant to the land, mine, or undertaking to which the aforesaid Change Approval is appurtenant.

(e) This permit shall become void if the Change Approval with respect to which the permit is issued should terminate, be abandoned or cancelled, or amended so as to render this permit unnecessary.

(f) This permit is issued and accepted on the understanding that the permittee shall indemnify and save harmless the Government of the Province of British Columbia for all loss, damage to works, cost or expense suffered by the permittee by reason of the Crown land or any portion thereof being submerged or damaged by erosion or otherwise affected by flooding.

(g) The holder of this permit shall not be entitled to compensation if the Crown grants permits to other persons to occupy the land affected by this permit.

(h) In the event of a dispute at any time with respect to the area or boundaries of the land affected by this permit, the holder shall, at his own expense, have the said land surveyed by a duly authorized surveyor.



Michael Currie
Assistant Water Manager

Paragraphs 34.4(2)(b) and 35(2)(b) *Fisheries Act* Authorization
September 2024 Amendment[1]

Authorization issued to
BC Ministry of Environment and Climate Change Strategy (ENV) *(hereafter referred to as the "Proponent")*

Attention to:
Thyren Jacobs
PO Box 9337 Stn Prov Govt
Victoria, BC
V8W 9M1

Location of Proposed Project

Nearest community: Mission
District: Fraser Valley Regional District
Province: British Columbia
Name of watercourses and coordinates:

Priority sites:

1. CR-12 - Pattison Creek (near Sylvester Road): 49.224318°, -122.225164°
2. CR-28 - Carratt Creek (at Carratt Road bridge): 49.262427°, -122.217317°
3. CR-38 - Davies Creek: 49.175456°, -122.227440°

Remaining nine (lower priority) sites:

4. CR-13 - Legace Creek (near 11744 Stave Lake Road): 49.215732°, -122.251508°
5. CR-14 - Legace Creek (at 10491 Farms Road): 49.191343°, -122.250592°
6. CR-15 - Legace Creek (at Seux Road): 49.217294°, -122.236456°
7. CR-16 - Legace Creek (from confluence with Pattison Creek to Seux Road Bridge): 49.131411°, -122.135081°
8. CR-17 - Legace Creek (between Pattison Creek and Allan Lake)
   Site 1 - Failed Driveway: 49.235909°, -122.218453°
   Site 2 - Legace Creek Tributary: 49.240045°, -122.217729°
9. CR-34 - South Herford Creek: 49.208806°, -122.230723°
10. CR-35 - McNab Creek: 49.245478°, -122.216991°
11. CR-36 - Eng Creek: 49.249415°, -122.217877°
12. CR-37 - North Herford Creek: 49.209358°, -122.231182°

[1] September 2024 Amendment: This is the second amendment to *Fisheries Act* Authorization 22-HPAC-01308 originally issued on October 27, 2022. The previous amendment was issued on November 23, 2023. Amendments to this Authorization will be highlighted in footnotes. All previous Authorizations related to the Project are rescinded and no longer valid.

Valid Authorization Period

This Authorization remains in force from the Date of Issuance until Fisheries and Oceans Canada (DFO) confirms to you in writing that all of the requirements of this Authorization have been met, in particular those requirements relating to monitoring, offsetting measures and contingency measures[2].

Please note that this Authorization may contain more specific timing requirements and limitations. These are set out in the Conditions of Authorization section.

Description of Proposed Project

The proposed project of which the works, undertakings or activities authorized is a part of involves:

- Emergency works to remove accumulations of sediment, organic debris or anthropogenic debris ("debris") in locations where it poses a risk to downstream infrastructure (e.g., bridges or homes) under high flow conditions in the fall and spring periods between 2022 and 2024[3]; and/or
- Completing emergency works to stabilize bank slopes and implement erosion protection measures.

The project is described in the following documents, hereafter referred to collectively as the "Project Plan":

- Application Form and supporting documents for the Issuance of an Authorization under Paragraphs 34.4(2)(b) and 35(2)(b) of the *Fisheries Act* (Emergency Situation) received on October 13, 2022.
- The *Ministry of Environment and Climate Change Strategy: Pattison, Carratt and Davies Creeks – Sediment Removal and Bank Protection Environmental Management Plan* report produced by Associated Environmental Consultants Inc. dated October 2022.
- The *Form for Authorization Holders to Request an Amendment to an Authorization* dated June 16, 2023.
- The *Form for Authorization Holders to Request an Amendment to an Authorization* dated September 9, 2024[4].

Description of Authorized works, undertakings or activities likely to result in the death of fish by means other than fishing and/or the harmful alteration, disruption or destruction of fish habitat:

- Site isolation using either pumps or temporary diversion channels;
- Removal of watercourse substrate (including sediment or debris) using excavators, large trucks, and hand tools;

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[2] November 2023 Amendment: Changed from December 31, 2030 expiry to "This Authorization remains in force from the Date of Issuance until Fisheries and Oceans Canada (DFO) confirms to you in writing that all of the requirements of this Authorization have been met, in particular those requirements relating to monitoring, offsetting measures and contingency measures."

3 November 2023 Amendment: Changed from "in the 2022 fall and 2023 spring periods" to "in the fall and spring periods between 2022 and 2024".

[4] September 2024 Amendment: Project Plan document added.

- Relocation and/or removal of large woody debris from the watercourses using excavators, large trucks, and hand tools;
- Bank repairs and installation of erosion protection measures; and
- Removal of riparian vegetation for site access.

The authorized works, undertakings or activities are likely to result in the following impacts to fish and fish habitat:

- Alteration and disruption of aquatic habitat including substrate removal and replacement likely to result in a reduction in habitat availability and complexity, and cause sedimentation.
- Site isolation leading to a temporary disruption to fish passage which may impact life history stages including spawning, migration, overwintering and rearing.
- Alteration and disruption to stream bank habitat likely to result in a reduction in habitat function of both the aquatic and riparian habitat.
- Alteration, disruption and destruction of riparian habitat for site access.

Riparian and aquatic footprints of the above WUAs for Pattison, Carratt and Davies Creeks shall not exceed what is described in the Project Plan. For the nine lower-priority sites, riparian and aquatic footprints shall not exceed what is required to alleviate flood risk based on the Risk Assessment Methodology of the Project Plan.

Conditions of Authorization

The above-described work, undertaking or activity must be carried on in accordance with the following conditions.

1. **Conditions that relate to the period during which the work, undertaking or activity can be carried on**

   The work, undertaking or activity that is/are authorized to be carried on during the following period:

   FROM: Date or Issuance TO: December 31, 2025[5]

   If the Proponent cannot complete the work, undertaking or activity during this period, Fisheries and Oceans Canada (DFO) must be notified in advance of the expiration of the above time period. An application for amendment, suspension or cancellation of the authorization should be submitted to DFO.

   The periods during which other conditions of this authorization must be complied with are provided in their respective sections below.

[5] November 2023 Amendment: Changed from December 31, 2023 to December, 31, 2025.

2. Conditions that relate to measures and standards to avoid and mitigate impacts to fish and fish habitat

2.1 Works, undertakings or activities shall be conducted in a manner that avoids the death of fish.

2.2 A Qualified Environmental Professional will be onsite during high-risk instream and riparian works (e.g., substrate removal, riparian vegetation removal) to oversee/direct avoidance and mitigation measures to reduce impacts to fish and fish habitat and avoid unauthorized death of fish by means other than fishing and harmful alteration, disruption and destruction of fish habitat.

2.2.1 Conduct full time observations for all fish species that may be present near and within the project footprint and modify or direct works to the extent possible to avoid or minimize potential injury and death of fish;

2.2.2 Prior to sediment removal and other instream disturbances, isolate work site(s) and salvage fish;

2.2.3 Fish salvage methodologies should consider the winter nocturnal activity of juvenile salmonids (e.g. Pacific salmon and trout species) that may spend the day concealed in the stream substrates. Where isolation occurs, conduct fish salvage between dusk and dawn (sunset/sunrise) when fish emerge to forage, to avoid and mitigate against the death of juvenile fish;

2.2.4 Relocate all salvaged fish species from the work area, or those holding below a work area, back to the same watercourse in a nearby area that is not impacted by construction or removal works or its zone of influence (i.e., areas of higher turbidity due to instream works);

2.2.5 Conduct full time monitoring for deleterious substance released during the removal of sediment and direct avoidance and mitigation measures to reduce impacts to fish and fish habitat and avoid unauthorized death of fish by means other than fishing and harmful alteration, disruption and destruction of fish habitat and to prevent their further movement into the watercourse; and

2.2.6 Monitor implementation of the conditions of this authorization.

2.3 Sediment and erosion control: Sediment and erosion control measures must be in place and shall be upgraded and maintained, such that release of sediment is avoided at the location of the authorized work, undertaking, or activity. Monitor the watercourse for signs of sedimentation resulting from the works, undertakings or activities and take corrective action if required.

2.3.1 Areas of streambank disturbed during the works shall be rehabilitated to a stable condition (e.g. re-sloped and contoured) and protected from erosion.

2.4 List of measures and standards to avoid and mitigate impacts to fish and fish habitat:

2.4.1 Every reasonable effort should be made to minimize the frequency and duration of instream works, including excavation. Work from established infrastructure, above the high water mark (i.e., top of bank), or at a minimum above the water line when possible. Restrict instream disturbance to the area(s) required to access and remove accumulations of sediment;

2.4.2 Fish passage is to be maintained around the isolated work zones through the implementation of a diversion channel where practicable. Sites with expected adult salmon presence with spawning and/or overwintering habitat upstream should be prioritized for a diversion channel. If a diversion channel is not practicable and fish are observed holding below the work zone, ongoing fish salvage is required to relocate fish around the work zone;

2.4.3 Large woody debris can only be removed from the floodplain if it poses imminent risk to downstream infrastructure and property. Where possible, stockpile the natural debris removed from the floodplain to an area that can be accessed for future restoration work. Reinstall root wads or large woody debris below the high water mark where practicable;

2.4.4 Do not stockpile materials such as rock, riprap, or dirt in areas where the material has the potential to enter fish-bearing waters;

2.4.5 Maintain all machinery on site in a clean condition and free of fluid leaks. All heavy equipment should use environmentally friendly oil ("enviro-oil");

2.4.6 Store fuel a minimum of 30 m from any watercourse[6]. Wash, refuel and service machinery and store fuel and other materials for the machinery in such a way as to prevent any deleterious substances from entering the watercourse;

2.4.7 Have spill containment and clean-up materials within operating machinery and vehicles and on site in case of leaking deleterious substances (e.g., fuel, oil, grease) from extracted anthropogenic debris. Report leaks or spills of deleterious substances that have caused, or are about to cause, the unauthorized death of fish by means other than fishing and/or the harmful alteration, disruption or destruction of fish habitat to DFO.PACViolations-infractionsPAC.MPO@dfo-mpo.gc.ca and to Observe, Record, Report at 1-800-465-4336 or DFO.ORR-ONS.MPO@dfo-mpo.gc.ca;

2.4.8 Dispose of all anthropogenic debris removed at an appropriate waste management facility as required; and

2.4.9 Works must be conducted in the dry. Follow DFO's interim Codes of Practice for Temporary Cofferdams and Diversion Channels (https://www.dfo-mpo.gc.ca/pnw-ppe/codes/cofferdams-batardeaux-eng.html) and End-of-Pipe Fish Protection Screens for

[6] September 2024 Amendment: Condition 2.4.6 revised for clarity from "Fuel should be stored a minimum of 30 m from any watercourse" to "Store fuel a minimum of 30 m from any watercourse".

Small Water Intakes in Freshwater (https://www.dfo-mpo.gc.ca/pnw-ppe/codes/screen-ecran-eng.html) if isolation and pumping is required. Follow DFO's Code of Practice for Temporary Fords[5] (https://www.dfo-mpo.gc.ca/pnw-ppe/codes/temporary-fords-traversees-temporaires-eng.html).

If works cannot be conducted in the dry due to challenging instream conditions, sediment removal in the wet can occur if all other measures and conditions in Section 2 (as well as outlined in The *Form for Authorization Holders to Request an Amendment to an Authorization* dated September 9, 2024) have been applied[7].

2.5 Avoid removal of riparian vegetation, particularly mature trees, as much as possible. Where removal of riparian vegetation is not avoidable:

2.5.1 Prune or top the vegetation instead of grubbing/uprooting;

2.5.2 Construct access points and approaches perpendicular to the watercourse;

2.5.3 Rehabilitate areas of the streambank disturbed during the works to a stable condition (e.g., sloped and contoured and protected from erosion);

2.5.4 Re-vegetate disturbed areas with native trees, shrubs and grasses species suitable for the site; and

2.5.5 Where possible, incorporate bioengineering (i.e., pocket planting, live staking, root wad placement, etc.) within the bank restoration and erosion protection designs.

2.6 Avoid the installation of riprap bank slopes to the extent practicable.

2.7 Avoid works, undertakings or activities in Critical Habitat (as defined under the *Species at Risk Act*), or the handling or harm of species listed as Threatened or Endangered under the *Species at Risk Act*. If these aforementioned works, undertakings or activities are required, works must stop and Proponent shall contact DFO for additional guidance and/or permitting.

2.8 Contingency measures shall be put in place if monitoring required in section 3 below indicates that the measures and standards to avoid and mitigate impacts to fish and fish habitat are not successful.

2.9 Dates by which these measures and standards shall be implemented: Measures and standards to avoid and mitigate impacts to fish and fish habitat shall be implemented prior to the initiation of works, undertakings or activities.

[7] September 2024 Amendment: Condition 2.4.9 revised to allow for sediment removal in cases where only partial isolation can be obtained.

3. Conditions that relate to monitoring and reporting of measures and standards to avoid and mitigate impacts to fish and fish habitat.

3.1 Monitoring of avoidance and mitigation measures: The Proponent shall monitor the implementation of avoidance and mitigation measures referred to in section 2 of this authorization and report to DFO, within 30 days post-construction, and indicate whether the measures and standards to avoid and mitigate impacts to fish and fish habitat were conducted according to the conditions of this authorization. This shall be done by:

3.1.1 Demonstration of effective implementation and functioning: Providing dated photographs and inspection reports to demonstrate effective implementation and functioning of mitigation measures and standards described above to limit the impacts to fish and fish habitat to what is covered by this authorization; and

3.1.2 Contingency measures: Providing details of any contingency measures that were followed, to prevent impacts greater than those covered by this authorization in the event that mitigation measures did not function as described.

3.2 Other monitoring and reporting conditions:

3.2.1 Providing dated photographs of each debris removal, inspection reports and details outlining how each condition of this Authorization was met, and whether avoidance and mitigation measures were effective in reducing or limiting serious harm to fish to what is authorized herein;

3.2.2 Providing a geospatial polygon that accurately represents the completed HADD footprint(s). Geospatial polygon data should be collected using WGS 1984 to four (4) decimal places (e.g., 28.5234ºN, 80.6830ºW). Geospatial polygon data must be supplied in Shape File (.shp) format to ReferralsPacific@dfo-mpo.gc.ca with reference to DFO file: 22-HPAC-01308. In addition to the geospatial polygon, the following data must also be supplied in an Excel file (i.e., metadata):

- The date of sediment/debris removal, the type of debris removed (e.g., log jam, boulders etc.), the watercourse of removal, the coordinates of removal, if leaks or spills of deleterious substances were documented and mitigation measures to contain and clean leaks and spills;
- The type of HADD (e.g., riparian removal, aquatic footprint, etc.), the date of the HADD, and HADD area per habitat type (based on depth during high and low water seasons, high water mark); and
- Brand name and model of GPS unit, the coordinate system used, and guaranteed accuracy of GPS unit.

3.2.3 Providing a summary of observational mortality for the death of fish (e.g., eggs, alevins, fry) by means other than fishing related to the works, undertakings or activities.

3.2.4 Providing a summary of the fish salvaged. The information summarized shall include dates, the number of individuals salvaged, the location of salvage and relocation, and the nature of any effects to fish salvaged (capture, death, sub-lethal harm, etc.).

3.2.5 Providing details of any contingency measures that were followed, should prescribed mitigations not function as intended, to contain the impacts to fish and fish habitat to that which is authorized herein.

4. Conditions that relate to offsetting

4.1 Upon receipt and review of the monitoring results and supporting documentation outlined in section 3 above, DFO will determine whether offsetting is required.

4.2 If offsetting is required, the Proponent shall prepare a draft offsetting plan, consistent with the DFO's *Policy for Applying Measures to Offset Adverse Effects on Fish and Fish Habitat Under the Fisheries Act* and *Applicant's Guide Supporting the "Authorizations Concerning Fish and Fish Habitat Protection Regulations"* and provide it to DFO within 45 days of receipt that an Offsetting Plan is required.

4.3 If offsetting is required, the offsetting plan shall include the information identified in Schedule 1, Section 16 of the *Authorizations Concerning Fish and Fish Habitat Protection Regulations*, including an offsetting effectiveness monitoring plan.

4.4 Once acceptable to DFO, the offsetting plan shall be implemented with any additional requirements from DFO.

Authorization Limitations and Application Conditions

The Proponent is solely responsible for plans and specifications relating to this authorization and for all design, safety and workmanship aspects of all the works associated with this authorization.

The holder of this authorization is hereby authorized under the authority of Paragraphs 34.4(2)(b) and 35(2)(b) of the *Fisheries Act*. R.S.C., 1985, c.F-14, to carry on the work(s), undertaking(s) and/or activity(ies) that are likely to result in impacts to fish and fish habitat as described herein.

This authorization does not purport to release the applicant from any obligation to obtain permission from or to comply with the requirements of any other regulatory agencies.

This authorization does not permit the deposit of a deleterious substance in water frequented by fish. Subsection 36(3) of the *Fisheries Act* prohibits the deposit of any deleterious substances into waters frequented by fish unless authorized by regulations made by Governor in Council.

It is also your *Duty to Notify* DFO if you have caused, or are about to cause, the unauthorized death of fish by means other than fishing and/or the harmful alteration, disruption or destruction of fish habitat. Such

notifications should be directed to DFO.PACViolations-InfractionsPAC.MPO@dfo-mpo.gc.ca **and** to Observe, Record, Report at 1-800-465-4336 or DFO.ORR-ONS.MPO@dfo-mpo.gc.ca.

The failure to comply with any condition of this authorization constitutes an offence under Paragraph 40(3)(a) of the *Fisheries Act*, and may result in charges being laid under said Act.

A copy of this authorization should be kept on site while the work is in progress and upon request be provided to relevant federal or provincial officials. The authorization holder is responsible for ensuring work crews are familiar with, and able to adhere to, the conditions.

This authorization cannot be transferred or assigned to another party. If the work(s), undertaking(s) or activity(ies) authorized to be conducted pursuant to this authorization are expected to be sold or transferred, or other circumstances arise that are expected to result in a new Proponent taking over the work(s), undertaking(s) or activity(ies), the Proponent named in this authorization shall advise DFO in advance.

Date of Issuance: September 17, 2024

Approved by: Rotinsky, Brenda Digitally signed by Rotinsky, Brenda Date: 2024.09.17 15:22:34-07'00'

Brenda Rotinsky
Watershed Operations Regulatory Manager
Fish and Fish Habitat Protection Program
Fisheries and Oceans Canada

APPENDIX F

WSA WORK EXTENSION MEMO

Keystone Environmental
Knowledge-Driven Results

September 13, 2024

Ministry of Environment and Climate Change Strategy - Surrey
200 – 14070 152 St
Surrey, BC V3R 0Y3

Attn: Thyren Jacobs

Re: Lagace Creek Instream Works – Works After September 15, 2024
CR14 and CR17 – WSA Approvals 2011310 and 2011242
File No.: 19279

BACKGROUND

This letter report is regarding the instream works, specifically flood mitigation via sediment removal and bank stabilization on Lagace Creek in the Hatzic region of the Fraser Valley Regional District. These works were authorized in two locations under *Water Sustainability Act* (WSA) Change Approval 2011310 and Change Approval 2011242.

Approval 2011310 was issued for location CR14, near the bridge crossing Lagace Creek on Dale Road, over a reach from approximately 550 m downstream to 70 m upstream of the bridge. Approval 2011242 was issued for the areas approximately 90 m north of Lundgren Road at Sylvester Road, and approximately 350 m north of Lundgren Road at Sylvester Road. In addition, works at both locations were permitted under *Fisheries Act* Authorization 22-HPAC-01308.

The WSA Approvals stipulate that the instream works occur during the reduced risk instream work window, from August 1 to September 15, with an extended work window potentially available based on project justification and risk subject to Qualified Environmental Professional (QEP) advice. Paragraph (2) h. (i-iv) of the WSA Approvals details the QEP advice required.

Instream works are proposed to occur after September 15 due to delays in completion of works. Completion of works was delayed as, for a significant portion of the reduced risk instream work window, water levels within Legace Creek (i.e., during the instream works window) were too high to for the contractor to meet the *Fisheries Act* Authorization requirement of works being conducted in the dry.

A combination of isolation of excavation areas in Lower Lagace Creek (CR14) (i.e., utilizing a combination of "super sacks" filled with sand, poly sheeting, and steel road plating) in conjunction with dewatering (i.e., via multiple 6-inch diameter suction pumps) was not able to successfully dewater excavation areas. Incoming water, despite isolation measures, exceeded the pumps' capacity to evacuate the water until September 12, after which water levels decreased allowing permit conditions to be met.

Presented below is a rationale for not pursuing works at the north removal area of CR17 and for pursuing works at the south removal area of CR17 as well as CR14. The provided rationale addresses the requirements of the WSA Approvals.

Suite 320-4400 Dominion Street
Burnaby, BC V5G 4G3 | Canada
Ph: 604.430.0671
Fax: 604.430.0672
Email: KeyInfo@KeystoneEnvironmental.ca
Web: KeystoneEnvironmental.ca

CR17 NORTH EXCAVATION

The north removal area at CR17 would require extensive vegetation removal for access to sediment removal areas. In addition, the north removal area at CR17 contains complex stream habitat (i.e., multiple channels around a gravel island, undercut banks, extensive woody debris along the stream bank) which would require intensive salvage efforts to mitigate risk to fish and wildlife.

To date, no works have occurred in this location.

Initiating these works after September 15 would increase the risk to fish and wildlife values, as detailed below:

- In general, due to the relatively higher habitat values represented by this site, the potential severity of environmental impacts is much higher;
- This area represents sensitive fish and wildlife habitat values for several species of management concern including species at risk that have been observed near the Site (i.e. western toad and northern red legged frog);
- Significantly greater time and effort would be required to adequately salvage for amphibians within the vegetated area prior to works starting as cooler weather and additional moisture from rains would facilitate increased dispersal by amphibians;
- This work site is at greater risk from to inclement weather (i.e., increased precipitation and winds) which can create cascading effects on works:
  - increased stream flows increase the risk of flow fluctuations which could overwhelm pump capacity and fish and wildlife isolation fencing;
  - increased prevalence of leaf litter would increase the risk of accumulations at fencing and pump intakes compromising isolation;
  - erosion and sediment control risk would be increased – significant clearing of currently vegetated areas would be required for laydown, sediment stockpiling and loading of trucks, creating large areas of erosion potential;
  - return of adult salmon – increased rain can trigger return of adult salmon to streams for spawning;
- Preliminary discussions of completing the work indicated that multiple "throws" of material from the far side of the excavation would be required to reach the load out point, which increases sedimentation risk and requires machinery to repeatedly cross a bypassed stream channel. Any failure of the bypass or isolation would create large increases in suspended sediments with associated impacts to fish and wildlife as well as their associated habitat;

Adequate additional measures to compensate for the above risks will result in an increased footprint of the works, and negatively affect the sensitive fish and wildlife habitat that are present. Therefore, it is Keystone Environmental's assessment that works at the north removal area at CR17 should not proceed past September 15 consistent with best management practices as well as the terms and conditions of the existing permitting documents.

CR14 AND SOUTH CR17

In general, CR14 and South CR17 are associated with roadside access which has been previously cleared. As such, habitat values at these locations are less sensitive to disturbance in association with proposed works. It is Keystone Environmental's assessment that implementation of the measures described below can address any increase in risk to fish, wildlife, or their habitat associated with completed the proposed works after September 15.

The following advice can effectively mitigate the risks in these locations.

Timing Of Works

Generally, based on expected conditions, isolation and dewatering of the works areas is considered feasible past September 15 without additional impacts to environmental values. Background water quality has been consistently measured below 4.0 NTU with a dissolved oxygen of 8.0mg/L or higher. No changes to channel stability have been noted since the beginning of the works.

Fish and amphibian salvages during the works to date have captured and relocated numerous organisms, including native species such as coho (*Oncorhynchus kisutch*), chinook (*O. tshawytscha*), rainbow trout (*O. mykiss*), cutthroat trout (*O. clarkii clarkii*), prickly sculpin (*Cottus asper*), threespine stickleback (*Gasterosteus aculeatus*), signal crayfish (*Pacifastacus leniusculus*), Pacific lamprey (*Lampetra tridentata*), and red legged frog *(Rana aurora*). Invasive species have included pumpkinseed (*Lepomis gibbosus*), large mouth bass (*Micropterus salmoides*), green frog (*Lithobates clamitans*) and bull frog (*Lithobates catesbeianus*). To date, no adult salmon have been observed within Lagace Creek.

If current conditions persist, water levels are expected to stay low or continue to decrease, with minimal erosion concerns during active works.

Construction Mitigation

All instream works occurring after September 15 will be subject to full time environmental monitoring, consistent with monitoring efforts to date. Fish and wildlife salvage crews will perform salvages prior any vegetation removal and dewatering works and will also perform active salvaging during excavation works as necessary.

All stockpiles and exposed areas will be covered at the end of each workday. All areas in which works are completed will be covered with poly sheeting (cocomatting in areas specified by design drawings) until restoration and planting works occur.

Works will not occur during periods of significant rainfall (forecasted rain events of 25 mm or more within a 24-hour period). Additional poly sheeting, silt fencing and "super sacks" will be on Site to cover exposed slopes/soils and sediment stockpiles, and to reinforce stream isolation. If multiple days of continuous significant rain are forecast, works preparing new removal areas will not be initiated to eliminate the risk of blowouts of instream isolation from rising water levels and minimize the erosion risk of exposed soils.

ADDITIONAL WORKS DURATION

Completing the instream works at CR14 and the south (smaller) excavation at CR17 is expected to take no more than 15 additional days, weather permitting. Works are anticipated to be completed by September 30. Within this timeframe, in response to rainfall, it may be required to pause works to allow water levels to recede before resuming dewatering and excavation.

If you have any questions, please contact the undersigned.

Sincerely,

Keystone Environmental Ltd.



Jeff Prowse, R.P.Bio.
Project Manager

Jeremy Nilson, R.P.Bio.
Senior Project Manager

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APPENDIX K – SUBSTANTIAL PERFORMANCE

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Associated Engineering (B.C.) Ltd.
500 - 2889 East 12th Avenue
Vancouver, BC V5M 4T5 Canada
www.ae.ca

TEL: 604.293.1411

March 5, 2026
Reference/Project No.: 2022-2632-03

Amy Vallarino
Senior Project Manager, Environmental Disaster Operations Team
Ministry of Environment and Parks
PO Box 9337 Provincial Government
Victoria, BC V8W 9M1

Re: HATZIC EMERGENCY WORKS PROGRAM - LAGACE CREEK S-CR-14/17
CONTRACT NO. MWK25EPFLOOD0001
CERTIFICATE OF SUBSTANTIAL COMPLETION

Dear Amy:

Attached is the Certificate of Completion for the above noted project for QM LP, dba QM Environmental (QM Environmental). As per Section 7(3) of the Builders Lien Act (the Act), the contract has been substantially completed. Associated Engineering (B.C.) Ltd. (Associated) agrees to set the date for Substantial Performance as August 12, 2025. The request for certification of completion was received on February 23, 2026, with final documentation received August 15, 2025. As per Section 8(1) of the Act, the holdback period expires at the end of 55 days after the certificate's issuance (today): April 29, 2026.

As per Section 7(4)(c) of the Act, a Notice of Certification of Completion will be posted on-site.

Should you require any additional information regarding the above, please contact the undersigned.

Yours truly,

Alyson Meyers, P.Eng.
Contract Administrator

AM

cc: Michael Bailey, QM Environmental

BRITISH COLUMBIA

Natural Resource Ministries

Contract Completion Certificate

PROJECT NAME AND LOCATION:	CONTRACT/ FILE NO. MWK25EPFLOOD0001
MINISTRY: Ministry of Environment and Parks	
CONTRACTOR: QM LP, dba QM Environmental	
CONTRACTOR'S ADDRESS: 200 – 5035 South Service Road, Burlington, ON L7L 6M9	
DESCRIPTION OF WORK: Creek remediation work, including sediment removal, bank restoration, and erosion protection. .	

MINISTRY REPRESENTATIVE: *Choose one of the following by placing a check mark in the appropriate box.*

☐ This is to certify that, as of _____, 20___, "**Total Performance of the Work**" has been met to the Province's satisfaction in accordance with the Contract Document and the Agreement dated _____, 20___. Any outstanding monies due to the Contractor will be processed for payment upon receipt of a final payment claim by the Contractor, subject to satisfaction of any outstanding contract conditions.

☒ This is to certify that, as of _____August 12_____, 2025_, "**Substantial Performance of the Work**" has been met to the Province's satisfaction in accordance with the Contract Document and the Agreement dated _____August 23_____, 2024_. The following is a list of deficiencies and/or outstanding work that must be completed by the Contractor prior to the Province certifying "Total Performance of the Work":

n/a

CONTRACT COORDINATOR: To be Completed for Management Consulting Contracts:

Action plan for implementing recommendations required: **YES** ☐; **NO** ☐

(Required when recommendations are accepted and the significance of the issues involved warrants it.)

Developing and monitoring the action plan will be the responsibility of :

DATED THE _5th__ DAY OF __March_____, 2026_____	MINISTRY REPRESENTATIVE'S SIGNATURE

DISTRIBUTION: **Original** to Contract File Copy to Contractor

APPENDIX L – RECORD DRAWINGS

SHEET LIST TABLE

SHEET	DRAWING NAME	REVISION	DRAWING TITLE	DRAWING DESCRIPTION
GENERAL				
1	2632-03-G-3001	3	COVER PAGE	
2	2632-03-G-3002	3	LEGEND	
CIVIL				
3	2632-03-C-3101	3	PLAN	S-CR-14 SEDIMENT REMOVAL
4	2632-03-C-3102	3	PLAN	S-CR-14 PROPOSED SAND RECOVERY STATIONS
5	2632-03-C-3103	3	PLAN	S-CR-14 SEDIMENT REMOVAL EXTENTS
6	2632-03-C-3104	3	PLAN	S-CR-14 EROSION PROTECTION
7	2632-03-C-3501	3	DETAIL 1 OF 5	EXISTING SAND RECOVERY STATION
8	2632-03-C-3502	3	DETAIL 2 OF 5	PROPOSED SAND RECOVERY STATION
9	2632-03-C-3503	3	DETAIL 3 OF 5	BANK PROTECTION
10	2632-03-C-3504	3	DETAIL 4 OF 5	FENCE AND GATE INSTALLATION
11	2632-03-C-3505	3	DETAIL 5 OF 5	DENSE LIVE STAKING

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY HATZIC EMERGENCY WORKS PROGRAM LAGACE CREEK - SITE S-CR-14/17

PLOT DATE: 3/13/2026 12:50:18 PM
SAVE DATE: 2/23/2026 11:41:16 AM SAVED BY: ROZONJ
DWG PATH: \\ae.ca\data\working\van\2022-2632-03\civil\model (for cad_civil3d only)\2632-03-g-3001.dwg

Associated Engineering

BEST MANAGED COMPANIES
Platinum member

BRITISH COLUMBIA

BC MINISTRY OF ENVIRONMENT
AND CLIMATE CHANGE STRATEGY
HATZIC EMERGENCY
WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

THE INFORMATION CONTAINED ON THESE DRAWINGS ORIGINATED FROM SOURCES OTHER THAN THE DESIGN PROFESSIONAL AND ASSOCIATED ENGINEERING (B.C.) LTD. DOES NOT WARRANT OR REPRESENT THAT SUCH INFORMATION IS ACCURATE OR REPRESENTS THE ORIGINAL DESIGN AS CONTAINED IN THE CONTRACT DOCUMENTS.

REV	DATE	DESIGN	DRAWN	DESCRIPTION
3	2026MAR13	R. KARSGAARD	J. ROZON	ISSUED FOR RECORD
2	2024AUG23	R. KARSGAARD	J. ROZON	ISSUED FOR CONSTRUCTION
1	2024JUL11	R. KARSGAARD	J. ROZON	ISSUED FOR RFP AND PERMITTING
0	2024JUN14	R. KARSGAARD	J. ROZON	ISSUED FOR RFP

DRAWING	REVISION	SHEET
2632-03-G-3001	3	1

IF NOT 50 mm ADJUST SCALES
50 mm

SCALE(S) SHOWN ARE INTENDED FOR ANSI D (22X34) SIZE DRAWINGS, TABLOID (11X17) SIZE DRAWINGS ARE 1/2 OF SCALE(S) SHOWN UNLESS NOTED OTHERWISE

ROAD

EXISTING	DESIGN	
	100+000	CONTROL LINE
		GRAVEL ROAD
		EDGE OF PAVEMENT
		CURB (ACTUAL WIDTH)
		SIDEWALK (ACTUAL WIDTH)
		CURB DEPRESSION
		GUIDE RAIL

PROFILE VIEW

EXISTING	DESIGN	
		GROUND
		WATER MAIN
		SANITARY SEWER
		STORM SEWER

SURVEY

EXISTING	DESIGN	
HUB		SURVEY HUB
MON		MONUMENT
IP		IRON PIN
IPF		IRON PIN (FOUND)
LP		LEAD PLUG
U		UNIDENTIFIED MANHOLE
MW		MONITORING WELL
PZ		PIEZOMETER
OW		OBSERVATION WELL

CONTOUR

EXISTING	DESIGN	
		MAJOR
		MINOR

PROPERTY

EXISTING	DESIGN	
		PARCEL / LOT LINE
		EASEMENT
		STATUTORY ROW
		ROAD ROW

GAS / OIL

EXISTING	DESIGN	
G	G	GAS
OIL	OIL	OIL
		VAULT BOX
		VALVE BOX
		MANHOLE
		METER

WATER

EXISTING	DESIGN	
W	W	WATER MAIN
F	F	FIRE SUPPRESSION
IR	IR	IRRIGATION
RW	RW	RAW WATER
PW	PW	POTABLE WATER
		VAULT BOX
FH	FH	FIRE HYDRANT
		MANHOLE
		METER CHAMBER
		CROSS FLANGE
		TEE FLANGE
		END CAP / PLUG
		GATE VALVE
		THRUST BLOCK
		45 DEGREE ELBOW
		90 DEGREE ELBOW
		WYE
ENS	ENS	ENCASEMENT
		WATER LEVEL
		COUPLING
		REDUCER
		WELL
CS	CS	CURB STOP / CURB BOX

SANITARY SEWER

EXISTING	DESIGN	
SS	SS	SANITARY SEWER
FM	FM	SANITARY FORCEMAIN
COMB	COMB	SANITARY COMBINED SEWER
		MANHOLE
		COMBINED MANHOLE
		VALVE CHAMBER
		CLEANOUT
		VALVE BOX
		FLOW DIRECTION
LS	LS	LIFT / PUMP STATION

COMMUNICATIONS / TELEPHONE

EXISTING	DESIGN	
CATV	CATV	CABLE
FO	FO	FIBRE OPTIC CABLE
T	T	TELEPHONE / LINE
UT	UT	UNDERGROUND TELEPHONE
		COMMUNICATIONS VAULT BOX
		TELEPHONE MANHOLE
		TELEPHONE VAULT BOX
		COMMUNICATIONS MANHOLE
		TELEPHONE PEDESTAL

STORM DRAINAGE

EXISTING	DESIGN	
CP	CP	CULVERT (Ø AND TYPE)
D	D	STORM SEWER
CB	CB	CATCH BASIN
DCB	DCB	DOUBLE CATCH BASIN
DICB	DICB	DITCH INLET CATCH BASIN
CB	CB	CATCH BASIN / MANHOLE
LB	LB	LAWN BASIN
		MANHOLE
STC	STC	STORMCEPTOR
		OIL INTERCEPTOR
		VALVE BOX
CI	CI	CULVERT INLET
CO	CO	CULVERT OUTLET
		HEADWALL
		DITCH FLOW

ELECTRICAL / POWER

EXISTING	DESIGN	
P	P	POWER / COMM / CONDUIT
OP	OP	OVERHEAD POWER
UP	UP	UNDERGROUND POWER
		VAULT / HYDRO BOX
PB	PB	PULL BOX
J	J	JUNCTION BOX
TV	TV	TRANSFORMER VAULT MANHOLE
TP	TP	TRANSFORMER PAD
M	M	METER
E	E	MANHOLE
		LIGHT / LAMP STANDARD
		HYDRO / UTILITY POLE
		GUY WIRE
SIG	SIG	SIGNAL
SIG	SIG	SIGNAL WITH OVERHEAD ARM

MISCELLANEOUS

EXISTING	DESIGN	
X	X	FENCE
O	O	SILT FENCE
ABN		ABANDONED PIPE
		BOTTOM OF BANK
		TOP OF BANK
EW		EDGE OF WATER
		BUILDING
		200 YEAR FLOOD EXTENTS
		PROJECT EXTENTS
		PROJECT FOOTPRINT
		PROPOSED SAND RECOVERY STATION
		DENSE LIVE STAKING
		COCONUT MATTING

MISCELLANEOUS

EXISTING	DESIGN	
MAXIMUS CREEK		CREEK (OVER 3 m WIDE) (WIDTH OF CREEK SHOWN TO SCALE)
TP	TP	TEST PIT
BH	BH	BORE HOLE
FP	FP	FLAG POLE
PM	PM	PARKING METER
MB	MB	MAILBOX
		BOULDER
		RAILWAY SIGNAL LIGHT
BO	BO	POST/BOLLARD (ANNOTATE AS REQUIRED)
		NO POST BARRIER / JERSEY BARRIER (SCALE AS REQUIRED)
		SIGN
		GATE
		BUSH
		TREE (DECIDUOUS) (SCALE AS REQUIRED)
		TREE (CONIFEROUS) (SCALE AS REQUIRED)
EL 1000	100.000	SPOT ELEVATION
% 2 1	% 2 1	SLOPE
213.5 214.0 214.5		GRID, CO-ORDINATE REGISTRATION

HATCH PATTERNS

- EXISTING SAND RECOVERY STATION
- PROPOSED SAND RECOVERY STATION
- EXISTING RIPRAP
- LIVE STAKE CLUSTERS
- SOIL
- SEDIMENT REMOVAL
- PERMANENT GRAVEL
- TEMPORARY GRAVEL
- COCONUT MATTING AND HYDRAULIC SEEDING

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Associated Engineering

BEST MANAGED COMPANIES Platinum member

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BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: NTS

BRITISH COLUMBIA

GENERAL LEGEND

DRAWING	REVISION	SHEET
2632-03-G-3002	3	2

IF NOT 50 mm ADJUST SCALES
50 mm

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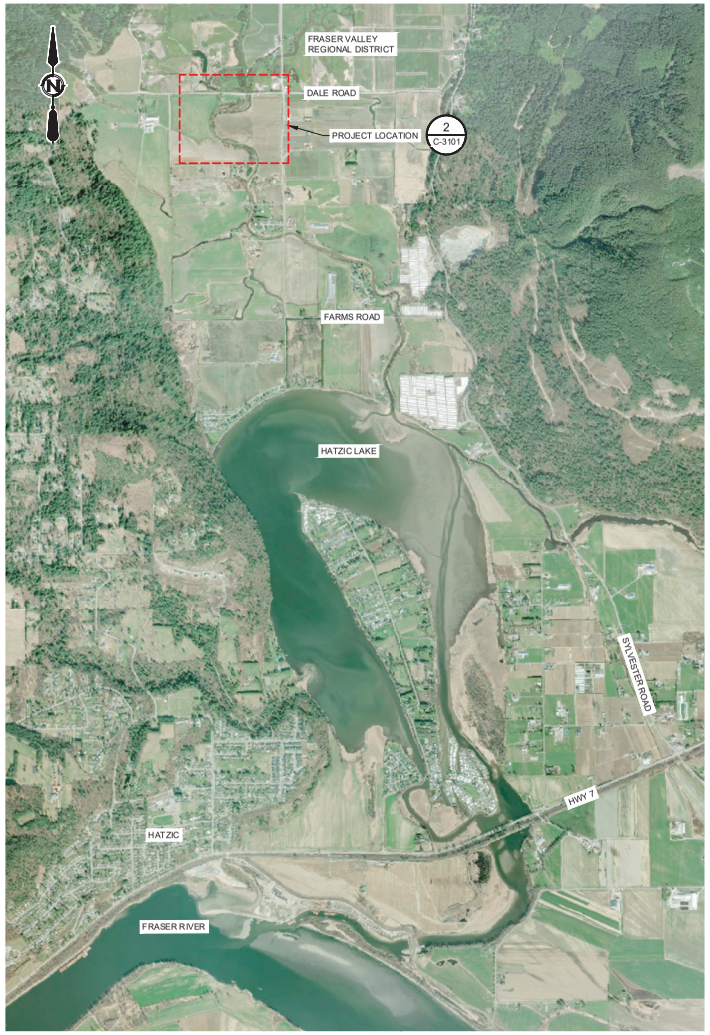

1 C-3101 PLAN NTS
REGIONAL AREA

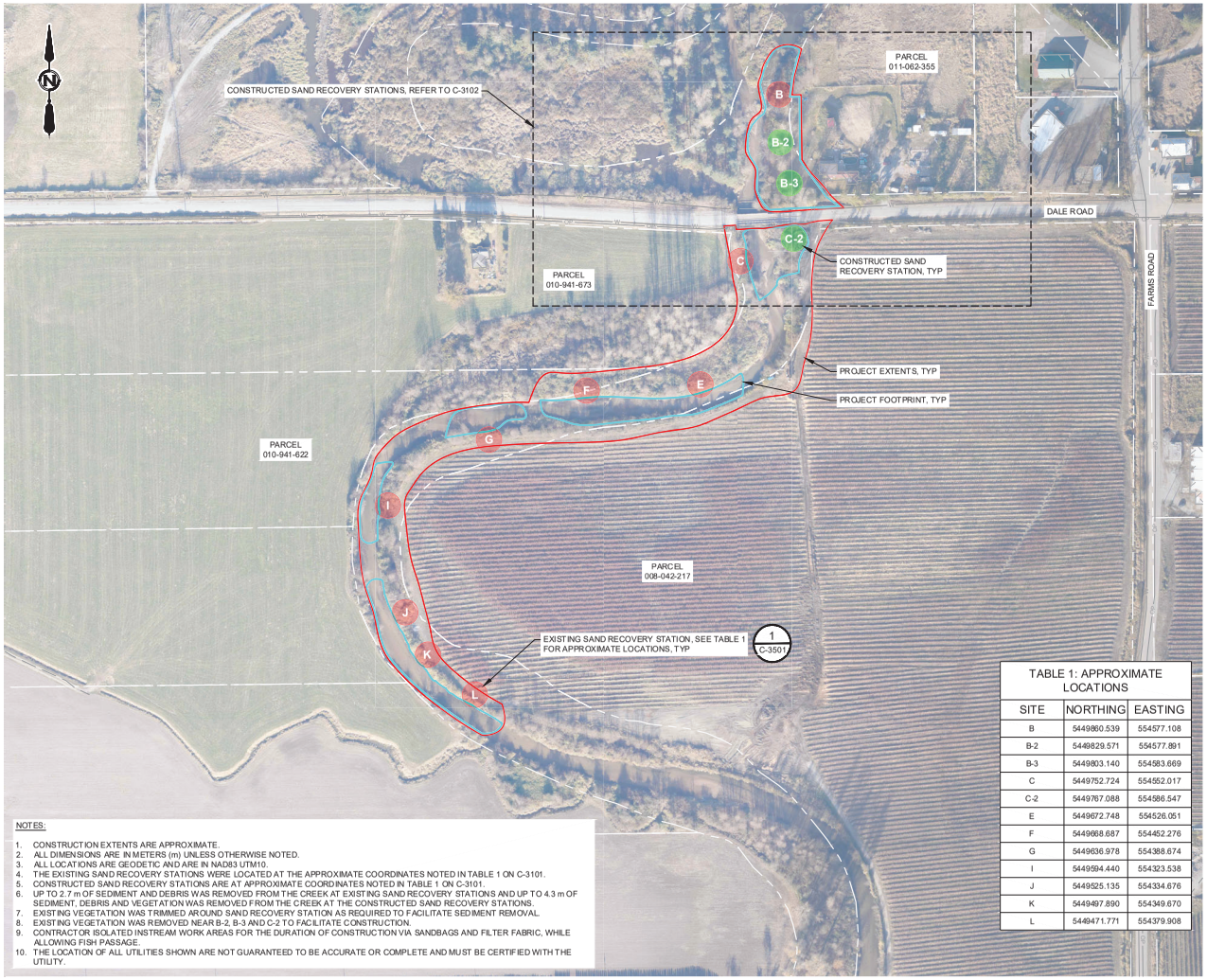

TABLE 1: APPROXIMATE LOCATIONS

SITE	NORTHING	EASTING
B	5449860.539	554577.108
B-2	5449829.571	554577.891
B-3	5449803.140	554583.669
C	5449752.724	554552.017
C-2	5449767.088	554586.547
E	5449672.748	554526.051
F	5449668.687	554452.276
G	5449636.978	554388.674
I	5449594.440	554323.538
J	5449525.135	554334.676
K	5449497.890	554349.670
L	5449471.771	554379.908

NOTES:

1. CONSTRUCTION EXTENTS ARE APPROXIMATE.
2. ALL DIMENSIONS ARE IN METERS (m) UNLESS OTHERWISE NOTED.
3. ALL LOCATIONS ARE GEODETIC AND ARE IN NAD83 UTM10.
4. THE EXISTING SAND RECOVERY STATIONS WERE LOCATED AT THE APPROXIMATE COORDINATES NOTED IN TABLE 1 ON C-3101.
5. CONSTRUCTED SAND RECOVERY STATIONS ARE AT APPROXIMATE COORDINATES NOTED IN TABLE 1 ON C-3101.
6. UP TO 2.7 m OF SEDIMENT AND DEBRIS WAS REMOVED FROM THE CREEK AT EXISTING SAND RECOVERY STATIONS AND UP TO 4.3 m OF SEDIMENT, DEBRIS AND VEGETATION WAS REMOVED FROM THE CREEK AT THE CONSTRUCTED SAND RECOVERY STATIONS.
7. EXISTING VEGETATION WAS TRIMMED AROUND SAND RECOVERY STATION AS REQUIRED TO FACILITATE SEDIMENT REMOVAL.
8. EXISTING VEGETATION WAS REMOVED NEAR B-2, B-3 AND C-2 TO FACILITATE CONSTRUCTION.
9. CONTRACTOR ISOLATED INSTREAM WORK AREAS FOR THE DURATION OF CONSTRUCTION VIA SANDBAGS AND FILTER FABRIC, WHILE ALLOWING FISH PASSAGE.
10. THE LOCATION OF ALL UTILITIES SHOWN ARE NOT GUARANTEED TO BE ACCURATE OR COMPLETE AND MUST BE CERTIFIED WITH THE UTILITY.

2 C-3101 PLAN 1:1500
PROJECT LOCATION

PLOT DATE: 3/13/2026 12:53:50 PM
SAVE DATE: 2/23/2026 11:44:46 AM SAVED BY: ROZONJ
DWG PATH: \\aecad\data\working\ran\2022-2632-03\civil\model (for cad_civil3d only)\2632-03-c-3101.dwg

Associated Engineering

CANADA BEST MANAGED COMPANIES
Platinum member

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0	2024JUN14	R. KARSGAARD	J. ROZON	ISSUED FOR RFP

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: AS SHOWN

BRITISH COLUMBIA

CIVIL
PLAN
S-CR-14 SEDIMENT REMOVAL

DRAWING	REVISION	SHEET
2632-03-C-3101	3	3

IF NOT 50 mm ADJUST SCALES
50 mm

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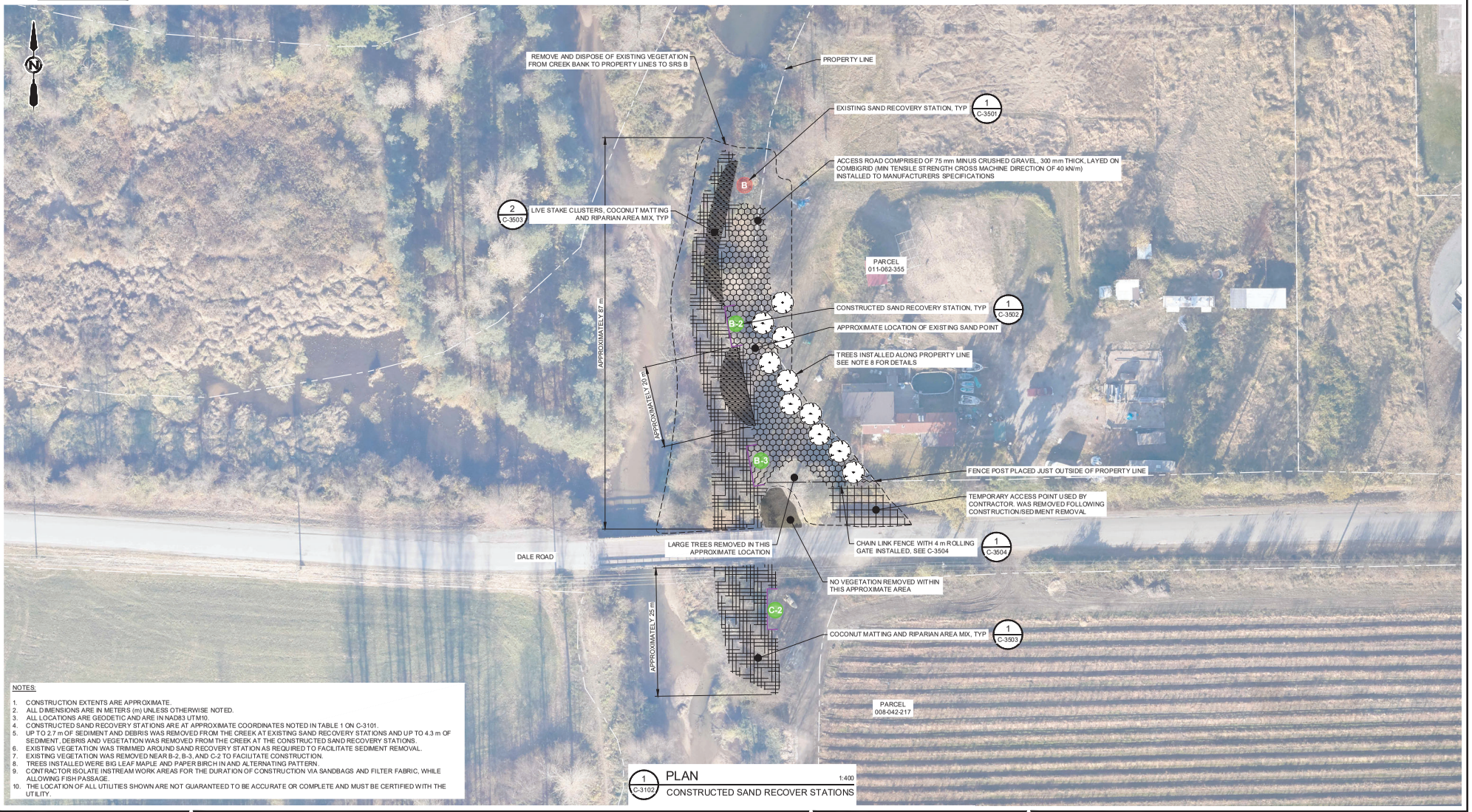

NOTES:

1. CONSTRUCTION EXTENTS ARE APPROXIMATE.
2. ALL DIMENSIONS ARE IN METERS (m) UNLESS OTHERWISE NOTED.
3. ALL LOCATIONS ARE GEODETIC AND ARE IN NAD83 UTM10.
4. CONSTRUCTED SAND RECOVERY STATIONS ARE AT APPROXIMATE COORDINATES NOTED IN TABLE 1 ON C-3101.
5. UP TO 2.7 m OF SEDIMENT AND DEBRIS WAS REMOVED FROM THE CREEK AT EXISTING SAND RECOVERY STATIONS AND UP TO 4.3 m OF SEDIMENT, DEBRIS AND VEGETATION WAS REMOVED FROM THE CREEK AT THE CONSTRUCTED SAND RECOVERY STATIONS.
6. EXISTING VEGETATION WAS TRIMMED AROUND SAND RECOVERY STATION AS REQUIRED TO FACILITATE SEDIMENT REMOVAL.
7. EXISTING VEGETATION WAS REMOVED NEAR B-2, B-3, AND C-2 TO FACILITATE CONSTRUCTION.
8. TREES INSTALLED WERE BIG LEAF MAPLE AND PAPER BIRCH IN AND ALTERNATING PATTERN.
9. CONTRACTOR ISOLATE INSTREAM WORK AREAS FOR THE DURATION OF CONSTRUCTION VIA SANDBAGS AND FILTER FABRIC, WHILE ALLOWING FISH PASSAGE.
10. THE LOCATION OF ALL UTILITIES SHOWN ARE NOT GUARANTEED TO BE ACCURATE OR COMPLETE AND MUST BE CERTIFIED WITH THE UTILITY.

1 C-3102 PLAN 1:400
CONSTRUCTED SAND RECOVER STATIONS

PLOT DATE: 3/13/2026 12:56:13 PM
SAVE DATE: 2/23/2026 11:46:00 AM SAVED BY: ROZONJ
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Associated Engineering

BEST MANAGED COMPANIES
Platinum member

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BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: AS SHOWN

BRITISH COLUMBIA

CIVIL
PLAN
S-CR-14 PROPOSED SAND RECOVERY STATIONS

DRAWING	REVISION	SHEET
2632-03-C-3102	3	4

IF NOT 50 mm ADJUST SCALES
50 mm

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NOTES:

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2. ALL DIMENSIONS ARE IN METERS (m) UNLESS OTHERWISE NOTED.
3. ALL LOCATIONS ARE GEODETIC AND ARE IN NAD83 UTM10.
4. THE LOCATION OF THE EXISTING SAND RECOVERY STATIONS ARE AT THE APPROXIMATE COORDINATES NOTED IN TABLE 1 ON C-3101.
5. CONSTRUCTED SAND RECOVERY STATIONS ARE AT APPROXIMATE COORDINATES NOTED IN TABLE 1 ON C-3101.
6. UP TO 2.7 m OF SEDIMENT AND DEBRIS WAS REMOVED FROM THE CREEK AT EXISTING SAND RECOVERY STATIONS AND 4.3 m OF SEDIMENT, DEBRIS AND VEGETATION WAS REMOVED FROM THE CREEK AT CONSTRUCTED SAND RECOVERY STATIONS.
7. EXISTING VEGETATION WAS TRIMMED AROUND SAND RECOVERY STATION AS REQUIRED TO FACILITATE SEDIMENT REMOVAL.
8. EXISTING VEGETATION WAS REMOVED AROUND B-2, B-3, AND C-2 TO FACILITATE INSTALLATION.
9. CONTRACTOR ISOLATED INSTREAM WORK AREAS FOR THE DURATION OF CONSTRUCTION VIA SANDBAGS AND FIBER FABRIC, WHILE ALLOWING FISH PASSAGE.
10. THE LOCATION OF ALL UTILITIES SHOWN ARE NOT GUARANTEED TO BE ACCURATE OR COMPLETE AND MUST BE CERTIFIED WITH THE UTILITY.

TABLE 3: APPROXIMATE VOLUME REMOVED

SITE	CUBIC METERS
B	290
B-2 AND B-3	470
C AND C-2	620
E	185
F	320
G	105
I	310
J	450
K	95
L	85
TOTAL	2930

PLOT DATE: 3/13/2026 12:57:30 PM
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Associated Engineering

CANADA BEST MANAGED COMPANIES
Platinum member

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BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: AS SHOWN

BRITISH COLUMBIA

CIVIL
PLAN
S-CR-14 SEDIMENT REMOVAL EXTENTS

DRAWING	REVISION	SHEET
2632-03-C-3103	3	5

IF NOT 50 mm ADJUST SCALES
50 mm

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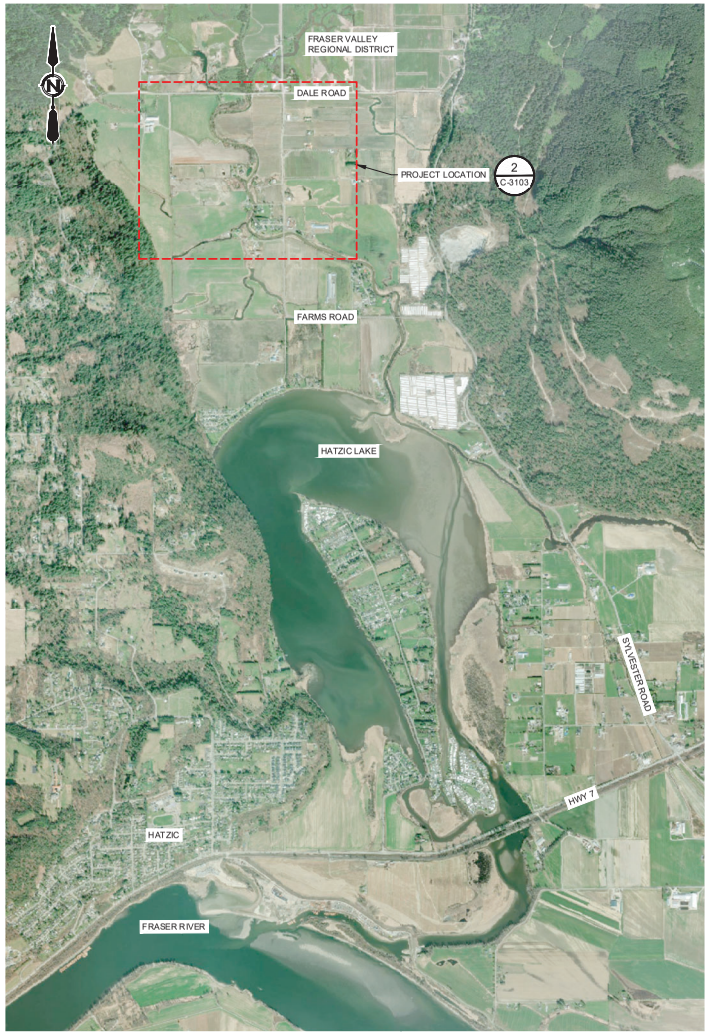
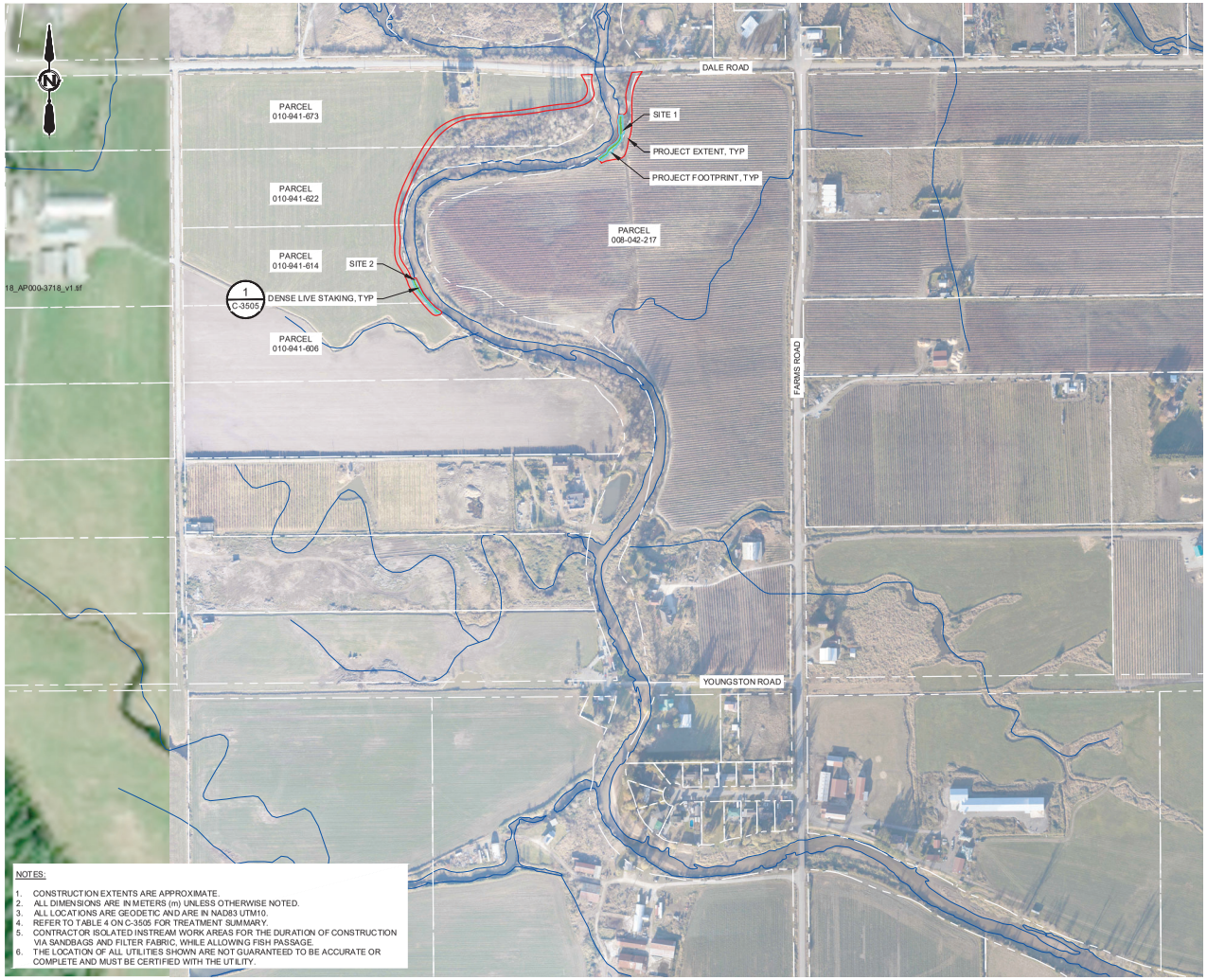


1 C-3103 PLAN NTS
REGIONAL AREA



NOTES:

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2. ALL DIMENSIONS ARE IN METERS (m) UNLESS OTHERWISE NOTED.
3. ALL LOCATIONS ARE GEODETIC AND ARE IN NAD83 UTM10.
4. REFER TO TABLE 4 ON C-3505 FOR TREATMENT SUMMARY.
5. CONTRACTOR ISOLATED INSTREAM WORK AREAS FOR THE DURATION OF CONSTRUCTION VIA SANDBAGS AND FILTER FABRIC, WHILE ALLOWING FISH PASSAGE.
6. THE LOCATION OF ALL UTILITIES SHOWN ARE NOT GUARANTEED TO BE ACCURATE OR COMPLETE AND MUST BE CERTIFIED WITH THE UTILITY.

2 C-3103 PLAN 1:3000
PROJECT LOCATION

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Platinum member

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BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: AS SHOWN

BRITISH COLUMBIA

CIVIL
PLAN
S-CR-14 EROSION PROTECTION

DRAWING	REVISION	SHEET
2632-03-C-3104	3	6

IF NOT 50 mm ADJUST SCALES
50 mm
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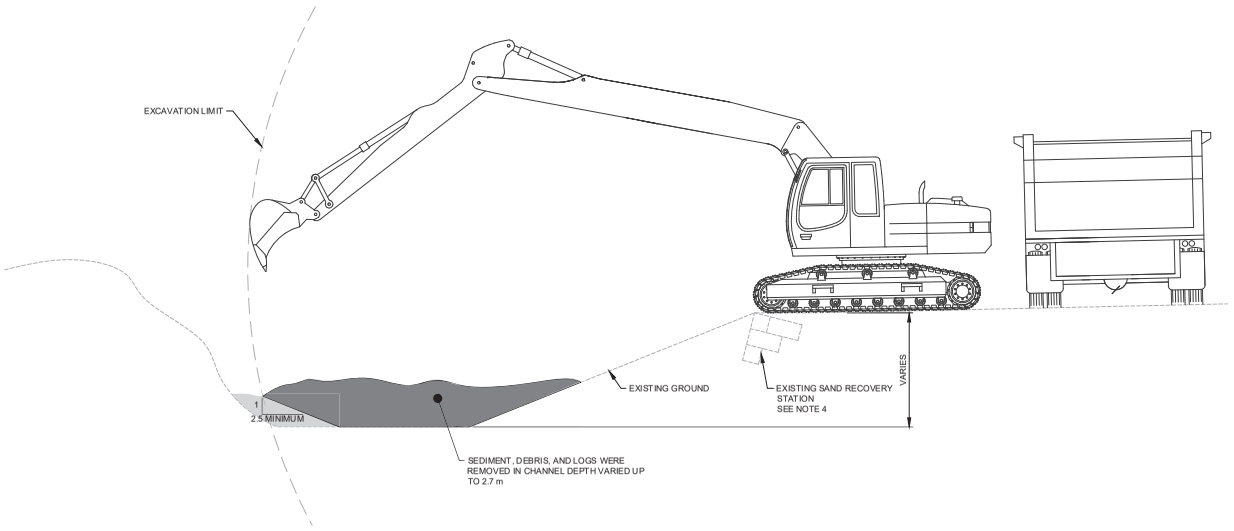

1 TYPICAL DETAIL NTS
EXISTING SAND RECOVERY STATION EXCAVATION

NOTES:

1. CONSTRUCTION EXTENTS ARE APPROXIMATE.
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3. ALL LOCATIONS ARE GEODETIC AND ARE IN NAD83 UTM10.
4. THE LOCATION OF THE EXISTING SAND RECOVERY STATIONS ARE AT THE APPROXIMATE COORDINATES NOTED IN TABLE 1 ON C-3101.
5. CONSTRUCTED SAND RECOVERY STATIONS ARE AT APPROXIMATE COORDINATES NOTED IN TABLE 1 ON C-3101.
6. UP TO 2.7 m OF SEDIMENT AND DEBRIS WAS REMOVED FROM THE CREEK AT EXISTING SAND RECOVERY STATIONS AND UP TO 4.3 m OF SEDIMENT, DEBRIS AND VEGETATION TO BE REMOVED FROM THE CREEK AT CONSTRUCTED SAND RECOVERY STATIONS AS NOTED ON THE DRAWINGS.
7. EXISTING VEGETATION WAS TRIMMED AROUND SAND RECOVERY STATION AS REQUIRED TO FACILITATE SEDIMENT REMOVAL.
8. EXISTING VEGETATION WAS REMOVED NEAR B-2, B-3, AND C-2 TO FACILITATE CONSTRUCTION.
9. CONTRACTOR ISOLATED INSTREAM WORK AREAS FOR THE DURATION OF CONSTRUCTION VIA SANDBAGS AND FILTER FABRIC, WHILE ALLOWING FISH PASSAGE.
10. THE LOCATION OF ALL UTILITIES SHOWN ARE NOT GUARANTEED TO BE ACCURATE OR COMPLETE AND MUST BE CERTIFIED WITH THE UTILITY.

PLOT DATE: 3/13/2026 1:01:03 PM
SAVE DATE: 2/23/2026 11:51:23 AM SAVED BY: ROZONJ
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BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

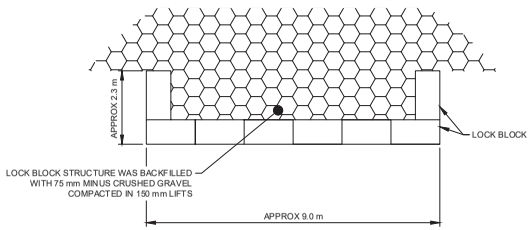
SCALE: AS SHOWN

BRITISH COLUMBIA

CIVIL
DETAIL 1 OF 5
EXISTING SAND RECOVERY STATION

DRAWING	REVISION	SHEET
2632-03-C-3501	3	7

IF NOT 50 mm ADJUST SCALES
50 mm
SCALE(S) SHOWN ARE INTENDED FOR ANSI D (22X34) SIZE DRAWINGS, TABLOID (11X17) SIZE DRAWINGS ARE 1/2 OF SCALE(S) SHOWN UNLESS NOTED OTHERWISE



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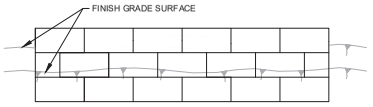

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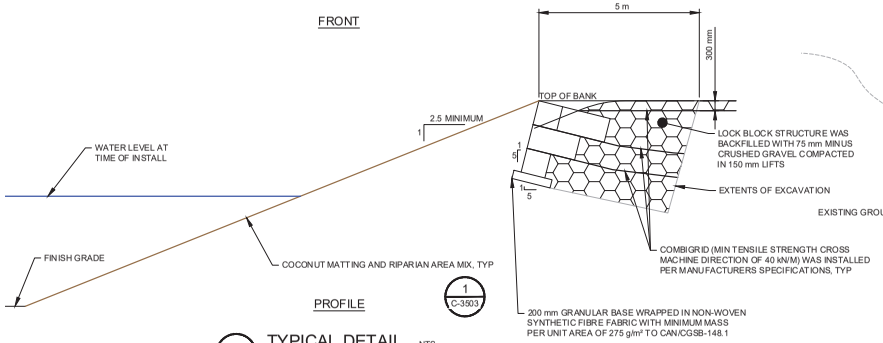
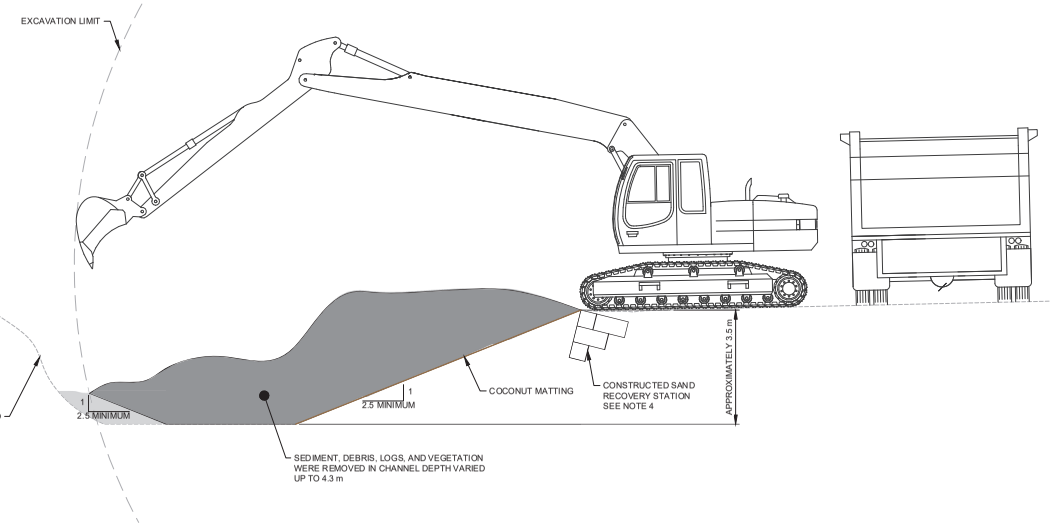


PROFILE

1
C-3503

1 TYPICAL DETAIL NTS
LOCK BLOCK STRUCTURE



2 TYPICAL DETAIL NTS
CONSTRUCTED SAND RECOVERY STATION EXCAVATION

NOTES:

1. CONSTRUCTION EXTENTS ARE APPROXIMATE.
2. ALL DIMENSIONS ARE IN METERS (m) UNLESS OTHERWISE NOTED.
3. ALL LOCATIONS ARE GEODETIC AND ARE IN NAD83 UTM10.
4. THE LOCATION OF THE EXISTING SAND RECOVERY STATIONS ARE AT THE APPROXIMATE COORDINATES NOTED IN TABLE 1 ON C-3101.
5. CONSTRUCTED SAND RECOVERY STATIONS ARE AT APPROXIMATE COORDINATES NOTED IN TABLE 1 ON C-3101.
6. UP TO 2.7 m OF SEDIMENT AND DEBRIS WAS REMOVED FROM THE CREEK AT EXISTING SAND RECOVERY STATIONS AND UP TO 4.3 m OF SEDIMENT, DEBRIS AND VEGETATION WAS REMOVED FROM THE CREEK AT PROPOSED SAND RECOVERY STATIONS AS NOTED ON THE DRAWINGS.
7. EXISTING VEGETATION WAS TRIMMED AROUND SAND RECOVERY STATION TO FACILITATE SEDIMENT REMOVAL.
8. EXISTING VEGETATION WAS REMOVED NEAR B-2, B-3, AND C-2 TO FACILITATE CONSTRUCTION.
9. CONTRACTOR ISOLATED INSTREAM WORK AREAS FOR THE DURATION OF CONSTRUCTION VIA SANDBAGS AND FILTER FABRIC, WHILE ALLOWING FISH PASSAGE.
10. THE LOCATION OF ALL UTILITIES SHOWN ARE NOT GUARANTEED TO BE ACCURATE OR COMPLETE AND MUST BE CERTIFIED WITH THE UTILITY.

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REV	DATE	DESIGN	DRAWN	DESCRIPTION
3	2026MAR13	R. KARSGAARD	J. ROZON	ISSUED FOR RECORD
2	2024AUG23	R. KARSGAARD	J. ROZON	ISSUED FOR CONSTRUCTION
1	2024JUL22	R. KARSGAARD	J. ROZON	ISSUED FOR RFP AND PERMITTING
0	2024JUN14	R. KARSGAARD	J. ROZON	ISSUED FOR RFP

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BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: AS SHOWN

BRITISH COLUMBIA

CIVIL
DETAIL 2 OF 5
PROPOSED SAND RECOVERY STATION

DRAWING	REVISION	SHEET
2632-03-C-3502	3	8

IF NOT 50 mm ADJUST SCALES
50 mm

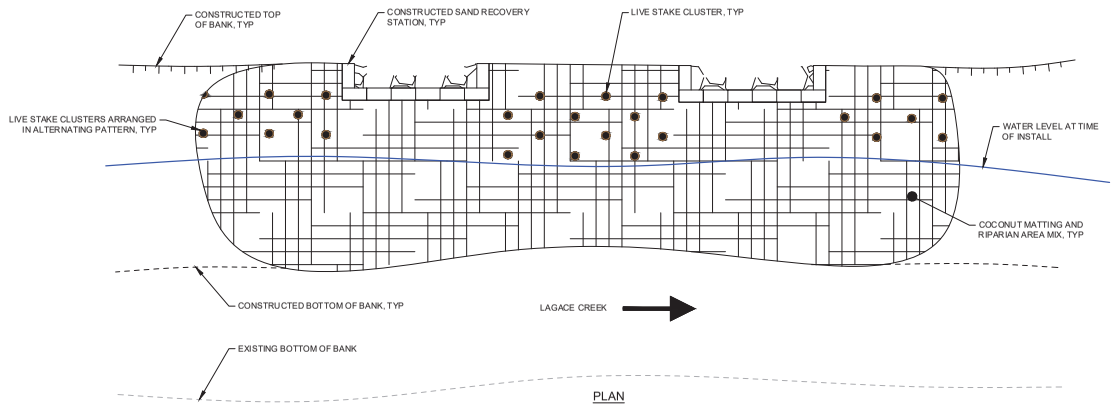
SCALE(S) SHOWN ARE INTENDED FOR ANSI D (22X34) SIZE DRAWINGS, TABLOID (11X17) SIZE DRAWINGS ARE 1/2 OF SCALE(S) SHOWN UNLESS NOTED OTHERWISE

VEGETATED RIPRAP SPECIFICATIONS:

1. HARVESTING.
1.1. THE HARVESTING OF LIVE STAKES WAS CONDUCTED BY A LOCAL NURSERY OR QUALIFIED PROFESSIONAL EXPERIENCED WITH LIVE STAKING WITHIN 48 HOURS OF INSTALLATION.
1.2. SUITABLE NATIVE WILLOW AND RED OSIER-DOGWOOD SPECIES WAS HARVESTED FROM WITHIN 100 KM OF THE PROPERTY AND WITHIN 300 M IN ELEVATION.
1.3. NATIVE PLANTS GROWING IN SIMILAR CONDITIONS WERE SELECTED.
1.4. NO HARVEST OCCURRED IN SENSITIVE AREAS.
1.5. STRAIGHT CUTTINGS WERE HARVESTED DURING THE DORMANT SEASON OCTOBER TO APRIL, AFTER LEAF DROP OR BEFORE LEAF OUT.
1.6. STRAIGHT STEMS WERE SELECTED 25 TO 75 MM IN DIAMETER AND 1.5 - 2M IN LENGTH.
1.7. SIDE BRANCHES WERE REMOVED BY CLIPPING THEM CLOSE TO THE MAIN STEM.
1.8. LIVE STAKES WERE STORED IN CLEAN COOL WATER (IN A DRY DARK CELLAR OR A DRY COLD ROOM) FOR AT LEAST 24 HOURS UNTIL PLANTED FOR AT MOST 10 DAYS. (APRIL/MAY OR OCTOBER/NOVEMBER) FOR UP TO 8 WEEKS).

2. LIVE CLUSTER PREPARATION AND STAKING DURING CONSTRUCTION
2.1. SOIL POCKETS WERE CREATED FOR THE LIVE STAKE CLUSTERS DURING THE PREFERRED SHOULDER SEASON, SITE PREPARATION REQUIREMENTS INCLUDED:
2.1.1. REMOVING ANY DEBRIS, ROCKS, OR OTHER OBSTRUCTIONS FROM THE PLANTING AREA ALONG THE RIPRAP SLOPE TO CREATE AN EASY PLANTING SURFACE.
2.1.2. EXCAVATING THE SOIL FOR THE POCKET AREA TO A DEPTH OF 0.5 M DEPTH INTO NATIVE SOIL, WHICH ALLOWED FOR ADEQUATE ROOT PENETRATION AND WATER ABSORPTION.
2.1.3. STAGGERING THE PLACEMENT OF LIVE STAKE CLUSTERS SITES, AND SPACE STAKES 0.1 M APART, AS SHOWN IN TYPICAL DETAIL 2 ON C-3503, FOR AN ESTIMATED TOTAL OF 25 CLUSTERS.
2.1.4. ENSURING THAT THE BASE OF THE SOIL POCKET EXCAVATION WAS BETWEEN 0.5 m BELOW THE TOP OF BANK AND THE LOW WATER LEVEL AT TIME OF INSTALLATION, AS PER TYPICAL DETAIL 2 ON C-3503.
2.1.5. ADDING TOPSOIL TO THE SOIL POCKET TO IMPROVE SOIL QUALITY AND FERTILITY. IMPORTING WEED-FREE TOPSOIL.
2.1.6. STAKE CLUSTERS WERE PLACED APPROXIMATELY 0.25 m ABOVE THE TOE OF THE LOW WATER LEVEL AT TIME OF PLANTING.
2.1.7. COCONUT MATTING WAS CUT TO A LENGTH TO ENTIRELY WRAP AROUND THE SOIL POCKET ONCE BUILT (0.3 M DIAMETER), APPROXIMATELY 1 TO 2 M.
2.1.8. RIPRAP INSTALLED WAS TO THE CORRECT ELEVATION. COCONUT MATTING WAS LAID FLAT ON THE RIPRAP BELOW THE PREPARED SOIL POCKET EXCAVATION AREA.
2.1.9. SOIL WAS PLACED ON THE COCONUT MATTING TO A DIAMETER OF 30 CM UP TO THE DEPTH OF THE RIPRAP.
2.1.10. FOUR STAKES WERE PLACED IN THE SOIL, AT 10 CM DISTANCE APART, THEN COCONUT MATTING WRAPPED AROUND THE SOIL AND STAKES MADE A CIRCULAR CLUSTER THAT IS 30 CM IN DIAMETER. THEN MORE RIPRAP WAS PLACED.

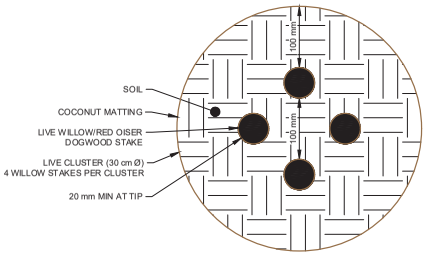
3. INSTALLATION
3.1. LIVE STAKES WERE INSTALLED WHILE THEY WERE DORMANT IN EARLY FALL TO MID-SPRING (OCTOBER TO MAY BEFORE LEAF-OUT OR AFTER LEAF DROP), IN UNFROZEN GROUND.
3.2. LIVE STAKES WERE SOAKED FOR A MINIMUM OF 24 HOURS AND NO LONGER THAN 14 DAYS PRIOR TO PLANTING.
3.3. LIVE STAKES WERE INSTALLED WITH A MINIMUM OF 80% BURIAL (CONTACT WITH SOIL) AND AT LEAST 200 MM OF THE LIVE STAKE ABOVE THE RIPRAP.
3.4. THE FOUR LEAF BUDS REMAINED ABOVE GROUND AND SHOULD BE FACING IN AN UPRIGHT DIRECTION.
3.5. CUTTINGS THAT WERE DAMAGED DURING INSTALLATION, WERE REMOVE BY PROVIDING A CLEAN CUT BELOW THE DAMAGED SECTION.
3.6. SOIL WAS TAMPED AROUND LIVE STAKE AND ADDING SOIL.



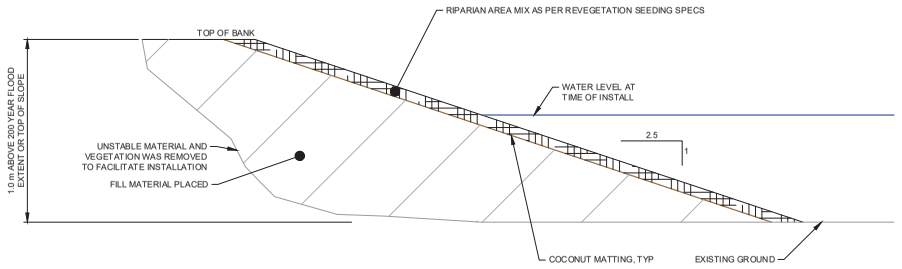
PLAN

NOTE:
THE TARGET NUMBER OF CLUSTERS WAS ONE CLUSTER PER 3 m², 0.5 m BELOW TOP OF BANK, AND 0.25 m ABOVE WATER LEVEL AT TIME OF INSTALL.

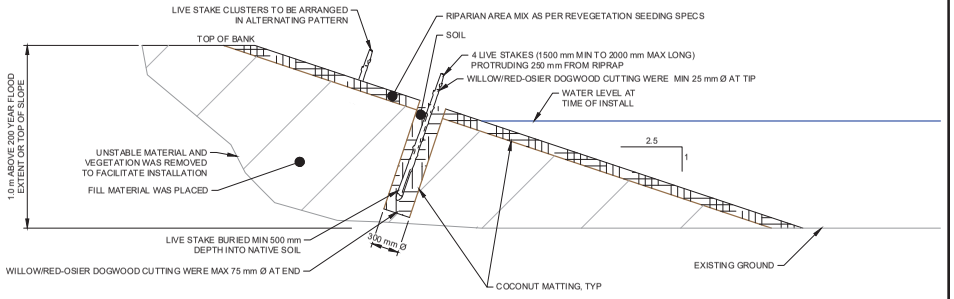
DISCLAIMER:
BIOENGINEERING IS A NATURE-BASED SOLUTION THAT IS DEPENDANT UPON THE VIABILITY OF THE PRESCRIBED MATERIALS, THE EXPERIENCE OF INSTALLERS, AND POST-INSTALLATION WATERING OR WEEDING. SAID VIABILITY IS CONTINGENT ON MANY FACTORS OUTSIDE OF THE DESIGNER'S CONTROL SUCH AS CLIMACTIC CONDITIONS, ENVIRONMENTAL FACTORS, AND HUMAN INTERACTIONS. THE NOTED DESIGN MEETS THE PROJECT DESIGN INTENT; HOWEVER, NO GUARANTEES ARE INFERRED OR IMPLIED.



LIVE STAKE CLUSTER PLAN



1 TYPICAL DETAIL NTS
100 kg CLASS RIPRAP



VEGETATED RIPRAP SECTION

2 TYPICAL DETAIL NTS
VEGETATED RIPRAP

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BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: AS SHOWN

BRITISH COLUMBIA

CIVIL
DETAIL 3 OF 5
BANK PROTECTION

DRAWING	REVISION	SHEET
2632-03-C-3503	3	9

IF NOT 50 mm ADJUST SCALES
50 mm

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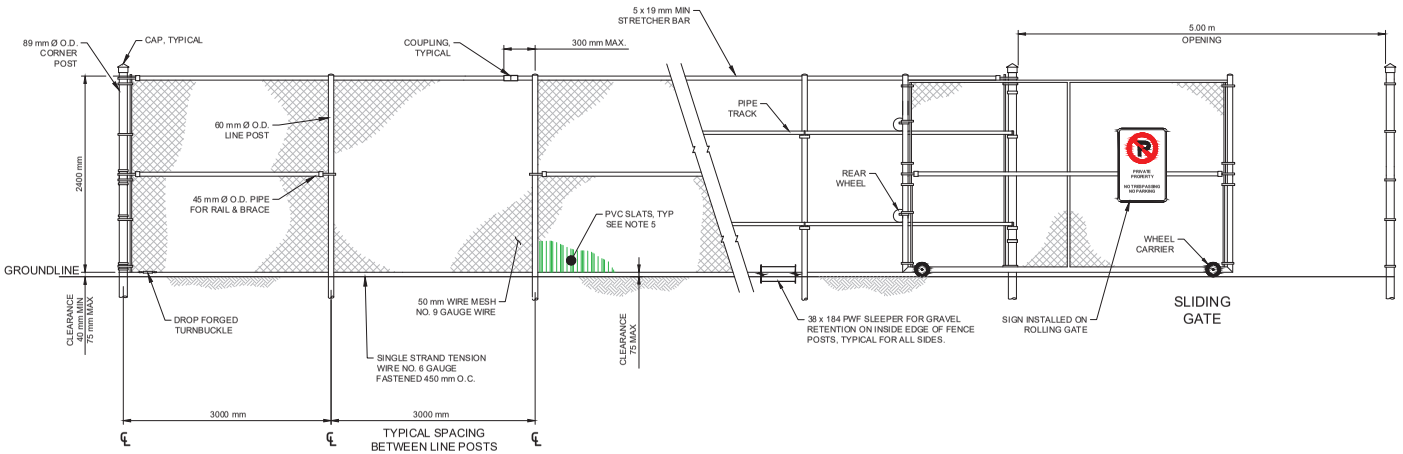
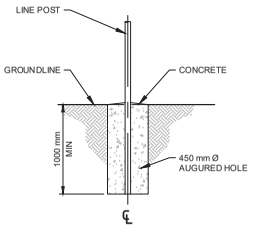
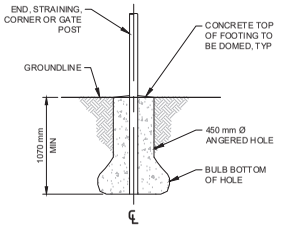


1 C-3102 **DETAIL** NTS
FENCE AND ROLLING GATE



2 **TYPICAL DETAIL** NTS
LINE POST SUPPORT IN EARTH



3 **TYPICAL DETAIL** NTS
CORNER, END AND GATE POST SUPPORT IN EARTH

NOTES:

1. CONSTRUCTION EXTENTS ARE APPROXIMATE.
2. ALL DIMENSIONS ARE IN METERS (m) UNLESS OTHERWISE NOTED.
3. ALL LOCATIONS ARE GEODETIC AND ARE IN NAD83 UTM10.
4. PVC SLATS WERE PLACED WITHIN THE WIRE MESH. COLOUR IS GREEN THAT MATCHES THE SURROUNDING VEGETATION.
5. THE LOCATION OF ALL UTILITIES SHOWN ARE NOT GUARANTEED TO BE ACCURATE OR COMPLETE AND MUST BE CERTIFIED WITH THE UTILITY.

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BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

SCALE: AS SHOWN

BRITISH COLUMBIA

CIVIL
DETAIL 4 OF 5
FENCE AND GATE INSTALLATION

DRAWING	REVISION	SHEET
2632-03-C-3504	3	10

IF NOT 50 mm ADJUST SCALES
50 mm
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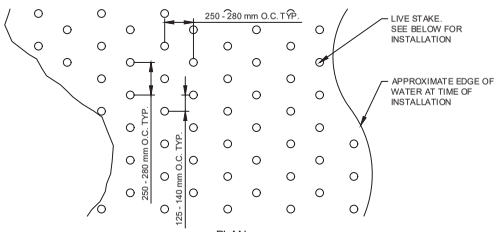
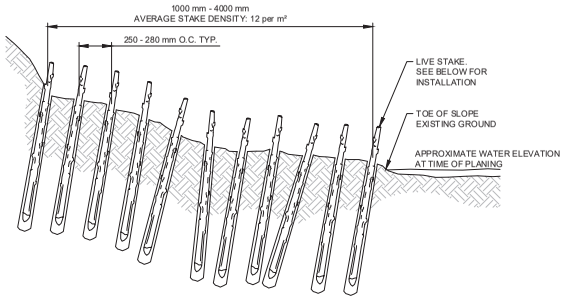
BIOENGINEERING SPECIFICATIONS:

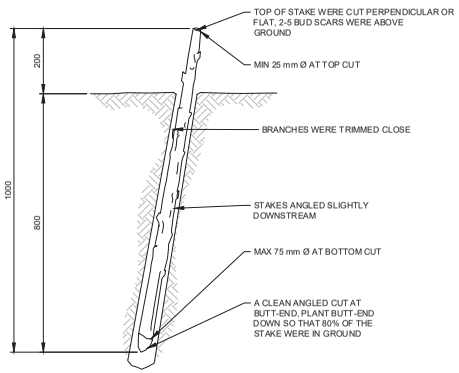
1. PLANT MATERIAL
1.1. ONLY NATIVE SPECIES WAS INSTALLED. NATIVE PLANT MATERIAL IN CLOSE PROXIMITY TO THE PROJECT SITE WAS USED. PLANT MATERIAL WAS SOURCED FROM WITHIN 100 km OF LAGACE CREEK.
1.2. PLANTS WERE GENERALLY TRUE TO TYPE AND STRUCTURALLY SOUND, HEALTHY AND VIGOROUS AND FREE OF DISEASE, INSECT INFESTATIONS, INSECT EGGS, WILDLIFE DAMAGE, SUNSCALD, FROST CRACKS AND MECHANICAL WOUNDS. STEMS WERE COVERED IN SMOOTH BARK (I.E. NOT FURROWED). PRUNING CUTS SHOWED VIGOROUS BARK ON ALL EDGES AND ALL PARTS WERE MOIST AND SHOWED LIVE, GREEN CAMBIUM TISSUE WHEN CUT.
1.3. LIVE CUTTINGS FROM NATIVE STANDS:
1.3.1. LOCATION OF CUTTINGS WERE DOCUMENTED. TARGETED HARVESTING WAS WITHIN LAGACE CREEK PROJECT FOOTPRINT (WITHIN THE DREDGING FOOTPRINT), AS THE TIMING WINDOW WAS APPROPRIATE FOR HARVESTING.
1.3.2. CUTTINGS WERE NOT TAKEN FROM WITHIN LAGACE CREEK CHANNEL MARGINS WHERE NO DREDGING OCCURRED.
1.3.3. COLLECTION FOR LIVE STAKING OCCURED UNDER SUPERVISION OF PERSONNEL WITH TRAINING AND EXPERIENCE IN LIVE STAKING.
1.4. ACCEPTABLE SPECIES INCLUDED:
1.4.1. NATIVE WILLOW SPECIES (SALIX SP)
1.5. HARVESTING OF CUTTINGS
1.5.1. CUTTINGS WERE HARVESTED DURING THE DORMANT SEASON (BETWEEN LEAF-OFF IN FALL AND PRIOR TO SPRING BUD BREAK). STEMS WERE SELECTED THAT ARE A MINIMUM OF 25 mm AT THE TOP AND A MAXIMUM OF 75 mm AT THE BOTTOM IN DIAMETER, KEEPING THEM FULL LENGTH UNTIL THE TIME OF INSTALLATION WHERE POSSIBLE. DURING HARVEST, SIDE BRANCHES WERE REMOVED BY CLIPPING THEM CLOSE TO THE MAIN STEM.
1.5.2. STAKE LENGTHS WERE A MINIMUM OF 1.25 m AND A MAXIMUM OF 2.0 m.
1.5.3. STEMS WERE CUT TO LENGTH BASED ON THE DETAIL DRAWINGS AFTER INSTALLATION.
1.5.4. CUTTINGS WERE WRAPPED INTO MANAGEABLE BUNDLES USING NATURAL TWINE, AND BURLAP. EACH BUNDLE WAS MARKED WITH FLAGGING TAPE, AND RECORDED WITH THE SPECIES AND HARVESTING DATE AND GENERAL LOCATION.
1.5.5. HEALTHY, STRAIGHT AND LIVE WOOD AT LEAST 1 YEAR OLD WAS HARVESTED.
1.6. PREPARATION:
1.6.1. PRIOR TO INSTALLATION, CUTTINGS WERE SOAKED FOR A MINIMUM OF 24 HOURS AND NO LONGER THAN 14 DAYS. WATER TEMPERATURE MIMICKED THE CREEK TEMPERATURE AT THE TARGETED TIME OF INSTALLATION.
1.6.2. APPROXIMATELY 80 TO 100 PERCENT OF THE LENGTH OF THE CUTTING WERE IN CONTACT WITH WATER (WEIGHT ON TOP IF SOAKING IN A HORIZONTAL POSITION).
2. ENVIRONMENTAL MANAGEMENT
2.1. ACCESS POINTS INTO THE CHANNEL AS IDENTIFIED ON DRAWING C-3104 WERE USED.
2.2. BEST MANAGEMENT PRACTICES, EROSION CONTROL MITIGATION MEASURES, SITE ISOLATION METHODS AND ANY OTHER APPLICABLE MEASURES IN THE CEMP WERE USED.
2.3. WORK COMMENCED "IN THE DRY" AND AN ISOLATED WORKSITE FROM WATER AND FISH AT ALL TIMES WAS MAINTAINED.
2.4. EXISTING NATIVE VEGETATION WAS NOT DISTURBED, DAMAGED, OR REMOVED.
3. INSTALLATION
3.1. DENSE LIVE STAKING:
3.1.1. LIVE CUTTINGS WERE INSTALLED IN THE DORMANT SEASON.
3.1.2. ONLY WILLOW CUTTINGS WAS USED.
3.1.3. CUTTINGS UP TO 1.25 m LONG WERE INSTALLED APPROXIMATELY 1.0 m DEEP.
3.1.4. CUTTINGS DID NOT PROTRUDE FROM THE SURFACE MORE THAN 25 cm IN LENGTH.
3.1.5. THIS TREATMENT ALONG THE TOE OF THE CREEK BANKS SLOPES, IN LOCATIONS SHOWN ON C-3104, WHERE THE CHANNEL MARGIN IS UNVEGETATED WAS APPLIED. STAKES WERE INSTALLED FROM THE WATERS EDGE UP THE BANK TO A MAXIMUM OF 4 m (HORIZONTAL) WIDTH.
3.1.6. CUTTINGS WERE NOT INSTALLED WHERE VEGETATION IS GROWING.
3.1.7. CLEAN CUTS WERE MADE AND DAMAGE STAKES OR SPLIT ENDS DURING INSTALLATION WERE NOT USED.
3.1.8. THE STAKES WERE INSTALLED BY HAND.
3.1.9. THE STAKES WERE LIGHTLY TAMPED INTO THE HOLE WITH A RUBBER MALLET.
3.1.10. THE INSTALLATION ANGLE OF THE CUTTING IN THE SEDIMENT VARIED. SLIGHT ANGLE DOWNSTREAM WAS PREFERRED.
3.1.11. ALL ACTIVITY AND FOOT TRAFFIC WAS ABOVE WATER TO PREVENT EROSION AND SEDIMENTATION.
3.1.12. THE WIDTH OF TOE STAKING VARIED.
3.1.13. TOE STAKING STARTED JUST ABOVE WATER AT TIME OF CONSTRUCTION.
3.1.14. NO EXISTING NATIVE WOODY VEGETATION WAS DISTURBED OR DAMAGE IN TREATMENT AREA.
3.1.15. LIVE STAKES WERE NOT INSTALLED AROUND EXISTING NATIVE WOODY VEGETATION.
4. WATERING
4.1. THE CUTTINGS WERE WATERED IMMEDIATELY AFTER INSTALLATION.



PLAN



CROSS SECTION



CROSS SECTION

1 TYPICAL DETAIL NTS
DENSE LIVE STAKING

TABLE 4: DENSE LIVE STAKING TREATMENT SUMMARY

LOCATION	APPROXIMATE AREA	APPROXIMATE LINEAR METERS	STAKE DENSITY	APPROXIMATE NUMBER OF STAKES	TREATMENT
SITE 1	60.2 m²	67 m	12 PER m²	722.4	DENSE LIVE TOE STAKING
SITE 2	100 m²	60 m	12 PER m²	1200	DENSE LIVE TOE STAKING
SAND RECOVER STATIONS UPSTREAM OF DALE ROAD	96 m²	44 m	3 PER m²	128	LIVE STAKE CLUSTERS
TOTALS	256.2 m²	171 m		2050.4	

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REV	DATE	DESIGN	DRAWN	DESCRIPTION
3	2026MAR13	R. KARSGAARD	J. ROZON	ISSUED FOR RECORD
2	2024AUG23	R. KARSGAARD	J. ROZON	ISSUED FOR CONSTRUCTION
1	2024JUL22	R. KARSGAARD	J. ROZON	ISSUED FOR RFP AND PERMITTING
0	2024JUN14	R. KARSGAARD	J. ROZON	ISSUED FOR RFP

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

HATZIC EMERGENCY WORKS PROGRAM
LAGACE CREEK - SITES S-CR-14/17
2022-2632-03

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