



LADYSMITH

Infrastructure Services

Request for Qualifications

No. 2024-IS-05

**Holland Creek (Mackie Rd) Dam D720190
Decommissioning Contractor**

For further information
please contact:

Michele Gill,
Senior Engineering
Technologist
250-245-6442
mgill@ladysmith.ca

RFP Issue Date:	June 28, 2024
RFP Closing Date:	July 11, 2024 at 2:00 pm,
RFP Opening:	July 11, 2024 2:15 pm,
Location of Bid Opening:	Ladysmith City Hall



LADYSMITH

1. Introduction

The Town of Ladysmith (Town) is seeking Statements of Qualifications for contractors with experience with earthworks, working in streams, stream restoration, site access, and specialty equipment. The Town plans to decommission a relatively small in-stream dam within Holland Creek, with limited access, steep embankments, and year round flows. Due to the unique aspects of this project, the Town would like to pre-qualify 2 or 3 contractors who are capable of completing the work and then request cost proposals to make a final selection.

There are two other dams on Holland Creek that require restoration in 2025 that Qualified Contractors would also be used for. The details of remediation are not yet known for the other two dams, but would be supplied to Qualified Contractors when requesting prices at a later time.

The work will need to be completed professionally, safely, within the 2024 fisheries window, and in accordance with the Water Sustainability Act (WSA) and BC Dam Safety regulations. The Town's consultant, Ecora Engineering and Environmental Ltd., has prepared a decommissioning plan by which the work shall be completed.



The dam consists of a wood crib structure built around the mid-1900s to provide water storage for use in mining operations. It is no longer in use for its original purpose and is beginning to show signs of deterioration. The upstream side of the dam has been in-filled over time with sand and gravel out-wash sediment. The dam is set in bedrock at the base of the creek channel, which consists of relatively steep embankments on both sides. A relatively narrow (approx. 2.5m average width) gravel trail (Holland Creek Trail) leads from

Mackie Road to the dam site, along the top of the west bank of Holland Creek. The required works are described in the preliminary decommissioning plan from Ecora. A detailed decommissioning plan as well as a WSA Section 11 permit is forthcoming.

In order to limit the release of sediment into the creek during the dam removal, it is anticipated that the decommissioning will be done in stages and the currently impounded material will be removed and disposed of off-site. The primary tasks associated with this construction project are anticipated to be:

- Temporary access to dam site;
- Isolation of worksite (diversion);
- Staged removal of dam and impounded sediment (offsite disposal);
- Re-grading of creekbed; and
- Site restoration.

2. Enquiries

All enquiries related to this “Request for Qualifications” are to be directed to:

Michele Gille, Senior Engineering Technologist
Town of Ladysmith
mgille@ladysmith.ca
250-245-6442

3. RFQ Addenda

It is the responsibility of the proponents to check periodically for any addenda that may be issued by the Town of Ladysmith. Addenda will be posted on the Town of Ladysmith website (www.ladysmith.ca/city-hall/bid-opportunities) and on BC Bid.

4. Statement of Qualifications Submission

Proponents are requested to submit their Qualifications **no later than 2:00pm on July 11, 2024** to the attention of:

Sue Bouma, Manager of Corporate Services
Town of Ladysmith
410 Esplanade - PO Box 220
Ladysmith, BC V9G 1A2
Email: bid@ladysmith.ca

Statement of Qualifications may be submitted by email or hard copy. The Town is not responsible for the timely receipt or adequacy of any electronic transmissions, and late receipt may be cause for rejection.

All submissions must be clearly marked “Request for Qualifications No. 2024-IS-05”. The

Qualifications Form in Appendix A must be completed and included in the submission. Additional information is expected from proponents, which may be presented in any reasonable format.

If this RFQ leads to a contract for work, the proponent will be required to obtain and provide proof of the following:

- A current business licence for operating in the Town of Ladysmith;
- A Clearance Letter from WorkSafe BC that confirms they are registered and in good financial standing with WorkSafe BC;
- Minimum \$2 million liability insurance with the Town of Ladysmith named as additional insured; and
- Federal, provincial and municipal permits when and where applicable.

Submissions in response to this RFQ will be opened privately at the Town of Ladysmith City Hall on **July 11, 2024 at 2:15pm**.

5. Statement of Qualifications Evaluation

The Town will evaluate proponents based upon but not limited to, the following:

- Quality of the Statement of Qualifications
- Principles of best value (see below)
- Demonstrated proven experience
- Accessibility and responsiveness
- Safety Record
- Reference checks

A scoring guide has not been provided for the Town's evaluation. A panel of three staff will review all submissions and determine as a panel which proponents should be shortlisted. The Town would like two or three shortlisted proponents, to which the Town intends to request quotation proposals for the described work on Mackie Dam.

The Town reserves the right to accept or reject any or all proponents either whole or in part at any time, or waive formalities in, or accept a proponent either whole or in part which is deemed most favourable in the interest of the Town. The Town will be under no obligation to proceed further with any submitted Qualifications and, should it decide to abandon same, it may, at any time, invite further proponents for the supply of the described services or enter into any discussions or negotiations with any party for the provision of the services. No alterations, amendments or additional information will be accepted after the closing date and time unless invited by the Town.

The Town of Ladysmith Purchasing Policy entails the following Principles of "Best Value":

- Procure the goods and services requirements of all departments in an efficient, timely and cost effective manner while maintaining the necessary controls;
- Engage in an open bidding process wherever practical;
- Ensure maximum value is obtained during the acquisition of goods and services. Where applicable, the total cost of the goods and services purchased should be taken into account. Total cost may include but not be limited to acquisition cost, disposal cost, residual value, training cost, maintenance cost, product performance and environmental impact;
- Take into account wherever practical the commitment to protection of the environment, and energy conservation;
- Ensure the acquisition of goods and services meets the requirements of applicable legislation and trade agreements, including the New West Partnership Trade Agreement, and the Agreement on Internal Trade; and
- Ensure that maximum value is realized when disposing of surplus goods, materials and equipment.
- The proponents contribution to the following community benefits:
 - *Economy*
 - Demonstrate job creation within the local area, which is defined as the Cowichan Valley Regional District and the Regional District of Nanaimo.
 - Contribute to a stronger local economy (buy local)
 - Increase training and apprenticeship opportunities
 - Provide work experience and employment opportunities for youth aged 15 to 24
 - Ensure that a Living Wage for the local area is paid
 - *Public Spaces*
 - Enhance community recreation, arts and/or culture infrastructure
 - Improve and enhance public spaces
 - Improve access to public spaces for people living with disabilities
 - *Environment*
 - Demonstrate that work undertaken exceeds requirements for environmental standards

6. Ownership of Submissions

All Statements of Qualifications and subsequent information materials shall become the property of the Town of Ladysmith after the closing date and time and will not be returned.

The submissions will be held in confidence by the Town subject to the provisions of the *Freedom of Information and Protection of Privacy Act*. This Request for Qualifications and

all associated documentation is the property of the Town of Ladysmith and shall not be copied or distributed without the prior written approval of the Town.

7. No Obligation

No contractual obligations shall arise between the Town and any proponent as a result of this RFQ or the making of any submission to the Town in response to this request. The Town reserves the right to, at any time, reject all submissions and terminate the RFQ process.

8. Respondent's Expense

Proponents are solely responsible for their own expenses in preparing and submitting a submission related to this RFQ. By making a submission, a proponent specifically waives and releases the Town from any and all costs, charges, liabilities, claims, or damages that may arise or be sustained by a proponent, including arising from or related to any actual or alleged unfair or unequal dealings between the Town and any proponent, or other party, or in any other way arising from or related to this RFQ.

9. Conflict of Interest

A proponent shall disclose in its submission any actual or potential conflicts of interest and existing business relationships it may have with the Town, its elected or appointed officials or employees.

10. Solicitation of Council Members and Town Staff

Proponents and their agents will not contact any member of the Town Council or Staff with respect to this RFQ, other than the Town's Representative named in Section 2, at any time prior to the award of an agreement or the cancellation of this RFQ. The Town may reject the submission of any proponent that makes, or attempts to make, such contact.

APPENDIX A QUALIFICATIONS FORM

THIS FORM MUST BE COMPLETED BY THE PROPONENT AND INCLUDED IN THE SUBMISSION. ADDITIONAL INFORMATION, RESUMES, SAFETY PLANS, PROJECT HIGHLIGHTS, EQUIPMENT LISTS, AVAILABILITY, ETC. SHOULD BE INCLUDED FOR THE TOWN'S EVALUATION PANEL. THERE IS NO OTHER SPECIFIED FORM OF SUBMISSION AND PROPONENTS ARE ENCOURAGED TO INCLUDE ANY OTHER INFORMATION THAT MAY ASSIST THE EVALUATION PANEL.

Company Name:

Date:

Name of Representative:

Address:

Phone:

Email:

Form of business organization: Corporation Partnership Sole Proprietorship

Years in business:

WorkSafe BC Registration Number:

What is the primary type of contract services that your business offers? If supplemental information describes this, please indicate "see attached":

Complete the following:

As an authorized signatory of _____, I _____
confirm that the above statements and supplemental information is true and accurate to
the best of my knowledge.

Signed, this _____ day of _____, 2024.

(Print name and position of Authorized Signatory)

(Signature of Authorized Signatory)

APPENDIX B PRELIMINARY DECOMMISSIONING PLAN



Holland Creek – Mackie Road Dam (D720190) Preliminary Decommissioning Report

Presented to:



Dated:

June 21, 2024

Ecora File No.:

230602

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Glossary of Terms

Abutment	That part of the valley side against which the dam is constructed. The left and right abutments of dams are defined with the observer looking downstream from the dam.
Acre-foot	A unit of volumetric measure that would cover 1 acre to a depth of 1 foot. One acre-foot is equal to 1,234 cubic meters.
Berm	A nearly horizontal step (bench) in the upstream or downstream sloping face of the dam.
Boil	A disruption of the soil surface due to water discharging from below the surface. Eroded soil may be deposited in the form of a ring (miniature volcano) around the disruption.
Breach	An opening through the dam that allows draining of the reservoir. A controlled breach is an intentionally constructed opening. An uncontrolled breach is an unintended failure of the dam.
Conduit	A closed channel (round pipe or rectangular box) that conveys water through, around, or under the dam.
Consequence Classification	A system that categorizes dams (extreme, very high, high, significant, or low) according to the degree of their potential to create adverse incremental consequences such as loss of life, property damage, or environmental impacts of a failure or disoperation of a dam.
Control section	A usually level segment in the profile of an open channel spillway above which water in the reservoir discharges through the spillway.

Cross section	A slice through the dam showing elevation vertically and direction of natural water flow horizontally from left to right. Also, a slice through a spillway showing elevation vertically and left and right sides of the spillway looking downstream.
Dam	A barrier constructed for the purpose of enabling the storage or diversion of water diverted from a stream or an aquifer, or both and other works that are incidental to or necessary for the barrier.
Dam Emergency Plan (DEP)	A formal document identifying potential emergency conditions that may occur at the dam and specifying pre-planned actions to minimize potential failure of the dam or minimize failure consequences including loss of life, property damage, and environmental impacts. (BC Dam Safety Reg. 40/2016, Section 9).
Dam failure	An uncontrolled release of all or part of the water impounded by the dam, whether or not caused by a collapse of the dam.
Dam Owner	With respect to a dam, any or all of the following: (a) the person who holds the current licence or is required to hold a licence for the dam; (b) the person who last held a licence for the dam, including a licence that has been suspended, cancelled, abandoned or terminated; (c) if there is no person to whom statement (a) or (b) applies, the owner of the land on which the dam is located or the person who had the dam constructed
BC Parks Representative	The person(s) with responsibility for the operation and maintenance of dam.
Dam Safety Officer (DSO)	The person designated in writing by the Province to work with Dam Owners to ensure compliance with the Dam Safety Reg. 40/2016.
Drain	A water collection system of sand and gravel and typically pipes along the downstream portion of the dam to collect seepage and convey it to a safe outlet. The drains can be located in the toe, foundation or drainage blanket.
Drainage area (watershed)	The geographic area on which rainfall flows into the dam.
Drawdown	The lowering or releasing of the water level in a reservoir over time or the volume lowered or released over a particular period of time.
Emergency	A condition that develops unexpectedly, endangers the structural integrity of the dam and/or downstream human life and property, and requires immediate action.
Evacuation map	A map showing the geographic area downstream of a dam that should be evacuated if it is threatened to be flooded by a breach of the dam or other large discharge.
Filter	The layers of sand and gravel in a drain that allow seepage through an embankment to discharge into the drain without eroding the embankment soil.
Freeboard	Vertical distance between a stated water level in the reservoir and the top of dam.
Gate	A general term for any mechanical device to control the flow of water in intakes, outlet works and over controlled spillways.
Groin	The area along the intersection of the face of a dam and the abutment.

Height of dam	The vertical distance between the crest of the dam and the lowest point at the downstream toe, which usually occurs in the bed of the outlet channel.
Hydrograph	A graphical representation of either the flow rate or flow depth at a specific point above or below the dam over time for a specific flood occurrence. It can include inflow, outflow, or a breach flow.
Incident Commander	The highest predetermined official available at the scene of an emergency situation.
Inflow Design Flood	Current practice for selection of a flood that a dam's spillway(s) should be able to safely pass as recommended by the Canadian Dam Association and is based off of the severity of the consequence classification for the dam.
Instrumentation	An arrangement of devices installed into or near dams that provide measurements to evaluate the structural behavior and other performance parameters of the dam and appurtenant structures.
Intake	Placed at the beginning of an outlet works waterway (power conduit, water supply conduit), the intake establishes the ultimate drawdown level of the reservoir by the position or size of its opening(s) to the outlet works. The intake may be vertical or inclined towers: drop inlet or submerged, box shaped structures. Intake elevations are determined by the head needed for discharge capacity, storage reservation to allow siltation, the required amount and rate of withdrawal, and the desired extreme drawdown level.
Inundation area or map	The geographic area downstream of the dam that would be flooded by a breach of the dam or other large discharge.
Joint Works Agreement	An agreement that describes how responsibilities and costs will be shared among two or more applicants or authorization holders for the construction and maintenance of works that are or are proposed to be jointly used under a water licence or use approval
Live Storage	The volume of water being held back by the dam that is between the low-level outlet and the spillway crest.
Low-Level Outlet	A conduit through a dam to allow for controlled release of the reservoir contents. Also see "Outlet Works"
Notification	To immediately inform appropriate individuals, organizations, or agencies about a potentially emergency situation so they can initiate appropriate actions.
Outlet works	An appurtenant structure that provides for controlled passage of normal water flows through the dam. Combination of intake structure, gates, conduits, tunnels, flow controls and energy dissipation devices to allow the release of water from the dam,
Owner's Designate	The owners of a dam in respect of which there are two or more owners must, on request of a dam safety officer and on or before the date specified by the dam safety officer, designate one of the owners for the purposes of receiving, providing, and retaining information and records in relation to the dam as required or authorized by the Water Sustainability Act Dam Safety Regulation.

Owner's Representative	The owners of a dam in respect of which there are two or more owners must, which will provide a representative to the management committee and perform responsibilities appointed by the management committee.
Persons in the immediate vicinity of the dam	Considered the persons located immediately downstream and adjacent to the dam where available warning time is very limited (where local emergency authorities could not be expected to respond in time).
Piping	The progressive destruction of an embankment or embankment foundation by internal erosion of the soil by seepage flows.
Potential Storage	The volume of water that reservoir can temporally hold between the spillway crest and dam crest when the reservoir is at maximum capacity.
Probable Max. Precipitation (PMP) & Probable Max. Flood (PMF)	The theoretically greatest precipitation (PMP) or resulting flood (PMF) that is meteorologically feasible for a given duration over a specific drainage area or at a particular geographical location.
Reservoir	The body of water impounded or potentially impounded by the dam.
Riprap	A layer of large rock, precast blocks, bags of cement, or other suitable material, generally placed on an embankment or along a watercourse as protection against wave action, erosion, or scour.
Risk	A measure of the likelihood and severity of an adverse consequence.
Seepage	The natural movement of water through the embankment, foundation, or abutments of the dam.
Single Command	One person overseeing the response and serving as the final decision-making authority. This form of command can be used when an emergency involves only one jurisdiction and there is no functional or jurisdictional overlap with another agency. The single commander is designated by the appropriate authority. In some cases, multiple agencies responding to the emergency may agree to designate a sole incident commander.
Slide	The movement of a mass of earth down a slope on the embankment or abutment of the dam.
Spillway (main)	The appurtenant structure that provides the controlled conveyance of excess water through, over, or around the dam.
Spillway (emergency)	An additional spillway, which usually has a crest elevation somewhat higher than the main spillway, designed to activate during extreme flood events to avoid overtopping the dam.
Spillway capacity	The maximum discharge the spillway can safely convey with the reservoir at the maximum design elevation.
Spillway crest	The lowest level at which reservoir water can flow over or into the spillway.
Tailwater	The body of water immediately downstream of the embankment at a specific point in time.

Toe of dam	The junction of the upstream or downstream face of an embankment with the ground surface.
Top of dam (crest of dam)	The elevation of the uppermost surface of an embankment which can safely impound water behind the dam.
Unified Command	Two or more individuals sharing authority over an emergency/disaster in which multiple agencies or jurisdictions are involved. It is a collaborative management method that can be used during an emergency response in which jurisdictional authority overlaps due to legal, geographical, or other factors, thus making single command impractical.

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1. Introduction

1.1 General

The Town of Ladysmith (ToL) engaged Ecora Engineering & Environmental Ltd. (Ecora) to undertake Dam Safety Inspections (DSI's) for three dams located along Holland creek following a notification from the Dam Safety Officer. Mackie Road Dam, provincial dam number D720190, was included in these inspections. The DSI report for Mackie Road Dam identified safety concerns related to the dam's condition and recommended decommissioning of the dam. The ToL had already committed to decommissioning the dam prior to the DSI undertaken by Ecora, subject to the approval from the regulator.

The purpose of this preliminary decommissioning report is to provide an overview of the decommissioning process and the required engineering procedures. The provincial dam safety program's objectives for decommissioning a dam includes;

- Removal of all potential hazards associated with the dam.
- Restoration of the dam site to a safe, stable, and maintenance-free condition.
- Restoration of natural functions and processes to stream hydrology, channel morphology, and ecosystems.

The dam decommissioning process required for Mackie Road Dam extracted from the Dam Decommissioning Guidelines from the Ministry of Water, Land and Resource Stewardship (WLRS) (formerly known of the Ministry of Forests, Lands, Natural Resource Operations and Rural Development, FLNRORD) is outlined below:

1. Decision to decommission dam.
2. Contract Qualified Professional(s).
3. Reviewable Project under Environmental Assessment (EA) or Canadian Environmental Assessment Act (CEAA).
4. Provide 120 days written notice to the DSO.
5. Request determination of plan submission requirements from DSO.
6. Prepare preliminary report to guide stakeholder engagement.
7. Stakeholder engagement, referrals, and First Nations (FN) consultation.
8. DSO review of stakeholder engagement.
9. DSO authorization to proceed with final design.
10. Submit final design report to Water Manager 90 days prior to construction approval.
11. Plan accepted.
12. Issuance of Leave to Commence Construction (Approval) letter.
13. Construction phase.
14. Submit Substantial Completion Report.
15. Monitoring and Adaptive management.

1.2 Background Information

Minimal background information exists for Mackie Road Dam, with the majority of current information available contained within the Ecora DSI report dated December 2023. The following information is currently available which was used as references during the preparation of this preliminary decommissioning report.

- Holland Creek Dam Safety Inspection – Mackie Road Dam (D720190), (Ecora, 2023).
- BC assessed watersheds – Government of Canada.
- Historical Satellite Orthographic Imagery.
- Information provided by the ToL.
- Topographical survey of the dam and development of a site plan.
- Summary of investigation reports findings and recommendations.

Documents that were not available for review and use in this report included but were not limited to:

- Dam Safety Audits.
- Record Drawings.
- Detailed design report.
- Record of Testing.
- Dam Safety Review (DSR).
- Dam Emergency Plan (DEP).
- Operations and Surveillance Manual (OMS).

1.2.1 Description of Dam, Watershed & Reservoir

Mackie Road Dam (UTM 10, 439271.650E, 5426221.390N) is a timber crib structure that appears to be founded on bedrock. It consists of interlocking timber cribs, which are typically backfilled with stone. The main timber crib on the upstream end has an approximate diameter/width of 500 mm while the other cribs have an approximate diameter/width of 400 mm. It is assumed that the timber cribs over time have worn from a rough sawn rectangular shape to a squircle (an intermediate shape between a square and circle). The dam has a maximum height of 3.8 m and a width of 12 m. A control structure exists on the left side of the dam consisting of an opening roughly 700 mm wide and 1000 mm high, the concrete structure to the left of the opening is 3.2 m long and 400 mm wide. This concrete wing wall raises the dam crest along this section by approximately 1 m. A timber facing has been placed along the downstream side of the cribbing, presumably to act as a water barrier, and to allow for the construction of a concrete wall behind (upstream) of the timber facing. Over time, the dam's reservoir has infilled with sediment so that it is almost at same level as the dam crest.

The purpose of the dam was believed to be for coal mining water supply or control, and the date of construction is unknown. It is reasonable to assume that the dam was constructed by the Wellington Collieries Company. The water license that is associated with the dam upstream of Mackie Road Dam outlines a water routing map dated May 1947 which identifies the Wellington Collieries Co. right of way along Holland Creek. The Wellington Collieries Co. was a coal mining company that was incorporated in 1902 to take control of coal mining operations in Ladysmith and Wellington.

The site inspection conducted by Ecora on September 17, 2023, is currently the only source of information on the dam type, which only included visual observations, inspections, and approximate measurements as detailed above. There is no more information available on how the dam was constructed and what to expect when uncovering obscured dam features. Therefore, the preliminary processes proposed in this report that are

pertaining to the dam structure are assumed based on general timber crib dam construction obtained from published sources. The bedrock elevations upstream of the dam are inferred based on downstream conditions.

Holland Creek originates on the northern and eastern slopes of the Coronation Mountains and flows approximately 12 km before discharging into the ocean. The Holland Creek watershed has an overall area of approximately 32.2 km² with a median elevation of 543 m, ranging from 1290 m to 5 m. The max slope within the watershed is 115% and the mean slope 18%. The watershed discharge point is into Ladysmith harbor (near the Holland Creek estuary trail head). Due to the unique topography, there are sub-watersheds where other minor creeks exist and either link with Holland Creek or convey flow to the same discharge point. The majority of the watershed is heavily forested and includes Holland Lake, Heart Lake, and a collection of small wetlands as storage sources.

Based on regional hydrometric gauge stations, peak flows are expected to primarily occur in the fall and early winter under significant rainfall events. Elevated flows can also be generated as a result of the spring freshet or due to extreme rainfall events during the summer.

Photographs of the dam were taken during the DSI with a standard camera as well as a DJI Mini 2 micro drone. Photographs of the dam site are included in Appendix C. Photographs are numbered 1 to 8 and document the condition of the dam during Ecora's site inspection on September 17, 2023.

1.2.2 Description of Land Status

Mackie Road Dam is within a local/regional park which is defined as Crown Land (ownership 81, schedule U), i.e. the land which the dam is situated on is owned by the provincial government. The ToL should confirm if tenure exists for the dam and if it includes conditions for the decommissioning. If so, the dam must be decommissioned as per the terms and conditions of the tenure documents.

The likely case is that no tenure exists for the dam given its history and the extent of information available. If it does have a tenure document associated with it, it may only permit and detail authorizing the occupation of Crown Land (Permit Over Crown Land (PCL)). For these cases, the WLRS details the following as conditions;

"The dam owner shall restore the surface of the land as nearly as may reasonably be possible to the dam conditions as it was prior to development of the dam and associated works. Any significant variance must be approved by a lands manager."

The land on which the dam is situated on is associated with two First Nation groups; Hul'qumi'num Treaty Group and Snuneymuxm First Nation. The Hul'qumi'num Treaty Group is a representation of five communities that are a part of southern Vancouver Island, a narrow corridor on the mainland to Yale in the east, and sections of the Salish Sea. The communities include Cowichan Tribes, Halalt, Lyackson, Ts'uubaa-asatx, and Penelakut. Snuneymuxm First Nation is one of the largest nations in B.C. located in the centre of Coast Salish territory on the eastern coast of Vancouver Island. It is understood that there are First Nation fishing sites downstream of Mackie Road Dam.

Most communities will not be directly affected considering the size of the dam, scope of the project, and distance to the communities. However, it is good due diligence to include the groups in the notification of work and any consultations that will be required.

1.2.3 Identification of Water Rights Holders & Stakeholders

It is currently understood that there are no water rights holders or registered water licenses associated with Mackie Road Dam. There are however current water licenses registered to the Town of Ladysmith upstream along Holland Creek;

- License Number: C017746 (Colonia Dr Dam – Local Provider; PD30734)

- License Number: C017746 (Holland Cr Water Supply Dam; PD30733)
- License Number: C029821 (Holland Creek – Surface Water/Stream Storage; PD30789 08A)

In the case that water licenses are still associated with the dam, abandonment of water rights must be made by written application through FrontCounter BC to a WLRS Water Manager. The water license abandonment is dependent on the completion of all environmental monitoring and demonstration that there will be no unforeseen adverse impacts related to decommissioning of the dam. Monitoring programs are a minimum of one year following the decommissioning.

Due to no known water licenses associated with Mackie Road Dam, and according to the regulations and recommendation from the DSO, a provisional water license should be applied for and put in place to be associated with the dam; the water license is then abandoned. This is required in order to complete the decommissioning process and filing of proper documentation with WLRS.

Stakeholders for Mackie Road Dam will be minimal due to the function and size of the dam. Stakeholders include any persons/group that could potentially be impacted by the decommissioning of the dam, therefore, any stakeholders that may be affected must be considered. A checklist is provided in the guidelines from WLRS, which has been adopted in the table below as a means to identify potential stakeholders.

Table 1 Stakeholder Identification

Potential Stakeholder	Identification
Seasonal and permanent residents proximal to the reservoir (homeowners, cottagers, landowners)	There are homeowners (assumed permanent) within close proximity west of the dam along Colonia Dr. These are not likely to be directly affected by the decommissioning but are a notable mention due to their proximity. The terrain in-between is densely forested and steep. The construction activities will be notable from a social point of view.
Downstream upland riparian landowners	The creek flows entirely through crown land, there are no identified riparian landowners.
Business owners (resort and marina owners, water sports rental suppliers, outfitters, etc.)	The Ladysmith Sewage Treatment plant is located 200 m north of the Holland Creek Outlet. The plant will likely not be affected by the decommissioning.
Local government(s) proximal to dam/reservoir or downstream that could be impacted (planning departments, local health departments, utilities)	The creek flows almost entirely through provincial park land (crown land). The creek flows beneath Dogwood Dr, the Trans Canada Hwy (TCH), and the Esquimalt & Nanaimo railway (inoperative). See discussion in hydrology assessment. Other than the town, the Ministry of Transportation & Infrastructure could be considered a stakeholder, although there is a low chance of the TCH being affected.
Sport, fishing, and recreational clubs	There are no clubs identified downstream or within close proximity to the dam. It is important to ensure signage is posted on the Holland Creek/Heart Lake trails and estuary areas to ensure proper notification during the construction phase in case clubs do utilize the trails for recreational purposes.
Not-for-profit environmental organizations (e.g. Ducks Unlimited, Trout Unlimited)	No activities identified in close proximity to the dam. Trout Unlimited or a similar organization may be contacted for riparian area rehabilitation consultation following the decommissioning, if required. See Appendix B Environmental Assessment for more information on fish presence.

Water licensees on the source or with groundwater wells nearby	See water rights holders' paragraph above and section 2.2 Hydrogeological Assessment.
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2. Site Characterization and Field Assessments

The subject site is situated at the bottom of a steep incised channel (ravine), which is densely forested, following the Holland creek trail. Access to the site is extremely limited, currently it is only accessible on foot. Bedrock is visible in the downstream channel and is assumed to run below the dam and upstream (see conceptual drawings for the inferred bedrock profiles). The channel banks upstream are densely vegetated and there are well established riparian areas. Currently the dam is acting as a fish barrier, and upstream fish passage is assumed to be not occurring (see the environmental assessment report for more information).

2.1 Preliminary Geotechnical / Structural Assessment

A geotechnical assessment of the site conditions would be helpful in determining the bedrock and ground conditions. However, due to the limited access of the site, scope of work, and the cost associated with completing a geotechnical assessment, it is not reasonable for this project. The bedrock profile for the purposes of the preliminary design is inferred and will be confirmed in the field by a qualified geotechnical engineer.

A geotechnical review will be conducted to assist in the decommissioning. This may include reviewing stability assessment of channel side slopes (dam abutments). A geotechnical review will also assist in determining channel bank rehabilitation procedures post-decommissioning. The channels design grade is dependent on the bedrock topography encountered. Preliminary inspections suggest that the side slopes above the riparian/high water point exhibit signs of erosion and shallow instability.

A structural assessment of the dam will not be required. It was determined in Ecora’s dam safety inspection report that the dam is in a state beyond rehabilitation and full decommissioning was recommended. Due to the size of the dam and considering no water is impounded, there will be no reservoir drawdown phase, hence no need for stability assessment or monitoring. No portions of the dam will remain post decommissioning, therefore there will be no structures remaining needing static and/or seismic analysis.

2.2 Preliminary Hydrogeological Assessment

When drawing down reservoirs, it is important to be aware of the effects it may have on surrounding aquifers. This can cause groundwater wells to yield less water and run the risk of running dry. An understanding of these potential effects is important, especially during the public engagement phase. Mackie Road Dam does not have a reservoir as the dam acts as a weir and does not retain water, and post decommissioning, the flow regime will be the same as it is with the dam in place. It is reasonable to assume that the dewatering of the small portion of Holland Creek will not influence any aquifers or groundwater wells.

In order to address any public concerns, it is noted that the closest identified groundwater well for observation purposes (OBS WELL 337) is 5.8 km north from the subject site on Holland Creek. The next closest well is approximately 7 km north-west (OBS WELL 436). These wells were identified from the Provincial Groundwater Observation Well Network. Both are located outside of the Holland Creek watershed and the size of the creek indicates that this will have no effect on groundwater levels at the identified observation wells. A private groundwater well exists on Jamison Rd approximately 1 km from the dam (Well Tag Number: 96207), however, the status is unlicensed. Further consideration on the effect of the aquifer/groundwater levels can be approached by the type of stratigraphy. From initial site reconnaissance, there exists a considerable amount of shallow bedrock, hence, no effective aquifer i.e. localized groundwater supply.

Due to the flow regime being unchanged, no reservoir being dewatered, and the presence of shallow bedrock, there is no concern for aquifers and groundwater levels running dry, and therefore no monitoring will be required.

2.3 Preliminary Hydrology Assessment

Due to the dam currently acting as a weir, as opposed to impounding water, the flow regime will not change once the decommissioning is complete. Therefore, a full hydrology assessment will not be required. This may have included, but not limited to;

- Rainfall/Snowpack data analysis.
- Stream flow data and ability to pass up to 1/100-year inflow design flood.
- Inundation mapping.
- Downstream culverts capacity.

However, there is a requirement to check certain hydrotechnical aspects of the finished channel. These include the performance of the channel to convey the same flowrate prior to decommissioning (e.g. hydraulic wave check), ensure channel grade and cross section is the same as it was prior to development, and to ensure that there are no areas susceptible to erosion or scour. This should be included in the final design of the channel to ensure that the site is left in a state that is safe for the public and environment, and that the channel will perform as per engineering guidelines.

No downstream hydrology will be considered in this decommissioning process due to it being outside the scope of the project. Further to this, due to the flow regime being the same as prior to decommissioning, there is no concern with the downstream hydrology. Ecora's dam safety inspection report touches on downstream considerations stating that there is considerable capacity beneath Dogwood Dr and the Trans Canada Hwy. In the event of a release of material, the culvert beneath the Esquimalt & Nanaimo railway will be the only possible point of blockage and localized flooding (railway is inoperative). See the sediment management plan for mitigating the risk of release of material.

2.4 Preliminary Fluvial Geomorphology Assessment

Fluvial Geomorphology is the process that rivers go through to form a specific channel and path. This involves the transfer of sediment and the interaction of flowing water with channel banks. Commissioning or decommissioning a dam can influence the morphology via changing flow regimes and sediment transportation. This can ultimately cause adverse effects to the natural channel environment, geometry, and aquatic communities.

The flow regime and land use of the catchment will be the same post decommissioning of Mackie Road Dam, hence no risk to changes to channel geometry via possible hydrological conditions. However, there is a risk of sediment transportation downstream of the dam. Since the dam was commissioned, sediment has been deposited and impounded behind it, which means sediment transportation downstream of the dam has been limited. Decommissioning allows sediment to mobilize and be deposited downstream. This process should be managed by utilizing all reasonable measures to minimize unreasonable downstream sediment transport. This topic is discussed in Section 4.1 Preliminary Sediment Management Assessment.

For the purposes of this project, there is minimal effort required in analysis due to the channel keeping the same flow regime and geometry. There will be no dramatic change to sediment and nutrient transport post decommissioning and the channel morphology will not be altered. As part of the monitoring process, it will be important to note any dominant channel patterns, aggradation or degradation, bank erosion and stability issues.

2.5 Assessment of Environmental Concerns

The requirements to determine whether a dam is reviewable under either the federal or provincial Environmental Assessment processes are unclear, considering conditions for every dam and reservoir is unique. This process is usually reserved for larger dams. It is valuable to complete an in-house EA as works could be undertaken in the water and it will ensure that all environmental aspects are considered and reported prior to stakeholder engagement, detailed design, and construction. Mackie Road Dam will require a minimum of one year of monitoring to ensure that the restored channel does not create adverse environmental impacts, this is subject to change depending on post decommissioning site conditions.

As per the environmental assessment report, it is possible that rainbow trout are present in the creek. In order to ensure due diligence and meet the expectations outlined in the environmental report, the construction period should take place during August and September. Rainbow trout migrate in spring and spawn in early summer; by conducting the work in the fall, this will avoid migration by default. These months will also be ideal as this is when the lowest flows occur in Holland Creek. The environmental report's focus was in the immediate vicinity of the dam and did not consider downstream habitats. There is a possibility of clam habitats existing downstream, it is important to consider this in the detailed design and may require further environmental investigation in order to ensure that no mobilized material will cover it up and cause damage.

Ecora's environmental team completed an environmental assessment report for this project. Refer to Ecora Engineering & Environmental Ltd., 2024. Ladysmith Dam Remedial Works Environmental Assessment Report attached as Appendix B in this report.

3. Economic and Social Impact Assessment

Once it is determined feasible to decommission the dam, it is required to identify what technical studies must be completed to identify anticipated impacts. All positive and negative effects of the decommissioning should be taken into consideration during stakeholder engagements. As per the WLRS Dam Decommissioning Guidelines;

“Consideration of environmental issues, public safety, historic value, aesthetic, archeological, societal, and First Nations interests is required to prevent or mitigate potential impacts related to the dam's removal and site rehabilitation. The results of this assessment will help guide the public comment and referral process.”

3.1 Social

As part of the public engagement, the dam owner must review sections 4, 5, 6 & 7 of the Public Consultation Policy Regulations (PCPR) under the Environmental Assessment Act for giving public notice of the decommissioning. The posting of public meetings should include background documents which provide information for informed discussions. The posting must also indicate time(s) and location(s) of meetings, and appropriate timelines for public comment periods. At least one formal comment period is required and should be between 30 and 75 days.

The dam removal will not create a loss in recreational opportunities, and once complete, there shouldn't be a concern with aesthetics. Due to the dense vegetation and wet climate at the subject site, dust generation will be kept at a minimum and won't affect nearby residents.

Construction activities will be a notable mention for social impact. During the construction phase, a portion of the Heart Lake Trail will be closed to the public and the development of a staging area, access to the site, and general construction activities will create a temporary loss of public accessibility. Construction noise will be generated and likely be heard by nearby residents. However, machinery size is limited due to access which will aid in maintaining reasonable noise levels. The ToL should ensure that this is properly addressed during the

consultation period and implement/plan mitigation measures (i.e. approved working hours) to minimize adverse effects and maximize benefits for the surrounding community and environment.

3.2 First Nations Considerations

The duty to consult is ultimately the Crown's responsibility, however, the dam owner should involve First Nation proponents early on. The ToL should reach out to Hul'qumi'num Treaty Group and Snuneymuxm First Nation (see section 1.2.2 Description of Land Status for more information) to consult on the following and present the project to the representatives.

- Identify any FN interests that may be affected by the proposed decommissioning.
- Identify and develop measures to prevent, avoid or mitigate any potential adverse effects on FN interests.
- Any community and traditional knowledge to incorporate into baseline studies.

The decommissioning is currently understood as having a positive impact to FN interests due to removal of a fish barrier, and the restoration of the channel as it was prior to the dam construction. Further to this, the dam is a small dam that is not providing any use, i.e. no water licenses associated with it. There are possible FN fishing sites downstream to the dam which should be confirmed during the consultation process. During the consultation process, spiritual, ceremonial, cultural sites, subsistence resources, land claims, or other FN values near the subject site should be confirmed.

3.3 Economic

The decommissioning of the dam will not affect the surrounding economy. There is no potential for loss of local business and the land use surrounding the site is primarily used recreationally. The dam removal will not affect neighboring property values.

3.4 Infrastructure

There is minimal infrastructure at risk from decommissioning Mackie Road Dam. Dogwood Dr and the Trans Canada Hwy cross Holland Creek approximately 2 km and 2.3 km downstream, respectively, via bridges with large hydraulic openings. This is a reasonable distance and unlikely that any release of water will affect the bridge piers or any respective features. The culvert beneath the Esquimalt & Nanaimo railway will be adequate to pass the outflows as the flow regime will remain unchanged.

Other than the infrastructure mentioned above, the channel does not come in close contact with other critical infrastructure. There is a minimal amount of water impounded by the dam, hence, low risk of damage to any infrastructure from uncontrolled release of water and/or impounded sediment.

4. Preliminary Design Plans, Drawings and Specifications

It is important to consider whether the dam may be partially or fully decommissioned. Partial decommissioning may only involve breaching a portion of the dam, while leaving other dam features intact. This will not be possible with Mackie Road Dam due to its size, age, and the deterioration the structure has undergone. In the event of a partial breach of Mackie Road Dam, there will be structural stability concerns.

Full decommissioning requires that all visible elements be removed from the site. It is acceptable to leave foundational material buried e.g. leave concrete sills at grade. Having the foundational materials undisturbed will maintain the overall channel stability. Small dams require a minimum of 0.5 m below the streambed to be removed. However, depending on ground conditions, this may not be feasible for Mackie Rd Dam due to the presence of shallow bedrock. The channel cross section and grade will be limited to the surface of exposed bedrock. However, it will still conform to the guidelines as the uncovered bedrock conditions will be similar to the conditions prior to development of the dam.

Three separate scenarios are assumed based off of most likely bedrock profiles/sections, and the bedrock will govern the profile and section of the channel if/when it is exposed. The bedrock profile was assumed based on the conditions at time of the DSI's site inspection and survey; this is illustrated in Figure 4.1 & Figure 4.2 for visualization.

Figure 4.1 U/S Bedrock Identification & Visualization

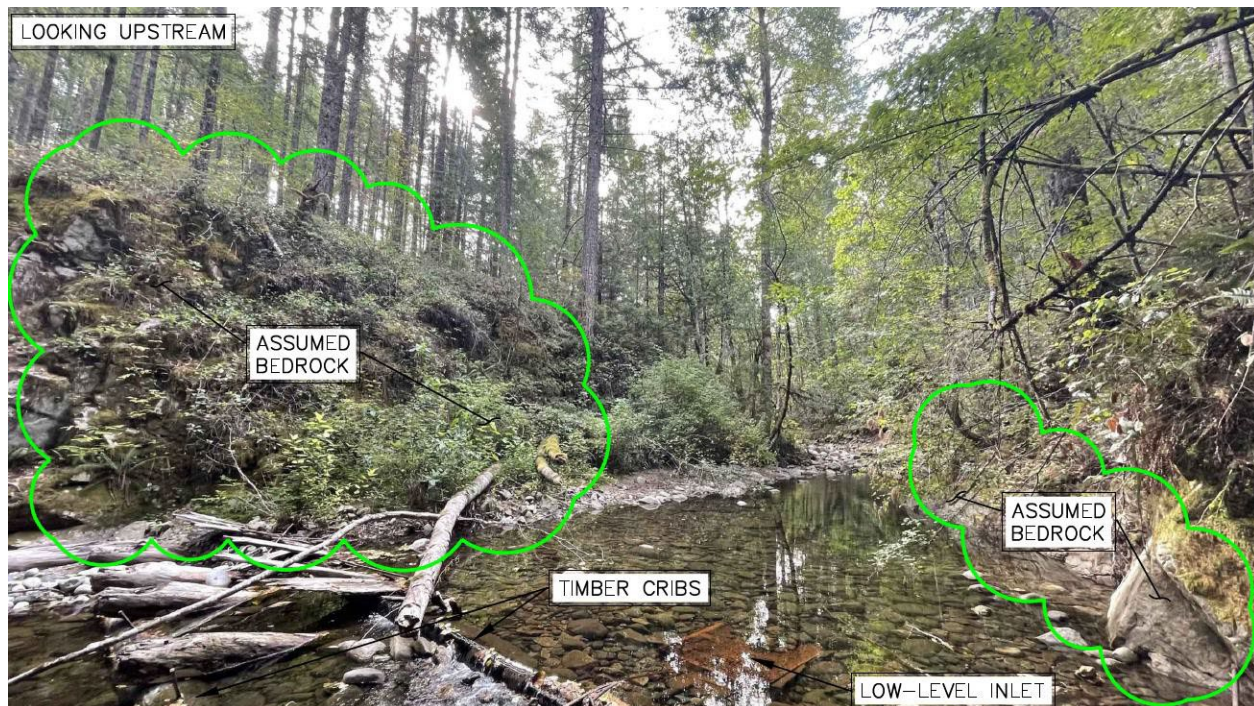
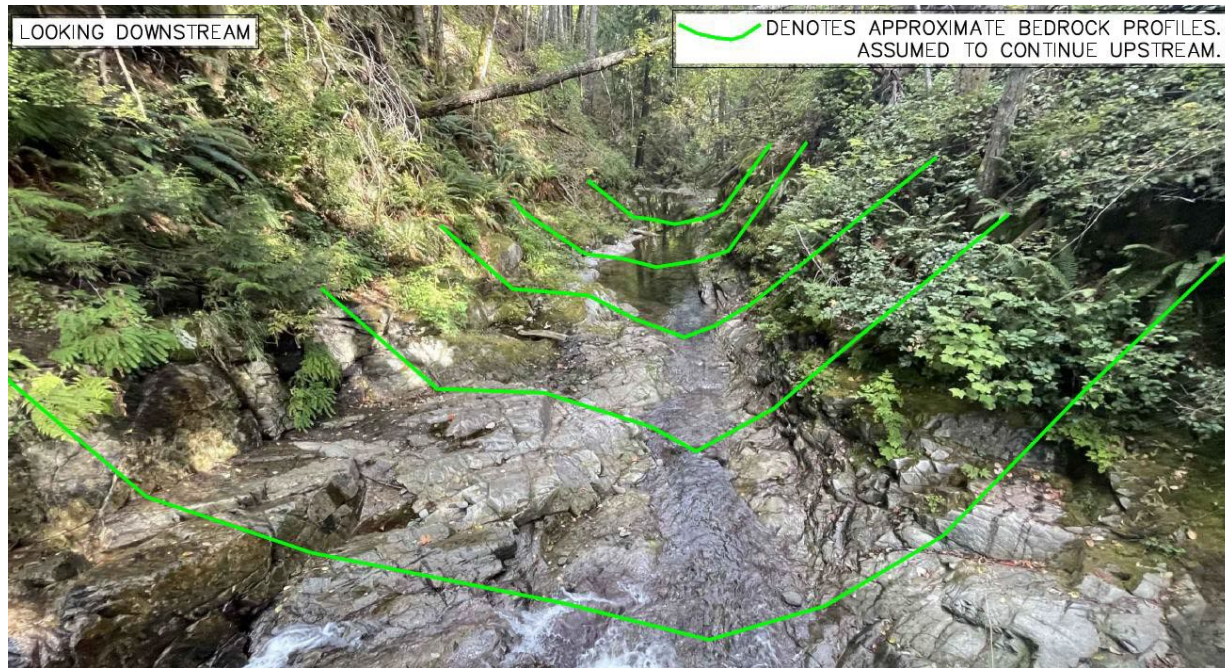


Figure 4.2 D/S Bedrock Identification & Visualization

Based off of the most probable bedrock scenarios, three conceptual designs were produced to illustrate the decommissioning. These can be seen in a preliminary drawing package, Appendix D. The most likely design is scenario 2, this is illustrated in a snapshot from a conceptual 3D model produced in AutoCAD InfraWorks, Figure 4.3 & 4.4.

1. **Scenario 1 (Steep Grade):** Grade the channel back to the final crib. This scenario will be combined with in-stream sediment management practices which will allow natural geomorphological processes to decrease this grade further downstream over time.
2. **Scenario 2 (Shallow Grade):** In order to achieve approximately the same grade as the current natural channel, the grading will need to extend ~35 m upstream of the dam. This scenario will govern if bedrock is not uncovered or is not at a reasonable depth below the existing grade. This will not require thorough sediment management post decommissioning due to the shallow grade.
3. **Scenario 3 (Waterfall):** Assuming that the bedrock profile is a lot shallower than expected, there could have existed a natural waterfall prior to the construction of the dam. This could be indicated by the relatively high elevation of the low-level outlet (center of the dam) which could have been limited by bedrock outcropping. If this is the case, the natural channel will follow the bedrock profile as encountered during construction and possibly be restored to a natural waterfall. Built up sediment will still have to be removed to limit downstream transportation.

Figure 4.3 **Mackie Rd Dam Existing 3D model**



Figure 4.4 **Mackie Rd Dam Removal Scenario 2 Shallow Grade 3D model**



4.1 Preliminary Sediment Management Assessment

The majority of sediment and river rock that has been deposited and currently impounded by the dam will be excavated, stockpiled, and removed offsite. There is enough volume impounded that there is a risk of a small debris flow affecting downstream areas should a short duration high intensity storm occur during decommissioning. In the event of large volumes of coarse sediment release, the downstream channel may also be susceptible to widening due to bank erosion. If there is a large volume of finer sediments beneath what is visible, release of this downstream could increase the water turbidity which will negatively impact fish and overall water quality. There is also a risk that this sediment may cause the release of excessive nutrients and/or pollutants that may have built up over the years; with the removal, this reduces the need and cost associated with sediment sampling and testing.

Below is a summary of the assumed scenarios presenting the estimated volumes of material to be removed. These were calculated using volume comparison reports between the inferred bedrock profile and existing ground generated in AutoCAD Civil3D.

- **Scenario 1 (Steep Grade):** Bedrock exists at a shallow depth beneath the upstream channel, sloping relatively steep towards the upstream end. Volume to be removed for scenario 1 (approx. 20% grade): 80 - 130 m³
- **Scenario 2 (Shallow Grade):** Bedrock beneath the upstream channel is at a depth of 3.8 m or more (height of dam) and is sloped reasonably shallow and/or is not found. Volume to be removed for scenario 2 (grading extents ≈ 35 m upstream), approx. 6-7% grade): 750 – 900 m³
- **Scenario 3 (Waterfall):** Bedrock exists directly beneath the dam and upstream channel which could have been a natural waterfall prior to commissioning of the dam. Volume to be removed for scenario 3 (bedrock inferred as 'waterfall') ≈ 50 - 100 m³

A size distribution analysis should be conducted before or at the time of construction on the impounded sediment. This will allow for debris flow analysis if required to support the decision on how much sediment needs to be removed.

Depending on the re-routing and constructability plans chosen, there could be different approaches towards the sediment management plan (Section 4.2 Constructability presents proposed re-routing options). In general, the sediment material should be removed while the dam is in place in a staged manner in order to minimize any release downstream. This means that the dam structure will act as a sediment barrier during the deconstruction process.

During deconstruction, it is important to ensure that when disturbing this sediment that the majority does not become mobile and create turbid conditions downstream. This is a standard requirement to maintain downstream habitats with clean water.

- The source of the temporary diversion (re-routing) should be set far enough upstream so that it is clean and unaffected by any construction activities. A turbidity curtain should be utilized, especially when managing the flow around different construction phases.
- The proposed water re-routing plan will be via a small open channel. There is a higher risk of turbid water with this, however the limited space does not make it viable to re-route using other methods (e.g. piping). This should be managed and monitored closely. The use of silt/turbidity curtains should be utilized.

A natural instream sediment redistribution will occur once all removal and regrading is complete, this means that the upstream sediment will naturally redistribute downstream over time. The channel grade will decrease, forming its own natural grade and optimize natural habitat along the downstream bedrock sections. The risk associated with this is if the sediment is distributed further downstream than expected, i.e. finer sediment becomes mobile in

high flows, it may affect some environmentally sensitive areas such as clam habitats in Ladysmith harbor and First Nations fishing areas; this should be assessed by a qualified professional during the detailed design phase.

Due to a significant amount of sediment impounded by the dam, reconstruction, and rehabilitation of the riparian areas at the channel re graded section will be required. This will involve implementing revegetation and environmental restoration plans for any exposed banks, where bedrock is not present.

4.2 Constructability

The process for re-routing or dewatering the channel at this site is difficult due to the limited space and steep creek banks. Below are some conceptual options for this process.

1. A proposed layout for the deconstruction of Mackie Road Dam is to temporarily re-route the water along the right side of the channel. The right side of the channel was chosen due to less shallow bedrock present. This will be achieved by removing a portion of the dam face and excavating a small channel following the right bank. The channel dimensions and specifications will be determined in the detailed design. The water will be re-routed through this channel leaving the left side of the channel dry. As part of the dewatering process, an attempt to reinstate the LLO could be considered in the discharge of additional flow. The impounded sediment/river rock on the dry portion will be excavated to reveal subsurface conditions and graded back to the point detailed in the design drawings, uncovering the timber cribs. The temporary diversion should be excavated further in a phased approach relative to the sediment excavation which should be uniform; this ensures the left portion remains dry, and the water remains in the temporary diversion. As the impounded sediment is removed offsite, the dam crest may be removed at the same rate as the sediment removal. If shallow bedrock is encountered during excavation, the temporary diversion method may need to be modified with the use of sandbags, tiger dam or barrel and pipe etc. to maintain this temporary diversion. See structural removal plan and Figure 4.3.a for more details and visualization.
2. A possible approach for the decommissioning is to conduct a partial removal. This means that a portion of the dam will be removed, along with a specific volume of the impounded sediment. Once the specified volume and dam features are removed, the creek and dam will be left until the following year. An advantage with this approach is that it ensures the construction window is achieved, ensuring environmental and engineering due diligence. This option will however require the dam structure and material that is left in place to be structurally sound, and to remobilize construction activities the following year. This could cause further complications with the engineering design, stakeholders, and is likely to increase decommissioning costs.

The maximum daily flow during construction should be calculated to ensure that the diversion method chosen is able to withstand a 1/10-year maximum flow. This will be checked during the hydrology conducted as part of the detailed design phase. This is important to ensure safety for anyone on site or downstream of the construction works. The construction is recommended to take place towards the end of August when the lowest flows occur as well as the least environmental risk.

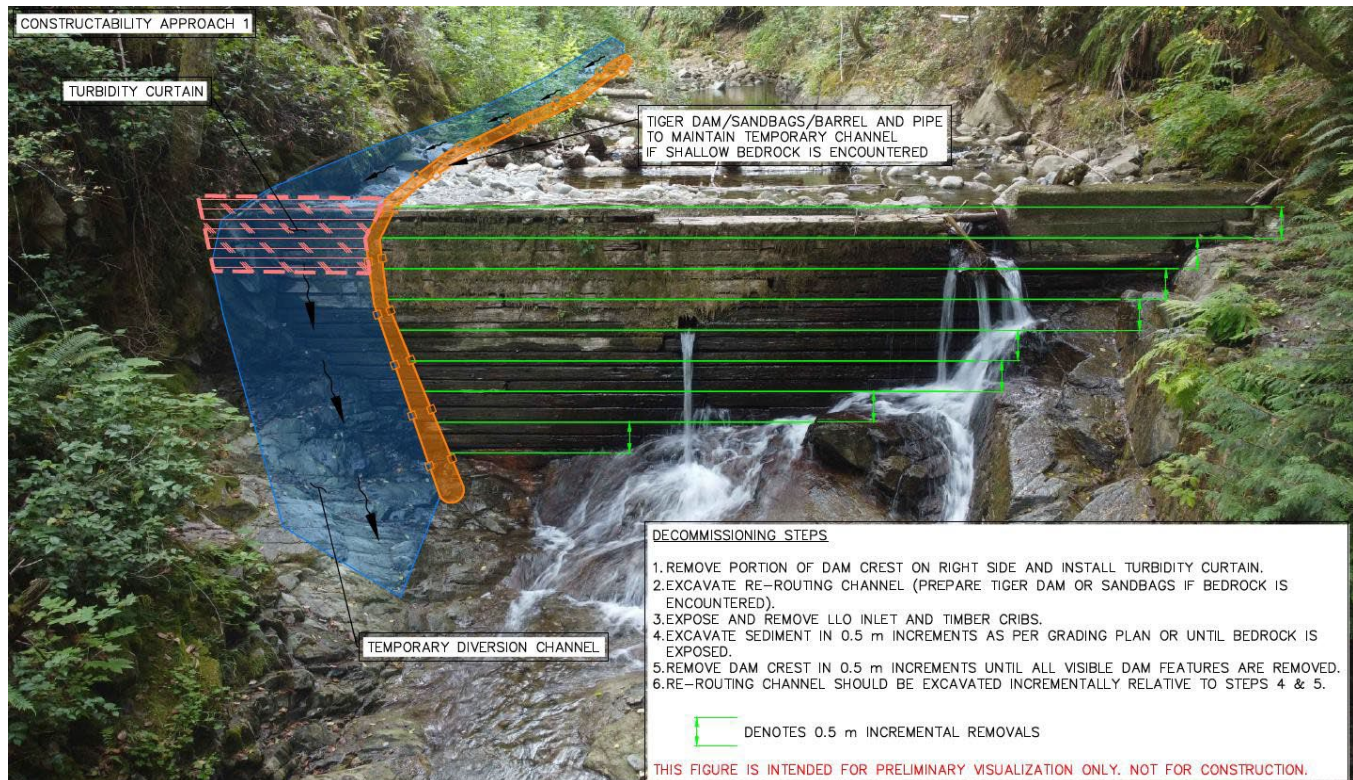
4.3 Preliminary Structural Removal Plan

The guidelines dictate that in order to authorize the abandonment of water rights (Section 31(1) of the WSA), no water shall be stored once decommissioning is complete. Mackie Road Dam does not have any known water licenses associated with it; however, a provisional water license should be obtained. The structural removal limits for the decommissioning of Mackie Road Dam should be defined as a full decommissioning. This means that no visible elements of the dam structure shall remain. The specification of the dam structure is unknown and will be assessed in the field on a regular basis.

It is proposed that the dam be deconstructed from the upstream end. The upstream end of the grading should be excavated to expose the first layer of cribs and low-level outlet, which shall be inspected and removed. Removal

of the structure should consist of phasing between mechanical removal of the impounded sediment, and dam structure. The dam crest should be removed section by section to keep up with the sediment removal; the crest should remain higher than the sediment excavation during the process. This process should be repeated at approximately 0.5 m incremental removals until bedrock is exposed, then removing the dam features down to the foundation. At that point, a qualified engineer should inspect the foundational elements and determine whether it can remain or not. It is proposed that the foundation may remain to ensure that no instability is induced in the channel section. The figure below provides visualization for constructability approach 1 as outlined here and in Section 4.2.

Figure 4.5 Constructability Approach 1 Visualized



4.4 Access

The access to the site is very limited and creating staging areas will be difficult. The access trail is narrow and should be assessed to determine the width required for construction equipment accessibility. The type of equipment needed will be determined in the detailed design phase.

Development of a staging area for machinery and spoil is limited. There should be an investigation into the extent of access to the left side (North-West) of the channel via the Heart Lake Trail from Mackie Rd. This will be the most direct and shortest route to the site. Alternatively, access to the Heart Lake Trail via Colonia Dr could also be a viable option. Both routes will need to be assessed to determine whether widening is required. The staging area and spoil area should be developed at the low point in the access trail above the dam site or near the entrance of the access road. Felling trees may be required here, this is again dependent on space and should be investigated. A further survey of the site is scheduled to be conducted and will be evaluated as part of the detailed design.

4.4.1 Access Constructability

The focus of the access will be determining how to reach the site and remove the impounded material off site with the appropriate machinery. Temporary access roads were assessed in AutoCAD Civil3D near the subject site within the limits of the current survey, however, the options analyzed were found unfeasible due to the shallow instability, steepness of the creek slopes and presence of bedrock. An access road further upstream into the creek at or around the end of Colonia Dr may be possible. This would mean that the equipment would have to traverse downstream for approximately 200 m and any obstacles, i.e. fallen trees, temporarily removed. Analysis of this option will be required pending further survey. A temporary road permit may be required from the land tenures branch if an access road is utilized.

Another option would be to utilize a mobile crane. There is a low point along Heart Lake Trail above Mackie Road Dam (approx. UTM 10, 439243E, 5426237N) which could act as a staging area for the mobile crane. Access to this location will have to be evaluated. The crane will be able to deliver machinery to the upstream channel along with a spoil removal bin (skip). This bin will be utilized by the crane to remove the impounded material. This may be the only viable option for decommissioning pending site investigation.

The site conditions should be evaluated to assess the constructability of the options presented above. An early contractor engagement site meeting should be held to ensure that the contractors have an adequate skill level capable of completing the works, and to obtain another perspective on the constructability of the works.

4.5 Monitoring & Adaptive Management

Post removal site surveillance and monitoring should be conducted for a minimum of one year including annual inspection report(s). This will mainly involve the physical monitoring of the site to ensure that it's performing as designed. It may also involve any maintenance involving bank stability and revegetation. Depending on the performance and site-specific issues, the monitoring may be extended for up to five years.

Adaptive management may include additional surveillance and maintenance, if necessary, of biological, physical, or environmental concerns. This may include, but not limited to:

- Beaver presence and potential impacts to the channel.
- Erosion or scour holes forming in exposed banks and/or channel sections.
- Stability and/or mobility issues with the upstream sediment.
- Target levels of regrowth / revegetation. Increased efforts on exposed soils could be required.
- Minimization of invasive species and maintained fish passage.

5. Discussion & Recommendations

Overall, there are a number of regulations and recommendations for dam decommissioning provided by the WLRS that will not pertain to Mackie Road Dam; these are all outlined in this preliminary decommissioning report. The focus of the decommissioning is to remove all visible elements of the dam safely and efficiently, and to restore the channel section and banks as reasonably possible to that prior to the development of the dam. Significant erosion or failure should be mitigated during the deconstruction and rehabilitation of the channel and ensure that the channel is tied into the banks in the most natural way possible. This report outlines the plan submission requirements as per the DSO's recommendations and provides relative information on the decommissioning process in order to facilitate stakeholder engagement, public and First Nation consultations, and the necessary details to move forward with the decommissioning authorization and final design.

Ecora recommends that the channel be re-graded to match the existing channel (scenario 2 if possible). This ensures that the restored channel will be as natural as possible while minimizing any potential for future erosion.

This is still dependent on the bedrock conditions which will be confirmed in the field at the time of construction. A staged structural removal should be executed in order to minimize any sediment becoming mobile and to ensure structural stability during deconstruction.

6. Closure

We trust this report meets your present requirements. If you have any questions or comments, please contact the undersigned.

Sincerely,

Ecora Engineering & Environmental Ltd.

Prepared by:



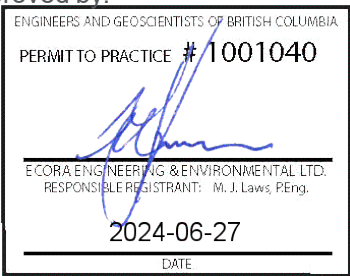
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0	2024-06-21	TWE	AK	MJL	Issued For Use

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Figures

Figure 1 Site Location & Inundation Path

SITE LOCATION & INUNDATION PATH



DAM SAFETY REVIEW MACKIE RD DAM LADYSMITH, BC

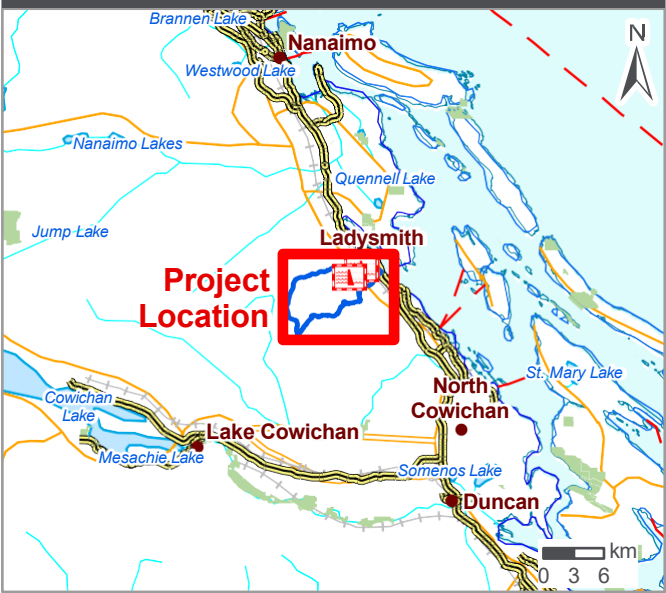
Legend

- Dam Location
- Inundation Path
- 20m TRIM Contour Lines
- Digital Road Atlas Roads
- Fresh Water Atlas Streams
- Highways
- Holland Creek Watershed
- PMBC Legal Parcels

References

Aerial Imagery: Maxar, 8/24/2021

LOCATION MAP



1:35,000

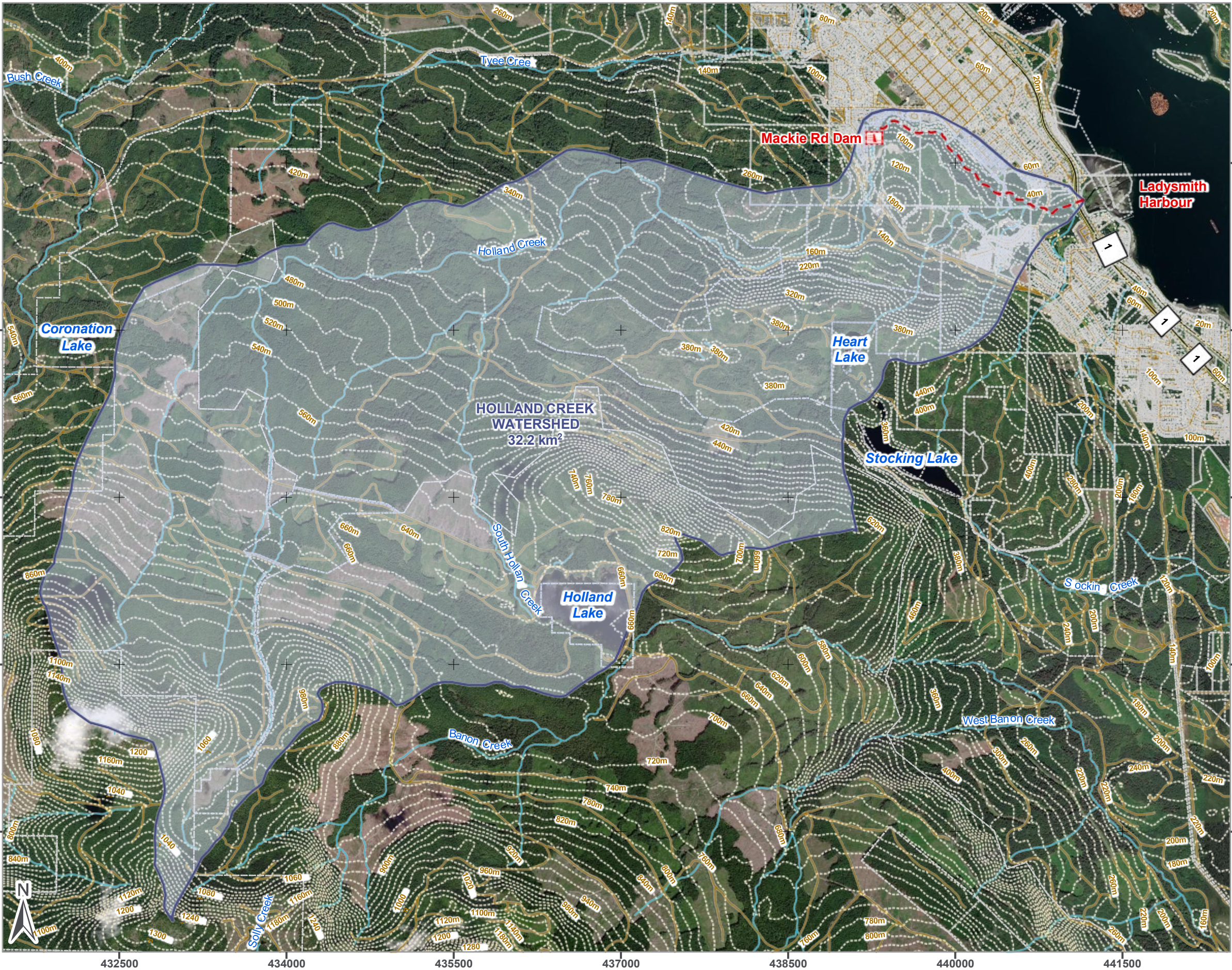
0 500 1,000 1,500 2,000 Meters

Project No.: 230602
Client: BC Parks

Date: 2024/04/23
Drawn: KH Check: CAC

NAD 1983 UTM Zone 10N

Figure 1.0



Appendix A

General Conditions

Standard of Care

Ecora Engineering and Resource Group Ltd. (Ecora) has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practicing under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report. No other warranty, expressed or implied is made.

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Where Ecora submits both electronic file and hard copy versions of reports, drawings and other project-related documents, only the signed and/or sealed versions shall be considered final and legally binding. The original signed and/or sealed version archived by Ecora shall be deemed to be the original for the Project. Both electronic file and hard copy versions of Ecora's deliverables shall not, under any circumstances, no matter who owns or uses them, be altered by any party except Ecora.

Soil, Rock and Groundwater Conditions

Classification and identification of soils, rocks and geological units have been based upon commonly accepted systems and methods employed in professional geotechnical practice. This report contains descriptions of the systems and methods used. Classification and identification of the type and condition of these materials or units involves judgment, and boundaries between different soil, rock or geologic types or units may be transitional rather than abrupt. Accordingly, Ecora does not warrant conditions represented herein as exact, but infers accuracy only to the extent that is common in practice.

Soil and groundwater conditions shown in the factual data and described in the report are the observed conditions at the time of their determination or measurement. Unless otherwise noted, those conditions form the basis of the recommendations in the report. Groundwater conditions may vary between and beyond reported locations and can be affected by annual, seasonal and meteorological conditions. The condition of the soil, rock and groundwater may be significantly altered by construction activities such as traffic, excavation, groundwater level lowering, pile driving, blasting on the site or on adjacent sites. Excavation may expose the soils to climatic elements such as freeze/thaw and wet /dry cycles and/or mechanical disturbance which can cause severe deterioration. Unless otherwise indicated the soil must be protected from these changes during construction.

Environmental and Regulatory Issues

The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise specifically stated and identified in the report. The presence or implication(s) of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for this project and have not been investigated or addressed.

Sample Disposal

Ecora will dispose all soil and rock samples for 30 days following issue of this report. Further storage or transfer of samples can be made at the Client's expense upon written request, otherwise samples will be discarded.

Construction Services

During construction, Ecora should be retained to perform sufficient and timely observations of encountered conditions to confirm and document that the subsurface conditions do not materially differ from those interpreted conditions considered in the preparation of Ecora's report and to confirm and document that construction activities do not adversely affect the suggestions, recommendations and opinions contained in Ecora's report. Adequate field review, observation and testing during construction are necessary for Ecora to be able to provide letters of assurance, in accordance with the requirements of many regulatory authorities. In cases where this recommendation is not followed, Ecora's responsibility is limited to interpreting accurately the information encountered at the borehole locations, at the time of their initial determination or measurement during the preparation of the Report.

Job Site Safety

Ecora is responsible only for the activities of our employees on the jobsite. The presence of Ecora's personnel on the site shall not be construed in any way to relieve the Client or any contractors on site from their responsibilities for site safety. The Client acknowledges that he, his representatives, contractors or others retain control of the site and that Ecora never occupy a position of control of the site. The Client undertakes to inform Ecora of all hazardous conditions, or other relevant conditions of which the Client is aware. The Client also recognizes that our activities may uncover previously unknown hazardous conditions or materials and that such a discovery may result in the necessity to undertake emergency procedures to protect our employees as well as the public at large and the environment in general.

Changed Conditions and Drainage

Where conditions encountered at the site differ significantly from those anticipated in this report, either due to natural variability of subsurface conditions or construction activities, it is a condition of this report that Ecora be notified of any changes and be provided with an opportunity to review or revise the recommendations within this report. Recognition of changed soil and rock conditions requires experience and it is recommended that Ecora be employed to visit the site with sufficient frequency to detect if conditions have changed significantly. Drainage of subsurface water is commonly required either for temporary or permanent installations for the project. Improper design or construction of drainage or dewatering can have serious consequences. Ecora takes no responsibility for the effects of drainage unless specifically involved in the detailed design and construction monitoring of the system.

Services of Sub consultants and Contractors

The conduct of engineering and environmental studies frequently requires hiring the services of individuals and companies with special expertise and/or services which we do not provide. Ecora may arrange the hiring of these services as a convenience to our Clients. As these services are for the Client's benefit, the Client agrees to hold the Company harmless and to indemnify and defend Ecora from and against all claims arising through such hiring's to the extent that the Client would incur had he hired those services directly. This includes responsibility for payment for services rendered and pursuit of damages for errors, omissions or negligence by those parties in carrying out their work. In particular, these conditions apply to the use of drilling, excavation and laboratory testing services.

Appendix B

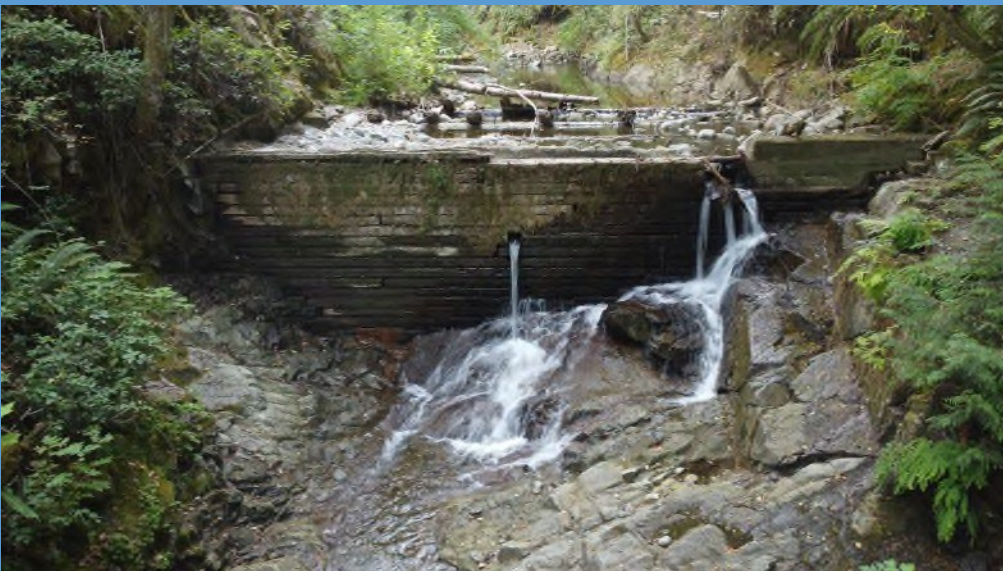
Ladysmith Dam Environmental Assessment Report



Ladysmith Dam Environmental Assessment Report

Presented To: Town of Ladysmith

Dated: June 27, 2024
Ecora File No.: 230602



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27 June 2024

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1. Introduction

Ecora Engineering & Resource Group Ltd. (Ecora) has been retained by the Town of Ladysmith (the Town) to prepare an Environmental Assessment (EA) report for the Holland Creek (Mackie Road) Dam (Reference ID: D720190) Assessment and Decommissioning project (hereafter referred to as ‘the Project’).

1.1 Project Details

The Holland Creek Dams, which are a series of three concrete gravity dams, require dam safety inspections and, in the case of the Mackie Road Dam D720190, also a decommissioning plan. Of the three dams, only Holland Creek Water Supply Dam (D720174) is currently active. The Holland Creek (Mackie Road) Dam (D720190) and Holland Creek (Colonia Drive) Dam (D720191) are currently abandoned. The requirement for the decommission of Mackie Road Dam arose after BC Dam Safety reviewed the condition of several dams along Holland Creek and noted the relatively poor condition of the Mackie Road Dam. According to the Project Request for Proposal (RFP), BC Dam Safety and the Town’s Council has determined that decommissioning the dam was likely the best path forward from the safety perspective. The other two dams reviewed require engineering input but are on a lower priority timeline.

This EA Report will provide the results of our environmental desktop studies and site visit for the above mentioned dam. However, the current proposed activities will be limited to the decommission of Mackie Road Dam only as per the engineering design drawings (Holland Creek Dam Safety Inspection – Mackie Road Dam Town of Ladysmith Existing Site Plan, 16 February 2023). As per the drawings, sediment removal will be conducted within the creek channel as part of the proposed activities. The goal for the dam decommission is to restore the original channel morphology within the project site.

1.2 Objectives

The objectives of the EA Report include:

- A biophysical inventory and background review of local resources that may be impacted by the Project.
- Identification of planned and potential impacts to species and habitats.
- Identification of species-at-risk that could be affected by the Project.
- A description of the scope of work and potential impacts that will need to be addressed.
- Guide construction schedules by identifying periods for construction that are the least-risk to species potentially affected by the project.
- Guide the preparation of a Construction Environmental Management Plan (CEMP) that will be used by the selected contractor as a guide to mitigate environmental risks during construction.
- An environmental monitoring plan.
- A description of potential restoration or enhancement opportunities.

1.3 Dam Locations

The EA addresses the above-referenced dams. These dams are located along Holland Creek (Watershed Code: 920-321500) within the Town and are under the Town’s Jurisdiction. Please refer to **Table 1** for the GPS Coordinates of the above-referenced dams. The location of each dam is depicted in the inset Figure 1 below.

Table 1. GPS Coordinates of Mackie Road Dam, Colonia Drive Dam, and Water Supply Dam

Dam	UTM Coordinates		
	Zone	Easting	Northing
Mackie Road Dam (D720190)	10	439271.650	5426221.390
Colonia Drive Dam (D720191)	10	439243.530	5425931.190
Water Supply Dam (D720174)	10	438049.240	5425084.430

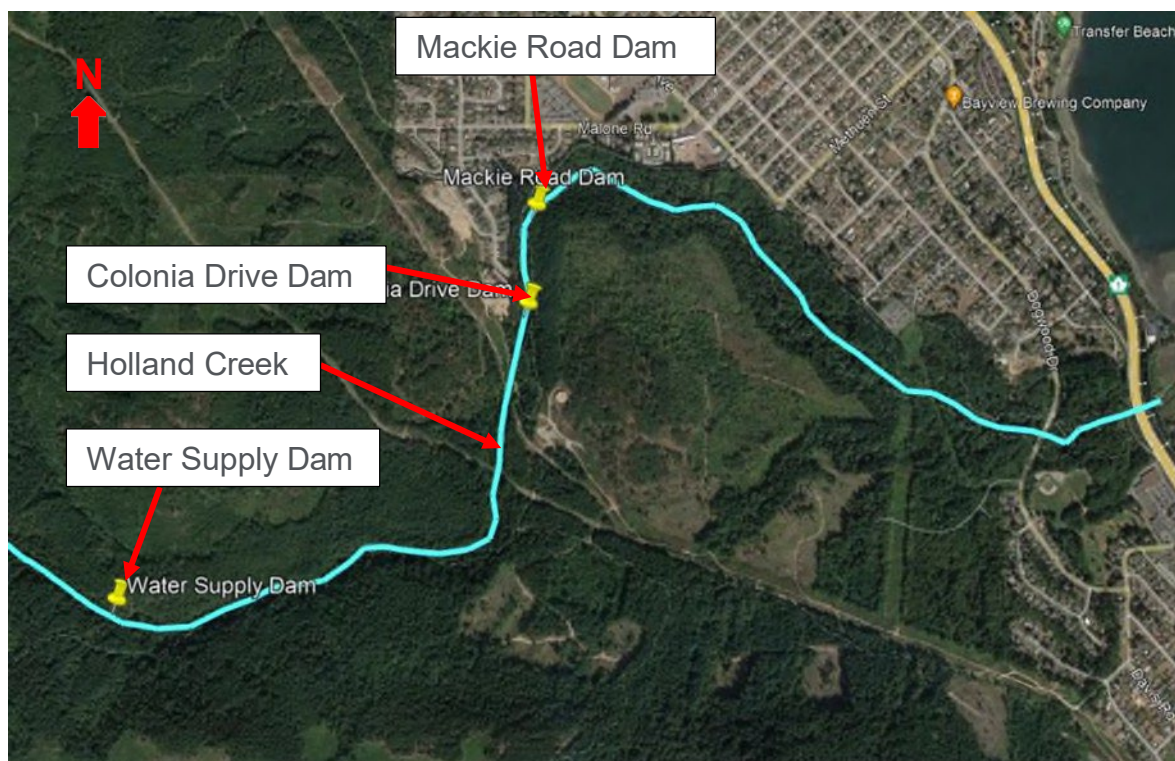


Figure 1. Google Earth Aerial Image showing the dam locations along Holland Creek

1.4 Climate and Weather

The Project occurs within the Coastal Western Hemlock (CWH) Biogeoclimatic Zone¹. On average, the CWH is the rainiest biogeoclimatic zone in British Columbia. The zone typically has a cool mesothermal climate: cool summers and mild winters. Mean annual temperature is about 8°C and ranges from 5.2 to 10.5°C among the CWH subzones. The mean monthly temperature is above 10°C for 4-6 months of the year. The mean temperature of the coldest month is 0.2°C and ranges from 6.6 to 4.7°C among the subzones. In the Town, November, December and January are the wettest months (rain: >180 mm per month) while July and August are the driest months (rain: <45 mm per month)².

2. Desktop Studies

2.1 Existing Documents and Online Database

Prior to the field assessment, the following studies were reviewed:

- Water Quality Assessment and Objectives for Holland Creek and Stocking Lake Watersheds Vancouver Island³ (Ministry of Environment, Lands, and Parks 1996);
- Preliminary Environmental Screening of Potential Water Supply Development Projects for The Town of Ladysmith³ (P.A. Harder and Associates Ltd., 2002); and

¹ Meidinger and Pojar. 1991. Ecosystem of British Columbia. Source: <https://www.for.gov.bc.ca/hfd/pubs/Docs/Srs/Srs06.htm>

² Source: <https://en.climate-data.org/north-america/canada/british-columbia/ladysmith-10445/>. Accessed on 12 December 2023.

³ Source: https://www.ladysmith.ca/docs/default-source/reports-2021/appendix-b.pdf?sfvrsn=8367ecad_6. Accessed on 13 December 2023.

- Holland Creek Environmental Monitoring⁴ (BS Consulting, 2012).

A review of the available online information was conducted to identify known species and environmental features within or adjacent to the Project. The following resources were reviewed:

- DFO Aquatic Species at Risk Map;
- BC Conservation Data Centre (CDC) Explorer;
- BC CDC iMap;
- Habitat Wizard;
- BC Fish Inventories Data Queries (FIDQ).

2.2 Aquatic Resources

2.2.1 Hydrology

As per the above-mentioned studies, Holland Creek is approximately 12 km in length with a drainage area of 28 km² ranging in elevation from sea level to 1300 m⁵. The Holland Creek Watershed receives an average of 2200 mm of precipitation per year with more than 80% of the rainfall occurring from October to March. Peak streamflow occurs in the winter period while low flows occur during summer (i.e., June – September). Surface flow within Holland Creek is affected by the following:

- Banon Creek – upstream of Holland Lake; surface water at the upper 7.5 km² of Banon Creek is diverted into Holland Lake from November to May.
- Holland Lake and Prevost Lake – upstream of Holland Creek; these lakes store water in the winter and release it in the summer.
- The withdrawal of water by the Town at the Water Supply Dam intake.

The net effect of this water regulation is to increase flow by up to 3 to 4 times during July, August, and September.

2.2.2 Fish Habitat

Holland Creek flows eastward from the headwaters into Ladysmith Harbour. Within the upstream portion, the creek has two main channels (i.e., the North and South Forks). The South Fork originates from the Holland Lake reservoir and connects with the mainstem channel approximately 2.9 km upstream from the Water Supply Dam (also referred to as the Chicken Ladder Dam). Holland Lake supports a good recreational fishery of stocked rainbow trout (*Oncorhynchus mykiss*), which have been found in the South Fork of Holland Creek suggesting that the reservoir population of Rainbow Trout have moved into Holland Creek.

According to the studies, instream habitat diversity is high within the middle reaches (i.e., upstream and downstream of the South Fork) of Holland Creek. The channel exhibits a pool-riffle morphology with a gradient of approximately 2-3%. Substrates within the creek mainly consist of gravel and cobble. The streambank is believed to be stable, and instream features such as Large Woody Debris (LWD) and Small Woody Debris (SWD) appear to be abundant. Riparian habitat along Holland Creek appears to be dense with both deciduous and coniferous tree species including western redcedar (*Thuja plicata*), douglas-fir (*Pseudotsuga menziesii*), and red alder (*Alnus rubra*). Crown closure is approximately between 15% - 35%.

The studies also show that habitat conditions in lower Holland Creek (i.e., downstream of Water Supply Dam) are strongly influenced by residual flow volumes after water has been diverted into the water supply system for the Town. The net effect from flow regulation has significantly increased natural creek flow levels in Holland Creek during the low flow months (i.e., July, August, and September). Hence, these modified flow conditions are believed to improve the fish habitat conditions for resident and anadromous fish in Holland Creek.

⁴ Source: <https://wordpress.viu.ca/rmot306/files/2016/08/VIU-Holland-Creek-WQ-Report-2012>. Accessed on 13 December 2023.

⁵ Source: https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-objectives/wqo_report_holland_stocking.pdf. Accessed on 12 December 2023.

Holland Creek anadromous (sea-run) fisheries are limited to the lower 2.3 km by impassable falls. These species include chum salmon (*Oncorhynchus keta*), coho salmon (*Oncorhynchus kisutch*), steelhead (*Oncorhynchus mykiss*), and cutthroat trout (*Oncorhynchus clarkii*). According to Google Earth, Mackie Road Dam is located approximately 2.4 km upstream of the Ladysmith Harbor. Such information suggests that Holland Creek anadromous fisheries may not reach to Mackie Road Dam. However, it is possible that the Holland Lake Rainbow Trout may be present at Mackie Road Dam.

2.2.3 Fish Presence

Desktop studies show that Holland Creek (Watershed Code: 920-321500) is inhabited by the following fish species.

Table 2. Fish Species documented in the Provincial Databases for Holland Creek

Common Name	Latin Name	BC List / SARA as per CDC Explorer ⁶
Chum Salmon	<i>Oncorhynchus keta</i>	Not Reviewed ⁷
Cutthroat Trout (Coastal)	<i>Oncorhynchus clarkii</i>	Blue ⁸
Coho Salmon	<i>Oncorhynchus kisutch</i>	Yellow ⁹
Cutthroat Trout	<i>Oncorhynchus clarkii</i>	No Status ¹⁰
Rainbow Trout / Steelhead	<i>Oncorhynchus mykiss</i>	Not Reviewed ¹¹

2.3 Terrestrial Resources

Desktop studies indicate that the following amphibians and reptiles were observed and recorded within 3 km of the Project (see Table 3).

Table 3. Amphibians and Reptiles documented in the Provincial Database within 3 km of the Project.

Common Name	Latin Name	BC list / SARA
Common Garter snake	<i>Thamnophis sirtalis</i>	Yellow
Western Red-backed Salamander	<i>Plethodon vehiculum</i>	Yellow
Common Wall Lizard	<i>Podarcis muralis</i>	Exotic
Northern Red-legged Frog	<i>Rana aurora</i>	Blue / 1-SC ¹² (2005)
Western Skink	<i>Plestiodon skiltonianus</i>	Blue / 1-SC (2005)

Habitat Wizard indicates that a Great Blue Heron (*Ardea Herodias*) colony is located approximately 2 km to the north of the Mackie Road Dam. Aerial image from Habitat Wizard suggests that the colony is surrounded by residential developments and road construction. The following wildlife species were observed and recorded within 3 km of the Project (see Table 4).

⁶ Source: <https://a100.gov.bc.ca/pub/eswp/search.do?sessionId=D2B202A03865057B4D16CB1D4BA21614>. Accessed on 13 December 2023.

⁷ Not Reviewed = Species and ecological communities that have not undergone a conservation status assessment (i.e., Provincial Conservation Status Rank is SNR). Species that have Provincial Conservation Status Ranks assigned from National General Status Program but have not been reviewed or verified by the BC CDC.

⁸ Blue = Includes any native species or ecological community considered to be of Special Concern (formerly Vulnerable) in British Columbia. Species or ecological communities of Special Concern have characteristics that make them particularly sensitive or vulnerable to human activities or natural events. Blue-listed species or ecological communities are at risk, but are not Extirpated, Endangered or Threatened.

⁹ Yellow = Includes species or ecological communities that are apparently secure and not at risk of extinction. Yellow-listed species may have red- or blue-listed subspecies.

¹⁰ No Status is assigned to the animal species record when all related infraspecies (e.g., subspecies, population, ecotype, etc.) in BC have been assigned to the Red, Blue, or Yellow List.

¹¹ Not Reviewed = Species and ecological communities that have not undergone a conservation status assessment (i.e., Provincial Conservation Status Rank is SNR); Species that have Provincial Conservation Status Ranks assigned from National General Status Program but have not been reviewed or verified by the BC CDC.

¹² SPECIAL CONCERN (SC): A species of special concern because of characteristics that make it is particularly sensitive to human activities or natural events.

Table 4. Wildlife species documented in the Provincial Database within 3 km of the Project.

Common Name	Latin Name	BC list / SARA
Great Blue Heron	<i>Ardea Herodias</i>	No Status
Double-crested Cormorant	<i>Phalacrocorax auritus</i>	Blue
Bald Eagle	<i>Haliaeetus leucocephalus</i>	Yellow

2.4 Species at Risk

A review of DFO Species at Risk Maps shows that no designated aquatic critical habitat is located within or adjacent to the dams. Habitat Wizard Incidental Observation Records indicate that two SARA Schedule 1 species (i.e., Northern Red-legged Frog and Western Skink) were identified offsite. As per the records, these two species were identified in the following locations:

- Northern Red-legged Frog - identified at the northern edge of Heart Lake approximately 1.8 Km to the south of Mackie Road Dam in 2015; and
- Western Skink - identified at the eastern edge of Stocking Lake approximately 3.3 Km to the south of Mackie Road Dam in 2014.

2.4.1 Northern Red-legged Frog

As per COSEWIC Assessment and Status Report on the Northern Red-legged Frog¹³ (2015), this species is an inhabitant of moist, lower elevation forests and requires both aquatic breeding habitats and terrestrial foraging habitats in a suitable spatial configuration to complete the different phases of its life cycle. The Northern Red-legged Frog breeds in a variety of permanent and temporary water bodies, including potholes, ponds, ditches, springs, marshes, margins of large lakes, and slow-moving portions of rivers. In British Columbia, distribution records and anecdotal observations suggest that the species is commonly found in second growth forests and occurs in suburban gardens and seasonal ponds in pasture and agricultural lands adjacent to forested areas. Based on its terrestrial habitat requirements (i.e., forested area or agricultural land adjacent to the forested areas), it is possible to encounter Northern red-legged frog within or adjacent to the dams.

2.4.2 Western Skink

CDC Species Summary indicates that habitats of Western Skink include grassland, chaparral, pinyon-juniper woodland, open pine or pine-oak woods, and rocky areas near streams (Stebbins 2003); the species is partial to open wooded foothills and is usually associated with rocks, under which it takes shelter (also digs burrows in soil). Although CDC Mapped Known locations show that all known Western Skink Critical Habitats are located within the southeastern BC, it is possible to encounter Western Skink within or adjacent to the dams based on its habitat preference (i.e., riparian treed habitat).

3. Field Assessment

Ecora assessed the dams on the following dates to document the existing environmental conditions at the Project area:

- 19 September 2023 to observe the habitat conditions at the dams during the low flow period.
- 27 and 28 October 2023 to observe the habitat conditions at the dams during the wet season.

Prior to the site visits, rainfall records from the two nearest monitoring stations (i.e., Nanaimo A Station and Chemainus Station) were reviewed to estimate the flow conditions associated with the precipitation events. As per Weather Canada¹⁴, both stations are approximately 8 km from Mackie Road Dam. Nanaimo A Station (Climate ID: 1025365) is located to the north of the dam. Chemainus Station (Climate ID: 1011500) is located to the south of the dam. As per the records, no

¹³ COSEWIC. 2015c. COSEWIC assessment and status report on the Northern Red-legged Frog *Rana aurora* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xii + 69 pp.

¹⁴ Source: https://climate.weather.gc.ca/historical_data/search_historic_data_e.html. Accessed on 19 December 2023.

precipitation was recorded at Nanaimo A Station prior to the site visits. Minimal precipitation (rain: 0.2 mm) was documented at Chemainus Station on 18 September 2023. Also, precipitation events (rain: 95.9 mm, snow: 6.8 cm) were documented on 24 and 25 October 2023 at Chemainus Station. Based on rainfall records, it is possible that precipitation events might have occurred at the dams 48 hours or 72 hours prior to the site visit on 27 October 2023. The site assessment was conducted in accordance with the following guidelines:

- Channel Conditions and Prescriptions Assessment¹⁵
- Riparian Assessment and Prescriptions Procedures¹⁶
- Provincial Fish Habitat Assessment Procedure¹⁷

At each dam, our assessment addresses the following areas:

- Approximately 50 m upstream of the dam
- Approximately 100 m downstream of the dam
- Riparian area measured approximately 30 m from the top of bank on both sides of the dam

3.1 Mackie Road Dam

Onsite observations suggest that Mackie Road Dam is located within a ravine with a width of approximately 20 m measured from Top of Ravine Bank. The dam is about 12 m wide and is approximately 4 m below the Top of Ravine Bank.

3.1.1 Instream Habitat Observations

At the upstream end of the dam, the channel exhibits a riffle-pool morphology with an average gradient of approximately 2%. The channel width is approximately 12 m. The dominant substrate appears to be cobble, and the subdominant substrate is gravel. Residual pool depth is approximately 15 cm. During the site visit on 28 October 2023, the channel had a wetted width of approximately 11 m and a wetted depth of approximately 40 cm. Habitat features such as SWD, LWD, and overhanging vegetation appear to be abundant within the channel.

The channel exhibits a step-pool morphology within approximately 20 m downstream of the dam with a gradient of approximately 7%. Within this area, substrate consists of bedrock, and no instream habitat features were noted. At the further downstream of the dam, the channel exhibits a cascade-pool morphology with a gradient of approximately 4%. The substrate mainly consists of boulder and cobble.

A permanent fish barrier (i.e., waterfall) is noted approximately 50 m downstream of the dam. The waterfall is approximately 10 m wide with a height of approximately 6 m (gradient: >80%). Onsite observations suggest that the waterfall is likely one of the impassable falls mentioned in the desktop studies.

3.1.2 Riparian Habitat Observations

Riparian vegetation adjacent to the dam appears to have been well-landscaped. At the canopy level, riparian vegetation consists of a mix of deciduous and coniferous trees including red alder, western redcedar, and Douglas-fir. At the shrub and ground level, riparian vegetation consists of salmonberry (*Rubus spectabilis*), bigleaf maple (*Acer macrophyllum*), and sword fern (*Polystichum munitum*).

¹⁵ Source: https://a100.gov.bc.ca/pub/acat/documents/r1740/CCPA_1098478880683_b225bfbc905247a28b95b537fcd305d4.pdf. Accessed on 19 December 2023.

¹⁶ Source: <https://www.for.gov.bc.ca/hfd/library/documents/Bib46218.pdf>. Accessed on 19 December 2023.

¹⁷ Source: https://a100.gov.bc.ca/pub/acat/documents/r15711/Fish_Habitat_Assessment_Procedures_1229454360370_60d06fb366d66d9a96f0f58ea082db1abc58c0fc1e3805cd799cd37fc0143bdb.pdf. Accessed on 19 December 2023.

3.2 Colonia Drive Dam

Onsite observations suggest that Colonia Drive Dam is located within a ravine with a width of approximately 15 m measured from Top of Ravine Bank. The dam is about 12 m in width and is approximately 2 m below the Top of Ravine Bank.

3.2.1 Instream Habitat Observations

Upstream of the dam, the channel exhibits a riffle-pool morphology for approximately 30 m. Further upstream of the dam, the channel exhibits a cascade-pool morphology where the boulder cluster was noted. Within the riffle-pool section, the average gradient is approximately 2%, and the channel width is approximately 12 m. The dominant substrate appears to be gravel, and the subdominant substrate is cobble. The residual pool depth is approximately 10 cm. During the site visit on 28 October 2023, the channel had a wetted width of approximately 11 m and a wetted depth of approximately 30 cm. Habitat features such as SWD, LWD, overhanging vegetation, boulder cluster were noted within assessed area within the channel.

The channel exhibits a step-pool morphology approximately 50 m downstream of the dam with a gradient of approximately 8%. Within this area, substrate consists of rock and boulder. Habitat features including boulder cluster and overhanging vegetation were noted within the channel.

3.2.2 Riparian Habitat Observations

At the canopy level, riparian vegetation consists of a mix of deciduous and coniferous trees including red alder, western red cedar, bigleaf maple, yew tree, and douglas fir. At the shrub and ground level, riparian vegetation consists of salal (*Ericaceae*), salmonberry, and sword ferns.

3.3 Water Supply Dam

During the site visit, the Water Supply Drive Dam was noted to be located approximately 15 m upstream of an impassable fall. The dam appears to be 10 m wide.

3.3.1 Instream Habitat Observations

At the upstream of the dam, the channel exhibits a riffle-pool morphology for approximately 25 m before changing into a cascade-pool morphology where the boulder clusters were noted. Within the riffle-pool section, the average gradient is approximately 2%, and the channel width is approximately 10 m. The dominant substrate appears to be gravel, and the subdominant substrate is cobble. The residual pool depth is approximately 10 cm. During the site visit on 27 October 2023, the wetted width was approximately 10 m, and the wetted depth was approximately 40 cm. Habitat features such as gravel bar and overhanging vegetation were noted along the channel.

The channel exhibits a step-pool morphology to the immediate downstream of the dam with a gradient of approximately 10%. A permanent fish barrier (i.e., fall) is noted approximately 15 m downstream of the dam. The substrate consists of bedrock. Habitat features including boulder group and overhanging vegetation were noted within the channel.

3.3.2 Riparian Habitat Observations

At the canopy level, riparian vegetation consists of a mix of deciduous-coniferous trees including red alder, western red cedar, and douglas fir. At the shrub and ground level, riparian vegetation consists of salal, salmonberry, and western brackenfern. Maintenance appears to have been conducted along the riparian area where evidence of invasive plants and household garbage was not observed during the site visits.

3.4 Species at Risk

During the site visits, no evidence of species at risk was identified within or adjacent to the project sites. However, based on the previous offsite incidental observation records, Ecora believes that a pre-construction wildlife survey needs to be conducted at each project site prior to the commencement of the construction.

Our desktop studies suggest a provincial red listed Ecological Community (i.e., Douglas-fir – arbutus, Shape ID: 139342) is located approximately 300 m to the south of Mackie Road Dam. During the site visits, no evidence of ecological community was identified at the location where Habitat Wizard shows due to local land development that is not associated with our project.

3.5 Overall Habitat Conditions

Based on our onsite observations, Ecora believes that **the existing habitats at each dam may provide local fish species with rearing potential.**

Due to the identified permanent fish barriers (i.e., waterfall 1 located approximately 50 m downstream of Mackie Road Dam and waterfall 2 located approximately 15 m downstream of Water Supply Dam), Ecora believes that the proposed scope of works (i.e., dam decommissioning) will not enable the anadromous fish species to access the further upstream habitat.

3.6 Holland Creek Existing Salmonid Spawning Habitat

In addition to the above-mentioned dams, Ecora also confirms the presence of the existing salmonid spawning habitat within Holland Creek. During the site visit on 27 October 2023, salmonid spawning activities were noted approximately 2.3 Km downstream of Mackie Road Dam.

4. Regulatory Framework and Permitting Requirements

To obtain all required permits and approvals prior to the commencement of the project, the following legislation and associated information was reviewed (Table 5).

Table 5. Applicable Legislation and Associated Environmental Permits for the Project.

Legislation	General Description	Required Permit or Approval	Project Requirements
Federal <i>Fisheries Act</i> , Subsection 35(1), 35(2), and 34	The <i>Fisheries Act</i> requires that projects avoid causing serious harm to fish unless authorized by the Minister of Fisheries and Oceans Canada.	DFO Request for Review	A DFO Request for Review will be required for the Project.
		DFO Scientific licence	A DFO Scientific licence will be required for the Project.
Federal <i>Species at Risk Act (SARA)</i> , Section 73 and 78	Authorizations (i.e., Section 73 Permit) are required by anyone conducting activities that may affect species listed in Schedule 1 of SARA, as extirpated, endangered, or threatened (e.g., scientific research permit) and which contravene the Act's general or critical habitat prohibitions (Sections 32-36).	SARA Permit	No Critical Habitat is identified within or adjacent to the Project; hence, no SARA Permit is required for the Project.
Federal <i>Migratory Birds Convention Act*</i>	Protects birds and their nests during the typical bird breeding season between March 15 and August 15 in southwestern BC	N/A	If vegetation clearing is required within the bird breeding season, then pre-clearing bird nest

			surveys will be completed by a QEP.
Provincial <i>Water Sustainability Act</i> (WSA), Section 11	Section 11 of WSA requires that “change in and about a stream” may only proceed under approval or by notification.	WSA Approval	A WSA Approval will be required for the Project.
Provincial <i>Wildlife Act</i> , Section 19	According to Section 19 of the <i>Wildlife Act</i> , anyone intending to collect freshwater fish from non-tidal British Columbia inland waters is required to have a Fish Collection Permit.	Provincial Fish Collection Permit	A Provincial Fish Collection Permit will be required for the Project.
<i>Wildlife Act</i> , Section 34	Protects birds and their nests during the bird breeding season as well as the nests, nest trees and eggs of certain species of bird all year	General Wildlife Permit	A General Wildlife Permit will be required for the Project.

5. Potential Environmental Effects and Proposed Mitigation Measures

Stream water quality can be impacted by changes made to the streambed. Works within a stream often result in the release of fine sediments and other deleterious substances. Works that damage or change the stream channel or encroach into the floodplain of a stream can cause a reduction of water clarity and visibility which impairs the ability of aquatic life to find food, mate, and escape predators.

5.1 Water Quality

5.1.1 Potential Effects

Stream water quality can be impacted by changes made to the streambed. Works within a stream often result in the release of fine sediments and other deleterious substances. Works that modify the stream channel can cause a reduction of water clarity and visibility which impairs the ability of aquatic life to find food, mate, and escape predators.

5.1.2 Recommended Mitigation Measures

Standards and Best Management Practices (BMPs) as outlined in Standards and Best Practices for Instream Works¹⁸ (MOELP, 2004), will be employed for instream works. Best management practices prescribe that instream works be performed when water levels within a stream are low (i.e., during the reduced risk instream work window) so that construction can be conducted with minimal disturbance to water flow or risk of sedimentation in a watercourse. Based on the least risk timing windows of Chum Salmon and Cutthroat Trout, the instream works timing window¹⁹ is anticipated to be 15 August to 15 September.

If needed, prior to the commencement of the project, an Erosion and Sediment Control (ESC) Plan will be prepared as per the Land Development Guidelines for the Protection of Aquatic Habitat²⁰ (DFO 1993). The ESC plan includes appropriate measures that will be implemented prior to construction. An Environmental Monitor (EM) will be on site to determine the effectiveness of these measures and determine if changes to the implemented measures are required. When instream works are ongoing, the EM will conduct water quality monitoring as per provincial approved water quality guidelines.

In addition, the following general mitigation measures will be implemented to minimize impacts to water quality:

¹⁸ Source: https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/bc-timber-sales/ems-sfm-certification/business-area/kamloops/standards_bmp_for_instream_works_2004.pdf. Accessed on 16 December 2023.

¹⁹ Source: https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/working-around-water/terms_conditions_van_island.pdf. Accessed on 16 December 2023.

²⁰ Source: www.sxd.sala.ubc.ca/9_resources/fed_%20files/fed%20land%20development%20guidelines.pdf. Accessed on 16 December 2023.

- Where possible, construction machinery will be parked over spill pads at least 30 m from all watercourses or drainages.
- Fueling of machinery will be conducted off-site at approved fueling locations at least 30 m from any watercourse/drainage.
- Prior to accessing riparian areas, the contractor will verify that machinery is in good working condition and free of fuel and lubricant leaks.
- Necessary maintenance oils/lubricants will be stored in a separate contained lay-down area and conducted well away from any watercourse/drainages.
- The use of toxic liquid paints, primers, solvents degreasers and rust inhibitors will be avoided.
- Drains and open joints on the bridge deck will be adequately sealed prior to sweeping or washing to prevent material or sediment-laden wash water from entering the watercourse.
- A spill kit will be maintained in the active construction area and spill-containment kits containing enough absorbent material will be present in the active work area in proximity to working machinery.
- All temporarily disturbed areas will be reseeded and replanted with native mixes/species outside of the permanent riprap footprint.
- Environmental monitoring will be conducted, as required, during construction works adjacent to the watercourse to confirm appropriate mitigation measures are being implemented.
- Works will be conducted in accordance with all applicable Acts, Regulations, Standards, and Guidelines to protect the water quality of onsite watercourses.

5.2 Fish Habitat Protection

5.2.1 Potential Effects

Potential negative environmental effects on fish and fish habitat resulting from dam decommission includes riparian vegetation clearing and streambed disturbance. Environmental effects which may result from the construction activities may include the following:

- Sedimentation and erosion concerns during and following construction;
- Temporary loss of riparian habitat;
- Minor changes in riparian cover habitat; and,
- Potential for deleterious substances to enter the watercourse during construction.

5.2.2 Recommended Mitigation Measures

Instream worksite isolation and fish salvage activities will be conducted prior to the restoration works. The required fish collection permits (i.e., both federal and provincial) will be obtained prior to the start of the Project. All salvage activities will follow the conditions of the permits. In addition, the following BMPs will be followed to mitigate impacts to fish and fish habitat:

- All instream works will occur within the appropriate timing window (i.e., August 15 to September 15).
- All fish salvage activities will be conducted by a Qualified Environmental Professional (QEP) who have the necessary Fish Salvage Permits in hand.
- Site isolation within a watercourse will be initiated by placing an upstream and downstream stop-net into the watercourse to prevent fish migration in or out of the work area.
- Fish salvage will be completed within the isolated work area by dip net and/or overnight Gee minnow trapping. All captured fish will be identified to species, enumerated and then relocated unharmed upstream of the work area.
- Fish salvage activities will include site isolation by using sediment fencing, polyethylene sheeting, sandbag, or metal sheet within the salvaged area.
- Surface water flow from upstream of the isolation plate will be conveyed around the work area by deploying an upstream fish-screened pump. If needed, flowing upstream water will be pumped back into the watercourse downstream of the isolated work area. With the fish salvage completed, the stop nets will be removed. The standing water within the isolated area will then be pumped from the isolated work area back to the watercourse using a fish-screened pump.
- If isolation is not required, instream works will be conducted in a cautious manner.
- Surface flow will be maintained at all times during instream work to protect downstream fish and fish habitat.

5.3 Riparian Re-Vegetation

5.3.1 Potential Effects

Temporary riparian vegetation disturbance (i.e., construction of temporary machinery site access) will be conducted as part of site preparation.

5.3.2 Recommended Mitigation Measures

To minimize riparian vegetation disturbance, the following mitigation measures are proposed:

- Onsite clearing and grubbing limits will be delineated prior to the vegetation clearing.
- Riparian vegetation disturbance and removal will be minimized where possible.
- If possible, onsite disturbed riparian areas should be re-vegetated immediately following the completion of the Project.
- A Riparian Planting Plan should be prepared to address onsite impacted areas and vegetation losses. It is anticipated that site restoration may include a combination of hydroseeding and riparian planting with local species that were identified onsite including the followings:
 - Recommended tree species: western red alder, broadleaf maple (*Acer macrophyllum*), vine maple (*Acer circinatum*), red alder (*Alnus rubra*), and douglas fir.
 - Recommended shrub species: salmonberry, sword fern, red-osier dogwood (*Cornus sericea* or *C. stolonifera*), pacific ninebark (*Physocarpus capitatus*), and western brackenfern
- Planting activities should be conducted as per BC Riparian Restoration Guidelines (MoE, 2008) as applicable:
 - All riparian plantings should be based on 1 tree or shrub per 1 square metre density.
 - All tree/shrub species should be of guaranteed nursery stock.
 - The botanical name should be used when ordering stock to ensure that the desired native species is being purchased. Each specimen should be tagged with the botanical name and the tag should be left attached after planting.
 - Stock planted during the fall (Sept. - Oct.) and spring (March - April) has the greatest likelihood of surviving. Regular watering may be required until the plants are established. Additional advice on proper planting procedures should be obtained from the nursery supplying the stock.
 - Tree stock should be a minimum of 1.2 m (4 ft) in height when purchased and planted 1.5 to 2 m apart.
 - Planting on a given area being enhanced must be successful to an 80% take. If more than 20% die over one year, replanting is required.
- **The Riparian Planting Plan shall be reviewed and approved by the Town before being finalized.**

5.4 Wildlife

5.4.1 Potential Effects

Potential effects for wildlife that may be present include interacting with personnel and equipment and temporary loss of nesting habitat for birds.

5.4.2 Recommended Mitigation Measures

Appropriate Best Management Practices (BMPs) will be implemented during project construction to avoid potential impacts to wildlife. If vegetation clearing is required within the Bird Breeding Season²¹ (i.e., April 15 to July 31) then pre-clearing bird nest surveys will be completed by a QEP. Where possible, potential nesting sites identified in the Project area will be retained. In addition, all onsite personnel will be required to store personal food appropriately to avoid attracting wildlife.

²¹ Source: https://www.ladysmith.ca/docs/default-source/bylaws-2021/official-community-plan-2023_dpa.pdf?sfvrsn=217df7db_2. Access on 15 January 2024.

5.5 Species at Risk

No Critical Habitats were within or adjacent to our project sites from the desktop studies. Hence, the proposed scope of works will not impact any known Critical Habitats.

5.5.1 Recommended Mitigation Measures

Based on the previous offsite incidental observation records, Ecora believes that a pre-construction wildlife survey needs to be conducted at each project site prior to the commencement of the construction. Prior to the survey, a General Wildlife Permit will be obtained and appropriate survey methods and efforts will be performed as per the applicable BMPs and the terms and conditions of the permit.

5.6 Construction

A detailed Construction Environmental Management Plan (CEMP) with work procedures shall be prepared prior to commencing construction. The CEMP will be submitted to the Town for review and approval prior to the start of works. Mitigation measures and BMPs detailed in the CEMP will include but not be limited to the following management plans / procedures:

- Project Staff – Roles and Responsibilities
- Instream Work Plan and Water Quality Monitoring Plan
- Fish Salvage Procedure
- Wildlife Management Plan
- Invasive Species Management Plan
- Riparian Planting Plan
- Erosion and Sediment Control Plan
- Waste Management Plan
- Spill Prevention and Emergency Response Procedures
- Fish Habitat Enhancement Plan

5.6.1 Least Risk Timing Windows

5.6.1.1 Instream Works

Instream works should be conducted as per the appropriate Least Risk Timing Window of 15 August to 15 September to protect local fish species within Holland Creek. It should be noted that the Least Risk Timing Window for fish species does not apply if the stream is dry due to seasonal variation. If instream works need to be conducted outside the Least Risk Timing Window, the corresponding regulators shall be contacted and appropriate rationale and mitigation measures shall be reviewed and approved by the regulators prior to the instream works.

5.6.1.2 Vegetation Clearing

Vegetation disturbance should be limited where possible. If vegetation clearing is proposed, clearing should be conducted outside the **Breeding Bird Season (i.e., 15 April to 31 July)**. If vegetation clearing has to be conducted during the Breeding Bird Season, pre-clearing bird nesting surveys by a QEP will be required to ensure compliance with the applicable regulations.

Upon the enforcement of the modernized Federal Migratory Birds (MBR) Convention Act²² (July 2022), nest protection for most migratory bird species has been limited to active nests (containing eggs or young), when they have conservation value. However, Schedule 1 of the MBR, 2022 identifies 18 species whose nests are protected year-round, and must be registered and confirmed inactive for a defined period (12 to 36 months, depending on the species) before they can be disturbed or destroyed. The list of species on Schedule 1 consists of 11 marine birds, 6 herons and egrets, and pileated woodpecker.

²² Source: <https://laws-lois.justice.gc.ca/eng/regulations/SOR-2022-105/index.html>. Accessed on 27 June 2024.

Our desktop studies and site visits suggest that it is possible to encounter the nests of Great blude heron or Pileated woodpecker within or adjacent to our project sites. As per Schedule 1 of the MBR, the defined periods for great blue heron and pileated woodpecker are 24 months and 36 months, respectively.

5.7 Environmental Monitoring

An Environmental Monitor (EM) must be retained to conduct onsite environmental monitoring before, during, after the construction. A detailed environmental monitoring and reporting requirements shall be included in the CEMP. At minimum, the EM will be responsible for the following tasks:

- Attending safety and environmental orientation meetings prior to the start of construction.
- Ensuring the installation and removal of erosion and sediment control measures have been completed correctly.
- Attending emergency spill incidents.
- Responding to unforeseen incidents, such as spills of hazardous substance or release of sediment to watercourses, within thirty (30) minutes of being notified.
- Preparing and being signatory of environmental monitoring reports.
- Ensure protective measures to be place prior to the instream works.
- Conduct pre-construction fish salvage and relocation.
- Conduct full time environmental monitoring for instream works.
- If needed, prior to vegetation disturbance, the project footprint will be inspected for invasive species and noxious weeds infestations.
- If needed, apply for environmental permits associated with the Project.
- Conduct wildlife survey/salvage prior to vegetation disturbance.
- Inspecting all areas of the project to ensure compliance with environmental guidelines and permits.
- Recommending proactive erosion and sediment controls, if applicable.
- Sampling and monitoring water quality, if applicable.
- Approving and attending work within or adjacent to Environmental Sensitive Areas (ESAs) and designated watercourses.
- Giving all construction personnel a brief environmental orientation prior to such personnel commencing work in any ESAs.
- Approving and attending work within ESAs and designated watercourses.
- Inspecting the project on a regular basis during any extended work stoppages (e.g., holidays).
- Providing dated photographs and Environmental Monitoring reports to demonstrate effective implementation and functioning of mitigation measures.
- Preparing weekly environmental monitoring reports with actions required (if any) to be submitted to the Client.
- Attending emergency spill incidents.

5.8 Overall Habitat Balance

The goal for the proposed activities (i.e., dam decommission) is to restore the original channel morphology of the creek within the project sites. From our site visit, Ecora has also confirmed that our project sites are isolated by impassable waterfalls. Hence, no instream habitat loss is anticipated from dam decommission. Temporary disturbance to the riparian area is anticipated as a result of site preparation that may involve vegetation clearing and grubbing. Riparian re-vegetation shall be conducted as per Section 5.3.2 of this EA Report. Overall, there should be no loss for the riparian habitat.

6. Conclusion and Closure

Prior to the commencement of the construction, all permits and approvals mentioned in Section 4 of this report must be obtained. A QEP will be onsite to conduct full time monitoring for all instream works (i.e., dam decommission and the associated riparian area disturbance) as per the approved water quality guidelines. A CEMP will be prepared to address all potential environmental- related issues over the course the construction. We trust this information meets your present requirements. If you have any questions or comments, please contact the above signed.

Appendix A

Site Photos



Photo No. 1	Date: 19 September 2023	Looking Towards: West	Location: Mackie Road Dam
Description: Looking at Mackie Road Dam during the low flow period.			



Photo No. 2	Date: 19 September 2023	Looking Towards: East	Location: Downstream of Mackie Road Dam
Description: Looking at the instream habitat to the immediate downstream of Mackie Road Dam during the low flow period.			



Photo No. 3	Date: 19 September 2023	Looking Towards: West	Location: Upstream of Mackie Road Dam
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Description: Looking at the instream habitat to the immediate upstream of Mackie Road Dam during the low flow period.



Photo No. 4	Date: 28 October 2023	Looking Towards: West	Location: Upstream of Mackie Road Dam
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Description: Looking at the instream habitat to the immediate upstream of Mackie Road Dam during the wet season.



Photo No. 5	Date: 28 October 2023	Looking Towards: West	Location: Mackie Road Dam
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Description: Riparian vegetation at Mackie Road Dam.



Photo No. 6	Date: 19 September 2023	Looking Towards: South	Location: Colonia Drive Dam
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Description: Looking at Colonia Drive Dam during the low flow period.



Photo No. 7	Date: 19 September 2023	Looking Towards: North	Location: Downstream of Colonia Drive Dam
Description: Looking at the instream habitat to the immediate downstream of Colonia Drive Dam during the low flow period.			



Photo No. 8	Date: 19 September 2023	Looking Towards: East	Location: Upstream of Colonia Drive Dam
Description: Looking at the instream habitat to the immediate upstream of Colonia Drive Dam during the low flow period.			



Photo No. 9	Date: 28 October 2023	Looking Towards: North	Location: Downstream of Colonia Drive Dam
Description: Looking at the instream habitat to the immediate downstream of Colonia Drive Dam during the wet season.			



Photo No. 10	Date: 28 October 2023	Looking Towards: South	Location: Upstream of Colonia Drive Dam
Description: Looking at the instream habitat to the immediate upstream of Colonia Drive Dam during the wet season.			



Photo No. 11	Date: 28 October 2023	Looking Towards: South	Location: Colonia Drive Dam
Description: Riparian vegetation at Colonia Drive Dam.			



Photo No. 12	Date: 19 September 2023	Looking Towards: West	Location: Water Supply Dam
Description: Looking at Water Supply Dam during the low flow period.			



Photo No. 13	Date: 19 September 2023	Looking Towards: South	Location: Upstream of Water Supply Dam
Description: Looking at the instream habitat to the immediate upstream of Water Supply Dam during the low flow period.			



Photo No. 14	Date: 19 September 2023	Looking Towards: South	Location: Downstream of Water Supply Dam
Description: Looking at the instream habitat to the immediate downstream of Water Supply Dam (red oval) during the low flow period.			



Photo No. 15	Date: 27 October 2023	Looking Towards: West	Location: Upstream of Water Supply Dam
Description: Looking at the instream habitat to the immediate upstream of Water Supply Dam during the wet season.			



Photo No. 16	Date: 27 October 2023	Looking Towards: NA	Location: Water Supply Dam
Description: Looking at the instream habitat to the immediate upstream and downstream of Water Supply Dam during the wet season (Panorama view).			



Photo No. 17	Date: 27 October 2023	Looking Towards: East	Location: Water Supply Dam
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Description: Looking at the instream feature (i.e., fall, red arrow) located to the immediate downstream of Water Supply Dam (red circle) during the wet season.



Photo No. 18	Date: 27 October 2023	Looking Towards: West	Location: 2.3 Km Downstream of Mackie Road Dam
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Description: Looking at the instream habitat approximately 2.3 Km downstream of Mackie Road Dam. Evidence of salmonid spawning activities were noted at this location.



Photo No. 19	Date: 27 October 2023	Looking Towards: West	Location: 2.3 Km Downstream of Mackie Road Dam
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Description: Looking at the instream habitat approximately 2.3 Km downstream of Mackie Road Dam. Evidence of salmonid spawning activities were noted at this location.



Photo No. 20	Date: 28 October 2023	Looking Towards: West	Location: 50 m Downstream of Mackie Road Dam
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Description: Looking at the permanent fist barrier (i.e., waterfall, red oval) approximately 50 m downstream of Mackie Road Dam.

Appendix C

Photographs



Photo 1 Downstream face of dam, looking southwest.



Photo 2 Low-Level metal intake grate and remnants of wooden flashboards, looking east (from left side of dam).



Photo 3 Top of dam with debris buildup on right side, looking northeast (downstream).



Photo 4 Control Structure on left side, view 1.



Photo 5 Control Structure on left side, view 2.



Photo 6 Seepage underneath left concrete abutment.



Photo 7 Major seepage at toe of downstream face.

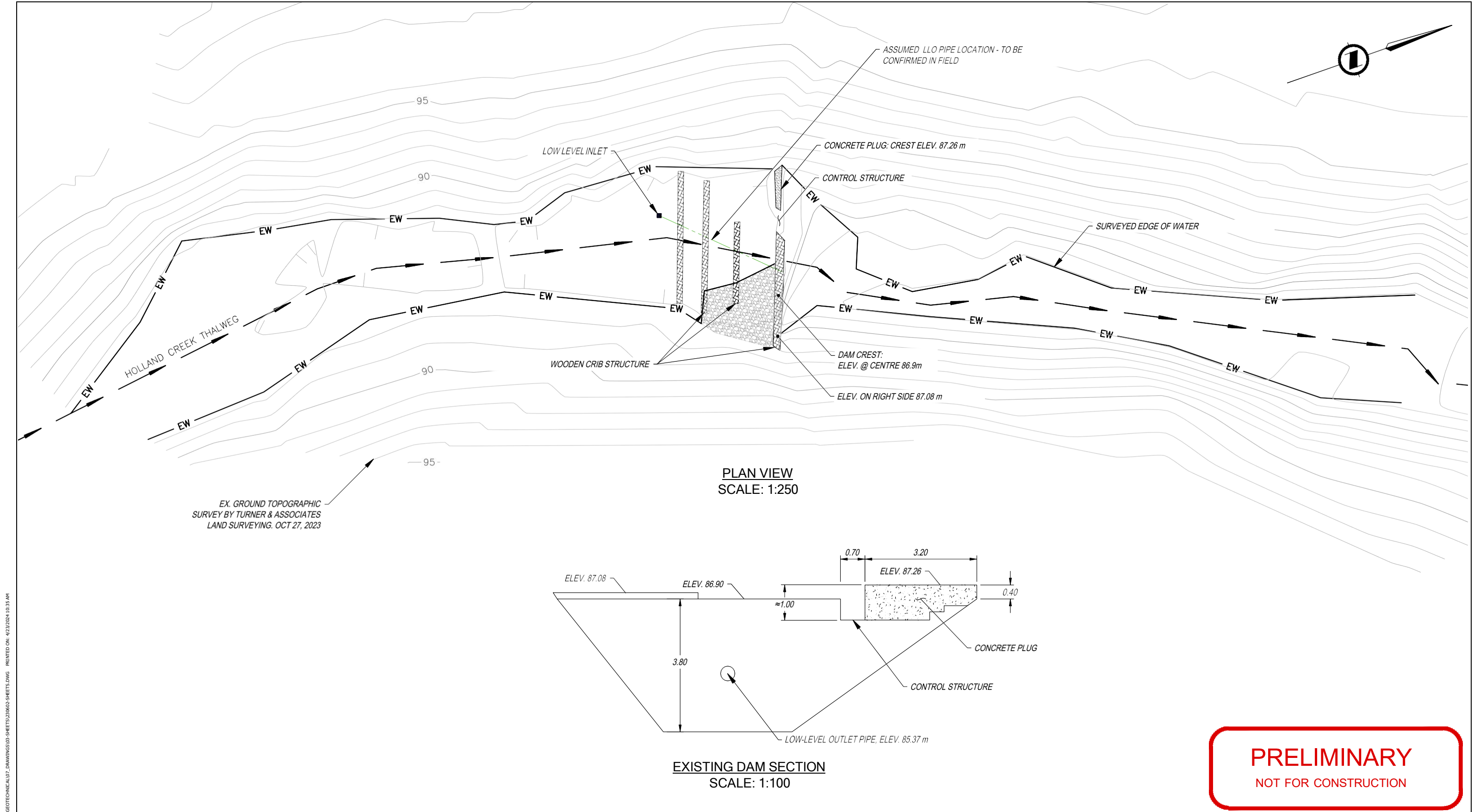


Photo 8 Vegetation built up on remnants of wooden flashboards on right side of upstream channel & miscellaneous debris.

Appendix D

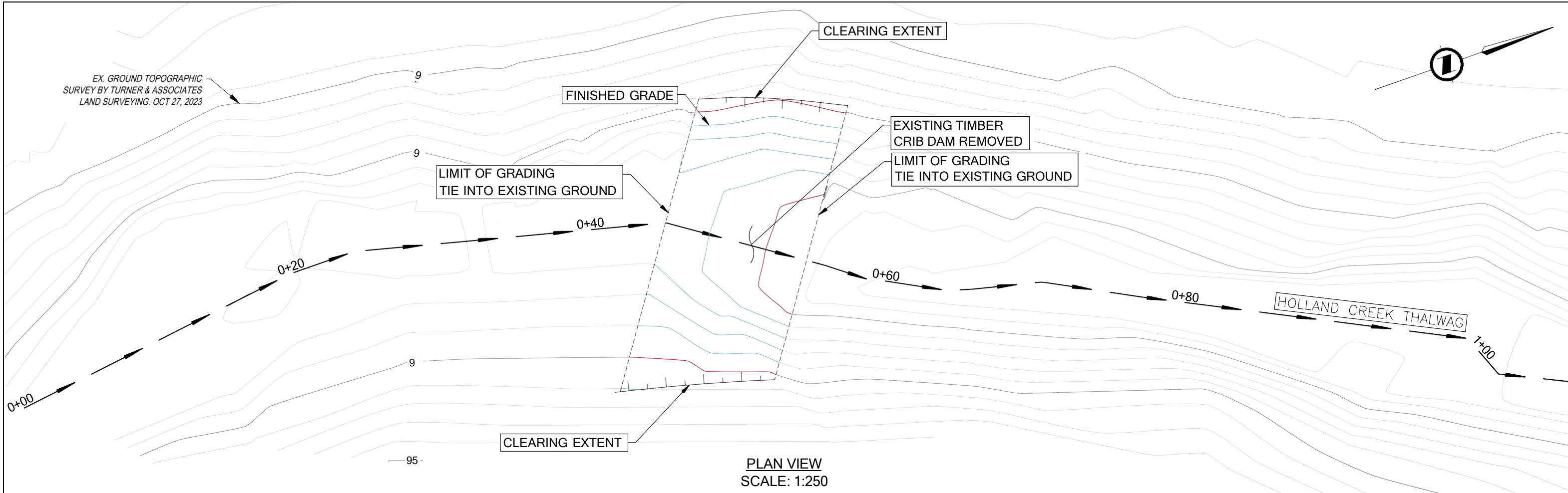
Drawings Package – Existing & Conceptual Site Plans & Profiles

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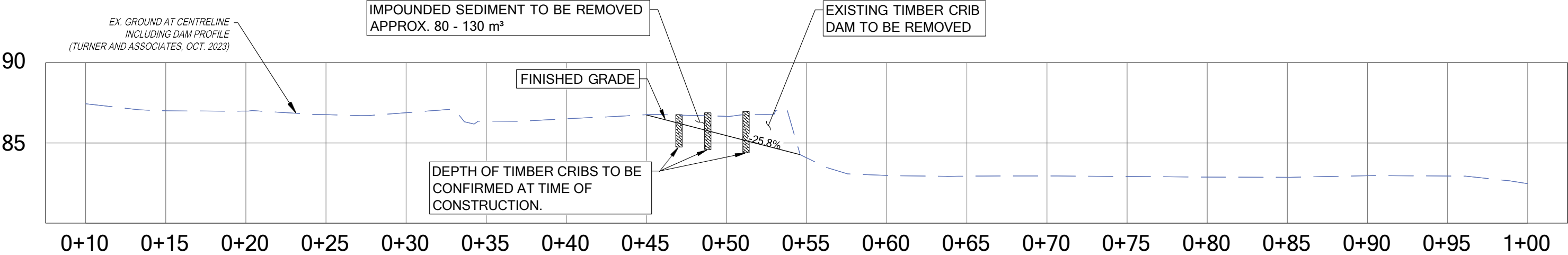


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0	24/06/25	JW	ISSUED FOR USE	AK		CHECKED: AT				
						DATE: FEB 16, 2023				
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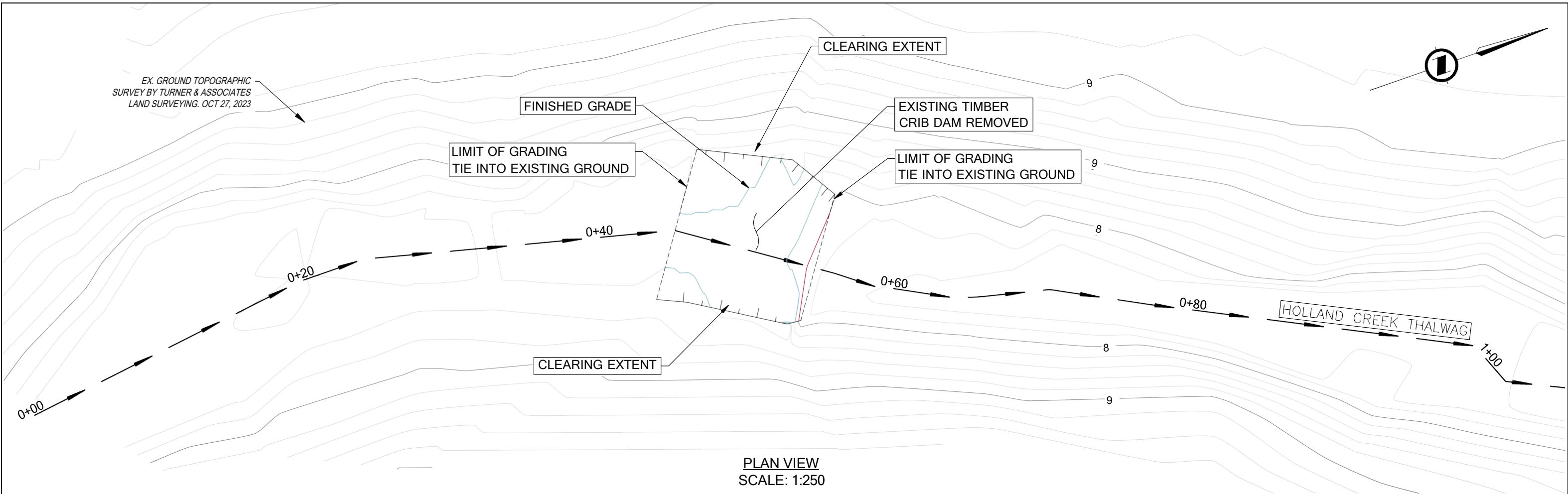


PROFILE VIEW
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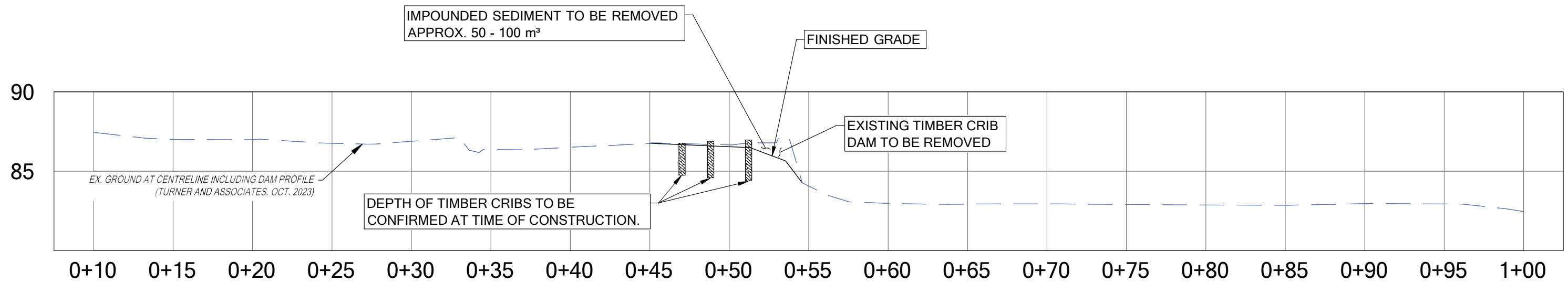
PRELIMINARY
NOT FOR CONSTRUCTION

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						CHECKED: AT				
						DATE: FEB 16, 2023				
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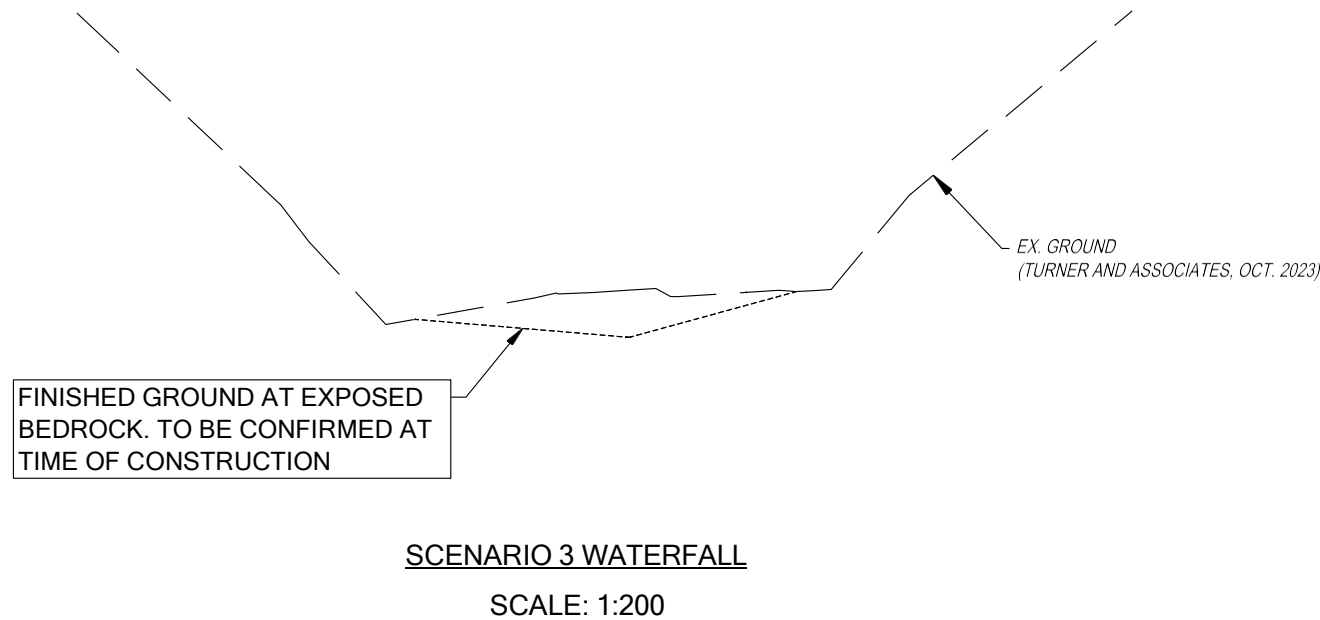
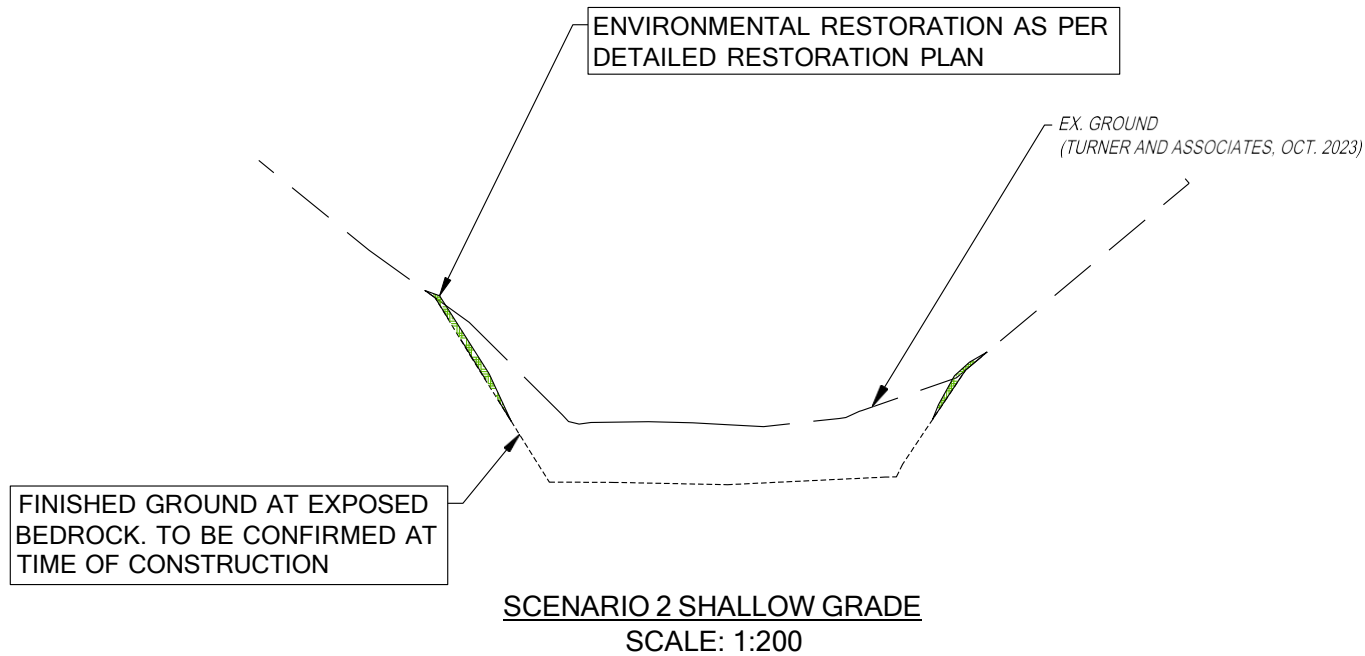
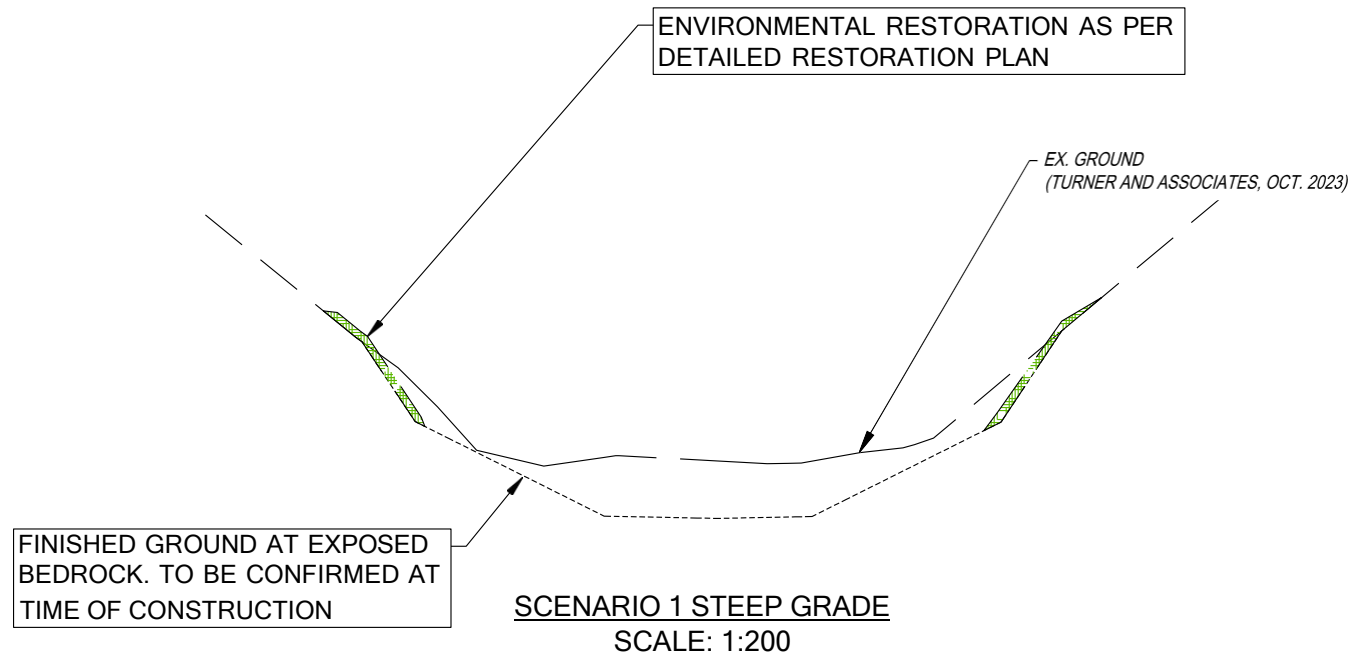


PROFILE VIEW
SCALE: 1:250

PRELIMINARY
NOT FOR CONSTRUCTION

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NOTE:

1. CHANNEL TO BE UNDERLAIN WITH GEOTEXTILE OR EROSION PREVENTION LAYER AS PER DETAILED SEDIMENT MANAGEMENT PLAN.
2. CHANNEL DEPTH, SIDE SLOPES AND PROFILE DEPENDANT ON BEDROCK CONDITIONS. ALL BEDROCK CONDITIONS ARE INFERRED FROM DOWNSTREAM SURVEYED SECTIONS & SITE CONDITIONS. TO BE CONFIRMED AT TIME OF CONSTRUCTION BY QUALIFIED GEOTECHNICAL ENGINEER. IF NO BEDROCK EXISTS ON SIDE SLOPES, MAXIMUM CHANNEL SIDE SLOPE SHOULD BE 2H:1V.

PRELIMINARY
NOT FOR CONSTRUCTION

						DESIGN: TWE	TOWN OF LADYSMITH HOLLAND CREEK DAM SAFETY INSPECTION - MACKIE RD DAM TOWN OF LADYSMITH TYP. CHANNEL SECTIONS		 <small>2045 ENTERPRISE WAY, KELOWNA, BC V1Y 9T5 PHONE: 250-469-9757 WWW.ECORA.CA</small>	
						DRAWN: JW				
0	24/06/25	JW	ISSUED FOR USE	AK		CHECKED: AT				
						DATE: FEB 16, 2023				
NO.	DATE (YY/MM/DD)	DRN	REVISION	CH'KD	PERMIT TO PRACTICE	SCALE: 1:250 H 1:250 V			DRAWING NO.	REV
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