# **Construction Environmental Management Plan**

# Vedder River– 2023 Vedder River Sediment Removal Project

Prepared for:

The Ministry of Environment and Climate Change Strategy and Sediment Removal Contractor(s)

Prepared by:

Nova Pacific Environmental Ltd.

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May 5, 2023



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**Table 1: Project Contact List** 

Entity/Role	Company	Contact Person	Office #	Cell #
Project Manager	Kerr Wood Leidal	Lawrence Francois	604 293-3245	s.22
Site Supervisor	ТВА	ТВА	ТВА	ТВА
Spill Coordinator	Nova Pacific Environmental	TBA	604-251-5216	TBA
Environmental Monitor	Nova Pacific Environmental	Bruce Wright	604-251-5216	s.22
Environmental Technician	Nova Pacific Environmental	Karen Frazer	604-251-5216	s.22
Environmental Technician	Nova Pacific Environmental	Josef Eriksson	604-251-5216	s.22
Environmental Technician	Nova Pacific Environmental	Ray Oliver	604-251-5216	s.22
Ministry Representative	Ministry of Environment and Climate Change Strategy (ENV)	Gulraiz Cheema	ТВА	778-704-7278
Asst. Ministry Representative	ТВА	ТВА	ТВА	ТВА
Project Engineer	Kerr Wood Leidal	Matt Stevenson	s.22	s.22
Provincial Emergency	Response Program	1-800-663-3456		
DFO Emergency Line		1-800-465-4336		

## **Signature Page**

Prepared by:

Nova Pacific Environmental Ltd.

Ray Oliver. Dip.Tech

Date: 21/04/2023

**Environmental Technician** 

Josef Eriksson. B.Sc.

Date: 21/04/2023

Date: 21/04/2023

Biologist

Reviewed by:

Nova Pacific Environmental Ltd.

Bruce F. Wright. B.Sc., MBA, R.P.Bio

#### CEMP for 2023 Vedder River Sediment Removal Project

Reviewed and understood by:	
CONTRACTOR	
Project Manager	Date:

## 1.0: INTRODUCTION

The purpose of this Construction Environmental Management Plan (CEMP) is to identify potential environmental impacts resulting from the works and the processes to be utilized by the contractor(s) to deliver the level of environmental management required by the Ministry of Forests (MOF), formerly Ministry of Forests, Lands, and Natural Resources Operations (FLNRO), Fisheries and Oceans Canada (DFO) and any other stakeholders for the 2023 Vedder River Sediment Removal Project (the 'Project').

The Project will occur along the Vedder River, in Chilliwack, BC. The excavation sites are located downstream of the Vedder Crossing, and between 1.5 km – 6 km south of Hwy 1, as shown in Figure 1.



Figure 1: Location of the excavation sites along the Vedder River.

This CEMP has been developed to provide guidance to all personnel, including contractors/sub-contractors and third-party service providers involved in the completion of the Project, to ensure that safe, compliant, environmentally, and socially responsible actions are taken to mitigate potential project effects on the environment. This CEMP is designed to comply with legislative requirements, conditions of the environmental approvals and guidelines set out by The Ministry (Water Sustainability Act and Dike Maintenance Act), and DFO (Fisheries Act). This CEMP identifies and outlines:

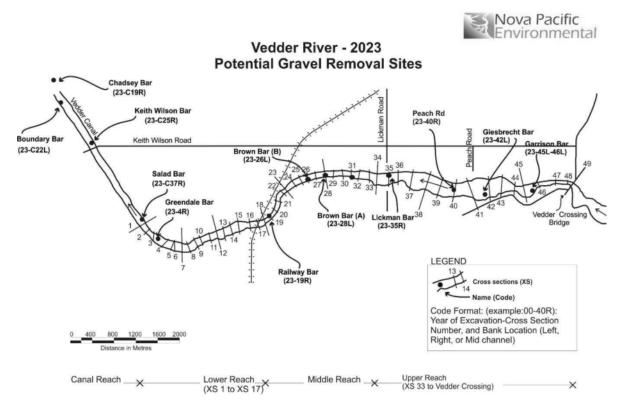
- Site and activity-specific environmental management and monitoring plans designed to protect the human and ecological environment,
- Key construction and operations activities, applicable environmental mitigation measures, and best management practices (BMPs), and
- Environmental monitoring, reporting, and regulatory compliance requirements.

This CEMP is considered a living document and will be updated as project planning and implementation is finalized. Once finalized, project personnel must comply with this CEMP or provide a suitable and approved alternative approach that can be incorporated into an updated CEMP, if necessary.

## 2.0: PROJECT INFORMATION

The eleven (11) potential sediment removal sites for 2023 (shown in Figures 1 and 2) have been selected to:

- Lower water levels where dike freeboard is limited;
- Trap sediment upstream of the freeboard limited area;
- Reduce future excessive excavation requirement in the Lower Reach when a large flood occurs and limit sediment movement into this reach during a flood to bolster the freeboard in limited areas;
- Increase capacity in the canal section of the river to lower the backwater curve, and to lower water levels in the freeboard limited area;
- Provide optimum habitat outcomes while meeting flood protection objectives for sediment removal; and/or
- Provide additional habitat in the immediate vicinity of the excavations where suitable habitat enhancement opportunities exist.



**Figure 2:** The 11 proposed excavations sites (with Brown A and B) for the 2023 Vedder River Sediment Removal Program with reach boundaries, site identifier codes and key infrastructure identified.

#### 2.1: Gravel Extraction Locations

#### 2.1.1 Garrison Bar

The Garrison Bar excavation is located 500 m downstream of the Vedder Crossing Bridge along the setback dike and Rotary Trail. The approximate geographical coordinates are 49.096822°N, -121.971522°W. The site identifier corresponding to Figure 2 is 23-45L-46L.

#### 2.1.2 Giesbrecht Bar

The Giesbrecht Bar excavation site is located at the foot of Giesbrecht Road along the setback dike and Rotary Trail. The approximate geographical coordinates are 49.097114°N, -122.984648°W. The site identifier corresponding to Figure 2 is 23-42L.

#### 2.1.3 Peach Road Downstream

The Peach Road Downstream excavation site is located along the setback dyke and Rotary Trail at the downstream end of Peach Park. The approximate geographical coordinates are 49.096568°N, -122.993423°W. The site identifier corresponding to Figure 2 is 23-40R.

#### 2.1.4 Lickman Bar

The Lickman Bar excavation site is located downstream of the Lickman Vedder River Parking Lot, along the setback dike and Rotary Trail. The approximate geographical coordinates are 49.116460°N, -122.090187°W. The site identifier corresponding to Figure 2 is 23-35R.

## 2.1.5 Brown Bar (A + B)

The Brown Bar excavation sites are located upstream 300 m North of the Bergman stockpile. The approximate geographical coordinates of Brown Bar A are 49.098800°N, -122.022865°W, and the coordinates of Brown Bar B are 49.098282° N, -122.025540°W. The site identifiers corresponding to Figure 2 are 23-28L (Brown A), and 23-26 L (Brown B).

#### 2.1.6 Railway Bar

The Railway Bar excavation site is located approximately 180m upstream from the railway bridge along the Rotary Trail. The approximate geographical coordinates are 49.092699°N, -122.035152°W. The site identifier corresponding to Figure 2 is 23-19R.

#### 2.1.7 Greendale Bar

The Greendale Bar excavation site is located 400 m upstream of the Greendale Stockpile site, along the Rotary Trail. The approximate geographical coordinates are 49.088418°N, -122.058839°W (downstream), 49.089433°N, -122.063018°W (upstream). The site identifier corresponding to Figure 2 are 23-3R-4R.

#### 2.1.8 Salad Bar

The Salad Bar excavation site is located 100 m downstream of the Greendale Stockpile site, along the Rotary Trail. The approximate geographical coordinates are 49.092662° N, -122.067025° W. The site identifier corresponding to Figure 2 is 23-C37R.

#### 2.1.9 Keith Wilson Bar

The Powerline excavation site is located 200 m upstream of the Keith Wilson Bridge, along the Rotary Trail. The approximate geographical coordinates are 49.097114 ° N, -122.984648° W. The site identifier corresponding to Figure 2 is 22-C25R.

## 2.1.10 Boundary Bar

The Boundary Bar excavation site is located at the foot of Giesbrecht Road along the setback dike and Rotary Trail. The approximate geographical coordinates are 49.101119° N, -122.076004° W. The site identifier corresponding to Figure 2 is 23-C22L.

## 2.1.11 Chadsey Bar

The Chadsey Bar excavation site is located downstream of Boundary Bar on the right bank of the Vedder River. The approximate geographical coordinates are 49.112657° N, -122.085685° W. The site identifier corresponding to Figure 2 is 23-C19R.

## 2.2: Access to Sites and Stockpiling locations

#### 2.2.1: Garrison Bar

Take exit off Vedder Mountain Rd, approximately 900 m northwest of Vedder Crossing.

#### 2.2.2 Giesbrecht Bar

Access from Giesbrecht Road along the dike to Giesbrecht stockpile and then east along Rotary Trail to the downstream end of bar. The existing large stockpile site is well away from the active channel, adjacent to the dike. This stockpile should be used if stockpiling is required. Commencing about 50 m to the west there is a series of enhanced groundwater fed rearing ponds and a channel that connects to the mainstem river upstream of the Vedder River Campground. However, this is far enough from the stockpile site that there is unlikely to be any interference.

#### 2.2.3 Peach Road Bar

Access to this site is from the south end of Peach Road, 250 m west along the Rotary Trail. There is no immediately adjacent stockpile site, however, it may be an option to travel along the setback dikes to the Hooge stockpile if stockpiling of excavated material is required.

#### 2.2.4 Lickman Bar

Access to this site is from the parking lot at the end of Lickman Road, downstream along the Vedder River Rotary Trail for approximately 100 m. A ramp and culvert will be used to access the bar approximately halfway down. This location provides the easiest access and keeps the required culvert away from the steep bank providing for easier management of the crossing and minimizing the on-bar haul requirements. A ramp can be installed directly from the parking lot area down onto the bar. There is no adjacent stockpile site, however, it may be an option to travel along the setback dikes to the Hooge stockpile if stockpiling of excavated material is required offsite.

## 2.2.5 Brown Bar (A + B)

The Brown Bar sites can be accessed travelling 300 m upstream from the Bergman stockpile along the Rotary Trail.

## 2.2.6 Railway Bar

The site can be accessed from Keith Wilson Road, south on Sinclair Road, then east along the setback dike to parking area. Proceed west along the trail atop the bank protection works. (Trail bypass remains but vehicle access has been closed off and the old haul route has been redeveloped as a trail). The distance from the excavation site to the Hooge stockpile (adjacent to the parking area) is about 750 m west along the Rotary Trail. This would create some requirement for trail restoration due to machinery access and degradation of the trail if the Hooge stockpile area is to be used.

#### 2.2.7 Greendale Bar

Access to site is along the north dike access road from east end of Keith Wilson Bridge to parking area at the Greendale Stockpile site, and along the Rotary Trail to existing access point. One or two culvert crossings of side channels or tributaries of the Vedder River may be required to access the excavation area. The Greendale stockpile site can be used for stockpiling excavated material is needed.

#### 2.2.8 Salad Bar

Access to site is east along Dyke Crest Road from east end of Keith Wilson Bridge to blocked access road approximately 100 m west of the parking area at the Greendale Stockpile site. The access road would need to be unblocked and crossing to the bar would likely require two culverts for crossing a side channel of the Vedder. The Greendale stockpile site can be used for stockpiling excavated material is needed.

#### 2.2.9 Powerline Bar

Access to site is north along the left bank dike road from the Fisherman's Corner parking lot to Keith Wilson Bridge. The existing ramp down from the dike road allows trucks to travel under the bridge and thence upstream to the bar access point. A ramp down to the bar will need to be constructed and at least one culvert will be required. Stockpile locations are currently being finalized.

#### 2.2.10 Keith Wilson Bar

Access to the site is from the east end of Keith Wilson Bridge. A secondary channel near the left bank may need to be crossed to access this bar. Small culverts should be sufficient. Stockpile locations are currently being finalized.

## 2.2.11 Boundary Bar

Access to site is northwest along the left bank dike road from the Fisherman's Corner parking lot. A ramp down from the dyke top to the low bank and then a second ramp down to the bar would be required. A culvert may be required to cross the microchannel along the left bank. Stockpile locations are currently being finalized.

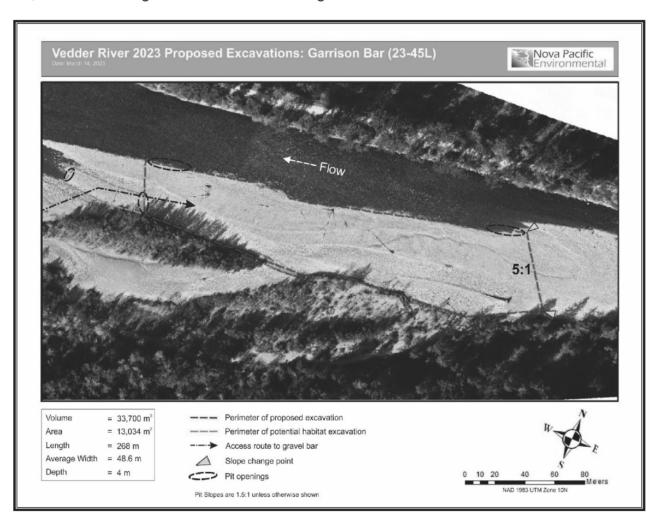
## 2.2.12 Chadsey Bar

Bar is accessed by travelling 1 km north from Keith Wilson Bar, along the north dike road. A culvert may be needed to access the bar. Stockpile locations are currently being finalized.

## 2.3: Excavation Details and Objectives

#### 2.3.1 Garrison Bar

The Garrison Bar excavation has been devised to remove sediment upstream of the freeboard limited area. The total projected volume of sediment to be taken from the pit is 33,700 m<sup>3</sup>. See Figure 3 for excavation diagram.



**Figure 3:** Garrison Bar Excavation. (Photo taken October 2022.)

#### 2.3.2 Giesbrecht Bar

The main purpose of this excavation would be to intercept sediment upstream of the area of freeboard limitation. The bar is estimated to be 1 m in height above low water levels during summer months, resulting in a 4 m excavation depth and higher yield of sediment. The total projected volume of sediment to be taken from the pit is 21,400 m<sup>3</sup>. See Figure 4 for excavation diagram.

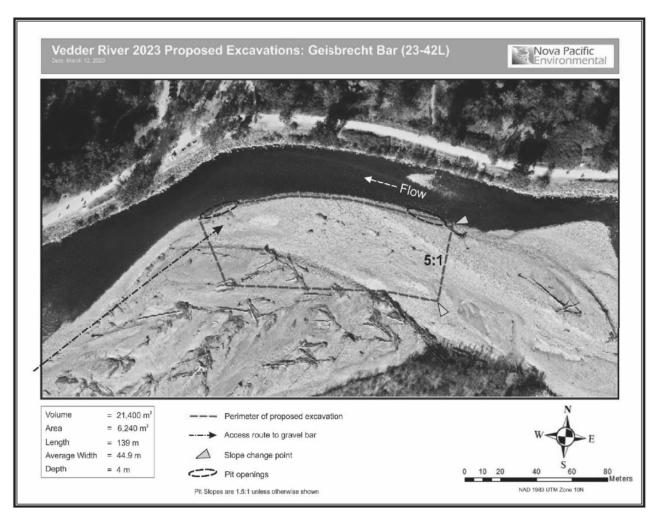


Figure 4: Giesbrecht Bar excavation. (Photo taken October 2022.)

#### 2.3.3 Peach Road Downstream

The purpose of the excavation at this site is to trap sediment upstream of the freeboard limited area. The bar top removal section of the excavation is intended to draw higher flows away from the left bank and into the right channel. The bar top removal can be excavated to a depth which will allow the formation of riffle and thereby increase habitat value at this location. The total volume of the Peach Pit is estimated to be 104,600 m<sup>3</sup>. See Figure 5 for the excavation diagram.

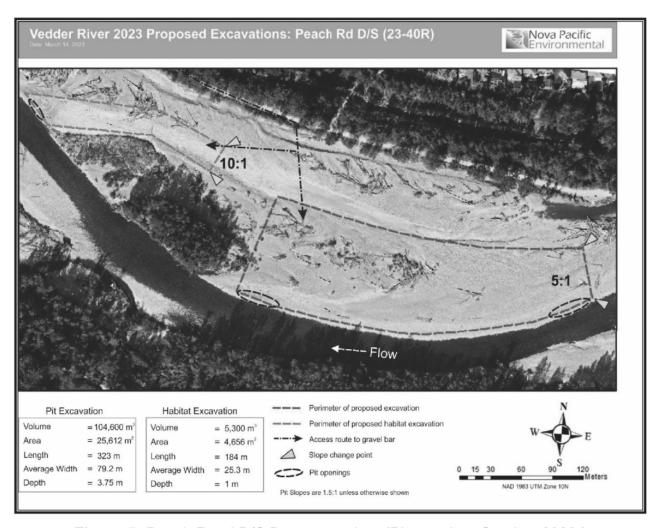


Figure 5: Peach Road D/S Bar excavation. (Photo taken October 2022.)

## Summary of Comments on FOR-2023-31668 - Harms - RED - South Coast.pdf

Page: 15

Number: 1 Author: Robert Akester
What freeboard limited area?

Date: 2023-04-21 11:32:00 AM

#### 2.3.4 Lickman Bar

The main objectives of this excavation are to trap sediment upstream of freeboard limited sections of the channel and to reduce flow pressures on the left bank. The bar top removal will also create riffle habitat and improve the connection of low flows to the secondary channel. The pit at Lickman is projected to have a volume of 12,300 m³, and the Bar Top Removal will have a volume of 7,400 m³. See Figure 6 for the excavation diagram.

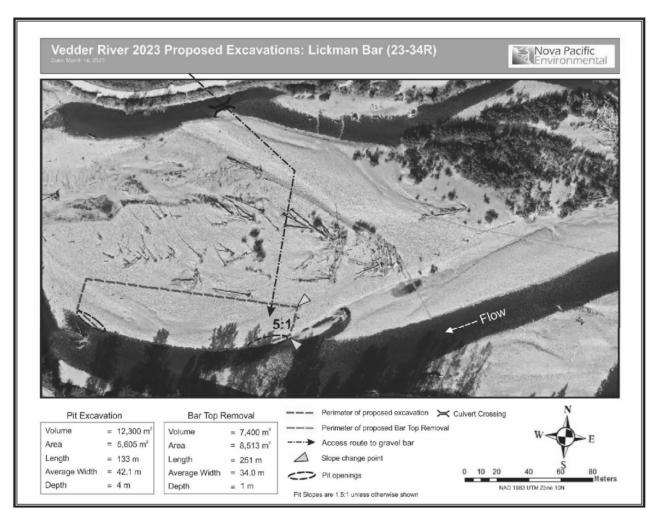


Figure 6: Lickman Bar excavation and Bar Top Removal. (Photo taken October 2022.)

## 2.3.5 Brown Bar (A + B)

The primary objective for this excavation is to increase freeboard within a freeboard limited section of the river. The habitat channel on the left bank will be excavated to provide spawning and rearing habitat for salmonids. Brown A excavation will yield approximately 4,300 m³, and Brown B excavation will yield roughly 23,300 m³. See Figure 7 for the excavation diagram.

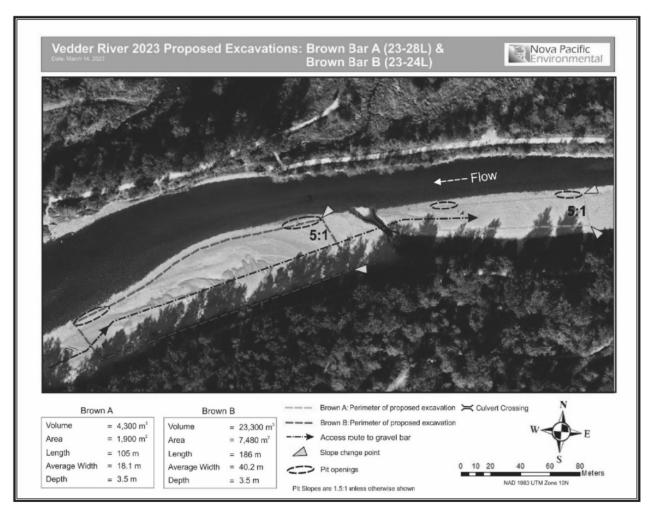


Figure 7: Brown Bar (A + B) excavation. (Photo taken October 2022.)

## 2.3.6 Railway Bar

This excavation will reduce the amount of sediment moving downstream into a freeboard limited section of the river below the railway as well as address a slight limitation of freeboard at this location. Excavations at this location have typically refilled quickly, therefore removal of sediment has been proposed. The target volume to be excavated from Railway Bar is 6,500 m<sup>3</sup>. See Figure 8 for the excavation diagram.

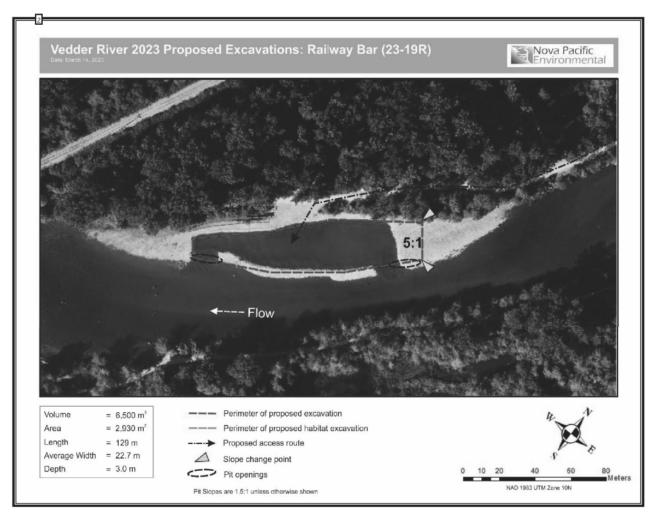


Figure 8: Railway Bar excavation. (Photo taken October 2022.)

## Page: 18

Number: 1 Author: Robert Akester
How does this relate to the CEMP? Date: 2023-04-21 11:35:00 AM Number: 2 Author: Robert Akester Date: 2023-04-21 11:37:00 AM
Hope this figure is not in the application report or is clearly explained as I would ask the question that it was clearly just excavated so.....?

#### 2.3.7 Greendale Bar

The purpose of this excavation is to remove sediment from the freeboard limited section of the river. The upstream bar top removal is intended to provide additional sediment whilst maintaining similar separation of flows around the vegetated island. The approximate volume to be excavated from the Greendale pit is 43,900 m³, and the volume of the habitat excavation is estimated to be 11,300 m³. The habitat excavation will consist of riffles zone habitat feature. See Figure 9 for the excavation diagram.

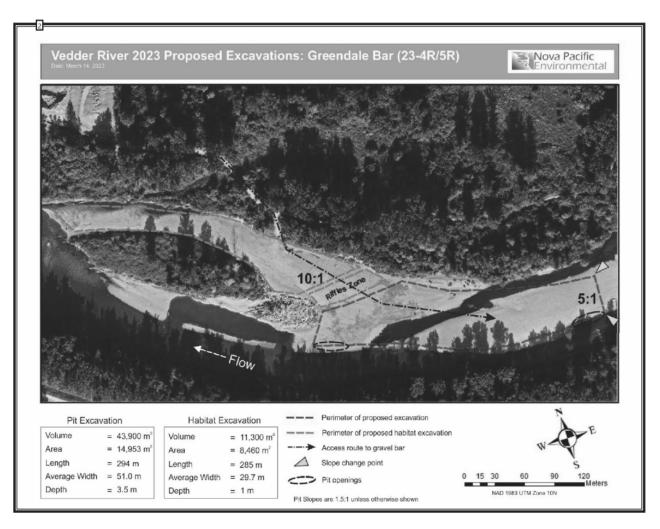


Figure 9: Greendale Bar excavation. (Photo taken October 2022.)

## Page: 19

Number: 1	Author: Robert Akester	Date: 2023-04-21 11:39:00 AM
Is habitat exc	avation just a channel except we	ere identified or will there be habitat features added?
Number: 2	Author: Robert Akester	Date: 2023-04-21 11:39:00 AM
See note above	ve	

#### 2.3.8 Salad Bar

This sediment bar is located in the freeboard limited section and is expected to directly lower water levels in the area. Habitat priorities are to ensure that the pink salmon spawning habitat upstream and the existing habitat channel along the right bank are maintained. The target volume to be excavated at Salad Bar is 9,300 m<sup>3</sup>. See Figure 10 for the excavation diagram.

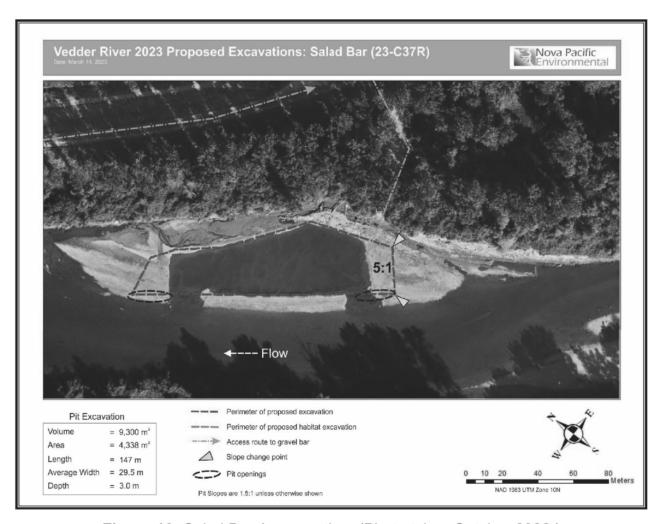


Figure 10: Salad Bar A excavation. (Photo taken October 2022.)

#### 2.3.9 Keith Wilson Bar

The objective of this excavation is to lower water levels in the freeboard limited area through backwater curve reduction. This excavation will likely refill slowly, providing riffle and pool habitat features through a few freshet cycles. Approximately 26,600 m<sup>3</sup> of sediment will be excavated from Keith Wilson Bar. See Figure 11 for excavation diagram.

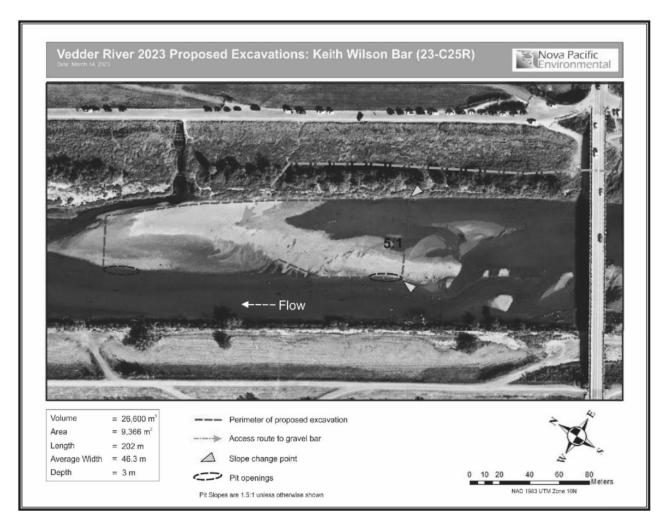


Figure 11: Keith Wilson Bar excavation. (Photo taken October 2022.)

## 2.3.10 Boundary Bar

This excavation is designed to improve the backwater curve, reducing risk of dyke overtopping upstream in the freeboard limited section of the Vedder River. In terms of flood risk benefits, this is the most effective of the proposed excavations. The target volume to be excavated from Boundary Bar is 22,300 m<sup>3</sup>. See Figure 12 for excavation diagram.

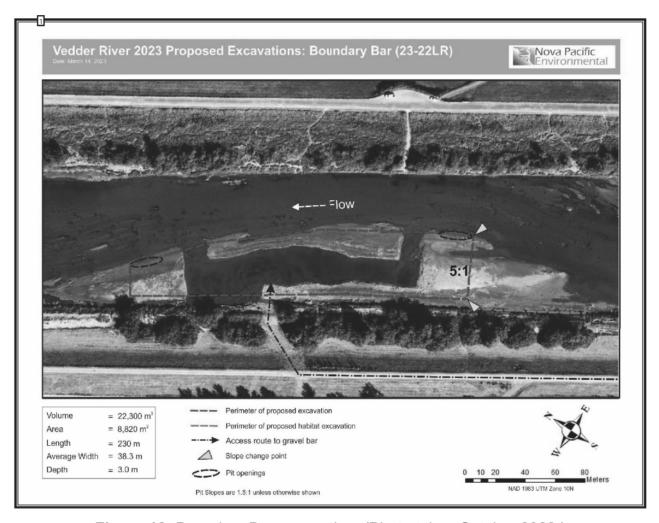


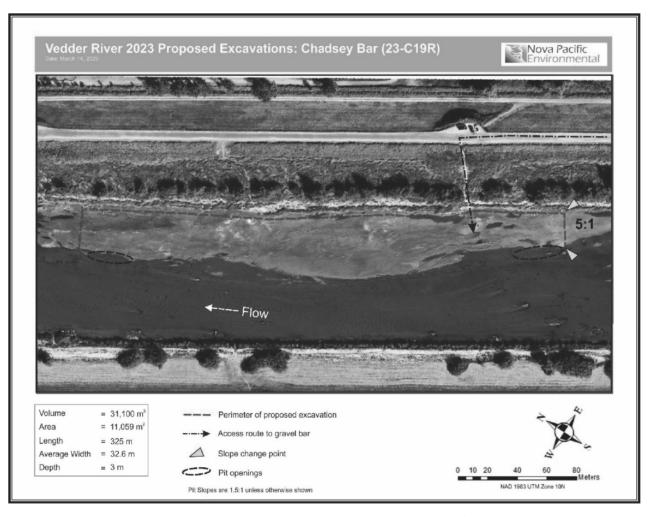
Figure 12: Boundary Bar excavation. (Photo taken October 2022.)

Number: 1 Author: Robert Akester
See note above

Date: 2023-04-21 11:40:00 AM

## 2.3.11 Chadsey Bar

The goal with this excavation is to improve the backwater curve, reducing risk of dyke overtopping upstream in the freeboard limited section of the Vedder River. In terms of flood risk benefits, this is the most effective of the proposed excavations. The target volume to be excavated from Boundary Bar is 31,100 m<sup>3</sup>. See Figure 13 for excavation diagram.



**Figure 13:** Chadsey Bar excavation. (Photo taken October 2022.)

## 2.4: Project Activities

#### 2.4.1: General

To complete the eleven (11) excavation sites on the Vedder River, the project activities will include:

- Removal of vegetation (i.e., Giesbrecht) to create access to the bar; all of the sites
  rely on existing access routes so removal will be limited to branches, and smaller
  plants.
- Installation of culvert crossings where necessary;
- Environmental protection (e.g., fish salvage, monitoring, isolation of excavation from flowing water);
- Deep pit and top of bar excavations on individual bars;
- Placement of Large Woody Debris (LWD);
- Habitat channel excavation and enhancements;
- Opening of the excavations to flowing water; and,
- Site cleanup and restoration.

#### 2.4.2: Environmental Risk Assessment

The environmental risks associated with the above noted activities include, but are not limited to:

- Temporary effects to ambient air quality through mobilizing and use of equipment (e.g., excavators, haul trucks, etc.) and construction activities creating dust by soil disturbances;
- Temporary effects to ambient noise levels through mobilizing and use of equipment at site, increased human presence, and excavation activities;
- Effect on ground surface through project activities involving ground disturbance (e.g. sediment removal, vegetation clearing, riprap removal, machinery access, etc.).
   Ground surface compaction caused by equipment, material laydown, and other project works;
- Possible soil contamination through accidental spill or release of deleterious substances:
- · Effects on water quality through accidental spills or release of deleterious substances

(e.g., fuel and oil for machinery or sediment laden water) during works;

- Temporary and short-term impacts to water quality through the introduction of fine sediment to the water;
- Temporary and short-term impacts to water quality from sediment mobilized to watercourse from construction activities;
- Possible introduction or spread if invasive plant species which may be transported to or from Project area through vehicles and equipment;
- Disturbance to vegetation through project activities (e.g. equipment movement and material laydown, gaining access to work area, and excavation work) that may damage or destroy vegetation;
- Temporary disturbance and direct or indirect harm to wildlife through vehicle collisions during mobilization to or from site and by accidental spill or release of a deleterious substance (e.g. hydrocarbons, uncured concrete);
- Direct or indirect harm to fish by accidental spill or release of a deleterious substance (e.g. hydrocarbons) or by increased turbidity in water due to sediments mobilized from soil disturbances;
- Inadvertently altering fish habitat during access and excavation as well as influences
  from unusually high flows during the excavations; These issues are strictly managed
  by the environmental monitor (EM); and,
- Inadvertently inflicting harm on endangered species, or disturbing endangered species' critical habitat.

## 2.5: Project Schedule

The work is anticipated to commence on August 1<sup>st</sup> and will be completed by September 30<sup>th</sup>. The 2023 least-risk fisheries work window for the Vedder River is between July 15 September 15. In previous years, excavations have extended to September 30 where conditions were suitable. This extension has been incorporated into the 2023 applications to meet the sediment removal targets. However, excavation sites upstream of pink salmon spawning areas will be completed first and by September 15.

## 2.6: Key Project Personnel

Table 1 (see above) provides the contact information for the key project personnel. The following sections provide a general overview of the responsibilities of each project constituent.

## 2.6.1: The Contractor (TBD)

The Contractor will be required to comply fully with the requirements of the provincial (The Ministry) and federal (DFO) permits as well as this CEMP. The Contractor will be in constant communication with the Environmental Monitor (EM) and Environmental Technicians (ET), as part of the CEMP implementation and monitoring process.

It is the responsibility of the Contractor to understand and adhere to this CEMP and undertake the following:

- Induction/training for personnel regarding potential environmental effects, the requirements of this CEMP, and Spill Response Procedures;
- Conduct regular inspections of work procedures and equipment operation to confirm compliance with standard procedures and prevent possible future effects;
- Check regular inspections of spill response measures and secondary containment to confirm compliance and containment goals are met; and,
- Provide the EM and ETs with the authority to modify and/or halt any construction activity at any time if deemed necessary for the protection of the environment.

#### 2.6.2: The Environmental Monitor

Mr. Bruce Wright B.Sc., R.P.Bio, MBA is an appropriately qualified professional (AQP) and has been retained by KWL to be the Environmental Monitor (EM) for the project. The primary responsibilities of the EM are:

- Ensure that the environmental protection objectives and requirements of all applicable approvals/permits are met and the requirements of this CEMP and other applicable conditions implemented;
- Modify and/or halt any construction activity at any time if deemed necessary for the protection of the environment;
- Monitoring and reporting as described in Section 5.1 of this plan; and
- Supervise/Manage any environmental technicians on the project.

#### 2.6.3: The Environmental Technician

Environmental Technicians (ET) from NPE will provide environmental monitoring when the EM is not onsite. The ET will have a sufficient level of environmental monitoring expertise to manage supervision and environmental risk as required. As stipulated in the DFO

Authorization, the ET will be supervised by the EM. The primary responsibilities of the ET are:

- To monitor the works when the EM is unavailable to be onsite or at another site when more than one excavation is underway concurrently;
- Provide daily reports to the EM of the day's activities when they are acting on their behalf;
- Ensure that the environmental protection objectives and requirements of all applicable approvals/permits are met and the requirements of this CEMP and other applicable conditions implemented;
- Modify and/or halt any construction activity at any time if deemed necessary for the protection of the environment; and,
- Monitoring and reporting as described in Section 5.1 of this plan.

# 3.0: RELEVANT ENVIRONMENTAL LEGISLATION AND REGULATION

The proponent has received or will receive the following environmental permits and approvals for this project:

- (i) Change Approval () under Section 11 of the *Water Sustainability Act* from the Ministry of Forests (MOF) has been issued for the sediment removal works on the Vedder River. The Letter of Advice can be found in Appendix A. In progress
- (ii) Section 35 (2) b Fisheries Act Authorization from Fisheries and Oceans Canada (DFO) regarding the sediment removal. The Letter of Advice (not provided yet) for the Vedder Sediment Removal authorization is currently in progress.

Additional legislations and regulations that may be applicable to the project include:

- Species at Risk Act (Federal)
- Migratory Bird Convention Act (Federal)
- BC Weed Control Act
- BC Riparian Areas Protection Act
- Heritage Conservation Act (Provincial)
- Wildlife Act (Provincial)

2

Number: 1 Author: Bruce Wright Date: 2023-04-20 9:38:00 PM
This will be an authorization- modify this section to include correct terminology

Number: 2 Author: Robert Akester Date: 2023-04-21 12:06:00 PM

We do not have the permit yet so is this true as it is not always the case. What did the permit from last year stipulate?

- Environmental Management Act (Provincial)
- Navigable Waters Works Regulations (Federal)

The Contractor will ensure the works completed in such a manner that does not contravene any legislation listed above or this CEMP.

Nova Pacific Environmental Ltd. is acquiring or have acquired the following permits:

- DFO and MOF fish salvage permits NPE In Progress
- Water Sustainability Act (WSA) change approval- In Progress
- Crown Land Use Permit- In Progress

## 4.0: ENVIRONMENTALLY SENSITIVE RESOURCES

The following provides a summary of environmental resources within the project vicinity.

## 4.1: Species of Concern

The Vedder River and the surrounding riparian area provide critical habitat for Pacific giant salamanders as well as western painted turtles. There also is designated critical habitat for Salish sucker within Salwein Creek, which drains into the Vedder River. For other species there are known occurrences within the Vedder River and its adjacent habitat. The species with known occurrences include the Oregon forestsnail, the western screech owl, northern red-legged frog, western painted turtle, and great blue heron. For more information including mitigation measures, see Appendix B. For species identification materials see Appendix C.

## 4.2: Aquatic Resources/ Environmental Timing Windows

There are seven (7) known designated watercourse within the vicinity of the project area:

- Vedder River
- Salwein Creek
- Brown Creek
- Street Creek
- Peach Creek
- Stewart Slough
- Lewis Slough

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First time I heard of this Creek in the report, are we working near it and therefore is a big concern or just a worthy note? The Vedder River joins the Sumas River about 3 kms before flowing into the Fraser River. Upstream of Vedder Crossing, the Vedder River becomes the Chilliwack River. The Vedder River provides important habitat for several fish species including all five Pacific salmon species, bull trout (a provincially blue-listed species), white sturgeon (a species listed as endangered under COSEWIC), cutthroat trout, and steelhead. While there are (7) watercourses in the area, it is expected that only the Vedder River will be directly affected by the works.

## 4.3 Fishery Timing Window / Least Risk Instream Work Window

The least risk instream work window for the Vedder River is the period from <u>August 1 to September 15</u>. However, due to the volume of material to be moved, the success of the project may require an extension beyond September 15<sup>th</sup>. NPE has initiated the application process to include an extension until September 30<sup>th</sup>, 2023. Continuing low flows are an important consideration for any extension as this could affect the upstream migration timing for adult salmon as well as the feasibility of completing the works in isolation of flowing water. In addition, the start of spawning by pink salmon may also limit any extension to the window, particularly at sites where excavations are upstream of expected or active pink salmon spawning areas. It is anticipated that this constraint may limit activity after September 15<sup>th</sup> to sites located in the Vedder Canal. Work on all sites will be ordered to ensure that only the most downstream sites are at risk of remaining incomplete by September 15<sup>th</sup>.

## 4.4 Least Risk Breeding Bird Window

The works have the potential to affect birds that inhabit the riparian area, and as a result, the Least Risk Bird Nesting Window will apply. This is the period of <u>August 18 to March 24</u> of any given year.

The intent of this window is to reduce potential risk of contravention to the Migratory Bird Convention Act. If clearing and/or grubbing operations are required during the nesting period (March 25 to August 17 of any given year), an Appropriately Qualified Professional (AQP) should conduct an intensive survey of the area(s) where vegetation is to be removed. It is advised a bird nest survey to be conducted, in which clearing should be completed within 7 days.

In the event any active nests are identified, the work will be halted in the area and the EM will develop and implement a site-specific nest management plan.

In accordance with Section 34 of the BC Wildlife Act, nests for osprey, eagle, peregrine falcon, gyrfalcon, heron, or burrowing owl are protected year-round, whether the nest is occupied or not. In the event a protected nest is found, the work will be halted, and the EM will develop and implement a site-specific nest management plan.

# 5.0: PROJECT MITIGATION MEASURES AND ENVIRONMENTAL SPECIFICATIONS

The potential environmental impacts that may result from project activities can be avoided or minimized through implementation of environmental standards, guidelines, BMPs, and site-specific mitigation measures. The following sections provide mitigation measures and standard best practices relevant to project work which will be implemented during the works to mitigate the risk to natural resources including aquatic and terrestrial habitat values. These measures will also ensure the works are compliant with all applicable legislation, the requirements of the permits for the project and this CEMP.

The following Best Management Practices (BMPs) and guidelines are applicable to this project. The project team has the responsibility to be familiar with these BMPs.

- Land Development Guidelines for the Protection of Aquatic Habitat
  - http://dfo-mpo.gc.ca/Library/16535.pdf
- A User's Guide for Working In and Around Water
  - http://www2.gov.bc.ca/assets/gov/famring-natural-resources-and-industry/natural-resource-use/land-water-use/crown-

## 5.1: Environmental Monitoring and Reporting

A qualified environmental monitor (EM) for this project, provided by NPE will conduct environmental monitoring and oversee the implementation of the CEMP. When the EM is not available onsite, the ET will act as the EM in his stead. The primary responsibility of the EM is to ensure that the environmental protection objectives and requirements of all applicable approvals/permits are met and the requirements of this CEMP and other applicable conditions are implemented. The EM or their representative has the authority to modify and/or halt any construction activity at any time if deemed necessary for the protection of the environment.

Responsibilities of the EM include, but are not limited to:

- Fill out an Environmental Orientation Record (Appendix D) with the Contractor's site supervisor,
- Supervise/manage the ET when the ET is acting as EM on the site.
- · An ET shall be onsite:
  - During installation of Erosion and Sediment Control (ESC) infrastructure, fish salvage, instream works, and ESC removal,

- Full time when instream works are being completed,
- Within 24 hours of a significant rain event (25mm precipitation per 24 hours).
   The weather network website:
   (https://www.theweathernetwork.com/ca/weather/british-columbia/chilliwack)
   will be used to forecast significant rain events.
- Communicate the requirements of the CEMP to project team members during preconstruction and tailgate meetings and promote BMPs during the project,
- Be available throughout the duration of the work to all matters related to the protection of the environment,
- Review erosion and sediment control features during site visits to ensure they are installed properly and functioning as intended,
- Review the Contractor's work procedures to ensure functionality and compliance with the CEMP and applicable regulations, standards, and BMPs,
- Attend site meetings, as required, and provide advice in preparing for work activities in a manner that mitigates adverse effects,
- Measure/assess key environmental indicators (e.g., turbidity) during routine monitoring to determine if work being conducted is in accordance with the CEMP.
- Inspect hazardous material containment, storage, transportation, and disposal to ensure compliance with applicable legislation and regulation,
- Liaise directly with project members and provide technical advice to resolve situations that may impact the environment as they arise,
- Maintain complete records of activities related to the implementation of the CEMP.
   This includes any measurements taken, photographs, and incident reports,
- The EM and/or the Contractor will be responsible for making any and all incident reports to Environmental Agencies under the Fisheries Act, Water Sustainability Act, Environmental Management Act, and any other relevant acts. The environmental incident will be reported to the Ministry of Environment Representative prior to or concurrently to reporting to the environmental authorities. A template for an Environmental Incident Report can be found in Appendix E.

## 5.2: Air Quality and Dust Control

The following BMPs are recommended to avoid or minimize impacts to air quality:

- Dust emissions will be controlled at the source, where possible, to contain or limit the release of dust particles to the air.
- Idling should be minimized as much as possible.
- All equipment, vehicles, and stationary emission sources will be well-maintained and used at optimal loads to minimize emissions.
- Equipment and vehicles will be turned off when not in active use.
- Combustion engines will be located away from sensitive receptors such as fresh air intakes, air conditioners, and windows,
- A staging zone for trucks that are waiting to load or unload material in the Contract area will be established away from sensitive receptors.
- Vehicles or equipment producing excessive exhaust will be repaired or replaced prior to being used on the project.
- Stationary emission sources (e.g., portable diesel generators, compressors, etc.) will be used only as necessary and turned off when not in use.
- Dust generating activities will be minimized as much as possible, especially during windy periods. As outlined in, application and handling of the any dust palliative, with the exception of water, should be in compliance with the Ministry of Transportation's documents "Dust Management Environmental Best Practice for Highway Maintenance Activities" and "Maintenance Guidelines for Dust Palliatives and Gravel Road Stabilization".
- Regular haul road maintenance is required to prevent accumulation of mud or fines that could result in silt laden runoff to aquatic habitat.
- Water application must be performed in such a way that does not generate sediment-laden water that may be transported to ditches or streams that lead to fish habitat.
- Regular sweeping is required to control mud and dirt tracking onto public roads, utilizing wet broom cleaning during dry weather conditions.
- Material loads entering or exiting the site will be covered as appropriate to prevent sediment release or air born dust generation.
- No burning of oils, rubber, tires and any other material will take place at the site.
- Stabilize exposed soils outside of bars, stockpile areas and haul routes with growing

medium, compost seed and plants, as soon as possible.

#### 5.3: Noise and Vibration

The following BMPs are recommended to avoid or minimize potential project effects resulting from noise:

- Construction activities are restricted to the working hours from 7 a.m. to 5 p.m.
   Monday through Saturday in accordance with the City of Chilliwack bylaws. Should construction activities be required outside these hours, the Contractor will notify the City for approval.
- The affected community will be notified of the nature and likely duration of any particularly noisy operations and when it will be necessary to work outside the restricted hours.
- All equipment will be properly maintained to limit noise emission and fitted with functioning exhaust and muffler systems. Machinery covers and equipment panels will be well fitted and remain in place to muffle noise. Bolts and fasteners will be tight to avoid rattling.
- Engines will be turned off when not in use or reduced to limited idle (or as appropriate to reduce air emissions).

## 5.4: Machinery and Equipment

The following BMPs are recommended to avoid or minimize potential environmental impacts from machinery and equipment:

- Equipment and machinery will be in good operating condition and maintained free of leaks, excess oil and grease, invasive species, and noxious weeds. Equipment will be inspected daily for leaks or spills.
- All active and stationary fuel powered equipment (vehicles, machinery, generators etc.) will require secondary spill containment (i.e., spill trays). Spill trays will be utilized while equipment is inactive and during active works, where deemed possible,
- Hydraulic machinery should use environmentally friendly hydraulic fluids (i.e., nontoxic to aquatic life, and bio- degradable).
- Equipment will be operated at optimum rated loads and be turned off when not in use to minimize exhaust and noise emissions. Equipment producing excessive exhaust or noise will be repaired or replaced.

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- Refueling of equipment will occur on land at least 30 m from the water, where possible.
- Refueling of machinery will follow the Refueling Management Plan in Section 7.
- Refueling areas will have spill containment kits immediately accessible and personnel will be knowledgeable in the use of these kits.
- Washing of equipment and machinery will occur at least 30 m from the river, ditches, streams, and/or drainages.

#### 5.5: Erosion and Sediment Control Plan

For erosion and sediment control (ESC) to be effective on site the following measures will need to be deployed to meet or exceed the standards outlined in the Ministry of Water Land and Air Protection "Best Practices for Urban and Rural Development" and the DFO "Land Development Guidelines for the protection of Aquatic Habitat. The following ESC measure will be implemented:

- Prior to commencement of the work, the Contractor must obtain sufficient quantities
  of silt fence, sandbags, erosion control blanketing and polyethylene sheeting,
  necessary to stabilize disturbed ground.
- All works will be conducted in a manner that will prevent the release of sediment or sediment laden waters to the Vedder River, watercourses, ditches, storm sewers and swales draining to fish habitat.
- ESC materials must be on-site, available for inspection and installed prior to the commencement of any ground disturbances.
- Effective ESC measures are to be installed before starting work to prevent the entry of sediment into the ditches or storm sewers.
- These measures will be inspected by the EM or their representative regularly during the course of construction.
- Stockpiled material will be set back at least 30 m from the Vedder River or any other drainages where possible. All material will be taken to pre-approved stockpiles.
- Material stockpiled for more than one day is to be covered by weighted poly sheeting and encircled with silt fencing to ensure no entry of sediment laden water from stockpile runoff to drainages or watercourses.
- During significant rain events (> 20 mm in 24 hours) stockpiles are to be covered by weighted poly sheeting and encircled with silt fencing to ensure no entry of sediment laden water from stockpile runoff to drainages or watercourses.

- If stockpiled materials cannot be stored 30 m from the Vedder River or other drainages, they will be covered by weighted poly sheeting and encircled with silt fencing as appropriate to ensure no entry of sediment laden water from stockpile runoff.
- Necessary repairs will be made by the Contractor immediately if any damages occur such that ESC is compromised.
- Generated debris tracking onto municipal roadways must be swept on a regular basis and at the end of the project.
- All efforts will be made to leave undisturbed native vegetation, where possible, as vegetation retention will reduce erosion potential.
- All disturbed slopes, watercourse banks and ground surfaces that may contribute sediment-laden water into sensitive fish habitats during precipitation events must be stabilized through application of organic (i.e., straw or erosion control blanket) or inorganic (i.e., plastic) mulches over the course of the workday.
- Once started, work will be pursued to completion as quickly as possible.
- Effective sediment and erosion control measures are to be maintained until revegetation of disturbed areas is achieved.
- The EM will recommend suspending excavation in heavy rainfall scenario's (>25 mm over 24-hour period).
- Excavation pits will be isolated from flow throughout the excavation activities. Pit
  openings will then be excavated in such manner that any contained turbid water
  discharges in accordance with section 5.13
- The berm will be opened at the downstream end of the pit first, to ensure the pit does not fill with water.
- Building a berm around sections of the pit perimeter is recommended if river level rises close to the top of pit level, if a breach of pit isolation is imminent or as directed by the environmental monitor.
- All erosion protection works will be completed within the dry section of the bar.
- Silt fences or curtains will be installed as needed. This may be necessary on haul routes specifically. See Appendix F for silt curtain installation instructions.

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#### 5.6: Fish and Fish Habitat Protection Plan

The following BMPs are recommended to avoid or minimize the potential impacts to fish and fish habitat that may result from in-water construction activities:

- A fish salvage will be completed for all instream works where necessary. Fish salvage permits are currently being processed by MOF and DFO for this project.
- Excavation design mitigation includes: field fit design optimization, a gently sloped upstream end of the excavation and two wide openings to ensure fish do not become trapped.
- All project personnel will avoid activities that may, directly or indirectly deposit deleterious substances of any type in water frequented by fish in a manner contrary to Section 36(3) of the Fisheries Act, or adversely affect fish or fish habitat in a manner contrary to Section 35(1) of the Fisheries Act.
- Unless otherwise approved in writing by DFO or MOF, any construction activities
  occurring below the HWM of the Vedder River that may impact fish or fish habitat
  should be carried out only within the Fishery Timing Window from August 1 to
  September 15.
- Equipment (e.g., heavy machinery) used in and around water will be kept clean and in good working condition (i.e., free of leaks, excess oil, and grease).
- Any hydraulic machinery used near water will use environmentally friendly hydraulic fluids (i.e., non-toxic to aquatic life, and bio-degradable).
- All materials to be used in and around water, should be clean (i.e., they will not
  present any risk of leaching contaminants or affecting water/sediment chemistry).
- An initial soft-start procedure for excavation works will be conducted to allow fish to move away from the project area.
- Work will immediately cease should there be reasonable grounds to believe that the
  project has harmed fish or fish habitat including observation of distressed, injured, or
  dead fish or aquatic wildlife. The work will not resume until authorized by the EM.
- If distressed, injured, or dead fish are observed following the initiation of work, the EM will halt work immediately and oversee the implementation of mitigation measures before work restarts.

## 5.7: Species at Risk Mitigation Plan

To avoid potential impacts to Species at Risk in the vicinity of the Vedder River, the following pre-construction mitigation measures should be implemented:

- EM will walk haul routes prior to use.
- Operators will be instructed to pay careful attention while on haul routes.
- Pictures will be included that enable operators to identify species at risk.
- Vegetation removal will be limited and subject to review by EM.
- For in-depth information pertaining to Species at Risk mitigation, see Appendix B.
- For species identification materials see Appendix C.

#### 5.8: Bird and Wildlife Protection Plan

To avoid potential impacts to wildlife, the following pre-construction mitigation measures should be implemented:

- If clearing and/or grubbing operations for the Site are required, a nest survey will be conducted to ensure that no nests protected under the BC Wildlife Act are present, regardless of the time of year.
- If clearing and/or grubbing operations for the Site are required during the regional breeding migratory nesting period, which is March 25<sup>th</sup> to August 17<sup>th</sup> of any given year then the EM must conduct an intensive survey of the area following the Breeding Bird Nest Survey Protocol, as per the Migratory Birds Convention Act (MBCA).
- A pre-construction survey for raptor nests will also be completed. In accordance
  with the BC Wildlife Act, Section 34, nests of Osprey, eagle, peregrine falcon,
  gyrfalcon, heron, or burrowing owl are protected year-round, whether or not the
  nest is occupied. In the event a protected nest is found, the AQP will be
  responsible for developing and implementing a site-specific nest management
  plan.

Clearing activities can commence if no active nests are found. In the event any active nests are identified the works will cease in the area and the Contractor's EM will be responsible for developing and implementing a site-specific nest management plan including appropriate mitigation measures for the duration of the nest occupancy

## 5.8.1: Breeding Bird Nest Survey Protocol

## Survey Requirements for Areas to be Cleared and Grubbed.

Both vegetated habitats and non-vegetated habitats (i.e., rock outcrops) have the potential to support nesting birds, although bird abundance is generally greater in heavily vegetated areas. In addition, many man-made structures such as retention ponds, bridges, utility towers, and larger culverts have the potential for nesting bird activity.

#### **Survey Timing**

Bird nest surveys should be conducted during the appropriate seasonal timing window. In general, this window occurs between March 25<sup>th</sup> and August 17<sup>th</sup>.

Bird nest surveys should be carried out within the first 3 to 4 hours after sunrise. Surveys should not be undertaken during periods of inclement weather (e.g., heavy rain, fog or snow) or under windy conditions.

Note: Non-passerine species such as raptors or owls may have different seasonal nesting windows and are active at different times of the day. If environmental assessments have identified the potential for non-passerine bird species, then alternate survey timing may be required.

#### **Team Member Qualifications**

All nest surveys must be conducted by, or under the direction of an AQP who will be responsible for sign-off on all surveys. All survey team members must have sufficient experience with bird identification and biology.

## **Survey Effort**

Survey duration must be a minimum of 1 hr/ha and will be longer if searches are occurring in complex habitats. The AQP will be responsible for determining the effort required within these parameters.

Survey team members will walk transects through the area to be cleared to search for bird nests and nesting activity. Where appropriate, surveyors should also use additional survey techniques to increase the likelihood of finding nests such as behavioral cues and bird song identification.

Surveys should be conducted both within the clearing and grubbing limits and, where feasible and appropriate, up to 30 meters beyond the limits.

#### **Determining Nest Activity**

Each nest observed during the survey must be mapped and designated as either **active** or **inactive**. If the contents of the nest are easily observed from a distance, indicators such as new nesting material and/or eggs can be used to determine activity. Other means of determining nest activity can include observations of adult birds exhibiting nesting or territorial behaviour.

Observed nests that are in good condition but do not appear to be occupied at the time of the survey must still be considered active until additional observation periods have been undertaken. Observation periods must include 2 separate one-hour duration survey efforts conducted on consecutive days. To avoid unnecessary disturbance, a nest should be observed from a distance if it is considered active.

#### **Active Nest Buffers**

A No Work Zone buffer must be applied to any active nests identified. The AQP is responsible for developing and implementing a nest management plan including an appropriate buffer width, buffer marking, and mitigation measures for the duration of the nest occupancy. Buffer zones will be determined based on factors such as surrounding vegetative cover, topography, species sensitivity to disturbance, existing disturbance in the area, or proposed construction activities in the vicinity of the nest.

## **New Surveys**

It is advised that a bird nest survey be conducted prior to vegetation removal. Once the survey is complete, vegetation clearing must begin within 3 days of the end of the survey cycle. Clearing and grubbing can be undertaken for up to 10 days after the end of the survey cycle, if the AQP determines that ongoing construction activities will preclude additional nesting activity.

#### Survey Extensions

If vegetation clearing does not begin within 3 days of the end of the survey cycle or cannot be completed within the 10-day clearing window, then additional survey work will be required prior to vegetation removal.

#### Reassessment of Active Nests

A minimum of 14 days after a nest is designated as active, the nest can be reassessed.

Reassessment will consist of a minimum 1-hour nest observation period on 2 separate days, with the timing for these reassessments based on the likelihood of observing birds at the nest. Potential disturbance of birds must be minimized during the observation period.

If watches have been conducted and no bird presence and/or breeding activity is noted, nest status can change from active to inactive. As a final verification of inactivity, the nest will be approached and inspected.

If at any time the nest is found to be active, the AQP will determine the appropriate buffer and the same procedure for an active nest will be followed.

## 5.9: Invasive Plant Management Plan

The following BMPs for Managing Invasive Plants on Roadsides from the Ministry of Transportation and the Invasive Species Council of BC (ISC) will be implemented throughout the duration of the works.

- Identify invasive plants within the work area. The EM should consult the invasive plant inventory and treatment maps prior to construction commencement, as well as conduct a pre-work survey for invasives within any areas to be cleared or grubbed.
- Record and report any invasive plants using the Report a Weed® app or online database, call regional invasive species organization, or call the Invasive Species Council of BC.
- The area containing invasive vegetation will be flagged and a 'no work zone' buffer will be established.
- Avoid parking, turning around, or staging equipment in invasive plant infested areas.
- Inspect and clean vehicles before entering a weed-free area and before leaving an infested area.
- Minimize roadside disturbance and retain desirable vegetation where possible.
- Where possible, begin moving or brushing in an invasive plant-free area and end in infested areas.
- Do not use materials contaminated with invasive plants.
- Restore disturbed sites and remove unsuitable waste material.
- Re-seed disturbed areas with grass mixtures that are free of weeds, locally adapted, quick to establish, and approved by the Ministry.

## 5.10: Water Quality Monitoring Plan

Sufficient measures to keep water quality within an accepted standard during the work will be employed throughout the project duration. Water quality will be visually inspected by the EM at the water quality monitoring stations (WQMS) at a minimum of (1) sample for every three (3) hours during active works instream. Regular sampling will include but is not limited to turbidity measurements. Background will be established during each sampling period by measuring turbidity and/or visually observing the upstream water source (WQMS 1).

At a minimum, a decision to proceed with water sampling must address the following:

- Sampling for turbidity (NTU) will occur when visually the downstream water quality is noticeably different from the background (upstream) water quality,
- Sampling for NTU during rain events where conditions have the potential to adversely
  affect the water quality,
- The frequency of sampling will be determined by the Environmental Monitor as necessary to ensure water quality requirements are being met,
- The excavator will maintain isolation of the excavation site from flowing water until
  the day following completion to allow settlement in the pit of the heavier sediments.
  The turbid water can then be released downstream in a single plume for a short
  duration. Pit openings well follow conditions outlined in section 5.13 as opposed to
  the continuous release of turbid water throughout the excavation.
- Prior to opening each excavation, background turbidity and readings from the enclosed pit will also be collected. Additional readings will be taken downstream as the plume of turbid water exits the excavation site.
- Sampling will document water quality immediately upstream (background) and at least 30 m downstream of construction activities according to the following water quality guidelines:

Except during the openings, exceedances listed in Tables 2 and 3 below will be reported to the EM and/or the Site Supervisor immediately and additional ESC measures will be initiated if water quality values do not meet these above criteria.

Table 2: Water Quality Criteria for Aquatic Life for Turbidity and Total Suspended Solids\*

Turbidity (NTU)	Total Suspended Sediments
Change from background of 8 NTU for a duration of 24 hours during clear flows	Change from background of 25 mg/L for a duration of 24 hours during clear flows
Change from background of 2 NTU for a duration of 30 days during clear flows	Change from background of 5 mg/L for a duration of 30 days during clear flows
Change from background of 5 NTU when background is 8 – 50 NTU	Change from background of 10 mg/L when background is 25 – 100 mg/L
Change from background of 10% NTU when background is >50 NTU	Change from background of 10% NTU when background is >100 mg/L

<sup>\*</sup>British Columbia Approved Water Quality Guidelines Aquatic Life, Wildlife & Agriculture, August 2019

## 5.11: Waste Management Plan

- A small amount of general refuse and non-hazardous construction waste may be generated on the site.
- Food and food waste will be stored in animal proof containers or within trailers, so it
  is not accessible by wildlife.
- The Contractor will provide designated waste bins for the disposal of nonhazardous solid wastes and separate marked bins for hazardous waste.
- All construction waste will be separated from domestic food waste and removed from the site once the receiving bins are full.
- All solid waste will be either recycled or disposed of at approved waste disposal facilities.
- Littering is prohibited and monitoring for this activity will be on-going throughout the project.
- There will be no disposal of solid wastes into sumps, ditches, river, streams, culverts, road edges, or private property.

## 5.12: Hazardous Materials Management Plan

Management of hazardous materials will be addressed via the following measures:

- The Contractor must provide a spill response plan which the EM, ET's and construction crew must become familiar with. The plan should be accessible to project personnel. (Section 6.0),
- Ensure all equipment and machinery are in good working order, clean, and free of leaks or excess oil/grease,
- Refueling of land-based equipment must be completed by a mobile refueling service to avoid storage of bulk fuel onsite,
- An operator must remain by the fuel nozzle during all refueling to ensure no spills occur and to be able to shut of the source if a s pill does occur,
- Fueling or servicing of land-based equipment will not be completed within 30 m of any watercourse or surface water feature where practical,
- If the fueling or servicing cannot be completed 30 m form the Vedder River or a
  drainage, then spill tray(s) should be placed under the equipment during the refueling
  or service and spill pads used where necessary to precent accidental release of
  hydrocarbons into the surrounding environment.
- Fuels, oil, grease, and other substances deleterious to aquatic life will be prevented from entering any watercourse or storm sewer,
- All stationary gas or diesel-powered equipment and liquid storage containers stored within the project area must be stored in a secondary containment tray with 125% capacity of all the containers and situated to avoid potential damage to it or containment,
- The Contractor must provide fully stocked emergency spill kits and barrels which will be present onsite at all times during construction,
- Any spills of substances toxic to aquatic life of reportable quantities (see Appendix G)
  will be immediately reported to the Emergency Management BC 24-hour
  phoneline at 1-800-663-3456,
- Contact BC One Call (1-800-474-6886) prior to any ground disturbance,
- Fuel and hydrocarbon-based lubricants must be stored in designated storage areas, such as a lockable metal cabinet (or an alternative approved by the EM), a minimum of 30 m in from the river, streams, ditches, and catch basins,
- All hazardous material must be properly stored, contained, and labelled in accordance with relevant acts and regulations at least 30 m from any drainage,

- If any hazardous materials are utilized at the site, the labeling must be in accordance with the Transportation of Dangerous Goods (TDG) regulations as well as the manufacturers SDS,
- It is not anticipated that the works will uncover contaminated soils,
- In the event of a hydrocarbon spill, the absorbent materials or soils saturated with oil
  or gasoline are classified as Hazardous Waste, and
- The BC Hazardous Waste Regulations and the federal TDG must be adhered to with respect to storage, transportation, and disposal of hazardous wastes.

## 5.13: Pit Opening Mitigation Procedures

- The EM or appropriately experienced ET must be on site for all openings.
- Material from the opening should be trucked offsite.
- Excavate as much as possible prior to breaching containment.
- Casting material from the opening into the pit should only be used where no option to haul off site is possible or for the latter part of the excavation as the final design parameters are met.
- Where material is to be cast, a receiving area within the pit should be excavated prior to the opening.
- Material to be cast must be released at or below the water level to minimize suspension of sediments.
- Open the downstream first unless the downstream opening is required for access and the EM approves.
- To achieve an appropriate depth of the opening, the EM will identify the distance to be excavated out into the channel; never more than machines reach from the dry part of the bar.
- Material from the channel should be drawn into the pit and not lifted until it is out of the flowing channel.
- The EM will provide a specific plan for each opening.

## 6.0: SPILL PREVENTION AND EMERGENCY RESPONSE PLAN

## 6.1: Spill Preparedness

The Spill Response Plan should be reviewed with all construction staff in the pre- construction meeting and staff should be trained to respond to spills. The Plan should be updated when required to include any materials of a deleterious nature that could be spilled not previously identified. The Spill Response Plan will be updated with the following project-specific information for the staff to familiarize themselves with:

- Identification of all hazardous materials present on site as well as waste storage and secondary containment. Understanding of reportable spill quantities and reporting requirements. Material Safety Data Sheets (MSDS) will be kept on site and made available to all construction team members.
- Identification of the locations of spill response equipment and materials for containment and clean-up as well as instruction on how to use them effectively.
- As work will be conducted in and around water, spill barrels will be stored on site at key locations.

## 6.2: Environmental Spill Response

The purpose of the Spill Prevention and Emergency Response Plan is to identify potential risks at or in proximity to the Site, provide procedures to facilitate rapid deployment of resources in the event of a spill to minimize the impact and risk to the environment, the public and personnel on Site. The Contractor will be familiar with the regulatory requirements and be adequately prepared with personnel and equipment to respond within the shortest possible time. A copy of the Contractor's Emergency Spill Response Plan Can be found in Appendix H.

The Contractor is to implement the following mitigation measures to avoid spills and provide adequate response in the event of a spill:

- The Contractor will maintain equipment and machinery in good working condition, and free of leaks or excess oil and grease, to prevent contamination to the environment. Equipment that contains oils and greases (e.g., excavators, cranes, generators) and requires periodic maintenance will be serviced by a mechanic with necessary supplies to contain potentially deleterious substances. All machinery should be serviced off-site, however, if onsite servicing is required it should be done at least 30 m from any drainage.
- Each machine working on-site will have a spill kit containing, as a minimum: 20 oil

- absorbent sheets, two 1.2 m absorbent socks, heavy duty disposal bags, a roundnose shovel or equivalent, and suitable Personal Protective Equipment (PPE).
- A spill barrel will be kept within the work site as well as at all refueling sites. It will
  contain, as a minimum: 100 oil absorbent sheets, 100 universal sorbent pads, 25 kg
  of dry oil sorbent, four 1.2 m oil linkable absorbent socks; four 1.2 m universal
  linkable absorbent socks, four 3 m sorbent linkable floating booms, 1 roll of 25 m x
  4 m poly sheeting, ten disposable bags, and PPE.
- Used spill response materials will be bagged in heavy-duty polyethylene bags, labelled, and disposed of appropriately.
- Spill kits will be inspected regularly by the Contractor and EM and will be refilled immediately when spill response materials are used.
- Adhere to the mitigation measures outlined in the Fuel Management Plan (Section 7.0).
- The Spill Prevention and Emergency Response Plan will be visibly posted at the Site.
- The Contractor will designate a staff member as the Spill Coordinator. This staff member will have knowledge of spill mitigation, containment, and reporting procedures.
- All personnel are to be made aware of the content of the Spill Prevention and Emergency Response Plan, the location of response materials, response procedures and emergency contact names and numbers. Spill contingency procedures will be posted in visible locations within the Contractor's work Site offices and trailers. Spill response equipment and supplies are to be kept in accessible and visible locations which are to be made known to personnel during Site safety orientations.
- Sorbent material will be on hand at the work areas as a means of containing and soaking up any spilled substance before it reaches the groundwater table or open water.
- Empty drums/pails are to be kept onsite for storage of waste oil, solvents, used sorbents, contaminated soil, etc. Drums/pails will have tight fitting lids and be protected from the elements by tarping. They are to be immediately labelled for identification of contents.

## 6.3: Environmental Incident Reporting

Deleterious substances are not permitted to be released into the environment. In the event of a spill, regardless of size, the Contractor will:

- Take immediate action to minimize environmental consequences and manage resolution of the incident.
- Determine the type of material and estimated volume spilled.
- Gather information to complete an initial Environmental Incident Report (EIR). The EIR will include a description of the time and location of the incident, a description of what occurred and the cause, the product name and substance in the event of the spill, an estimate of the volume of spilled product, and a description of containment and/or mitigation measures employed.
- The EM and/or the Contractor is responsible for making all incident reports to the Environmental Agencies for contraventions under the Fisheries Act, Water Sustainability Act, Environmental Management Act, and any other relevant acts. The environmental incident will be reported to the environmental authorities, such as Emergency Management BC.
- Any incident reports made during the reporting period will be appended to the weekly reports.
- A copy of the Environmental Incident Report form can be found in Appendix E.

## 6.4: Communication Pathway

Section 2.4 presents a list of emergency contacts based on the Project requirements. This list will be updated as needed over the duration of the Project.

## 6.5: Emergency Spill Response Plan

Emergency Response Plans outline spill response and reporting procedures that will be implemented during the Project. A copy of the Emergency Spill Response Plan can be found in Appendix H.

## 6.6: Public Concerns Protocol

There is a possibility that members of the public or other stakeholder groups will voice their concerns pertaining to the sediment removal. If this occurs, operators and on-site personnel should relay the concerns to the Environmental Monitor (EM). The EM will endeavor to

address the concerns of the individual(s). If the EM is not able to allay the concerns of the stakeholder, the EM will direct the individual to the Ministry representative Gulraiz Cheema, the Ministry of Environment and Climate Change strategy representative for this project.

## 7.0: FUEL MANAGEMENT PLAN

The fuel management plan provides measures to ensure the receiving environment is adequately protected from construction-related fuels and products on site. Best management practices for land-based operations include:

- Fuel storage tanks/containers will be clearly labeled, and their locations will be made known to all onsite personnel.
- Refueling equipment and tanks will be clean and in good working order. Fuel tanks
  will be situated within appropriate secondary containment (an impermeable
  containment facility capable of holding 125% of the storage tank contents). This
  will be achieved using double-walled storage tanks or sit-in containers constructed
  out of impermeable material, such as aluminum or plastic.
- All fuels, oils, lubricants, and other petrochemical products will not be stored within 30 m of any waterbody.
- Where practical, equipment will not be fueled within 30 m of a waterbody. If possible, one area will be designated for fuel transfer.
- Refueling will occur on a flat surface to minimize potential off-site runoff. Spill trays
  are to be used during the refueling process, and a spill kit should be on-hand at the
  refueling site.
- Any fuel spilled will be immediately cleaned up and reported to the EM (see Section 6.0).

## 8.0: RIPARIAN RESTORATION PLAN

Exposed soil resulting from culvert crossing installations and/or site access will be replanted following the disturbance to the soil. A planting strategy will be compiled, and planting will be conducted by NPE as required.

#### 9.0: BIBLIOGRAPHY

Government of Alberta. 2011. Alberta Transportation Erosion and Sediment Control Manual.

https://open.alberta.ca/dataset/aaae5384-c0e0-4421-9fd8-6ab835c6f3af/resource/5ae2cd05-f29f-4f71-a88f-08ac702125a9/download/2011-erosion-sediment-control-manual-june-2011.pdf

South Coast Conservation Program. 2022. Coastal (Pacific) Giant Salamander.

http://www.sccp.ca/species-habitat/coastal-pacific-giant-salamander

South Coast Conservation Program. 2022. Great Blue Heron fannini ssp.

http://www.sccp.ca/species-habitat/great-blue-heron-fannini-ssp

South Coast Conservation Program. 2022. Northern Red-legged Frog.

http://www.sccp.ca/species-habitat/northern-red-legged-frog

South Coast Conservation Program. 2022. Oregon Forestsnail.

http://www.sccp.ca/species-habitat/oregon-forestsnail

South Coast Conservation Program. 2022. Salish Sucker.

http://www.sccp.ca/species-habitat/salish-sucker

South Coast Conservation Program. 2022. Western Painted Turtle – Pacific Coast Population.

http://www.sccp.ca/species-habitat/western-painted-turtle-pacific-coast-population

South Coast Conservation Program. 2022. Western Screech Owl kennicottii ssp.

http://www.sccp.ca/species-habitat/western-screech-owl-kennicotii-ssp

# **Appendix A– Environmental Permits**

# Appendix B- SARA Screening Report for Proposed Vedder River Sediment Removal Program

# **Appendix C– Species at Risk Identification Material**

#### **Pacific Giant Salamander:**



"Snout to vent length 6.25 – 17 cm, Adults up to 35 cm total length including the tail. This is the largest salamander in BC (and possibly the southeast). The plump body has a wide, wedge-shaped head and fleshy legs. Skin is smooth, dark brown to dark grey usually with brown or tan marbling on the dorsal area from head to tail and upper parts of the legs. The chin and belly is pale grey or cream, eyes vary in colour, often similar to the marbling colouration. Older adults may lose the marbling on the body. Once in terrestrial form, adults have 12-13 indistinct lateral "costal grooves" (vertical indents that look like ribs). Larvae, which are totally aquatic, can reach 20 cm and start out in a somewhat tadpole-like state with only a tail, small forelimbs and external gills. Larval colour is somewhat a monotone light brown with indistinct mottling and lighter ventral areas than adults. Gills are bushy and reddish-brown. Neotenes (aquatic individuals which retain larval physiology but are capable of breeding) may reach full adult size (35 cm). Under some conditions (possibly due to lowered riparian habitat complexity), neotenes can outnumber terrestrial individuals. \*This species is sometime referred to as the Pacific Giant Salamander" (South Coast Conservation Program, 2022).

#### Western Painted Turtle:



"Size (shell diameter): Hatchlings 2-2.5 cm, Juveniles 10cm, Mature adults 25 cm (females larger than males). The carapace (upper shell) of adults is smooth, olive-green to dark brown. Outer edges can be patterned with red lines. The head, neck and tail are olive to greenish-black and striped with yellow. The intricate black and yellow branching pattern on the plastron (lower shell) is not present on all individuals, though the plastron is always red or orange. Colour patterning can be variable between individuals and between populations. The upper jaw has a notch located just under the nostrils. Males have very long front claws and thicker tails with a cloacal (tail vent) opening that is closer to the end of the tail than to the carapace. Females have shorter front claws, and thinner tails with cloacal openings closer to the carapace than to the end of the tail. Hatchlings have rounder carapaces that are slightly keeled along the length and similar but more vibrant colouration than adults" (South Coast Conservation Program, 2022).

#### Salish Sucker:



"Length: Up to 24 cm. Common to members of its genus, this species has a fairly long snout ending in a rounded point. The body shape is elongated and cylindrical, scales are small, the tailfin is moderately forked with rounded tips, and the anal fin is large. The sub-terminal mouth is toothless, with fleshy "lips". The mouth and lips of suckers are designed to act like a vacuum cleaner to gather food from the stream bottom. The lips are covered with numerous papillae (minute fleshy projections), which act as sensory receptors for detecting food items. At breeding time, both males and females develop a broad rose or wine-coloured band along their sides which is most vivid in the males" (South Coast Conservation Program, 2022).

#### **Great Blue Heron:**



"Height: 60 cm, Wingspan 1.5 m. Both sexes are similar. Adult Great Blue Heron are tall, long-legged wading birds with a sinuous neck held in an "S" curve at rest and in flight. The long thick bill is yellow and black, the head and face are white. In mature birds, plumage is a steel blue-grey with dark blue-grey flight and tail feathers. As birds mature a distinctive black plume extends from above the eye to beyond the back of head and a bib of long trailing plumes on the chest and scapula area become more pronounced. Juveniles are grey-brown on the back and upper wing plumage and lack the black eyebrow and adult head and bib plumes" (South Coast Conservation Program, 2022).

## Northern Red-Legged Frog:





"Snout to vent length 4-8 cm, females up to 10 cm. Coloration and patterning for both aquatic and terrestrial phases is extremely variable depending on time of year, age and geographic location. Dorsal colors range from tan, olive, and grey to a rich reddish-brown. The back and sides have varying levels of dark flecking, with small spots on the flanks and groin area. Hind legs have dark mottled banding (more so on the lower portion of the leg). The upper and lower lip, chin, chest, and belly have various levels of mottling which becomes reduced and replaced by varying levels of red (especially on the groin and hind legs) as the frog matures. A dark eye-mask extends from the snout to around the eye and tympanum (eardrum) to the shoulder. Two light brown "dorsolateral" folds of skin run along the back from behind the eye to the groin area. Males develop a "nuptial pad" on each thumb to assist in gripping females ("amplexus") during breeding. Tadpoles reach 2-7 cm before metamorphosing and are tan to brown with degrees of mottling and gold flecking throughout. The tail is at least as long as the body and the tailfin extends onto the back" (South Coast Conservation Program).

## Oregon Forestsnail:



A "pulmonate" snail, this species have evolved their mantle cavity into a lung (instead of gills as still found in some snails). Breathing is through a single opening on the right side of the body which either remains open or opens and closes. One of the largest land snails in BC, the shell has 5 to 6 whorls (spirals) with lighter colored axial ribs (thin bands that cross each whorl). The uppermost whorls are often pale from wear. Shell colour ranges from gold to dark brown, lightening to amber around the aperture (shell opening). As the snail matures the shell can become bleached looking and begin to flake. This species lacks the 'hairs' found on the shell of other land snail species like the Pygmy Oregonian and Northwestern Hesperian. The thick white aperture lip of adult snails is evident when viewing the snail from below; juveniles lack this thickened aperture lip. Shell diameter 2.8-3.5 cm, shell diameter is 1.4 to 1.7 times shell height.". (South Coast Conservation Program, 2022)

#### Western Screech Owl:



"Length 19-25.5 cm, Weight 120-305 g. A small owl with yellow eyes, a small beak and black eyebrow ridges that lead up in a "Y" configuration to short ear tufts on the corners of the head. The head is crowned with a triangular russet and black cap that follows the eyebrow ridge to the ear tufts. Ear tufts may not always be visible, depending on the owl's 'mood'. A master of arboreal camouflage, the white to pale-grey plumage is streaked with black and brown making it difficult to see against tree trunks or cavities where it generally roosts and nests. The coastal subspecies tends to have greater brown coloration while the interior subspecies is greyer. As with most raptors, females are generally larger and heavier than males" (South Coast Conservation Program, 2022).

#### Mountain Beaver:



Also referred to as "Aplodontia," "Boomer," "Ground Bear," or "Giant Mole". Mountain Beaver are primarily a fossorial (sub-surface oriented) rodent living in burrows in and near moist riparian forest communities. Most burrow colonies are in areas with proximity to a water source, well-developed, firm soils, and abundant vegetation. Little is understood about BC's populations which are limited in distribution and subject to a number of threats from human activities including forest clearing, development, genetic isolation, and domestic pet predation(South Coast Conservation Program, 2022). The Mountain Beaver is a medium-sized rodent with the general appearance of a muskrat except the tail is well-furred and short. The body is thick, and covered with coarse, dark brown fur (Carraway and Verts 1993). Average adult body mass is 806 g (Lovejoy and Black 1974). In Canada, average mass of Mountain Beaver in the lower Fraser Valley is 948 g (Ransome unpub. data). Total length ranges from 300-470 mm, including the 20-40 mm long tail (Ingles 1965)

## Appendix D- Environmental Orientation Record



## ENVIRONMENTAL ORIENTATION CHECKLIST

The Environmental Orientation Checklist (EOC) shall be completed for all works involving an environmental component. The Environmental Monitor is responsible for ensuring that the environmental requirements of the work are reviewed with the Contractor before work is started, and that a record of the discussion is documented on the EOC. The form must be signed by both the Environmental Monitor and the Contractor. By signing the EOC, the Contractor indicates he/she has been advised of the environmental requirements of the project.

	Date:	are coo, are contractor morest	s ney sile has been advised of the environ	ineria regonement	or the project.	
1	Project Information					
	Project Title					
	Project Description					
	Project Location	8				
2	Contractor Information (if	applicable)		1000000	INTERNATION	9
	Company Name					
	Company Address					
	Site Contact/Representative	e Name				
	Tel.#	Fax#	E-r	mail		
3		ent Plan Review the environme Regulatory approvals or Best N	ntal issues and requirements of the wo anagement Practices (BMP)	rk as specified in the	e Environmenta	
	Is there an EMP, CMP,BMF	or Field Guide for the work?			☐ Yes	□ NA
	Have the environmental rec checklist below to guide dis	quirements been reviewed with	the Contractor and the Contractor's sta	ff? (Use the	☐ Yes	□ NA
	Environmental Issues		Environmental Management Plan Requirements		Discussed	NA
	Fish and Aquatic - habitat a	lteration, disturbance or loss				0
	Site isolation & Bypass					0
	Instream footprint mitigation	1			0	u
	Riparian footprint mitigation removal and mitigation)	n (Vegetation disturbance or			0	0
	Noxious weed control					
	Wildlife and Bird - habitat a	Iteration, disturbance or loss				0
	Soil erosion/compaction V siltation	Nater quality - erosion and				0
	Disturbance to Heritage Re	sources/Archaeological Sites				0
	Noise Concerns					0
	Hazardous waste (garbage	)			0	



## ENVIRONMENTAL ORIENTATION CHECKLIST

	Environmental Protection Requirements	Discussed	NA
Air emissions/ dust generation/other .	-		
Generation and disposal of waste (litter, latrine)			0
Fuel and flammable storage		0	0
Fuel-Spill of Spill of hazardous substances		0	
Generation and disposal of hazardous substances			0
Property Considerations			0
Do the tools and equipment meet the requirements?		0	
Permits and Approvals Information: Ensure the necessary oprior to starting work.	environmental permits and approvals relating to the	work have been ob	tained
Are environmental notification, permits, licenses or approvals	required?	□ Yes	□ NA
List applicable regulatory requirements and permit reference n	numbers.	1 = .46	
Have the permits, licenses and approvals obtained and/or che	House the same of	☐ Yes	□ NA
Have the permits, licenses and approvals obtained and/or che Emergency Response Plan/Oil and Chemical Spill Respon	House the same of	☐ Yes	□ NA
	nse Plan	☐ Yes	
Emergency Response Plan/Oil and Chemical Spill Respon	nse Plan		□ NA
Emergency Response Plan/Oil and Chemical Spill Response Has the Oil and Chemical Spill Response Plan been discusse	nse Plan	☐ Yes	□ NA
Emergency Response Plan/Oil and Chemical Spill Response Has the Oil and Chemical Spill Response Plan been discusse Are there spill kits available on location? Where are the spill kits located? Does the contractor have an Emergency Response Plan? Has	d?	☐ Yes	□ NA □ NA
Emergency Response Plan/Oil and Chemical Spill Response Plan been discussed Are there spill kits available on location?  Where are the spill kits located?	d?	☐ Yes☐ Yes☐ Yes☐ Yes☐	□ NA
Emergency Response Plan/Oil and Chemical Spill Response Has the Oil and Chemical Spill Response Plan been discusse Are there spill kits available on location? Where are the spill kits located? Does the contractor have an Emergency Response Plan? Has	d?	☐ Yes	□ NA
Emergency Response Plan/Oil and Chemical Spill Response Plan been discussed.  Are there spill kits available on location?  Where are the spill kits located?  Does the contractor have an Emergency Response Plan? Has Environmental Incident Reporting  Environmental Incident Reporting Procedures discussed?	nse Plan d? s it been discussed? e environmental requirements of the work a	☐ Yes☐ Yes☐ Yes☐ Yes☐ Yes☐	□ NA □ NA
Emergency Response Plan/Oil and Chemical Spill Response Has the Oil and Chemical Spill Response Plan been discusse Are there spill kits available on location?  Where are the spill kits located?  Does the contractor have an Emergency Response Plan? Has Environmental Incident Reporting  Environmental Incident Reporting Procedures discussed?  The undersigned has been briefed on the	s it been discussed? e environmental requirements of the work a	☐ Yes☐ Yes☐ Yes☐ Yes☐ Yes☐ Setailed above	□ NA □ NA

# **Appendix E– Environmental Incident Report Form**



# **ENVIRONMENTAL INCIDENT REPORT FORM**

NAME OF OPERATOR:					
BUSINESS ADDRESS:					
RELEVANT ENVIRONMENT PLAN:					
DATE AND TIME OF INCI	DENT:				
DATE AND TIME OF VER	BAL NOTIFICATIO	N:			
DETAILS OF PERSON MA	AKING REPORT:				
NAME:	TELEPHONE:		EMAIL:		
DETAILS OF WITNESS/WITNESSES:					
NAME:	TELEPHONE:		EMAIL:		
LOCATION:					
PROJECT:					
SITE LOCATION:					
MUNICIPALITY:					
INCIDENT SITE (TICK AS REQUIRED):					
OFFSHORE (CWTH WATERS)			VESSEL		
OFFSHORE (STATE WATERS)			PIPELINE		
ONSHO	RE (MAINLAND)		DRILLING UNIT		
ONSHORE (ISLAND)			PRODUCTION FACILITY		
ONSHORE (INLAND WATERS)			OTHER		

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ACTIVITY BEING UNDERTAKEN AT TIME OF THE INCIDENT:							
ENVIRONMENTAL (	CONS	SEQUENCE L	EVEL	:			
CATASTROPHIC		MODERATE			coı	MMENT:	
MAJOR		MINOR					
INCIDENT TYPE:							
UNA	UTHC	DRISED CLEA	RING	[		SPILL INCIDENT	
		FAUNA INCID	DENT	[		ATMOSPHERIC RELEASE	
			FIRE	[		OTHER	
DESCRIPTION OF IN	ICID	ENT:					
ANY SAFETY CONC	ERN	IS ASSOCIAT	ΓED W	/ITH	THE	INCIDENT:	
ENVIRONMENTAL (	CONG	CERNS (FILL	IN AS	S AP	PLIC	ABLE):	
VOLUME OF MATERIAL SPILLED / RELEASED (Gas - m³, Liquid - L)							
SIZE OF AREA AFFECTED (m²)							
TYPE / COMPOSITION OF MATERIAL SPILLED / RELEASED							
HAS THE EMERGENCY RESPONSE PLAN BEEN PUT INTO ACTION? YES / NO							
WHAT ARE THE MAIN ENVIRONMENTAL SENSITIVITIES IN THE AREA AND IS THERE A POTENTIAL FOR THESE TO BE IMPACTED AS A RESULT OF THE INCIDENT (I.E. WHAT IS THE DISTANCE OF THE ENVIRONMENTAL SENSITIVITIES FROM THE SOURCE OF THE RELEASE / FIRE)?							
ENVIRONMENTAL CONDITIONS AT TIME OF INCIDENT (WHERE RELEVANT):							
WIND SPEED & DIRECTION							
CURRENT SPEED & D	IREC	TION					
WATER DEPTH							

IS FURTHER ACTION REQUIRED? (I	l.e. Remediation)
FURTHER ACTION REQUIRED BY:	
CORRECTIVE ACTIONS TO PREVEN	NT RECURRENCE:
[	
TEMPERATURE	
VISIBILITY	
PRECIPITATION	
TOPOGRAPHY	
OTHER INFORMATION	KEN (DV DEDOCNIONED ATOD MAKING DEDOCT) AND
INTERNAL INSTRUCTIONS:	KEN (BY PERSON/OPERATOR MAKING REPORT) AND
COMMENTS:	
	<b>-</b> .
Prepared by:	Date:

FORM COMPLETE

# **Appendix F– Silt Fence Installation Instructions**

Silt Fence	
Sediment Control	B.M.P. #1

### **Description and Purpose**

- Permeable fabric barriers installed vertically on support posts along contours to collect sediment laden sheet flow runoff
- Causes water to pond allowing sediment to settle out as water filters through fabric
- Entraps and minimizes coarse sediment from sheet flow or overland flow from entering waterbodies
- · Perimeter control for sediment transport and deposition

### Applications

- Temporary measure
- · Used at bottom of cut or fill slopes to collect sediment laden runoff
- · Used along streams (or channels) banks
- · Used around stockpiles
- Midslope grade-break (using "J-hook" or "smile" pattern to effect ponding, filtering and sedimentation)

### Advantages

- Low permeability silt fences have high filtering capabilities for fine sand to coarse silt
- Filter fence more effective than straw bales at filtering out sediment

### Limitations

- · Applicable for sheet flow, cannot handle concentrated channel flow volumes
- May fail under high runoff events
- · Limit to locations suitable for temporary ponding of sediment laden runoff
- Low permeability silt fences may not be strong enough to support weight of water retained behind it and may require reinforcement (i.e., wire mesh and stronger support)
- · Sediment build up needs to be removed on a regular basis
- Damage to fence may occur during sediment removal
- · Useable life of approximately one year dependent on regular maintenance

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Silt Fence	
Sediment Control	B.M.P. #1

#### Construction

- · Two methods of installation are commonly used
  - Trench method
  - Mechanical (slicing) installation method (e.g. Tommy Silt Fence Machine or equivalent)
- Trench Method
  - Select location of silt fence (usually along contours)
  - Drive support posts a minimum of 0.3 m into ground, spaced a maximum of 2 m apart
  - Excavate trench approximately 0.15 m deep by 0.15 m wide for entire length of fence along upstream side of posts
  - Attach the wire mesh or snow fencing, if used as reinforcement, to upstream side of posts with staples
  - Extend filter fabric to base of trench and attach over wire mesh or snow fence, if used, on upstream side of posts
  - Backfill and compact soil in trench, being careful not to damage fence
- Mechanical Installation Method
  - Select location of silt fence (usually along contours)
  - Use mechanical installation machine to embed the fabric a minimum of 0.15 m into the ground. One mechanical installation method is by slicing (with special equipment) the geotextile fabric embeds into the ground without excavation and backfill. There is only minor disturbance of the ground. Tamping of ground is required for compaction.
  - Drive support posts a minimum of 0.3 m into ground, spaced a maximum of 2 m apart
  - Attach the wire mesh or snow fencing, if used as reinforcement to silt fence fabric, to upstream side of posts with staples
  - Extend filter fabric to base of trench and attach over wire mesh or snow fence, if used, on upstream side of posts

### Construction Considerations

Site Selection

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Silt Fence	
Sediment Control	B.M.P. #1

- Size of drainage area should be no greater than 0.1 ha per 30 m length of silt fence
- Maximum flow path length above silt fence should be no greater than 30 m
- Maximum slope gradient above the silt fence should be no greater than 2H:1V
- · Fence should be placed on contour to produce proper ponding
- Fence should be placed far enough away from toe of slope to provide adequate ponding area (minimum of 1.8 m away from toe of slope is recommended)
- · Ends of fence should be angled upslope to collect runoff
- Fence should not extend more than 0.6 m above grade
- Posts can be wood or metal material dependent on design and ground conditions
- · Posts should be placed on downstream side of fence
- Posts should not be spaced greater than 2 m apart
- Wire mesh or standard snow fencing may be placed between the posts and fabric barrier to provide additional strength and support reinforcement
- Geotextile should be cut from a continuous roll to avoid joints (if joints are necessary, the wrapping of fabric around the fence post and a minimum overlap of 0.2 m with staples should be used to attach the fabric to the post)
- Fence (and wire mesh or snow fence, if used) should be attached to posts with heavy duty staples, tie wires, or hog rings
- Fence (and wire mesh or snow fence, if used) should be dug into a trench at least 0.15 m deep to prevent undercutting of fence by runoff
- Trench backfill should be compacted
- Long runs of silt fence are more prone to failure than short runs
  - Maximum length of each section of silt fence should be 40 m
  - Silt fence should be installed in 'J' hook or 'smile' configuration, with maximum length of 40 m, along contours allowing an escape path for ponded water (minimizes overtopping of silt fence structure)

### Inspection and Maintenance

- Inspection frequency should be in accordance with the PESC and TESC Plans
- Repair undercut fences and repair or replace split, torn, slumping or weathered fabric immediately

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Silt Fence	
Sediment Control	B.M.P. #1

- Sediment build up should be removed once it accumulates to a depth of 0.2 m
- · Remove fence after vegetation is established
- Deactivate fabric by cutting-off top portion of fabric above ground; bottom trenchedin portion of fence fabric can be left in-ground thus minimizing ground disturbance

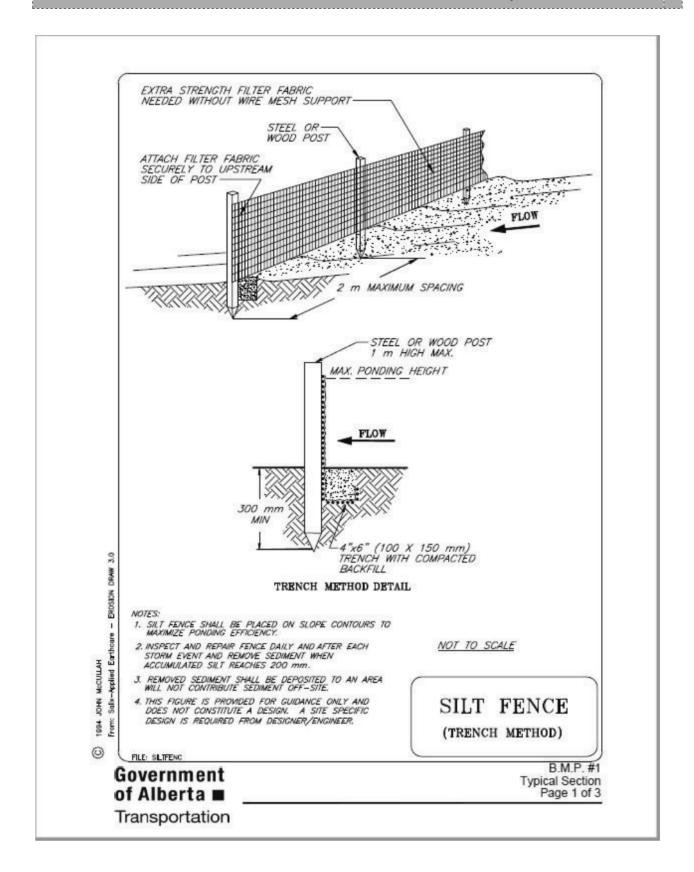
### Similar Measures

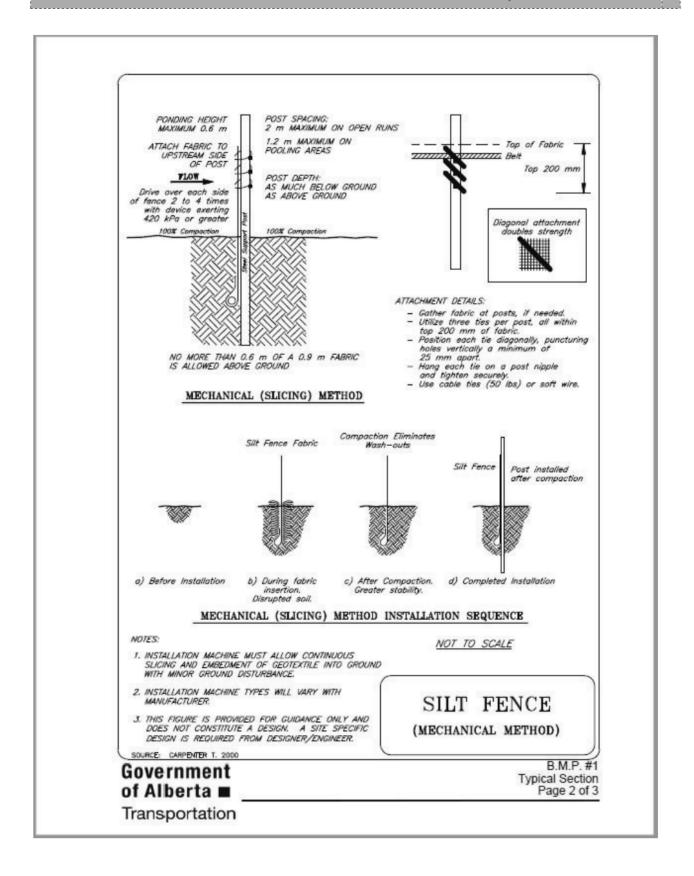
- Straw Bales
- Rock Barrier
- Permeable/Synthetic Barriers

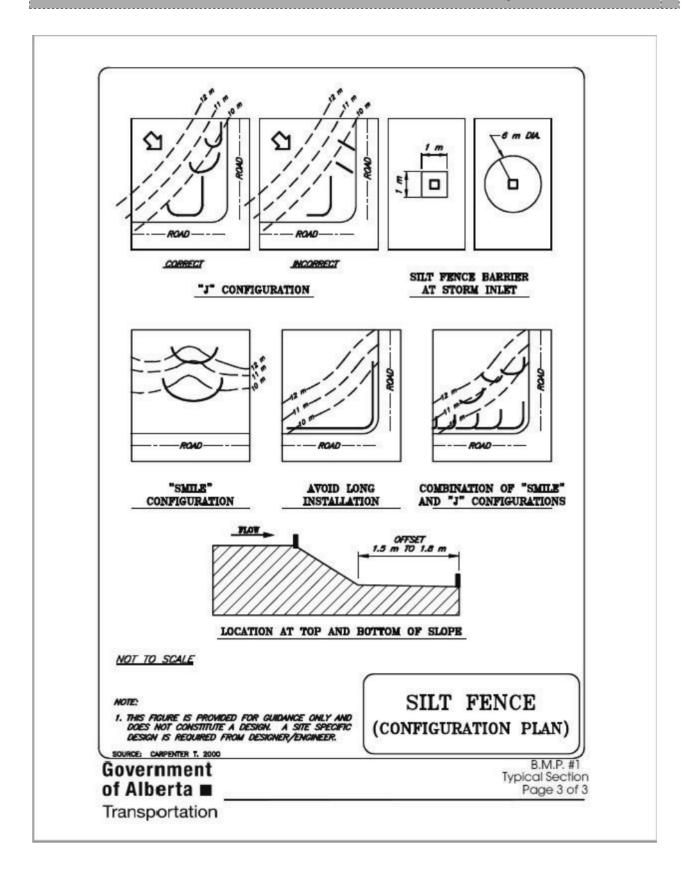
### **Design Considerations**

- For a silt fence system to work as a system, the following factors should be considered:
  - a) quantity adequate number and frequency of fence for efficient ponding and sedimentation
  - b) installation workmanship
  - c) compaction backfill and trenching of fabric
  - d) support posts adequately embedded, appropriate selection of post material and spacing
  - e) attachment secure fabric to post
- · Install silt fences in a 'J' hook or 'smile' configuration

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# Appendix G- Reportable Spills

# Appendix H-Spill Response Plan

# Spill Response and Remediation Plan

If a spill of fuel, oils, lubricants, or other harmful substances occurs at the site, the following procedures will be implemented:

# 1. Ensure Safety

- Ensure personal, public, and environmental safety.
- Wear appropriate Personal Protective Equipment (PPE)
- Never rush in, always determine the product spilled before taking action.
- Warn people in the immediate vicinity.
- Ensure no ignition sources nearby if spill is of a flammable material.

# 2. Stop the Flow (when possible)

- Act quickly to reduce the risk of environmental impacts.
- Close valves, shut off pumps or plug holes/ leaks, set containers upright.
- Stop the flow of the spill at its source.

### 3. Secure the Area.

- Limit access to spill area
- Prevent unauthorized entry onto site.
- 4. Contain the Spill.
- Block off and protect ditches, drains and culverts.
- Prevent spilled material from entering drainage structures (ditches, culverts, drains)
- Use spill sorbent material to contain spill.
- If necessary, use a dike, berm or any other methods to prevent any discharge off site.
- Make any effort to minimize contamination.
- Contain as close to the source as possible.

### 5. Notify/Report.

- · Notify Site Supervisor, Environmental Monitor (or alternate) and provide spill details
- When necessary, the first external call should be made to (see spill reporting requirements):
   Emergency Management BC (EMBC)) 1-800-663-3456 (24 hours)
- Provide necessary spill details to other external agencies (see spill reporting requirements)

### 6. Site Remediation

- Remove the impact/debris; decontaminate any equipment or tools used in the cleanup.
- Clean up the affected area.
- Utilize appropriate absorbent pads or other materials based on the type of substance spilled.
- Dispose of waste materials at an approved disposal site; and
- Restore site to environmental regulatory standards.



# **Proposed 2023 Vedder River Sediment Removal Project**

# 2023 Hydraulic Assessment Report

FINAL Report May 5, 2023 KWL Project No. 3427.018

### Prepared for:

Ministry of Environment and Climate Change Strategy



# Prepared by:





Ministry of Environment and Climate Change Strategy 2023 Hydraulic Assessment Report Final Report May 5, 2023

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**Report Submission** 

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# **Executive Summary**

The November 2021 atmospheric river events resulted in significantly high volumes of sediment and debris in the Vedder Canal and Vedder River. Though no major flooding of infrastructure was reported, deposited sediment and debris have reduced the capacity of the Vedder floodway and pose an erosion risk to bridge infrastructure and riverbanks.

Kerr Wood Leidal was retained by the Ministry of Environment and Climate Change to carry out detailed assessments into the hydraulic, environmental, geomorphic, and archaeological context of proposed sediment removal on the Vedder Canal and Vedder River to restore and improve creek/river hydraulic capacity. Nova Pacific Environmental was retained by Kerr Wood Leidal as the environmental subconsultant to carry out a detailed assessment of the environmental considerations associated with sediment removal plans. The Nova Pacific Environmental report entitled *Proposed 2023 Vedder River Sediment Removal Project: Environmental Assessment Report* should be read in conjunction with this report to address the environmental considerations associated with the proposed sediment removal plan.

Based on 85 years of recorded data at the Water Survey of Canada gauge, referred to as Chilliwack River at Vedder Crossing (08MH001), the November 15, 2021 atmospheric river event is the second largest event in the recorded history of the Vedder River. A review of the last 20 years of gauge data shows a trend of lesser flood events over the last decade with many at or below a 2-year return period, a 50% annual exceedance probability. The November 2021 atmospheric river event is by far the largest maximum daily flow event in the last two decades with a 200-year return period or 0.5% annual exceedance probability.

A hydraulic assessment completed in the spring of 2022 as part of the ongoing program of biennial gravel removal program estimated 440,700 m³ of sediment was deposited between 2020 and 2022, most of which likely occurred during the November 2021 atmospheric river events. Consistent with the biennial sediment removal approach adopted by the Vedder River Area Management Committee, the City of Chilliwack intended to remove a target volume of 110,000 m³ in 2022. However, various limitations resulted in a reduced removal quantity of 35,130 m³ from five sediment bar locations. The remaining sediment in the Vedder River is estimated at 405,570 m³, or 92% of the sediment deposited from the flood event.

Updated hydraulic modelling was completed to understand the impact of this deposited sediment in terms of the changes to the flood profile, floodway capacity and freeboard of existing dikes. The freeboard requirement for this reach is 0.75 m, areas where the computed water surface elevation is within 0.75 m of the adjacent dike crest are considered freeboard deficient.

The study reach considered in this assessment is a 12.5 km long section of the Vedder River between the Vedder Crossing bridge and the Highway 1 bridge. The pre- and post-flood conditions were modelled and compared. The results indicate that deposited sediments have increased the flood profile by an average of 27.6 cm across the study reach with a maximum increase of 105 cm at the Southern Railway of BC bridge.

Pre-flood freeboard deficiencies were contained to one zone on the right dike in the upper canal and lower river reaches. Hydraulic modelling estimated the mean freeboard in this zone at 72 cm (3 cm freeboard deficit) and the minimum freeboard at 70 cm (5 cm freeboard deficit).

Post-flood freeboard deficiencies significantly expanded to five separate zones spanning the upper canal to the middle river reach. Hydraulic modelling estimated the mean freeboard in these zones ranging from 60 to 68 cm (7 to 15 cm freeboard deficit) and the minimum freeboard at 44 cm (31 cm freeboard deficit).

To mitigate impacts posed by the deposited sediment, a sediment removal plan was developed in collaboration with Nova Pacific Environmental with additional input from the program's Task Force Committee. A total of 11 potential sediment removal sites were identified using the guidelines outlined in the Vedder River Management

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Area Plan. Three of the included sites, Boundary, Salad and Railway bars, were previously excavated in 2022. These locations are referred to as 'Optional' sites since 2023 excavation is dependent on the extent of sediment infill over the 2023 freshet. To assess the effectiveness of the proposed sediment extraction, two scenarios for sediment removal were modelled. Scenario 1 excludes the three optional sites assuming sediment infill does not occur before the 2023 works. Scenario 1 has a total potential sediment volume of 325,200 m³, or 82% of the sediment deposited from the flood event. Scenario 2 includes all 11 sites. Scenario 2 has a total potential sediment volume of 364,000 m³, or 91% of the sediment deposited from the flood event.

Hydraulic simulations were carried out for each scenario and the resulting flood profiles were compared against the baseline (post-flood) flood profile to assess the impact and effectiveness of proposed sediment removals. For both scenarios modelled, the removal of sediments resulted in a considerable reduction in flood profile elevation.

For Scenario 1, the average reduction in flood profile along the entire study reach was estimated at 7 cm, with a maximum improvement of 67 cm. In terms of freeboard, Scenario 1 had a positive impact on all freeboard deficient zones except for the zone on the left dike immediately upstream of the Southern Railway of BC bridge (likely due to the lack of excavation at Railway Bar site).

For Scenario 2, the average reduction in flood profile along the entire study reach was estimated at 8 cm, with a maximum improvement of 67 cm. In terms of freeboard, Scenario 2 had a positive impact on all freeboard-deficient zones. Including removals at the three optional sites, Boundary, Salad and Railway bars, offers improved freeboard across all freeboard deficient zones.

Channel maintenance activities, or sediment removal, could reduce the flood hazard by improving available freeboard and providing sediment traps in the upper reach to mitigate the risk of sediment transport to the freeboard-limited lower and middle reaches. The proposed sediment removal plans account for excavation of 82% and 91% of the deposited sediments from the November 2021 ARE, respectively.

Consideration for stockpiling of sediments was reviewed to reduce potential risk to the program. Ultimately, the transport and stockpiling of excavated sediments will be the responsibility of the successful contractor, however, ensuring options and suitable capacity at nearby stockpile sites is likely to result in an efficient construction. Based on our assessment, existing stockpiles do not have sufficient capacity for the proposed sediment removal plan. Two potential stockpile locations were identified, and applications are underway to utilize them as stockpile sites for the 2023 works.

To ensure the scope of this program considers appropriate archaeological context, Kerr Wood Leidal engaged WSP to complete a review of the 2012 archaeological overview assessment and review the proposed 2023 sediment removal plans to consider any potential new data or archaeological findings.s.18 s.18

A high-level desktop review of the proposed sediment removal plan was completed to assess possible changes in the geomorphic 'equilibrium' or stability to features of concern in the vicinity of the proposed excavations. Based on this review, the proposed excavation sites are unlikely to impact the stability of nearby geomorphic features during periods of flow that are less than formative.

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# 1. Introduction

Kerr Wood Leidal (KWL) was engaged by the Ministry of Environment and Climate Change Strategy (ENV) to undertake a detailed assessment to better understand the impact of the November 2021 atmospheric river event (ARE) on the Vedder Canal and Vedder River and provide recommendations for the removal of sediment. The mandate of the 2021 Atmospheric River Event in BC Waterway Sediment Assessment and Removal Program is to restore and improve creek/river hydraulic capacity. The Vedder Canal and Vedder River site is identified as Site ID: S-CR-7 under the ENV Emergency Works program.

As part of this program's mandate, KWL has worked in collaboration with various task force members and subconsultants to assess the impact of the November 2021 ARE on the Vedder Canal and Vedder River and develop a sediment removal plan to restore hydraulic capacity. This report addresses hydraulic considerations while the Nova Pacific Environmental (NPE) *Proposed 2023 Vedder River Sediment Removal Project: Environmental Assessment Report* addresses environmental considerations.

# 1.1 Scope of Work

The purpose of this report is to present the findings of detailed assessments into the hydraulics, geomorphology, and archaeology of proposed sediment removal on the Vedder Canal and Vedder River. Findings of the environmental assessment are provided in the NPE report entitled *Proposed 2023 Vedder River Sediment Removal Project: Environmental Assessment Report*.

Detailed assessments associated with this scope of work include:

- Engineering field investigations
- Field survey and analysis
- Environmental planning (completed by subconsultant Nova Pacific Environmental)
- Hydraulic assessment
- Geomorphology
- Archaeological overview assessment review and update
- Sediment removal planning
- Engagement and communication with the Task Force Working Group (a multi-ministry, stakeholder, and rightsholder forum)

All works listed above and presented herein are intended to support stakeholder engagement and regulatory review of the proposed sediment removal plan including information required by Fisheries and Oceans Canada (DFO) and the BC Ministry of Forests (MoF) in support of applications for required permits under the Fisheries Act (Section 35) and Water Sustainability Act (Section 11), respectively.

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# 1.2 Background

The November 2021 atmospheric river resulted in significantly high volumes of sediment and debris in the Vedder Canal and Vedder River. Though no major flooding of infrastructure was reported the sediment and debris continue to reduce flood conveyance capacity and pose an erosion risk to bridge infrastructure and riverbanks.

A hydraulic assessment and stakeholder consultation process was completed in spring of 2022 by the City of Chilliwack, the City of Abbotsford, and the Province as part of the ongoing program of biennial gravel removal. The assessment showed that much more sediment was deposited during the November 2021 event than the average annual sediment deposition over the last 25 years. The hydraulic assessment determined that approximately 440,700 m³ of sediment was deposited over the past two years, most of which likely occurred during the November 2021 ARE, based on a comparison with previous surveys. The amount of sediment deposition from the recent flood event is significantly higher than the previous long-term average, which was about 42,000 m³ per year or 84,000 m³ over two years. The average annual deposition rate has increased to 55,000 m³/year as a result of the flood event in November 2021.

This significant deposition of material has resulted in negative impacts to the flood profile and available dike freeboard. This was found to be prominent in the reaches with limited freeboard in the upstream section of the Vedder Canal and in the lower and middle reaches of the Vedder River. The critical limited freeboard zone in the Vedder River's lower reach has expanded when compared to previous years (2016-2020). Sediment removals are required to maintain flood capacity in the river and sufficient freeboard.

Consistent with the biennial sediment removal approach adopted by the Vedder River Area Management Committee (VRMAC), the City of Chilliwack intended to remove a target volume of 110,000 m³ for 2022. However, various limitations resulted in a reduced removal quantity of 35,130 m³ from five (5) sediment bar locations detailed in Section 3. Additionally, the City of Chilliwack has upgraded the existing Vedder River Right Dike in 2022 by raising it for approximately 1 km to address freeboard deficient reaches.

The hydraulic analysis incorporates the above discussed 2022 changes to reflect the current flood risk and freeboard deficiencies. The proposed 2023 plan was developed based on the results of the hydraulic analysis including relevant environmental mitigation design and other inputs from stakeholders considering existing regulatory requirements.

# **Background Reports & Data**

The following list summarizes background reports and information that was reviewed as part of the detailed assessment presented in this report:

- Willis Cunliffe Tait & Company Ltd. (1975). West Dyke Improvements (Issued As-Constructed).
- The Vedder River Management Committee (1983). Vedder River Management Area Plan.
- Province of British Columbia, Ministry of Environment, Lands & Parks Water Management Division (1996). Vedder River Gravel Management Plan.
- Bland Engineering (1998). Vedder River Set Back Dykes Left Dyke Improvements (Issued As-Constructed).
- J.W. Wedler & Associates Ltd. (2000). Vedder River Set Back Dyke F.P.A.F. Project Number 99-02-113 (Issued as Record Drawing).

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- Bland Engineering (2008). Vedder River Hydraulic Profile 2008 Update.
- Hay & Company Consultants (2010). Vedder River Hydraulic Profile Update 2010.
- Golder Associates (2011). West Dyke Upgrade (Left Bank) Chilliwack, B.C. (Issued As-Built)
- Ministry of Environment Water Stewardship Division (2012). Vedder River and Vedder Canal Dike (April 30, 2012 revision).
- Tetratech EBA Inc. (2015). Vedder River Management Area Plan Update.
- Northwest Hydraulic Consultants (2020). British Columbia Extreme Flood Project, Regional Flood Frequency Analysis.
- Kerr Wood Leidal (2022). Vedder River Hydraulic Profile Update 2022.
- Kerr Wood Leidal (2022). Preliminary site assessment of potential areas of immediate concern Site S-CR-7 Vedder Canal/ Vedder River
- Onsite Engineering (2022). West Dike Updates (Right Bank) (Issued for Construction).
- Nova Pacific Environmental (2023). Proposed 2023 Vedder River Sediment Removal Project: Environmental Assessment Report.
- Nova Pacific Environmental (2023). Construction Environmental Management Plan 2023 Vedder River Sediment Removal Project.

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# 2. Study Area

The Vedder River is located about 80 km east of Vancouver in the City of Chilliwack. This watercourse, generally referred to as the Chilliwack River upstream of Vedder Crossing Bridge and the Vedder River between the Vedder Canal and Vedder Crossing Bridge is a highly productive and diverse system that sustains wildlife populations and provides ecological and recreational value.

The project study area refers to a 12.5 km reach extending from Vedder Crossing Bridge downstream to the Highway 1 Bridge. The project area is generally divided into four (4) sub-reaches, referred to as the canal, lower reach, middle reach, and upper reach based on their unique geometries and characteristics (Figure 2-1). Within the study area, a total of 85 established cross-section locations are surveyed on a regular (biennial) basis to assist in hydraulic modelling and quantification of the sediment deposition through the study area.

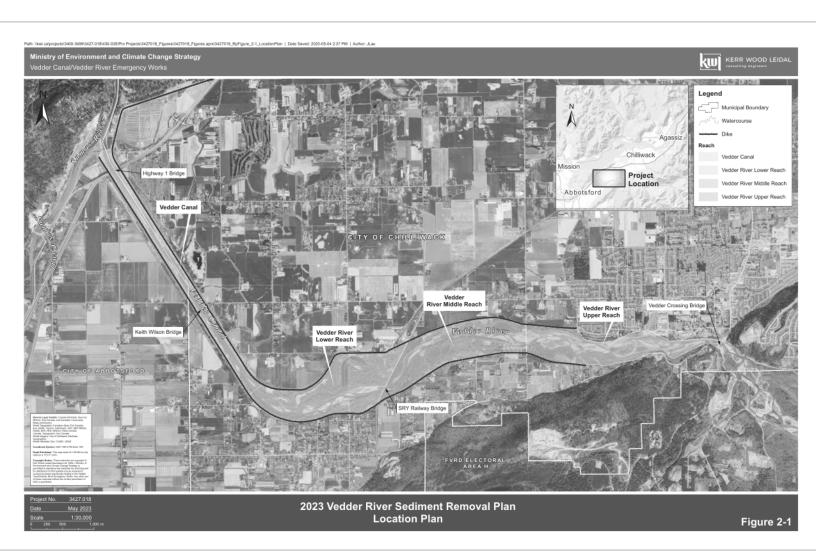
The canal reach is approximately 4.3 km in length and extends from the confluence point with the Sumas River (XS C7) to the Vedder River Lower Reach (XS C37). The canal is characterized by a low overall channel bed slope, -0.13% on average, and a uniform cross-sectional area with setback dikes on each bank. Channel wetted width in this reach is approximately 75 m with the maximum floodplain width at approximately 175 m, from top of right dike to top of left dike.

The Vedder River's lower reach is approximately 2.4 km in length and extends from the upstream end of the canal (XS 1) to the Southern Railway of British Columbia (SRY) Bridge (XS 17-1). The lower reach is characterized by a lower overall channel bed slope, -0.21% on average, and a diverse channel formation with setback dikes on each bank. The Blue Heron Reserve is located on the right (north) bank and setback dikes are at their widest extent within this reach. Channel wetted width in the lower reach ranges from 40 to 60 m with the maximum floodplain width ranging from 500 to 1,000 m (due to the Blue Heron Reserve).

The Vedder River's middle reach is approximately 2.7 km in length and extends from the SRY Bridge (XS 17-2) to Lickman Road (XS 35). The middle reach is characterized by a relatively higher overall channel bed slope, 0.51% on average, and a diverse channel formation with setback dikes on each bank. Channel wetted width in the middle reach ranges from 25 to 60 m with the maximum floodplain width ranging from 500 to 600 m.

The Vedder River's upper reach is approximately 3.4 km in length and extends from Lickman Road (XS 35) to the Vedder Crossing Bridge (XS 49). The upper reach is characterized by a moderate channel bed slope, 0.29% on average, and a diverse channel formation with partial setback dikes on each bank. The Right Dike ends at Webster Road (XS 38) while the Left Dike ends an additional 390 m upstream (XS 39). Channel wetted width in the upper reach ranges from 20 to 60 m with the maximum floodplain width ranging from 175 to 500 m (due to a constriction near Vedder Crossing Bridge).

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# 3. Field Survey

There is a long history of cross-sectional surveys at established locations along the Vedder Canal and Vedder River that have been carried out for decades under the direction of VRMAC. For the purposes of this study, the 2020 and 2022 channel geometry surveys were considered to establish, to the best of our ability, a pre- and post-November 2021 ARE condition. In addition to the cross-sectional data, KWL commissioned the collection of LiDAR data and an updated bathymetric and topographic survey to represent summer 2022 VRMAC excavations.

All data detailed in the sections below were used to formulate an understanding of the pre- and post-November 2021 ARE conditions in the Vedder Canal and Vedder River and to support hydraulic modelling efforts to better understand the flood profile.

# 3.1 Terrain & Bathymetry

Two sets of survey data, from 2020 and 2022, were used to quantify changes in sediment throughout the study area and provide geometry for hydraulic modelling. These data sets spanned the entire study area, from just downstream of the Highway 1 bridge at the confluence of the Sumas River and Vedder Canal to Vedder Crossing bridge (Figure 3-1 and Figure 3-2).

The 2020 channel geometry survey was conducted by CRA Canada Survey Inc. in February 2020. The river channel was surveyed from bank to bank with additional points on the top of the setback dikes where applicable. Additional cross sections XSC7, XSC8 and XSC9 were surveyed in the Vedder Canal from the Highway 1 Bridge to the mouth. Paired distance-elevation survey data were provided in .XLS format oriented looking downstream. Data was supplied in .DWG plan format for volume calculations.

The 2022 channel geometry survey was conducted by McElhanney between January 25 and February 10, 2022. The river channel was surveyed from bank to bank, where possible. Vegetation, large woody debris, and swift water impeded access at some locations limiting survey coverage. Where necessary KWL used 2020 survey data to fill any gaps and assumed no major bank failures or avulsions occurred between the 2020 and 2022 surveys. This was verified by a KWL site inspection of select locations on April 7, 2022. Additional cross sections XSC7, XSC8 and XSC9 were surveyed in the Vedder Canal from the Highway 1 Bridge to the mouth. Paired distance-elevation survey data were provided in .XLS format oriented looking downstream. Data was supplied in .DWG plan format for volume calculations.

In addition to the two surveys noted above, an additional survey was commissioned to collect bathymetric and topographic data to represent changes to the system due to summer (August / September) 2022 VRMAC excavations. This survey work was completed between October 5 and 7<sup>th</sup>, 2022 and captured the pit excavations at Boundary Bar, Powerline Bar, Salad Bar, Greendale Bar, and Railway Bar (Figure 3-3).

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# 3.2 LiDAR & Orthoimagery

Field inspections by KWL engineers indicated significant changes had occurred along the Vedder River. Updated terrain data and orthoimagery was requested to better understand the impact of the November 2021 ARE as well as provide an opportunity to update the overbank (floodplain) portion of the 1D hydraulic models. Overbank areas had not been surveyed since the 2004 overbank survey and potential for changes resulting from flood events was likely.

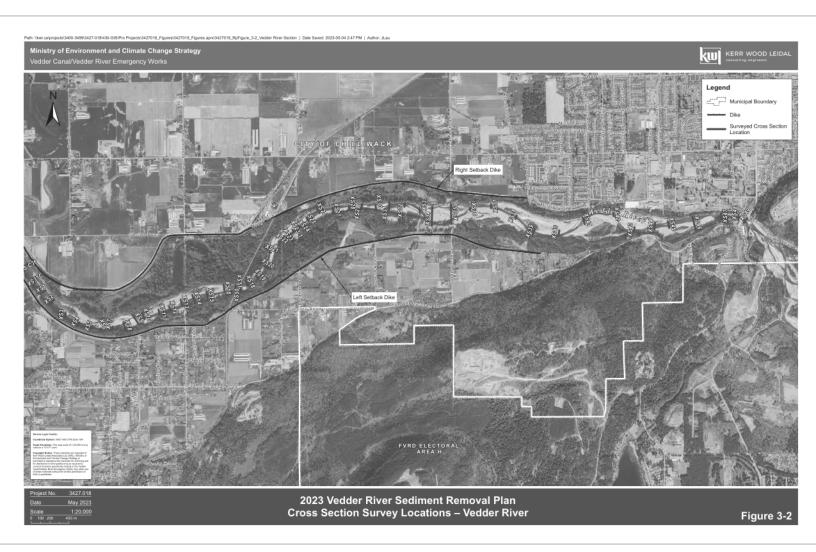
A Light Detection and Ranging (LiDAR) dataset was collected on October 2, 2022 by McElhanney and provided as ASPRS LiDAR Data Exchange Format (LAS) version 1.4. Terrain data was provided as 'Bare Earth' classification with all other points (for vegetation and structures) removed.

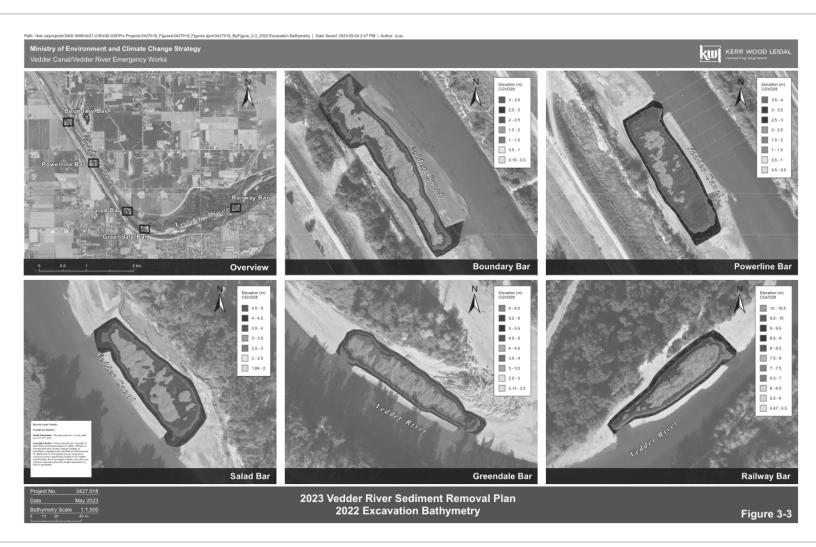
An orthophoto was also collected as part of the deliverables and provided in .tiff format. This orthophoto has a resolution of 10 cm which provides detail of existing sediment bars and formation of the river (Figure 3-4).

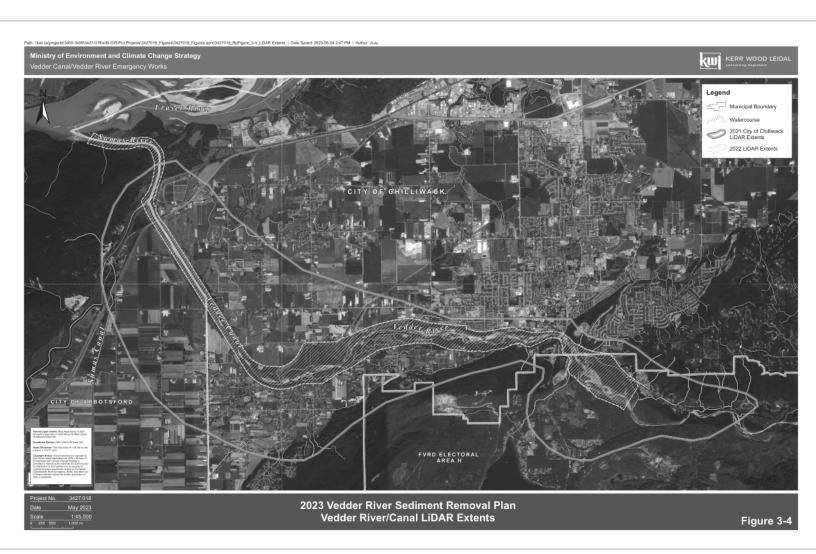
The LiDAR terrain and orthophoto were collected when water levels in the Vedder River were low. Flow in the river at the time of the LiDAR scan was reported at the WSC 08MH001 gauge as 11.8 m<sup>3</sup>/s to 12.1 m<sup>3</sup>/s.

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# 4. Flood Record

Floods have been reported and documented on the Vedder River over the last century with many of them causing inundation and damage to property bordering the river. For example, the December 1975 flood caused extensive damage to the town of Yarrow which led to the implementation of flood control works including setback dikes, groynes, and channel maintenance.

The Water Survey of Canada (WSC) maintains a gauge near the Vedder Crossing bridge, referred to as Chilliwack River at Vedder Crossing (08MH001). There are 85 years of recorded data associated with this gauge spanning from 1912 to the present. The top 10 flood events, ranked by average daily discharge, are presented below in Table 4-1. Upon review of the flood record, the November 2021 ARE is the second largest event in the 08MH001 gauge history.

A review of the last 20 years of gauge data shows a trend of lesser flood events over the last decade with many at or below a 2-year return period with 50% annual exceedance probability (AEP). The November 2021 ARE is by far the largest event in the last two decades with a 200-year return period or 0.5% AEP.

Table 4-1: Chilliwack River at Vedder Crossing Top 10 Flood Events.

Rank	Year	Average Daily Discharge <sup>1</sup> [m³/s]	Date
1	1917	765	December 29
2	2021	719 <sup>2</sup>	November 15
3	1989	684 <sup>3</sup>	November 9-10
4	2003	616	October 20-21
5	1914	566	January 6
6	1921	538	December 12
7	1980	533	December 26
8	1975	530	December 3
9	1924	498	February 12
10	1928	487	January 12

#### Notes

- The November 10, 1990 floods are not noted in this table as no data is currently available from the WSC Vedder River gauge (08MH001) for those events.
- Data extracted from the Environment and Climate Change Canada Historical Hydrometric Data web site (<a href="https://wateroffice.ec.gc.ca/mainmenu/historical\_data\_index\_e.html">https://wateroffice.ec.gc.ca/mainmenu/historical\_data\_index\_e.html</a>) on March 21, 2023.

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Discharge values are average daily flows.

<sup>&</sup>lt;sup>2</sup> Data provided as an estimate only.

<sup>&</sup>lt;sup>3</sup> Flow data sourced from Hydrology of the November 1989 Chilliwack River Flood, and Some Observations on the Impact of Forest Management, Peter Jordan, March 14, 1990.

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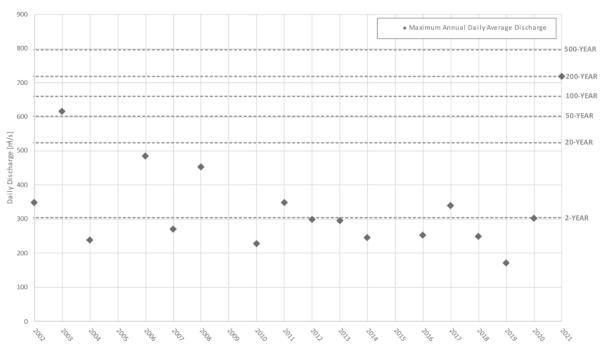


Figure 4-1: Recent Flood History (2002 to 2021) from Chilliwack River at Vedder Crossing (08MH001) with Annual Exceedance Probabilities.

Notes:

2020)

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Extracted from the Environment and Climate Change Canada Historical Hydrometric Data web site (https://weteroffice.ec.gc.ca/mainmenu/historical\_data\_index\_e.html) on March 21, 2023. Return Period Flows sourced from British Columbia Extreme Flood Project. Regional Flood Frequency Analysis (IMHC 2020).



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# 5. Sediment Volume Estimates

Sediment aggradation of the Vedder Canal and Vedder River was calculated using the average end area method. To our knowledge, no excavation of sediments occurred between the 2020 and 2022 surveys. Natural bed material deposition was calculated as the difference between surveyed surfaces. Calculated changes in channel sediment quantities by reach were completed as part of the 2022 Vedder Hydraulic Update and are summarized below in Table 5-1. Between the 2020 and 2022 surveys, all reaches showed considerable aggradation with a total increase of 440,700 m³. The Lower River reach showed the greatest accumulation at 144,900 m³.

It is likely the majority of material deposited is a result of the November 2021 ARE as this event is likely the only channel-changing flow between the 2020 and 2022 survey. The lack of significant flood events since November 2006 likely caused the reduced sedimentation in the Vedder River and Vedder Canal in recent years before the November 2021 flood.

Table 5-1: Changes in Sediment Quantities By Reach Between 2020 and 2022 Surveys.

Location	Bed Change	Excavation	Total Natural Deposition
	(m³)	(m³)	(m³)
Vedder Canal	84,600	0	84,600
Vedder River (Total)	356,150	0	356,150
Vedder Lower Reach	144,900	0	144,900
Vedder Middle Reach	74,800	0	74,800
Vedder Upper Reach	136,500	0	136,500
Totals	440,700	0	440,700

Based on the bathymetric survey data and information received from the City of Chilliwack, it is estimated that the 2022 VRMAC excavations removed approximately 35,130 m³. Extracted volumes by sediment bar are presented in Table 5-2 below. These excavations occurred following the 2022 channel geometry survey and should be accounted for in any proposed hydraulic modelling or proposed sediment removal planning. The remaining sediment deposited from the November 2021 ARE is estimated at 405,570 m³.

Table 5-2: 2022 VRMAC Excavated Volumes By Sediment Bar.

Location	Excavated Volume
Location	(m³)
Boundary Bar	6,260
Powerline Bar	6,570
Salad Bar	6,620
Greendale Bar	10,000
Railway Bar	5,680
Totals	35,130

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# 6. Hydraulic Analysis

Hydraulic modeling of the Vedder River was completed with US Army Corps of Engineers (USACE) HEC-RAS v 6.3.1 software<sup>1</sup>. The HEC-RAS model was used to estimate the water level for a design flow of 1470 m<sup>3</sup>/s, intended to represent the 200-year return period flood (0.5% annual exceedance probability) maximum instantaneous peak flow.

# 6.1 2023 Model Development

# **Model Topographic Surfaces**

The topography in the model consists of multiple merged datasets including LiDAR, topographic and bathymetric surveys, as described in Section 3.

A Digital Elevation Model (DEM) of the channel and floodplain portion of the study area was created by exporting the combined LiDAR, topographic and bathymetric surveys to produce a singular two-dimensional surface for modelling. To accurately capture site details, the surface was created at a resolution of 1 m.

# Cross Section & Bridge Crossings

The cross sections in the model were meticulously digitized with reference to the previous 1D model to accurately represent the river geometry. The modelled area includes approximately 13 km of river length using 85 surveyed cross section locations with an elevation drop of 30 m. The model also includes three (3) bridges in the study area, namely, Vedder Crossing bridge, SRY bridge and Keith Wilson bridge. The Highway 1 bridge is immediately downstream of the model area and is not included in this study. Bridge dimensions and parameters from the previous 1D model were assessed and used in the study. In addition to the existing cross sections of previous model, new cross-sections were introduced to precisely capture the geometry of the river.

# Roughness Values

Manning's n values from the previous model were reviewed and adopted in the study. For newly introduced cross sections, the Manning's value was interpolated with the closest cross sections. The range of Manning's n values used in the model are as follows.

Channel n = 0.030 to 0.036
 Overbank n = 0.030 to 0.200

# **Boundary Conditions**

The design flow of 1,470 m³/s, intended to represent the 200-year (0.5% annual exceedance probability) maximum instantaneous peak flow is used as the upstream boundary condition. The boundary condition at the downstream end of the model is a water surface elevation of 7.4 m. This water surface elevation is a best estimate of the downstream water level, based on regression analysis of peak levels recorded downstream at Barrowtown Pump Station corresponding to the maximum instantaneous peak flows recorded at the WSC gauge Chilliwack River at Vedder Crossing².

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<sup>&</sup>lt;sup>1</sup> US Army Corp of Engineers, HEC-RAS 6.3.1 Hydraulic Model [Computer Software]. Washington, DC.

<sup>&</sup>lt;sup>2</sup> Schlumberger Water Services Report, March 2010, Vedder River Dike Breach Modelling.

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In addition to the upstream and downstream boundary conditions listed above, a flow split at the SRY bridge was adopted for this study based on Bland's assumption in the 2008 Hydraulic Update report<sup>3</sup>. It was assumed that 200 m³/s leave the main channel on the right bank between XS21 and XS22 and 150 m³/s leave just downstream of XS18 on the left bank under the design flood conditions. Overbank flow travels through the left bank trestle structure and the right bank relief opening through the railway embankment. The split flows were assumed to rejoin the river at XS13.

### **Baseline Model**

To assess the existing, or baseline, condition of the study reach, the previous 1D hydraulic models were updated with new topographic data. The existing 1D hydraulic models were not georeferenced, and it was necessary to georeference the existing model in order to update the geometry with the latest data available. To achieve this, a new baseline model was built using the DEM discussed in Section 6.1.1. In addition, some existing cross-sections were extended, and new cross-sections were introduced to precisely capture the overbanks, meanders, and other crucial topographic variations. Moreover, the old model included blocked areas to represent groynes and bridge approaches; these have been replaced in the new model with ineffective flow areas as a more realistic representation of these river training works.

This georeferenced model was run with the design flow to compare the results with those from the previous model. There were differences at many cross sections, which were mainly due to the more accurate representation of the river channel and bed, the introduction of additional cross sections, and the change of blocked areas with ineffective flow areas.

This model is intended to represent the current 2023 conditions to assess potential flood hazard associated with limited freeboard. This model includes the 2022 channel geometry survey from winter 2022 as well as the updated survey of VRMAC excavations from summer 2022.

## **Existing Flood Protections**

The setback dikes on the Vedder River were constructed in the early 1980s based on a flood flow of 1,250 m³/s and a dike freeboard of 0.75 m. During 1998-2000, the setback dikes were upgraded by raising critical sections about 0.4 m above the 1984 as-built profile to provide 0.6 m freeboard over the 1996 flood profile (1,330 m³/s). The left setback dike was further raised in 2010 corresponding to the increased design flood of 1,470 m³/s and to meet the provincial standard for Fraser River flood protection, based on the 2008 NHC Fraser River Hydraulic Model. The raised sections are between Keith Wilson Bridge on the Vedder Canal and XS14 in the Vedder River on the left (south) side. Additional raising of the right dike was completed in 2022 to an elevation of 11.5 m between the Greendale Stockpile and Blue Heron Reserve (XS 6 to XS 14).

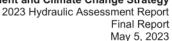
Dike crest elevations were obtained from a review of engineering drawings provided by the City of Chilliwack and compared against the recent (2022) LiDAR topography.

# 6.2 Flood Profile Analysis

Flood profiles are computed water surface elevations (WSE) that are used to better understand the risk of flooding within the study area. For the purposes of this assessment, the 2020 model is intended to represent the pre-November 2021 ARE (or pre-flood) conditions. The baseline model is intended to represent post-November 2021 ARE (or post-flood) conditions while also accounting for the 2022

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<sup>&</sup>lt;sup>3</sup> Bland Engineering (2008). Vedder River Hydraulic Profile 2008 Update.





VRMAC excavations. The baseline flood profile was calculated and compared to the 2020 model results to assess the impact of sediment aggradation on the flood profile and changes to the capacity of the floodway. The mean increase in water surface elevation from the pre-flood and post-flood models is 27.6 cm, with a maximum increase in water surface elevation of 105 cm at the SRY bridge (XS 17-1). Results of this comparison are represented in Figure 6-1 and a table of model results is provided in Appendix A.

To understand areas with the highest risk of flood impact, computed water surface elevations were compared against dike crest elevations to identify areas where limited freeboard was present. The target freeboard in the study area is 0.75 m. Areas, where the computed water surface elevation is within 0.75 m of the adjacent dike crest, are considered freeboard deficient.

Pre-flood model results indicate one area of freeboard deficiency on the right dike in the upper canal (XS C36) and lower river (XS 3) reaches. In this area the flood profile comes within 70 cm of the dike crest, resulting in a freeboard deficiency of up to 5 cm. This freeboard limited area is detailed in Table 6-1 below and highlighted in Figure 6-2.

Table 6-1: Pre-flood Freeboard Deficient Zone.

Location	Freeboard Limited XS's	Minimum Freeboard (cm)	Mean Freeboard (cm)
Right Dike – Upper Canal / Lower River Reach	XS C36, XS 3	70	72

Baseline, or post-flood, model results indicate five (5) separate areas of freeboard deficiency spanning from the upper canal to the middle river reach. The same, but expanded, freeboard limited area in the upper canal and lower river reach is present but now extends from XS C35 to XS 3. In the post-flood modelling, the flood profile comes within 50 cm of the adjacent dike crest, resulting in a freeboard deficiency of up to 25 cm. Two (2) new freeboard limited areas are estimated on the right dike in the Blue Heron Reserve (XS 13 to XS 15) and near the Hooge Stockpile (XS 26 to XS 28). Freeboard deficiencies in these areas range from 22 cm to 8 cm, respectively. Two (2) new freeboard limited areas are also estimated on the left dike from Community Road to the SRY bridge (XS 9 to XS 16) and immediately upstream of the SRY bridge (XS 18 to XS 20). Freeboard deficiencies in these areas range from 31 cm to 18 cm, respectively. Freeboard limited areas are detailed in

Table 6-2 below and highlighted in Figure 6-3.

Table 6-2: Baseline Freeboard Deficient Zones.

Location	Freeboard Limited XS's	Minimum Freeboard (cm)	Mean Freeboard (cm)
Right Dike – Upper Canal / Lower River Reach	XS C35, XS C36, XS 1, XS 2, XS 3	50	65
Right Dike – Lower River Reach	XS 13, XS 14, XS 15	53	64
Left Dike – Lower River Reach	XS 9, XS 10, XS 11, XS 12, XS 13, XS 14, XS 15, XS 16	44	60
Right Dike – Middle River Reach	XS 26, XS 27, XS 28	67	68
Left Dike – Middle River Reach	XS 18, XS 19, XS 20	57	67

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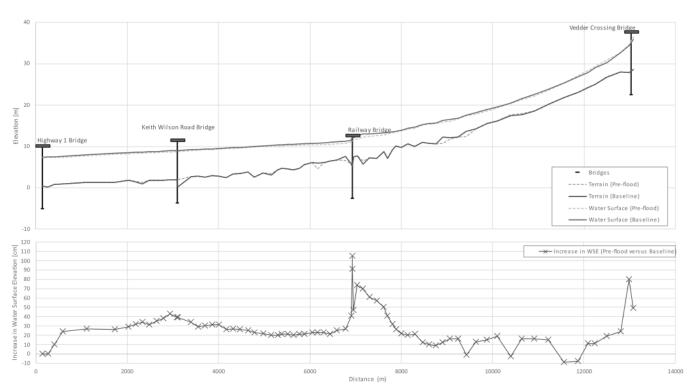
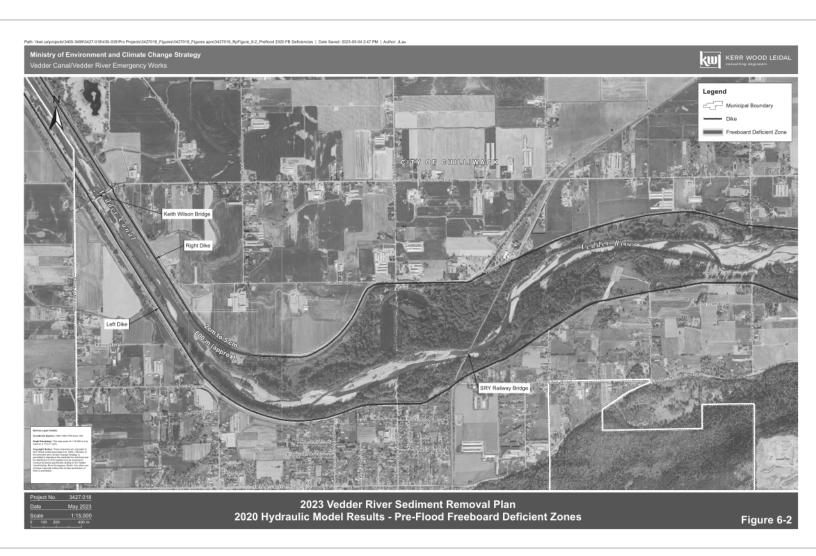


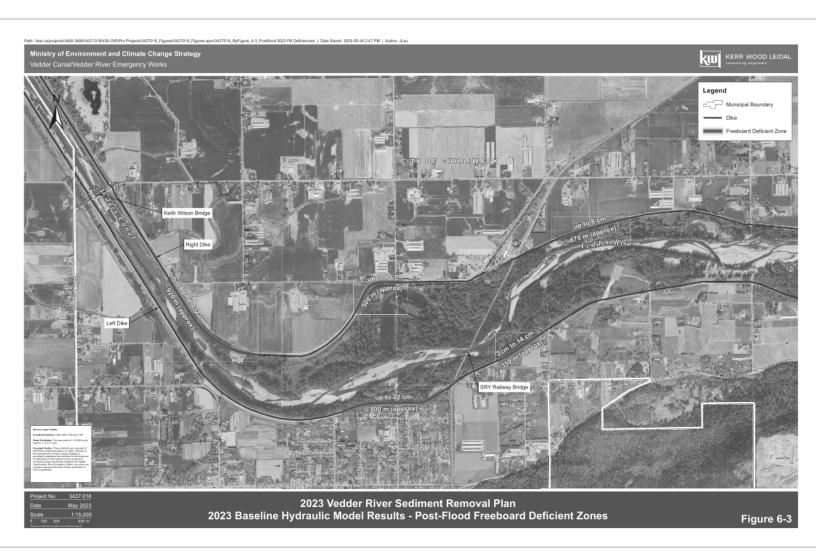
Figure 6-1: Change in Flood Profile From Pre-Flood (2020 Data) to Post-Flood (2023 Baseline) and Associated Increase in Water Surface Elevation.

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### 7. Proposed Channel Improvements

#### 7.1 Proposed Sediment Removal Plan

A sediment removal plan was developed in collaboration with Nova Pacific Environmental with additional input from the program's Task Force Committee. A total of 11 potential sediment removal sites were identified to:

- Reduce the flood profile in freeboard-limited areas.
- Trap sediment upstream of the freeboard limited areas.
- Increase capacity in the canal reach to reduce the backwater impacts to the flood profile in the lower river reach freeboard limited area.
- Provide optimum habitat outcomes while facilitating the removal of sediments in support of the floodway objective.
- Provide additional habitat in the immediate vicinity of sediment excavations (where suitable).

All proposed sediment excavation sites were selected using the guidelines outlined in the Vedder River Management Area Plan and reiterated in the NPE *Proposed 2023 Vedder River Sediment Removal Project: Environmental Assessment Report.* Excavation footprint, slopes, and access were all designed by NPE. For individual excavation site details – please refer to the NPE Environmental Assessment Report.

Three sites included in the 2023 sediment removal plan were previously excavated as part of the 2022 VRMAC works. These sites, including Boundary Bar, Salad Bar, and Railway Bar, are dependent on the extent of sediment infill over the 2023 freshet. As such, the status of these bars is represented as 'optional' and a model scenario has been run to test the impact to the flood profile if they are not excavated as part of the 2023 scope of works.

Two scenarios for sediment removal were modelled to assess the effectiveness of the proposed sediment extraction. The scenarios were developed based on Proposed and Optional sediment removal options.

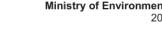
- Scenario 1: Removal of all Proposed removal bars.
  - o Total estimated excavation volume = 325,200 m<sup>3</sup>.
- Scenario 2: Removal of all bars, Proposed and Optional.
  - Total estimated excavation volume = 364,000 m<sup>3</sup>.

Excavated volumes were estimated using the proposed excavation extents and side slopes, as provided by NPE, and LiDAR terrain surface of the sediment bars. An approximately 3 m depth of excavation below the adjacent water surface was adopted for all pit excavations, while habitat and bar top excavations were based on depth inputs from NPE. The water surface was estimated using data collected during the LiDAR scan with a Vedder River flow of approximately 12 m³/s. These volumes are intended to represent the highest possible yield based on optimal conditions in the field. Significant variation in excavated volumes could likely be encountered in the field depending on conditions at the time of the works. Actual excavation yield is likely to be less than the estimated volumes.

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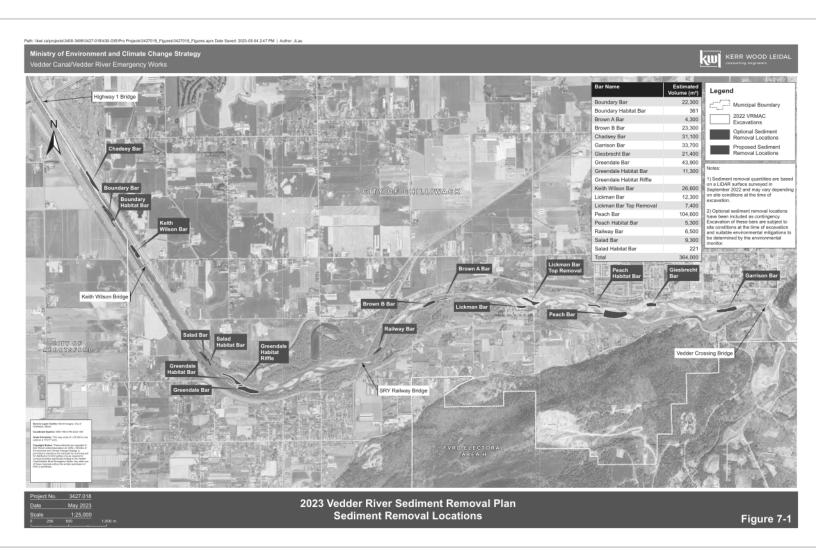
All estimates of proposed excavated extent, volume, and specific locations are based on the best available information at the time of planning sediment removals. However, freshet flows in spring 2023 are likely to alter sediment bar geometry and significant variations to the volumes excavated at any given site are possible due to site conditions including water levels during construction window. Actual excavation details will be determined in the field at the time of the works.

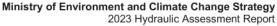
An overview of the selected sites is provided in Figure 7-1. Table 7-1 summarizes the site names, and differentiates between the various types of excavations, the status, and the estimated volumes.

Table 7-1: 2023 Proposed Sediment Excavation Sites and Estimated Excavation Volumes – Ordered From Upstream to Downstream.

Location	Type of Excavation	Site Status	Proposed Excavation Volume
			(m³)
Garrison Bar	Pit Excavation	Proposed	33,700
Giesbrecht Bar	Pit Excavation	Proposed	21,400
Peach Bar	Pit Excavation	Proposed	104,600
Peach Habitat Bar	Habitat Excavation	Proposed	5,300
Lickman Bar	Pit Excavation	Proposed	12,300
Lickman Bar Top Removal	Bar Top Removal	Proposed	7,400
Brown A Bar	Pit Excavation	Proposed	4,300
Brown B Bar	Pit Excavation	Proposed	23,300
Railway Bar	Pit Excavation	Optional	6,500
Greendale Bar	Pit Excavation	Proposed	43,900
Greendale Habitat Bar	Habitat Excavation	Proposed	11,300
Greendale Habitat Riffle	Habitat Riffle	Proposed	0
Salad Bar	Pit Excavation	Optional	9,300
Salad Habitat Bar	Habitat Excavation	Optional	300
Keith Wilson Bar	Pit Excavation	Proposed	26,600
Boundary Bar	Pit Excavation	Optional	22,300
Boundary Habitat Bar	Habitat Excavation	Optional	400
Chadsey Bar	Pit Excavation	Proposed	31,100
Total for excav	364,000		
Tota	I for excavation of Prope	osed sites only	325,200

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#### 7.2 Hydraulic Effects on Profile

For each sediment removal scenario, a 2D terrain was created using proposed excavation extents, side slopes, and depths from the sediment removal plans described above. The 1D channel geometries for each scenario were updated to include detail at each excavation site as proposed excavation extents typically do not extend through one (1) or more of the established cross-section locations. Additional sections are inserted to better represent hydraulic conditions along the proposed excavation sites.

Hydraulic simulations were carried out for each scenario and the resulting flood profiles were compared against the baseline (post-flood) flood profile to assess the impact and effectiveness of proposed sediment removals. For both scenarios modelled, the removal of sediments resulted in a considerable reduction in flood profile elevation.

For Scenario 1 (Proposed bars only), the average reduction in flood profile along the entire study reach was estimated at 7 cm, with a maximum improvement of 67 cm. In terms of freeboard, Scenario 1 had a positive impact on all freeboard deficient zones except for the zone on the left dike immediately upstream of the SRY bridge (XS 18 to XS 20). This is likely because Scenario 1 does not include any proposed excavation at Railway Bar. A summary of freeboard deficient zones and the mean improvement associated with Scenario 1 sediment removals are provided below in Table 7-2. Figure 7-2 compares the flood profile, terrain, and improvement to freeboard between the baseline and Scenario 1 model results. Figure 7-4 highlights the remaining freeboard deficient zones associated with the Scenario 1 sediment removals.

Table 7-2: Scenario 1 Improvement to Baseline Freeboard Deficient Zones.

Table 7-2. Ocenario i improvement to baseline i reeboard bencient 20nes.										
Location	XS with Adequate Freeboard	Remaining Freeboard Limited XS	Mean Improvement to Freeboard (cm)							
Right Dike – Upper Canal / Lower River Reach	XS C35, XS 1	XS C36, XS 2, XS 3	5.8							
Right Dike – Lower River Reach	XS 15	XS 13, XS 14	5.3							
Left Dike – Lower River Reach	XS 9	XS 10, XS 11, XS 12, XS 13, XS 14, XS 15, XS 16	6.1							
Right Dike – Middle River Reach		XS 26, XS 27, XS 28	29.0							
Left Dike – Middle River Reach	XS 18, XS 19, XS 20		0.0							

For Scenario 2 (Proposed and Optional bars), the average reduction in flood profile along the entire study reach was estimated at 8 cm, with a maximum improvement of 67 cm. In terms of freeboard, Scenario 2 had a positive impact on all freeboard-deficient zones. Including removals at the three optional sites, Boundary, Salad and Railway bars, offers improved freeboard across all freeboard deficient zones. A summary of freeboard deficient zones and the mean improvement associated with Scenario 1 sediment removals are provided below in Table 7-3. Figure 7-3 compares the flood profile, terrain, and improvement to freeboard between the baseline and Scenario 2 model results. Figure 7-5 highlights the remaining freeboard deficient zones associated with the Scenario 2 sediment removals.

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Table 7-3: Scenario 2 Improvement to Baseline Freeboard Deficient Zones.

Location	XS' with Adequate Freeboard	Remaining Freeboard Limited XS'	Mean Improvement to Freeboard (cm)
Right Dike – Upper Canal / Lower River Reach	XS C35, XS 1, XS 2	XS C36, XS 3	8.0
Right Dike – Lower River Reach	XS 15	XS 13, XS 14	6.3
Left Dike – Lower River Reach	XS 9	XS 10, XS 11, XS 12, XS 13, XS 14, XS 15, XS 16	7.4
Right Dike – Middle River Reach		XS 26, XS 27, XS 28	29.0
Left Dike – Middle River Reach	XS 18, XS 19, XS 20		1.3

Model results, including the flood profile, dike (left and right) elevations and freeboard values, are provided in Appendix B to compare the Baseline, Scenario 1, and Scenario 2 sediment removals.

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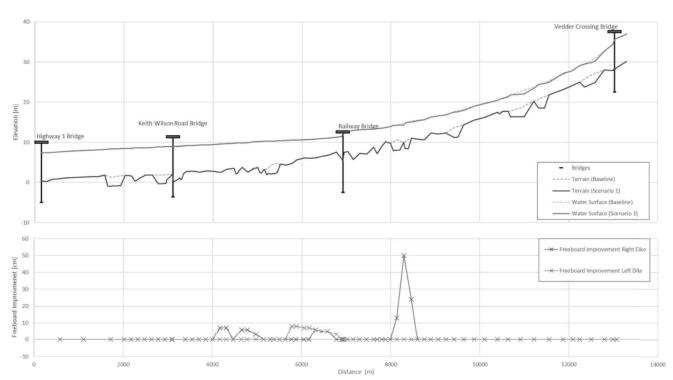


Figure 7-2: Flood Profiles and Improvement on Freeboard Comparing Baseline Versus Scenario 1 Sediment Removal Option.

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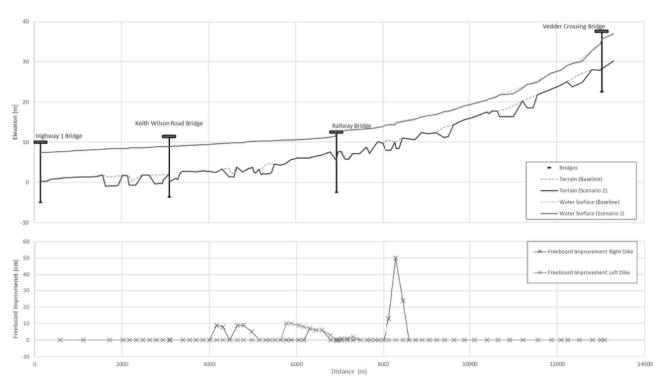
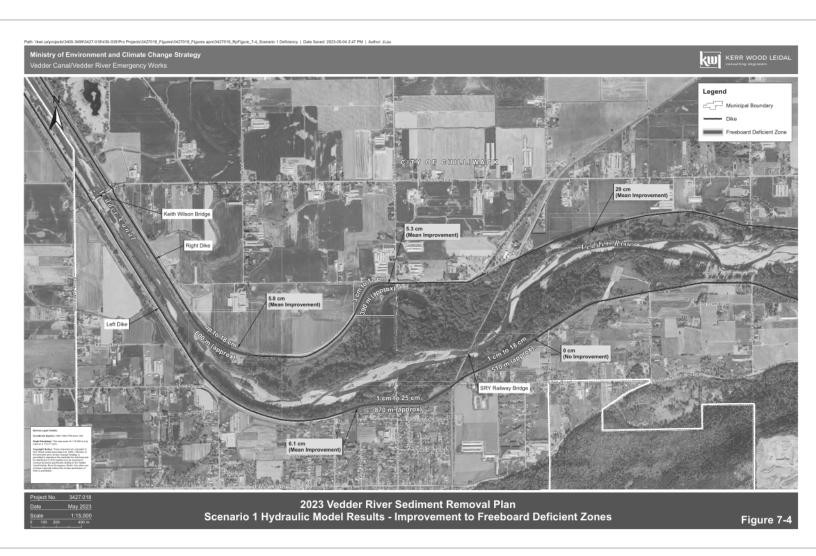


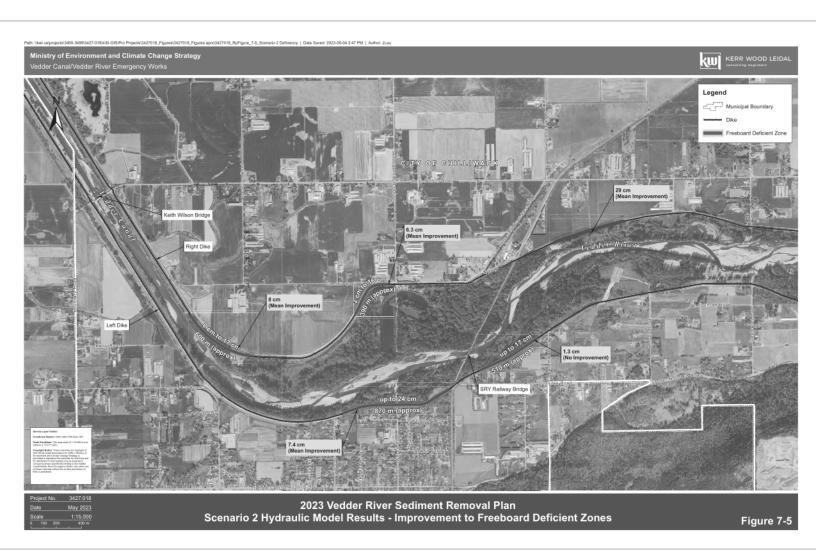
Figure 7-3: Flood Profiles and Improvement on Freeboard Comparing Baseline Versus Scenario 2 Sediment Removal Option.

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#### 8. Other Considerations

#### 8.1 Stockpiling of Sediments

Due to the large volume of sediment proposed for removal within a short instream window, the capacity of nearby temporary stockpiling sites was reviewed to reduce potential risk to the program. Ultimately, the transport and stockpiling of excavated sediments will be the responsibility of the successful contractor, however, ensuring options and suitable capacity at nearby stockpile sites is likely to result in an efficient construction. As such, an assessment of the existing stockpiles, access routes from the proposed excavation sites, and identification of potential new stockpile sites was completed. The stockpiling criteria and information provided in this section do not impact the design of the proposed sediment plan but address the viability of the construction.

An overview of existing and potential stockpile sites in relation to the program's study area is presented in Figure 8-1. A summary of stockpiles with potential (or estimated) capacity, area, and existing stockpiled material is contained in Table 8-1 below.

Table 8-1: Summary of Existing and Potential Stockpiles.

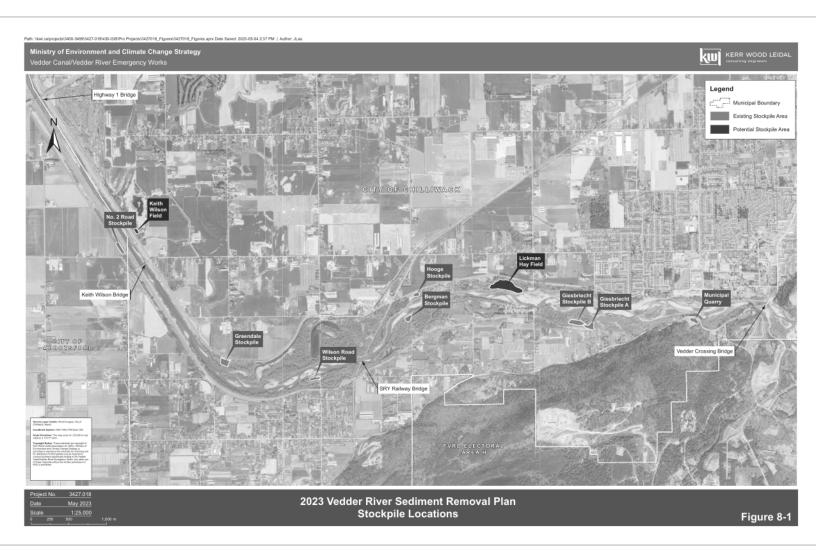
Stockpile Name	Status	Stockpile Area (m²)	Existing Material <sup>1</sup> (m³)	Potential Maximum Capacity <sup>2</sup> (m³)
Municipal Quarry	Existing	5,300	-	16,100
Giesbrecht Stockpile A	Existing	8,100	-	34,100
Giesbrecht Stockpile B	Existing	11,150	-	67,100
Lickman Hayfield	Potential	42,351	-	348,800
Hooge Stockpile	Existing	3,467	4,600	12,400
Bergman Stockpile	Existing	5,242	-	23,800
Wilson Road Stockpile	Existing	5,870	-	19,300
Greendale Stockpile	Existing	9,094	17,100	44,100
No. 2 Road Stockpile	Existing	7,282	-	36,000
Keith Wilson Field Stockpile	Potential	2,818	-	10,000
Municipal Quarry	Existing	5,300	-	16,100

<sup>&</sup>lt;sup>1</sup> Volume estimated using total stockpile area; 2H:1V side slopes, and an estimated stockpile height.

A conditional withdrawal (Section 17) application form has been submitted to request the use of the Lickman Hayfield for stockpiling of sediments. Ongoing discussions are underway to understand whether the Keith Wilson Field will be feasible as a stockpile site due to its limited capacity.

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<sup>&</sup>lt;sup>2</sup> based on stockpile material present in the LiDAR dataset collection on October 4, 2022.





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## 8.2 Archaeological Context s.18

#### 8.3 Geomorphological Context

A high-level desktop review of the proposed sediment removal plan was completed to assess possible changes in the geomorphic 'equilibrium' or stability to features of concern (e.g., thalweg, riffle, pools) in the vicinity of the proposed excavations.

Generally, the magnitude of the annual peak flow will largely govern the geomorphic changes that occur along gravel bed rivers. In many gravel bed river systems, peak flows (or 'formative flows') that exceed the threshold for notable bed sediment transport are typical of when formative channel changes can occur. In many gravel bed rivers, formative flow can be approximated by the 2-year return period flow. Higher peak flows generally result in greater geomorphic change. The morphology and the location of geomorphic features can change as a result of formative flow events. As such, the proposed excavation sites are unlikely to impact the stability of nearby geomorphic features during periods of flow that are less than formative flows.

However, it is difficult, and likely beyond the scope of this review, to predict how the proposed excavations may or may not impact the stability of nearby geomorphic features during formative flow conditions.

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#### 9. Discussion

The November 2021 atmospheric river events resulted in significantly high volumes of sediment and debris in the Vedder Canal and Vedder River. As the second largest event in the recorded history of the Vedder River and a large event following a decade of lesser flood events, the November 2021 atmospheric river event deposited an estimated 440,700 m³ of sediment. With excavations undertaken by the City of Chilliwack in 2022 removing 35,130 m³, the remaining sediment in the Vedder River is estimated at 405,570 m³, or 92% of the sediment deposited during the flood event. The impact of this deposited sediment on the Vedder can be represented by:

- A mean increase in flood profile of 27.6 cm across the study reach.
- A maximum increase in flood profile of 105 cm at the SRY bridge.
- An increase from one (1) to five (5) freeboard deficient zones.
- An increase from a maximum pre-flood freeboard deficit of 5 cm to a maximum post-flood deficit of 31 cm.

Channel maintenance activities, or sediment removal, could reduce the flood hazard by improving available freeboard and providing sediment traps in the upper reach to mitigate the risk of sediment transport to the freeboard-limited lower and middle reaches. The Scenario 1 sediment removal plan has a target excavated sediment yield of 325,200 m³ and does not include removal of the three (3) optional sites. The Scenario 2 sediment removal plan has a target excavated sediment yield of 364,000 m³ and includes all proposed and optional sites. The proposed sediment removal plans account for excavation of 82% (Scenario 1) and 91% (Scenario 2) of the deposited sediments from the November 2021 ARE. The benefits of the proposed sediment removal plan can be summarized as:

- A mean reduction in flood profile of 7 to 8 cm, for Scenario 1 and 2, respectively.
- A maximum reduction in flood profile of 67 cm, for both Scenario 1 and 2.
- A decrease from five (5) to four (4) freeboard deficient zones, for both Scenario 1 and 2.
- A decrease from a maximum post-flood freeboard deficit of 31 cm to a maximum post-removal deficit of 25 and 24 cm, for Scenario 1 and 2, respectively.

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#### **Revision History**

Revision #	Date	Status	Revision	Author
0	May 5, 2023	FINAL	Final for submission with regulatory applications	MSJS

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## Appendix A

# Pre-Flood versus Post-Flood Hydraulic Model Results

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	,	2020 Pre-Flood			2023 Baseline	
Cross Section	2020 W.L. (7.4 m)	L Dike F.B. (m)	R Dike F.B. (m)	2023 W.L. (7.4 m)	L Dike F.B. (m)	R Dike F.B. (m)
XS 49	36.56	L DIKE F.B. (III)	K DIKE F.B. (III)	35.87	L DIKE F.B. (III)	K DIKE F.B. (III)
XS 48	34.71			34.40		
XS 47	32.66			32.72		
XS 46	30.91			30.25		
XS 45	29.22			29.06		
XS 44	28.34			27.92		
XS 43	27.06			26.89		
XS 42	25.35			25.38		
XS 41	23.58			23.79		
XS 40	22.25	1.00		22.62	4.44	
XS 39 XS 38	21.37 20.50	1.33 1.29	1.70	21.56 20.43	1.14 1.36	1.77
XS 37	19.35	1.65	1.65	19.61	1.39	1.39
XS 36	18.57	1.93	1.93	18.98	1.52	1.52
XS 35	17.82	1.75	1.58	18.18	1.39	1.22
XS 34	17.39	1.28	1.42	17.59	1.08	1.22
XS 33	16.72	1.48	1.58	16.83	1.37	1.47
XS 32	16.03	1.41	1.77	16.57	0.87	1.23
XS 31	15.90	1.22	1.40	16.31	0.81	0.99
XS 30	15.60	1.32	1.35	15.71	1.21	1.24
XS 29	15.42	1.13	1.18	15.53	1.02	1.07
XS 28	15.13	1.11	0.87	15.33	0.91	0.67
XS 27	14.45	1.07	0.95	14.72	0.80	0.68
XS 26	14.18	1.30	0.87	14.35	1.13	0.70
XS 25	13.79	1.09	1.11	13.95	0.93	0.95
XS 24	13.57	1.22	1.18	13.71	1.08	1.04
XS 23-1	13.24	1.37	1.26	13.54	1.07	0.96
XS 23	12.99	1.41	1.19	13.40	1.00	0.78
XS 22	12.78	1.57		13.29	1.06	
XS 21	12.63	1.51		13.20	0.94	
XS 20 XS 19	12.45 12.23	1.34 1.31		13.08	0.71 0.57	
XS 18	11.81	1.61		12.97 12.68	0.74	
XS 50	11.73	1.52	1.25	12.19	1.06	0.79
XS 172	11.32	1.02	1.20	12.13	1.00	0.75
SRBC	11.02			12.22		
XS 171	11.13			12.13		
XS 51	11.09	2.03	1.71	11.46	1.66	1.34
XS 16	10.81	1.19	1.50	11.29	0.71	1.02
XS 15	10.69	0.98	1.11	11.08	0.59	0.72
XS 14	10.56	0.95	0.94	10.97	0.54	0.53
XS 13	10.52	0.76	0.98	10.84	0.44	0.66
XS 12	10.41	0.95	1.09	10.74	0.62	0.76
XS 11	10.40	0.88	1.10	10.72	0.56	0.78
XS 10	10.34	0.96	1.16	10.65	0.65	0.85
XS 9	10.30	0.98	1.20	10.60	0.68	0.90
XS 8 XS 7	10.29 10.25	1.09	1.21 1.25	10.56	0.82	0.94
XS 7 XS 6	10.25	1.06 1.22	1.25	10.47 10.38	0.83 0.94	1.03 1.12
XS 5	10.08	1.23	1.22	10.33	0.98	0.97
XS 4	10.06	1.22	1.04	10.30	0.98	0.80
XS 3	9.97	1.33	0.73	10.14	1.16	0.56
XS 2	9.86	1.44	0.79	9.96	1.34	0.69
XS 1	9.69	1.58	0.96	9.91	1.36	0.74
XS C37	9.61	1.67	0.94	9.79	1.49	0.76
XS C36	9.51	1.67	0.70	9.71	1.47	0.50
XS C35	9.45	1.81	0.94	9.65	1.61	0.74
XS C34	9.33	1.86	0.95	9.52	1.67	0.76
XS C33	9.26	2.02	1.10	9.41	1.87	0.95
XS C32	9.20	2.07	1.48	9.38	1.89	1.30
XS C31	9.11	2.23	1.66	9.26	2.08	1.51
XS C29	9.03	2.17	1.74	9.24	1.96	1.53
XS C271 XS C27	8.76 8.74	2.75 2.67	3.02	9.03 9.01	2.48	2.75
XS C27 XS C26	8.74 8.65	2.62	3.00 1.56	9.01 8.96	2.40 2.31	2.73 1.25
XS C25	8.60	2.33	1.57	8.85	2.08	1.32
XS C25 XS C24	8.53	2.33	1.65	8.75	2.08	1.43
XS C24 XS C23	8.49	2.44	2.00	8.70	2.23	1.79
XS C22	8.39	2.60	1.98	8.66	2.33	1.71
XS C21	8.32	2.60	1.93	8.59	2.33	1.66
XS C20	8.26	2.69	1.92	8.48	2.47	1.70
XS C18	8.13	2.70	2.12	8.32	2.51	1.93
XS C14	7.76	3.17	2.49	7.98	2.95	2.27
XS C10	7.40	3.58	2.90	7.67	3.31	2.63

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## Appendix B

# Baseline versus Sediment Removal Scenarios Model Results

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		Pre Grave	l Removal	Post Gravel Removal - Scenario 1					
Cross Section	Water Level Change with Gravel Removal- Scenario 1 (m)	L Dike F.B. (m)	R Dike F.B. (m)	L Dike F.B. (m)	R Dike F.B. (m)				
XS 49	0.00								
XS 48	0.00								
XS 47 XS 46	0.00								
XS 45 XS 45	-0.42 0.01								
XS 44	-0.05								
XS 43	0.25								
XS 42	-0.40								
XS 41	-0.33								
XS 40 XS 39	-0.67	444		4.04					
XS 39 XS 38	-0.20 0.00	1.14	1.77	1.34 1.36	1.77				
XS 37	0.01	1.39	1.39	1.38	1.38				
XS 36	-0.01	1.52	1.52	1.53	1.53				
XS 35	-0.19	1.39	1.22	1.58	1.41				
XS 34	-0.05	1.08	1.22	1.13	1.27				
XS 33	-0.01	1.37	1.47	1.38	1.48				
XS 32 XS 31	-0.02	0.87	1.23 0.99	0.89	1.25				
XS 31 XS 30	-0.02 -0.08	0.81 1.21	1.24	0.83 1.29	1.01				
XS 29	-0.18	1.02	1.07	1.20	1.25				
XS 28	-0.24	0.91	0.67	1.15	0.91				
XS 27	-0.50	0.80	0.68	1.30	1.18				
XS 26	-0.13	1.13	0.70	1.26	0.83				
XS 25	0.00	0.93	0.95	0.93	0.95				
XS 24	0.00	1.08	1.04	1.08	1.04				
XS 23-1 XS 23	0.00	1.07	0.96 0.78	1.07 1.00	0.96				
XS 22	0.00	1.06	0.76	1.06	0.76				
XS 21	0.00	0.94		0.94					
XS 20	0.00	0.71		0.71					
XS 19	0.00	0.57		0.57					
XS 18	0.00	0.74		0.74					
XS 50	0.00	1.06	0.79	1.06	0.79				
XS 172	-0.01								
SRBC XS 171	0.00								
XS 51	-0.02	1.66	1.34	1.68	1.36				
XS 16	-0.03	0.71	1.02	0.74	1.05				
XS 15	-0.05	0.59	0.72	0.64	0.77				
XS 14	-0.05	0.54	0.53	0.59	0.58				
XS 13	-0.06	0.44	0.66	0.50	0.72				
XS 12	-0.07	0.62	0.76	0.69	0.83				
XS 11 XS 10	-0.07 -0.08	0.56 0.65	0.78 0.85	0.63 0.73	0.85				
XS 9	-0.08	0.68	0.85	0.76	0.98				
XS 8	-0.08	0.82	0.94	0.90	1.02				
XS 7	-0.08	0.83	1.03	0.91	1.11				
XS 6	-0.05	0.94	1.12	0.99	1.17				
XS 5	-0.04	0.98	0.97	1.02	1.01				
XS 4	-0.03	0.98	0.80	1.01	0.83				
XS 3	-0.03	1.16	0.56	1.19	0.59 0.75				
XS 2 XS 1	-0.06 -0.06	1.34 1.36	0.69 0.74	1.40 1.42	0.75				
XS C37	-0.06	1.49	0.76	1.55	0.82				
XS C36	-0.07	1.47	0.50	1.54	0.57				
XS C35	-0.07	1.61	0.74	1.68	0.81				
XS C34	-0.08	1.67	0.76	1.75	0.84				
XS C33	-0.08	1.87	0.95	1.95	1.03				
XS C32	-0.09	1.89	1.30	1.98	1.39				
XS C31 XS C29	-0.10 -0.10	2.08 1.96	1.51 1.53	2.18 2.06	1.61				
XS C29	-0.10	2.48	2.75	2.60	2.87				
XS C27	-0.12	2.40	2.73	2.52	2.85				
XS C26	-0.04	2.31	1.25	2.35	1.29				
XS C25	-0.01	2.08	1.32	2.09	1.33				
XS C24	-0.05	2.20	1.43	2.25	1.48				
XS C23	-0.06	2.23	1.79	2.29	1.85				
XS C22	-0.06	2.33	1.71	2.39	1.77				
XS C21 XS C20	-0.05 -0.06	2.33	1.66 1.70	2.38	1.71				
XS C20 XS C18	-0.06	2.47	1.70	2.53 2.48	1.76				
XS C16	0.00	2.95	2.27	2.95	2.27				
XS C10	0.00	3.31	2.63	3.31	2.63				

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Cross Section	Water Level Change with Gravel Removal-	Pre Grave			oval - Scenario 2
V6 46	Scenario 2 (m)	L Dike F.B. (m)	R Dike F.B. (m)	L Dike F.B. (m)	R Dike F.B. (m)
XS 49	0.00				
XS 48 XS 47	0.00				
XS 46	-0.42				
XS 45	0.01				
XS 44	-0.05				
XS 43	0.25				
XS 42	-0.40				
XS 41	-0.33				
XS 40	-0.67				
XS 39	-0.20	1.14		1.34	
XS 38	0.00	1.36	1.77	1.36	1.77
XS 37	0.01	1.39	1.39	1.38	1.38
XS 36	-0.01	1.52	1.52	1.53	1.53
XS 35	-0.19	1.39	1.22	1.58	1.41
XS 34	-0.05	1.08	1.22	1.13	1.27
XS 33	-0.01	1.37	1.47	1.38	1.48
XS 32	-0.02	0.87	1.23	0.89	1.25
XS 31 XS 30	-0.02 -0.08	0.81 1.21	0.99 1.24	0.83 1.29	1.01
XS 29	-0.18	1.02	1.24	1.20	1.32 1.25
XS 28	-0.16	0.91	0.67	1.15	0.91
XS 27	-0.50	0.80	0.68	1.30	1.18
XS 26	-0.13	1.13	0.70	1.26	0.83
XS 25	-0.01	0.93	0.95	0.94	0.96
XS 24	-0.02	1.08	1.04	1.10	1.06
XS 23-1	-0.02	1.07	0.96	1.09	0.98
XS 23	-0.02	1.00	0.78	1.02	0.80
XS 22	-0.02	1.06		1.08	
XS 21	-0.03	0.94		0.97	
XS 20	-0.02	0.71		0.73	
XS 19	-0.01	0.57		0.58	
XS 18	-0.01	0.74		0.75	
XS 50	0.00	1.06	0.79	1.06	0.79
XS 172	-0.01				
SRBC					
XS 171	0.00				
XS 51	-0.02	1.66	1.34	1.68	1.36
XS 16	-0.03	0.71	1.02	0.74	1.05
XS 15 XS 14	-0.06 -0.06	0.59	0.72 0.53	0.65 0.60	0.78 <b>0.59</b>
XS 14	-0.07	0.44	0.66	0.51	0.73
XS 12	-0.08	0.62	0.76	0.70	0.73
XS 11	-0.09	0.56	0.78	0.65	0.87
XS 10	-0.10	0.65	0.85	0.75	0.95
XS 9	-0.10	0.68	0.90	0.78	1.00
XS 8	-0.10	0.82	0.94	0.91	1.04
XS 7	-0.10	0.83	1.03	0.94	1.13
XS 6	-0.07	0.94	1.12	1.01	1.19
XS 5	-0.06	0.98	0.97	1.04	1.03
XS 4	-0.04	0.98	0.80	1.02	0.84
XS 3	-0.05	1.16	0.56	1.21	0.61
XS 2	-0.09	1.34	0.69	1.43	0.78
XS 1	-0.09	1.36	0.74	1.45	0.83
XS C37	-0.05	1.49	0.76	1.54	0.81
XS C36	-0.08	1.47	0.50	1.55	0.58
XS C35	-0.09	1.61	0.74	1.70	0.83
XS C34 XS C33	-0.09 -0.10	1.67 1.87	0.76 0.95	1.76 1.97	0.85 1.05
XS C33	-0.10	1.87	1.30	2.00	1.05
XS C32	-0.12	2.08	1.51	2.20	1.63
XS C29	-0.12	1.96	1.53	2.08	1.65
XS C271	-0.14	2.48	2.75	2.62	2.89
XS C27	-0.14	2.40	2.73	2.54	2.87
XS C26	-0.06	2.31	1.25	2.37	1.31
XS C25	-0.03	2.08	1.32	2.11	1.35
XS C24	-0.07	2.20	1.43	2.27	1.50
XS C23	-0.08	2.23	1.79	2.31	1.87
XS C22	-0.04	2.33	1.71	2.37	1.75
XS C21	-0.03	2.33	1.66	2.36	1.69
XS C20	-0.06	2.47	1.70	2.53	1.76
XS C18	0.03	2.51	1.93	2.48	1.90
XS C14	0.00	2.95	2.27	2.95	2.27
XS C10	0.00	3.31	2.63	3.31	2.63

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Withheld pursuant to/removed as

# Proposed 2023 Vedder River Sediment Removal Project: Environmental Assessment Report

# Nova Pacific Environmental 5/05/2023

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#### 1.0: INTRODUCTION

Following the atmospheric rainfall event of November 2021, the inflow of approximately 440,700m<sup>3</sup> of sediment into the Vedder River was deemed to constitute a significant flood risk and as a result an odd year sediment removal has been initiated by the Ministry of Environment and Climate Change Strategy (ENV). For the 2023 cycle, ENV has retained Kerr Wood Leidal Associates, Ltd. (KWL) to manage the excavation program and conduct hydraulic modeling of the Vedder River to determine where sediment removal should occur to address the flood risk and restore dike freeboard conditions. KWL has retained Nova Pacific Environmental, Ltd. (NPE) to develop specific plans for removals that would meet flood risk objectives while ensuring that fish habitat and other environmental and regulatory concerns were met.

The purpose of this document is to provide information required by Fisheries and Oceans Canada (DFO) and the BC Ministry of Forests (MoF) to support the applications for required permits under the Fisheries Act (Section 35) and Water Sustainability Act (Section 11), respectively.

The following accompanying documents are being submitted separately as part of the application package to the DFO and MoF. Items 1 thru 8 are new documents related to the proposed 2023 excavations. Items 9 and 10 provide information on the most recent habitat assessment and monitoring works completed on the Vedder River. These documents are referenced in this report and are identified as follows:

- Proposed 2023 Vedder River Sediment Removal Project- 2023 Hydraulic Assessment (KWL May 2023).
- 2. Construction Environmental Management Plan Vedder Vedder River Sediment Removal Project.
- 3. Three (3) Figures from KWL (sediment removal plan, access route, and stockpile locations (2023).
- 4. ZIP files from KWL pertaining to sediment removal sites, access routes, and stockpile sites (2023).
- 5. NPE shape files locating the footprint and outline of each excavation as shown in this document (2023).
- 6. Three (3) Letters of consent to remove gravel from land held by the Cities of Abbotsford, Chilliwack and Mark Gore respectively (2023).
- 7. Two (2) Letters of authorization from the Ministry of Environment and Climate Change Strategy (ENV) to appoint Nova Pacific Environmental as its agent (2023).
- 8. Archaeologist Overview Assessment Report (2023).



- 9. Archaeologist Chance Find Procedure (2023).
- 10. 2016 Vedder River Gravel Excavations Habitat Changes and Environmental Impacts (NPE Jan 2018).
- 11. 2022 Vedder River Sediment Removal Monitor's Report (NPE Dec 2022).
- 12. SARA Screening Report for the Proposed Vedder River Sediment Removal Program (2023).

Historically, the Vedder River Area Management Committee (VRMAC) manages the floodway capacity of the Vedder River in part, through periodic sediment removals. In 1994, deep pit excavations were initiated to replace previous bar top removal excavations that were perceived as inferior from the habitat retention perspective. This ongoing effort has reduced the risk of flooding while maintaining habitat values along the Vedder River for over 25 years. The Vedder River exhibits ongoing accumulation of sediments such that the capacity of the channel diminishes over time. To meet provincial flood protection standards to maintain 1 in 200-year flow capacity (Q200), sediment accumulation and dike freeboard are typically assessed every two years and based on this assessment, excavations are planned. These assessments and excavations are typically implemented in even numbered, non-pink salmon spawning years.

The atmospheric river of November 2021 resulted in significant flows in the Chilliwack/Vedder River that added 440,700 m³ of sediment into the Vedder River between Vedder Crossing and the Highway 1 Bridge. Hydraulic modelling performed by KWL determined that the sediment deposition increased the 1 in 200-year flood profile leaving several sections of dike along the Vedder River and Canal without the required freeboard. Following this event, the long-term average sediment deposition rate was determined to be 55,000 cubic meters per year or 110,000 m³ biennially. As a result of the significant deposition of November 2021, 110,000 m³ of sediment was planned to be excavated from the Vedder River in August and September of 2022. Due to a myriad of factors, only 35,000 m³ was excavated from the Vedder River in 2022. The table below summarizes the results of the 2022 program.

**Table 1**. 2022 Vedder River schedule and volume totals.



2022 Vedder River Sediment Removal																				
Schedule and Volume Summary																				
Site	Target Volume	Volume Removed*	% of target achieved	29-Aug	30-Aug	31-Aug	1-Sep	2-Sep	3-Sep	4-Sep	5-Sep	6-Sep	7-Sep	8-Sep	9-Sep	10-Sep	11-Sep	12-Sep	13-Sep	14-Sep
Railway Bar	7,500	5,677 m3	75.69		91							-0							$\Box$	
Greendale Bar	9,600	10,002 m3	104.19									0-				-0				
Greendale Scalp	incl. above	incl. above	n/a															9		
Salad Bar	8,400	6,618 m3	78.79		9		_		-										$\Box$	
Powerline Bar	7,500	6,659 m3	87.59										0-		9				$\neg$	
Boundary Bar	14,000	6,263 m3	44.74												0-	_	_			
Total	47,000	35,129	74.74																	
*	based on sto	ckpile surveys	by Jakes Const	ruc	tion	1													$\neg$	_

Until 2016, biennial excavations had been required to meet the freeboard requirements for the Vedder River. Terms of reference provided by the updated Vedder River Management Area Plan (EBA Tetra Tech, 2015) recommend removing the long-term average biennial sediment accumulation volume. However, lower rates of sediment accumulation resulted in this activity being deferred from 2016 until 2022.

#### 1.1: 2023 Vedder River Sediment Removal Program

For the summer 2023 sediment removal cycle, KWL and NPE have identified 12 bars with a combined total removable volume of 364,000 m³ (Figure 1). The following sections provide details for the proposed excavations (including adjacent bar top removal and habitat excavations) for 2023. The provided information includes excavation strategies, habitat conditions, mitigation and enhancement provisions, and project logistics. Additional information provided in the appendices address methodology, hydraulic profile, endangered species under the Species at Risk (SARA 2004), and reference materials.

Decisions to alter or drop specific sites will be based on potential changes that may occur during the 2023 spring freshet, agency reviews, site specific effectiveness, habitat protection and enhancement considerations, and logistics. This could lead to significant variation of the volume for any specific site; however, the total removal will not exceed 364,000 m<sup>3</sup>.

Hydraulic modeling shows the 1:200-year flood profile of the Vedder River and Canal has increased (KWL 2023). Several areas in the Middle and Lower Reach of the river as well as the upper end of the canal do not meet the provincial dike freeboard requirement of 0.75 m. The



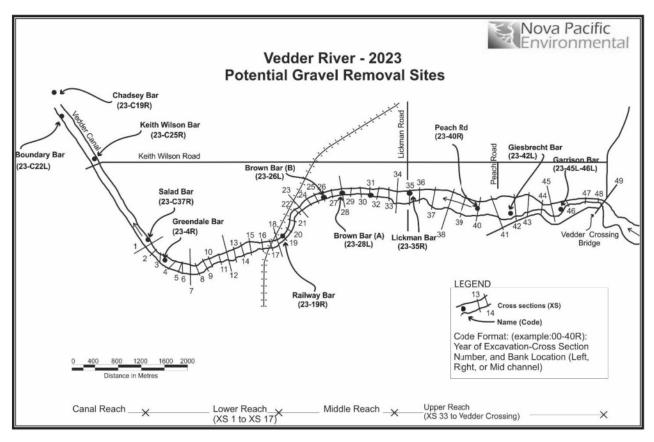
2023 proposed excavations will help to mitigate these freeboard limitations, limit future movement of excess sediment from the November 2021 atmospheric event into these areas and help to restore the river to the conditions prior to that event.

The 12 potential sediment removal locations for 2023 (shown in Figure 1) have been selected to:

- lower water levels where dike freeboard is limited;
- trap sediment upstream of the freeboard limited area in order to reduce future excessive
  excavation requirement in the Lower Reach and, when a large flood occurs limit sediment
  movement into this reach to help retain freeboard during flooding;
- increase capacity in the canal section of the river to lower the backwater curve to lower water levels in the freeboard limited area;
- provide optimum habitat outcomes while meeting flood protection objectives for sediment removal; and/or,
- provide additional habitat in the immediate vicinity of the excavations where suitable habitat enhancement opportunities exist.

Each of the excavations proposed for 2023 is adjacent to actively used fish habitat for spawning, rearing, and/or migration. This report will provide details of each proposed excavation, the adjacent fish habitats, expected fish utilization, potential impacts, and mitigating measures to be implemented during excavation.





**Figure 1:** Locations of proposed excavations for the 2023 Vedder River Sediment Removal Program.

#### 1.2: General Habitat Assessment and Monitoring Post-Excavation

Authorizations from DFO and MOF for previous sediment removals on the Vedder River have relied on a habitat assessment protocol that illustrates habitat changes arising from the removals. The assessment protocol includes detailed evaluation of habitat types both before and after the excavation. In addition, spawning locations for pink and chum salmon have been tracked on the entire Vedder River for the years, 1994 to 2014, as part of the excavation assessment activities. Since 2014, this spawning tracking looks at habitat and spawning only at, and around, the individual excavation sites.

A detailed review of the fish habitat and excavation work conducted as part of the 2016 and 2022 programs have been attached to this submission (Appendix A-2). A similar approach to program assessment will be followed in 2023. Current habitat conditions are noted for each proposed



excavation in Section 7 of this document and more detailed habitat mapping will be conducted following the 2023 freshet, just prior to excavation. This information will be provided to the permitting agencies and stakeholders once available.

Assessments of previous excavations similar to the ones proposed for 2023 has allowed for the development of sediment removal procedures that focus on providing optimal outcomes for fish and fish habitat. However, it is important to remember that the Vedder River is subject to significant natural changes arising from the deposition and erosion of bed material. For details on the hydrological rationale for the removals, the reader is referred to the Vedder River Hydraulic Profile 2023 Report (KWL 2023), which has been submitted as part of the application package.

#### 1.3: Applicant Information

The Ministry of Environment and Climate Change (ENV) has entered into a contract with KWL in order to fulfill the desired excavations. In order to do this, Nova Pacific has been sub-contracted to provide expertise, both in terms of pit design and in terms of environmental mitigation. Information associated with the proposed work is provided in Table 2. The proponent has provided a letter to allow NPE to work on their behalf regarding all permitting activities for the proposed project.

**Table 2:** Applicant information for the proposed Vedder River Sediment Removal Program.

Name:	Ministry of Environment and Climate Change
Contact Name:	Gulraiz Cheema
Email:	gulraiz.cheema@gov.bc.ca
Mailing Address:	PO Box 9337
	Stn Prov Govt
	Victoria BC
	V8W 9M1



#### 2.0: EXCAVATION SITE SELECTION

#### 2.1: Planning and Implementation Process Overview

Annual sediment accumulations are currently approximately 55,000 cubic meters per year on average with more sediment moving in years of major flow events, such as 2021, and less sediment in years with lower flow. The estimate of material required for removal in each cycle is based on the results of surveys conducted at the start of each cycle and the hydraulic modeling, as discussed below.

Previously, each excavation cycle on the Vedder River began with an updated survey of more than 70 previously determined cross sections. This information was used for hydraulic modeling to identify areas of accumulation and degradation of substrate to determine quantities of sediment in various sections of the river and to predict the water level and dike freeboard in a 1 in 200-year flood (KWL 2023). In addition to maintaining freeboard, excavations proposed for 2023 are intended to provide continued recovery from the atmospheric river event of November 2021.

Despite the emergency conditions, site selection is based on the guidelines outlined in Table 3 and included in the Vedder River Management Area Plan. Aerial photographs of the river taken during the late Summer of 2022 were used to help identify potential excavation locations. The candidate bars were then assessed in the field to identify key habitat features, identify potential habitat enhancement opportunities, and to devise a site-specific excavation plan to ensure optimal habitat outcomes.

The guidelines are applied to ensure the protection of existing features and optimization of anticipated post-excavation conditions. Logistic issues are also evaluated at this stage, including access, stockpile locations, and potential effects on other resource users. Once a set of feasible and environmentally sound excavations are identified, they are compared to the identified freeboard deficiencies and calculated volumes of material required to meet channel capacity objectives. Additional hydraulic modeling is completed using this information to determine the effect of the removals on flood water levels and freeboard. A final set of target excavations is then selected to meet the flood reduction objectives while minimizing disruption to fish habitat. Once the program plan is established, permitting is initiated.



During the implementation stage, the suite of excavation sites that have been selected are tendered. Immediately prior to removal, NPE will layout a field fit excavation plan to ensure that the habitat outcome objectives are met. During removal, a qualified environmental professional (QEP) monitors the activities to ensure that the excavations proceed in environmentally sound manner and in accordance with the plans and program objectives. Specific attention is also paid to the habitat enhancement aspects of the excavations. A survey is undertaken after the removal to determine the actual removal volume. One year after removal, a detailed evaluation of post-excavation changes and a supplementary biological assessment by a registered professional biologist (RPBio) are completed to assess habitat changes along the river and canal. This assessment report is submitted to the regulatory agencies and is generally made available to a range of stakeholders and the public.

Table 3: Guidelines and Constraints Followed During Excavations.

No.	Guidelines	
1	No excavations in pink spawning years in the reach where most pink salmon spawn.	
2	Avoid excavating in areas of sub-gravel percolation as this may impact chum salmon spawning and water levels in enhanced off-channel habitat.	
3	Work only in isolation from flowing water.	
4	Leave the upstream third of bars.	
5	Adherence to the fisheries work windows.	
6	Avoid digging consecutive bars because of potential interaction between them.	
7	Excavate channels to replicate natural streambed shape to minimize post-excavation changes.	
8	Protect areas adjacent to points where secondary channels branch off from the main flow.	
9	Avoid excavating in areas adjacent to sensitive habitat.	
10	Avoid digging long pits associated with elevation drops or which can affect long sections of the river.	
11	Leave gently sloped inside edges on the upper end of cuts to prevent head cutting and to leave stable habitat for chum salmon spawners.	
12	Open the upstream end of deep sediment pits so that head-cutting can occur, and to encourage sediment flow into the pits.	
13	Construct internal, cross channel berms in long pits or where there is a significant elevation drop.	
14	Leave the downstream ends of bars since this will preserve tailouts which provide rearing and spawning opportunities.	
15	Ensure riffles are not bypassed by excavation.	



16	Adjacent dry channels should be deepened and stabilized with flow control structures such as large woody debris complexes.
17	Leave pits with large head differences closed to prevent chum spawning within them or fish trapping.
18	Open excavations thoroughly to avoid creating fish traps. Two deep openings adjacent to the main channel should prevent this problem.
19	Use caution when designing excavation where the thalweg approaches the pit at an angle of more than a few degrees. Design mitigation may include options to reduce the opening or move the excavation or the opening downstream when this condition is encountered.

# 2.2: Timing Considerations

Beginning in 2023, planning and implementation of sediment removal projects on the Vedder River requires that planning be initiated prior to the fall freshet due to the need to obtain approvals and complete the works during the reduced risk fisheries window the following summer. Hydraulic modeling, and environmental site selection and design are based on aerial imagery and Lidar data as well as field work, that precedes most of the fall, winter and spring high flow periods. Detailed assessment of excavations and related habitat conditions is usually completed in the late summer and fall and incorporates additional aerial photography and ground truthing linked to water levels and observations of spawning around the excavations.

This timing allows an appropriate, early spring start to review by the regulatory agencies. The start of excavations is dependent on dropping water levels as well as the least risk timing window for instream works, which is the period of least risk to fish and fish habitat between July 15 to September 15. This window occurs when most seasonal outmigration of smolts is complete and prior to the onset of spawning behaviour of returning adult fish. Accordingly, the excavations are expected to begin around August 1 and continue at least until September 15. In previous years, excavations have extended to September 30 where conditions were suitable. This extension may be necessary in 2023 to meet the sediment removal targets. Continuing low flows are an important consideration for any extension as this could affect the upstream migration timing for adult salmon as well as the feasibility of completing the works in isolation. In addition, the start of spawning by pink salmon may also limit any extension to the window, particularly at sites where excavations are upstream of expected or active pink salmon spawning areas. It is anticipated that this constraint will limit activity after September 15<sup>th</sup> to sites located in the Vedder Canal. Work on all sites will be ordered to ensure that only the most downstream sites are at risk of remaining incomplete by September 15<sup>th</sup>. Monitoring of adult salmon migration



would be added to the responsibilities of the environmental monitor as required. The Environmental Monitor will collaborate with Sumas First Nation Fish Counting activities to ensure that their knowledge and preliminary findings inform any decision to extend works past September 15<sup>th</sup>. For the purposes of this application, an extension to September 30 has been incorporated.

## 2.3: Candidate Bars and Final Bar Selection for 2023

To ensure that the best possible suite of sediment removal sites were selected, a preliminary overview of the whole of the Vedder River was conducted. From this overview, 12 sites were selected that best meet the ENV objectives to maintain floodway capacity while optimizing fish habitat value (Table 4). Railway, Salad, and Boundary Bar were all excavated in 2022 and their feasibility to proceed is dependent on the extent to which they refill.

**Table 4:** List of Candidate Bars Considered for 2023 Sediment Removals (identified from upstream to downstream).

#	Bar Name	Plan Developed	Yield (m³)	Comments
1	Garrison	Y	33,700	Opportunity to trap lots of sediment upstream of freeboard limited sections.
2	Giesbrecht	Υ	21,400	Upstream gravel trap. Expected to refill without significantly affecting habitat.
3	Peach Road Downstream	Υ	104,600	Expected to trap gravel and take away from the left bank.
	Peach Road Habitat Excavation	Y	5,300	Habitat excavation as well. The deep pit excavation will trap sediment upstream and the habitat excavation is expected to add rearing and spawning habitat as a result of sub gravel percolation.
4	Lickman	Υ	12,300	Expected to refill in similar configuration. Similar potential to limit erosion as with Peach Road.
	Lickman Bar Top Removal	Y	7,400	Bar top removal should help increase riffle habitat.
5a	Brown A	Y	4,300	Relatively small, but accessible. Frequent previous excavations. Sediment trap potential.



5b	Brown B	Υ	23,300	Opportunity to remove sediment from a freeboard limited area and improving microchannel habitat.
6	Railway Bar	Y (optional)	6,500	Relatively small but accessible. Frequent previous excavations. Sediment trap potential. Dependent on refilling from 2022 excavation
7	Greendale Bar	Υ	43,900	Access is feasible but challenging. Proximal to freeboard limited zone. Several previous successful excavations.
	Greendale Habitat Excavation	Υ	11,300	Opportunity to maintain flow in secondary channel, and to remove sediment upstream of freeboard limited area.
	Salad Bar	Y (optional)	9,300	Limited volume, but easily accessible. Easy improvement to microchannel habitat.
8	Salad Habitat Bar	Y (optional)	300	Extending existing side channel upstream, removing sediment and providing habitat Dependent on refilling from 2022 excavation
9	Keith Wilson Bar	Υ	26,600	Accessible. Several successful past excavations.
	Boundary Bar	Y (optional)	22,300	Opportunity to remove sediment in freeboard limited area and make improvements to microchannel.
10	Boundary Habitat Bar	Y (optional)	400	Excavation of channel along bank, tie-in to upstream main channel, providing habitat Dependent on refilling from 2022 excavation
11	Chadsey Bar	Υ	31,100	Similar profile and size to Keith Wilson Bar. Next in line for canal D/S to U/S strategy initiated in 2014.
	Total for all sites (optional and Proposed)		364,000	
	Total for Proposed Sites only		325,200	



# 3.0: FISH HABITAT IN THE VEDDER AND EXCAVATION DESIGN

## 3.1: General Considerations for Fish Habitat

Salmonid species known to occur within the Vedder River include all five Pacific salmon: Chinook (Oncorhynchus tshawytscha), chum (Oncorhynchus keta), coho (Oncorhynchus kisutch), pink (Oncorhynchus gorbuscha), sockeye (Oncorhynchus nerka), as well as steelhead trout (Oncorhynchus mykiss). The life stages of salmonids that have been documented within the Vedder River include spawning, rearing, and migration. All excavation planning and implementation decisions consider these species and their utilization of habitats within the Vedder River. Excavations take place within the window where fish utilization is at its lowest, after most juvenile salmonids have migrated out of the area and before spawning. In addition, excavations have been traditionally conducted in non-pink salmon spawning (even) years.

Protecting spawning habitat for salmonids is of critical concern for sediment removal efforts on the Vedder River which involves preserving known spawning habitat areas as well as identifying opportunities to enhance or create new spawning habitat opportunities for these species. Typically, only chum and pink salmon spawn in the river reaches where the excavations take place. Generally, pink salmon have been noted to spawn in channel tail-out areas above riffles. Chum salmon most often spawn below riffles and within side channels where sub-sediment flows are emerging. All excavations are designed to avoid disruption to these sub-sediment flows and, where possible, include opportunities to enhance flows in these habitat channels. Sockeye and coho salmon, along with steelhead, travel through the Vedder River on route to their preferred spawning areas in smaller tributaries or upstream in the Chilliwack River. Very occasionally, spawning Chinook salmon or their redds have been observed in the Vedder River. The excavations are planned to minimize changes that could detrimentally impact redds placed post-excavation.

Salmonids are known to rear in many locations along the river, including around the excavations. Concentrations of juvenile salmonids have been noted in pools, downstream of riffles in glide tails, along channel edges where cover is available, and within microchannels that are frequently found along the inside edge of sediment bars. Each sediment removal site is designed to avoid changes that would result in detrimental impacts to these habitat features and frequently incorporate measures to enhance these habitat features. The guidelines provided in the next section address the key approaches that are used.



Both adult and juvenile salmonid migration can be affected by the proposed excavations and mitigation steps will be undertaken to minimize any of these potential impacts. Mitigation consists primarily of creating deep, wide openings to the excavations to prevent pits from becoming isolated pools.

Habitat mapping is typically conducted annually during low flows and comparisons are made before and approximately one year after for each excavation site. This assessment is currently being completed for the 2022 excavation cycle. The current aerial imagery used in this report was captured by KWL on October 2, 2022. This imagery, in conjunction with prior habitat mapping data from spawning surveys and recent physical assessments of the candidate bars, is used to develop an update of the habitat conditions along the river to support excavation design. Additional imagery and a detailed inventory of habitat conditions will be collected before excavations begin to allow an accurate characterization of the effects of the impacts and to ensure that the work is completed in a way that optimizes the habitat objectives.

# 3.2: Environmental Focus in Excavation Design

Each excavation has been prepared in accordance with best management practices developed specifically for the Vedder River Sediment Removal Program. These were developed in cooperation with the Vedder River Technical Committee (VRTC) and VRMAC with significant contribution and collaboration with DFO and provincial agency staff between 1994 and 2012. Designs incorporate inputs from professional biologists and hydrologists and rely on the documented experience from more than 90 individual excavations since 1994 to predict what will happen post-construction and to fine tune the designs to ensure neutral or beneficial outcomes. Amendments have been made to the design guidelines to expand the range of removal options and improve fish habitat outcomes. The guidelines underwent a comprehensive review as part of the 2015 Vedder River Management Area Plan update. The latest version of the guidelines is presented in Table 3 above.

Potential sediment removal sites are evaluated, based on their potential to provide an effective removal while avoiding harm to fish and fish habitat. The guidelines (Table 3) were developed through adaptive management to provide optimal habitat outcomes from the sediment removal program and inform the design, monitoring and assessment of the excavations over several iterations of sediment removal. Several guidelines, such as adhering to the fisheries window and working in isolation of flowing water, are typically requirements of the Authorization and are



intended to avoid detrimental impacts during the excavation. Not all guidelines are followed for each pit and some guidelines apply only to relatively rare circumstances.

Each excavation site is designed to yield optimal habitat in its post-excavation condition. Gentle slopes, strategic flow inlets and outlets, and careful placement and delineation of the excavation footprint are employed to ensure habitat impacts are minimal. Large channel changes and post-excavation effects, such as head-cutting, are avoided by not bypassing riffles, leaving the upstream ends of bars, and avoiding sequential sediment bars. Habitat mitigation and enhancements are incorporated where appropriate and include placement of large woody debris (LWD), enhancement of secondary channels or micro-channels, and occasionally other initiatives such as constructing channels or riparian planting.

The habitat mapping exercise provides an evaluation of the changes or effects for each excavation site. The assessment area for each site is intended to capture all changes related to each excavation. However, the effects of natural changes are difficult to extricate from effects caused by the sediment removal operations. In effect, we are looking for the impact of the changes due to the excavations on a dynamic and constantly changing system.

The habitat methodology and most recent assessments have been attached to the application (Appendix A-2). Given the similarity of the excavation forms and locations over the years and the consistent application of guidelines per our described methodology, the outputs from past habitat mapping provide the best predictor for possible impacts from the currently proposed excavations. This vast amount of data has already been collected, analyzed in-depth, and shows that the program generally yields a net gain of fish habitat, on average. Section 7 of this document includes a discussion of the anticipated outcome for each proposed excavation.

## 3.2.1 LWD Placement Strategy

Large Woody Debris placement in and around the excavations are one element of habitat enhancement at each excavation. LWD placement at each site is dependent on the local availability of suitable logs and root wads as well as suitable locations. As LWD placement is frequent and repeated with each excavation cycle, a percentage of washouts and other natural modifications are expected.

No anchors are employed due to the changing nature of the target placement locations and concerns that anchoring materials such as cable and ballast would detrimentally affect river conditions or fish habitat and constitute a safety hazard to recreational users of the river.



GPS coordinates are recorded for each of the major LWD placements, and a photographic record is created. Additional single LWD pieces will be keyed in on occasion but may not be tracked. This aspect of LWD placement is considered mitigation and not generally considered in determining net impacts to habitat.

Large woody debris placements are evaluated on the basis of their contribution to conditions one year later. In effect, they are a contributing factor to an anticipated higher habitat rating. As such, they are only deemed to be successful if they are still functioning at the time of evaluation one year later. This allows a safe and natural approach to LWD enhancement without imposing a rigorous success rate applied to each individual placement.

#### 3.2.2 Pink Salmon Habitat Concerns in a Pink Salmon Dominant Run Year

Returning adult pink salmon will be present in the Vedder River and will begin spawning shortly after the completion of the excavations. The adults will hold in pools below suitable spawning areas and then move a short distance upstream to spawn. Pink salmon spawn in the fall and after eggs hatch and the alevins are sufficiently developed, they emerge as fry. The fry immediately begin heading downstream and enter the Fraser River estuary soon after. Because of these lifecycle considerations, protecting the spawning habitat is the main requirement for protecting pink salmon stocks. It is critical to protect pink salmon and their habitat during non-pink (even) year excavations. If this critical habitat becomes degraded, it may take several years to re-establish, and as such, this is a core element of the guidelines and mitigation strategies for sediment removal projects in the Vedder River. Mitigation strategies for reducing risk to pink salmon and their habitat include:

- 1. Design guidelines that ensure the retention of habitats that support pink salmon spawning.
- 2. Best management practices that limit impacts to pink salmon spawning areas arising directly from excavation activities
- 3. An ongoing program of habitat and spawning distribution that allows effective prediction of pink salmon spawning locations.

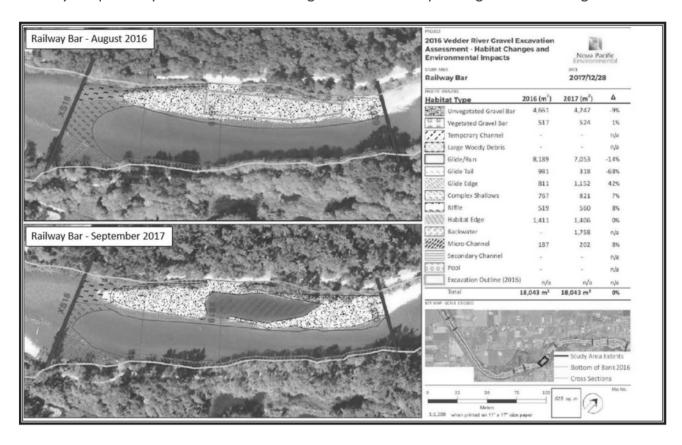
Since 1999, and in accordance with the guideline 'No excavations in pink spawning (odd) years in the reach where most pink salmon spawn'. One reason for this guideline is precautionary. With fewer stocks present in the river in the immediate aftermath of the excavations, the risk of a detrimental outcome is reduced.



A key aspect of the planning focuses on protecting pink salmon spawning habitat during the even, non-pink years, a full year ahead of when the habitat is used for spawning. Several of the guidelines, (Table 3 above) including 2, 4, 6, 14, and 15 directly contribute to the preservation of pink salmon spawning habitat. In particular, number 15, not bypassing riffles ensures that the river does not divert through the pit and that the glide tail habitats where pink salmon spawning is most evident are retained.

One of the objectives of the 2023 excavation cycle will be to excavate in a way that mitigates risk to pink salmon spawning areas. In particular, it has been important to choose bars and establish site design elements such that the excavations will not upset the glide tail-riffle sequences that pink salmon rely on for spawning. While this phenomenon is not widely cited in fisheries literature, it is clearly evident in the distribution of spawning in the Vedder River and has been observed every pink year since 1995.

Monitoring of pink salmon spawning since 1995 allows for reliable predictions of major spawning locations throughout the Vedder River. Figure 2 illustrates the habitat conditions noted at Railway Bar pre and post excavation while Figure 3 shows the spawning located at the glide tail.





**Figure 2:** Habitat mapping of Railway Bar location prior to excavation in 2016 (top) and one year later in 2017(bottom) shows the glide, glide tail and riffle sequence downstream of the excavation.

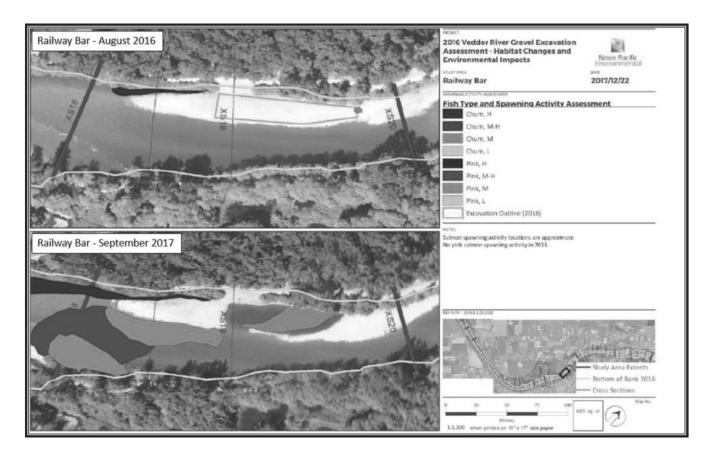


Figure 3: Habitat distribution of Pink Salmon and chum in the vicinity of Railway Bar in 2016 (top) and 2017(bottom)

The locations of suitable spawning habitat for pink salmon, particularly over the longer term, varies with hydrological processes, sediment deposition and degradation. However, the spawning location relative to the key habitat features remains consistent for each of the bars, despite changing configuration. Figures 4 and 5 illustrate the locational variation of spawning locations at Greendale Bar between 2006 and 2013.



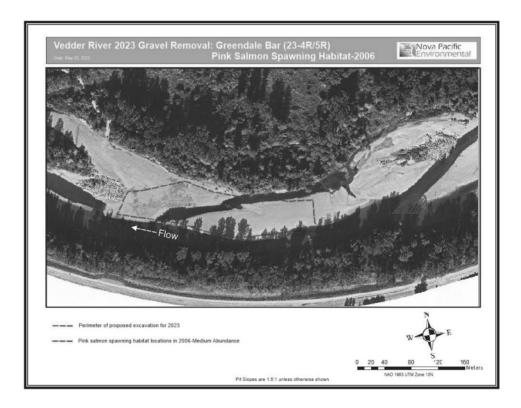


Figure 4: Spawning locations of pink salmon in 2006.

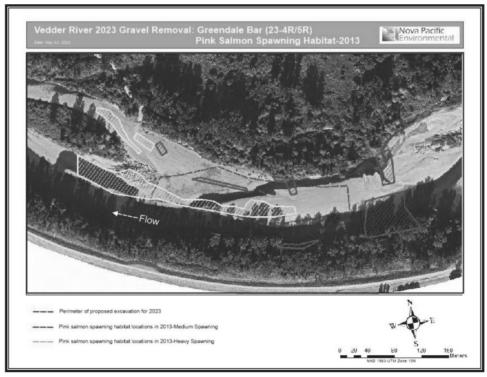


Figure 5: Spawning locations of pink salmon in 2013.



Accordingly, pit location and design has reduced impacts and risk for pink salmon redds and retains spawning habitat. The observed pink spawning locations just upstream of riffles have proven to be stable if the excavation sites are located on bars between riffles with adequate design features to prevent head cutting, interaction with other sites and bypassing of riffles. It is important to note that the excavations take place within a dynamic system where natural hydraulic changes are ongoing.

The concentration of pink spawners drops off downstream of Salad Bar and upstream of Lickman Road (likely due to a change in flow and substrate conditions), so excavations in the canal and upstream reach would have little or no effect on pinks. The observed patterns of redd selection are less apparent during more abundant runs as spawners are displaced to less favourable locations. Each bar has been selected and designed to retain characteristics that support pink spawning, principally the riffle structures within the channel. Guidelines 4, 10, 14 and 15 are particularly focused on achieving this result.



# 4.0: CONSTRUCTION MITIGATION MEASURES AND MONITORING

Once the final set of sediment removal sites is approved, removals are monitored to ensure that the excavations follow the design, and that Best Management Practices (BMPs) are followed. Several of the key BMPs that are universal to all work on the Vedder are discussed here and in more detail for specific bars in Section 7 of this document. In addition, a Construction Environmental Plan (CEMP) has been prepared for these works and is included with this document in the permitting submissions.

All works are to be completed with adherence to the following BMPs:

- Standards and Best Practices for Instream Works. BC Ministry of Water, Land and Air, March, 2004:
- Measures to Avoid Causing Harm to Fish and Fish Habitat. Fisheries and Oceans Canada, 2013;
- A User's Guide to Working in and Around Water: Understanding the Regulation under British Columbia's Water Act. BC Ministry of Environment, May 2005 (revised 2009); and,
- A Field Guide to Fuel Handling, Transportation and Storage. BC Ministry of Water, Land and Air Protection, 2002.

Excavations for maintaining the capacity of the Vedder River will be conducted "in the dry" or outside the flowing waters of the Vedder River. This means that a perimeter buffer zone or berm will be maintained throughout the excavation process to ensure no deleterious materials from the excavation enter the Vedder River. Bar access is selected to limit disruptions from any culvert crossings and to minimize destruction of riparian habitat.

Most locations have existing access that requires only minimal clearing of small-scale vegetation and construction of a ramp down to the bar surface. A bird nest survey will be conducted prior to any small-scale vegetation removal.

Fuelling of vehicles and equipment will generally not occur within 30 m of the river. Fuel trucks are expected to deliver to site so that no fuel will be stored on site. Spill trays will be utilized during refilling. All equipment and vehicles will be cleaned and inspected before commencing work at any of the Vedder River sites. Vehicles and equipment will use environmentally friendly hydraulic fluid and be free of any leaks, soil, and contaminants, including invasive vegetation such as Himalayan blackberry. More detail regarding these protocols can be found in the CEMP documentation accompanying this application.



# 4.1: Hauling and Stockpiling Activities

During hauling, water can flow out of the loaded gravel truck and there is more potential for spillage if the water content of the excavated material is high, particularly on access ramps. Generally, the environmental monitor will direct the operators to briefly stockpile the material adjacent to the pit so it can drain before being loaded onto trucks. Where conditions warrant, the monitor will allow material to be loaded directly from the pit to the trucks, however, if excess water is apparent on the bar surface, ramps, or roads, this will be halted. Water runoff will be limited to areas that are still to be excavated or the footprint of the access route that is to be restored. Any runoff will be directed to the excavation footprint or to a temporary settling pond using grading or silt fencing, as required. Small amounts of water dripping along the haul routes during dry weather periods is effective at limiting dust generation. Runoff from excavated material, once it is transported to the stockpile site also has the potential to enter sensitive habitats if the stockpiles are near any of these habitats or watercourse or drainages that connect to these habitats. All stockpile areas will be monitored periodically during active use to ensure that all sediment and runoff water remains within the stockpile footprint. Depending on footprint and expected height, material destined for any particular stockpile site may need to be excavated using the two-step approach, first moving the material out of the pit and onto the bar and then after time to drain onto the trucks.

Silt fencing will be available on site for deployment at the discretion of the environmental monitor to ensure that silt laden water does not enter the flowing channel of the river or any other watercourse that may be proximal to haul routes or stockpile sites. Generally, silt fencing will not be required as runoff can be directed into when there is insufficient unexcavated area or berm elevation.

# 4.2: Excavation Openings

Generally, once an excavation is complete, it will be opened to the main flow of the river to ensure that it interacts with the main channel as intended, and to ensure that fish, including salmon fry and adult spawners, do not get trapped within an isolated pond. The "opening" of the gravel bar will produce a one-time localized turbidity event as the turbid water contained within



the enclosed area is flushed out. Although dependent on the size of the excavation and the relative size of openings, the period of turbidity will be short in duration.

To minimize the impact of this one-time turbidity event, the environmental monitor will be on site and will direct the pit opening.

Typically, the downstream end is opened first so movement of disturbed sediments into the active channel is not exacerbated by water flowing out. When the upstream end is subsequently opened, the disturbed sediments naturally flow into the pit as the river flow enters and the excavation acts as a settling pond for the larger sediments. A soft-start procedure will be followed when opening the excavation to minimize deleterious effects to fish and fish habitat. The openings will be excavated to the maximum extent possible before breaking containment to keep the turbidity in the excavation footprint as low as possible. Turbidity monitoring and plume tracking during previous excavations shows that the turbidity is within acceptable limits except for a short distance downstream, typically across a narrow part of the channel adjacent to the bank below the downstream opening. Previous experience has shown that the plume dissipates quickly as the water contained in the pit is flushed out and diluted. Turbidity data collected during previous higher flow periods will be provided for comparison purposes. New written guidelines for openings will be provided to the contractors in 2023. These have been incorporated into the accompanying CEMP.

# 4.3: High Water Considerations

Occasionally, during the work window for this project, high water conditions may require the need to repair or build up sections of the berm to maintain containment. To ensure that this is done safely, clean excavators may be allowed to briefly enter the wetted channel but only in areas that were dry during the preceding days excavation activity. This approach to berm repair is preferable to allowing river flows to enter the excavation area as that could result in erosion and related sediment deposition and stranding of fish within an excavation pit that is temporarily open to the flowing channel.

In the event of a significant breach of the excavation site, a berm will be left to separate the completed portion and a new pit initiated. This berm would then be breached during the opening discussed above.



#### 4.4: Access to Sites

Access to the sites is managed according to well established practices. Generally, all of the selected bars are accessible via existing routes. Bars without suitable access usually results in exclusion from the sediment removal program. Access routes include the tops of dikes, existing armoured banks with access roads already in place, and other existing access roads and trails. The access routes may require some trimming of branches to assure safe conditions on the haul roads, but clearing is not normally required. If vegetation removal is required, it will only be to the extent necessary to access the bar. Any trees noted in the area will be protected where possible. Access to the bar surface usually requires a ramp down from the bank and often the crossing of small secondary channels or microchannels near the toe of the bank. Traffic on the sediment bars will be confined to the footprint and a single access track with pullouts, if required. Details of access for each bar are provided in Section 7.

Culverts will be sized to ensure that flow to affected channels is maintained. An environmental monitor will supervise their installation. The culverts will be carefully placed, and flow directed through them before ramp construction begins. Typically, a single wet crossing by an excavator is allowed to access material for ramps and cover for the culverts. This material is usually obtained from the excavation footprint but on occasion it is necessary to use a borrow pit that is refilled once access to the footprint area is completed. If appropriate, the borrow pit will be situated to function as a settling pond for any runoff from trucks accessing the ramp. Culvert length will be such that spillage from haul trucks does not enter the flowing water. This is particularly critical where a channel is adjacent to the bank and culverts are required for the ramp. Where appropriate, isolation of the work area and fish salvage will be conducted before ramp installation. All vehicles and equipment will be inspected and free of leaks prior to works. More detail regarding these protocols can be found in the CEMP documentation accompanying this application.

Once the project is completed, all access structures down on to the bar will be removed and the area will be restored to original condition. Details on access to each individual site can be found in Section 7.

# 4.5: Turbidity Monitoring

Previous field studies will be used to develop a turbidity monitoring system that would be adaptable to sediment removal sites and to collect turbidity data during construction works.



Turbidity measurements will be taken prior to the start of excavations upstream and downstream of each excavation area and during the sediment extraction works.

The turbidity readings will be obtained using a LaMotte 2020we Turbidimeter. The 2020we meter meets or exceeds Environmental Protection Agency (EPA) design specifications for National Primary Drinking Water Regulations and the National Pollutant Discharge Elimination System turbidity monitoring programs as specified by the US EPA Method 180.1 (USEPA 1993). Turbidity measurements will be collected throughout the works to ensure compliance with the BC Water Quality Guidelines (WQGs) for aquatic life, wildlife, and agriculture. If reading of noncompliance occur, excavation works may be stopped to identify sources and institute remedial measures. Once these are in place, works will continue as per discretion of the EM. Details of the WQG's and these practices are provided in Section 4.2 above and Section 5.10 of the accompanying CEMP document.

Prior to opening each excavation, turbidity readings from the enclosed pit will be collected. Baseline readings will be taken upstream of the enclosed pit, and additional readings will be taken downstream as the plume of turbid water exits the excavation site. The turbidity readings will allow us to track the plume as it leaves the pit and to evaluate the effectiveness of more stringent practices planned for 2023 (see attached CEMP).

## 5.0 POST-EXCAVATION ASSESSMENT

Post-excavation assessments include follow-up surveys to ensure that objectives are being met and detailed habitat mapping to ensure that habitat changes are in balance with expectations and confirm no net loss of habitat arising from the sediment removal program. Habitat mapping provides an objective method for tracking and rating habitat conditions before and one year after each sediment removal activity.

The habitat mapping is conducted through analysis of aerial photos of the excavation locations taken at the same flow levels as the pre-construction in conjunction with ground-truthing at each bar. Habitat elements are mapped out to attain an overall habitat ranking value for the excavation location both before and after the excavation. Each habitat element (e.g., pool, riffle, glide) is given a habitat rating based on a methodology developed specifically for the Vedder River to compare pre- and post-habitat values in the vicinity of the excavation sites. Spawning surveys are also conducted for chum salmon each year and for pink salmon during non-



excavation years. More detail on this can be found in the assessment report for the 2016 excavations that has been included as Appendix A-2. Note that this report is the latest in a series of reports that describe monitoring and assessment works completed on the Vedder River. The assessment report for the 2022 cycle is still ongoing. A full list of reports on the Vedder River prepared by NPE can be found in Appendix B.

Habitat mapping provides an evaluation of the changes at each individual excavation. Until 2014, habitat conditions were evaluated along the entire river. Recently, it was determined that virtually all of the changes linked to the excavation activity could be evaluated by looking at a smaller area; typically extending one cross section up and one cross section down captured nearly all changes related to each excavation. However, the effects of natural changes are difficult to extricate from effects caused by the sediment removal operations. In effect, we are looking for the impact of our changes on a dynamic and constantly changing system. Given the similarity of the excavation locations and forms over the years and the consistent application of guidelines per the described methodology, the results of this assessment provide an excellent predictor of anticipated outcomes. A vast amount of data has already been collected, analyzed in depth, and shows that the program generally yields a net gain to fish habitat on average. This is not a surprising outcome given that optimization of fish habitat is a key driver of the program and is paramount at the tactical level (i.e. specific excavation detail planning).



# 6.0: ANTICIPATED EFFECTS FROM THE EXCAVATIONS

Once the excavations are completed, they are opened to the flowing water of the river. The downstream end is opened first to ensure that water levels do not increase in the pit and to limit sediment outflow when the downstream opening is excavated. When the upstream end is opened, sediments are washed into the pit where they settle. The water in the pit, however, retains high turbidity and this creates a temporary increase in turbidity downstream as it is displaced, usually within a few hours.

With the onset of the fall freshet, higher flows will tend to modify the shape of the excavation. Filling begins immediately as openings widen and outer berms are eroded. In some cases, the erosion of the berm is encouraged by excavating to a steeper slope. Some head-cutting is possible, which can affect adjacent riffles near the upstream end of the excavation, but this is normally avoided by leaving gentle slopes and a substantial upstream buffer from areas of head differences.

There are usually more wetted habitats present when the detailed follow-up assessment is completed one year later. Habitat diversity is often increased as a result of the excavations and the habitat ratings calculated provide a mix of increases and decreases to habitat value. These changes occur in an environment that is changing with each freshet and separating the effects of the excavation from the natural changes is challenging. Each excavation is designed so that the changes related to the excavations are similar to natural changes and no net loss in habitat is anticipated. Where larger changes occur, this often recapitulates the effects of a natural avulsion even though the river is generally confined.

One apparent long-term trend is that in the majority of cases fish habitat ratings improve, or are similar to pre-excavation ratings, following excavation and some time for channel adjustment. Later, habitat ratings tend to drop as sediment fills in the various aquatic habitats.

The long-term strategy of removing annual expected targets led to some degradation of parts of the channel bed over the last few cycles when peak flows were relatively low. This was exacerbated by the 2018 avulsion to, and subsequent accumulation of sediment in, an old habitat pond near the Soowahlie First Nation Reserve just upstream of Vedder Crossing. However, this degree of channel lowering did not appear to influence the observed pattern of habitat changes with most excavations still showing gains in habitat ratings one year after excavation.

With the atmospheric river event of 2021, sediment has moved through the system resulting in freeboard limitations in the canal, lower and middle reaches. The most recent assessment of



available freeboard, together with an evaluation of the effectiveness of the proposed removals is presented in the accompanying documentation, 2023 Vedder River Hydraulic Assessment (KWL - May 2023)

Both channel aggradation and degradation influence fish habitat values whether or not this is an impact of anthropogenic sediment removal programs. Fish habitat values could be negatively affected if the channel were deepening and thereby leading to a loss of riffle areas and a net loss of habitat, for example. Riffles offer high value habitat due to their contribution to primary productivity and associated larval insect grazers as well as the feeding niche they provide for juvenile salmonids. In other river systems, serious negative habitat outcomes have been noted where sediment depletion has occurred from uncontrolled sediment removal (Kondfolf *et al* 2002). However, removals from the Vedder River, limited to long term average inflows, have not shown any evidence of systemic effects from lowering of the channel (NPE 1994 -2016). These rates were evaluated and established by the Vedder River Management Area Plan Update (EBA Tetratech 2015). The type and distribution of habitats remains similar with increases in shallower wetted habitats and habitat complexity, providing for a positive outcome. For 2023, the large volume of material to be removed is tied to the unusual (1:200) year flood and the amount of gravel deposited.

The detailed habitat mapping along with regular surveys and hydraulic modeling shows that riverbed degradation is not of concern within the sustainable long-term strategy in effect for the Vedder River. Where the sediment removal program results in lowering of the bed, there appears to be a corresponding lowering of the water level as the geomorphology of the river remains similar. There are also natural changes occurring in the river, such as bank erosion, natural channel shifts and the continuous downstream movement of sediment. Periodic erosion tends to widen the active channel and contributes to channel capacity without lowering the riverbed. Annual mapping of habitats is an ongoing component of the Vedder River Sediment Management Program to ensure that this remains the case and to ensure that longer term changes do not arise. The most recent completed assessment is provided in Appendix A-2. In addition to providing the results from the 2016 excavation, this report provides a detailed description of the habitats in the Vedder River as well as the methodology used for the assessment.



# 7.0: INDIVIDUAL EXCAVATION DETAILS

Plans for each of the 11 proposed excavations are provided in this Section along with a brief description of location, access, stockpile sites, existing habitats, and site-specific mitigation plans. Excavation designs are based on the established BMPs for the Vedder River Sediment Removal program that are described in Section 3 above.

Bar names are consistent in their approximate locations and the named bars tend to be persistent features of the river. However, these bars vary in their position upstream and downstream, laterally, and occasionally they can be absent altogether depending on the location of the thalweg. To ensure that excavation locations are accurately represented, each excavation site has a unique identifier that includes the year (first two digits), cross section (second two digits), followed by a 'C' if the cross section is in the canal, and the lateral position in the river ('R' for bars adjacent or near the right bank, 'L' for bars adjacent or near the left bank, 'M' for midchannel bars), for example, Bergman Bar's unique identifier was 20-23L for Bergman Bar when it was excavated in 2020 at cross section 23 on the left bank.

Estimated removal volumes have been calculated to take sloped edges into account. Specific LWD placements have not been identified, although it is expected that each excavation will include some LWD. Habitat enhancement excavations have been added to excavation sites where appropriate.

A description of the habitat conditions found at each of the excavation sites is provided in this section. These conditions will be delineated and quantified using the habitat mapping methodologies described in (NPE 2016). An updated set of aerial photos will be taken to ensure that unrelated changes occurring during the 2023 spring freshet are excluded from the analysis.

Terminology used in habitat descriptions are consistent with that used during the assessment phase and in the 2022 Vedder River Sediment Removal Habitat Assessment Report (NPE 2022).

### 7.1: Garrison Bar

Site Name: Garrison Bar Site Number: 1

**Identifier:** 23-45L **Coordinates:** 49.097141 ° N, -121.971359° W

Location: Garrison Bar is located approximately 500 m downstream of the Vedder Crossing

Bridge on the left side of the main channel.

Ownership: Provincial Crown



Previous Excavations (bar name/identifier): 2008 (Garrison, 08-46L), 2010 (Garrison, 10-45L)

Stockpile: City of Chilliwack Quarry on Vedder Mountain Road

Length: 268 m Width: 48.6 m Depth: 4 m

Expected Sediment Yield: 33,700 m<sup>3</sup>

## Bar Access and Stockpile

The City of Chilliwack Quarry is available to be used as a stockpile site for 2023. It is located on Vedder Mountain Road approximately 100 m west of the proposed access point from Vedder Mountain Road. There is direct access from Vedder Mountain Road onto the Rotary Trail which descends along the road embankment to the floodplain. The route then veers off the trail out onto unvegetated gravel bar. From the road to the gravel bar is approximately 150 m and the excavation site is a further 230 m over unvegetated gravel bar (Figure 2). The area between the road and the gravel bar is sparsely vegetated and will not require revegetation. There is one tree that may need to be felled along the edge of the gravel bar, and if so, should be replaced with several smaller trees of a similar species. The Rotary Trail includes a relatively new pedestrian bridge that will need to be safe-guarded and temporarily adapted to support heavy equipment. The bridge was constructed to accommodate flow from a new stream formed by an avulsion that occurred during the rainfall events of November 2021.

Under some conditions, a channel flows along the edge of the bar at the toe of the bank. A culvert may be needed at this location to accommodate potential rainfall flows related to the new channel.



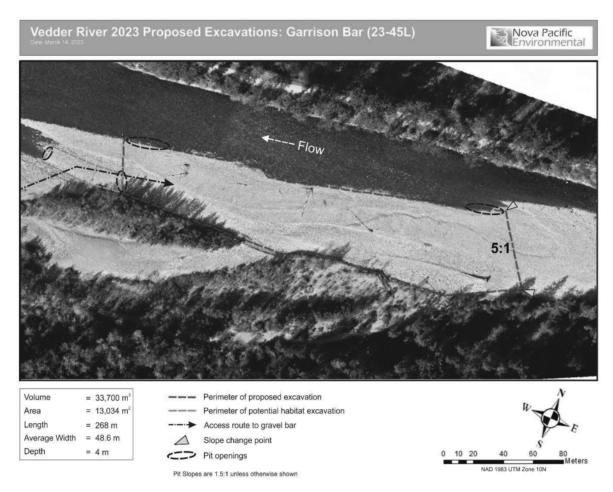


Figure 2: Garrison Bar excavation site.

## Objectives and Effectiveness

The main purpose of this excavation would be to intercept sediment upstream of the area of freeboard limitation. The bar is estimated to be 1 m in height above low water levels resulting in a 4 m excavation depth and higher yield of sediment.

# **Mitigation Plans**

The mitigation measures described in Section 4.0 of this document will be followed, particularly those related to hauling material. Measures including "stand-by" silt fencing, sediment traps, and strict maintenance will be incorporated to prevent input of sediment into the river or habitat channel related to any culverts that are required. Excavation design mitigation includes the gently sloped upstream end of the excavation and two wide openings to ensure fish to not become trapped. The excavation is located along a single glide between two riffles and options



for enhancements such as placement of LWD are limited. Figure 2 shows a habitat excavation that will be added as a habitat enhancement if conditions warrant at the time of excavation. This shallow channel will provide riffle habitat.

#### **Habitat Considerations**

The section of Garrison Bar that is planned to be excavated is adjacent to glide habitat and is in between two riffles.

#### Fish Habitat Utilization

This section of the river functions primarily as a migratory path for salmonids although some rearing of salmonid juveniles could be expected within the channel along the edges and downstream of riffles. Relatively high velocities and laminar flow limit conditions for spawning at this location. The distribution of pink and chum spawners in the Vedder River tends to be further downstream with almost all pink salmon found to be spawning in the Middle and Lower reaches of the Vedder River and upstream half of the Vedder Canal.

#### **Previous Outcomes**

There have been two previous excavations at Garrison Bar. In 2008, there was a slight decline (-1.4% change in habitat rating) in the habitat rating. In 2010, the habitat rating increased moderately (+3.8%) with improvements in wetted habitat with the addition of riffle's, shallows, glides, and runs.

## **Anticipated Outcome**

In 2023, we anticipate improved edge habitat along the right bank with some potential to establish a secondary channel along this bank. The excavation is intended primarily to retain material upstream, and this excavation is expected to refill with a similar configuration.

#### 7.2: Giesbrecht Bar

Site Name: Giesbrecht Bar Site Number: 2

**Identifier:** 23-42L **Coordinates:** 49.097114 ° N, -122.984648° W

Location: Approximately 800m upstream of the Giesbrecht stockpile site and directly across the

river from Peach Road.

Ownership: Provincial Crown



Previous Excavations (bar name/identifier): 1996 (Peach Road, 96-42R), 2008 (Peach, 08-41L),

2010 (Peach Road, 10-41/42L), 2016 (Giesbrecht, 16-41L)

Stockpile: Giesbrecht Stockpile

Length: 139 m Width: 44.9 m Depth: 4 m

Expected Sediment Yield: 21,400 m<sup>3</sup>

## Bar Access and Stockpile

The bar can be accessed from Giesbrecht Road along the dike to Giesbrecht stockpile and then briefly along Rotary Trail to the original access road. The original access road remains and continues to the downstream end of bar which can be accessed with one or two culverts. From there the access route follows along the unvegetated gravel bar for approximately 375 m to the downstream end of the excavation site (Figure 3). A previous access road may be followed to avoid damage to the Rotary Trail and for the final access to the bar. Some sections of this road may need to be widened and some woody debris will need to be removed. Although the route was last used in 2010, it remains mostly open. If established trees need to be removed, it is recommended that removed trees be replaced along the edges but not within the route. Some stakes could be added where the access route joins the unvegetated gravel bar.

The existing, large stockpile site is well away from the active channel and adjacent to the dike. Commencing about 50 m to the west, there is a series of enhanced groundwater-fed rearing ponds and a channel that connects to the mainstem river upstream of the campground. The campground is far enough from the stockpile site that interference is unlikely. Access is likely to require a single crossing of a small channel where the access route transitions on the bar.



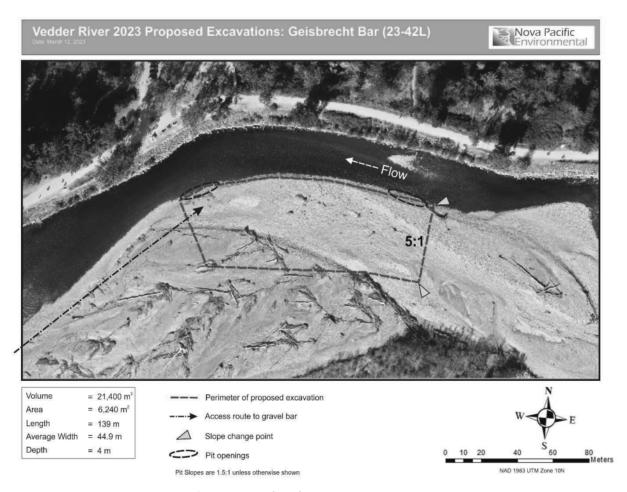


Figure 3: Giesbrecht Bar excavation site.

# Objectives and Effectiveness

The main purpose of this excavation would be to intercept sediment upstream of the area of freeboard limitation. The bar is estimated to be 1 m in height above low water levels resulting in a 4 m excavation depth and higher yield of sediment.

## **Mitigation Plans**

The mitigation measures described in Section 4.0 of this document will be followed, particularly those related to hauling material. Measures including "stand-by" silt fencing, sediment traps, and strict maintenance will be incorporated to prevent input of sediment into the river or habitat channel related to any culverts that are required. Culvert installation will be in accordance with appropriate BMP's. Excavation design mitigation includes the gently sloped upstream end of the excavation and two wide openings to ensure fish do not become trapped. The excavation is



located along a single glide between two riffles and options for enhancements such as placement of LWD are limited.

## **Habitat Considerations**

Habitats at this location include a riffle section, followed by a fast glide or run along the bar with a second riffle downstream. The main channel flows along the right bank, which is armoured. A secondary channel branches off well upstream of the excavation site and provides a diversity of habitats with good riparian vegetation. This is separated from the excavation area by a large, vegetated island. There are substantial log jams located on the bar surface that could provide refugia during higher flows. These will remain undisturbed.

#### Fish Habitat Utilization

This section of the river functions primarily as a migratory path for salmonids although some rearing of salmonid juveniles could be expected within the channel along the edges and downstream of riffles. Relatively high velocities and laminar flow limit the conditions for spawning at this location. The distribution of pink and chum spawners in the Vedder River tends to be further downstream with almost all pink salmon found to be spawning in the Middle and Lower Reaches of the Vedder River as well as the upstream half of the Vedder Canal.

#### **Previous Outcomes**

Giesbrecht has been excavated several times previously with generally neutral results. In 2016 (the most recent excavation), there was a loss of riffle, shallows, and gravel bar, however this was offset by a gain of secondary channel habitat, as well as glide and run habitat. The 2016 excavation also resulted in flow being directed away from the hardened right bank.

## **Anticipated Outcome**

It is expected that the pit will refill quickly, returning to the current configuration without significantly affecting any of the adjacent features. Habitat values before and after are expected to be similar.

#### 7.3: Peach Road Downstream Bar

Site Name: Peach Road D/S Site Number: 3

Identifier: 23-40R Coordinates: 49.096568° N, -122.993423° W



**Location:** Approximately 275 m downstream of Peach Park at the foot of Peach Road.

Ownership: Provincial Crown, and Private Ownership

Previous Excavations (bar name/identifier): 1996 (Giesbrecht, 96-40L), 2006 (Giesbrecht, 06-

40L), 2016 (Giesbrecht, 16-41L)

Stockpile: Hooge Stockpile

Length: 323 m

Width: 79.2 m

Width (habitat exc.): 25.3 m

Depth: 3.75 m

Depth (habitat exc.): 1 m

Expected Sediment Yield: 104,600 m<sup>3</sup> Expected sediment yield (habitat exc.): 5,300 m<sup>3</sup>

## Bar Access and Stockpile

Access is from the south end of Peach Road, 250 m west along the Rotary Trail (Figure 4). It is anticipated that there will be a new stockpile site located approximately 1.2 km downstream near Lickman Road, but this is pending approval. Alternatively, the material can be transported directly off-site.



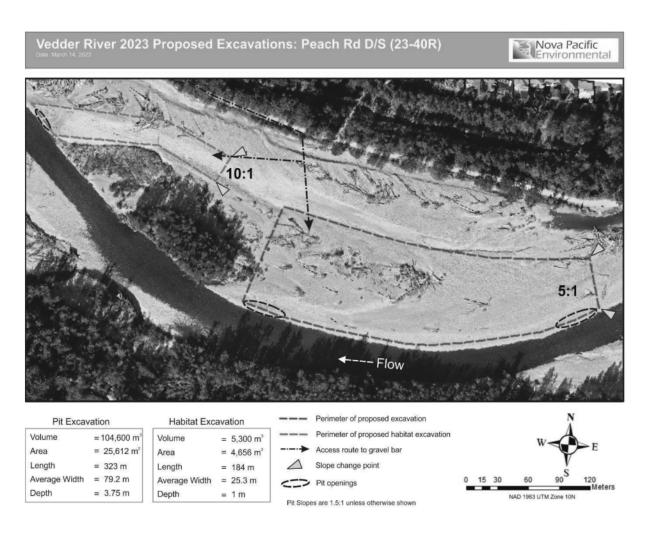


Figure 4: Peach Road D/S Bar excavation and habitat excavation.

## Objectives and Effectiveness

The purpose of this excavation is to trap sediment upstream of the freeboard limited area and limit erosion on the left bank. The habitat section of the excavation is intended to provide a channel fed by sub-gravel percolation during low flows for rearing and potentially some spawning. However, in the event that sub-gravel flows are less than anticipated, the resultant backwater will also contribute to habitat value.



## **Mitigation Plans**

The mitigation measures relating to access and excavation practices described in Section 4.0 of this document will be followed. Installation of a culvert will be required near the upstream end of the bar and a ramp will be constructed from the Rotary Trail down to the bar. Access from there, over the unvegetated gravel bar will be limited to a single track with pullout as needed. Installation of the culvert will be completed using appropriate BMP's that most effectively limit impacts on fish in that channel. Some LWD from within the excavation footprint will be keyed in at strategic locations along the bank and channel.

Despite the larger size of this excavation, it is consistent with the guidelines being located along a single glide feature with a section of riffles upstream and downstream. The site design also includes a gentle upstream slope.

#### **Habitat Considerations**

Peach Road D/S Bar is a large point bar with a secondary channel on the right. The LWD on the site is abundant, and there is a stand of cottonwoods on the bar just downstream of the pit, which was previously attached to the left bank. The habitat types adjacent to the deep pit excavation at Peach Bar are mainly glide with riffles upstream and downstream of the proposed excavation footprint.

Erosion along the left bank of the river is apparent as the flow is directed around the bar. Excavation of the bar will take some of the pressure off this bank and help to maintain the integrity of the bank without the requirement of armoring. Reduced erosion could allow riparian vegetation to colonize the area and limit the introduction of fine sediments into the river at this location.

#### Fish Habitat Utilization

The main channel fronting this excavation is used for fish migration and to a lesser extent for rearing and spawning. The cut bank opposite is eroding rapidly which limits its value as rearing habitat although the cover provided by LWD being recruited at this location and the overhanging cutbacks would be of high value if the erosion rate was lessened or if this bank became stable. The secondary channels on the right bank are expected to support significant amounts of chum spawning as well as rearing for juvenile salmonids.



#### **Previous Outcomes**

Most recently excavated in 2010, Peach Road excavations have typically resulted in either neutral results or in slight improvements to habitat. The 2010 excavation resulted in a positive outcome largely to due the addition of riffles and a reduction in bank erosion.

## Anticipated Outcome

The deep pit excavation is expected to refill without significantly changing the habitat configuration in the vicinity. The habitat excavation is anticipated to provide a groundwater fed channel or back channel which will contribute rearing and potential spawning habitat. Overall, impacts to fish are expected to be neutral with potentially significant gains from the habitat component of the excavations.

### 7.4: Lickman Bar

Site Name: Lickman Bar Site Number: 4

**Identifier:** 23-35R **Coordinates:** 49.116460° N, -122.090187° W

Location: Downstream of Lickman Vedder River Parking Lot.

Ownership: Provincial Crown

Previous Excavations (bar name/identifier): 1998 (Lickman, 98-34R), 2006 (Campground, 06-

34L), 2008 (Campground, 08-34L), 2008 (Lickman, 08-34M), 2016 (Lickman, 16-35M)

**Stockpile:** Hooge Stockpile

The Lickman excavation includes a deep pit excavation and a bar top removal with the following

parameters.

Length: 133 mLength (bar top): 251 mWidth: 42.1 mWidth (bar top): 34 mDepth: 4 mDepth (bar top): 1 m

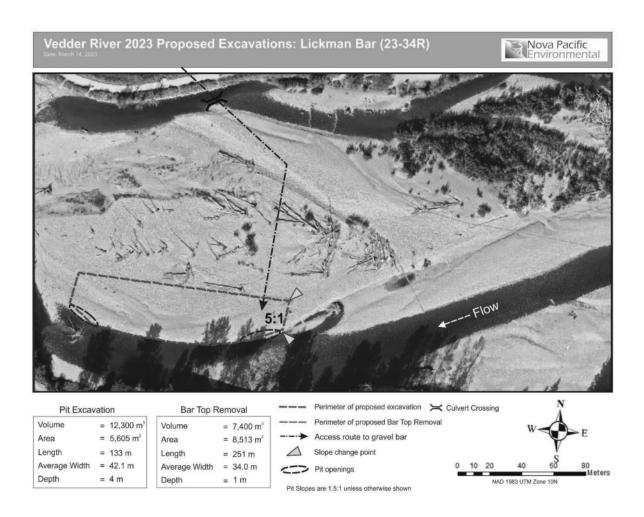
Expected Sediment Yield: 12,300 m<sup>3</sup> Expected Sediment Yield (bar top): 7,400 m<sup>3</sup>

#### Bar and Stockpile Access

Access to this site is from the parking lot at the end of Lickman Road, downstream along the Vedder River Rotary Trail for approximately 100 m (Figure 5). A ramp and culvert will be used to access the bar approximately halfway along. This location provides the easiest access and keeps the required culvert away from the steep bank providing for easier management of the crossing and minimizing the on-bar haul requirements.



There is no currently adjacent stockpile site, however, approval to use the hayfield 150 m downstream of Lickman Road is pending. In the event that this cannot be arranged it may be an option to travel along the setback dikes to the Hooge Stockpile. Alternatively, the material can be transported directly offsite.



**Figure 5**: Lickman Bar excavation site.

# Objectives and Effectiveness

The main objectives of this excavation are to trap sediment upstream of freeboard limited sections of the channel and to reduce flow pressures on the left bank. The bar top removal will also create riffle habitat and improve the connection of low flows to the secondary channel.



## **Mitigation Plans**

This excavation is very similar to the Peach Road excavation, immediately upstream, and the mitigation plans are similar. Installation of a culvert will be required near the downstream end of the proposed bar top removal area. Installation of the culvert will be completed using appropriate BMP's that most effectively limit any impacts on fish in that channel. Some LWD from within the excavation footprint or nearby, will be keyed in at strategic locations along the bank and channel.

The site design includes a gentle upstream slope for channel stability and two large openings to ensure easy passage in and out for fish. The bar top removal will be left dry with a slight berm at the upstream end. The objective is to allow a natural riffle shape to form during higher flows and avoid the potential for introduction of low flows that may stop and go prior to the onset of higher fall flows.

#### **Habitat Considerations**

The upstream section of the bar includes ample LWD as well as areas of established vegetation. There is a secondary channel that branches off at the upstream end of the bar. This channel provides a variety of habitat features before it rejoins the main channel downstream. The main channel along the bar is glide habitat with riffles at both the upstream and downstream ends. The excavation will not extend past the slope breaks upstream and downstream to prevent significant changes in the local morphology. As a result, the deep pit component of this site is confined to a small portion of the bar area.

#### Fish Habitat Utilization

As with Peach Road Bar, the main channel fronting this excavation is used for fish migration as well as rearing and spawning to a lesser extent. The cut bank on the opposite side is eroding rapidly. This limits its value as rearing habitat, although the cover provided by LWD and the overhanging cutbacks would be of high value if this bank became stable or if the erosion rate was lessened.

Previous assessments have shown pink and chum salmon spawning in the vicinity of XS35 near the proposed excavation, however the current configuration in the main channel appears to offer limited potential for spawning. Glide tail habitat located near the downstream end of the proposed excavation could support pink salmon spawning. The secondary channels on the right bank are expected to support significant amounts of chum spawning as well as rearing for juvenile salmonids.



Riffle habitats are located below the glide tail areas and within the microchannels crossing the bar. These areas support primary production of algae and macro-invertebrates, providing food to rearing salmon. The proposed Lickman Bar excavation is planned to limit changes to this basic geomorphology and protect the basic habitat characteristics of this section of the Vedder River. Riffle habitat areas are avoided because their control on water elevation upstream can be lost if they are bypassed, and this could cause potentially detrimental habitat changes.

The excavation at this location is expected to refill with most of the existing habitat features remaining largely unchanged.

#### Previous Outcomes

The excavations at Lickman have almost always resulted in habitat gains, usually due to an increase in habitat complexity, especially riffle, pool, edge, and shallows habitat. The most noteworthy excavation in terms of habitat gains was the 1998 excavation which produced significant increases in riffle, glide, and microchannel habitat.

## **Anticipated Outcome**

The deep pit excavation is expected to refill without significantly changing the habitat configuration in the vicinity. The scalp area may refill or remain as a riffle and continue to provide additional flow to the secondary channels along the right bank. The scalp provides channel capacity and hydraulic improvements and offers significant benefits for fish habitat if it remains as a riffle. Overall, impacts are expected to be neutral with potential significant gains from the scalp components of the excavations.

The scalp excavation will create riffle habitat and direct additional flow to the downstream half of the secondary channel. Mitigating erosion on the left bank at this location is expected to yield a small improvement of habitat edge properties on the left bank while increased flow to the right bank is expected to increase riffle habitat.

#### 7.5a: Brown Bar A

Site Name: Brown Bar A Site Number: 5

**Identifier:** 23-28L **Coordinates:** 49.098800° N, -122.022865 ° W **Location:** Approximately 450 m upstream of the stockpile at the north end of Bergman Rd.



Ownership: Provincial Crown Land

Previous Excavations (bar name/identifier): 1995 (Brown A, 95-30L), 1998 (Bergman B, 98-28L),

2002 (Bergman B, 02-28L) **Stockpile:** Bergman Stockpile

Length: 105 m Width: 18.1 m Depth: 3.5 m

Expected Sediment Yield: 4,300 m<sup>3</sup>

# Bar Access and Stockpile

Brown Bar A will be accessed from Brown Bar B. A culvert crossing will likely be required.

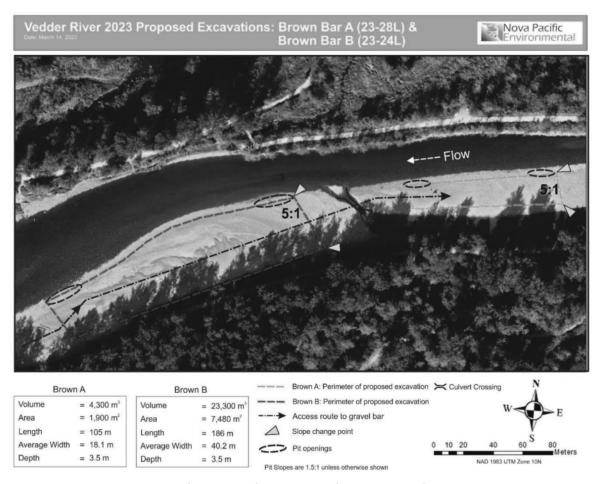


Figure 6: Brown A (Upstream) + Brown B (Downstream) excavation sites.

**Objectives and Effectiveness** 



The primary objective for this excavation is to remove sediment from a section of the river that is freeboard limited (XS26-XS28).

# **Mitigation Plans**

The mitigation measures described in Section 4.0 of this document will be followed, particularly those related to hauling material. Measures including "stand-by" silt fencing, sediment traps and strict maintenance would be incorporated to prevent input of sediment into the river or habitat channel related. If required, a culvert will be installed using appropriate BMP's that most effectively limit any impacts on fish in the channel between Brown Bars A and B.

#### Habitat Considerations

Brown A is located downstream of a riffle and is adjacent to glide habitat. There is also a microchannel on the left bank. A buffer will be left between the microchannel and the pit and the entrance to the microchannel will be deepened as required. The adjacent bank provides good overhanging cover that is particularly effective along the microchannel habitat upstream. The riparian vegetation will be left undisturbed.

#### Fish Habitat Utilization

In addition to salmon fry rearing, this section of the Vedder River has historically been an area that features heavy pink salmon spawning above riffles. There have also been chum redds documented in this section of the river.

#### **Previous Outcomes**

Brown Bar has not been excavated in recent years, primarily because the gravel more often deposits on the opposite bank downstream and this narrower section usually has very limited sediment availability. Excavations at this cross section have been met with neutral results, however in 2002 the excavation resulted in substantial habitat gains largely as a result of increases in microchannel habitat and other increases in habitat diversity.

# **Anticipated Outcome**



The anticipated result will be an increase in freeboard, as well as sediment trapping to prevent sediment from accumulating in other freeboard limited sections. It is expected that the current glide-riffle sequences will be retained.

#### 7.5b: Brown Bar B

Site Name: Brown Bar B Site Number: 6

**Coordinates:** 49.098282° N, -122.025540 ° W **Location:** Approximately 210 m upstream of the stockpile at the north end of Bergman Rd.

Ownership: Provincial Crown Land

**Previous Excavations:** There have not been previous excavations at this cross section, however Bergman Bar (24 L), has been excavated frequently over the years and Brown Bar upstream (30L have been excavated previously. In 1998 and 2002, excavations took place at cross section 28 but were referred to as Bergman B.

Stockpile: Bergman Stockpile

Length: 186 m Width: 40.2 m Depth: 3.5 m

Expected Sediment Yield: 23,300 m<sup>3</sup>

## Bar Access and Stockpile

Brown Bar B can be accessed from the Bergman Stockpile located at the north foot of Bergman Road by following the Rotary Trail northeast for approximately 100 m. An angled ramp will be constructed down to the bar surface. A culvert is not expected to be required at this location as the microchannel is deflected across the bar between Brown Bar A and B.

## Objectives and Effectiveness

The primary objective for this excavation is to remove sediment from a section of the river that is freeboard is limited (XS26-XS28), and to trap sediment upstream of other freeboard limited sections of the River.

## Mitigation Plans

The mitigation measures described in Section 4.0 of this document will be followed, particularly those related to hauling material. Measures including "stand-by" silt fencing, sediment traps and



strict maintenance, particularly at the ramp upon to the Rotary Trail would be incorporated to prevent input of sediment into the river or adjacent habitat channel.

#### **Habitat Considerations**

Brown Bar B is located upstream of a glide riffle sequence, and features overhanging riparian vegetation on the left bank. The pit will likely be excavated close to the bank to provide wetted habitat edge as the bar refills and potential further microchannel habitat.

#### Fish Habitat Utilization

In addition to migration and rearing habitat, this section of the Vedder River has exhibited medium to heavy pink and chum spawning in previous years.

#### **Previous Outcomes**

This cross section (on the right bank) has not been excavated before, however, the outcomes described for Bergman A would be representative the expectations at this site.

## Anticipated Outcome

The anticipated result will be an increase in freeboard, as well as sediment trapping to prevent sediment from accumulating in other freeboard limited sections. It is expected that the current glide-riffle sequences will be retained.

## 7.6: Railway Bar

Site Name: Railway Bar Site Number: 7

**Identifier:** 23-19R **Coordinates:** 49.092699° N, -122.035152° W

**Location:** Approximately 180 m upstream from the railway bridge

Ownership: Provincial Crown

Previous Excavations (bar name/identifier): 1994 (Railway, 94-19R), 1998 (Railroad, 98-19R), 2004 (Railway, 04-19R), 2006 (Railway, 06-18R), 2008 (Railway, 08-18R), 2010 (Railway 10-18R),

2014 (Railway, 14-20R), 2016 (16-19R), and 2022 (Railway, 22-19R)

**Stockpile:** Hooge Stockpile

Length: 129 m Width: 22.7 m Depth: 3.0 m

Expected Sediment Yield: 6,500 m<sup>3</sup>



## Bar Access and Stockpile

From Keith Wilson Rd, south on Sinclair Rd, then east along the setback dike to the parking area (Figure 7). Proceed west along the trail atop the bank protection works. (A trail bypass remains but vehicle access has been closed off and the old haul route has been redeveloped as a trail). The distance from the excavation site to the Hooge Stockpile adjacent to the parking area is about 750 m, which is on the Rotary Trail.

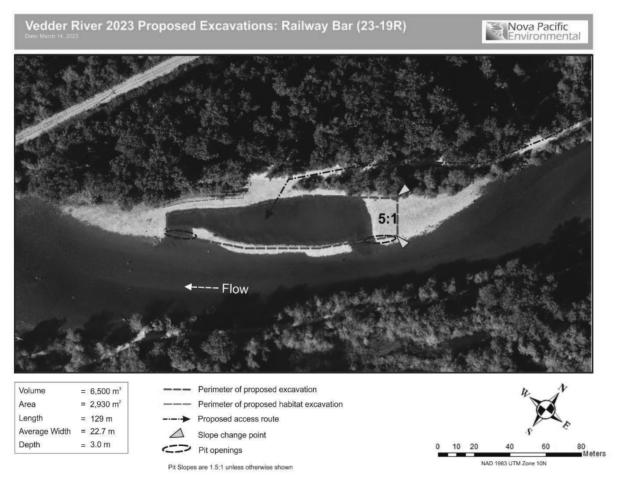


Figure 7: Railway Bar excavation.



## Objectives and Effectiveness

This excavation will reduce the amount of sediment moving downstream into a freeboard limited section of the river below the railway as well as address a slight limitation of freeboard at this location. Excavations at this location have typically refilled quickly and inclusion of this excavation is dependent on its refilling since the 2022 excavation.

## **Mitigation Plans**

The mitigation measures described in Section 4.0 of this document will be followed. A gentle upstream slope and wide openings will be constructed to limit risk of fish trapping within this excavation site.

Excavating the habitat channel at the downstream corner has typically been included to maintain the habitat values of the small channel downstream of the excavation. Recently, a culvert connection to off channel Salwein Creek habitat has been added. The channel will be excavated to allow for spawning and to maintain access. This work will be done in cooperation with the FVWC and is conditional on the support of the DFO Resource Restoration Branch who installed the culvert. Another option may be for the DFO Resource Restoration Branch to undertake this activity.

#### **Habitat Considerations**

Due to the flatter slope at this location, the pattern of glide, glide tail and riffle is less evident, however, there are slight glide-riffle sequences upstream and downstream of the proposed excavation. Immediately downstream of the excavation, on the right bank, there is an area of habitat edge with overhanging riparian vegetation and there is good quality riparian vegetation along the left bank.

## Fish Habitat Utilization

In 2016, the habitat area at the tail of the bar showed heavy chum salmon spawning.

In 2017, a significant area of pink salmon spawning was observed in the main channel downstream of the excavation area. This activity is associated with a glide tail/riffle sequence. The complex shallows habitat on the left bank is located above the riffle downstream so it also functions like a glide tail in attracting pink spawners. Some pink salmon spawning was also observed throughout the channel along the bar and in the backwater along the right bank at the downstream of the bar.



The diversity of habitat on the left bank provides lots of rearing opportunity for salmon fry and trout, but this area typically remains undisturbed by the activity at Railway Bar.

The habitat edges provide suitable rearing opportunities for salmonid fry. The opposite bank provides habitat complexity particularly where parts of the original bank armour has disintegrated providing cut bank and boulder clusters.

#### Previous Outcomes

Railway Bar has been the most frequently excavated bar over the years because it fills in a predictable manner, generally within a year. It provides an opportunity to excavate with very little risk to habitat and fish. It never requires a culvert and is also relatively easy to access and close to a stockpile site. Typically the excavations result in a modest improvement to the habitat habitat rating arising from increased habitat complexity that tends to decline over time as aggradation is ongoing in the area The 2016 excavation, for example, lead to a moderate habitat gain primarily as a result of an increase of glide edge and microchannel habitat, both of which had positive impacts on spawning habitat.

## **Anticipated Outcome**

Railway Bar is expected to refill so that it is very similar one to two years after the excavation. The work will result in less accumulation of sediment in freeboard limited sections of the channel immediately downstream and help to maintain flow capacity at the railway bridge. Only minor changes to the surrounding habitat configurations are expected as a result of this removal.

### 7.7: Greendale Bar

Site Name: Greendale Bar Site Number: 8

**Location:** Approximately 500 m upstream of the Greendale Stockpile

Ownership: City of Chilliwack

**Previous Excavations (bar name/identifier):** 1994 (Greendale, 94-4R), 1998 (Greendale, 98-4R), 2000 (Greendale, 00-4R), 2004 (Greendale, 04-5R), 2006 (Greendale, 06-4R), 2008 (Greendale, 08-4R), 2010 (Greendale, 10-6R), 2012 (Greendale, 12-6R), and 2022 (Greendale, 22-3R-4R)

Stockpile: Greendale Stockpile

**Length (d/s):** 294 m **Width (d/s):** 51 m



**Depth (d/s):** 3.5 m

Expected Sediment Yield (d/s): 43,900 m<sup>3</sup>

Site Name: Greendale Habitat Excavation Site Number: 9

**Identifier:** 22-3L **Coordinates:** 49.089703° N, -122.061449° W

**Location:** Approximately 400 m upstream of the Greendale Stockpile

Ownership: City of Chilliwack Stockpile: Greendale Stockpile

Length: 285 m Width: 29.7 m Depth: 1 m

**Volume:** 11,300 m<sup>3</sup>

### Bar Access

Along north dike access road from east end of Keith Wilson Bridge to parking area at Greendale Stockpile (Figure 8). Thence along the Rotary Trail to existing bar access point. One or two culverts may be required to access the excavation area.



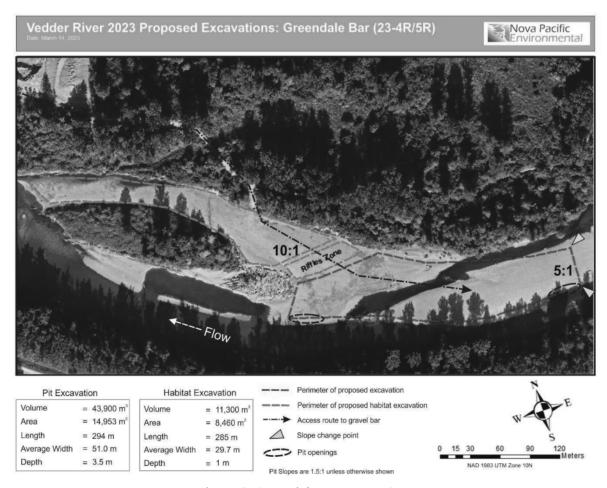


Figure 8: Greendale Bar excavation.

## Objectives and Effectiveness

The purpose of this excavation is to remove sediment from the downstream freeboard limited reach of the river. There are freeboard limitations immediately upstream and downstream of this site between cross sections 14 to 7 and 3 to 1. The downstream habitat excavation is intended to remove additional sediment whilst restoring flows to the secondary channel north of the vegetated island. This will increase the contribution of riparian habitat and increase the availability aquatic habitats in this secondary channel. In addition, the constructed riffle will also add to habitat value.



## **Mitigation Plans**

The mitigation measures described in Section 4.0 of this document will be followed. Measures including "stand-by" silt fencing, sediment traps and strict maintenance of these structures will be incorporated to prevent input of sediment into the river or habitat channel related to any culverts that are required. Excavated sediments will be allowed to drain as needed before transporting as a means to prevent runoff of silty water.

The two components of the excavation have been situated such that the integrity of the island, secondary channel and LWD complex are maintained.

#### **Habitat Considerations**

The main section of the Greendale Bar excavation has glide habitat along the left that is bounded by a glide tail and riffle downstream. The bank on the opposite side is armoured but has well established riparian vegetation. As the profile of the river is flatter, these features are less defined but continue to play a role in defining spawning locations. This site was the location of a bar top removal excavation in 2022 and it is anticipated that this area will continue to fill during the spring freshet. It is anticipated that the small channel crossing the excavation site will be dry during the excavation. In the event that it remains wetted during the excavation time frame design configuration changes may be required.

Greendale Bar is adjacent to a longstanding vegetated island which provides additional bank and riparian habitat. The flow splits around the island with the main flow on the left bank and a temporary channel along the right bank. During higher flows this channel provides riffle habitat at its upstream extent and glide habitat downstream. Until recently, the channel was flowing during much lower flows and previously had been a continuously wetted channel. The habitat excavation is intended to restore and help to maintain this feature. There is high-quality riparian habitat along both banks and the island.

#### Fish Habitat Utilization

Previously, a microchannel and LWD complex at the upstream end of the vegetated island provided excellent rearing opportunities for juvenile salmonids. However, with the gravel movement of November 2021, these features have been lost and the habitat functionality in the secondary channel is reduced. The secondary channel still provides habitat during higher flows, including refugia.



Pink salmon spawning habitat is abundant in this area, extending from the downstream end of Greendale Bar upstream along the full width of the main channel. along with the outer edge of the island and continuing to the upstream bar. However, this pattern has also changed since 2021, however, the extent of this influence will not be known until the 2023 spawning season. This section of the river also provides substantial opportunities for salmonid rearing.

#### **Previous Outcomes**

Greendale Bar excavations have typically led to habitat gains. The 2008 excavation accurately represents the typical changes that have been observed as a result of this excavation, which were increases in riffle, backwater, microchannel, glide tail, and LWD leading to a significant habitat gain.

## **Anticipated Outcome**

Greendale bar has been excavated at least nine times previously and has refilled in a similar fashion but with variation in the split around the island. It is expected that the bar will refill with a potentially persistent riffle habitat feature into the secondary channel which will be optimal for spawning. With a more substantial excavation in the secondary channel, it is anticipated that the feature will function as aquatic habitat during lower flows. It is also expected that this secondary channel, with the addition of LWD, will also provide rearing habitat for juveniles.

#### 7.8: Salad Bar

Site Name: Salad Bar Site Number: 9

**Location:** 100 m downstream of the Greendale Stockpile

Ownership: City of Chilliwack

Previous Excavations (bar name/identifier): 1994 (Salad, 94-2R), 2004 (Salad, 04-37CR), 2006

(Salad, 06-37CR), 2008 (Salad, 08-37CR), 2014 (Salad, 14-C37R), and 2022 (Salad, 22-C37R).

**Stockpile:** Greendale Stockpile

Length: 147 m Width: 29.5 m Depth: 3 m

Expected Sediment Yield: 9,300 m<sup>3</sup>

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This site was excavated in 2022 but has been noted to have substantially filled since. Further filling is anticipated in the Spring freshet.

## Bar Access

East along the north dike access road from the east end of Keith Wilson Bridge to the blocked Salad Bar access road 100 m west of the parking area at the Greendale Stockpile (Figure 9). The access road will need to be unblocked and crossing to the bar may require one or two culverts.



Figure 9: Salad Bar excavation site.

## Objectives and Effectiveness

Salad bar is located in the freeboard limited section and is expected to directly lower water levels in the area. Habitat priorities are to ensure that the pink salmon spawning habitat upstream and the existing habitat channel along the right bank are maintained.



As this excavation was completed in 2022, its inclusion in the program is subject to the refilling pattern that occurs in the winter and spring of 2023.

## Mitigation Plans

The mitigation measures described in Section 4.0 of this document will be followed. The excavation perimeter has been set back from the microchannel along the right bank to maintain the integrity of existing habitat. Excavation positioning and slopes will be set to ensure that the existing riffle configuration around this bar are maintained. As this bar has a low profile and may require a culvert crossing, measures including "stand-by" silt fencing, sediment traps at the crossing and strict maintenance would be incorporated as needed to prevent input of sediment into the river or habitat channel. Excavation of the upstream end of the microchannel will be undertaken again in 2023 due to the recently observed heavy input of sand, likely related to the additional sediment burden from November 2021.

#### **Habitat Considerations**

The primary habitat considerations at Salad Bar are the existing microchannel along the right bank and the availability of pink salmon spawning opportunities along the bar and upstream. There has typically been a "wedge" of sediment extending across the river from salad bar in a downstream direction, however, since 2018 and likely during the atmospheric river event, this appears to have moved upstream and is now apparent at the downstream end of Greendale Bar. Upstream of the wedge, there is extensive pink salmon spawning. Bank conditions provide complexity and LWD is present in the microchannel that provides instream cover and flow velocity reduction. The riparian vegetation along the right bank provides good cover and includes numerous large cottonwood trees.

LWD will be keyed in to the microchannel as appropriate. The existing habitat channel along the right bank will be enhanced at the upstream end of the bar. The existing access road extends right to the bank so no damage to riparian vegetation will occur.

### Fish Habitat Utilization

Rearing habitat for juvenile salmonids is present along the bank. There is significant overhanging vegetation as well as some LWD availability for cover. Pink salmon spawning is typically prolific in the area Immediately upstream of this bar. However, chum salmon spawning drops off here



compared to areas upstream, likely as the sediments are finer and sub sediment percolation lessens.

#### **Previous Outcomes**

Salad Bar excavations have typically produced mixed results, with either small losses or gains in wetted habitat. One positive outcome that has been typical of this excavation has been the improvement to microchannel habitat.

## **Anticipated Outcome**

Salad bar is expected to refill to the current configuration. Being downstream it may fill more slowly than some of the upstream bars. Increased riffle habitat may be achieved as the excavation fills in. Improvement and maintenance of the microchannel habitat is also anticipated.

#### 7.9: Keith Wilson Bar

Site Name: Keith Wilson Bar Site Number: 10

**Identifier:** 22-C25R **Coordinates:** 49.104567° N, -122.078431° W

Location: 100 m downstream of Keith Wilson Bridge

Ownership: City of Chilliwack

Previous Excavations (bar name/identifier): 2002 (Keith Wilson, 02-26canalR), 2006 (Keith

Wilson, 06-37CR), and 2016 (16-C29R)

Stockpile: to be determined

Length: 202 m Width: 46.3 m Depth: 3 m

Expected Sediment Yield: 26,600 m<sup>3</sup>

#### Bar Access and Stockpile

Access is from east end of Keith Wilson Bridge. There is a ramp on each side of the bridge down to the overbank area of the canal. The trucks can travel behind existing riparian habitat to the bar access point where a ramp down will be required. A culvert crossing may be required to access this bar.



Several stockpile sites may be available for use. Boundary Road Stockpile is closest but would require the trucks to cross Keith Wilson Bridge. Other stockpiles upstream will also have other uses and could require travel of up to 6 km in each direction.

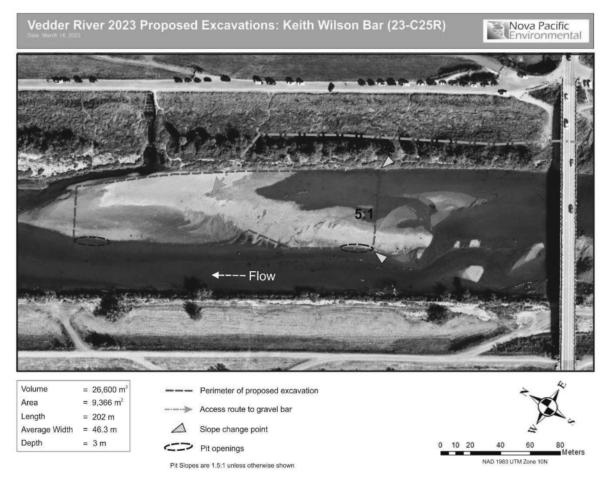


Figure 10: Keith Wilson Bar excavation site.

## Objectives and Effectiveness

To improve backwater curve reducing the flood risk potential upstream. Due to the low profile of this bar, it may be necessary to construct berms into the wetted perimeter at the start of the excavation. For the balance of the perimeter, the berms are normally just buffer strips that rely on the bar profile to maintain isolation however as this bar is very flat, it may be necessary to add material around the whole perimeter of the excavation. With the constructed berms, fish salvage will be undertaken as the wetted area is isolated.



## **Mitigation Plans**

The mitigation measures described in Section 4.0 of this document will be followed, particularly in relation to culverts. The excavation area has been extended right to the bank to restore habitat edge value and set the stage for reestablishment of the microchannel along the left bank. Measures including "stand-by" silt fencing, sediment traps, and strict maintenance would be incorporated to prevent input of sediment into the river or habitat channel related to any culverts that are required.

#### **Habitat Considerations**

The upstream end of the bar will be maintained to retain the complexity and the direction of the thalweg upstream of the bar. The excavation is designed to restore value to the right bank either by providing bank edge or microchannel habitat. Coordination with outflows from the Pump station may be required to ensure that the downstream end of the excavation is not eroded by discharges.

### Fish Habitat Utilization

Keith Wilson Bar still shows the typical gravel deposition pattern of the sites discussed above with a slight slope break upstream and downstream of the excavation and a deeper glide between. There is also a microchannel along the right bank although this is atypical because it is intermittently flooded with the discharge from the adjacent pump station.

The configuration is similar to the glide tail/riffle paired habitats noted in the sites discussed above. However, due to the lower flow velocity and flatter slope these habitat features are not obvious and do not meet the definitions or functionality of their upstream counterparts.

Keith Wilson Bar is located downstream of the zones in which chum salmon spawning has been noted. This is likely due to a combination of factors including streambed shape, flow velocities and substrate which is generally too fine for spawning. However, riffles, glide tail and pool habitat upstream of the bar provide spawning habitat for pink salmon.

The banks on both sides of the canal, while not heavily treed, still provide good riparian conditions due to a well-developed layer of shrubs, and non-woody plants. Snorkel surveys have noted salmon fry using this type of edge habitat within the Vedder Canal.

#### Previous Outcomes



The first two excavations at Keith Wilson resulted in neutral habitat outcomes, however the most recent habitat excavation in 2016 resulted in substantial habitat gains largely as a result of an increase in wetted habitat (increased microchannel habitat) and overall habitat complexity.

In 2016, erosion of the berm was caused by discharge from the pump station. To avoid this in 2023, it is recommended that the discharge be directed away using silt cloth. This can be set up as a barrier or laid directly on the substrate at risk of erosion.

## Anticipated Outcome

The bar will slowly refill. Habitat conditions along the right bank will be improved by the proximity of deeper water. Ideally, a microchannel will form along the right bank as the excavation refills. The habitat complexity of shallows and riffles on the left side the excavation should be maintained.

## 7.10: Boundary Bar

Site Name: Boundary Bar Site Number: 11

Location: 800 m downstream of Keith Wilson Bridge

Ownership: City of Abbotsford

Previous Excavations (bar name/identifier): 2002 (Boundary, 02-23canalL), 2014 (Boundary, 14-

C23L), and 2022 (Boundary, 22-C22L) **Stockpile:** Boundary Road Stockpile

Length: 230 m Width: 38.3 m Depth: 3 m

Expected Sediment Yield: 22,300 m<sup>3</sup>

#### Bar Access

Northwest along the left bank dike road from the Fisherman's Corner parking lot at No. 2 Road and Boundary. A ramp down from the dike top to the low bank and then a second ramp down to the bar would be required. This access was utilized in 2022. A culvert may be required to cross the microchannel along the left bank.



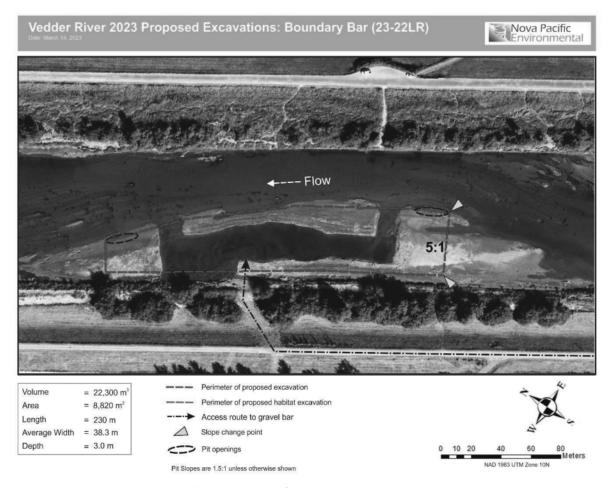


Figure 11: Boundary Bar excavation site.

## Objectives and Effectiveness

To improve the backwater curve, reducing risk of dike overtopping upstream in the freeboard limited section of the Vedder River. Due to the low profile of this bar, it may be necessary to construct berms into the wetted perimeter at the start of the excavation. Typically, the berms are just buffer strips between the excavation and the wetted channel that rely on the bar profile to maintain isolation. With the constructed berms, fish salvage will be undertaken as the wetted area is isolated.

## Mitigation Plans

The mitigation measures described in Section 4.0 of this document will be followed, particularly those related to hauling material. Measures including "stand-by" silt fencing, sediment traps and strict maintenance will be incorporated to prevent input of sediment into the river or



microchannel. Where appropriate, material will be excavated and allowed to drain prior to being loaded onto the haul trucks.

Habitat enhancements will be added along the upstream length of the microchannel including deepening of shallow sections and addition of LWD.

#### **Habitat Considerations**

Despite limited cover and shallow depths, the left bank microchannel supports juvenile salmonids and other fish. The alternating bar configuration in the canal reach provides a variety of edge habitats but due to the low profile and fine substrates spawning is limited or absent. Maintaining the integrity of the individual bars nonetheless remains important to minimize disruption of habitat values in the reach.

### Fish Habitat Utilization

Boundary Bar does not provide opportunities for chum or pink salmon spawning, due to relatively slower flows and fine substrate size. As with other canal reach bars, there is limited riparian vegetation and LWD along the edges of Boundary Bar. The canal section of the Vedder River in general is primarily used by salmonids for migration to and from spawning areas upstream along with some rearing habitat opportunities for salmon fry noted along the bar edges.

#### Previous Outcomes

Boundary has had three past excavations, with the most recent excavation occurring in 2022 (results still to be determined). Out of the first two excavations there was one excavation with a reduced habitat rating, and one excavation with an increased habitat rating. These changes were due to decreases and increases in riffle and glide habitats respectively.

## **Anticipated Outcome**

Presence of fines and woody debris have limited the excavation depth at this site during previous excavations. It is expected this excavation will improve water levels upstream through removal of a significant amount of sediment from the canal section of the Vedder River. Impacts to fish add fish habitat are expected to be neutral at this excavation site. Excavation at this site is based on expected refilling from the 2022 excavation. Potentially, a remnant of the 2022 pit could alter or prevent the excavation proposed at this location.



## 7.11: Chadsey Bar

Site Name: Chadsey Bar Site Number: 12

Location: 1,500 m downstream of Keith Wilson Bridge

Ownership: City of Chilliwack

Previous Excavations (bar name/identifier): 2002 (Chadsey, 02-19canalR)

**Stockpile:** to be determined

Length: 325 m Width: 37.6 m Depth: 3 m

Expected Sediment Yield: 31,100 m<sup>3</sup>

## Bar Access and Stockpile

Northwest along the right bank dike road from the Keith Wilson Bridge (Figure 12). A ramp down from the dike top to the low bank and then a second ramp down to the bar would be required. A culvert may be required to cross the microchannel along the right bank.

Several stockpile sites may be available for use. Boundary Road Stockpile is closest but would require the trucks to cross Keith Wilson Bridge. Other stockpiles upstream will also have other uses and could require travel of up to 7.2 km in each direction.



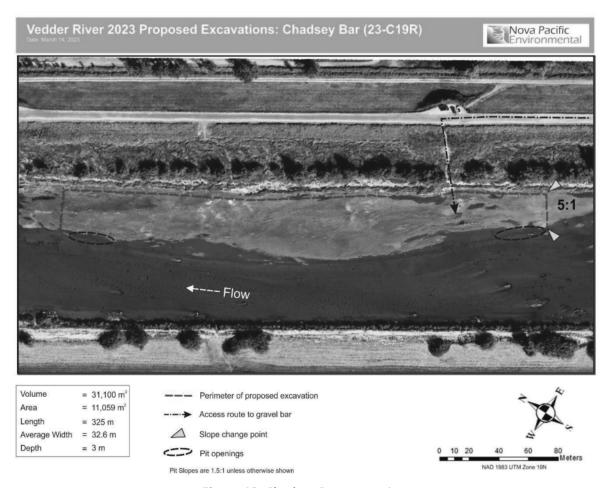


Figure 12: Chadsey Bar excavation.

## Objectives and Effectiveness

The primary objective of this excavation is to improve the backwater curve, reducing risk of dike overtopping upstream in the freeboard limited section of the Vedder River. The secondary objective of the excavation is to excavate and enhance the microchannel adjacent to the right bank.

## **Mitigation Plans**

The mitigation measures described in Section 4.0 of this document will be followed, particularly those related to hauling material. Measures including "stand-by" silt fencing, sediment traps, strict site maintenance and allowing excavated material to drain prior to loading the trucks will be incorporated to prevent input of sediment into the river or microchannel.



Habitat enhancements will be added along the length of the bank including deepening of shallow sections and addition of LWD. Where no edge features are available, excavation may extend right to the bank with a shelf left to support reformation of habitat edge or microchannel habitat. For this excavation the pit will extend to the habitat edge features.

#### **Habitat Considerations**

Despite limited cover and shallow depths, the right bank in this section of the canal supports juvenile salmonids and other fish. Currently the section at Chadsey Bar is dry during low flow conditions. The alternating bar configuration in the canal reach provides a variety of edge habitats but due to the low profile and fine substrates spawning is limited or absent. Maintaining the integrity of the individual bars nonetheless remains important to maintain habitat values in the reach.

## Fish Habitat Utilization

This section of the Vedder River provides key migratory and rearing habitat but is not known to support spawning. LWD structures and cut bank areas in the vicinity of Chadsey Bar provide habitat for juvenile rearing.

#### Previous Outcomes

Chadsey Bar was excavated once in 2002 and resulted in a moderate habitat gain due to gains in habitat edge and glide habitat.

## **Anticipated Outcome**

This excavation is expected to significantly improve water levels upstream through removal of a significant amount of sediment from the canal section of the Vedder River. It is anticipated that the impacts of this excavation will improve fish habitat along the right bank by deepening and lowering the riverbed at this location.



## 8.0: OFFSETTING AND MITIGATION

Following the flood of 1975 and subsequent setback dike construction, the Vedder River Management Area Plan identified the ongoing need to remove sediment and to maintain fish habitat within the river.

Since 1994, mapping of habitats has shown that the ongoing removal program, as it has been executed, has allowed habitat values to persist. A higher percentage of excavations showing an increase in habitat value from pre to post suggests that ongoing aggradation tends to lower the habitat ratings and that periodic excavation allows an increase in habitat ratings. The adaptive system of constraints, guidelines and planning procedures in use since 1998 has provided a successful approach for meeting floodway capacity objectives while maintaining habitat values. Standard mitigation measures including excavation site slopes, excavation outside of flowing waters, and location of site in relation to existing river features including sensitive habitat have resulted in a mostly positive or neutral set of outcomes across the 95 previously completed excavations. It is worth noting that the changes to the river in the post excavation period are attributable to the freshet conditions and the volume of sediment moved as well as the excavations themselves. While these effects are not readily separated, natural changes may outweigh those that appear to be related to the excavations. However, in designing and evaluating individual excavations consideration of how the changes caused by the excavation influence the natural processes is needed to ensure that the excavation strategy that meets the habitat objectives.

Overall, this approach has resulted in no net loss of habitat (Wright et al 2018). However, since there is some risk of a negative outcome at some sites as well as potential short term negative effects due to the mechanics of implementing the sediment removal program, (e.g. culvert crossings, pit openings and bar access) a mix of habitat excavation and enhancement activities are built into each individual excavation.

Habitat enhancement consists primarily of placement of LWD, deepening entrances to secondary channels, complexing secondary channels, creating riffles, particularly at inlets and outlets to excavation sites, and providing habitat focused excavations in conjunction with the larger pit type excavations. Placement of LWD is dependent on local supply and opportunity for placement but typically most sites allow a few LWD complexes consisting of one to three pieces. Key LWD features created will be georeferenced and tracked. Additional placements in less desirable locations may be completed, but not tracked. Entrances to channels are deepened as required to ensure that secondary channels continue to flow. Channel enhancements are undertaken



when previously existing channels have filled or when temporary channels can be effectively deepened. An additional benefit arises where sub gravel flows can be enhanced by deepening channels adjacent to excavations. Typically, one or two significant channel improvement projects are undertaken in each cycle. For 2023, this includes major habitat excavations at Peach Road Bar, and Greendale Bar, as well as microchannel enhancements at Brown Bar (A and B), Salad Bar, Keith Wilson Bar, Boundary Bar, and Chadsey Bar.

Specific offsets planned for each site and mitigations of the temporary impacts have been incorporated into the excavation design. Due to the nature of the river and the large amount of sediment movement, the impacts and benefits of these activities are uncertain. There is also potential for spring freshet changes to alter the conditions so that planned habitat work is not feasible or desirable. As with the excavation footprints, final design of the habitat focused activities may require modification in the field. Should this be the case, changes to the habitat work will be discussed along with the habitat mapping following the 2023 spring freshet.



## 9.0: CONCLUSION

Fish utilize a wide variety of habitats in the Vedder River and are present in wetted habitats adjacent to each proposed excavation. The pattern of that usage is correlated to habitat types that are the focus of the ongoing assessment and management of the Vedder River Sediment Removal Program. The program relies on careful and detailed application of the excavation design guidelines to avoid detrimental impacts to these habitats and to ensure that high habitat values are maintained in the Vedder River despite the high rate of natural and anthropogenic change.

A habit balance statement is not included with this submission primarily due to the fact that the amount of habitat is constant throughout the process and only the quality varies. So post excavation assessment demonstrates that each individual bar is either positive negative or neutral and historically the vast majority of the excavations result in a positive or neutral outcome. Even the negative ones reflect a reconfiguration of habitat types that falls within the normal variations in the river. An example of the assessment protocol that has been followed has been submitted along with this application (Wright et al 2018).

The proposed work is expected to substantially meet the program objectives to increase flow conveyance and improve dike freeboard with no net loss in fish habitat.



## 10.0: REFERENCES

BC Ministry of Environment. (n.d.). BC Species and Ecosystems Explorer database *Available at:* <u>http://a100.gov.bc.ca/pub/eswp/</u>

BC Ministry of Environment. (n.d.). Fish Inventory Data Queries (FIDQ) database Available at: http://www.env.gov.bc.ca/fish/fidq/

BC Ministry of Forests, Lands and Natural Resource Operations (MFLNRO). (2016). Change Approval for 2016 Vedder River Sediment Removal (dated August 8, 2016)

EBA Tetratech, 2015. VEDDER RIVER MANAGEMENT AREA PLAN UPDATE Vedder River Management Area Committee (VRMAC). Available at: http://vedderriver.ca/

Groot, C. and L. Margolis. (1993). Pacific Salmon Life Histories. UBC Press. Vancouver, BC.

Kerr Wood Leidal Associates, Ltd. (KWL). (2020). 2020 Hydraulic Assessment of the Vedder River.

Kondolf, G. Mathias, Smeltzer, Matt and Kimball, Lisa. (2002). Freshwater Gravel Mining and Dredging Issues. white paper prepared for Washington Department of Fish and Wildlife Washington Department of Ecology Washington Department of Transportation by the Center for Environmental Design Research at University of California, Berkeley

MacIssac, E. A. (n.d.). Salmonids and the Hydrologic and Geomorphic Features of their Spawning Streams in British Columbia.

Available at: https://www.for.gov.bc.ca/hfd/pubs/docs/Lmh/Lmh66/Lmh66 ch14.pdf

Nova Pacific Environmental, Ltd. (NPE). (2017). Proposed 2017 Soowahlie First Nations Chilliwack River Bank Armoring Continuation

Vedder River Management Area Committee (VRMAC). (2020). Vedder River Information Webpage

Available at: http://vedderriver.ca/

Wright, B.F. and T. Kozlova. (2016). 2016 Vedder River Sediment Removal Environmental Monitors Report. Prepared for the Vedder River Management Area Committee.

Wright, B.F., T. Kozlova, and M. Richard. (2018). 2016 Vedder River Sediment Excavations Habitat Changes and Environmental Impacts. Prepared for the Vedder River Management Area Committee.



# APPENDIX A - LIST OF VEDDER RIVER ENVIRONMENTAL REPORTS PREPARED BY NPE FROM 1994 to 2016



# COMPENDIUM OF VEDDER RIVER ENVIRONMENTAL REPORTS PREPARED BY NPE FROM 1994-2016 Most of these reports are available at: <a href="http://vedderriver.ca/">http://vedderriver.ca/</a>

- Wright, B.F. and M. Robinson. (1994). Environmental Monitors Report Vedder River Gravel Removal Project 1994. Prepared for the Ministry of Environment and Vedder River Management Committee. 16 p.
- 2. Wright, B.F. and M. Robinson. (1995). Assessment of the Environmental Impacts from 1994 Vedder River Gravel Bar Excavations. Prepared for Ministry of Environment Lands and Parks, District of Chilliwack, City of Abbotsford. 13 p.
- 3. Wright, B.F. and M. Robinson. (1995). Vedder River Gravel Removal Environmental Monitor's Report 1995. Prepared for Ministry of Environment Lands and Parks, District of Chilliwack, City of Abbotsford. 14 p.
- 4. Wright, B.F. (1997). Evaluation of Habitat Changes and Environmental Impacts Following the 1995 Gravel Excavations. Prepared for B.C. Ministry of Environment Lands and Parks. 24p.
- 5. New Pacific Ventures. (1999). Habitat Changes and Environmental Impacts Following 1996 Gravel Excavations on the Vedder River. Prepared for the Vedder River Management Committee. 22 p.
- 6. New Pacific Ventures. (1999). Habitat Changes and Environmental Impacts Following the 1997 Gravel Excavations on the Vedder River. Prepared for the Vedder River Management Committee. 9 p.
- 7. Scholz, P.S., Wright, B.F., M.C. Robinson, and V. Galay. (2001). Habitat Changes and Environmental Impacts Following 1998 Gravel Excavations on the Vedder River. Prepared for the Vedder River Management Area Committee. 45 p.
- 8. Wright, B.F. (1999). Gravel Removal Constraints, Guidelines, and Planning Procedures for the Protection of Fish Habitat: The Vedder River Floodway Protection Program 1994 to 1998 Working Document. Prepared for the Vedder River Management Area Committee. 48 p.
- Wright, B.F. and P.S. Scholz. (2003). Habitat Changes and Environmental Impacts Following 2000 Gravel Excavations on the Vedder River. Prepared for the Vedder River Management Area Committee. 35 p.
- Scholz, P.S. and B.F. Wright. (2003). Environmental Monitors Report on 2002 Excavations of Gravel Bars on the Vedder River. Prepared for the Vedder River Management Area Committee. 72 p.
- Patton, T., Scholz, P.S. and B.F. Wright. (2005). Habitat Changes and Environmental Impacts Following 2002 Gravel Excavations on the Vedder River. Prepared for the Vedder River Management Area Committee. 33 p.



- Carl, C., Wright, B.F. and T. Patton. (2005). 2004 Vedder River Gravel Excavations Environmental Monitors Report. Prepared for the Vedder River Management Area Committee. 21 p.
- 13. Murray, R. and B.F. Wright. (2007). Assessment of Fish Habitat Changes in the Vedder River Following Gravel Excavations in 2004 and a Review of the Assessment Methodology. Prepared for the Vedder River Management Area Committee. 35 p.
- 14. Coe, K., Wright, B.F. and R. Murray. (2007). 2006 Vedder River Gravel Excavations Environmental Monitors Report. Prepared for the Vedder River Management Area Committee. 29 p.
- 15. Nova Pacific Environmental. (2008). Post Excavation Assessment of 2006 Vedder River Gravel Excavations. Prepared for the Vedder River Management Area Committee. 57 p.
- 16. Nova Pacific Environmental. (2008). 2008 Vedder River Gravel Excavations Environmental Monitors Report. Prepared for the Vedder River Management Area Committee.
- 17. Wright, B.F., P.S. Scholz and K. DeBoer. (2010). 2008 Vedder River Gravel Excavations Habitat Changes and Environmental Impacts. Prepared for the Vedder River Management Area Committee.
- 18. DeBoer, K. and B.F. Wright. (2010). 2010 Environmental Monitors Report. Prepared for the Vedder River Management Area Committee. 48 p.
- Wright, B.F., and T. Kozlova. (2012). 2010 Vedder River Gravel Excavation Habitat Changes and Environmental Impacts. Prepared for the Vedder River Management Area Committee.
- 20. Kozlova, T. and B.F. Wright. (2010). 2012 Vedder River Sediment Removal Environmental Monitors Report. Prepared for the Vedder River Management Area Committee.
- 21. Wright, B.F., T. Kozlova, and C. Hegele. (2014). 2012 Vedder River Gravel Excavations Habitat Changes and Environmental Impacts. Prepared for the Vedder River Management Area Committee.
- 22. Wright, B.F. and T. Kozlova. (2014). 2014 Vedder River Sediment Removal Environmental Monitors Report. Prepared for the Vedder River Management Area Committee.
- 23. Wright, B.F., T. Kozlova, and D. Campbell. (2016). 2014 Vedder River Gravel Excavations Habitat Changes and Environmental Impacts. Prepared for the Vedder River Management Area Committee.
- 24. Wright, B.F. and T. Kozlova. (2016). 2016 Vedder River Sediment Removal Environmental Monitors Report. Prepared for the Vedder River Management Area Committee.
- 25. Wright, B.F., T. Kozlova, and M. Richard. (2018). 2016 Vedder River Gravel Excavations Habitat Changes and Environmental Impacts. Prepared for the Vedder River Management Area Committee.



## **Date and Signature Page**

The effective date of this report titled "Proposed 2023 Vedder River Sediment Removal Project" is March 20, 2023.

Signed,

Bruce F. Wright, B.Sc. MBA, RPBio

Dated: March 20, 2023

Signed,

Rob Akester, B.Sc., RPBio

Dated: March 20, 2023



## **Change Approval and Notification (Changes In and** About a Stream)

Tracking Number: 100415064

## **Applicant Information**

If approved, will the authorization be issued to an Individual or Company/Organization?

Company/Organization

What is your relationship to the

Consultant

Company/Organization?

#### APPLICANT COMPANY/ORGANIZATION CONTACT INFORMATION

Applicant is an Individual or an Organization to whom this authorization Permit / Tenure / Licence will be issued, if approved.

Name: Ministry of Environment and Climate Change Strategy **Doing Business As:** Ministry of Environment and Climate Change Strategy

Phone: 778-704-7278

Fax:

Gulraiz.Cheema@gov.bc.ca Email:

**BC Incorporation Number:** Extra Provincial Inc. No:

**Society Number:** 

**GST Registration Number:** 

**Contact Name:** Gulraiz Cheema

**Mailing Address:** 9337 Stn Prov Govt, Victoria, B.C.

Victoria BC V8W 9M1

#### **CONSULTANT INFORMATION**

Please enter the contact information of the Individual/Organization who is acting on behalf of the applicant.

Name: NOVA PACIFIC ENVIRONMENTAL LTD.

**Doing Business As:** Nova Pacific Environmental

Phone: 604-251-5216

Fax:

bfw@novapacific.net Email:

**BC Incorporation Number:** 

Extra Provincial Inc. No: Vancouver

**Society Number:** 

**GST Registration Number:** 

**Contact Name:** Stefanie Schoenberger 97 Renfrew Street N **Mailing Address:** Vancouver BC V5K3N6

Letter(s) Attached: Yes (Letter\_of\_Appointment\_MOF- signed.pdf)

## **CORRESPONDENCE E-MAIL ADDRESS**

If you would like to receive correspondence at a different email address than shown above, please provide the correspondence email address here. If left blank, all correspondence will be sent to the above given email address.

Email: bfw@novapacific.net

Contact Name: **Bruce Wright** 

## **ELIGIBILITY**

Please answer the following questions related to your Change Approval/Notification.

Answer Warning Is this application to support oil and gas activity that is being No authorized by the Oil and Gas Commission?

Is your application for a funded high-speed internet Nο Connectivity Project?

Tracking Number: 100415064 | Version 1.0 | Submitted Date: May 5, 2023

Is this application in relation to increasing the solution housing units within British Columbia?  A Housing related project, for the purpose of the must be for a specific development and the demust increase the number of housing units on land/property.	is application, evelopment	
TECHNICAL INFORMATION		
SOVERNMENT AND FIRST NATION FEE EXEMP	TION REQUEST	
Do you belong to, are you applying on behalf of, o	or are you:	
A provincial government ministry		
The Government of Canada		
A First Nation for water use on reserve land		
A person applying to use water on Treaty Lands		
A Nisga'a citizen		
An entity applying to use water from the N	isga'a Water Reservation?	
	Yes	
Are you an existing exempt client? Please enter your client number: Fee Exemption Category: Please enter any supporting information that will assist in determining your eligibility for a fee exemption. Please refer to help for details on fee exemption criteria and requirements.	Yes 167706 British Columbia Government Ministry The Ministry of Environment and Climate Change Strategy is the proponent for this project and Nova Pacific Environmental is acting as their agent in this regard.	
APPLICATION BY GOVERNMENT		
Are you, or are you applying on behalf of, a government entity?  What type of government are you applying for?	government OR you are working on behalf of the government.  Yes  Provincial Government	
YPE OF WORKS		
ease select the type of Notifications/Approvals you want to apply for as part of this application.		

Please select the type of works	Notification
to be undertaken:	☐ Road Crossing Culvert - Construction / Maintenance / Removal
	☐ Clear Span Bridge - Construction / Maintenance / Removal
	☐ Pipeline Crossing – Construction / Maintenance
	☐ Dry Hydrant – Construction / Maintenance
	☐ Pier, Wharf, (including docks) – Construction / Maintenance / Removal
	☐ Cutting of annual vegetation in a stream channel
	☐ Dike or Erosion Protection Works - Repair / Maintenance
	☐ Storm Sewer Outfalls – Construction / Maintenance
	☐ Control of Eurasian Watermilfoil or other invasive aquatic vegetation
	☐ Ice Bridge / Winter Ford or Snowfill - Construction / Maintenance
	☐ Maintenance of minor and routine nature by a public utility

		l of a beaver dam (as authorized under the Wildlife Act) ction of a temporary ford		
	☐ Constru	ction of a temporary diversion around a worksite		
	Notification Columbia:	may only be undertaken by the Crown in right of either Canada or British		
	☐ Flow or v	vater level measuring device - Construction / Maintenance / Removal e or screen, fish or game guard - Construction / Removal tat - Restoration / Maintenance		
	Municipality	may only be undertaken by the Crown in right of either British Columbia or a  /: hannel - Restoration / Maintenance		
	For the following two options, you must report the changes to a habitat officer within 72 hours after making the change. You must comply with any Terms and Conditions specified by the habitat officer that relate to Section 44(2) of the Water Sustainability Regulation.  ☐ Clearing of an obstruction from a bridge or culvert during a flood emergency  ☐ Construction of placement of erosion protection works or flood protection works during a flood emergency			
	Approval:			
☐ Bridge (o☐ Stream I		bris Removal by machine - Plan required		
		No		
Columbia NOTE: Answer the questi	on below as I	nis constitutes a Notification or a Change Approval lies with the Province of British  No. The Dike Maintenance Act (DMA) Approval application is currently transitioning to  This question will be updated once the transition is complete.		
SITES				
Click on the Add Sites button to add	one or more	sites.		
SITE				
Location ID:		Boundary Bar		
STREAM				
Name of the Stream: Source Flows Into:		Vedder River Fraser River		
PROPOSED WORKS				
Detailed Description of Works:		Detailed documentation on the rationale for the 2023 sediment removal program is provided in supporting documents attached to this application.		
		Due to the substantial sediment input from November 2021, KWL and NPE have identified11 bars with a combined total removable volume of 354,700 m3 for the 2023 sediment removal cycle. Boundary Bar site accounts for 6.3% of this total.		

Decisions to alter specific sites will be based on potential changes that may occur during the 2023 spring freshet, agency reviews, site specific effectiveness, habitat protection and enhancement considerations, and logistics. This could lead to significant variation in the total volume or the volume for any specific site; however, the total removal will not exceed 354,700 m3.

Hydraulic modeling shows the 1:200 year flood profile of the Vedder River and Canal has increased (KWL 2023). Several areas in the Middle and Lower Reach of the river as well as the upper end of the canal do not meet the provincial dike freeboard requirement of 0.75 m. The 2023 proposed excavations will address these freeboard limitations, limit future movement of excess sediment from the November 2021 atmospheric event into these areas and help to restore the river to the conditions prior to that event.

One of the objectives of the 2023 excavation cycle will be to excavate in a way that mitigates risk to pink salmon spawning areas. In particular, it is important to select excavation site locations and establish a site design that will not upset the glide-glide tail-riffle sequences that support the glide tail habitat pink salmon rely on for spawning. As pink salmon head directly downstream upon emergence as fry, this is a key element to sustain during the excavations.

Using an excavator and gravel trucks, 22,300 m3 will be removed from within the dry perimeter of Boundary Bar (left bank of channel), at low flow. Habitat enhancements will be added along the upstream length of the microchannel including deepening of shallow sections and addition of LWD. Upon completion of the excavation the pit will be opened to the main channel of the river.

Boundary Bar is downstream of where pink and chum spawning have been observed and is lacking the glide tail habit preferred for pink spawning. 8,820 m2

Footprint of Project:

## PROPOSED TIMING FOR WORKS

Instream Start Date: Instream End Date:

Is the proposed timing within the approved regional timing window?

Aug 1, 2023 Sep 30, 2023

No

If works are proposed outside the listed windows the proponent must engage a qualified professional to assess species and habitats present and determine if a site specific plan can be developed to ensure compliance with the Fisheries Act

Reason to do work outside of approved timing window:

The start of excavations is dependent on dropping water levels as well as the least risk timing window for instream works, which is between July 15 to September 15. This window occurs when most seasonal outmigration of smolts is complete and prior to the onset of spawning behaviour of returning adult fish. Accordingly, the excavations are expected to begin around August 1 and continue at least until September 15. In previous years, excavations have extended to September 30 where conditions were suitable. This extension may be necessary in 2023 to meet the sediment removal targets. Continuing low flows are an important consideration for any extension as this could affect the upstream migration timing for adult salmon as well as the feasibility of completing the works in isolation. In addition, the start of spawning by pink salmon may also limit any extension to the window, particularly at sites where excavations are upstream of expected or active pink salmon spawning areas. It is anticipated that this constraint will limit activity after September 15th to sites located in the Vedder Canal. Work on all sites will be ordered to ensure that only the most downstream sites are at risk of remaining incomplete by September 15th. Monitoring of adult salmon migration would be added to the

responsibilities of the environmental monitor as required. The Environmental Monitor will collaborate with Sumas First Nation Fish Counting activities to ensure that their knowledge and preliminary findings inform any decision to extend works past September 15th. For the purposes of this application, an extension to September 30 has been incorporated.

## LOCATION OF WORKS

Provide a legal description of the land(s)

PID 013571494

where works are proposed:

PARCEL "L" (EXPLANATORY PLAN 42474) NORTH WEST QUARTER AND OF THE SOUTH WEST QUARTER SECTION 7 TOWNSHIP 23 NEW WESTMINSTER

DISTRICT

**Geographic Coords of Works: Photo of Works Location:** 

49.1088210, -122.0830950

Boundary Bar - Design drawing for the Boundary excavation.

#### LAND OWNERSHIP AT THE WORKS

Land Ownership:	□ Applicant owns land □ Land is Crown Land but applicant has tenure □ Land is Crown Land but tenured to Ministry of Transportation □ A third Party owns the land but the applicant has lease or tenure ☑ A third Party owns the land but applicant has written consent Name of Land Owner that owns the land where your works are proposed: City of Abbotsford □ Land is Crown Land but the applicant does not have a tenure  For all private lands, you must obtain and provide the landowner's written consent. The consent form must describe the proposed project and contain the landowner's written consent using the upload documents section of this form.
SITE	
Location ID:	Brown Bar (A+B)
STREAM	
Name of the Stream: Source Flows Into:	Vedder River Fraser River
PROPOSED WORKS	

**Detailed Description of Works:** 

Due to the substantial sediment input from November 2021, KWL and NPE have identified 11 bars with a combined total removable volume of 354,700 m3 for the 2023 sediment removal cycle.

Brown Bar (A +B) accounts for 7.8 % of this total.

Decisions to alter specific sites will be based on potential changes that may occur during the 2023 spring freshet, agency reviews, site specific effectiveness, habitat protection and enhancement considerations, and logistics. This could lead to significant variation in the total volume or the volume for any specific site; however, the total removal will not exceed 354,700 m3.

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Hydraulic modeling shows the 1:200 year flood profile of the Vedder River and Canal has increased (KWL 2023). Several areas in the Middle and Lower Reach of the river as well as the upper end of the canal do not meet the provincial dike freeboard requirement of 0.75 m. The 2023 proposed excavations will address these freeboard limitations, limit future movement of excess sediment from the November 2021 atmospheric event into these areas and help to restore the river to the conditions prior to that event.

One of the objectives of the 2023 excavation cycle will be to excavate in a way that mitigates risk to pink salmon spawning areas. In particular, it is important to select excavation site locations and establish a site design that will not upset the glide-glide tail-riffle sequences that support the glide tail habitat pink salmon rely on for spawning. As pink salmon head directly downstream upon emergence as fry, this is the key element to sustain during the excavations.

Using an excavator and gravel trucks, 27,600 m3 will be removed from within the dry perimeter of Brown Bar A (4,300 m3) + B (23,300 m3) (left bank of channel), at low flow. Upon completion of the excavation the pit will be opened to the main channel of the river. Brown Bar (A + B) are located in a section of the Vedder River where pink and chum spawning have been observed, and where glide tail habit preferred for pink spawning has been noted. The site location and design are such that the glide-glide tail-riffle sequence will remain intact, and spawning activities should not be impacted. 9,380 m2

#### **Footprint of Project:**

#### PROPOSED TIMING FOR WORKS

Instream Start Date: Instream End Date:

Is the proposed timing within the approved regional timing window?

Aug 1, 2023 Sep 30, 2023

No

If works are proposed outside the listed windows the proponent must engage a qualified professional to assess species and habitats present and determine if a site specific plan can be developed to ensure compliance with the Fisheries Act

## Reason to do work outside of approved timing window:

The start of excavations is dependent on dropping water levels as well as the least risk timing window for instream works. This window occurs when most seasonal outmigration of smolts is complete and prior to the onset of spawning behaviour of returning adult fish. Accordingly, the excavations are expected to begin around August 1 and continue at least until September 15. In previous years, excavations have extended to September 30 where conditions were suitable. This extension may be necessary in 2023 to meet the sediment removal targets. Continuing low flows are an important consideration for any extension as this could affect the upstream migration timing for adult salmon as well as the feasibility of completing the works in isolation. In addition, the start of spawning by pink salmon may also limit any extension to the window, particularly at sites where excavations are upstream of expected or active pink salmon spawning areas. It is anticipated that this constraint will limit activity after September 15th to sites located in the Vedder Canal. Work on all sites will be ordered to ensure that only the most downstream sites are at risk of remaining incomplete by September 15th. Monitoring of adult salmon migration would be added to the responsibilities of the environmental monitor as required. The Environmental Monitor will collaborate with Sumas First Nation Fish Counting activities to ensure that their knowledge and preliminary findings inform any decision to extend works past September 15th. For the purposes of this application, an extension to September 30 has been incorporated.

Provide a legal description of the land(s)

where works are proposed:

PID 001035100

LOT 3 SECTION 3 AND 4 TOWNSHIP 23 NEW WESTMINSTER DISTRICT PLAN

68730

Geographic Coords of Works: Photo of Works Location:

49.0988000, -122.0228650

LAND OWNERSHIP AT THE WORKS

Land Ownership:	☐ Applicant owns land ☐ Land is Crown Land but applicant has tenure ☐ Land is Crown Land but tenured to Ministry of Transportation ☐ A third Party owns the land but the applicant has lease or tenure ☐ A third Party owns the land but applicant has written consent ☑ Land is Crown Land but the applicant does not have a tenure
SITE	
SITE	
Location ID:	Chadsey Bar
STREAM	
Name of the Stream: Source Flows Into:	Vedder River Fraser River

#### **PROPOSED WORKS**

#### **Detailed Description of Works:**

Due to the substantial sediment input from November 2021, KWL and NPE have identified 11 bars with a combined total removable volume of 354,700 m3 for the 2023 sediment removal cycle. Chadsey Bar accounts for 8.8 % of this total.

Decisions to alter specific sites will be based on potential changes that may occur during the 2023 spring freshet, agency reviews, site specific effectiveness, habitat protection and enhancement considerations, and logistics. This could lead to significant variation in the total volume or the volume for any specific site; however, the total removal will not exceed 354,700 m3.

Hydraulic modeling shows the 1:200 year flood profile of the Vedder River and Canal has increased (KWL 2023). Several areas in the Middle and Lower Reach of the river as well as the upper end of the canal do not meet the provincial dike freeboard requirement of 0.75 m. The 2023 proposed excavations will address these freeboard limitations, limit future movement of excess sediment from the November 2021 atmospheric event into these areas and help to restore the river to the conditions prior to that event.

One of the objectives of the 2023 excavation cycle will be to excavate in a way that mitigates risk to pink salmon spawning areas. In particular, it is important to select excavation site locations and establish a site design that will not upset the glide-glide tail-riffle sequences that support the glide tail habitat pink salmon rely on for spawning. As pink salmon head directly downstream upon emergence as fry, this is the key element to sustain during the excavations.

Using an excavator and gravel trucks, 31,100 m3 will be removed from within the dry perimeter of Chadsey Bar (right bank of channel), at low flow. Upon completion of the excavation the pit will be opened to the main channel of the river. Chadsey Bar is downstream of where pink and chum spawning have

	been observed and is lacking the glide tail habit preferred for pink spawning.  Habitat enhancements will be added along the length of the bank including deepening of shallow sections and addition of LWD. Where no edge features are available, excavation may extend right to the bank with a shelf left to support reformation of habitat edge or microchannel habitat. For this excavation the pit will extend to the habitat edge features.
Footprint of Project:	11,059 m2
PROPOSED TIMING FOR WORKS	
Instream Start Date: Instream End Date: Is the proposed timing within the approved regional timing window?	Aug 1, 2023 Sep 30, 2023 No
	If works are proposed outside the listed windows the proponent must engage a qualified professional to assess species and habitats present and determine if a site specific plan can be developed to ensure compliance with the Fisheries Act
Reason to do work outside of approved timing window:	The start of excavations is dependent on dropping water levels as well as the least risk timing window for instream works, which is between July 15 to September 15. This window occurs when most seasonal outmigration of smolts is complete and prior to the onset of spawning behaviour of returning adult fish. Accordingly, the excavations are expected to begin around August 1 and continue at least until September 15. In previous years, excavations have extended to September 30 where conditions were suitable. This extension may be necessary in 2023 to meet the sediment removal targets. Continuing low flows are an important consideration for any extension as this could affect the upstream migration timing for adult salmon as well as the feasibility of completing the works in isolation. In addition, the start of spawning by pink salmon may also limit any extension to the window, particularly at sites where excavations are upstream of expected or active pink salmon spawning areas. It is anticipated that this constraint will limit activity after September 15th to sites located in the Vedder Canal. Work on all sites will be ordered to ensure that only the most downstream sites are at risk of remaining incomplete by September 15th. Monitoring of adult salmon migration would be added to the responsibilities of the environmental monitor as required. The Environmental Monitor will collaborate with Sumas First Nation Fish Counting activities to ensure that their knowledge and preliminary findings inform any decision to extend works past September 15th. For the purposes of this application, an extension to September 30 has been incorporated.
LOCATION OF WORKS	
Provide a legal description of the land(s) where works are proposed: Geographic Coords of Works: Photo of Works Location:	PARCEL "K" (EXPLANATORY PLAN 42473) NORTH WEST QUARTER SECTION 7 TOWNSHIP 23 NEW WESTMINSTER DISTRICT 49.1130470, -122.0864210
LAND OWNERSHIP AT THE WORKS	
Land Ownership:	□ Applicant owns land □ Land is Crown Land but applicant has tenure □ Land is Crown Land but tenured to Ministry of Transportation □ A third Party owns the land but the applicant has lease or tenure ☑ A third Party owns the land but applicant has written consent □ Land is Crown Land but the applicant does not have a tenure  For all private lands, you must obtain and provide the landowner's written
Tracking Number: 100415064   Version 1.0   Submitted Dat	

consent. The consent form must describe the proposed project and contain the landowners address, telephone number and postal code. Upload a copy of the landowner's written consent using the upload documents section of this form.

SITE

**Location ID:** Garrison Bar

**STREAM** 

Name of the Stream: Vedder River
Source Flows Into: Fraser River

#### PROPOSED WORKS

#### **Detailed Description of Works:**

Due to the substantial sediment input from November 2021, KWL and NPE have identified 11 bars with a combined total removable volume of 354,700 m3 for the 2023 sediment removal cycle. Garrison Bar accounts for 9.5 % of this total.

Decisions to alter specific sites will be based on potential changes that may occur during the 2023 spring freshet, agency reviews, site specific effectiveness, habitat protection and enhancement considerations, and logistics. This could lead to significant variation in the total volume or the volume for any specific site; however, the total removal will not exceed 354,700 m3.

Hydraulic modeling shows the 1:200 year flood profile of the Vedder River and Canal has increased (KWL 2023). Several areas in the Middle and Lower Reach of the river as well as the upper end of the canal do not meet the provincial dike freeboard requirement of 0.75 m. The 2023 proposed excavations will address these freeboard limitations, limit future movement of excess sediment from the November 2021 atmospheric event into these areas and help to restore the river to the conditions prior to that event.

One of the objectives of the 2023 excavation cycle will be to excavate in a way that mitigates risk to pink salmon spawning areas. In particular, it is important to select excavation site locations and establish a site design that will not upset the glide-glide tail-riffle sequences that support the glide tail habitat pink salmon rely on for spawning. As pink salmon head directly downstream upon emergence as fry, this is the key element to sustain during the excavations.

Using an excavator and gravel trucks, 33,700 m3 will be removed from within the dry perimeter of Garrison Bar (left bank of channel), at low flow. Excavation design mitigation includes the gently sloped upstream end of the excavation and two wide openings to ensure fish to not become trapped. The excavation is located along a single glide between two riffles and options for enhancements such as placement of LWD are limited. Upon completion of the excavation the pit will be opened to the main channel of the river. Garrison Bar is upstream of where pink and chum spawning have been observed and is lacking the glide tail habit preferred for pink spawning.

13,100 m2

#### **Footprint of Project:**

#### PROPOSED TIMING FOR WORKS

Instream Start Date: Aug 1, 2023
Instream End Date: Sep 30, 2023
Is the proposed timing within the approved No

regional timing window?	
	If works are proposed outside the listed windows the proponent must engage a qualified professional to assess species and habitats present and determine if a site specific plan can be developed to ensure compliance with the Fisheries Act
Reason to do work outside of approved timing window:	The start of excavations is dependent on dropping water levels as well as the least risk timing window for instream works, which is between July 15 to September 15. This window occurs when most seasonal outmigration of smolts is complete and prior to the onset of spawning behaviour of returning adult fish. Accordingly, the excavations are expected to begin around August 1 and continue at least until September 15. In previous years, excavations have extended to September 30 where conditions were suitable. This extension may be necessary in 2023 to meet the sediment removal targets. Continuing low flows are an important consideration for any extension as this could affect the upstream migration timing for adult salmon as well as the feasibility of completing the works in isolation. In addition, the start of spawning by pink salmon may also limit any extension to the window, particularly at sites where excavations are upstream of expected or active pink salmon spawning areas. It is anticipated that this constraint will limit activity after September 15th to sites located in the Vedder Canal. Work on all sites will be ordered to ensure that only the most downstream sites are at risk of remaining incomplete by September 15th. Monitoring of adult salmon migration would be added to the responsibilities of the environmental monitor as required. The Environmental Monitor will collaborate with Sumas First Nation Fish Counting activities to ensure that their knowledge and preliminary findings inform any decision to extend works past September 15th. For the purposes of this application, an extension to September 30 has been incorporated.
LOCATION OF WORKS	
Provide a legal description of the land(s) where works are proposed:	Part of Primary: SECTION 1, TOWNSHIP 23, EAST OF THE COAST MERIDIAN, NEW WESTMINSTER DISTRICT
Geographic Coords of Works: Photo of Works Location:	49.0971410, -121.9713590
LAND OWNERSHIP AT THE WORKS	
Land Ownership:	<ul> <li>□ Applicant owns land</li> <li>□ Land is Crown Land but applicant has tenure</li> <li>□ Land is Crown Land but tenured to Ministry of Transportation</li> <li>□ A third Party owns the land but the applicant has lease or tenure</li> <li>□ A third Party owns the land but applicant has written consent</li> <li>☑ Land is Crown Land but the applicant does not have a tenure</li> </ul>
SITE	
Location ID:	Giesbrecht Bar
STREAM	
Name of the Stream: Source Flows Into:	Vedder River Fraser River

PROPOSED WORKS

### **Detailed Description of Works:**

Due to the substantial sediment input from November 2021, KWL and NPE have identified 11 bars with a combined total removable volume of 354,700 m3 for the 2023 sediment removal cycle. Giesbrecht Bar accounts for 6.0% % of this total.

Decisions to alter specific sites will be based on potential changes that may occur during the 2023 spring freshet, agency reviews, site specific effectiveness, habitat protection and enhancement considerations, and logistics. This could lead to significant variation in the total volume or the volume for any specific site; however, the total removal will not exceed 354,700 m3.

Hydraulic modeling shows the 1:200 year flood profile of the Vedder River and Canal has increased (KWL 2023). Several areas in the Middle and Lower Reach of the river as well as the upper end of the canal do not meet the provincial dike freeboard requirement of 0.75 m. The 2023 proposed excavations will address these freeboard limitations, limit future movement of excess sediment from the November 2021 atmospheric event into these areas and help to restore the river to the conditions prior to that event.

One of the objectives of the 2023 excavation cycle will be to excavate in a way that mitigates risk to pink salmon spawning areas. In particular, it is important to select excavation site locations and establish a site design that will not upset the glide-glide tail-riffle sequences that support the glide tail habitat pink salmon rely on for spawning. As pink salmon head directly downstream upon emergence as fry, this is the key element to sustain during the excavations.

Using an excavator and gravel trucks, 21,400 m3 will be removed from within the dry perimeter of Giesbrecht Bar (left bank of channel), at low flow. Excavation design mitigation includes the gently sloped upstream end of the excavation and two wide openings to ensure fish do not become trapped. The excavation is located along a single glide between two riffles and options for enhancements such as placement of LWD are limited. Upon completion of the excavation the pit will be opened to the main channel of the river. Giesbrecht Bar is upstream of where pink and chum spawning have been observed and is lacking the glide tail habit preferred for pink spawning. 6,240 m2

**Footprint of Project:** 

### PROPOSED TIMING FOR WORKS

Instream Start Date: Instream End Date:

Is the proposed timing within the approved regional timing window?

Aug 1, 2023 Sep 30, 2023 No

If works are proposed outside the listed windows the proponent must engage a qualified professional to assess species and habitats present and determine if a site specific plan can be developed to ensure compliance with the Fisheries Act

# Reason to do work outside of approved timing window:

The start of excavations is dependent on dropping water levels as well as the least risk timing window for instream works, which is between July 15 to September 15. This window occurs when most seasonal outmigration of smolts is complete and prior to the onset of spawning behaviour of returning adult fish. Accordingly, the excavations are expected to begin around August 1 and continue at least until September 15. In previous years, excavations have extended to September 30 where conditions were suitable. This extension may be necessary in 2023 to meet the sediment removal targets. Continuing low flows are an important consideration for any extension as this could affect the upstream migration timing for adult salmon as well as the feasibility of completing the works in isolation. In addition, the start of spawning by pink

Tracking Number: 100415064 | Version 1.0 | Submitted Date: May 5, 2023

salmon may also limit any extension to the window, particularly at sites where excavations are upstream of expected or active pink salmon spawning areas. It is anticipated that this constraint will limit activity after September 15th to sites located in the Vedder Canal. Work on all sites will be ordered to ensure that only the most downstream sites are at risk of remaining incomplete by September 15th. Monitoring of adult salmon migration would be added to the responsibilities of the environmental monitor as required. The Environmental Monitor will collaborate with Sumas First Nation Fish Counting activities to ensure that their knowledge and preliminary findings inform any decision to extend works past September 15th. For the purposes of this application, an extension to September 30 has been incorporated.

#### LOCATION OF WORKS

Provide a legal description of the land(s) where works are proposed: Geographic Coords of Works:

Part of Primary: SECTION 2, TOWNSHIP 23, EAST OF THE COAST MERIDIAN,

NEW WESTMINSTER DISTRICT 49.0977000, -121.9855000

Photo of Works Location:		
AND OWNERSHIP AT THE WORKS		
Land Ownership:	☐ Applicant owns land ☐ Land is Crown Land but applicant has tenure ☐ Land is Crown Land but tenured to Ministry of Transportation ☐ A third Party owns the land but the applicant has lease or tenure ☐ A third Party owns the land but applicant has written consent ☑ Land is Crown Land but the applicant does not have a tenure	
SITE		
Location ID:	Greendale Bar	
STREAM		
Name of the Stream:	Vedder River	
Source Flows Into:	Fraser River	

### **PROPOSED WORKS**

### **Detailed Description of Works:**

Due to the substantial sediment input from November 2021, KWL and NPE have identified 11 bars with a combined total removable volume of 354,700 m3 for the 2023 sediment removal cycle. Greendale Bar accounts for 15.6% % of this total.

Decisions to alter specific sites will be based on potential changes that may occur during the 2023 spring freshet, agency reviews, site specific effectiveness, habitat protection and enhancement considerations, and logistics. This could lead to significant variation in the total volume or the volume for any specific site; however, the total removal will not exceed 354,700 m3.

Hydraulic modeling shows the 1:200 year flood profile of the Vedder River and Canal has increased (KWL 2023). Several areas in the Middle and Lower Reach of the river as well as the upper end of the canal do not meet the provincial dike freeboard requirement of 0.75 m. The 2023 proposed excavations will address these freeboard limitations, limit future movement of excess sediment from the November 2021 atmospheric event into these areas and help to

restore the river to the conditions prior to that event.

One of the objectives of the 2023 excavation cycle will be to excavate in a way that mitigates risk to pink salmon spawning areas. In particular, it is important to select excavation site locations and establish a site design that will not upset the glide-glide tail-riffle sequences that support the glide tail habitat pink salmon rely on for spawning. As pink salmon head directly downstream upon emergence as fry, this is the key element to sustain during the excavations.

Using an excavator and gravel trucks, 55,200 m3 will be removed from within the dry perimeter of Greendale Bar (right bank of channel), at low flow. 11,300 m3 of the total volume to be taken out at Greendale Bar will come from the habitat excavation in the side channel. Upon completion of the excavation the pit will be opened to the main channel of the river. The two components of the excavation have been situated such that the integrity of the island, secondary channel and LWD complex are maintained. Greendale Bar is located in a section of the Vedder River where significant pink and chum spawning have been observed, and where glide tail habit preferred for pink spawning has been noted. The site location and design are such that the glide-glide tail-riffle sequence will remain intact, and spawning activities should not be impacted. 23,413 m2

**Footprint of Project:** 

#### PROPOSED TIMING FOR WORKS

Instream Start Date:

Instream End Date:

Is the proposed timing within the approved regional timing window?

Aug 1, 2023 Sep 30, 2023

No

If works are proposed outside the listed windows the proponent must engage a qualified professional to assess species and habitats present and determine if a site specific plan can be developed to ensure compliance with the Fisheries Act

Reason to do work outside of approved timing window:

The start of excavations is dependent on dropping water levels as well as the least risk timing window for instream works, which is between July 15 to September 15. This window occurs when most seasonal outmigration of smolts is complete and prior to the onset of spawning behaviour of returning adult fish. Accordingly, the excavations are expected to begin around August 1 and continue at least until September 15. In previous years, excavations have extended to September 30 where conditions were suitable. This extension may be necessary in 2023 to meet the sediment removal targets. Continuing low flows are an important consideration for any extension as this could affect the upstream migration timing for adult salmon as well as the feasibility of completing the works in isolation. In addition, the start of spawning by pink salmon may also limit any extension to the window, particularly at sites where excavations are upstream of expected or active pink salmon spawning areas. It is anticipated that this constraint will limit activity after September 15th to sites located in the Vedder Canal. Work on all sites will be ordered to ensure that only the most downstream sites are at risk of remaining incomplete by September 15th. Monitoring of adult salmon migration would be added to the responsibilities of the environmental monitor as required. The Environmental Monitor will collaborate with Sumas First Nation Fish Counting activities to ensure that their knowledge and preliminary findings inform any decision to extend works past September 15th. For the purposes of this application, an extension to September 30 has been incorporated.

### LOCATION OF WORKS

Provide a legal description of the land(s) where works are proposed:

PARCEL "A" (REFERENCE PLAN 4832) DISTRICT LOT 449 GROUP 2 NEW WESTMINSTER DISTRICT

Geographic Coords of Works: Photo of Works Location:	49.0884180, -122.0588390		
AND OWNERSHIP AT THE WORKS			
Land Ownership:	□ Applicant owns land □ Land is Crown Land but applicant has tenure □ Land is Crown Land but tenured to Ministry of Transportation □ A third Party owns the land but the applicant has lease or tenure ☑ A third Party owns the land but applicant has written consent □ Land is Crown Land but the applicant does not have a tenure  For all private lands, you must obtain and provide the landowner's written consent. The consent form must describe the proposed project and contain the landowner's address, telephone number and postal code. Upload a copy of the landowner's written consent using the upload documents section of this form.		
SITE			
SITE  Location ID:	Keith Wilson Bar		
Location ID:			
Location ID:			
Location ID:	Keith Wilson Bar		
STREAM  Name of the Stream:	Keith Wilson Bar  Vedder River		

354,700 m3.

Decisions to alter specific sites will be based on potential changes that may occur during the 2023 spring freshet, agency reviews, site specific effectiveness, habitat protection and enhancement considerations, and logistics. This could lead to significant variation in the total volume or the volume for any specific site; however, the total removal will not exceed

Hydraulic modeling shows the 1:200 year flood profile of the Vedder River and Canal has increased (KWL 2023). Several areas in the Middle and Lower Reach of the river as well as the upper end of the canal do not meet the provincial dike freeboard requirement of 0.75 m. The 2023 proposed excavations will address these freeboard limitations, limit future movement of excess sediment from the November 2021 atmospheric event into these areas and help to restore the river to the conditions prior to that event.

One of the objectives of the 2023 excavation cycle will be to excavate in a way that mitigates risk to pink salmon spawning areas. In particular, it is important to select excavation site locations and establish a site design that will not upset the glide-glide tail-riffle sequences that support the glide tail habitat pink salmon rely on for spawning. As pink salmon head directly downstream upon emergence as fry, this is the key element to sustain during the excavations.

Using an excavator and gravel trucks, 26,600 m3 will be removed from within the dry perimeter of Keith Wilson Bar (right bank of channel), at low flow. A berm may be required at the upstream end due to the low profile. The

excavation area has been extended right to the bank to restore habitat edge value and set the stage for reestablishment of the microchannel along the left bank. Upon completion of the excavation the pit will be opened to the main channel of the river. Keith Wilson Bar is located just downstream of glide tail habitat, however the site location and excavation design are such that neither the glide habitat will remain intact and the spawning activities should not be impacted.

9,366 m2

Footprint of Project:

### PROPOSED TIMING FOR WORKS

Instream Start Date: Instream End Date:

Is the proposed timing within the approved regional timing window?

Aug 1, 2023 Sep 30, 2023

No

If works are proposed outside the listed windows the proponent must engage a qualified professional to assess species and habitats present and determine if a site specific plan can be developed to ensure compliance with the Fisheries Act

Reason to do work outside of approved timing window:

The start of excavations is dependent on dropping water levels as well as the least risk timing window for instream works, which is between July 15 to September 15. This window occurs when most seasonal outmigration of smolts is complete and prior to the onset of spawning behaviour of returning adult fish. Accordingly, the excavations are expected to begin around August 1 and continue at least until September 15. In previous years, excavations have extended to September 30 where conditions were suitable. This extension may be necessary in 2023 to meet the sediment removal targets. Continuing low flows are an important consideration for any extension as this could affect the upstream migration timing for adult salmon as well as the feasibility of completing the works in isolation. In addition, the start of spawning by pink salmon may also limit any extension to the window, particularly at sites where excavations are upstream of expected or active pink salmon spawning areas. It is anticipated that this constraint will limit activity after September 15th to sites located in the Vedder Canal. Work on all sites will be ordered to ensure that only the most downstream sites are at risk of remaining incomplete by September 15th. Monitoring of adult salmon migration would be added to the responsibilities of the environmental monitor as required. The Environmental Monitor will collaborate with Sumas First Nation Fish Counting activities to ensure that their knowledge and preliminary findings inform any decision to extend works past September 15th. For the purposes of this application, an extension to September 30 has been incorporated.

### **LOCATION OF WORKS**

Provide a legal description of the land(s) where works are proposed:

Geographic Coords of Works: Photo of Works Location:

PARCEL "G" (EXPLANATORY PLAN 42091) SOUTH EAST QUARTER AND OF THE SOUTH WEST QUARTER SECTION 7 TOWNSHIP 23 NEW WESTMINSTER

DISTRICT

49.1045670, -122.0784310

### LAND OWNERSHIP AT THE WORKS

Land Ownership:	☐ Applicant owns land
	☐ Land is Crown Land but applicant has tenure
	☐ Land is Crown Land but tenured to Ministry of Transportation
	☐ A third Party owns the land but the applicant has lease or tenure
	☑ A third Party owns the land but applicant has written consent
	☐ Land is Crown Land but the applicant does not have a tenure

For all private lands, you must obtain and provide the landowner's written

consent. The consent form must describe the proposed project and contain the landowners address, telephone number and postal code. Upload a copy of the landowner's written consent using the upload documents section of this form.

SITE

Lickman Bar

**STREAM** 

Name of the Stream: Vedder River
Source Flows Into: Fraser River

#### PROPOSED WORKS

### **Detailed Description of Works:**

Due to the substantial sediment input from November 2021, KWL and NPE have identified 11 bars with a combined total removable volume of 354,700 m3 for the 2023 sediment removal cycle. Lickman Bar accounts for 5.6 % of this total.

Decisions to alter specific sites will be based on potential changes that may occur during the 2023 spring freshet, agency reviews, site specific effectiveness, habitat protection and enhancement considerations, and logistics. This could lead to significant variation in the total volume or the volume for any specific site; however, the total removal will not exceed 354,700 m3.

Hydraulic modeling shows the 1:200 year flood profile of the Vedder River and Canal has increased (KWL 2023). Several areas in the Middle and Lower Reach of the river as well as the upper end of the canal do not meet the provincial dike freeboard requirement of 0.75 m. The 2023 proposed excavations will address these freeboard limitations, limit future movement of excess sediment from the November 2021 atmospheric event into these areas and help to restore the river to the conditions prior to that event.

One of the objectives of the 2023 excavation cycle will be to excavate in a way that mitigates risk to pink salmon spawning areas. In particular, it is important to select excavation site locations and establish a site design that will not upset the glide-glide tail-riffle sequences that support the glide tail habitat pink salmon rely on for spawning. As pink salmon head directly downstream upon emergence as fry, this is the key element to sustain during the excavations.

Using an excavator and gravel trucks, 19,700 m3 will be removed from within the dry perimeter of Lickman Bar (right bank of channel), at low flow. Of the 19,700 m3, 7,400 m3 will be from the bar top removal. Some LWD from within the excavation footprint or nearby, will be keyed in at strategic locations along the bank and channel. The bar top removal will be left dry with a slight berm at the upstream end. The objective is to allow a natural riffle shape to form during higher flows and avoid the potential for introduction of low flows that may stop and go prior to the onset of higher fall flows. Upon completion of the excavation the pit will be opened to the main channel of the river. Lickman Bar is located just upstream of glide tail habitat, however the site location and excavation design are such that neither the glide habitat will remain intact and the spawning activities should not be impacted. 5,605 m2

**Footprint of Project:** 

Instream Start Date: Instream End Date: Is the proposed timing within the approved regional timing window?	Aug 1, 2023 Sep 30, 2023 No
	If works are proposed outside the listed windows the proponent must engage a qualified professional to assess species and habitats present and determine if a site specific plan can be developed to ensure compliance with the Fisheries Act
Reason to do work outside of approved timing window:	The start of excavations is dependent on dropping water levels as well as the least risk timing window for instream works, which is between July 15 to September 15. This window occurs when most seasonal outmigration of smolts is complete and prior to the onset of spawning behaviour of returning adult fish. Accordingly, the excavations are expected to begin around August 1 and continue at least until September 15. In previous years, excavations have extended to September 30 where conditions were suitable. This extension may be necessary in 2023 to meet the sediment removal targets. Continuing low flows are an important consideration for any extension as this could affect the upstream migration timing for adult salmon as well as the feasibility of completing the works in isolation. In addition, the start of spawning by pink salmon may also limit any extension to the window, particularly at sites where excavations are upstream of expected or active pink salmon spawning areas. It is anticipated that this constraint will limit activity after September 15th to sites located in the Vedder Canal. Work on all sites will be ordered to ensure that only the most downstream sites are at risk of remaining incomplete by September 15th. Monitoring of adult salmon migration would be added to the responsibilities of the environmental monitor as required. The Environmental Monitor will collaborate with Sumas First Nation Fish Counting activities to ensure that their knowledge and preliminary findings inform any decision to extend works past September 15th. For the purposes of this application, an extension to September 30 has been incorporated.
LOCATION OF WORKS	
Provide a legal description of the land(s) where works are proposed: Geographic Coords of Works: Photo of Works Location:	PID 001035363 LOT 8 SECTION 3 TOWNSHIP 23 NEW WESTMINSTER DISTRICT PLAN 68730 49.0976000, -122.0090000
LAND OWNERSHIP AT THE WORKS	
Land Ownership:	<ul> <li>□ Applicant owns land</li> <li>□ Land is Crown Land but applicant has tenure</li> <li>□ Land is Crown Land but tenured to Ministry of Transportation</li> <li>□ A third Party owns the land but the applicant has lease or tenure</li> <li>□ A third Party owns the land but applicant has written consent</li> <li>☑ Land is Crown Land but the applicant does not have a tenure</li> </ul>
SITE	
Location ID:	Peach Road Bar
STREAM	

Vedder River

Fraser River

Name of the Stream:

**Source Flows Into:** 

### **PROPOSED WORKS**

### **Detailed Description of Works:**

Due to the substantial sediment input from November 2021, KWL and NPE have identified 11 bars with a combined total removable volume of 354,700 m3 for the 2023 sediment removal cycle. Peach Road Bar accounts for 31.0% % of this total.

Decisions to alter specific sites will be based on potential changes that may occur during the 2023 spring freshet, agency reviews, site specific effectiveness, habitat protection and enhancement considerations, and logistics. This could lead to significant variation in the total volume or the volume for any specific site; however, the total removal will not exceed 354,700 m3.

Hydraulic modeling shows the 1:200 year flood profile of the Vedder River and Canal has increased (KWL 2023). Several areas in the Middle and Lower Reach of the river as well as the upper end of the canal do not meet the provincial dike freeboard requirement of 0.75 m. The 2023 proposed excavations will address these freeboard limitations, limit future movement of excess sediment from the November 2021 atmospheric event into these areas and help to restore the river to the conditions prior to that event.

One of the objectives of the 2023 excavation cycle will be to excavate in a way that mitigates risk to pink salmon spawning areas. In particular, it is important to select excavation site locations and establish a site design that will not upset the glide-glide tail-riffle sequences that support the glide tail habitat pink salmon rely on for spawning. As pink salmon head directly downstream upon emergence as fry, this is the key element to sustain during the excavations.

Using an excavator and gravel trucks, 109,900 m3 will be removed from within the dry perimeter of Peach Road Bar (right bank of channel), at low flow. Of the 109,900 m3, 5,300 m3 will be from the habitat excavation which will provide a naturally shaped groundwater fed secondary channel on site. Some LWD from within the excavation footprint will be keyed in at strategic locations along the bank and channel as well as within the habitat excavation. Despite the larger size of this excavation, it is consistent with the guidelines being located along a single glide feature with a section of riffles upstream and downstream. The site design also includes a gentle upstream slope.

Upon completion of the excavation the pit will be opened to the main channel of the river. Peach Road Bar is located between two glide-glide tail- riffle sequences, however the site location and excavation design are such that these sequences will not be affected by the works. Pink spawning is not known to take place at this location as it is upstream of the river reaches that generally support this.

Footprint of Project:

### PROPOSED TIMING FOR WORKS

Instream Start Date: Instream End Date:

Is the proposed timing within the approved regional timing window?

Aug 1, 2023 Sep 30, 2023 No

25,612 m2

If works are proposed outside the listed windows the proponent must engage a qualified professional to assess species and habitats present and determine if a site specific plan can be developed to ensure compliance with the Fisheries Act

Reason to do work outside of approved timing window:

The start of excavations is dependent on dropping water levels as well as the least risk timing window for instream works, which is between July 15 to

September 15. This window occurs when most seasonal outmigration of smolts is complete and prior to the onset of spawning behaviour of returning adult fish. Accordingly, the excavations are expected to begin around August 1 and continue at least until September 15. In previous years, excavations have extended to September 30 where conditions were suitable. This extension may be necessary in 2023 to meet the sediment removal targets. Continuing low flows are an important consideration for any extension as this could affect the upstream migration timing for adult salmon as well as the feasibility of completing the works in isolation. In addition, the start of spawning by pink salmon may also limit any extension to the window, particularly at sites where excavations are upstream of expected or active pink salmon spawning areas. It is anticipated that this constraint will limit activity after September 15th to sites located in the Vedder Canal. Work on all sites will be ordered to ensure that only the most downstream sites are at risk of remaining incomplete by September 15th. Monitoring of adult salmon migration would be added to the responsibilities of the environmental monitor as required. The Environmental Monitor will collaborate with Sumas First Nation Fish Counting activities to ensure that their knowledge and preliminary findings inform any decision to extend works past September 15th. For the purposes of this application, an extension to September 30 has been incorporated.

### **LOCATION OF WORKS**

Provide a legal description of the land(s)

where works are proposed:

PID 026-563-606

LOT B SECTION 2 TOWNSHIP 23 NEW WESTMINSTER DISTRICT PLAN BCP21840

PID 001035649

LOT 12 SECTION 4 TOWNSHIP 23 NEW WESTMINSTER DISTRICT PLAN 68730

Due to the substantial sediment input from November 2021, KWL and NPE

49.0965680, -121.9934230

Geographic Coords of Works:

Photo of Works Location:	
LAND OWNERSHIP AT THE WORKS	
Land Ownership:	□ Applicant owns land □ Land is Crown Land but applicant has tenure □ Land is Crown Land but tenured to Ministry of Transportation □ A third Party owns the land but the applicant has lease or tenure ☑ A third Party owns the land but applicant has written consent ☑ Land is Crown Land but the applicant does not have a tenure  For all private lands, you must obtain and provide the landowner's written consent. The consent form must describe the proposed project and contain the landowners address, telephone number and postal code. Upload a copy of the landowner's written consent using the upload documents section of this form.
SITE	
Location ID:	Railway Bar
STREAM	
Name of the Stream: Source Flows Into:	Vedder River Fraser River
PROPOSED WORKS	

Tracking Number: 100415064 | Version 1.0 | Submitted Date: May 5, 2023

**Detailed Description of Works:** 

have identified 11 bars with a combined total removable volume of 354,700 m3 for the 2023 sediment removal cycle. Railway Bar accounts for 1.8 % of this total.

The following sections provide details for the proposed excavations (including adjacent bar top removal and habitat excavations) for 2023. The information includes excavation strategies, habitat conditions, mitigation and enhancement provisions, and project logistics.

Decisions to alter specific sites will be based on potential changes that may occur during the 2023 spring freshet, agency reviews, site specific effectiveness, habitat protection and enhancement considerations, and logistics. This could lead to significant variation in the total volume or the volume for any specific site; however, the total removal will not exceed 354,700 m3.

Hydraulic modeling shows the 1:200 year flood profile of the Vedder River and Canal has increased (KWL 2023). Several areas in the Middle and Lower Reach of the river as well as the upper end of the canal do not meet the provincial dike freeboard requirement of 0.75 m. The 2023 proposed excavations will address these freeboard limitations, limit future movement of excess sediment from the November 2021 atmospheric event into these areas and help to restore the river to the conditions prior to that event.

One of the objectives of the 2023 excavation cycle will be to excavate in a way that mitigates risk to pink salmon spawning areas. In particular, it is important to select excavation site locations and establish a site design that will not upset the glide-glide tail-riffle sequences that support the glide tail habitat pink salmon rely on for spawning. As pink salmon head directly downstream upon emergence as fry, this is the key element to sustain during the excavations. Using an excavator and gravel trucks, 6,500 m3 will be removed from within the dry perimeter of Railway Bar (right bank of channel), at low flow. The downstream corner will be excavated, in consultation with the DFO resource enhancement branch, to maintain the habitat values of the small channel downstream of the excavation.

Upon completion of the excavation the pit will be opened to the main channel of the river. Railway Bar is located in a section of the Vedder River where pink and chum spawning have been observed, and where glide tail habit preferred for pink spawning has been noted downstream of the excavation. The site location and design are such that the glide-glide tail-riffle sequences will remain intact, and spawning activities should not be impacted. 2,930 m2

**Footprint of Project:** 

### PROPOSED TIMING FOR WORKS

Instream Start Date: Instream End Date:

Is the proposed timing within the approved regional timing window?

Aug 1, 2023 Sep 30, 2023

No

If works are proposed outside the listed windows the proponent must engage a qualified professional to assess species and habitats present and determine if a site specific plan can be developed to ensure compliance with the Fisheries Act

Reason to do work outside of approved timing window:

The start of excavations is dependent on dropping water levels as well as the least risk timing window for instream works, which is between July 15 to September 15. This window occurs when most seasonal outmigration of smolts is complete and prior to the onset of spawning behaviour of returning adult fish. Accordingly, the excavations are expected to begin around August 1 and

Tracking Number: 100415064 | Version 1.0 | Submitted Date: May 5, 2023

continue at least until September 15. In previous years, excavations have extended to September 30 where conditions were suitable. This extension may be necessary in 2023 to meet the sediment removal targets. Continuing low flows are an important consideration for any extension as this could affect the upstream migration timing for adult salmon as well as the feasibility of completing the works in isolation. In addition, the start of spawning by pink salmon may also limit any extension to the window, particularly at sites where excavations are upstream of expected or active pink salmon spawning areas. It is anticipated that this constraint will limit activity after September 15th to sites located in the Vedder Canal. Work on all sites will be ordered to ensure that only the most downstream sites are at risk of remaining incomplete by September 15th. Monitoring of adult salmon migration would be added to the responsibilities of the environmental monitor as required. The Environmental Monitor will collaborate with Sumas First Nation Fish Counting activities to ensure that their knowledge and preliminary findings inform any decision to extend works past September 15th. For the purposes of this application, an extension to September 30 has been incorporated.

### **LOCATION OF WORKS**

Provide a legal description of the land(s)

where works are proposed:

PID 001035100

LOT 3 SECTION 3 AND 4 TOWNSHIP 23 NEW WESTMINSTER DISTRICT PLAN

68730

Geographic Coords of Works: Photo of Works Location:

49.0926990, -122.0351520

#### LAND OWNERSHIP AT THE WORKS

Land Ownership:	☐ Applicant owns land ☐ Land is Crown Land but applicant has tenure ☐ Land is Crown Land but tenured to Ministry of Transportation ☐ A third Party owns the land but the applicant has lease or tenure ☐ A third Party owns the land but applicant has written consent ☑ Land is Crown Land but the applicant does not have a tenure

Location ID: Salad Bar

### **STREAM**

Name of the Stream: Vedder River
Source Flows Into: Fraser River

### PROPOSED WORKS

### **Detailed Description of Works:**

Due to the substantial sediment input from November 2021, KWL and NPE have identified 11 bars with a combined total removable volume of 354,700 m3 for the 2023 sediment removal cycle. Salad Bar accounts for 2.6 % of this total.

Decisions to alter specific sites will be based on potential changes that may occur during the 2023 spring freshet, agency reviews, site specific effectiveness, habitat protection and enhancement considerations, and logistics. This could lead to significant variation in the total volume or the volume for any specific site; however, the total removal will not exceed 354,700 m3.

Tracking Number: 100415064 | Version 1.0 | Submitted Date: May 5, 2023

Hydraulic modeling shows the 1:200 year flood profile of the Vedder River and Canal has increased (KWL 2023). Several areas in the Middle and Lower Reach of the river as well as the upper end of the canal do not meet the provincial dike freeboard requirement of 0.75 m. The 2023 proposed excavations will address these freeboard limitations, limit future movement of excess sediment from the November 2021 atmospheric event into these areas and help to restore the river to the conditions prior to that event.

One of the objectives of the 2023 excavation cycle will be to excavate in a way that mitigates risk to pink salmon spawning areas. In particular, it is important to select excavation site locations and establish a site design that will not upset the glide-glide tail-riffle sequences that support the glide tail habitat pink salmon rely on for spawning. As pink salmon head directly downstream upon emergence as fry, this is the key element to sustain during the excavations.

Using an excavator and gravel trucks, 9,300 m3 will be removed from within the dry perimeter of Salad Bar (right bank of channel), at low flow. Excavation of the upstream end of the microchannel will be undertaken again in 2023 due to the recently observed heavy input of sand, likely related to the additional sediment burden from November 2021.

Upon completion of the excavation the pit will be opened to the main channel of the river. Salad Bar is located in a section of the Vedder River where heavy pink spawning has been observed, and where glide tail habit preferred for pink spawning has been noted downstream and upstream of the excavation. The site location and design are such that the glide-glide tail-riffle sequences will remain intact, and spawning activities should not be impacted. 4,338 m2

### **Footprint of Project:**

### PROPOSED TIMING FOR WORKS

Instream Start Date: Instream End Date:

Is the proposed timing within the approved regional timing window?

Aug 1, 2023 Sep 30, 2023 No

If works are proposed outside the listed windows the proponent must engage a qualified professional to assess species and habitats present and determine if a site specific plan can be developed to ensure compliance with the Fisheries Act

# Reason to do work outside of approved timing window:

The start of excavations is dependent on dropping water levels as well as the least risk timing window for instream works, which is between July 15 to September 15. This window occurs when most seasonal outmigration of smolts is complete and prior to the onset of spawning behaviour of returning adult fish. Accordingly, the excavations are expected to begin around August 1 and continue at least until September 15. In previous years, excavations have extended to September 30 where conditions were suitable. This extension may be necessary in 2023 to meet the sediment removal targets. Continuing low flows are an important consideration for any extension as this could affect the upstream migration timing for adult salmon as well as the feasibility of completing the works in isolation. In addition, the start of spawning by pink salmon may also limit any extension to the window, particularly at sites where excavations are upstream of expected or active pink salmon spawning areas. It is anticipated that this constraint will limit activity after September 15th to sites located in the Vedder Canal. Work on all sites will be ordered to ensure that only the most downstream sites are at risk of remaining incomplete by September 15th. Monitoring of adult salmon migration would be added to the responsibilities of the environmental monitor as required. The Environmental Monitor will collaborate with Sumas First Nation Fish Counting activities to

	ensure that their knowledge and preliminary findings inform any decision to extend works past September 15th. For the purposes of this application, an extension to September 30 has been incorporated.		
LOCATION OF WORKS			
Provide a legal description of the land(s) where works are proposed:  Geographic Coords of Works: Photo of Works Location:	PID 007570163 PARCEL "A" (REFERENCE PLAN 4833) DISTRICT LOT 83 GROUP 2 NEW WESTMINSTER DISTRICT 49.0926620, -122.0670250		
LAND OWNERSHIP AT THE WORKS			
Land Ownership:	□ Applicant owns land □ Land is Crown Land but applicant has tenure □ Land is Crown Land but tenured to Ministry of Transportation □ A third Party owns the land but the applicant has lease or tenure ☑ A third Party owns the land but applicant has written consent □ Land is Crown Land but the applicant does not have a tenure  For all private lands, you must obtain and provide the landowner's written consent. The consent form must describe the proposed project and contain the landowners address, telephone number and postal code. Upload a copy of the landowner's written consent using the upload documents section of this form.		
PERMIT OVER CROWN LAND			
entitled to request a Permit Over Crown Land (PCL	.). A PCL authoriz iired, the applicat	equire an authorization. A person applying for a Change Approval is set the flooding of Crown land or the construction, maintenance or sion fee will be automatically calculated and added to your owing circumstances apply to your application:	
any of your works are located on or crossing Crov	wn land		
Do any of the above apply to your application?		Yes	
Do have an existing Crown Land Tenure, Perm Land or Mines Lease that covers the affected		No	
TOTAL PCL AREA Enter the Total Crown Land Area for all sites.			
Provide Total PCL Area?		Yes	
Total PCL Area:		21.87 ha	
OPTION TO CHANGE A PERMIT OVER CROWN LA	ND TO A CROWN	I LAND TENURE	
Do you want to change from a Permit Over Cr Land Act tenure application?	own Land to a	No	
PCL FEE REQUIRED			

A Permit Over Crown Land application fee has been added to your application. You will also be required to pay a Permit Over Crown Land rental fee after your application has been reviewed and the rental fee determined.

### LOCATION INFORMATION

### LAND DETAILS

### **DRAWINGS**

A Drawing to Scale is required that meets the Application Drawing Standards. Choose one of the options below to submit the required map/drawing.

Additionally, it is recommended that you provide a topographical map showing the general location of the property where the water is proposed to be used and the works constructed in relation to nearby communities, highways, railways and other water sources.

(this additional map will not be necessary if your Drawing to Scale is provided using the Geomark Service or a spatial file such as .KML or .KMZ)

☑ I have created my map(s) using my own Geographic Information System (GIS)

### SPATIAL FILES

Do you have a spatial file from your GIS system? You can upload it here.

NOTE: Shapefile is the preferred format and requires a closed polygon, projection in BC Albers/NAD 83 and the .dbf, .shp, .shx and .prj files. Other Commonly Used Spatial File Formats may also be submitted.

Description	Filename
Boundary Bar	Boundary.dbf
Boundary Bar	Boundary.prj
Boundary Bar	Boundary_Habitat.shx
Boundary Bar	Boundary_Habitat.shp
Boundary Bar	Boundary_Habitat.sbx
Boundary Bar	Boundary_Habitat.sbn
Boundary Bar	Boundary_Habitat.prj
Boundary Bar	Boundary_Habitat.dbf
Boundary Bar	Boundary.shx
Boundary Bar	Boundary.shp
Boundary Bar	Boundary.sbx
Boundary Bar	Boundary.sbn
Brown Bar	Brown_A.dbf
Brown Bar	Brown_B.shp

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Brown Bar	Brown_B.sbx
Brown Bar	Brown_B.sbn
Brown Bar	Brown_B.prj
Brown Bar	Brown_B.shx
Brown Bar	Brown_A.shx
Brown Bar	Brown_A.shp
Brown Bar	Brown_A.sbx
Brown Bar	Brown_A.sbn
Brown Bar	Brown_A.prj
Brown Bar	Brown_B.dbf
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Chadsey Bar	Chadsey.prj
Chadsey Bar	Chadsey.sbn
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Chadsey Bar	Chadsey.shp.xml
Chadsey Bar	Chadsey.sbx
Garrison Bar	Garrison.sbn
Garrison Bar	Garrison.sbx
Garrison Bar	Garrison.shp
Garrison Bar	Garrison.shx
Garrison Bar	Garrison.prj
Garrison Bar	Garrison.dbf
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Geisbreicht Bar	Giesbrecht.prj
Geisbreicht Bar	Giesbrecht.sbx
Geisbreicht Bar	Giesbrecht.shp
Geisbreicht Bar	Giesbrecht.shx
Geisbreicht Bar	Greendale.dbf
Geisbreicht Bar	Greendale.prj

Geisbreicht Bar	Giesbrecht.sbn
Greendale Bar	Grendale_Habitat.shp
Greendale Bar	Grendale_Habitat.sbx
Greendale Bar	Grendale_Habitat.sbn
Greendale Bar	Grendale_Habitat.prj
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Greendale Bar	Greendale Habitat Riffle. shp
Greendale Bar	GreendaleHabitatRiffle.sbx
Greendale Bar	Greendale Habitat Riffle.sbn
Greendale Bar	GreendaleHabitatRiffle.prj
Greendale Bar	GreendaleHabitatRiffle.dbf
Greendale Bar	Greendale.shx
Greendale Bar	Greendale.shp
Greendale Bar	Greendale.sbx
Greendale Bar	Grendale_Habitat.shx
Greendale Bar	Greendale.sbn
Keith Wilson Bar	Keith_Wilson.dbf
Keith Wilson Bar	Keith_Wilson.prj
Keith Wilson Bar	Keith_Wilson.shx
Keith Wilson Bar	Keith_Wilson.sbx
Keith Wilson Bar	Keith_Wilson.shp
Keith Wilson Bar	Keith_Wilson.sbn
Lickman Bar	Lickman.dbf
Lickman Bar	Lickman.prj
Lickman Bar	Lickman.sbn
Lickman Bar	Lickman.sbx
Lickman Bar	Lickman.shp
Lickman Bar	Lickman_Scalp.shx
Lickman Bar	Lickman_Scalp.dbf
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Lickman Bar	Lickman_Scalp.sbx
Lickman Bar	Lickman_Scalp.shp
Lickman Bar	Lickman.shx
Peach bar	Peach.dbf
Peach bar	Peach.prj
Peach bar	Peach.sbn
Peach bar	Peach.sbx
Peach bar	Peach.shp
Peach bar	Peach.shp.xml
Peach bar	Peach_Habitat.shx
Peach bar	Peach_Habitat.dbf
Peach bar	Peach_Habitat.prj
Peach bar	Peach_Habitat.sbn
Peach bar	Peach_Habitat.sbx
Peach bar	Peach_Habitat.shp
Peach bar	Peach.shx
Railway Bar	Railway.dbf
Railway Bar	Railway.prj
Railway Bar	Railway.shx
Railway Bar	Railway.sbx
Railway Bar	Railway.shp
Railway Bar	Railway.sbn
Salad Bar	Salad.dbf
Salad Bar	Salad.prj
Salad Bar	Salad.sbn
Salad Bar	Salad.sbx
Salad Bar	Salad.shp
Salad Bar	Salad.shx

Salad Bar	SaladHabitat.dbf
Salad Bar	SaladHabitat.prj
Salad Bar	Salad Habitat.sbn
Salad Bar	Salad Habitat.sbx
Salad Bar	Salad Habitat.shp
Salad Bar	Salad Habitat.shx
accessroutes.dbf	AccessRoutes.dbf
accessroutes.prj	AccessRoutes.prj
accessroutes.shp	AccessRoutes.shp
accessroutes.shx	AccessRoutes.shx
potentialstockpile.dbf	PotentialStockpile.dbf
potentialstockpile.prj	PotentialStockpile.prj
potentialstockpile.shp	PotentialStockpile.shp
potentialstockpile.shx	PotentialStockpile.shx
proposedgravel excavation	Proposed Gravel Excavation_20
proposedgravelexcavation	Proposed Gravel Excavation_20
proposedgravelexcavation	Proposed Gravel Excavation_20
proposedgravelexcavation	Proposed Gravel Excavation_20

# ATTACHED DOCUMENTS

Document Type	Description	Filename	
Other	2016 Vedder River Assessment Report	Vedder 2016 Assessment Repo	
Other	2022 Vedder Monitor's Report	2022 Vedder River Sediment	
Other	Archaeological chance find procedures	6-Archaeological Chance Fin	
Other	City of Abbotsford Letter of consent	COA Nova Pacific Letter of	
Other	City of Chilliwack Letter of Consent	City of Chilliwack Letter o	
Other	Construction Environmental Management Plan	Vedder Sediment Removal CEM	
	Construction Limitonniental Management Fidir	vedder Sediment Nemoval CEM	
0.1	2521		
Other	DFO letter of appointment	DFO_Letter of appointmemt.pdf	

Other	Environmental Assessment Report	Proposed 2023 Vedder River
Other	Hydraulic Assessment Report	4-2023-05-05_VedderHydrauli
Other	MOF letter of appointment Letter_of_Appointmen	
Other	Mark Gore Letter of Consent	mark gore consent letter.pdf
Other	SARA screening report	SARA Screening Report for P
Other	Sediment Removal Plan	2-Sediment Removal Plan.pdf
Other	Stockpile location plan 3-Stockpile Location	
Other	Vedder River AOA	5-VE22419 - Vedder River 20
Other	Vedder location plan	1-Vedder Location Plan.pdf

### PRIVACY DECLARATION

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FrontCounter BC Program Director FrontCounter BC, Provincial Operation 441 Columbia Street Kamloops, BC V2C 2T3

☑ Check here to indicate that you have read and agree to the privacy declaration stated above.

### REFERRAL INFORMATION

Some applications may also be passed on to other agencies, ministries or other affected parties for referral or consultation purposes. A referral or notification is necessary when the approval of your application might affect someone else's rights or resources or those of the citizens of BC. An example of someone who could receive your application for referral purposes is a habitat officer who looks after the fish and wildlife in the area of your application. This does not apply to all applications and is done only when required.

Please enter contact information below for the person who would best answer questions about your application that may arise from anyone who received a referral or notification.

Company /
Organization:

Ministry of Environment and Climate Change

Contact Name: Contact Address:	Gulraiz Cheema Mailing Address: PO Box 9337 Stn Prov Govt, Victoria, BC V8W 9M1
Contact Phone: Contact Email:	778-704-7278 gulraiz.cheema@gov.bc.ca
I hereby consent to the disc	losure of the information contained in this application to other agencies, government ministries or

other affected parties for referral or First Nation consultation purposes.

### **IMPORTANT NOTICES**

Please review the "Important Notices" below and then check the declaration at the bottom confirming that everything in this application is complete and accurate.

- I understand that the submission of this application does not provide authority under the Water Sustainability Act to construct works in and about a stream. I also understand that my application must be reviewed before a decision is made as to whether an approval may be granted and that, as part of that review, additional information may be requested of me.
- The application may be subject to further requirements under the federal Fisheries Act. Please refer to Fisheries and Oceans Canada Projects Near Water webpage (http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html) for information on how to ensure your project complies with the Fisheries Act.

### **DECLARATION**

☑ I declare that the information contained on this form is complete and accurate.		
Surrey		
No		

APPLICANT SIGNATURE	
Applicant Signature	Date

OFFICE USE ONLY		
Office Surrey	File Number 2010455	Project Number 744075
	Disposition ID	Client Number

Tracking Number: 100415064 | Version 1.0 | Submitted Date: May 5, 2023 Page 30 of 30 From: Bruce Wright (bfw@novapacific.net)

**To:** Currie, Michael FOR:EX (Michael.Currie@gov.bc.ca)

Cc: Josef Eriksson (jeriksson@novapacific.net); Karen Frazer (kfrazer@novapacific.net); Lawrence

Francois (LFrancois@kwl.ca)

Subject: Proposed 2023 Vedder River Sediment Removal Project

Sent: 05/12/2023 00:58:25

Message Body:

**[EXTERNAL]** This email came from an external source. Only open attachments or links that you are expecting from a known sender.

Hi Michael.

Please be advised that the total volume proposed to be removed is 364,000 cubic meters

On the application we have included a common overview for each of the sites which has been modified somewhat for each individual excavation. In these sections we used the older estimate of 354,700 cubic meters as the total to be removed.

To the best of my knowledge, the EA report, the hydraulic report and other supporting documents include the correct figure.

Thanks for the conversation today.

Bruce

Bruce F. Wright, B.Sc. MBA. RPBio

President/Principal Biologist

Nova Pacific Environmental Ltd.

97 N Renfrew Street, Vancouver BC V5K 3N6

C: 604.318.9183 O: 604.251.5216

<span style="color:#4472C4">bfw@novapacific.net</span> | <span
style="color:#4472C4">http://www.novapacific.net/</span>

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# **Construction Environmental Management Plan**

# Vedder River– 2023 Vedder River Sediment Removal Project

# Prepared for:

The Ministry of Environment and Climate Change Strategy and Sediment Removal Contractor(s)

Prepared by:

Nova Pacific Environmental Ltd.

97 North Renfrew Street Vancouver, BC V5K 3N6 Tel: 604.251.5216 • WWW.NOVAPACIFIC.NET

June 26, 2023



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#### CEMP for 2023 Vedder River Sediment Removal Project

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### **APPENDICES**

- Appendix A: Environmental Permits
- Appendix B: SARA Screening Report for Proposed Vedder River Gravel Removal Project
- Appendix C: Species at Risk Identification Material
- Appendix D: Environmental Orientation Record Form
- Appendix E: Environmental Incidence Report Form
- Appendix F: Silt Curtain Installation Instructions
- Appendix G: Reportable Spills
- Appendix H: Contractor Spill Response Plan

**Table 1: Project Contact List** 

Entity/Role	Company	Contact Person	Office #	Cell #
Project Manager	Kerr Wood Leidal	Lawrence Francois	604-293-3245	s.22
Site Supervisor	ТВА	ТВА	ТВА	ТВА
Spill Coordinator	Nova Pacific Environmental	TBA	604-251-5216	TBA
Environmental Monitor	Nova Pacific Environmental	Bruce Wright	604-251-5216	s.22
Environmental Technician	Nova Pacific Environmental	Karen Frazer	604-251-5216	s.22
Environmental Technician	Nova Pacific Environmental	Josef Eriksson	604-251-5216	s.22
Environmental Technician	Nova Pacific Environmental	Ray Oliver	604-251-5216	s.22
Ministry Representative	Ministry of Environment and Climate Change Strategy (ENV)	Gulraiz Cheema	ТВА	778-704-7278
Asst. Ministry Representative	ТВА	ТВА	ТВА	ТВА
Project Engineer	Kerr Wood Leidal	Matt Stevenson	s.22	s.22
Provincial Emergency Response Program		1-800-663-3456		
DFO Emergency Line		1-800-465-4336		

# **Signature Page**

Prepared by:

Nova Pacific Environmental Ltd.

Ray Oliver. Dip.Tech

**Environmental Technician** 

Date: 26/06/2023

Josef Eriksson. B.Sc.

**Biologist** 

Date: 26/06/2023

Reviewed by:

Nova Pacific Environmental Ltd.

Bruce F. Wright. B.Sc., MBA, R.P.Bio

President

Date: 26/06/2023

### CEMP for 2023 Vedder River Sediment Removal Project

Reviewed and understood by:	
CONTRACTOR	
Project Manager	Date:

# 1.0: INTRODUCTION

The purpose of this Construction Environmental Management Plan (CEMP) is to identify potential environmental impacts resulting from the works and the processes to be utilized by the contractor(s) to deliver the level of environmental management required by the Ministry of Forests (MOF), formerly Ministry of Forests, Lands, and Natural Resources Operations (FLNRO), Fisheries and Oceans Canada (DFO) and any other stakeholders for the 2023 Vedder River Sediment Removal Project (the 'Project').

The Project will occur along the Vedder River, in Chilliwack, BC. The excavation sites are located downstream of the Vedder Crossing, and between 1.5 km – 6 km south of Hwy 1, as shown in Figure 1.



Figure 1: Location of the excavation sites along the Vedder River.

This CEMP has been developed to provide guidance to all personnel, including contractors/sub-contractors and third-party service providers involved in the completion of the Project, to ensure that safe, compliant, environmentally, and socially responsible actions are taken to mitigate potential project effects on the environment. This CEMP is designed to comply with legislative requirements, conditions of the environmental approvals and guidelines set out by The Ministry (Water Sustainability Act and Dike Maintenance Act), and DFO (Fisheries Act). This CEMP identifies and outlines:

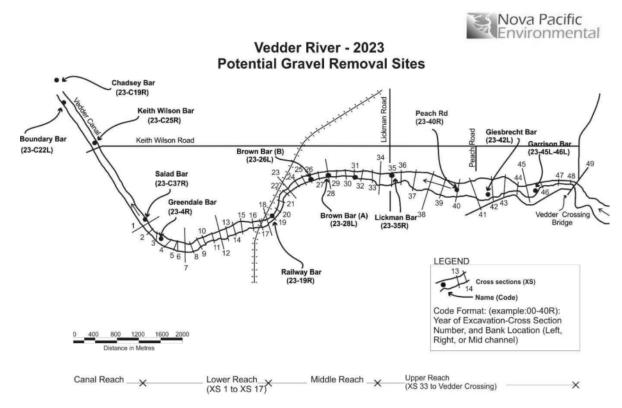
- Site and activity-specific environmental management and monitoring plans designed to protect the human and ecological environment,
- Key construction and operations activities, applicable environmental mitigation measures, and best management practices (BMPs), and
- Environmental monitoring, reporting, and regulatory compliance requirements.

This CEMP is considered a living document and will be updated as project planning and implementation is finalized. Once finalized, project personnel must comply with this CEMP or provide a suitable and approved alternative approach that can be incorporated into an updated CEMP, if necessary.

# 2.0: PROJECT INFORMATION

The eleven (11) potential sediment removal sites for 2023 (shown in Figures 1 and 2) have been selected to:

- Lower water levels where dike freeboard is limited;
- Trap sediment upstream of the freeboard limited area;
- Reduce future excessive excavation requirement in the Lower Reach when a large flood occurs and limit sediment movement into this reach during a flood to bolster the freeboard in limited areas;
- Increase capacity in the canal section of the river to lower the backwater curve, and to lower water levels in the freeboard limited area;
- Provide optimum habitat outcomes while meeting flood protection objectives for sediment removal; and/or
- Provide additional habitat in the immediate vicinity of the excavations where suitable habitat enhancement opportunities exist.



**Figure 2:** The 11 proposed excavations sites (with Brown A and B) for the 2023 Vedder River Sediment Removal Program with reach boundaries, site identifier codes and key infrastructure identified.

### 2.1: Gravel Extraction Locations

### 2.1.1 Garrison Bar

The Garrison Bar excavation is located 500 m downstream of the Vedder Crossing Bridge along the setback dike and Rotary Trail. The approximate geographical coordinates are 49.096822°N, -121.971522°W. The site identifier corresponding to Figure 2 is 23-45L-46L.

### 2.1.2 Giesbrecht Bar

The Giesbrecht Bar excavation site is located at the foot of Giesbrecht Road along the setback dike and Rotary Trail. The approximate geographical coordinates are 49.097114°N, -122.984648°W. The site identifier corresponding to Figure 2 is 23-42L.

### 2.1.3 Peach Road Downstream

The Peach Road Downstream excavation site is located along the setback dyke and Rotary Trail at the downstream end of Peach Park. The approximate geographical coordinates are 49.096568°N, -122.993423°W. The site identifier corresponding to Figure 2 is 23-40R.

### 2.1.4 Lickman Bar

The Lickman Bar excavation site is located downstream of the Lickman Vedder River Parking Lot, along the setback dike and Rotary Trail. The approximate geographical coordinates are 49.116460°N, -122.090187°W. The site identifier corresponding to Figure 2 is 23-35R.

# 2.1.5 Brown Bar (A + B)

The Brown Bar excavation sites are located upstream 300 m North of the Bergman stockpile. The approximate geographical coordinates of Brown Bar A are 49.098800°N, -122.022865°W, and the coordinates of Brown Bar B are 49.098282°N, -122.025540°W. The site identifiers corresponding to Figure 2 are 23-28L (Brown A), and 23-26 L (Brown B).

### 2.1.6 Railway Bar

The Railway Bar excavation site is located approximately 180m upstream from the railway bridge along the Rotary Trail. The approximate geographical coordinates are 49.092699°N, -122.035152°W. The site identifier corresponding to Figure 2 is 23-19R.

### 2.1.7 Greendale Bar

The Greendale Bar excavation site is located 400 m upstream of the Greendale Stockpile site, along the Rotary Trail. The approximate geographical coordinates are 49.088418°N, -122.058839°W (downstream), 49.089433°N, -122.063018°W (upstream). The site identifier corresponding to Figure 2 are 23-3R-4R.

### 2.1.8 Salad Bar

The Salad Bar excavation site is located 100 m downstream of the Greendale Stockpile site, along the Rotary Trail. The approximate geographical coordinates are 49.092662° N, -122.067025° W. The site identifier corresponding to Figure 2 is 23-C37R.

### 2.1.9 Keith Wilson Bar

The Powerline excavation site is located 200 m upstream of the Keith Wilson Bridge, along the Rotary Trail. The approximate geographical coordinates are 49.097114 ° N, -122.984648° W. The site identifier corresponding to Figure 2 is 22-C25R.

# 2.1.10 Boundary Bar

The Boundary Bar excavation site is located at the foot of Giesbrecht Road along the setback dike and Rotary Trail. The approximate geographical coordinates are 49.101119° N, -122.076004° W. The site identifier corresponding to Figure 2 is 23-C22L.

# 2.1.11 Chadsey Bar

The Chadsey Bar excavation site is located downstream of Boundary Bar on the right bank of the Vedder River. The approximate geographical coordinates are 49.112657° N, -122.085685° W. The site identifier corresponding to Figure 2 is 23-C19R.

# 2.2: Access to Sites and Stockpiling locations

### 2.2.1: Garrison Bar

Take exit off Vedder Mountain Rd, approximately 900 m northwest of Vedder Crossing.

### 2.2.2 Giesbrecht Bar

Access from Giesbrecht Road along the dike to Giesbrecht stockpile and then east along Rotary Trail to the downstream end of bar. The existing large stockpile site is well away from the active channel, adjacent to the dike. This stockpile should be used if stockpiling is required. Commencing about 50 m to the west there is a series of enhanced groundwater fed rearing ponds and a channel that connects to the mainstem river upstream of the Vedder River Campground. However, this is far enough from the stockpile site that there is unlikely to be any interference.

### 2.2.3 Peach Road Bar

Access to this site is from the south end of Peach Road, 250 m west along the Rotary Trail. There is no immediately adjacent stockpile site, however, it may be an option to travel along the setback dikes to the Hooge stockpile if stockpiling of excavated material is required.

### 2.2.4 Lickman Bar

Access to this site is from the parking lot at the end of Lickman Road, downstream along the Vedder River Rotary Trail for approximately 100 m. A ramp and culvert will be used to access the bar approximately halfway down. This location provides the easiest access and keeps the required culvert away from the steep bank providing for easier management of the crossing and minimizing the on-bar haul requirements. A ramp can be installed directly from the parking lot area down onto the bar. There is no adjacent stockpile site, however, it may be an option to travel along the setback dikes to the Hooge stockpile if stockpiling of excavated material is required offsite.

# 2.2.5 Brown Bar (A + B)

The Brown Bar sites can be accessed travelling 300 m upstream from the Bergman stockpile along the Rotary Trail.

# 2.2.6 Railway Bar

The site can be accessed from Keith Wilson Road, south on Sinclair Road, then east along the setback dike to parking area. Proceed west along the trail atop the bank protection works. (Trail bypass remains but vehicle access has been closed off and the old haul route has been redeveloped as a trail). The distance from the excavation site to the Hooge stockpile (adjacent to the parking area) is about 750 m west along the Rotary Trail. This would create some requirement for trail restoration due to machinery access and degradation of the trail if the Hooge stockpile area is to be used.

### 2.2.7 Greendale Bar

Access to site is along the north dike access road from east end of Keith Wilson Bridge to parking area at the Greendale Stockpile site, and along the Rotary Trail to existing access point. One or two culvert crossings of side channels or tributaries of the Vedder River may be required to access the excavation area. The Greendale stockpile site can be used for stockpiling excavated material is needed.

### 2.2.8 Salad Bar

Access to site is east along Dyke Crest Road from east end of Keith Wilson Bridge to blocked access road approximately 100 m west of the parking area at the Greendale Stockpile site. The access road would need to be unblocked and crossing to the bar would likely require two culverts for crossing a side channel of the Vedder. The Greendale stockpile site can be used for stockpiling excavated material is needed.

### 2.2.9 Keith Wilson Bar

Access to the site is from the east end of Keith Wilson Bridge. A secondary channel near the left bank may need to be crossed to access this bar. Small culverts should be sufficient. Stockpile locations are currently being finalized.

# 2.2.10 Boundary Bar

Access to site is northwest along the left bank dike road from the Fisherman's Corner parking lot. A ramp down from the dyke top to the low bank and then a second ramp down to the bar would be required. A culvert may be required to cross the microchannel along the left bank. Stockpile locations are currently being finalized.

# 2.2.11 Chadsey Bar

Bar is accessed by travelling 1 km north from Keith Wilson Bar, along the north dike road. A culvert may be needed to access the bar. Stockpile locations are currently being finalized.

# 2.3: Excavation Details and Objectives

### 2.3.1 Garrison Bar

The Garrison Bar excavation has been devised to remove sediment upstream of the freeboard limited area. The total projected volume of sediment to be taken from the pit is 33,000 m<sup>3</sup>. The volume of a proposed habitat excavation downstream of the pit is estimated at 721 m<sup>3</sup>. See Figure 3 for excavation diagram.

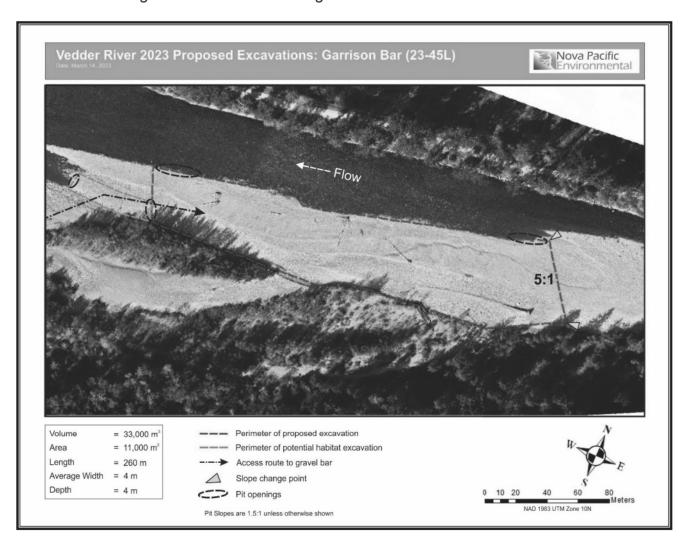


Figure 3: Garrison Bar Excavation. (Photo taken October 2022.)

### 2.3.2 Giesbrecht Bar

The main purpose of this excavation would be to intercept sediment upstream of the area of freeboard limitation. The bar is estimated to be 1 m in height above low water levels during

summer months, resulting in a 4 m excavation depth and higher yield of sediment. The total projected volume of sediment to be taken from the pit is 21,400 m<sup>3</sup>. See Figure 4 for excavation diagram.

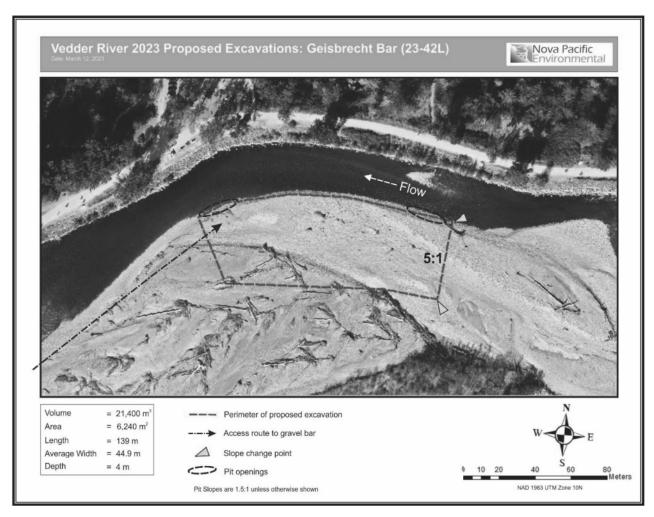


Figure 4: Giesbrecht Bar excavation. (Photo taken October 2022.)

#### 2.3.3 Peach Road Downstream

The purpose of the excavation at this site is to trap sediment upstream of the freeboard limited area. The bar top removal section of the excavation is intended to draw higher flows

away from the left bank and into the right channel. The bar top removal can be excavated to a depth which will allow the formation of riffle and thereby increase habitat value at this location. The total volume of the Peach Pit is estimated to be 104,600 m<sup>3</sup>. See Figure 5 for the excavation diagram.

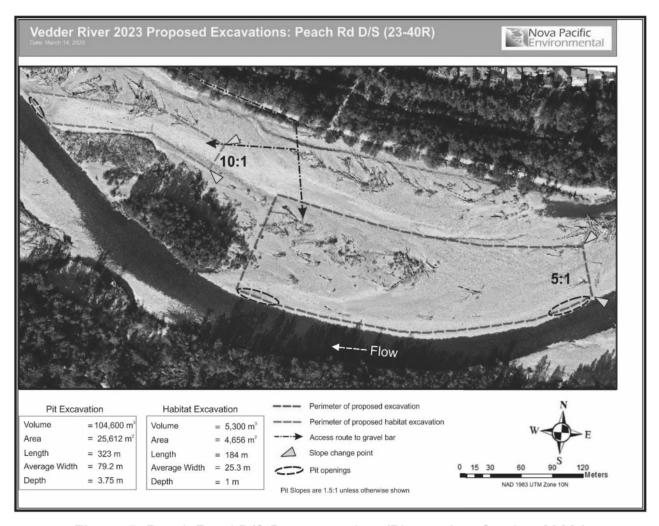


Figure 5: Peach Road D/S Bar excavation. (Photo taken October 2022.)

#### 2.3.4 Lickman Bar

The main objectives of this excavation are to trap sediment upstream of freeboard limited sections of the channel and to reduce flow pressures on the left bank. The bar top removal will also create riffle habitat and improve the connection of low flows to the secondary channel. The pit at Lickman is projected to have a volume of 12,300 m³, and the Bar Top Removal will have a volume of 7,400 m³. See Figure 6 for the excavation diagram.

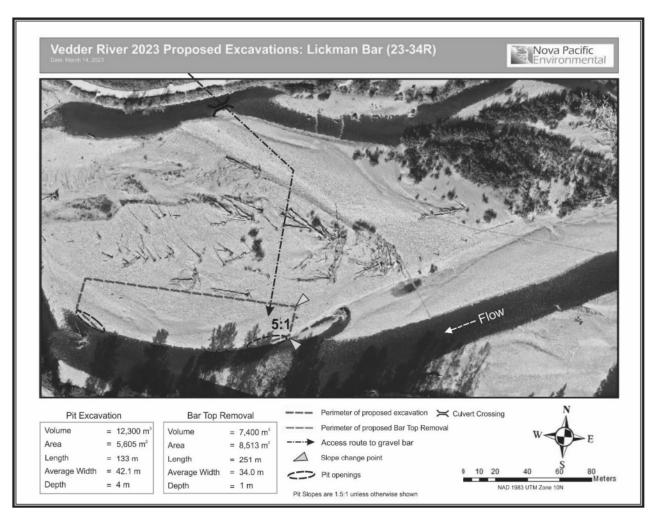


Figure 6: Lickman Bar excavation and Bar Top Removal. (Photo taken October 2022.)

## 2.3.5 Brown Bar (A + B)

The primary objective for this excavation is to increase freeboard within a freeboard limited section of the river. The habitat channel on the left bank will be excavated to provide spawning and rearing habitat for salmonids. Brown A excavation will yield approximately 4,300 m³, and Brown B excavation will yield roughly 23,300 m³. See Figure 7 for the excavation diagram.

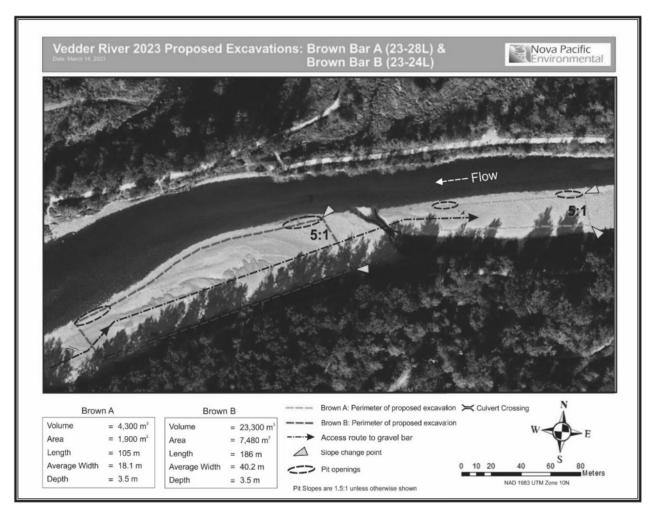


Figure 7: Brown Bar (A + B) excavation. (Photo taken October 2022.)

## 2.3.6 Railway Bar

This excavation will reduce the amount of sediment moving downstream into a freeboard limited section of the river below the railway as well as address a slight limitation of freeboard at this location. Excavations at this location have typically refilled quickly, therefore removal of sediment has been proposed. The target volume to be excavated from Railway Bar is 6,500 m<sup>3</sup>. Excavation along the north bank of the river is proposed for habitat compensation, with an estimated extraction volume of 81 m<sup>3</sup>. See Figure 8 for the excavation diagram.

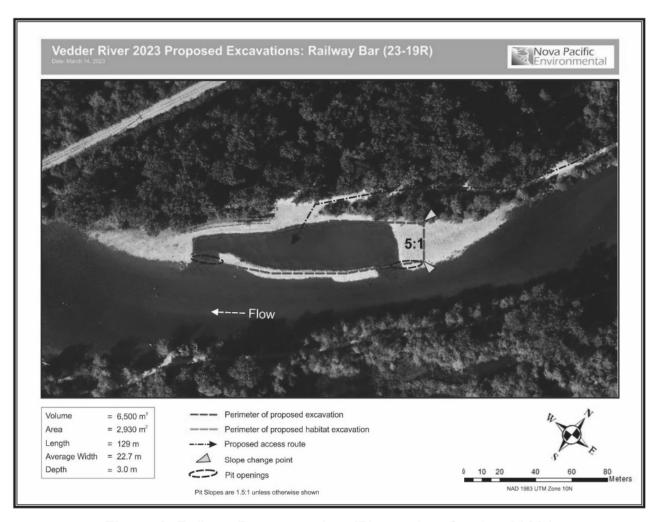


Figure 8: Railway Bar excavation. (Photo taken October 2022.)

#### 2.3.7 Greendale Bar

The purpose of this excavation is to remove sediment from the freeboard limited section of the river. The upstream bar top removal is intended to provide additional sediment whilst maintaining similar separation of flows around the vegetated island. The approximate volume to be excavated from the Greendale pit is 43,900 m³, and the volume of the habitat excavation is estimated to be 11,300 m³. The habitat excavation will consist of riffles zone habitat feature. See Figure 9 for the excavation diagram.

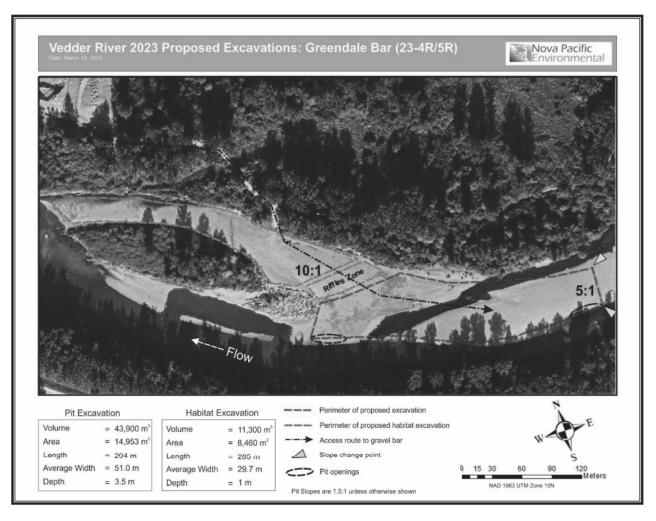


Figure 9: Greendale Bar excavation. (Photo taken October 2022.)

#### 2.3.8 Salad Bar

This sediment bar is located in the freeboard limited section and is expected to directly lower water levels in the area. Habitat priorities are to ensure that the pink salmon spawning habitat upstream and the existing habitat channel along the right bank are maintained. The target volume to be excavated at Salad Bar is 9,300 m³. Habitat compensation is proposed upstream of the pit excavation, with approximately 202 m³ of sediment excavated. See Figure 10 for the excavation diagram.

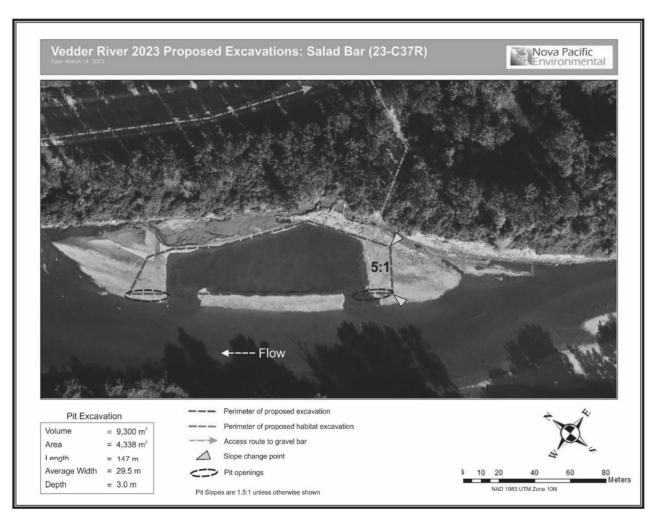


Figure 10: Salad Bar A excavation. (Photo taken October 2022)

## 2.3.9 Keith Wilson Bar

The objective of this excavation is to lower water levels in the freeboard limited area through backwater curve reduction. This excavation will likely refill slowly, providing riffle and pool habitat features through a few freshet cycles. Approximately 26,600 m<sup>3</sup> of sediment will be excavated from Keith Wilson Bar. See Figure 11 for excavation diagram.

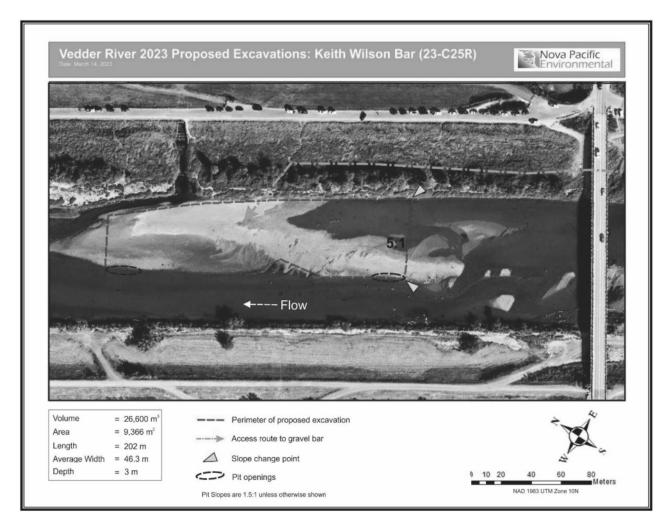


Figure 11: Keith Wilson Bar excavation. (Photo taken October 2022.)

## 2.3.10 Boundary Bar

This excavation is designed to improve the backwater curve, reducing risk of dyke overtopping upstream in the freeboard limited section of the Vedder River. In terms of flood risk benefits, this is the most effective of the proposed excavations. The target volume to be excavated from Boundary Bar is 22,300 m<sup>3</sup>. Proposed habitat excavation upstream of the pit is estimated at 305 m<sup>3</sup>. See Figure 12 for excavation diagram.

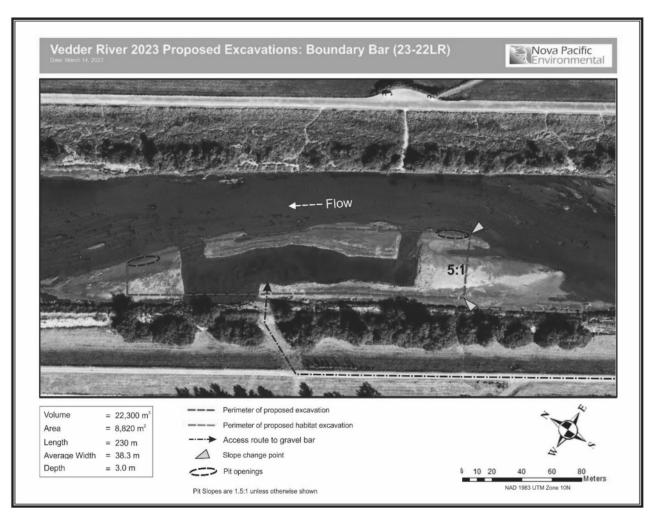
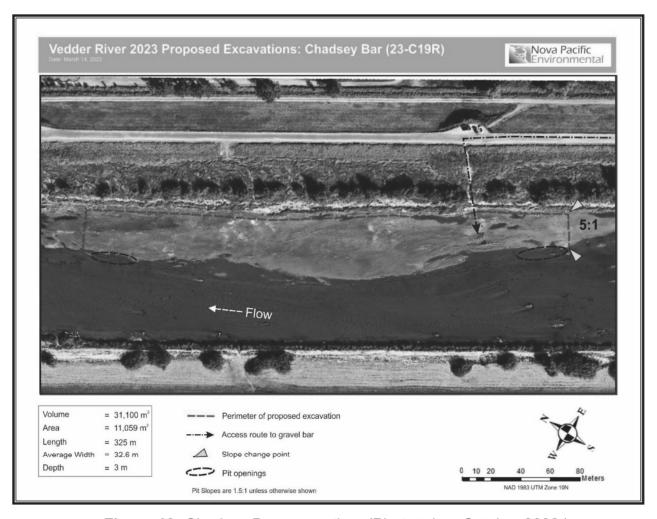


Figure 12: Boundary Bar excavation. (Photo taken October 2022.)

## 2.3.11 Chadsey Bar

The goal with this excavation is to improve the backwater curve, reducing risk of dyke overtopping upstream in the freeboard limited section of the Vedder River. In terms of flood risk benefits, this is the most effective of the proposed excavations. The target volume to be excavated from Boundary Bar is 31,100 m<sup>3</sup>. See Figure 13 for excavation diagram.



**Figure 13:** Chadsey Bar excavation. (Photo taken October 2022.)

## 2.4: Project Activities

#### 2.4.1: **General**

To complete the eleven (11) excavation sites on the Vedder River, the project activities will include:

- Removal of vegetation (i.e., Giesbrecht) to create access to the bar; all of the sites rely on existing access routes so removal will be limited to branches, and smaller plants.
- Installation of culvert crossings where necessary;
- Environmental protection (e.g., fish salvage, monitoring, isolation of excavation from flowing water);
- Deep pit and top of bar excavations on individual bars;
- Placement of Large Woody Debris (LWD);
- Habitat channel excavation and enhancements;
- · Opening of the excavations to flowing water; and,
- Site cleanup and restoration.

#### 2.4.2: Environmental Risk Assessment

The environmental risks associated with the above noted activities include, but are not limited to:

- Temporary effects to ambient air quality through mobilizing and use of equipment (e.g., excavators, haul trucks, etc.) and construction activities creating dust by soil disturbances;
- Temporary effects to ambient noise levels through mobilizing and use of equipment at site, increased human presence, and excavation activities;
- Effect on ground surface through project activities involving ground disturbance (e.g. sediment removal, vegetation clearing, riprap removal, machinery access, etc.).
   Ground surface compaction caused by equipment, material laydown, and other project works;
- Possible soil contamination through accidental spill or release of deleterious substances:
- Effects on water quality through accidental spills or release of deleterious substances

(e.g., fuel and oil for machinery or sediment laden water) during works;

- Temporary and short-term impacts to water quality through the introduction of fine sediment to the water;
- Temporary and short-term impacts to water quality from sediment mobilized to watercourse from construction activities;
- Possible introduction or spread if invasive plant species which may be transported to or from Project area through vehicles and equipment;
- Disturbance to vegetation through project activities (e.g. equipment movement and material laydown, gaining access to work area, and excavation work) that may damage or destroy vegetation;
- Temporary disturbance and direct or indirect harm to wildlife through vehicle collisions during mobilization to or from site and by accidental spill or release of a deleterious substance (e.g. hydrocarbons, uncured concrete);
- Direct or indirect harm to fish by accidental spill or release of a deleterious substance (e.g. hydrocarbons) or by increased turbidity in water due to sediments mobilized from soil disturbances;
- Inadvertently altering fish habitat during access and excavation as well as influences from unusually high flows during the excavations; These issues are strictly managed by the environmental monitor (EM); and,
- Inadvertently inflicting harm on endangered species, or disturbing endangered species' critical habitat.

# 2.5: Project Schedule

The work is anticipated to commence on August 1<sup>st</sup> and will be completed by September 30<sup>th</sup>. The 2023 least-risk fisheries work window for the Vedder River is between July 15 September 15. In previous years, excavations have extended to September 30 where conditions were suitable. This extension has been incorporated into the 2023 applications to meet the sediment removal targets. However, excavation sites upstream of pink salmon spawning areas will be completed first and by September 15.

# 2.6: Key Project Personnel

Table 1 (see above) provides the contact information for the key project personnel. The following sections provide a general overview of the responsibilities of each project constituent.

## 2.6.1: The Contractor (TBD)

The Contractor will be required to comply fully with the requirements of the provincial (The Ministry) and federal (DFO) permits as well as this CEMP. The Contractor will be in constant communication with the Environmental Monitor (EM) and Environmental Technicians (ET), as part of the CEMP implementation and monitoring process.

It is the responsibility of the Contractor to understand and adhere to this CEMP and undertake the following:

- Induction/training for personnel regarding potential environmental effects, the requirements of this CEMP, and Spill Response Procedures;
- Conduct regular inspections of work procedures and equipment operation to confirm compliance with standard procedures and prevent possible future effects;
- Check regular inspections of spill response measures and secondary containment to confirm compliance and containment goals are met; and,
- Provide the EM and ETs with the authority to modify and/or halt any construction activity at any time if deemed necessary for the protection of the environment.

#### 2.6.2: The Environmental Monitor

Mr. Bruce Wright B.Sc., R.P.Bio, MBA is an appropriately qualified professional (AQP) and has been retained by KWL to be the Environmental Monitor (EM) for the project. The primary responsibilities of the EM are:

- Ensure that the environmental protection objectives and requirements of all applicable approvals/permits are met and the requirements of this CEMP and other applicable conditions implemented;
- Modify and/or halt any construction activity at any time if deemed necessary for the protection of the environment;
- Monitoring and reporting as described in Section 5.1 of this plan; and
- Supervise/Manage any environmental technicians on the project.

#### 2.6.3: The Environmental Technician

Environmental Technicians (ET) from NPE will provide environmental monitoring when the EM is not onsite. The ET will have a sufficient level of environmental monitoring expertise to manage supervision and environmental risk as required. As stipulated in the DFO

Authorization, the ET will be supervised by the EM. The primary responsibilities of the ET are:

- To monitor the works when the EM is unavailable to be onsite or at another site when more than one excavation is underway concurrently;
- Provide daily reports to the EM of the day's activities when they are acting on their behalf:
- Ensure that the environmental protection objectives and requirements of all applicable approvals/permits are met and the requirements of this CEMP and other applicable conditions implemented;
- Modify and/or halt any construction activity at any time if deemed necessary for the protection of the environment; and,
- Monitoring and reporting as described in Section 5.1 of this plan.

# 3.0: RELEVANT ENVIRONMENTAL LEGISLATION AND REGULATION

The proponent has received or will receive the following environmental permits and approvals for this project:

- (i) Change Approval under Section 11 of the *Water Sustainability Act* from the Ministry of Forests (MOF) has been issued for the sediment removal works on the Vedder River. The Letter of Advice can be found in Appendix A. In progress
- (ii) Section 35 (2) b Fisheries Act Authorization from Fisheries and Oceans Canada (DFO) regarding the sediment removal. The Fisheries Act Authorization application is currently under review.

Additional legislations and regulations that may be applicable to the project include:

- Species at Risk Act (Federal)
- Migratory Bird Convention Act (Federal)
- BC Weed Control Act
- BC Riparian Areas Protection Act
- Heritage Conservation Act (Provincial)
- Wildlife Act (Provincial)

- Environmental Management Act (Provincial)
- Navigable Waters Works Regulations (Federal)

The Contractor will ensure the works completed in such a manner that does not contravene any legislation listed above or this CEMP.

Nova Pacific Environmental Ltd. is acquiring or have acquired the following permits:

- DFO and MOF fish salvage permits NPE In Progress
- Fisheries Act Authorization In Progress
- Water Sustainability Act (WSA) change approval- In Progress
- Crown Land Use Permit- In Progress

## 4.0: ENVIRONMENTALLY SENSITIVE RESOURCES

The following provides a summary of environmental resources within the project vicinity.

## 4.1: Species of Concern

The Vedder River and the surrounding riparian area provide critical habitat for Pacific giant salamanders as well as western painted turtles. There also is designated critical habitat for Salish sucker within Salwein Creek, which drains into the Vedder River. For other species there are known occurrences within the Vedder River and its adjacent habitat. The species with known occurrences include the Oregon forestsnail, the western screech owl, northern red-legged frog, western painted turtle, and great blue heron. For more information including mitigation measures, see Appendix B. For species identification materials see Appendix C.

# 4.2: Aquatic Resources/ Environmental Timing Windows

There are seven (7) known designated watercourse within the vicinity of the project area:

- Vedder River
- Salwein Creek
- Brown Creek
- Street Creek
- Peach Creek
- Stewart Slough

#### · Lewis Slough

The Vedder River joins the Sumas River about 3 kms before flowing into the Fraser River. Upstream of Vedder Crossing, the Vedder River becomes the Chilliwack River. The Vedder River provides important habitat for several fish species including all five Pacific salmon species, bull trout (a provincially blue-listed species), white sturgeon (a species listed as endangered under COSEWIC), cutthroat trout, and steelhead. While there are (7) watercourses in the area, it is expected that only the Vedder River will be directly affected by the works.

## 4.3 Fishery Timing Window / Least Risk Instream Work Window

The least risk instream work window for the Vedder River is the period from <u>August 1 to September 15</u>. However, due to the volume of material to be moved, the success of the project may require an extension beyond September 15<sup>th</sup>. NPE has initiated the application process to include an extension until September 30<sup>th</sup>, 2023. Continuing low flows are an important consideration for any extension as this could affect the upstream migration timing for adult salmon as well as the feasibility of completing the works in isolation of flowing water. In addition, the start of spawning by pink salmon may also limit any extension to the window, particularly at sites where excavations are upstream of expected or active pink salmon spawning areas. It is anticipated that this constraint may limit activity after September 15<sup>th</sup> to sites located in the Vedder Canal. Work on all sites will be ordered to ensure that only the most downstream sites are at risk of remaining incomplete by September 15<sup>th</sup>.

## 4.4 Least Risk Breeding Bird Window

The works have the potential to affect birds that inhabit the riparian area, and as a result, the Least Risk Bird Nesting Window will apply. This is the period of <u>August 18 to March 24</u> of any given year.

The intent of this window is to reduce potential risk of contravention to the Migratory Bird Convention Act. If clearing and/or grubbing operations are required during the nesting period (March 25 to August 17 of any given year), an Appropriately Qualified Professional (AQP) should conduct an intensive survey of the area(s) where vegetation is to be removed. It is advised a bird nest survey to be conducted, in which clearing should be completed within 7 days.

In the event any active nests are identified, the work will be halted in the area and the EM will develop and implement a site-specific nest management plan.

In accordance with Section 34 of the BC Wildlife Act, nests for osprey, eagle, peregrine falcon, gyrfalcon, heron, or burrowing owl are protected year-round, whether the nest is occupied or not. In the event a protected nest is found, the work will be halted, and the EM will develop and implement a site-specific nest management plan.

# 5.0: PROJECT MITIGATION MEASURES AND ENVIRONMENTAL SPECIFICATIONS

The potential environmental impacts that may result from project activities can be avoided or minimized through implementation of environmental standards, guidelines, BMPs, and site-specific mitigation measures. The following sections provide mitigation measures and standard best practices relevant to project work which will be implemented during the works to mitigate the risk to natural resources including aquatic and terrestrial habitat values. These measures will also ensure the works are compliant with all applicable legislation, the requirements of the permits for the project and this CEMP.

The following Best Management Practices (BMPs) and guidelines are applicable to this project. The project team has the responsibility to be familiar with these BMPs.

- Land Development Guidelines for the Protection of Aquatic Habitat
  - http://dfo-mpo.gc.ca/Library/16535.pdf
- A User's Guide for Working In and Around Water
  - <a href="http://www2.gov.bc.ca/assets/gov/famring-natural-resources-and-industry/natural-resource-use/land-water-use/crown-industry/natural-resource-use/land-water-use/land-

# 5.1: Environmental Monitoring and Reporting

A qualified environmental monitor (EM) for this project, provided by NPE will conduct environmental monitoring and oversee the implementation of the CEMP. When the EM is not available onsite, the ET will act as the EM in his stead. The primary responsibility of the EM is to ensure that the environmental protection objectives and requirements of all applicable approvals/permits are met and the requirements of this CEMP and other applicable conditions are implemented. The EM or their representative has the authority to modify and/or halt any construction activity at any time if deemed necessary for the protection of the environment.

Responsibilities of the EM include, but are not limited to:

- Fill out an Environmental Orientation Record (Appendix D) with the Contractor's site supervisor,
- Supervise/manage the ET when the ET is acting as EM on the site.
- · An ET shall be onsite:
  - During installation of Erosion and Sediment Control (ESC) infrastructure, fish salvage, instream works, and ESC removal,

- Full time when instream works are being completed,
- Within 24 hours of a significant rain event (25mm precipitation per 24 hours).
   The weather network website:
   (https://www.theweathernetwork.com/ca/weather/british-columbia/chilliwack)
   will be used to forecast significant rain events.
- Communicate the requirements of the CEMP to project team members during preconstruction and tailgate meetings and promote BMPs during the project,
- Be available throughout the duration of the work to all matters related to the protection of the environment,
- Review erosion and sediment control features during site visits to ensure they are installed properly and functioning as intended,
- Review the Contractor's work procedures to ensure functionality and compliance with the CEMP and applicable regulations, standards, and BMPs,
- Attend site meetings, as required, and provide advice in preparing for work activities in a manner that mitigates adverse effects,
- Measure/assess key environmental indicators (e.g., turbidity) during routine monitoring to determine if work being conducted is in accordance with the CEMP.
- Inspect hazardous material containment, storage, transportation, and disposal to ensure compliance with applicable legislation and regulation,
- Liaise directly with project members and provide technical advice to resolve situations that may impact the environment as they arise,
- Maintain complete records of activities related to the implementation of the CEMP.
   This includes any measurements taken, photographs, and incident reports,
- The EM and/or the Contractor will be responsible for making any and all incident reports to Environmental Agencies under the Fisheries Act, Water Sustainability Act, Environmental Management Act, and any other relevant acts. The environmental incident will be reported to the Ministry of Environment Representative prior to or concurrently to reporting to the environmental authorities. A template for an Environmental Incident Report can be found in Appendix E.

# 5.2: Air Quality and Dust Control

The following BMPs are recommended to avoid or minimize impacts to air quality:

- Dust emissions will be controlled at the source, where possible, to contain or limit the release of dust particles to the air.
- Idling should be minimized as much as possible.
- All equipment, vehicles, and stationary emission sources will be well-maintained and used at optimal loads to minimize emissions.
- Equipment and vehicles will be turned off when not in active use.
- Combustion engines will be located away from sensitive receptors such as fresh air intakes, air conditioners, and windows,
- A staging zone for trucks that are waiting to load or unload material in the Contract area will be established away from sensitive receptors.
- Vehicles or equipment producing excessive exhaust will be repaired or replaced prior to being used on the project.
- Stationary emission sources (e.g., portable diesel generators, compressors, etc.) will be used only as necessary and turned off when not in use.
- Dust generating activities will be minimized as much as possible, especially during windy periods. As outlined in, application and handling of the any dust palliative, with the exception of water, should be in compliance with the Ministry of Transportation's documents "Dust Management Environmental Best Practice for Highway Maintenance Activities" and "Maintenance Guidelines for Dust Palliatives and Gravel Road Stabilization".
- Regular haul road maintenance is required to prevent accumulation of mud or fines that could result in silt laden runoff to aquatic habitat.
- Water application must be performed in such a way that does not generate sediment-laden water that may be transported to ditches or streams that lead to fish habitat.
- Regular sweeping is required to control mud and dirt tracking onto public roads, utilizing wet broom cleaning during dry weather conditions.
- Material loads entering or exiting the site will be covered as appropriate to prevent sediment release or air born dust generation.
- No burning of oils, rubber, tires and any other material will take place at the site.
- Stabilize exposed soils outside of bars, stockpile areas and haul routes with growing

medium, compost seed and plants, as soon as possible.

#### 5.3: Noise and Vibration

The following BMPs are recommended to avoid or minimize potential project effects resulting from noise:

- Construction activities are restricted to the working hours from 7 a.m. to 5 p.m. Monday through Saturday in accordance with the City of Chilliwack bylaws. Should construction activities be required outside these hours, the Contractor will notify the City for approval.
- The affected community will be notified of the nature and likely duration of any particularly noisy operations and when it will be necessary to work outside the restricted hours.
- All equipment will be properly maintained to limit noise emission and fitted with functioning exhaust and muffler systems. Machinery covers and equipment panels will be well fitted and remain in place to muffle noise. Bolts and fasteners will be tight to avoid rattling.
- Engines will be turned off when not in use or reduced to limited idle (or as appropriate to reduce air emissions).

# 5.4: Machinery and Equipment

The following BMPs are recommended to avoid or minimize potential environmental impacts from machinery and equipment:

- Equipment and machinery will be in good operating condition and maintained free of leaks, excess oil and grease, invasive species, and noxious weeds. Equipment will be inspected daily for leaks or spills.
- All active and stationary fuel powered equipment (vehicles, machinery, generators etc.) will require secondary spill containment (i.e., spill trays). Spill trays will be utilized while equipment is inactive and during active works, where deemed possible,
- Hydraulic machinery should use environmentally friendly hydraulic fluids (i.e., nontoxic to aquatic life, and bio- degradable).
- Equipment will be operated at optimum rated loads and be turned off when not in use to minimize exhaust and noise emissions. Equipment producing excessive exhaust or noise will be repaired or replaced.

- Refueling of equipment will occur on land at least 30 m from the water, where possible.
- Refueling of machinery will follow the Refueling Management Plan in Section 7.
- Refueling areas will have spill containment kits immediately accessible and personnel will be knowledgeable in the use of these kits.
- Washing of equipment and machinery will occur at least 30 m from the river, ditches, streams, and/or drainages.

#### 5.5: Erosion and Sediment Control Plan

For erosion and sediment control (ESC) to be effective on site the following measures will need to be deployed to meet or exceed the standards outlined in the Ministry of Water Land and Air Protection "Best Practices for Urban and Rural Development" and the DFO "Land Development Guidelines for the protection of Aquatic Habitat. The following ESC measure will be implemented:

- Prior to commencement of the work, the Contractor must obtain sufficient quantities
  of silt fence, sandbags, erosion control blanketing and polyethylene sheeting,
  necessary to stabilize disturbed ground.
- All works will be conducted in a manner that will prevent the release of sediment or sediment laden waters to the Vedder River, watercourses, ditches, storm sewers and swales draining to fish habitat.
- ESC materials must be on-site, available for inspection and installed prior to the commencement of any ground disturbances.
- Effective ESC measures are to be installed before starting work to prevent the entry of sediment into the ditches or storm sewers.
- These measures will be inspected by the EM or their representative regularly during the course of construction.
- Stockpiled material will be set back at least 30 m from the Vedder River or any other drainages where possible. All material will be taken to pre-approved stockpiles.
- Material stockpiled for more than one day is to be covered by weighted poly sheeting and encircled with silt fencing to ensure no entry of sediment laden water from stockpile runoff to drainages or watercourses.
- During significant rain events (> 20 mm in 24 hours) stockpiles are to be covered by weighted poly sheeting and encircled with silt fencing to ensure no entry of sediment laden water from stockpile runoff to drainages or watercourses.

- If stockpiled materials cannot be stored 30 m from the Vedder River or other drainages, they will be covered by weighted poly sheeting and encircled with silt fencing as appropriate to ensure no entry of sediment laden water from stockpile runoff.
- Necessary repairs will be made by the Contractor immediately if any damages occur such that ESC is compromised.
- Generated debris tracking onto municipal roadways must be swept on a regular basis and at the end of the project.
- All efforts will be made to leave undisturbed native vegetation, where possible, as vegetation retention will reduce erosion potential.
- All disturbed slopes, watercourse banks and ground surfaces that may contribute sediment-laden water into sensitive fish habitats during precipitation events must be stabilized through application of organic (i.e., straw or erosion control blanket) or inorganic (i.e., plastic) mulches over the course of the workday.
- Once started, work will be pursued to completion as quickly as possible.
- Effective sediment and erosion control measures are to be maintained until revegetation of disturbed areas is achieved.
- The EM will recommend suspending excavation in heavy rainfall scenario's (>25 mm over 24-hour period).
- Excavation pits will be isolated from flow throughout the excavation activities. Pit
  openings will then be excavated in such manner that any contained turbid water
  discharges in accordance with Section 5.13.
- The berm will be opened at the downstream end of the pit first, to ensure the pit does not fill with water.
- Building a berm around sections of the pit perimeter is recommended if river level rises close to the top of pit level, if a breach of pit isolation is imminent or as directed by the environmental monitor.
- All erosion protection works will be completed within the dry section of the bar.
- Silt fences or curtains will be installed as needed. This may be necessary on haul routes specifically. See Appendix F for silt curtain installation instructions.

#### 5.6: Fish and Fish Habitat Protection Plan

The following BMPs are recommended to avoid or minimize the potential impacts to fish and fish habitat that may result from in-water construction activities:

- A fish salvage will be completed for all instream works where necessary. Fish salvage permits are currently being processed by MOF and DFO for this project.
- Excavation design mitigation includes: field fit design optimization, a gently sloped upstream end of the excavation and two wide openings to ensure fish do not become trapped.
- All project personnel will avoid activities that may, directly or indirectly deposit
  deleterious substances of any type in water frequented by fish in a manner contrary
  to Section 36(3) of the Fisheries Act, or adversely affect fish or fish habitat in a
  manner contrary to Section 35(1) of the Fisheries Act.
- Unless otherwise approved in writing by DFO or MOF, any construction activities
  occurring below the HWM of the Vedder River that may impact fish or fish habitat
  should be carried out only within the Fishery Timing Window from August 1 to
  September 15.
- Equipment (e.g., heavy machinery) used in and around water will be kept clean and in good working condition (i.e., free of leaks, excess oil, and grease).
- Any hydraulic machinery used near water will use environmentally friendly hydraulic fluids (i.e., non-toxic to aquatic life, and bio-degradable).
- All materials to be used in and around water, should be clean (i.e., they will not
  present any risk of leaching contaminants or affecting water/sediment chemistry).
- An initial soft-start procedure for excavation works will be conducted to allow fish to move away from the project area.
- Work will immediately cease should there be reasonable grounds to believe that the
  project has harmed fish or fish habitat including observation of distressed, injured, or
  dead fish or aquatic wildlife. The work will not resume until authorized by the EM.
- If distressed, injured, or dead fish are observed following the initiation of work, the EM will halt work immediately and oversee the implementation of mitigation measures before work restarts.
- Contractors will not move to the next site until the EM is satisfied that all works (i.e.
  pit excavation, pit opening and habitat enhancements) has been completed
  according to the design at the current bar.
- The EM will ensure that the culverts are an appropriate size (at least 75 cm diameter)

to ensure that flow to the affected channel will be maintained.

 The EM will direct the Contractor on the installation of one to three pieces of LWD at each site, where feasible.

Contingency measures to minimize impacts to fish and fish habitat include the following:

- In the event of adverse weather events such as heavy rainfall, any runoff from the site and disturbed grounds will be directed into the pit. Silt cloth will be used to contain any turbid water around the access ramps and stockpiles, as needed.
- If water levels rise higher than expected during pit excavations, the EM may direct the Contractor to strategically build up the berm surrounding the excavation.
- In the event that a major rainstorm causes the inundation of the pit, the EM will direct the Contractor to halt the excavation. Water levels will be allowed to return to normal and excavation will resume in a new isolated pit within the same footprint. When the excavation site is fully completed the berm left between the original excavation and the new excavation will be breached using the excavator.
- The EM will monitor water levels and spawning activity to determine if works can continue beyond the Least Risk Window period, i.e. from Sept 15 to 30.
- If works continue beyond the Least Risk Window period, i.e. past Sept 15, the works
  will be managed such that only bars in the canal reach will be completed beyond Sept
  15. If works are commencing at a new bar, the EM will complete a pre-assessment
  of spawning activity in the area prior to the works commencing.

# 5.7: Species at Risk Mitigation Plan

To avoid potential impacts to Species at Risk in the vicinity of the Vedder River, the following pre-construction mitigation measures should be implemented:

- EM will walk haul routes prior to use.
- Operators will be instructed to pay careful attention while on haul routes.
- Pictures will be included that enable operators to identify species at risk.
- Vegetation removal will be limited and subject to review by EM.
- For in-depth information pertaining to Species at Risk mitigation, see Appendix B.
- For species identification materials see Appendix C.

#### 5.8: Bird and Wildlife Protection Plan

To avoid potential impacts to wildlife, the following pre-construction mitigation measures should be implemented:

- If clearing and/or grubbing operations for the Site are required, a nest survey will be conducted to ensure that no nests protected under the BC Wildlife Act are present, regardless of the time of year.
- If clearing and/or grubbing operations for the Site are required during the regional breeding migratory nesting period, which is March 25<sup>th</sup> to August 17<sup>th</sup> of any given year then the EM must conduct an intensive survey of the area following the Breeding Bird Nest Survey Protocol, as per the Migratory Birds Convention Act (MBCA).
- A pre-construction survey for raptor nests will also be completed. In accordance
  with the BC Wildlife Act, Section 34, nests of Osprey, eagle, peregrine falcon,
  gyrfalcon, heron, or burrowing owl are protected year-round, whether or not the
  nest is occupied. In the event a protected nest is found, the AQP will be
  responsible for developing and implementing a site-specific nest management
  plan.

Clearing activities can commence if no active nests are found. In the event any active nests are identified the works will cease in the area and the Contractor's EM will be responsible for developing and implementing a site-specific nest management plan including appropriate mitigation measures for the duration of the nest occupancy

## 5.8.1: Breeding Bird Nest Survey Protocol

## Survey Requirements for Areas to be Cleared and Grubbed.

Both vegetated habitats and non-vegetated habitats (i.e., rock outcrops) have the potential to support nesting birds, although bird abundance is generally greater in heavily vegetated areas. In addition, many man-made structures such as retention ponds, bridges, utility towers, and larger culverts have the potential for nesting bird activity.

#### **Survey Timing**

Bird nest surveys should be conducted during the appropriate seasonal timing window. In general, this window occurs between March 25<sup>th</sup> and August 17<sup>th</sup>.

Bird nest surveys should be carried out within the first 3 to 4 hours after sunrise. Surveys should not be undertaken during periods of inclement weather (e.g., heavy rain, fog or snow) or under windy conditions.

Note: Non-passerine species such as raptors or owls may have different seasonal nesting windows and are active at different times of the day. If environmental assessments have identified the potential for non-passerine bird species, then alternate survey timing may be required.

#### **Team Member Qualifications**

All nest surveys must be conducted by, or under the direction of an AQP who will be responsible for sign-off on all surveys. All survey team members must have sufficient experience with bird identification and biology.

## **Survey Effort**

Survey duration must be a minimum of 1 hr/ha and will be longer if searches are occurring in complex habitats. The AQP will be responsible for determining the effort required within these parameters.

Survey team members will walk transects through the area to be cleared to search for bird nests and nesting activity. Where appropriate, surveyors should also use additional survey techniques to increase the likelihood of finding nests such as behavioral cues and bird song identification.

Surveys should be conducted both within the clearing and grubbing limits and, where feasible and appropriate, up to 30 meters beyond the limits.

#### **Determining Nest Activity**

Each nest observed during the survey must be mapped and designated as either **active** or **inactive**. If the contents of the nest are easily observed from a distance, indicators such as new nesting material and/or eggs can be used to determine activity. Other means of determining nest activity can include observations of adult birds exhibiting nesting or territorial behaviour.

Observed nests that are in good condition but do not appear to be occupied at the time of the survey must still be considered active until additional observation periods have been undertaken. Observation periods must include 2 separate one-hour duration survey efforts conducted on consecutive days. To avoid unnecessary disturbance, a nest should be observed from a distance if it is considered active.

#### **Active Nest Buffers**

A No Work Zone buffer must be applied to any active nests identified. The AQP is responsible for developing and implementing a nest management plan including an appropriate buffer width, buffer marking, and mitigation measures for the duration of the nest occupancy. Buffer zones will be determined based on factors such as surrounding vegetative cover, topography, species sensitivity to disturbance, existing disturbance in the area, or proposed construction activities in the vicinity of the nest.

#### **New Surveys**

It is advised that a bird nest survey be conducted prior to vegetation removal. Once the survey is complete, vegetation clearing must begin within 3 days of the end of the survey cycle. Clearing and grubbing can be undertaken for up to 10 days after the end of the survey cycle, if the AQP determines that ongoing construction activities will preclude additional nesting activity.

#### Survey Extensions

If vegetation clearing does not begin within 3 days of the end of the survey cycle or cannot be completed within the 10-day clearing window, then additional survey work will be required prior to vegetation removal.

#### Reassessment of Active Nests

A minimum of 14 days after a nest is designated as active, the nest can be reassessed.

Reassessment will consist of a minimum 1-hour nest observation period on 2 separate days, with the timing for these reassessments based on the likelihood of observing birds at the nest. Potential disturbance of birds must be minimized during the observation period.

If watches have been conducted and no bird presence and/or breeding activity is noted, nest status can change from active to inactive. As a final verification of inactivity, the nest will be approached and inspected.

If at any time the nest is found to be active, the AQP will determine the appropriate buffer and the same procedure for an active nest will be followed.

# 5.9: Invasive Plant Management Plan

The following BMPs for Managing Invasive Plants on Roadsides from the Ministry of Transportation and the Invasive Species Council of BC (ISC) will be implemented throughout the duration of the works.

- Identify invasive plants within the work area. The EM should consult the invasive plant inventory and treatment maps prior to construction commencement, as well as conduct a pre-work survey for invasives within any areas to be cleared or grubbed.
- Record and report any invasive plants using the Report a Weed® app or online database, call regional invasive species organization, or call the Invasive Species Council of BC.
- The area containing invasive vegetation will be flagged and a 'no work zone' buffer will be established.
- · Avoid parking, turning around, or staging equipment in invasive plant infested areas.
- Inspect and clean vehicles before entering a weed-free area and before leaving an infested area.
- Minimize roadside disturbance and retain desirable vegetation where possible.
- Where possible, begin moving or brushing in an invasive plant-free area and end in infested areas.
- Do not use materials contaminated with invasive plants.
- Restore disturbed sites and remove unsuitable waste material.
- Re-seed disturbed areas with grass mixtures that are free of weeds, locally adapted, quick to establish, and approved by the Ministry.

# 5.10: Water Quality Monitoring Plan

Sufficient measures to keep water quality within an accepted standard during the work will be employed throughout the project duration. Water quality will be visually inspected by the EM at the water quality monitoring stations (WQMS) at a minimum of (1) sample for every three (3) hours during active works instream. Regular sampling will include but is not limited to turbidity measurements. Background will be established during each sampling period by measuring turbidity and/or visually observing the upstream water source (WQMS 1).

At a minimum, a decision to proceed with water sampling must address the following:

- Sampling for turbidity (NTU) will occur when visually the downstream water quality is noticeably different from the background (upstream) water quality,
- Sampling for NTU during rain events where conditions have the potential to adversely affect the water quality,
- The frequency of sampling will be determined by the Environmental Monitor as necessary to ensure water quality requirements are being met,
- The excavator will maintain isolation of the excavation site from flowing water until
  the day following completion to allow settlement in the pit of the heavier sediments.
  The turbid water can then be released downstream in a single plume for a short
  duration. Pit openings well follow conditions outlined in section 5.13 as opposed to
  the continuous release of turbid water throughout the excavation.
- Prior to opening each excavation, background turbidity and readings from the enclosed pit will also be collected. Additional readings will be taken downstream as the plume of turbid water exits the excavation site.
- Sampling will document water quality immediately upstream (background) and at least 30 m downstream of construction activities according to the following water quality guidelines:

Except during the openings, exceedances listed in Tables 2 and 3 below will be reported to the EM and/or the Site Supervisor immediately and additional ESC measures will be initiated if water quality values do not meet these above criteria.

Table 2: Water Quality Criteria for Aquatic Life for Turbidity and Total Suspended Solids\*

Turbidity (NTU)	Total Suspended Sediments
Change from background of 8 NTU for a duration of 24 hours during clear flows	Change from background of 25 mg/L for a duration of 24 hours during clear flows
Change from background of 2 NTU for a duration of 30 days during clear flows	Change from background of 5 mg/L for a duration of 30 days during clear flows
Change from background of 5 NTU when background is 8 – 50 NTU	Change from background of 10 mg/L when background is 25 – 100 mg/L
Change from background of 10% NTU when background is >50 NTU	Change from background of 10% NTU when background is >100 mg/L

<sup>\*</sup>British Columbia Approved Water Quality Guidelines Aquatic Life, Wildlife & Agriculture, August 2019

# 5.11: Waste Management Plan

- A small amount of general refuse and non-hazardous construction waste may be generated on the site.
- Food and food waste will be stored in animal proof containers or within trailers, so it
  is not accessible by wildlife.
- The Contractor will provide designated waste bins for the disposal of nonhazardous solid wastes and separate marked bins for hazardous waste.
- All construction waste will be separated from domestic food waste and removed from the site once the receiving bins are full.
- All solid waste will be either recycled or disposed of at approved waste disposal facilities.
- Littering is prohibited and monitoring for this activity will be on-going throughout the project.
- There will be no disposal of solid wastes into sumps, ditches, river, streams, culverts, road edges, or private property.

# 5.12: Hazardous Materials Management Plan

Management of hazardous materials will be addressed via the following measures:

- The Contractor must provide a spill response plan which the EM, ET's and construction crew must become familiar with. The plan should be accessible to project personnel (Section 6.0),
- Ensure all equipment and machinery are in good working order, clean, and free of leaks or excess oil/grease,
- Refueling of land-based equipment must be completed by a mobile refueling service to avoid storage of bulk fuel onsite,
- An operator must remain by the fuel nozzle during all refueling to ensure no spills occur and to be able to shut of the source if a spill does occur,
- Fueling or servicing of land-based equipment will not be completed within 30 m of any watercourse or surface water feature where practical,
- If the fueling or servicing cannot be completed 30 m form the Vedder River or a
  drainage, then spill tray(s) should be placed under the equipment during the refueling
  or service and spill pads used where necessary to precent accidental release of
  hydrocarbons into the surrounding environment.
- Fuels, oil, grease, and other substances deleterious to aquatic life will be prevented from entering any watercourse or storm sewer,
- All stationary gas or diesel-powered equipment and liquid storage containers stored within the project area must be stored in a secondary containment tray with 125% capacity of all the containers and situated to avoid potential damage to it or containment,
- The Contractor must provide fully stocked emergency spill kits and barrels which will be present onsite at all times during construction,
- Any spills of substances toxic to aquatic life of reportable quantities (see Appendix G)
  will be immediately reported to the Emergency Management BC 24-hour
  phoneline at 1-800-663-3456,
- Contact BC One Call (1-800-474-6886) prior to any ground disturbance,
- Fuel and hydrocarbon-based lubricants must be stored in designated storage areas, such as a lockable metal cabinet (or an alternative approved by the EM), a minimum of 30 m in from the river, streams, ditches, and catch basins,
- All hazardous material must be properly stored, contained, and labelled in accordance with relevant acts and regulations at least 30 m from any drainage,

- If any hazardous materials are utilized at the site, the labeling must be in accordance with the Transportation of Dangerous Goods (TDG) regulations as well as the manufacturers SDS,
- It is not anticipated that the works will uncover contaminated soils,
- In the event of a hydrocarbon spill, the absorbent materials or soils saturated with oil
  or gasoline are classified as Hazardous Waste, and
- The BC Hazardous Waste Regulations and the federal TDG must be adhered to with respect to storage, transportation, and disposal of hazardous wastes.

# 5.13: Pit Opening Mitigation Procedures

- The EM or appropriately experienced ET must be on site for all openings.
- Material from the opening should be trucked offsite.
- Excavate as much as possible prior to breaching containment.
- Casting material from the opening into the pit should only be used where no option to haul off site is possible or for the latter part of the excavation as the final design parameters are met.
- Where material is to be cast, a receiving area within the pit should be excavated prior to the opening.
- Material to be cast must be released at or below the water level to minimize suspension of sediments.
- Open the downstream first unless the downstream opening is required for access and the EM approves.
- To achieve an appropriate depth of the opening, the EM will identify the distance to be excavated out into the channel; never more than machines reach from the dry part of the bar.
- Material from the channel should be drawn into the pit and not lifted until it is out of the flowing channel.
- The EM will provide a specific plan for each opening.

## 6.0: SPILL PREVENTION AND EMERGENCY RESPONSE PLAN

# 6.1: Spill Preparedness

The Spill Response Plan should be reviewed with all construction staff in the pre- construction meeting and staff should be trained to respond to spills. The Plan should be updated when required to include any materials of a deleterious nature that could be spilled not previously identified. The Spill Response Plan will be updated with the following project-specific information for the staff to familiarize themselves with:

- Identification of all hazardous materials present on site as well as waste storage and secondary containment. Understanding of reportable spill quantities and reporting requirements. Material Safety Data Sheets (MSDS) will be kept on site and made available to all construction team members.
- Identification of the locations of spill response equipment and materials for containment and clean-up as well as instruction on how to use them effectively.
- As work will be conducted in and around water, spill barrels will be stored on site at key locations.

# 6.2: Environmental Spill Response

The purpose of the Spill Prevention and Emergency Response Plan is to identify potential risks at or in proximity to the Site, provide procedures to facilitate rapid deployment of resources in the event of a spill to minimize the impact and risk to the environment, the public and personnel on Site. The Contractor will be familiar with the regulatory requirements and be adequately prepared with personnel and equipment to respond within the shortest possible time. A copy of the Contractor's Emergency Spill Response Plan Can be found in Appendix H.

The Contractor is to implement the following mitigation measures to avoid spills and provide adequate response in the event of a spill:

- The Contractor will maintain equipment and machinery in good working condition, and free of leaks or excess oil and grease, to prevent contamination to the environment. Equipment that contains oils and greases (e.g., excavators, cranes, generators) and requires periodic maintenance will be serviced by a mechanic with necessary supplies to contain potentially deleterious substances. All machinery should be serviced off-site, however, if onsite servicing is required it should be done at least 30 m from any drainage.
- Each machine working on-site will have a spill kit containing, as a minimum: 20 oil

- absorbent sheets, two 1.2 m absorbent socks, heavy duty disposal bags, a roundnose shovel or equivalent, and suitable Personal Protective Equipment (PPE).
- A spill barrel will be kept within the work site as well as at all refueling sites. It will
  contain, as a minimum: 100 oil absorbent sheets, 100 universal sorbent pads, 25 kg
  of dry oil sorbent, four 1.2 m oil linkable absorbent socks; four 1.2 m universal
  linkable absorbent socks, four 3 m sorbent linkable floating booms, 1 roll of 25 m x
  4 m poly sheeting, ten disposable bags, and PPE.
- Used spill response materials will be bagged in heavy-duty polyethylene bags, labelled, and disposed of appropriately.
- Spill kits will be inspected regularly by the Contractor and EM and will be refilled immediately when spill response materials are used.
- Adhere to the mitigation measures outlined in the Fuel Management Plan (Section 7.0).
- The Spill Prevention and Emergency Response Plan will be visibly posted at the Site.
- The Contractor will designate a staff member as the Spill Coordinator. This staff member will have knowledge of spill mitigation, containment, and reporting procedures.
- All personnel are to be made aware of the content of the Spill Prevention and Emergency Response Plan, the location of response materials, response procedures and emergency contact names and numbers. Spill contingency procedures will be posted in visible locations within the Contractor's work Site offices and trailers. Spill response equipment and supplies are to be kept in accessible and visible locations which are to be made known to personnel during Site safety orientations.
- Sorbent material will be on hand at the work areas as a means of containing and soaking up any spilled substance before it reaches the groundwater table or open water.
- Empty drums/pails are to be kept onsite for storage of waste oil, solvents, used sorbents, contaminated soil, etc. Drums/pails will have tight fitting lids and be protected from the elements by tarping. They are to be immediately labelled for identification of contents.

# 6.3: Environmental Incident Reporting

Deleterious substances are not permitted to be released into the environment. In the event of a spill, regardless of size, the Contractor will:

- Take immediate action to minimize environmental consequences and manage resolution of the incident.
- Determine the type of material and estimated volume spilled.
- Gather information to complete an initial Environmental Incident Report (EIR). The EIR will include a description of the time and location of the incident, a description of what occurred and the cause, the product name and substance in the event of the spill, an estimate of the volume of spilled product, and a description of containment and/or mitigation measures employed.
- The EM and/or the Contractor is responsible for making all incident reports to the Environmental Agencies for contraventions under the Fisheries Act, Water Sustainability Act, Environmental Management Act, and any other relevant acts. The environmental incident will be reported to the environmental authorities, such as Emergency Management BC.
- Any incident reports made during the reporting period will be appended to the weekly reports.
- A copy of the Environmental Incident Report form can be found in Appendix E.

# 6.4: Communication Pathway

Section 2.4 presents a list of emergency contacts based on the Project requirements. This list will be updated as needed over the duration of the Project.

# 6.5: Emergency Spill Response Plan

Emergency Response Plans outline spill response and reporting procedures that will be implemented during the Project. A copy of the Emergency Spill Response Plan can be found in Appendix H.

#### 6.6: Public Concerns Protocol

There is a possibility that members of the public or other stakeholder groups will voice their concerns pertaining to the sediment removal. If this occurs, operators and on-site personnel should relay the concerns to the Environmental Monitor (EM). The EM will endeavor to

address the concerns of the individual(s). If the EM is not able to allay the concerns of the stakeholder, the EM will direct the individual to the Ministry representative Gulraiz Cheema, the Ministry of Environment and Climate Change strategy representative for this project.

## 7.0: FUEL MANAGEMENT PLAN

The fuel management plan provides measures to ensure the receiving environment is adequately protected from construction-related fuels and products on site. Best management practices for land-based operations include:

- Fuel storage tanks/containers will be clearly labeled, and their locations will be made known to all onsite personnel.
- Refueling equipment and tanks will be clean and in good working order. Fuel tanks
  will be situated within appropriate secondary containment (an impermeable
  containment facility capable of holding 125% of the storage tank contents). This
  will be achieved using double-walled storage tanks or sit-in containers constructed
  out of impermeable material, such as aluminum or plastic.
- All fuels, oils, lubricants, and other petrochemical products will not be stored within 30 m of any waterbody.
- Where practical, equipment will not be fueled within 30 m of a waterbody. If possible, one area will be designated for fuel transfer.
- Refueling will occur on a flat surface to minimize potential off-site runoff. Spill trays
  are to be used during the refueling process, and a spill kit should be on-hand at the
  refueling site.
- Any fuel spilled will be immediately cleaned up and reported to the EM (see Section 6.0).

## 8.0: RIPARIAN RESTORATION PLAN

Exposed soil resulting from culvert crossing installations and/or site access will be replanted following the disturbance to the soil. A planting strategy will be compiled, and planting will be conducted by NPE as required.

# 9.0: BIBLIOGRAPHY

Government of Alberta. 2011. Alberta Transportation Erosion and Sediment Control Manual.

https://open.alberta.ca/dataset/aaae5384-c0e0-4421-9fd8-6ab835c6f3af/resource/5ae2cd05-f29f-4f71-a88f-08ac702125a9/download/2011-erosion-sediment-control-manual-june-2011.pdf

South Coast Conservation Program. 2022. Coastal (Pacific) Giant Salamander.

http://www.sccp.ca/species-habitat/coastal-pacific-giant-salamander

South Coast Conservation Program. 2022. Great Blue Heron fannini ssp.

http://www.sccp.ca/species-habitat/great-blue-heron-fannini-ssp

South Coast Conservation Program. 2022. Northern Red-legged Frog.

http://www.sccp.ca/species-habitat/northern-red-legged-frog

South Coast Conservation Program. 2022. Oregon Forestsnail.

http://www.sccp.ca/species-habitat/oregon-forestsnail

South Coast Conservation Program. 2022. Salish Sucker.

http://www.sccp.ca/species-habitat/salish-sucker

South Coast Conservation Program. 2022. Western Painted Turtle – Pacific Coast Population.

http://www.sccp.ca/species-habitat/western-painted-turtle-pacific-coast-population

South Coast Conservation Program. 2022. Western Screech Owl kennicottii ssp.

http://www.sccp.ca/species-habitat/western-screech-owl-kennicotii-ssp

# **Appendix A– Environmental Permits**

# Appendix B- SARA Screening Report for Proposed Vedder River Sediment Removal Program

# **Appendix C– Species at Risk Identification Material**

## **Pacific Giant Salamander:**



"Snout to vent length 6.25 – 17 cm, Adults up to 35 cm total length including the tail. This is the largest salamander in BC (and possibly the southeast). The plump body has a wide, wedge-shaped head and fleshy legs. Skin is smooth, dark brown to dark grey usually with brown or tan marbling on the dorsal area from head to tail and upper parts of the legs. The chin and belly is pale grey or cream, eyes vary in colour, often similar to the marbling colouration. Older adults may lose the marbling on the body. Once in terrestrial form, adults have 12-13 indistinct lateral "costal grooves" (vertical indents that look like ribs). Larvae, which are totally aquatic, can reach 20 cm and start out in a somewhat tadpole-like state with only a tail, small forelimbs and external gills. Larval colour is somewhat a monotone light brown with indistinct mottling and lighter ventral areas than adults. Gills are bushy and reddish-brown. Neotenes (aquatic individuals which retain larval physiology but are capable of breeding) may reach full adult size (35 cm). Under some conditions (possibly due to lowered riparian habitat complexity), neotenes can outnumber terrestrial individuals. \*This species is sometime referred to as the Pacific Giant Salamander." (South Coast Conservation Program, 2022)

## Western Painted Turtle:



"Size (shell diameter): Hatchlings 2-2.5 cm, Juveniles 10cm, Mature adults 25 cm (females larger than males). The carapace (upper shell) of adults is smooth, olive-green to dark brown. Outer edges can be patterned with red lines. The head, neck and tail are olive to greenish-black and striped with yellow. The intricate black and yellow branching pattern on the plastron (lower shell) is not present on all individuals, though the plastron is always red or orange. Colour patterning can be variable between individuals and between populations. The upper jaw has a notch located just under the nostrils. Males have very long front claws and thicker tails with a cloacal (tail vent) opening that is closer to the end of the tail than to the carapace. Females have shorter front claws, and thinner tails with cloacal openings closer to the carapace than to the end of the tail. Hatchlings have rounder carapaces that are slightly keeled along the length and similar but more vibrant colouration than adults." (South Coast Conservation Program, 2022)

### Salish Sucker:



"Length: Up to 24 cm. Common to members of its genus, this species has a fairly long snout ending in a rounded point. The body shape is elongated and cylindrical, scales are small, the tailfin is moderately forked with rounded tips, and the anal fin is large. The sub-terminal mouth is toothless, with fleshy "lips". The mouth and lips of suckers are designed to act like a vacuum cleaner to gather food from the stream bottom. The lips are covered with numerous papillae (minute fleshy projections), which act as sensory receptors for detecting food items. At breeding time, both males and females develop a broad rose or wine-coloured band along their sides which is most vivid in the males." (South Coast Conservation Program, 2022)

## **Great Blue Heron:**



"Height: 60 cm, Wingspan 1.5 m. Both sexes are similar. Adult Great Blue Heron are tall, long-legged wading birds with a sinuous neck held in an "S" curve at rest and in flight. The long thick bill is yellow and black, the head and face are white. In mature birds, plumage is a steel blue-grey with dark blue-grey flight and tail feathers. As birds mature a distinctive black plume extends from above the eye to beyond the back of head and a bib of long trailing plumes on the chest and scapula area become more pronounced. Juveniles are grey-brown on the back and upper wing plumage and lack the black eyebrow and adult head and bib plumes" (South Coast Conservation Program, 2022).

# Northern Red-Legged Frog:





"Snout to vent length 4-8 cm, females up to 10 cm. Coloration and patterning for both aquatic and terrestrial phases is extremely variable depending on time of year, age and geographic location. Dorsal colors range from tan, olive, and grey to a rich reddish-brown. The back and sides have varying levels of dark flecking, with small spots on the flanks and groin area. Hind legs have dark mottled banding (more so on the lower portion of the leg). The upper and lower lip, chin, chest, and belly have various levels of mottling which becomes reduced and replaced by varying levels of red (especially on the groin and hind legs) as the frog matures. A dark eye-mask extends from the snout to around the eye and tympanum (eardrum) to the shoulder. Two light brown "dorsolateral" folds of skin run along the back from behind the eye to the groin area. Males develop a "nuptial pad" on each thumb to assist in gripping females ("amplexus") during breeding. Tadpoles reach 2-7 cm before metamorphosing and are tan to brown with degrees of mottling and gold flecking throughout. The tail is at least as long as the body and the tailfin extends onto the back." (South Coast Conservation Program)

# Oregon Forestsnail:



"A "pulmonate" snail, this species have evolved their mantle cavity into a lung (instead of gills as still found in some snails). Breathing is through a single opening on the right side of the body which either remains open or opens and closes. One of the largest land snails in BC, the shell has 5 to 6 whorls (spirals) with lighter colored axial ribs (thin bands that cross each whorl). The uppermost whorls are often pale from wear. Shell colour ranges from gold to dark brown, lightening to amber around the aperture (shell opening). As the snail matures the shell can become bleached looking and begin to flake. This species lacks the 'hairs' found on the shell of other land snail species like the Pygmy Oregonian and Northwestern Hesperian. The thick white aperture lip of adult snails is evident when viewing the snail from below; juveniles lack this thickened aperture lip. Shell diameter 2.8-3.5 cm, shell diameter is 1.4 to 1.7 times shell height." (South Coast Conservation Program, 2022)

#### Western Screech Owl:



"Length 19-25.5 cm, Weight 120-305 g. A small owl with yellow eyes, a small beak and black eyebrow ridges that lead up in a "Y" configuration to short ear tufts on the corners of the head. The head is crowned with a triangular russet and black cap that follows the eyebrow ridge to the ear tufts. Ear tufts may not always be visible, depending on the owl's 'mood'. A master of arboreal camouflage, the white to pale-grey plumage is streaked with black and brown making it difficult to see against tree trunks or cavities where it generally roosts and nests. The coastal subspecies tends to have greater brown coloration while the interior subspecies is greyer. As with most raptors, females are generally larger and heavier than males". (South Coast Conservation Program, 2022)

#### Mountain Beaver:



"Also referred to as "Aplodontia," "Boomer," "Ground Bear," or "Giant Mole". Mountain Beaver are primarily a fossorial (sub-surface oriented) rodent living in burrows in and near moist riparian forest communities. Most burrow colonies are in areas with proximity to a water source, well-developed, firm soils, and abundant vegetation. Little is understood about BC's populations which are limited in distribution and subject to a number of threats from human activities including forest clearing, development, genetic isolation, and domestic pet predation(South Coast Conservation Program, 2022). The Mountain Beaver is a medium-sized rodent with the general appearance of a muskrat except the tail is well-furred and short. The body is thick, and covered with coarse, dark brown fur (Carraway and Verts 1993). Average adult body mass is 806 g (Lovejoy and Black 1974). In Canada, average mass of Mountain Beaver in the lower Fraser Valley is 948 g (Ransome unpub. data). Total length ranges from 300-470 mm, including the 20-40 mm long tail." (Ingles 1965)

# **Appendix D– Environmental Orientation Record**



# ENVIRONMENTAL ORIENTATION CHECKLIST

The Environmental Orientation Checklist (EOC) shall be completed for all works involving an environmental component. The Environmental Monitor is responsible for ensuring that the environmental requirements of the work are reviewed with the Contractor before work is started, and that a record of the discussion is documented on the EOC. The form must be signed by both the Environmental Monitor and the Contractor. By signing the EOC, the Contractor indicates he/she has been advised of the environmental requirements of the project.

	Date:	une coc, the contractor indicate	is ne/sne has been advised of the environi	nentai requirement	or the project.			
1	Project Information			Killing Indiana	10000			
	Project Title	THE RESERVE TO A PERSON NAMED IN						
	Project Description							
	Project Location	11						
2	Contractor Information (if	applicable)		-		2.01		
	Company Name							
	Company Address							
	Site Contact/Representative	e Name						
	Tel.#	Fax#	E-m	ail				
3	Environmental Management Plan Review the environmental issues and requirements of the work as specified in the Environmental Management Plan (EMP), Regulatory approvals or Best Management Practices (BMP)							
	Is there an EMP, CMP,BMP	☐ Yes	□ NA					
	Have the environmental requirements been reviewed with the Contractor and the Contractor's staff? (Use the checklist below to guide discussion)					O NA		
	Environme	ental Issues	Environmental Management Plan	Requirements	Discussed	NA		
	Fish and Aquatic - habitat a	Iteration, disturbance or loss				0		
	Site isolation & Bypass				0	0		
	Instream footprint mitigation	1			0	u		
	Riparian footprint mitigation removal and mitigation)	n (Vegetation disturbance or			0	0		
	Noxious weed control				0	0		
	Wildlife and Bird - habitat a	Iteration, disturbance or loss			0	0		
	Soil erosion/compaction V siltation	Nater quality - erosion and			0	0		
	Disturbance to Heritage Re	sources/Archaeological Sites			0			
	Noise Concerns					0		
	Hazardous waste (garbage	)			0	0		



# ENVIRONMENTAL ORIENTATION CHECKLIST

Environmental Issues		Environmental Protection Requirements	Discussed	00000
Air emissions/ dust generation/other				0
Generation and disposal of waste (litter, latrine)			0	0
Fuel and flammable storage				0
Fuel-Spill of Spill of hazardous substances			0	.0
Generation and disposal of hazardous substances	12		0	0
Property Considerations				0
Do the tools and equipment meet the requirement	s?		0	0
Permits and Approvals Information: Ensure the prior to starting work.	necessary environmental	permits and approvals relating to the	e work have been	obtained
Are environmental notification, permits, licenses of	r approvals required?		□ Yes	O NA
List applicable regulatory requirements and permi	reference numbers.		10 103	1 4 10
Have the permits, licenses and approvals obtaine	d and/or checked?		☐ Yes	D NA
			☐ Yes	O NA
Emergency Response Plan/Oil and Chemical S	pill Response Plan		☐ Yes	O NA
Emergency Response Plan/Oil and Chemical S Has the Oil and Chemical Spill Response Plan be	pill Response Plan		□ Yes	O NA
Emergency Response Plan/Oil and Chemical S	pill Response Plan			O NA
Emergency Response Plan/Oil and Chemical S Has the Oil and Chemical Spill Response Plan be	pill Response Plan		□ Yes	O NA
Emergency Response Plan/Oil and Chemical S Has the Oil and Chemical Spill Response Plan be Are there spill kits available on location?  Where are the spill kits located?  Does the contractor have an Emergency Response	en discussed?	ssed?	☐ Yes	
Emergency Response Plan/Oil and Chemical S Has the Oil and Chemical Spill Response Plan be Are there spill kits available on location? Where are the spill kits located?	en discussed?	ssed?	☐ Yes	O NA
Emergency Response Plan/Oil and Chemical S Has the Oil and Chemical Spill Response Plan be Are there spill kits available on location?  Where are the spill kits located?  Does the contractor have an Emergency Response	en discussed?  se Plan? Has it been discu	ssed?	☐ Yes	O NA
Emergency Response Plan/Oil and Chemical S Has the Oil and Chemical Spill Response Plan be Are there spill kits available on location?  Where are the spill kits located?  Does the contractor have an Emergency Response Environmental Incident Reporting	en discussed?  en Plan? Has it been discussed?		☐ Yes☐ Yes☐ Yes☐ Yes☐	O NA
Emergency Response Plan/Oil and Chemical S Has the Oil and Chemical Spill Response Plan be Are there spill kits available on location? Where are the spill kits located?  Does the contractor have an Emergency Response Environmental Incident Reporting  Environmental Incident Reporting Procedures dis-	en discussed?  en Plan? Has it been discussed?	ntal requirements of the work	☐ Yes☐ Yes☐ Yes☐ Yes☐	0 NA
Emergency Response Plan/Oil and Chemical S Has the Oil and Chemical Spill Response Plan be Are there spill kits available on location?  Where are the spill kits located?  Does the contractor have an Emergency Response Environmental Incident Reporting  Environmental Incident Reporting Procedures discontinuous Contractor Incident Reporting Procedures Contractor Incident R	en discussed?  en Plan? Has it been discussed?	ntal requirements of the work	☐ Yes☐ Yes☐ Yes☐ Yes☐ Ses detailed abo	O NA

# **Appendix E– Environmental Incident Report Form**



## **ENVIRONMENTAL INCIDENT REPORT FORM**

NAME OF OPERATOR:				
BUSINESS ADDRESS:				
RELEVANT ENVIRONME	NT PLAN:			
DATE AND TIME OF INCI	DENT:			
DATE AND TIME OF VER	BAL NOTIFICATIO	N:		
DATE AND TIME OF VER	DAL NOTHIOATIC			
DETAILS OF PERSON MA	AVING DEDORT:			
	AKING REPORT:			
NAME:	TELEPHONE:		EMAIL:	
DETAILS OF WITNESS/W	ITNESSES:			
NAME:	TELEPHONE:		EMAIL:	
LOCATION:				
PROJECT:				
SITE LOCATION:				
MUNICIPALITY:				
INCIDENT SITE (TICK AS	REQUIRED):			
OFFSHORE (	CWTH WATERS)		VESSEL	
OFFSHORE (STATE WATERS)			PIPELINE	
	RE (MAINLAND)		DRILLING UNIT	
ONS	SHORE (ISLAND)		PRODUCTION FACILITY	
ONSHORE (INLAND WATERS)			OTHER	

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ACTIVITY BEING UNDERTAKEN AT TIME OF THE INCIDENT:							
ENVIRONMENTAL CONSEQUENCE LEVEL:							
CATASTROPHIC			MMENT:				
INCIDENT TYPE:							
UNA	UTHC	ORISED CLEA		[		SPILL INCIDENT	
		FAUNA INCID	DENT	[		ATMOSPHERIC RELEASE	
			FIRE	[		OTHER	
DESCRIPTION OF IN	ICID	ENT:					
ANY SAFETY CONC	ERN	IS ASSOCIAT	ΓED W	/ITH	THE	INCIDENT:	
ANY SAFETY CONCERNS ASSOCIATED WITH THE INCIDENT:							
ENVIRONMENTAL CONCERNS (FILL IN AS APPLICABLE):							
VOLUME OF MATERIAL SPILLED / RELEASED (Gas - m³, Liquid - L)							
SIZE OF AREA AFFECTED (m²)							
TYPE / COMPOSITION	I OF I	MATERIAL SP	ILLED	/ RE	LEAS	ED	
HAS THE EMERGENCY RESPONSE PLAN BEEN PUT INTO ACTION? YES / NO							
WHAT ARE THE MAIN ENVIRONMENTAL SENSITIVITIES IN THE AREA AND IS THERE A POTENTIAL FOR THESE TO BE IMPACTED AS A RESULT OF THE INCIDENT (I.E. WHAT IS THE DISTANCE OF THE ENVIRONMENTAL SENSITIVITIES FROM THE SOURCE OF THE RELEASE / FIRE)?							
ENVIRONMENTAL CONDITIONS AT TIME OF INCIDENT (WHERE RELEVANT):							
	WIND SPEED & DIRECTION						
CURRENT SPEED & D	CURRENT SPEED & DIRECTION						
WATER DEPTH							

IS FURTHER ACTION REQUIRED? (I	l.e. Remediation)
FURTHER ACTION REQUIRED BY:	
CORRECTIVE ACTIONS TO PREVEN	NT RECURRENCE:
TEMPERATURE	
VISIBILITY	
PRECIPITATION	
TOPOGRAPHY	
OTHER INFORMATION	
IMMEDIATE RESPONSE ACTION TA INTERNAL INSTRUCTIONS:	KEN (BY PERSON/OPERATOR MAKING REPORT) AND
COMMENTS:	
Prepared by:	Date:

FORM COMPLETE

# **Appendix F– Silt Fence Installation Instructions**

Silt Fence	9
Sediment Control	B.M.P. #1

#### **Description and Purpose**

- Permeable fabric barriers installed vertically on support posts along contours to collect sediment laden sheet flow runoff
- Causes water to pond allowing sediment to settle out as water filters through fabric
- Entraps and minimizes coarse sediment from sheet flow or overland flow from entering waterbodies
- · Perimeter control for sediment transport and deposition

#### Applications

- Temporary measure
- · Used at bottom of cut or fill slopes to collect sediment laden runoff
- · Used along streams (or channels) banks
- Used around stockpiles
- Midslope grade-break (using "J-hook" or "smile" pattern to effect ponding, filtering and sedimentation)

#### Advantages

- Low permeability silt fences have high filtering capabilities for fine sand to coarse silt
- Filter fence more effective than straw bales at filtering out sediment

#### Limitations

- · Applicable for sheet flow, cannot handle concentrated channel flow volumes
- May fail under high runoff events
- · Limit to locations suitable for temporary ponding of sediment laden runoff
- Low permeability silt fences may not be strong enough to support weight of water retained behind it and may require reinforcement (i.e., wire mesh and stronger support)
- · Sediment build up needs to be removed on a regular basis
- · Damage to fence may occur during sediment removal
- Useable life of approximately one year dependent on regular maintenance

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Silt Fence	
Sediment Control	B.M.P. #1

#### Construction

- Two methods of installation are commonly used
  - Trench method
  - Mechanical (slicing) installation method (e.g. Tommy Silt Fence Machine or equivalent)
- Trench Method
  - Select location of silt fence (usually along contours)
  - Drive support posts a minimum of 0.3 m into ground, spaced a maximum of 2 m apart
  - Excavate trench approximately 0.15 m deep by 0.15 m wide for entire length of fence along upstream side of posts
  - Attach the wire mesh or snow fencing, if used as reinforcement, to upstream side of posts with staples
  - Extend filter fabric to base of trench and attach over wire mesh or snow fence, if used, on upstream side of posts
  - Backfill and compact soil in trench, being careful not to damage fence
- Mechanical Installation Method
  - Select location of silt fence (usually along contours)
  - Use mechanical installation machine to embed the fabric a minimum of 0.15 m into the ground. One mechanical installation method is by slicing (with special equipment) the geotextile fabric embeds into the ground without excavation and backfill. There is only minor disturbance of the ground. Tamping of ground is required for compaction.
  - Drive support posts a minimum of 0.3 m into ground, spaced a maximum of 2 m apart
  - Attach the wire mesh or snow fencing, if used as reinforcement to silt fence fabric, to upstream side of posts with staples
  - Extend filter fabric to base of trench and attach over wire mesh or snow fence, if used, on upstream side of posts

#### **Construction Considerations**

Site Selection

June 2011

Silt Fence	
Sediment Control	B.M.P. #1

- Size of drainage area should be no greater than 0.1 ha per 30 m length of silt fence
- Maximum flow path length above silt fence should be no greater than 30 m
- Maximum slope gradient above the silt fence should be no greater than 2H:1V
- · Fence should be placed on contour to produce proper ponding
- Fence should be placed far enough away from toe of slope to provide adequate ponding area (minimum of 1.8 m away from toe of slope is recommended)
- Ends of fence should be angled upslope to collect runoff
- Fence should not extend more than 0.6 m above grade
- Posts can be wood or metal material dependent on design and ground conditions
- · Posts should be placed on downstream side of fence
- · Posts should not be spaced greater than 2 m apart
- Wire mesh or standard snow fencing may be placed between the posts and fabric barrier to provide additional strength and support reinforcement
- Geotextile should be cut from a continuous roll to avoid joints (if joints are necessary, the wrapping of fabric around the fence post and a minimum overlap of 0.2 m with staples should be used to attach the fabric to the post)
- Fence (and wire mesh or snow fence, if used) should be attached to posts with heavy duty staples, tie wires, or hog rings
- Fence (and wire mesh or snow fence, if used) should be dug into a trench at least 0.15 m deep to prevent undercutting of fence by runoff
- Trench backfill should be compacted
- Long runs of silt fence are more prone to failure than short runs
  - Maximum length of each section of silt fence should be 40 m
  - Silt fence should be installed in 'J' hook or 'smile' configuration, with maximum length of 40 m, along contours allowing an escape path for ponded water (minimizes overtopping of silt fence structure)

#### Inspection and Maintenance

- Inspection frequency should be in accordance with the PESC and TESC Plans
- Repair undercut fences and repair or replace split, torn, slumping or weathered fabric immediately

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Silt Fence	
Sediment Control	B.M.P. #1

- Sediment build up should be removed once it accumulates to a depth of 0.2 m
- · Remove fence after vegetation is established
- Deactivate fabric by cutting-off top portion of fabric above ground; bottom trenchedin portion of fence fabric can be left in-ground thus minimizing ground disturbance

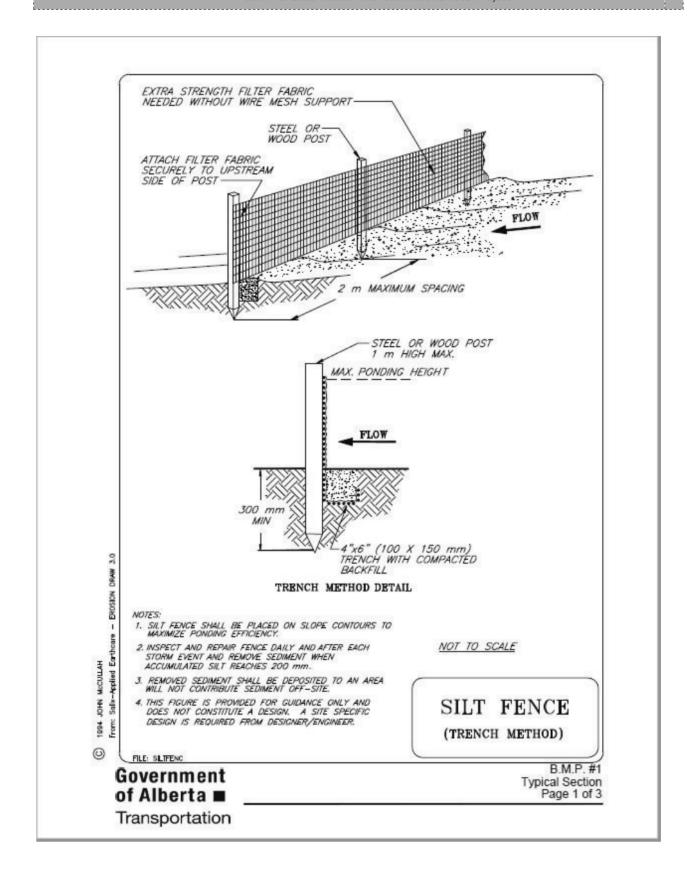
#### Similar Measures

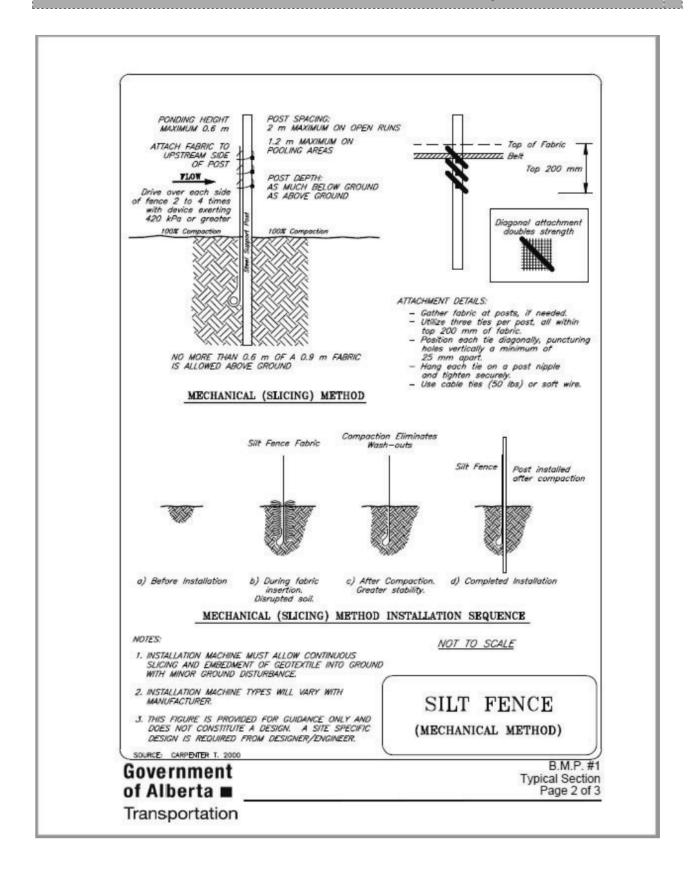
- Straw Bales
- Rock Barrier
- Permeable/Synthetic Barriers

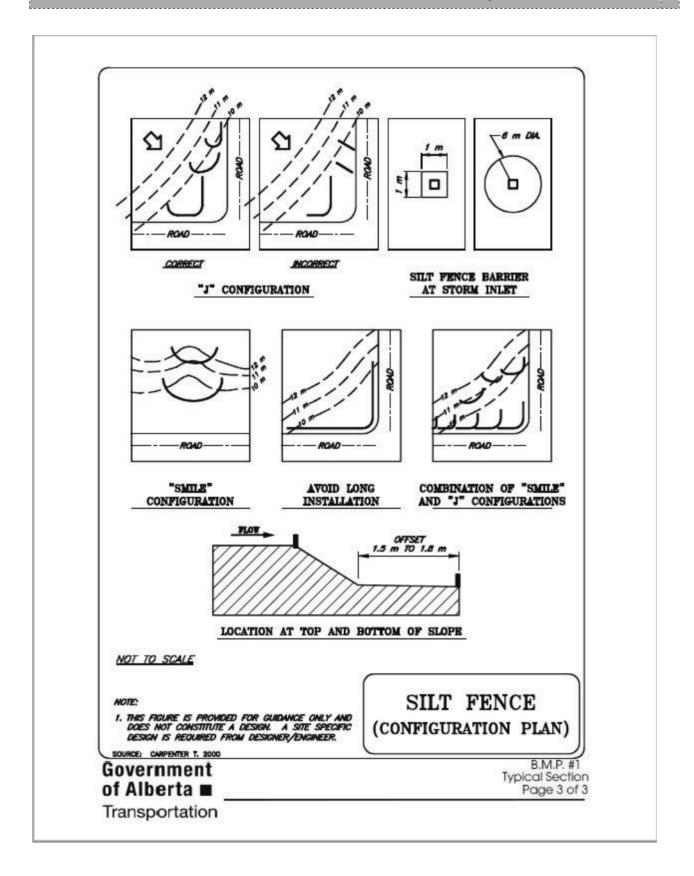
#### **Design Considerations**

- For a silt fence system to work as a system, the following factors should be considered:
  - a) quantity adequate number and frequency of fence for efficient ponding and sedimentation
  - b) installation workmanship
  - c) compaction backfill and trenching of fabric
  - d) support posts adequately embedded, appropriate selection of post material and spacing
  - e) attachment secure fabric to post
- · Install silt fences in a 'J' hook or 'smile' configuration

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# Appendix G- Reportable Spills

# Appendix H-Spill Response Plan

# Spill Response and Remediation Plan

If a spill of fuel, oils, lubricants, or other harmful substances occurs at the site, the following procedures will be implemented:

### 1. Ensure Safety

- Ensure personal, public, and environmental safety.
- Wear appropriate Personal Protective Equipment (PPE).
- Never rush in, always determine the product spilled before taking action.
- Warn people in the immediate vicinity.
- Ensure no ignition sources nearby if spill is of a flammable material.

### 2. Stop the Flow (when possible)

- Act quickly to reduce the risk of environmental impacts.
- Close valves, shut off pumps or plug holes/ leaks, set containers upright.
- Stop the flow of the spill at its source.

#### 3. Secure the Area.

- Limit access to spill area.
- Prevent unauthorized entry onto site.

### 4. Contain the Spill.

- Block off and protect ditches, drains and culverts.
- Prevent spilled material from entering drainage structures (ditches, culverts, drains)
- Use spill sorbent material to contain spill.
- If necessary, use a dike, berm or any other methods to prevent any discharge off site.
- Make any effort to minimize contamination.
- Contain as close to the source as possible.

#### 5. Notify/Report.

- Notify Site Supervisor, Environmental Monitor (or alternate) and provide spill details.
- When necessary, the first external call should be made to (see spill reporting requirements):
   Emergency Management BC (EMBC)) 1-800-663-3456 (24 hours)
- Provide necessary spill details to other external agencies (see spill reporting requirements)

#### 6. Site Remediation

- Remove the impact/debris; decontaminate any equipment or tools used in the cleanup.
- Clean up the affected area.
- Utilize appropriate absorbent pads or other materials based on the type of substance spilled.
- Dispose of waste materials at an approved disposal site; and
- Restore site to environmental regulatory standards.