

Phase 4 Viterra-Cascadia Terminal Capacity Expansion Project – Construction Environmental Management Plan

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LIST OF ACRONYMS AND ABBREVIATIONS

Acronym / Abbreviation	Definition
BC	British Columbia
BMP	best management practice
CCME	Canadian Council of Ministers of the Environment
CD	chart datum
CEMP	Construction Environmental Management Plan
CP	Canadian Pacific Railway Company
DFO	Fisheries and Oceans Canada
EM	environmental monitor
ENV	BC Ministry of Environment and Climate Change Strategy
ESC	erosion and sediment control
FAA	<i>Fisheries Act</i> Authorization
Hemmera	Hemmera Envirochem Inc.
HHWLT	higher high-water large tide
MMO	marine mammal observer
PER	Project and Environmental Review
Phase 4	Phase 4 Viterra-Cascadia Terminal Capacity Expansion Project
PLA	permits, licenses, and approvals
VFPA	Vancouver Fraser Port Authority
Project	Phase 4 Viterra-Cascadia Terminal Capacity Expansion Project
Proponent	Canadian Pacific Railway Company
QEP	Qualified Environmental Professional
SARA	<i>Species at Risk Act</i>
TDG	Transportation of Dangerous Goods
TSS	total suspended solids
Terminal	Viterra-Cascadia Grain Terminal

LIST OF SYMBOLS AND UNITS OF MEASURE

Symbol / Unit of Measure	Definition
%	percent
°	degrees of latitude or longitude
'	minutes of latitude or longitude
"	seconds of latitude or longitude
CD	chart datum
km	kilometre
m	metre
m ²	square metres
m ³	cubic metres
mm	millimetre
NTU	nephelometric turbidity units

1.0 INTRODUCTION

As part of the Vancouver Fraser Port Authority (VFPA) Burrard Inlet Road and Rail Improvement Project, Canadian Pacific Railway Company (CP or Proponent) is proposing Phase 4 of track expansion east of the Viterra-Cascadia Grain Terminal (Terminal) along the south shore of Burrard Inlet, approximately 1,000 m east of the Second Narrows in Burnaby, British Columbia (BC). This Phase 4 Viterra-Cascadia Terminal Capacity Expansion Project (Project or Phase 4) is in response to freight volumes in and out of the Terminal that have resulted in a shortage of track capacity during the peak shipping season. In addition, the Terminal is expanding capacity inside their own facility to prepare for the acceptance of increased grain volumes in unit trains. The purpose of the proposed expansion is to improve overall mainline and switching operations at the Terminal.

1.1 Purpose of the Construction Environmental Management Plan

Phase 4 will require approval from VFPA through their Project Environmental Review (PER) process, as well as a lease with VFPA for the expanded track within their jurisdiction.

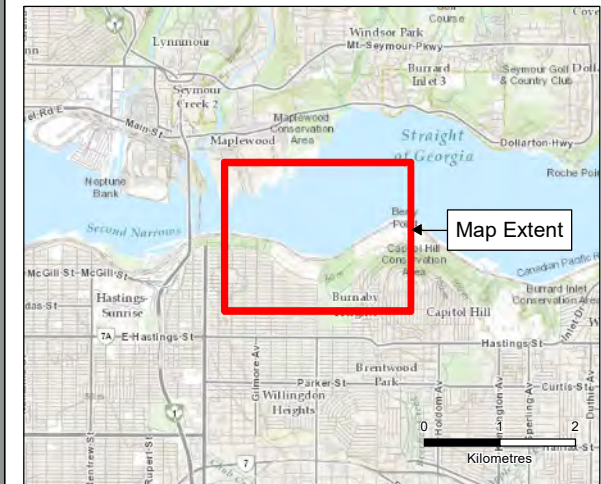
CP retained Hemmera Envirochem Inc. (Hemmera) to prepare this Construction Environmental Management Plan (CEMP). The CEMP has been requested by VFPA as part of the Project's application submission requirements. The CEMP will address the potential for construction-related activities to affect environmental resources or members of the surrounding community. The CEMP is based on the current environmental conditions of the Project, industry-standard environmental construction techniques, the scope of the proposed Project, and the assessments completed to date. The CEMP is intended to mitigate potential effects resulting from Project-related construction activities, specifically such effects as dust, noise, sedimentation, spills, and hazardous wastes. The guiding principle of the CEMP is the protection of the environment. All work must be carried out in accordance with this CEMP, applicable federal regulations, and industry best management practices (BMPs) and in compliance with related environmental permits and approvals.

Compliance with the CEMP will be a contractual requirement for the construction work onsite. If new information or changes to the proposed Project arise, the construction contractor will update the CEMP to reflect those changes.

The following sections are contained within this CEMP:

- Project information location, description, scheduling and timing, and environmental roles and responsibilities (**Section 1.0**)
- Key environmental and cultural features and values in the area that could be potentially affected by Project construction (**Section 2.0**)
- Potential effects of the Project on key environmental and cultural features and values (**Section 3.0**)
- Applicable environmental regulatory requirements (**Section 4.0**)
- Relevant BMPs for construction (**Section 5.0**)
- Site-specific mitigation measures to be applied throughout the phases of construction (**Section 6.0**)
- Protocol to respond to chance archaeological finds (**Section 7.0**)
- Protocol to respond during emergency situations or spills (**Section 8.0**)
- Post-construction follow-up (**Section 9.0**).

Overview



Legend

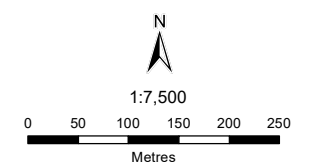
- CEMP Zone
- Proposed Track Extension
- Existing CP Railway
- CP Right-of-Way
- High Water Mark
- Low Water Mark
- Parcel Boundary

Notes

1. All mapped features are approximate and should be used for discussion purposes only.
2. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

Sources

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1.2 Project Location and Scope

The Project is located within the City of Burnaby, east of Viterra's Cascadia Terminal, between CP Mile 122.93 and 124.96 Cascade Subdivision. It is centred at approximately 49°17'25.6" N latitude and 123°00'13.2" W longitude. The Project encompasses the area of cuts and fills required for the track expansion, over approximately 1,500 m along the shoreline and extending into Burrard Inlet.

For construction purposes, the Project Area is divided into 3 zones, each with a different construction schedule (**Section 1.4**), as described below:








1. Zone 1 is the area between the western extent of the proposed alignment and approximately 450 m west of the existing Burrard Terminal (**Figure 1.2**).
2. Zone 2 is the area between Zones 1 and 3 (**Figure 1.3**).
3. Zone 3 is the area between approximately 294 m east of the existing Burrard Terminal and the west end of the Reed Point Marina parking lot (**Figure 1.4**).

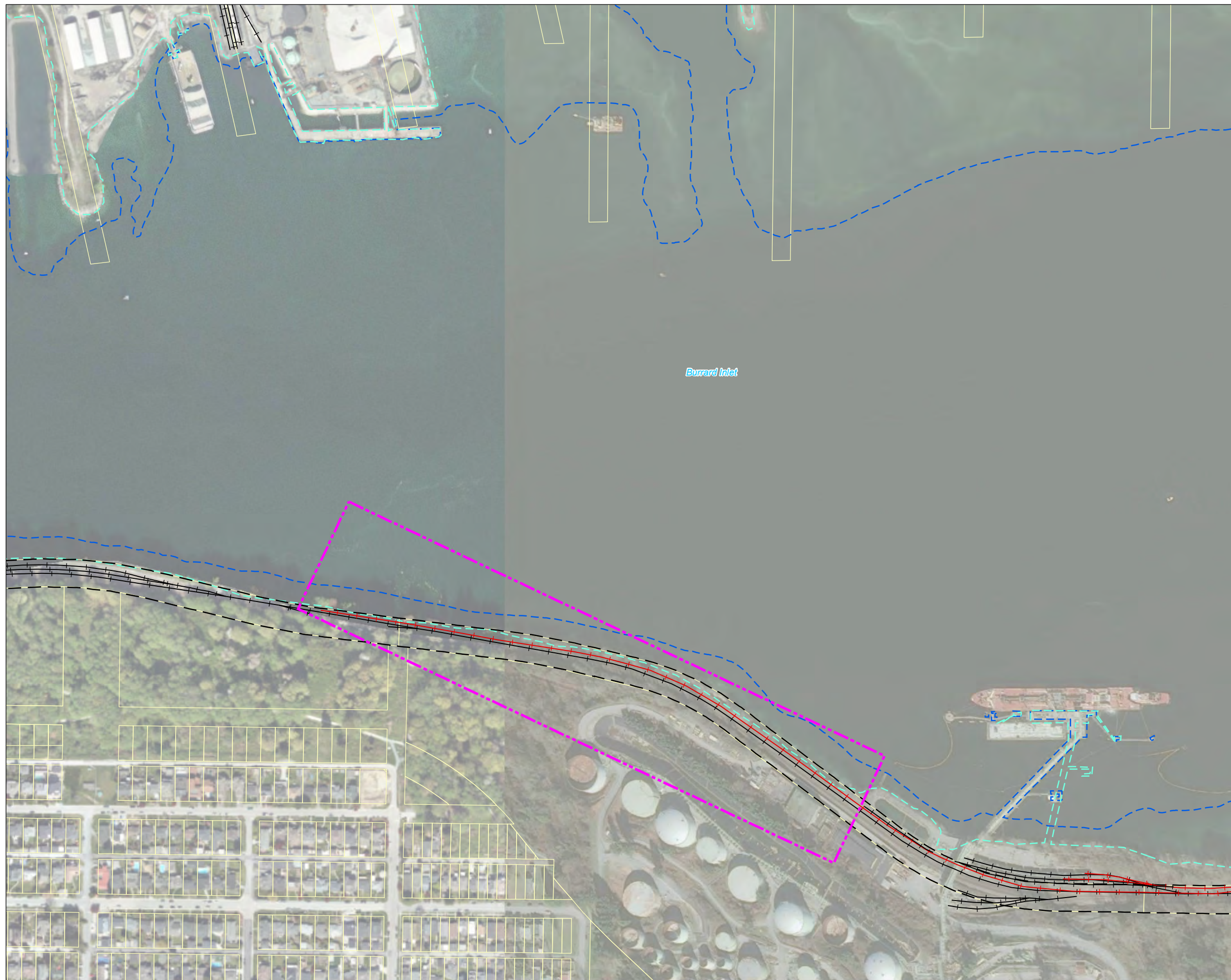
The tidal range at this location is approximately 5 m from the lower low-water large tide at 0 m chart datum (CD) and the higher high-water large tide (HHWLT) at +5 m CD, with a mean water level of +3 m CD. The intertidal zone (0 m to +5 m CD) is primarily rocky, transitioning up to a steep riprap embankment leading to approximately 5 m of patchy riparian vegetation that borders the edge of the existing, active CP rail lines.

The entire Project Area will lie within the existing CP right-of-way and within the VFPA lease area. While the exact footprint will depend on which track expansion option is selected, the Phase 4 footprint is estimated to be approximately 82,000 square metres (m²). This footprint is anticipated to include approximately 16,000 m² of riparian habitat and 48,000 m² of intertidal and 25,000 m² subtidal marine habitat. Footprint effects are expected to result in the harmful alteration, disruption, or destruction of 28,960 m² of fish habitat. Thus, Phase 4 is anticipated to require an authorization pursuant to section 35(2) of the federal *Fisheries Act*, RSC 1985, c. F-14 (**Section 4.1.3**). A *Fisheries Act* Authorization (FAA) would also necessitate offsetting for residual effects on fish and fish habitat. Residual effects are effects that remain following implementation of any mitigation measures.

Zone 1

Legend

-  CEMP Zone
-  Proposed Track Extension
-  Existing CP Railway
-  CP Right-of-Way
-  High Water Mark
-  Low Water Mark
-  Parcel Boundary

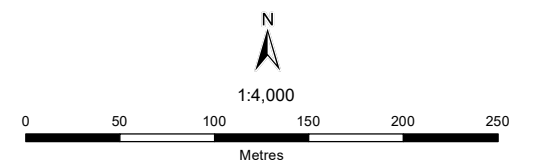


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







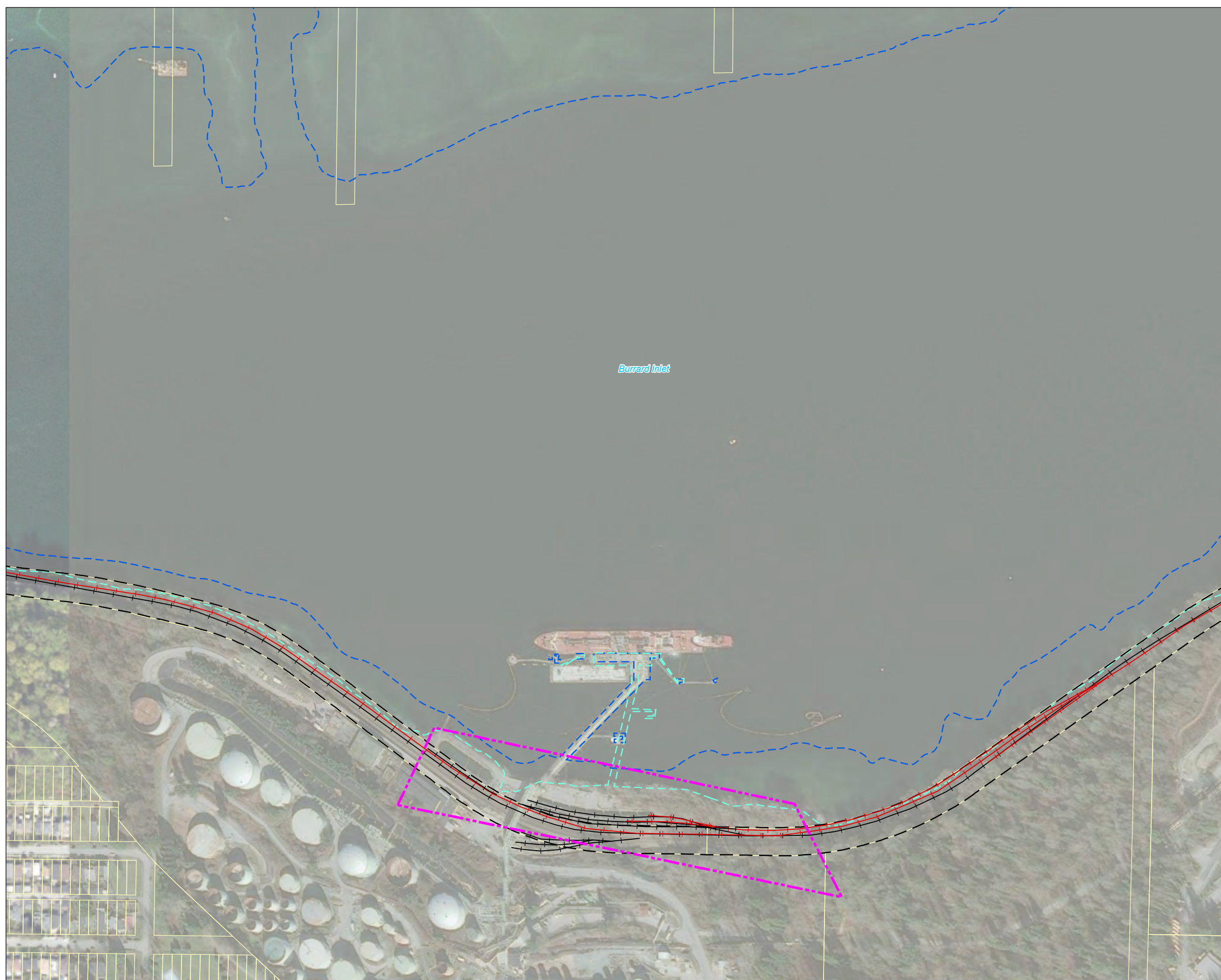
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Zone 2

Legend

-  CEMP Zone
-  Proposed Track Extension
-  Existing CP Railway
-  CP Right-of-Way
-  High Water Mark
-  Low Water Mark
-  Parcel Boundary

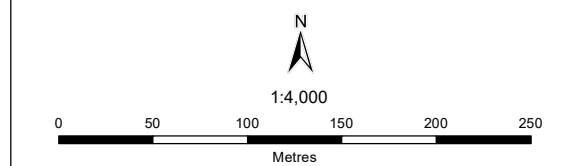


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






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Zone 3

Legend

-  CEMP Zone
-  Proposed Track Extension
-  Existing CP Railway
-  CP Right-of-Way
-  High Water Mark
-  Low Water Mark
-  Parcel Boundary

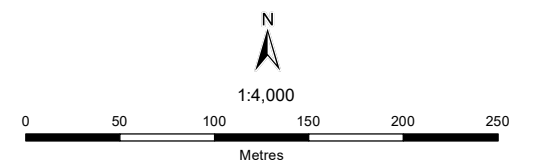
Burrard Inlet

Notes

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1.3 Project Description

Phase 4 will require reconfiguration of existing tracks associated with the Chevron Parkland Refinery and construction of a new control point at Mile 123.00. The increased track length will also add capacity for additional unloading of grain. The proposed track extension is located approximately 1,300 m east of the Terminal and would increase the length of the existing third track by approximately 1,500 m between CP Mile 122.93 and 124.96, as shown on **Figure 1.1**.

To extend the track, CP will widen the existing rail bed by placing clean, engineered fill material in the riparian area and marine environment (intertidal and potentially subtidal) in Burrard Inlet, resulting in permanent alteration and some permanent loss of intertidal and subtidal fish habitat in the marine environment. Access to perform construction work will be:

- Water-based access
- Roadway access
- Hi-rail access.

To inform construction, several studies have been conducted, including archaeological screening, geotechnical assessment, and biophysical surveys. These studies support design, environmental assessment, and permitting.

CP will continue to engage with Indigenous communities that express interest in the Project, including the Tsleil-Waututh and Squamish Nations.

1.4 Project Scheduling and Timing

Subject to receipt of all permits, licences, and approvals (PLAs), construction is proposed to for late 2023 and is estimated to take up to 18 months, with the exception of the offsetting construction (**Table 1.1**). Offsetting construction work will be undertaken in early 2023 consistent with the Offsetting Plan (Hemmera 2021b).

Table 1.1 Tentative Overall Construction Schedule

Task	Start	Finish
Pework – Site Preparation	September 2022	September 2022
Grading	September 2022	March 2023
Track construction	February 2023	May 2023
Offsetting Construction	January 2023	February 2023

The following is a summary of the anticipated construction timing of each zone:

1. **Zone 1:** Infill to above the high-water mark will take place between January and February 2023, and the work in the dry will follow continue into late March 2023.
2. **Zone 2:** Construction commences following infill portion of Zones 1 and 3.
3. **Zone 3:** In-water work starts in September 2022, and the work in the dry will follow and continue into early 2023.
4. **Offsetting:** Offsetting construction is expected to begin in early 2023 and be completed before the end of the first quarter in 2023.

A detailed timeline of the Project construction is provided in **Appendix A**.

1.5 Roles and Responsibilities

This section describes the roles and responsibilities of CP, the environmental monitor (EM), the Contractor, and the Cultural Monitor, as well as all onsite personnel and subcontractors. **Table 1.2** provides a summary of roles and responsibilities during construction.

Table 1.2 Roles and Responsibilities During Construction

Task	Roles and Responsibility			
	CP Rail	Construction Contractor	Cultural Monitor	Environmental Monitor (EM)*
Compliance with CEMP	✓	✓		✓
Compliance with applicable regulations, license, and permit conditions	✓	✓		✓
Working with the EM to identify and implement the most suitable BMPs	✓			
Communicating with the EM to coordinate site visits	✓	✓		
Identifying imminent threats to the environment and responding to EM-identified environmental issues and concerns in a timely manner.	✓	✓		
When out of compliance with the CEMP, rectifying the issue, ideally within 24 hours of notification from the EM	✓	✓		
Possessing all required PLAs necessary to undertake construction, intrusive soil work, and transport and handling of soils and wastes from the Project offsite		✓		
Communicating and coordinating with the Contractor to schedule Project visits based on work tasks			✓	✓
Observing Project health and safety protocols while onsite	✓	✓	✓	✓
Assisting in providing Project personnel with an understanding of Indigenous interests			✓	
Identifying any concerns with potential impacts on cultural resources and communicating these to Project personnel in a timely manner			✓	
Maintaining a strong knowledge of the Archaeological Chance Find Procedure and implementing these procedures while onsite			✓	
Keeping detailed field notes, including documenting any concerns regarding potential impacts to cultural resources, recommended mitigation measures, and mitigation measures employed			✓	
Conveying any concerns to the Contractor, Project Manager, and the Indigenous community they represent			✓	
Producing and providing monitoring activity reports to the Project Manager, and the Indigenous community they represent			✓	
Be present on site for any intrusive environmental work				✓

Task	Roles and Responsibility			
	CP Rail	Construction Contractor	Cultural Monitor	Environmental Monitor (EM)*
Enforce conditions of the CEMP and verify compliance with the CEMP, VFPA Category C project permit, and the Fisheries and Oceans Canada (DFO) FAA conditions				✓
Participating in daily tailgate meetings and discussing relevant sections of the CEMP and federal PLA conditions with the work crew				✓
Suspending work if the tasks planned have or will cause negative effects on the environment or are otherwise out of compliance with the PLAs				✓
Monitoring the effectiveness of mitigation measures				✓
Communicating with the Contractor any issues the work schedule or planned tasks that may have adverse environmental effects				✓
Completing incident reports (e.g., spills, stop work orders), and reporting incidents to the appropriate contacts onsite				✓
Helping guide the Contractor in achieving a high standard of environmental management				✓
Complete and submit environmental monitoring reports to CP, VFPA and DFO on a weekly basis and one final report				✓

* denotes a CP delegate

1.5.1 Proponent Responsibilities

During construction, CP will require that the Contractor’s onsite employees and subcontractors adhere to the CEMP’s environmental protection objectives, including:

- Assuring compliance with the CEMP for all employees, subcontractors, and visitors onsite and provide appropriate training on the CEMP
- Complying with applicable regulations, licences, and permit conditions
- Working with the EM to identify the most suitable BMPs for each work activity and implement these BMPs
- Communicating with the EM to coordinate their visits to assure CEMP compliance and responsible environmental protection
- Identifying imminent threats to the environment and responding to EM-identified environmental issues and concerns in a timely manner
- When out of compliance with the CEMP, rectifying the issue as soon as feasibly possible, and ideally within 24 hours of notification from the EM.

1.5.2 Contractor Responsibilities

During construction, CP will require that the Contractor's onsite employees and subcontractors adhere to the CEMP's environmental protection objectives:

- Assuring compliance with the CEMP for all employees, subcontractors, and visitors onsite, and provide appropriate training on the CEMP
- Complying with applicable regulations, licences, and permit conditions
- Working with the EM to identify the most suitable BMPs for each work activity and implement these BMPs
- Communicating with the EM to coordinate their visits to assure CEMP compliance and responsible environmental protection
- Identifying imminent threats to the environment and responding to EM-identified environmental issues and concerns in a timely manner
- When out of compliance with the CEMP, rectifying the issue as soon as reasonably possible, and ideally within 24 hours of notification from the EM.

The Contractor is responsible for:

- Possessing all required PLAs necessary to undertake the construction, intrusive soil work, and transport and handling of soils and wastes from the Project offsite
- Complying with the terms and conditions of these PLAs.

1.5.3 Cultural Monitor Responsibilities

During construction, Indigenous Community monitors will participate as Cultural Monitors. CP wishes to partner with the nations and encourage opportunities for meaningful participation.

Key duties and responsibilities of a Cultural Monitor include the following:

- Communicating and coordinating with the Contractor to schedule Project visits based on work tasks, including identifying any construction activities that could adversely affect cultural resources
- Travelling to and from the Project Area, as needed
- Observing Project health and safety protocols while onsite
- Assisting in providing Project personnel with an understanding of Indigenous interests related to cultural resources
- Identifying any concerns with potential impacts on cultural resources while onsite and communicating these to Project personnel in a timely and appropriate manner
- Maintaining a strong knowledge of the Archaeological Chance Find Procedure and implementing these procedures while onsite, as needed
- Keeping detailed field notes, including documenting any concerns regarding potential impacts to cultural resources, recommended mitigation measures, and mitigation measures employed
- Conveying any concerns the Cultural Monitor may have to the Contractor, Project Manager, and the Indigenous community they represent
- Producing and providing monitoring activity reports to the Project Manager, and the Indigenous community they represent, as needed.

1.5.4 Environmental Monitor Responsibilities

Onsite monitoring of construction activities is a key component for compliance with the CEMP, the VFPA Category C project environmental permit, and the Fisheries and Oceans Canada (DFO) Fisheries Act Authorization AA. CP will designate an Environmental Monitor prior to construction commencement. The frequency of site visits by the EM will depend upon the work tasks for each day as specified in the PLAs. Specifically, the EM will be present for any intrusive work (i.e., soil excavation or movement), in water or near-water work, installation, inspection, and maintenance of any erosion and sediment control (ESC) measures, work occurring during or within 24 hours of a significant rainfall (i.e., 12.5 mm or more within any given 24-hour period), and at the start-up of any new phases of work. The EM will have the authority to enforce the conditions in the CEMP and will verify compliance with the CEMP, the VFPA Category C project permit, and the Fisheries and Oceans Canada (DFO) FAA conditions.

Other tasks for which the EM is responsible include, but are not limited to:

The EM will complete and submit environmental monitoring reports to CP, VFPA, and DFO in accordance with the conditions of the VFPA project permit and the DFO FAA. The EM will complete daily reports for each day onsite for internal distribution. A CP delegate will prepare weekly and monthly summaries for external distribution to VFPA and DFO. Any incident reports and follow-up action reports will also be completed digitally in the field as necessary and uploaded once completed. The content of daily EM reports will include the following, at a minimum:

- Monitoring dates and times
- Weather over the reporting period
- Construction activities undertaken on each alignment
- Any issues identified
- Environmental protection and mitigation measures recommended and implemented and an update regarding maintenance of these items
- Outstanding items, including non-compliances with recommendations from the EM, regulatory agencies, or regulatory documents
- Monitoring plan for the following week.

Upon completion of the construction work onsite, CP will prepare a final report that will document the work completed, any discharges from the Project Area (waste, spills, water, soil), as well as remedial actions taken to rectify any issues onsite. The report will also include an as-built summary of the Project. This report will be sent to VFPA and DFO in accordance with PLA conditions.

In the event of any circumstances that result in non-compliance, the EM will determine whether a suspension of work is necessary, in consultation with the Contractor, CP, and relevant authorities. The Contractor must implement all applicable mitigation measures to address the non-compliance or until conditions change such that construction activities can once again be initiated in compliance with all environmental obligations.

1.6 Communication

All parties are responsible for communication during each phase of construction. This communication includes ensuring that a copy of this CEMP is readily available at the work site to key Project and construction personnel prior for the duration of construction activities, and Project personnel review the CEMP and understand their roles and responsibilities.

The EM will prepare weekly environmental monitoring reports, which will include Project activities and identify any associated environmental issue and mitigation measures. These reports will be forwarded to key CP representatives.

Project personnel must immediately report any environmental incidents to the CP representatives, who will ensure the appropriate notifications are made and ensure that site personnel address the incidents appropriately (**Section 8.0**). Any spill, accident, or malfunction potentially affecting the environment will be immediately communicated to Indigenous communities, relevant government agencies, and relevant stakeholders.

A preliminary list of Project contacts is presented in **Table 1.3**. This list will be maintained and distributed to key personnel throughout Project construction.

Table 1.3 Project Contact List

Company	Name	Role	Contact Information
CP	Chris Dane	Project Lead	Office: 604-944-5829 Mobile: 403-813-3941 Email: Chris_Dane@cpr.ca
	Kiley Gibson	Environmental Permitting Specialist	Office: 403-319-6234 Mobile: 403-813-6166 Email: Kiley_Gibson@cpr.ca
VFPA	Deborah Renn	VFPA Lead	Office: 604-665-9561 Mobile: N/A Email: deborah.renn@portvancouver.com
Hemmera	Joseph Walker	Environmental Project Manager	Office: 604-669-0424 Mobile: 778 557 7319 Email: jwalker@hemmera.com
Hatch Ltd.	Kelly McGarry	Project Engineering Lead	Office: 587-686-1095 Mobile: 403-471-7630 Email: Kelly.McGarry@hatch.com
Terra Archaeology Limited	Ewan Anderson	Consulting Archaeologist	Office: 250-361-7911 Mobile: 250-361-7911 Email: ewan@terraarchaeology.com
Contractor	TBD	TBD	Office: TBD Mobile: TBD Email: TBD
Environmental Monitor	TBD	TBD	Office: TBD Mobile: TBD Email: TBD
Cultural Monitor	TBD	TBD	Office: TBD Mobile: TBD Email: TBD
DFO	TBD	TBD	Office: TBD Mobile: TBD Email: TBD

Note: TBD – To be determined

2.0 ENVIRONMENTAL AND CULTURAL FEATURES OF THE PROJECT AREA

This section provides an overview of the identified environmental and cultural components of the Project. Although the focus of this description is on potential fish and fish habitat effects, the Project has the potential to affect wildlife and wildlife habitat as well, for example, by disturbing marine mammals or nesting birds.

2.1 History

The Project Area has been occupied by for thousands of years by several Indigenous communities. CP acknowledges that member nations of the Cowichan Nation Alliance, Lyackson First Nation, Musqueam Indian Band, Kwikwetlem First Nation, Squamish Nation, Stó:lō Nation, Stó:lō Tribal Council, Tsleil-Waututh Nation, and Ts'uubaa-asatx Nation have historical and current overlapping interests within and around the Project Area.

The Project Area is believed to have been filled around 1886 when the CP rail line was constructed (Hemmera 2021). An oil refinery (currently the Parkland Refining Plant) is located within the Project Area and has been operating since as early as 1949 (Hemmera 2021).

2.2 Surrounding Land Use

The rail line extends along the south shore of Burrard Inlet. The immediately surrounding land use is industrial. Residential land use is on average approximately 350 m from the Project location. North of the Project Area is the Burrard Inlet (**Figure 1.1**).

2.3 Geology

The Project site is located within the Kitsilano Formation, a rock formation that dates back to the Eocene era and consist of undivided sedimentary rocks (Geological S. 1995). Glacial sediments (vener) are located directly south of the site (Geological S. 1995). Because the topography and general water flow conditions are directed northward to the Burrard Inlet, it is assumed that unconsolidated glacial sediments and weathered sedimentary rocks combine with organics to constitute the local soil.

2.4 Weather and Climate

The Project is situated within the Pacific Maritime climate zone. The weather in this zone is some of the warmest and wettest in Canada, and monthly temperatures vary little relative to the rest of the country (Ecological Framework of Canada n.d). Weather and climatic conditions for this climate zone are summarized in **Table 2.1**. Vancouver International Airport, approximately 19 km to the west, was selected as the weather station most similar to the Project Area. Typically in this climate zone, the highest average annual precipitation (1,113 mm) and associated runoff occurs during the winter months, and the driest months on average are July and August (approximately 40 mm each month).

Table 2.1 Project Area Climate Information

Climate Zone	Pacific Maritime Ecozone
Average Temperature Range	5 degrees Celsius to 20 degrees Celsius
Average Total Annual Precipitation	1,113 mm at Vancouver International Airport, 19 km to the west
Weather Forecasts	www.weather.gc.ca www.theweathernetwork.com
Weather Phone (Environment Canada)	604-885-4100
Weather Notices (Environment Canada)	www.weatheroffice.pyr.ec.gc.ca/e-products

2.5 Contamination

The Project Area is not anticipated to contain contaminated substances.

2.6 Air and Noise Quality

As some work will be taking place in proximity to residences, noise, and exhaust generated during construction activities have the potential to be considered a nuisance.

2.7 Fish Habitat

This section summarizes the freshwater, riparian, intertidal, and subtidal habitat within the Project Area. Detailed information on fish habitat can be found in the Aquatic Effects Assessment (**Attachment 6.2**).

Freshwater Habitat

A desktop review of the Project Area identified the following watercourses (Hemmera 2020):

- Crabtown Creek
- Starfish Creek
- Mill Creek
- Rainbow Creek
- Unnamed Watercourse 1.

Of these watercourses, Rainbow Creek is the only stream that is permanent and provides functional habitat for fish. The other 4 watercourses are non-permanent and provide minimal to nil fish habitat value.

There are no documented freshwater aquatic species at risk that overlap the watercourses, nor any freshwater aquatic federally designated critical habitat within the Project Area.

Riparian Habitat

Marine riparian habitat provides shade, supplies, and/or filters shore-derived sediment, stabilizes shorelines, and filters and mineralizes non-point-source organic pollutants such as nitrates. Currently, the marine riparian vegetation within the Project footprint does not provide substantive benefits to fish habitat in terms of shading, bank stabilization, a buffer for erosion, or overhanging cover. The vegetation present

along the north side of the rail grade provides food and nutrient input to the marine environment through leaf and litter drop and shading of the highest intertidal elevations. The importance of this is greatly reduced given the surface area and volume of the receiving environment.

The following observations of riparian habitat were made during a field visit in July 2020. The marine riparian vegetation identified within the Project Area is located between the existing rail lines and the high-water level. Riparian vegetation consists of predominantly mixed salmonberry (*Rubus spectabilis*) and Himalayan blackberry (*Rubus armeniacus*). Larger trees found throughout the area include red alder (*Alnus rubra*), western hemlock (*Tsuga heterophylla*), and bigleaf maple (*Acer macrophyllum*). English ivy (*Hedera helix*), an invasive species¹, has colonized the Project Area and was observed growing on the bases of most mature trees and across the ground as low cover. East of the refinery, a wooded section of land approximately 200 m long persists seaward of the rail line; this wooded stand is characterized by mature red alder, black cottonwood trees, and bigleaf maple trees. East of this area, the vegetation narrows to a single strip of trees growing at the base of the rail ballast, immediately above the high-water level. Riparian vegetation east of the refinery is composed predominantly of salmonberry with intermittently scattered sword fern.

Intertidal Habitat

The following observations of riparian habitat were made during a field visit in July 2020. The intertidal zone is defined as the zone between the low-water level and the high-water level. Fluctuations in intertidal elevation determine the duration of exposure to air during each tidal cycle. The fluctuations in intertidal elevation and resulting change to key metrics, such as, air and seawater temperature, salinity, exposure to freshwater inputs during low tides, wave exposure, and species interactions² result in zones or bands of distinct marine flora and fauna along rocky Pacific Northwest shorelines. Bands in the upper intertidal zone are dominated by species such as barnacles, littorinid snails, and rockweed (*Fucus* spp.), all of which have high tolerance for variable atmospheric conditions (e.g., summer heat, winter freezing) and freshwater inputs (from runoff or rain). Bands in the lower subtidal comprise species requiring longer durations of seawater submersion (e.g., red algae, kelps), and are better adapted to interspecies interactions occurring in the marine ecosystem.

A total of 48,663 m² of intertidal habitat was mapped within the Project Area. Of this, 6,374 m² consists of *Fucus* habitat, 24,189 m² of benthic algal community, and 18,100 m² of unvegetated habitat. Kelp and benthic algal habitats occur in the intertidal zone.

¹ Invasive plants are plants that are not native to BC and the ecosystem in which they are present, exhibit aggressive growth, and outcomplete native plant species for resources.

² *Species interactions* refers to competition for space and resources, predation, and other interactions.

Subtidal Habitat

The nearshore shallow subtidal zone that lies below the low-water level is influenced by tidal currents and remains submerged during low tide. Within the Study Area, the subtidal zone demonstrates marked difference between the west side of the refinery and the east side.

East of the refinery, the grade is shallow, and the subtidal zone represents a continuation of the sand, gravel, and cobble substrates present in the mid- and low intertidal zones. The slope gradually steepens to the west as the Study Area near Second Narrows. The substrate west of the refinery is characterized by bedrock shelves and outcroppings with abundant erratic boulders descending to approximately -3 m CD, where it transitions to a flat sand and gravel seafloor.

2.8 Aquatic and Marine Species

This section presents the aquatic and marine species that occur or potentially occur in the Project Area, including both at-risk fish species and wildlife species as well as marine mammals, fish, invertebrates, marine macrophytes, birds, and invasive plants.

2.8.1 Species at Risk

This section presents the fish and wildlife species at risk that occur or may occur in the Project Area.

At-risk Fish Species

Six listed species of fish have the potential to occur in the Project Area (**Table 2.2**); however, the shallow depth and location of the Project is not considered optimal habitat for any of them. Coastal cutthroat trout (*Oncorhynchus clarkii clarkii*), which are provincially blue-listed, have a high likelihood of occurrence within the Project Area but are anticipated to avoid the area by moving into deeper waters when Project activities are occurring, as these trout are all highly mobile (Hemmera 2020).

Detailed information on at-risk species can be found in the Marine Fish and Fish Habitat Assessment (**Attachment 4.2.5**).

Table 2.2 At-risk Fish Species with the Potential to Occur in the Project Area

English Name	Scientific Name	Provincial Listing ¹	SARA ^{2,3}	Likelihood of Occurrence	Comments
Bluntnose sixgill shark	<i>Hexanchus griseus</i>	No status	1-SC (2009)	Low	Occurs within Burrard Inlet. However, it is unlikely to occur near the Project Area as it typically occurs deeper than 91 m.
Coastal cutthroat trout	<i>Oncorhynchus clarkii clarkii</i>	Blue	Not listed	High	Found in Burrard Inlet in lower densities than chum, Chinook and pink salmon. Forage in nearshore areas.
Eulachon – Fraser River population	<i>Thaleichthys pacificus</i>	Blue	Not listed	Low	Uncommon in Burrard Inlet.

English Name	Scientific Name	Provincial Listing ¹	SARA ^{2,3}	Likelihood of Occurrence	Comments
Green sturgeon	<i>Acipenser medirostris</i>	Red	1-SC (2006)	Low	Uncommon in Burrard Inlet.
Quillback rockfish	<i>Sebastes maliger</i>	No status	Not listed	Low	Common in Burrard Inlet but unlikely in the Project Area as this fish typically occurs deeper than 16 m.
Yelloweye rockfish	<i>Sebastes ruberrimus</i>	No status	1-SC	Moderate	Common in Burrard Inlet, but adults unlikely in the Area as they typically occur deeper than 19 m. Juveniles possible.

Notes:

- ¹ Red = endangered or threatened, Blue = special concern
- ² SARA = *Species at Risk Act*; Schedule 1 = federal species at risk, Schedule 2 = federal species at risk awaiting reassessment, Schedule 3 = federally designated as special concern awaiting reassessment
- ³ SC = special concern

At-risk Amphibians, Birds and Mammal Species

A search of the BC Conservation Data Centre (BC CDC 2021) returned 61 federally and provincially listed amphibian, bird, and mammal species that are known to occur in BC Ministry of Environment and Climate Change Strategy (ENV) Region 2 and that may use riparian, freshwater, intertidal, or subtidal habitat. The 61 species include species associated primarily with terrestrial habitat. Of these listed species, 43 may potentially use habitats at or near the Project Area, including 3 amphibians, 29 birds and 8 mammals.

It should be noted that most of these species are unlikely to be found within the Project Area because their known habitat preferences differ from onsite characteristics. These species are provincially red-listed or are listed as threatened or endangered under SARA, regardless of their likelihood of occurrence.

Based on input received from DFO, the following species listed under the SARA have been noted by DFO to potentially occur within Burrard Inlet:

- Leatherback sea turtle and northeast Pacific southern resident killer whales, which are currently listed as endangered
- Northeast Pacific transient killer whales, which are currently listed as threatened
- Humpback whale, harbour porpoise, and Steller sea lion, which are currently listed as special concern.

DFO further noted, in the determination letter dated April 16, 2019, that because the Project will not result in any prohibited effects on listed aquatic species at risk, no permit will be required under the SARA.

Watercourses and their associated riparian areas could provide suitable habitat for northern red-legged frog (*Rana aurora*), western toad (*Anaxyrus boreas*), and coastal tailed frog (*Ascaphus truei*). However, no work is anticipated to be conducted along the watercourses and Project-related activities is unlikely to interact with these species.

Of the listed bird species, great blue heron (*Ardea herodias fannini*), horned grebe (*Podiceps auritus*), long-tailed duck (*Clangula hyemalis*), surf scoter (*Melanitta perspicillata*), and western grebe (*Aechmophorus occidentalis*) have a high likelihood of occurring within the Project Area to forage only and are anticipated to avoid the area when Project activities are occurring.

Eight listed mammal species, including marine and terrestrial species, have the potential to occur near the Project Area (**Table 2.3**). Half of these species are provincially red-listed or listed as threatened or endangered under SARA, including the transient and resident populations of killer whale (*Orcinus orca*), little brown myotis (*Myotis lucifugus*), and long-tailed weasel (*Mustela frenata altifrontalis*). However, these species are not likely to use the Project Area or are anticipated to avoid the Project Area during construction activities. Keen’s myotis (*Myotis keenii*) and Townsend’s big-eared bat (*Corynorhinus townsendii*) have a high likelihood of occurring over the Project Area while foraging for insects. However, it is anticipated that they will avoid interacting with the equipment and will, therefore, not be measurably affected by the Project.

Detailed information on at-risk species can be found in the Marine Fish and Fish Habitat Assessment (**Attachment 4.2.5**), Species at Risk and Invasive Species Assessments with Vegetation Overview Plan (**Attachment 4.3.4**), and the Aquatic Effects Assessment (**Attachment 6.2**).

Table 2.3 At-risk Wildlife Species with the Potential to Occur in the Project Area

English Name	Scientific Name	Provincial Listing ¹	SARA ^{2,3}	Likelihood of Occurrence	Comments
Amphibians					
Coastal tailed frog	<i>Ascaphus truei</i>	Yellow	Special Concern	Low	Associated with watercourses and riparian areas.
Northern red-legged frog	<i>Rana aurora</i>	Blue	Special Concern	Low	Associated with watercourses and riparian areas.
Western toad	<i>Anaxyrus boreas</i>	Yellow	Special Concern	Low	Associated with watercourses and riparian areas.
Birds					
American bittern	<i>Botaurus lentiginosus</i>	Blue	Not listed	Low	Associated with marsh habitats.
American white pelican	<i>Pelecanus erythrorhynchos</i>	Red	Not at risk (May 1987)	Low	Uncommon in the area, observed in 2001.
Barn owl	<i>Tyto alba</i>	Blue	1-SC (2003)	Low	Uncommon, occasionally observed across Burrard Inlet from the Project Area
Barn swallow	<i>Hirundo rustica</i>	Blue	T (May 2011)	Moderate	Nest in cliffs and bridges, forage over open water.
Black scoter	<i>Melanitta americana</i>	Blue	Not listed	Low	Historically abundant, last observation from eBird was 2014.
Black swift	<i>Cypseloides niger</i>	Blue	E (May 2015)	Moderate	Nest in cliffs and bridges, forage over open water.

English Name	Scientific Name	Provincial Listing ¹	SARA ^{2,3}	Likelihood of Occurrence	Comments
Brandt's cormorant	<i>Phalacrocorax penicillatus</i>	Red	Not listed	Low	Uncommon, occasionally observed across Burrard Inlet from the Project Area.
Brant	<i>Branta bernicla</i>	Blue	Not listed	Low	Uncommon, last observed in 2014.
California gull	<i>Larus californicus</i>	Blue	Not listed	High	Very common throughout Burrard Inlet.
Caspian tern	<i>Hydroprogne caspia</i>	Blue	Not listed	Moderate	May forage for fish at the Project site.
Common nighthawk	<i>Chordeiles minor</i>	Yellow	1-T (2010)	Moderate	May nest on exposed gravel beds above the intertidal zone.
Double-crested cormorant	<i>Phalacrocorax auritus</i>	Blue	Not listed	High	May over-winter near the Project Area. Large nesting colony on Iron Workers Memorial Bridge (Second Narrows Crossing), located less than 1 km to the west of the Project site.
Eared grebe	<i>Podiceps nigricollis</i>	Blue	Not listed	Moderate	Occasional observations yearly from 2012 to present.
Great blue heron, <i>fannini</i> subspecies	<i>Ardea herodias fannini</i>	Blue	1-SC (2010)	High	May forage at the Project Area, no nesting colonies onsite.
Green heron	<i>Butorides virescens</i>	Blue	Not listed	Moderate	Commonly observed across Burrard Inlet from the Project Area.
Horned grebe	<i>Podiceps auritus</i>	Yellow	SC (April 2009)	High	Commonly observed on water.
Long-billed curlew	<i>Numenius americanus</i>	Blue	SC (May 2011)	Moderate	Occasional observations yearly from 2004 to 2017.
Long-tailed duck	<i>Clangula hyemalis</i>	Blue	Not listed	High	Commonly occurring.
Marbled murrelet	<i>Brachyramphus marmoratus</i>	Blue	T (May 2012)	Low	Occasionally observed using upland habitat, but the Project Area not considered optimal for this species.
Peregrine falcon, <i>anatum</i> subspecies	<i>Falco peregrinus anatum</i>	Red	1-SC (2012)	Moderate	May forage near the Project Area.
Purple martin	<i>Progne subis</i>	Blue	Not listed	Low	Breeds in nest boxes across Burrard Inlet from the Project Area but uncommon near the Project Area.
Red-necked phalarope	<i>Phalaropus lobatus</i>	Blue	SC (2014)	Low	Historically observed near the Project Area, last observed in 2012.

English Name	Scientific Name	Provincial Listing ¹	SARA ^{2,3}	Likelihood of Occurrence	Comments
Rough-legged hawk	<i>Buteo lagopus</i>	Blue	Not listed	Low	Uncommon, associated with marsh habitat.
Short-billed dowitcher	<i>Limnodromus griseus</i>	Blue	Not listed	Moderate	Occasional observations near the Project Area.
Surf scoter	<i>Melanitta perspicillata</i>	Blue	Not listed	High	Commonly occurring bird near the Project Area.
Tundra swan	<i>Cygnus columbianus</i>	Blue	Not listed	Moderate	Occasional observations near the Project Area.
Wandering tattler	<i>Tringa incana</i>	Blue	Not listed	Low	One recorded occurrence near the Project Area, in 1980.
Western grebe	<i>Aechmophorus occidentalis</i>	Red	SC (May 2014)	High	Commonly occurring bird at the Project Area.
Yellow-billed loon	<i>Gavia adamsii</i>	Blue	NAR (May 1997)	Low	Observed near the Project Area in 1994.
Mammals					
Harbour porpoise	<i>Phocoena phocoena</i>	Blue	1-SC (2005)	Moderate	Occasional observations in Burrard Inlet.
Keen's myotis	<i>Myotis keenii</i>	Blue	3 (2005)	High	Likely found foraging insects all over the the Project Area.
Killer whale (transient population)	<i>Orcinus orca</i> - pop. 3	Red	1-T (2003)	Low	Occasional observations in Burrard Inlet when foraging, but unlikely in shallow waters.
Killer whale (southern resident population)	<i>Orcinus orca</i> - pop. 5	Red	1-E (2003)	Low	Occasional observations in Burrard Inlet when foraging, but unlikely in shallow waters.
Little brown myotis	<i>Myotis lucifugus</i>	Yellow	Not listed	High	Likely found foraging insects across the the Project Area.
Long-tailed weasel, <i>altifrontalis</i> subspecies	<i>Mustela frenata altifrontalis</i>	Red	Not listed	Moderate	May be found at the Project Area; species prefers slow moving water bodies with soft substrate.
Steller sea lion	<i>Eumetopias jubatus</i>	Blue	1-SC (2005)	Low	May be found in subtidal marine habitat adjacent to the Project Area.
Townsend's big-eared bat	<i>Corynorhinus townsendii</i>	Blue	Not listed	High	Likely found foraging insects over the Project site.

Notes:

- ¹ Red = endangered or threatened, Blue = special concern
- ² SARA = *Species at Risk Act*, SC 2002, c. 29; Schedule 1 = federal species at risk, Schedule 2 = federal species at risk awaiting reassessment, Schedule 3 = federally designated as special concern awaiting reassessment
- ³ SC = special concern

2.8.2 Marine Mammals

Pinnipeds, including harbour seals (*Phoca vitulina*), California sea lion (*Zalophus californianus*) and Steller sea lions (*Eumetopias jubatus*), are known to occur in Burrard Inlet year-round. Orca (*Orcinus orca*) are also known to infrequently use Burrard Inlet for foraging. Any marine mammal using Burrard Inlet would need to transit past the Project Area, but these are expected to be infrequent visits, if at all, to utilize the nearshore habitat (Hemmera 2020).

2.8.3 Fish

Key fish species found in Burrard Inlet include 4 species of Pacific salmon: pink (*Oncorhynchus gorbuscha*), chum (*O. keta*), coho (*O. kisutch*), and Chinook (*O. tshawytscha*; **Attachment 6.2**). Nearshore marine areas provide important habitat for out-migrating juvenile salmon and serve as migration corridors and staging areas for adult salmon on their way to freshwater spawning grounds. Eleven salmon-bearing streams and rivers in Burrard Inlet³ support 5 species of Pacific salmon⁴ (Hemmera 2020). Juvenile salmon migrate seaward from late winter to late summer, with the bulk of the migration expected to be between March and May. Adults typically migrate to freshwater spawning habitats within salmon-bearing watercourses from June to January.

Several forage fish species can be found in Burrard Inlet, in particular Pacific herring (*Clupea pallasii*), anchovy, and eulachon (*Thaleichthys pacificus*). Pacific herring were historically abundant but have been extirpated in Burrard Inlet since the 1800s due to a dynamite fishery in Burrard Inlet near Coal Harbour, as well as contamination and habitat modifications. No known recent records exist of herring spawning in the Central Harbour of Burrard Inlet, and until 2019, herring had recently returned to False Creek, but not the wider inlet. Anchovy and eulachon (*Thaleichthys pacificus*) have, likewise, undergone historic population decline and are not frequently observed in Burrard Inlet.

In addition, the Project Area lies within the Eastern Burrard Inlet Rockfish Conservation Area, which was established by DFO in 2001 in response to the decline of inshore rockfish species. Rockfish Conservation Areas protect rockfish and rockfish habitats by prohibiting fishing, particularly ground fishing, and bottom trawling. The Eastern Burrard Inlet Rockfish Conservation Area covers 2.8 square kilometres, of which 2.3% provides habitat to rockfish (Hemmera 2021).

2.8.4 Invertebrates

Intertidal and subtidal surveys of marine habitat near the Westridge Marine Terminal in Burnaby, reported a total of 17 and 23 invertebrate species respectively (Hemmera 2020). Although located approximately 4 km from the Project Area, these surveys provide a broad overview of marine species that occur within similar habitat types in Burrard Inlet (especially the intertidal). Dominant intertidal species at this other site included periwinkles (*Littorina* spp.), limpets (*Patella vulgate*), common acorn barnacle (*Balanus glandula*), and blue mussels (*Mytilus* spp.). Dominant subtidal species included Dungeness crab (*Metacarcinus magister*), sunflower stars (*Pycnopodia helianthoides*), ochre stars (*Pisaster ochraceus*), giant plumose anemones (*Metridium farcimen*), and sea pens (*Ptilosarcus gurneyi*).

³ These 12 salmon-bearing streams and rivers in the Burrard Inlet are McKay Creek, Mosquito Creek, Lynn Creek, Seymour River, McCartney Creek, Windemere Creek, Mossom Creek, Noons Creek, School House Brook, Buntzen Bay Creek, and Indian River.

⁴ These 5 Pacific salmon species are Chinook, coho, chum, pink, and steelhead.

2.8.5 Marine Macrophytes

Species composition and coverage of marine vegetation vary throughout Burrard Inlet. Red algae currently appear to be the most widely distributed macroalgae species; however, patchy bull kelp (*Nereocystis luetkeana*) beds were historically more common in the nearshore habitats (Hemmera 2020).

A narrow fringe of bull kelp extends for several hundred metres east of the Second Narrows Bridge and ends approximately 130 m west of the Project Area (Hemmera 2020). It appears likely that this bull kelp bed has originated in part from historic rock placement from previous infilling works completed in the 1990s, which included subtidal rock reef installations.

2.8.6 Birds

Ducks, geese, herons, shorebirds and raptors feed and roost in mudflats, rocky shorelines, and forested areas along Burrard Inlet. As Burrard Inlet is also part of the Pacific Flyway route, it is a popular stop for many species of migratory waterfowl (Hemmera 2021). Burrard Inlet is recognized as an Important Bird Area and supports both residential and migratory bird populations, including western grebe (*Aechmophorus occidentalis*), Barrow's goldeneye (*Bucephala islandica*) and surf scoter (*Melanitta perspicillata*).

Second Narrows Bridge, also called Ironworkers Memorial Bridge, provides nesting habitat to a large, mixed breeding colony of double-crested cormorants (*Phalacrocorax auratus*) as well as pelagic cormorants (*Phalacrocorax pelagicus*). These species are expected to forage in the Project Area, particularly during the nesting period.

Vegetation clearing will occur outside the nesting bird risk window of March 15 to August 15 and, therefore, nesting bird surveys are not required for this work. If vegetation clearing occurs within the timing window, nesting bird surveys will be conducted prior to clearing.

2.9 Invasive Plants

Existing invasive species noted in the riparian vegetation included Himalayan balsam (*Impatiens glandulifera*), Himalayan blackberry (*Rubus armeniacus*), and English ivy (Hemmera 2021). Project construction activities have the potential to introduce or spread invasive species within the Project Area, including through contaminated media such as imported soil or on construction equipment.

3.0 POTENTIAL EFFECTS ON ENVIRONMENTAL AND CULTURAL FEATURES

This section describes the potential effects on environmental and cultural features that could occur as a result of proposed Project activities.

Effects are also documented and further quantified in the Habitat Assessment (**Attachment 4.2.5**) and in the Offsetting Plan (**Attachment 6.2**).

Potential effects that may be expected to occur as a result of the proposed Project have been summarized in **Table 3.1**. The table rows list the different land-based or in-water activities identified by DFO as potential sources of effects on fish and fish habitat (Hemmera 2021), which might occur as a result of the proposed Project and, therefore, have potential to result in an adverse effect in the absence of mitigation. The columns in this table describe potential adverse effects on fish and fish habitat.

This discussion of environmental effects on fish and fish habitat is followed by a description of mitigation measures for the potential effects in **Sections 3.0 to 7.0**, which also includes mitigation for other environmental and cultural values (i.e., in addition to fish and fish habitat).

Table 3.1 Project Assessment Using DFO’s Defined Activities and Timing of Potential Effects

Project Activities	Potential Sources of Effects on Fish and Fish Habitat			
	Change in Sediment Concentrations	Change in Contaminant Concentrations	Change in Habitat Structure and Cover	Mortality of Fish
Land-based Activities				
Use of industrial equipment	✓	✓	-	✓
Vegetation clearing	✓	-	✓	-
Grading	✓	-	✓	-
In-Water Activities				
Placement of materials and structures in water	✓	✓	✓	✓
Use of industrial equipment	✓	✓	-	✓

3.1 Changes in Sediment Concentrations

Land-based and in-water construction activities that have the potential to release sediment-laden water into the Burrard Inlet include the use of industrial equipment, vegetation clearing, grading, dredging, and the placement of material below the high-water level. Increased concentration of sediments may affect water quality and negatively affect fish survival and productivity by decreasing visibility (affecting feeding efficiency), damaging fish gills, altering species interactions (e.g., increasing or decreasing predation rates), and reducing habitat quality.

3.2 Changes in Contaminant Concentrations

Construction equipment used near and in Burrard Inlet may potentially release contaminants into the aquatic environment due to accidental spills. Changes in contaminant concentrations have the potential to cause fish mortality, affect growth or reproductive success, and contaminate underlying substrates, leading to avoidance and injury to marine invertebrates and fish.

3.3 Changes in Habitat Structure and Cover

The Project will result in the destruction or permanent alteration of approximately 5,028 m² of marine riparian vegetation, 4,029 m² of Fucus community, 2,704 m² of benthic algal community, 2 m² of kelp bed habitat, and 6,783 m² of unvegetated substrates.

The Project will result in the permanent alteration of 357 m² of marine riparian vegetation, 814 m² of Fucus community, 5,798 m² of benthic algal community, 963 m² of kelp bed, and 3,382 m² of unvegetated substrates. These substrates will be altered to modified intertidal habitat comprised of a 2:1 riprap slope on the outer (seaward) side of the new infill.

To summarize, the Project is expected to result in the destruction of approximately 11,314 m² (357 m² of lower-value riparian vegetation, 4,195 m² of intertidal habitat, and 6,761 m² of subtidal habitat). Furthermore, it is anticipated that the Project will result in the permanent alteration of approximately 18,546 m² (5,028 m² of riparian vegetation, 10,811 m² of intertidal habitat, and 2,706 m² of subtidal habitat).

3.4 Incidental Injury or Mortality of Fish

Direct injury or mortality of fish (including eggs, ova, and larvae) may result from physical disruption from industrial equipment in fish-bearing waters. For example, Dungeness or red rock crabs (*Cancer productus*) could be crushed during fill placement.

Increases in suspended solids can degrade surface water quality. Total suspended solids (TSS) in the marine environment can affect fish and benthic communities. An elevated load of suspended solids in surface water can damage fish gills, potentially causing laceration and infection or reducing the efficiency of gas exchange across the gill membrane. Elevated rates of sediment precipitation on the seabed can smother benthic communities, particularly small interstitial invertebrates or larval and juvenile forms of larger animals.

3.5 Injury, Mortality or Disturbance of Species at Risk

The total number of at-risk species within the Project Area is 27, consisting of 14 birds, 9 mammals, 3 amphibians, 1 snake, and 1 turtle. BMPs (refer to **Section 5.0**) and mitigation measures (refer to **Section 6.0**) are presented below. These measures are presented to minimize the risk of injury, mortality, or disturbance of species at risk.

3.6 Disturbance of Marine Mammals

As noted in the Habitat Assessment, pinnipeds, including harbour seals, California sea lions and Steller sea lions, are known to occur in Burrard Inlet year-round. Of these, Steller sea lions are special concern under SARA. There is even more limited potential for southern resident killer whales to be present (refer to **Section 2.8**). As noted for marine mammals that are SARA listed, disturbance could result if appropriate monitoring and mitigation is not adhered to.

3.7 Cultural Resources

To ensure that cultural resources are protected, representatives of local Indigenous communities are invited to participate as Cultural Monitors. Should any cultural artifacts be discovered during construction, the Chance Find Procedure document in **Appendix C** is to be followed.

3.8 Air and Noise

Air and underwater noise generated during Project activities may temporarily disturb fish and other wildlife through:

- Industrial equipment operating within the upland
- Dredging and marine vessel movements.

These activities are not expected to result in underwater sound pressure in excess of 206 dB (RMS) re: 1 μ Pa and lower 10 metres from the source, which is the limit above which the sound pressure could cause injury to or death of fish present in the area during the works.

4.0 REGULATORY BACKGROUND AND REQUIREMENTS

The following section describes the regulatory and policy framework under which construction work onsite is to be completed. The Project Area is on federal land (administered by VFPA), such that federal and VFPA regulations and policies are applicable; therefore, the Project is subject to a Category C project permit from VFPA. Furthermore, it has been determined that the Project will require an FAA from DFO. Any discharges and wastes removed from the Project Area are subject to applicable federal, provincial, municipal, and VFPA regulations and policies.

Federal legislation applicable to the CEMP for the Project is listed below, as well as provincial legislation that may be applicable where the Project Area or activities potentially affect non-federal land. A summary of applicable legislation is provided in **Table 4.1**.

4.1 Federal

4.1.1 *Canada Shipping Act, 2001*

The *Canada Shipping Act, 2001*, SC 2001, c. 26, governs safety of marine transportation and recreational boating, as well as protection of the marine environment.

4.1.2 *Canadian Environmental Protection Act, 1999*

The *Canadian Environmental Protection Act, 1999*, SC 1999, c. 33, respects pollution prevention and the protection of the environment and human health to contribute to sustainable development.

4.1.3 *Fisheries Act*

The *Fisheries Act* provides a framework for managing and controlling fisheries, conserving and protecting fish and fish habitat, and preventing pollution. If fish mortality is a likely result of a Project-related work, undertaking, or activity, then potentially affected fish and their habitat will need to be assessed relative to the productivity of the relevant fisheries.

This Project will require an FAA from DFO prior to construction. The FAA will contain a series of conditions that must be complied with through construction. The FAA will be appended to this CEMP upon receipt.

4.1.4 *Heritage Conservation Act*

The *Heritage Conservation Act*, RSBC 1996, c. 187, protects all archaeological sites on provincial Crown, municipal, or private land that predate the year 1846. Burial sites and rock art sites are protected regardless of age. Heritage inspection permits and heritage investigation permits are issued under section 12.2 of the Act, and alteration permits are issued under section 12.4.

If archaeological permits are required (in addition to those previously obtained), a qualified Professional Archaeologist, in good standing with the Archaeology Branch of the provincial Ministry of Forests, Lands, Natural Resource Operations and Rural Development, will prepare and submit the applications.

4.1.5 *Migratory Birds Convention Act*

The *Migratory Birds Convention Act*, SC 1994, c. 22, protects various species of migratory birds, including gamebirds, insectivorous birds, and non-gamebirds. This Act prohibits the disturbance, destruction, or removal of a nest or related shelter or egg of a migratory bird, as well as the possession of a live migratory bird or migratory bird carcass, nest, or egg.

4.1.6 *Species at Risk Act*

SARA protects wildlife species listed as extirpated, endangered, or threatened from being killed, harmed, harassed, or captured; the residences of these at-risk species from damage or destruction; and at-risk wildlife species on federal land and within federally designated critical habitat.

4.1.7 *Transportation of Dangerous Goods Act*

The *Transportation of Dangerous Act*, SC 1992, c. 34 (TDG Act), governs the handling and shipping of dangerous goods, as defined in the TDG Regulations (SOR/2001-286).

4.1.8 *Vancouver Fraser Port Authority*

The Project's size and complexity has been determined by VFPA to require a Category C permit. The permit will be appended to this CEMP upon receipt.

4.2 Provincial

Because CP is a federally regulated essential service, provincial regulatory considerations have not been considered.

Table 4.1 Applicable Permits, Approvals, and Notifications

Legislation	Applicability	Permit or Approval	Regulatory Agency	Responsible Party
Federal				
<i>Fisheries Act</i>	Project construction activities have the potential to cause harmful alteration, disruption, or destruction of fish habitat, based on final design and construction methodology.	<i>Fisheries Act</i> Authorization	DFO	Proponent's Qualified Environmental Professional (QEP)
	Fish salvage or sampling may be required.	Scientific Fish Collection Permit	DFO	Contractor's QEP
<i>Migratory Birds Convention Act</i>	Project activities have the potential to affect non-SARA-listed migratory birds and their habitat.	Migratory Birds Damage or Danger Permit	Environment and Climate Change Canada	Contractor's QEP
<i>Species at Risk Act (SARA)</i>	Project activities have low potential to affect at-risk species.	SARA Permit	Environment and Climate Change Canada	Contractor's QEP
VFPA	The Project requires a Category C permit.	PER Permit	VFPA	Proponent's QEP

5.0 BEST MANAGEMENT PRACTICES FOR CONSTRUCTION

Mitigation measures and specifications for the Project are presented below.

5.1 General Practices

All work onsite will be conducted in a manner that minimizes the negative effects on the local community and environment. This requires that work be completed in compliance with terms and conditions in the VFPA PER permit and DFO FAA. Work must also follow accepted industry standards, BMPs, and all applicable federal regulations and standards. All personnel, employees, contractors, and subcontractors will review the mitigation measures, applicable guidelines to ensure compliance.

The following guidance documents have been considered in the development of these general work practices:

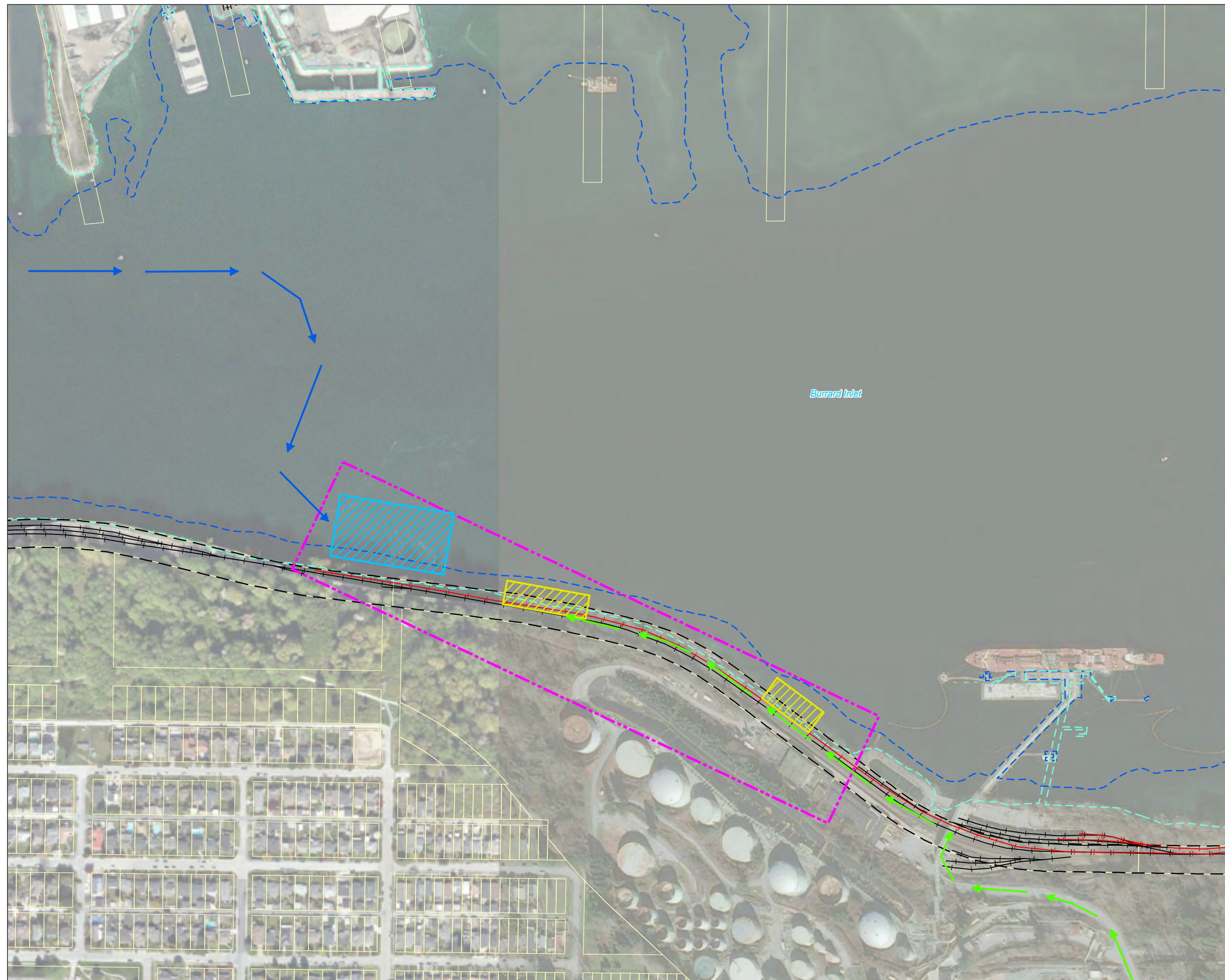
- Land Development Guidelines for the Protection of Aquatic Habitat (Chilibeck et al. 1992)
- Standards and Best Practices for Instream Works (Government of British Columbia 2004)
- Measures to Avoid Causing Harm to Fish and Fish Habitat (Government of Canada 2013)
- Canadian Water Quality Guidelines for the Protection of Aquatic Life (Canadian Council of Ministers of the Environment (CCME) 2007)
- British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife and Agriculture (Government of British Columbia 2019)
- A Field Guide to Fuel Handling, Transportation and Storage (Government of British Columbia 2002a)
- Summary of Environmental Standards and Guidelines for Fuel Handling, Transportation, and Storage (Hollenberg 1995)
- BC Guidelines for Industry Emergency Response Plans (Government of British Columbia 2002b)
- Viterra-Cascadia Terminal Capacity Expansion Project – Marine Fish and Fish Habitat Assessment (Hemmera 2020)
- DFO FAA (once available).

5.2 Access, Mobilization, and Laydown Areas

The Contractor shall prepare a site-specific Marine Access Plan that describes the point of ingress and egress and movement within the marine environment that will be implemented and maintained during all project activities. The Contractor shall implement the following measures within their Marine Access Plan:

- All construction access for transport of construction materials, equipment, and supplies to and from the Project Area is anticipated to be by marine barge.
- Debris, wastes, and other materials will also be removed by barge.
- Marine access points can be found in **Figure 5.1** and **Figure 5.3**. Marine vessels will follow the applicable laws and regulations regarding the loading and transport of their materials (e.g., TDG Act). **Figure 1.1** shows the Project location and construction boundary.
- The main access point for transporting materials onsite and offsite are shown in **Figure 5.1**, **Figure 5.2**, and **Figure 5.3**.
- The contractor required to minimize disturbance and impacts to the Bull Kelp as shown in **Figure 5.4**, and when possible, to the avoid Bull Kelp area located within the Site work area.

**Zone 1 Access and
Laydown and Staging Areas**



Legend

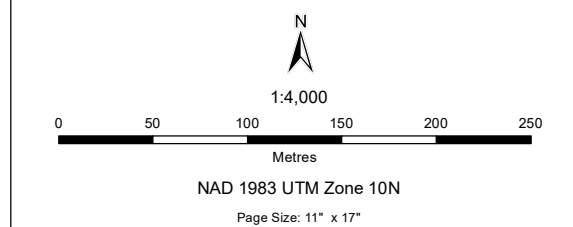
- CEMP Zone
- Land Based Laydown and Staging Area
- Marine Laydown and Staging Area
- ➔ Possible Ground Access Route
- ➔ Possible Marine Access Route
- +— Proposed Track Extension
- +— Existing CP Railway
- - - CP Right-of-Way
- - - High Water Mark
- - - Low Water Mark
- Parcel Boundary

Notes

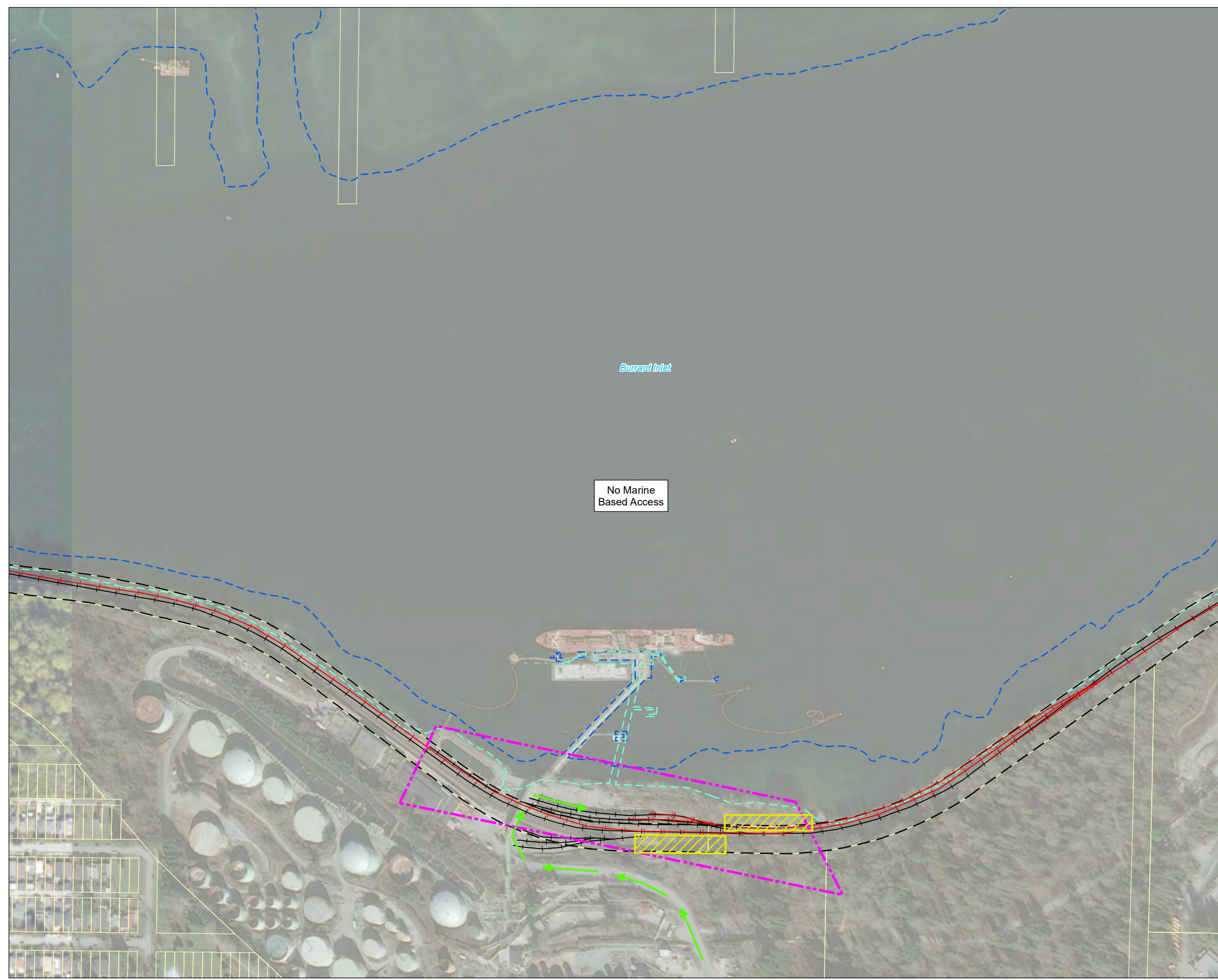
1. All mapped features are approximate and should be used for discussion purposes only.
2. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

Sources











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**Zone 2 Access and
Laydown and Staging Areas**



Legend

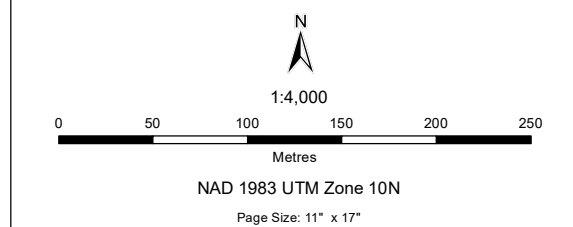
-  CEMP Zone
-  Land Based Laydown and Staging Area
-  Marine Laydown and Staging Area
-  Possible Ground Access Route
-  Proposed Track Extension
-  Existing CP Railway
-  CP Right-of-Way
-  High Water Mark
-  Low Water Mark
-  Parcel Boundary

Notes

1. All mapped features are approximate and should be used for discussion purposes only.
2. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

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**Zone 3 Access and
Laydown and Staging Areas**



Legend

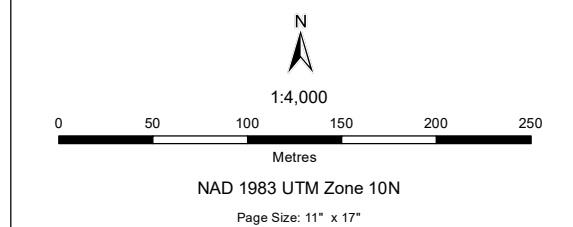
- CEMP Zone
- Land Based Laydown and Staging Area
- Marine Laydown and Staging Area
- ➔ Possible Ground Access Route
- ➔ Possible Marine Access Route
- +— Proposed Track Extension
- +— Existing CP Railway
- CP Right-of-Way
- - - High Water Mark
- - - Low Water Mark
- Parcel Boundary

Notes

1. All mapped features are approximate and should be used for discussion purposes only.
2. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

Sources

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5.3 Air Quality

The objective of air quality management is to minimize air emissions associated with construction. This includes mitigation for air emissions such as vehicle or equipment exhaust, dust, and vapours associated with onsite activities to avoid adverse health, safety, nuisance, and other environmental effects. The following air management actions must be taken during construction:

- Equipment and vehicles must be turned off when not in use and can only idle if they will be used within a reasonable amount of time (less than 3 minutes for vehicles or 5 minutes for non-road diesel engines), unless:
 - required for lighting (mobile light plants)
 - required for dewatering (i.e., mobile dewatering equipment)
 - required for safe operation during construction
 - required for safe operation of the vehicle or in accordance with the manufacturer's specifications
 - necessary to serve the purpose of the machine in the course of its operations (crane, cement mixer, cherry picker, boom lift or similar machine)
 - required for testing or maintenance
 - performing emergency work
 - as stated in a written anti-idling policy.
- All construction equipment and vehicles must be well maintained and and regularly inspected to ensure they are operating in proper condition. Maintenance logs must be updated, and daily logs must be completed following inspections to ensure they are in good working order.
- Dust-generating activities (e.g., earthworks) must be monitored and managed during dry periods and periods of high wind to avoid generation and transport of dust offsite. Use suppression agents (e.g., water) in instances where work cannot be rescheduled to a more appropriate time, following VFPA acceptance of suppression agent and application method prior to its use onsite. Contain and treat runoff due to use of suppression agents as necessary.
- Stockpiled soil must be kept in an appropriate laydown area and covered with polyethylene (poly). Active stockpiles must be secured (e.g., covered with anchored poly) at the end of each shift. Where stockpiles must be left inactive for several weeks or more, the method of securing them must be appropriate for preventing sedimentation and weed establishment (e.g., hydroseeding or more permanent cover).
- All vessels leaving the Project Area with soil must be covered to prevent dust generation and the release of loose gravel to the marine environment.

5.4 Noise and Vibration

Noise generation and vibrations resulting from equipment and associated activities during construction must be addressed by the Contractor through the following mitigation measures:

- Schedule all noise-generating construction activities on any day in accordance with the applicable restrictions, unless written approval has been received from the CP authorizing otherwise.
- Ensure that all equipment is well-maintained and muffled during construction to minimize unnecessary noise.
- Schedule any construction activities to take place within appropriate least risk timing windows.

- Ensure the size and power of tools used is appropriate to the job in order to limit noise from power tool operations.
- Position any noise-generating stationary equipment (e.g., generators or compressors) as far away from noise receptors as practical.
- Equipment and vehicles will be turned off when not in use and can only be allowed to idle if they will be used within a reasonable amount of time (less than 3 minutes for vehicles or 5 minutes for non-road diesel engines). Exceptions include mobile light plants for lighting, mobile dewatering equipment, and any health and safety equipment required for safe operation during construction.

The hours of work must be consistent with VFPA's standard work hours of Monday to Saturday 7:00 a.m. to 8:00 p.m. If work outside these hours is necessary, the following information must be prepared and submitted with a request for extended work hours to VFPA after issuance of the PER permit:

- Rationale for extended work hours request
- Construction methods as outlined in the CEMP, including but not limited to:
 - Project components and tasks associated with the extended work hours request
 - Description of the potential offsite noise disturbances from the work
 - Types of noise
 - Location onsite where noise will be generated
 - Proximity to residents and neighbours that may be affected
 - Dates and times of proposed work
 - Proposed mitigations that can be applied to minimize or prevent disturbances, such as limiting noise-generating activities to daytime hours, shrouding the work area, altering construction methods, or use of broadband backup alarms
 - Map of proposed work area and surrounding properties that may be affected by Project noise, generally within 1 km of work site
 - Site plan showing structures, buildings, and topography
 - A completed screening level noise worksheet.

The affected community and municipality will be notified of the nature and likely duration of any particularly noisy operations, pursuant to VFPA requirements, that may be forthcoming and when it will be necessary to work outside daytime and early evening hours.

5.5 Water Quality

The water quality mitigation measures presented below must be taken by the Contractor during construction to mitigate potential Project effects on water quality and monitoring to ensure water quality objectives are met.

5.5.1 General Best Practices

The Contractor must implement the following general best practices to mitigate potential adverse effects on water quality. This summary is followed by specific ESC measures in **Section 5.5.2** and proposed monitoring in **Section 5.5.3**.

- Do not permit sediment, sediment-laden waters, or other deleterious substances to enter Burrard Inlet at any time.

- Work with machinery only from the dry foreshore (during low tide), top of bank, temporary work pad, or barge.
- Do not let wheels and tracks of land-based equipment to enter the water at any time. If working in the intertidal zone, this will require careful monitoring of the change in tide levels.
- Operate machinery in a manner that minimizes disturbance to intertidal and subtidal habitats outside the immediate construction limits.
- Avoid seabed grounding and propeller wash when operating marine vessels. Avoid propeller wash by operating vessels in water with a minimum clearance of 1.5 m between the propeller and the seabed.
- Carry out all physical activities in a manner that prevents induced sedimentation of foreshore and nearshore areas and induced turbidity of local waters and prevents the release of sediment, sediment-laden waters, and turbid waters to the aquatic environment.
- Properly train dredging operators to operate equipment based on industry best practices, which include utilizing techniques that minimize the re-suspension of sediments in the water column.
- Conduct dredging only at locations to be infilled with riprap as part of marine infilling. Do not conduct dredging for the sole purpose of keying riprap into the native marine substrate to stabilize the new slope.
- Place marine fill using a crane and clamshell bucket in areas outlined in the design drawings only. To ensure accuracy of fill placement, position the crane using a geographic positioning system prior to placing any fill, and do so continually through the shift. In addition, equip the crane with a clamshell bucket to allow material to be placed with a minimal disturbance to the substrate and with high accuracy.
- Use subtidal fill that is composed of clean, fractured blast rock to increase the interlock of the fill structure and minimize erosion, slumping, or movement of the material.
- During all physical activities, comply with the following water quality criteria outlined in **Section 5.5.3**.
- Environmental monitoring must take place during all works below the HHWLT. Monitoring plans and requirements are outlined in **Section 5.5.3** below.

5.5.2 Erosion and Sediment Control

ESC measures must be implemented onsite to isolate the work area, decrease the amount of soil particle detachment, and avoid or minimize any potential sediment-laden runoff resulting from construction activities from entering Burrard Inlet.

The Contractor shall prepare a site-specific Environmental Protection Plan that describes the ESC methods that will be implemented, maintained, and inspected when Project activities, (e.g., clearing vegetation, moving soil, excavating, or placing fill) have the potential to disturb ground and/or contribute sediments to Burrard Inlet. The Contractor shall communicate the concept of “no erosion = no sedimentation” to all workers.

The Contractor shall implement the following mitigation measures to prevent erosion and manage sediment during construction, as determined with the EM to be applicable:

- Give priority to erosion source control techniques over sediment control techniques, as erosion control techniques are more effective and cheaper in the long run.
- Apply ESC measures as soon as soil disturbance or vegetation clearing has occurred to control and contain soil erosion and sediment runoff from entering the marine environment. Erosion control

measures include straw mulching; silt fencing; hay bales; geotextile fabric; erosion control blankets; mats; rock-lined channels; and polyethylene sheeting.

- Cover material stockpiles with temporary coverings (geotextile fabric, plastic sheets) and store in upland areas protected from tidal inundation.
- Cover exposed areas to prevent soil erosion and sediment runoff, particularly bare slopes that can be covered with coco-matting or mulch.
- Make ESC materials available and easily accessible for use onsite.
- Keep control measures in place until the affected work areas are stabilized and there is no longer a risk of sediment runoff, sedimentation, or soil erosion.
- Remove and dispose of temporary ESC measures when no longer required, as determined by the EM. When feasible, reduce, reuse, and recover any ESC materials throughout the construction period.
- Train onsite staff in the use, installation, and maintenance of ESC measures. The EM will review installation and approve placement and use prior to work beginning.
- Where possible, schedule earthworks to be conducted and completed during dry weather. When significant wet weather (over 12.5 mm of rain within 24 hours (City of Burnaby 2021a, 2021b)) is predicted or encountered, erect additional control measures promptly to minimize erosion potential.
- Minimize areas of exposed soil at any one time as follows:
 - Plan and phase construction activities
 - Retain vegetation as much as possible
 - Stabilize any exposed soils as soon as possible using temporary erosion control measures or by planting long-term vegetation (if during the appropriate time of year).
- Do not discharge petroleum hydrocarbons, solvents, heavy metal particulate, concrete, or any material that could be characterized as a deleterious substance as defined by the *Fisheries Act*. If water is discharged from the Project Area, the EM will verify that the water meets the applicable water quality standards (civic, provincial, municipal, federal). Discharge to another property requires permission from the property owner and tenure holders. Water quality will be monitored in accordance with **Section 5.5.3**.
- Do not track mud or dust onto civic lands or streets.
- Avoid clearing during heavy rainfall when sediment runoff potential is greatest.
- Operate and manoeuvre marine derricks, barges, and any tending vessels in such a way as to prevent disturbance to seabed substrates. Propeller wash can be minimized by operating vessels in water with a minimum clearance of 1.5 m between the propeller and the seabed.
- Prevent sediment runoff from occurring on material supply barges. Barges must not be washed or hosed down to remove residual supply materials (i.e., gravel or sand for beach construction), as this could result in sedimentation/turbidity of the water column from finer fractions and the potential for toxic deleterious materials (e.g., residues from oils, fuel, etc.) to enter the marine environment.
- Prevent sediment runoff from occurring on the temporary pad extension.
- Monitor continued effectiveness of all implemented measures and replace, repair, or improve as needed. Continually monitor for new sources of soil erosion and sediment runoff, and implement measures to control runoff and erosion, as needed.

5.5.3 Water Quality Monitoring Plan

Any water discharged from the Project Area shall be monitored to confirm that suspended solids, pH, and other water quality parameters meet required environmental performance indicators. The water quality monitoring program will comply with the conditions of permits/approvals issued by the regulatory agencies, BMPs, and BC Water Quality Guidelines (Government of British Columbia 2017).

Both TSS and turbidity can be used to assess total particulate matter in water⁵.

The BC ENV turbidity guideline for freshwater, marine, and estuarine habitats (measured in NTU), as presented in **Table 5.1**, will be applied as a benchmark against in field measurements during water quality monitoring.

Table 5.1 Turbidity Guideline

Change from Background	Duration
8 NTU	At any one time for a duration of 24 hours in all waters during clear flows or in clear waters
2 NTU	At any one time for a duration of 30 days in all waters during clear flows or in clear waters
5 NTU	At any time when background is 8 NTU to 50 NTU during high flows or in turbid waters
10 percent	When background is greater than 50 NTU at any time during high flows or in turbid waters
Maximum increase of 8 NTU	At any one time when background levels are between 8 and 80 NTU

Note: Background conditions can be established in either of 2 ways: collect samples prior to the daily start-up to reflect undisturbed conditions in Burrard Inlet or collect samples taken 100 m away on the upcurrent side of construction activity (depending on the direction of tidal currents).

Source: Canadian Council of Ministers of the Environment (CCME) 2007.

The EM shall conduct monitoring to comply with the preliminary water quality monitoring plan as follows:

- Establish sampling sites prior to commencing water quality monitoring or any works requiring EM.
- Establish the first monitoring site less than 10 m downcurrent (depending on tides) from the work area. In the unlikely event that a turbidity curtain is deployed, the first monitoring site should be located less than 10 m downcurrent from the curtain.
- Establish a pair of monitoring sites 30 m from the work site (1 upcurrent and 1 downcurrent).
- Establish an additional monitoring site 10 m downcurrent from the kelp bed.
- Establish additional paired monitoring sites at distances of 100 m, 200 m, 500 m, and 1,000 m as needed (1 upcurrent and 1 downcurrent to form a paired monitoring site) from the work site.

⁵ TSS is a measure of the dry weight mass of non-dissolved organic and inorganic solids suspended per unit volume of water, expressed in milligrams per litre. Turbidity is a measure of water clarity, specifically the amount light scattered as it passes through a sample of water and is measured in nephelometric turbidity units (NTUs). Often, water quality monitoring is conducted using turbidity (NTU) as a surrogate for TSS, because it can be measured in situ. Following laboratory analysis of TSS samples, a linear regression analysis can be completed to establish the site-specific relationship between NTU and TSS, if needed.

- Collect samples from approximately mid-depth of the water to avoid contaminating samples with detritus from the surface (dust, pollen, etc.) or with substrate (silt, fines, sand). Where not feasible to collect from mid-depth, use discretion to sample from a depth sufficient to meet the above criteria.
- Collect samples at a minimum of twice a day during the first week of work: prior to start-up and mid-morning during normal construction activities.
- For construction activities that are likely to temporarily increase turbidity (infilling below the HHWLT), collect water quality samples at 2-hour intervals while construction is underway.
- Collect samples every second day at the same 2 times of day when the onsite spatial and temporal variations in water quality are understood, from the second week of work until completion. Adjust the number of monitoring locations as needed based on initial findings and the site conditions.
- Conduct additional water quality monitoring within 24 hours of a significant rainfall event (over 12.5 mm of rain within 24 hours) (City of Burnaby 2021a, 2021b).

The monitoring site locations can be continually adjusted as construction is moved throughout the Project Area. Turbidity levels of the most downcurrent sampling location should always remain near those of background and within the CCME guidelines, regardless of upcurrent events. Impacts to adjacent habitats are not expected, in part, because of natural site conditions (high currents and tidal exchange, existing sedimentation levels) and mitigative Project re-design reducing sediment volume.

5.5.4 Water Quality Contingency Plan

If water quality guideline exceedances are detected or deemed likely to occur, the EM will implement the following mitigation measures:

- Communicate the results of ongoing water quality monitoring regularly to the Contractor and immediately communicate any spike or exceedance of water quality guidelines.
- If an exceedance is detected, and/or a visual turbidity plume is detected, collect additional samples (and the corresponding geographic positioning system location(s)) from all sampling locations and, if necessary, from the middle of the plume and as close to the source as possible (within safety limits).
- In the event of an exceedance, immediately stop the relevant construction activity. Collect samples and measure water quality parameters in situ until all sampling locations are within guideline levels.
- Prior to restarting construction, work with the Contractor to identify the reason for the exceedance and implement additional mitigation measures that may include, but are not limited to:
 - Deploying turbidity curtains around the work site (if feasible)
 - Reducing the rate of work (infill or dredge)
 - Washing materials (riprap) prior to in-water installation.

5.6 Machinery and Equipment

The work onsite will require various equipment and machinery to complete various construction tasks such as dredging, transportation, grading, etc. The Contractor must implement the following mitigation measures, in conjunction with the requirements of **Section 5.13**, to prevent and respond to spills:

- Maintain a list of equipment and machinery that will be used onsite, including the equipment type, fuel type, year of manufacture, and engine power rating, prior to mobilization to the Project Area.
- Maintain a machinery and equipment maintenance log and make available for review by the EM.

- Ensure that equipment used onsite is in good mechanical condition with no leaks, excess oil or grease, invasive species and noxious weeds. Complete daily checks and record on each piece of equipment prior to operation.
- Place absorbent pads, impervious tarps, or drip trays underneath stationary machinery and equipment.
- Use biodegradable hydraulic oil and grease for equipment that is working near water.
- Refuel equipment in compliance with A Field Guide to Fuel Handling, Transportation and Storage (Government of British Columbia 2002a). Complete all refuelling with a spill kit in the immediate vicinity, with personnel trained in the use of spill kits.
- Keep a spill kit on each piece of heavy equipment used within the Project Area. Ensure spill kits are easily accessible at all times and well stocked, with a list of materials included in each kit.
- Train all personnel in the maintenance, use, and locations of spill kits and keep records of such training.

5.7 Contaminated Soil and Groundwater Management

During any excavation or soil movement activities, areas of contamination or debris may be encountered. To manage potentially suspect materials, field assessment of suspect soil or material is necessary. Field screening includes visual and olfactory observations for evidence of contamination during any excavation activities. Examples of evidence of contamination may include: the presence of free product, sheen, staining, debris, or hydrocarbon odours.

If contaminated soil or groundwater is encountered, the Contractor shall manage potentially contaminated soil and groundwater as follows:

- Stockpile and cover soil in an approved temporary soil storage area, which has a continuous impermeable surface and appropriate grading to assist in managing runoff during periods of rainfall.
- Construct a berm around the temporary soil storage area to control any runoff and have appropriate water control measures as necessary (i.e., pumps and tanks available if needed).
- Once soil is classified, dispose or reuse it as appropriate based on analytical results and under the direction of a Qualified Environmental Professional (QEP).
- Treat any water encountered in open excavations as contaminated until analytical data shows otherwise. Dewater excavations and pump water into holding tanks. Treat water to ensure compliance with applicable criteria as necessary prior to discharge. Confirm that any permits for discharge are received prior to discharge, or prior to removal.

5.8 Wildlife Management

The construction is expected to be completed outside bird breeding period and thus, bird nest sweeps are not expected to be necessary. However, as raptor nests are protected year-round, a drone survey will be completed prior to construction commencement. For marine vegetation and wildlife management, please refer to **Section 5.10**.

The Contractor must implement the following wildlife management mitigation measures:

- Develop and implement an environmental training orientation program to all Project personnel and contractors that includes identification of at-risk species that may be present in the Project area.
- Remove all food wastes from the construction workspace daily to avoid attracting wildlife.
- Ensure Project personnel do not feed or harass wildlife, or destroy wildlife habitat that is not otherwise authorized for the Project.
- Limit areas of vegetation clearing and flag clearing boundaries.
- Avoid the bird breeding period (i.e., March 15 to August 15).
- Confirm that a required preclearing nest survey is conducted by a QEP if vegetation clearing takes place after March 14 or before August 16.
- If active nests of species protected by the *Migratory Birds Convention Act* are encountered during the nest survey, avoid the no-disturbance buffers flagged by the EM. Do not permit activity within this buffer while the nest is active and occupied. Have the QEP monitor any active nests until birds have fledged and the nest is confirmed to be inactive.
- Construction activities occurring in potential amphibian breeding habitat will be conducted outside of the amphibian breeding season (January through June) whenever possible. If the amphibian breeding season cannot be avoided, an EM will conduct surveys for evidence of breeding amphibians (e.g., egg masses, tadpoles). Any amphibians identified will be salvaged under a provincial wildlife permit.
- Have the EM survey the work area for presence of at-risk species before commencing work activities and conduct additional surveys in early spring for the presence of amphibian egg sacs.
- If any identified or previously unidentified species at risk or their potential habitat is encountered within the work area, immediately notify the EM. Suspend all work in the immediate area until an appropriate course of action has been determined.
- The EM will record the location of any species at risk encountered during construction activities in the daily monitoring report; if an identified species exhibits signs of sensory or other disturbance, the EM will identify appropriate mitigation measures as needed.
- Where practical, retain adjacent old or dying trees with signs of decay and place conservation emphasis on those containing cavities greater than 3 inches in diameter.
- Minimize construction noise above ambient levels by installing temporary structural noise barriers such as sandbags, baffle boxes, or sound walls beyond the buffered area.
- Limit construction activities to the time between dawn and dusk to avoid the illumination of adjacent habitat.

5.9 Vegetation Management

The following mitigation measures shall be followed during the vegetation removal to manage invasive plants:

- Before clearing any vegetation, confirm that a QEP has checked all areas of disturbance for the presence of invasive vegetation. Where invasive vegetation is present, develop a site-specific Invasive Species Management Plan that includes mitigation measures in the plan for working in and around areas of invasive vegetation.

- Minimize the vegetation clearing area to the extent possible. Minimize excessive soil disturbance when removing invasive species to avoid new introductions.
- Clear vegetation toward patches of invasive species to prevent spread into un-infested areas.
- Separate invasive plant parts from other organic material. Dispose of invasive plant species material in an appropriate manner: bag and/or designated green waste bin and remove material offsite to approved landfill location following protocols as described by the Invasive Species Council of Metro Vancouver (Invasive Species Council of Metro Vancouver 2020). Do not compost nor leave onsite.
- Remove Himalayan blackberry prior to fruit development to prevent spread of seeds (ideally before late-July).
- Use mechanical control such as hand-pulling and shovels to remove any invasive plants.
- Clean and inspect equipment daily and at a regular basis, especially when working near areas with invasive species. Clean machinery and equipment thoroughly after use.
- Inspect footwear, clothing (check pant cuffs), and equipment to confirm they are free of plant parts, seeds, propagules (i.e., any other material that may cause the species' spread), and pathogens before arriving and before leaving the worksite.
- Prevent the spread of invasive and noxious plant species onsite and offsite by using truck wash station and inspecting vehicles for plant material prior to entering the Project Area.
- Ensure any soil or fill coming into the Project Area comes from a location that is free of noxious weeds, especially Japanese knotweed (*Fallopia japonica*).
- Bring materials onsite to be used for backfilling, site preparation, or other uses only if they are from sources demonstrated to be clean and free of environmental contamination, invasive species and noxious weeds.
- Minimize bare soil exposure (e.g., cover stockpiled material with tarps, plant native species, cover with natural mulch/ground coverings etc.)

Additional information, including BMPs on invasive and noxious species that could occur in the Project Area, is available on the Invasive Species Council of Metro Vancouver (Invasive Species Council of Metro Vancouver 2020) and Metro Vancouver (Metro Vancouver 2020) websites.

5.10 Marine and Foreshore Resources

During marine and foreshore work, the Contractor shall minimize the potential effects to aquatic resources. Marine activities will be undertaken by both marine and land-based equipment. Marine activities will include vessel movement, dredging by clamshell, fill placement and grading, riprap placement, and the proposed offsetting works (including shallow rock reef construction).

The Contractor shall implement the following measures to address and mitigate potential adverse effects on marine fish and fish habitat:

- Do not directly or indirectly: (a) deposit or permit the deposit of a deleterious substance of any type in water frequented by fish in a manner contrary to p.36(3) of the *Fisheries Act*; or (b) adversely affect fish or fish habitat in a manner contrary to p.35(1) of the *Fisheries Act*.
- Time all in-water construction and maintenance activities to occur within the DFO Burrard Inlet reduced risk work window of August 16 to February 28.

- Complete work following accepted industry standards, BMPs, as well as applicable regulations and standards.
- Position barges and water-borne construction equipment with enough clearance to prevent damage to fish habitat.
- Properly maintain equipment and machinery to minimize unnecessary underwater noise pollution.
- Require vessels to follow operation requirements when close to marine mammals (i.e., the Marine Mammal Regulations, the Interim Order for the Protection of the Killer Whale (*Orcinus orca*) in the Waters of Southern British Columbia 2020, DFOs Notice to Mariners and Guidance for Watching Marine Wildlife (Government of Canada 2018, 2020; Transport Canada 2020).
- Require vessels to adhere to approach distance requirements identified in the Marine Mammal Regulations, 2018 (Government of Canada 2018) and the Interim Order for the Protection of the Killer Whale (*Orcinus orca*) in the Waters of Southern British Columbia (Transport Canada 2020), specifically:
 - 100 m away from any whale, dolphin, and/or porpoise
 - 200 m away from any whale, dolphin, and/or porpoise if in resting position or with their calf
 - 400 m away from any killer whale when within waters identified in Schedule 1 of the Interim Order (which includes the Project footprint)
 - 200 m away from any killer whale when outside waters identified in Schedule 1 of the Interim Order.
- Require vessels to reduce speed to less than 7 knots when within 1,000 m of the nearest marine mammal (Government of Canada 2020), to reduce engine noise and vessel wake. Avoid abrupt course changes.
- Turn off echosounders when not in use.
- Conduct all construction activities that take place below the HWL under the supervision of a trained Marine Mammal Observer (MMO). The MMO and EM roles can be fulfilled by the same individual.
 - During all subtidal works, require the MMO to scan the work area before and during ongoing works and document the presence, number, and behaviour of marine mammals in the area.
 - If marine mammals appear disturbed, require the MMO to advise the Contractor to stop or modify construction activities until the mammals have cleared the area.
 - Keep a daily log of MMO activities and summarize it in the Environmental Monitoring Report.
- Require vessels to avoid approaching within 100 m of a marine mammal in the water or a seal / sea lion haul out. If seals or sea lions are encountered, reduce boat speed, minimize wake, wash and noise, and then slowly pass without stopping. Avoid sudden changes in speed and direction.
- Pay attention and move away, slowly and cautiously, at the first sign of marine mammal disturbance or agitation.
- Do not disturb, move, feed or touch any marine wildlife, including seal pups.
- Immediately report emergency collisions with marine mammals, or a sighting of an entangled or injured marine mammal, to Coast Guard (VHF Channel 16) or Whale Emergency Network (1-800-465-4336). Additionally, contact Royal Canadian Navy Maritime Forces Pacific Formation Safety and Environment for all marine mammal issues.
- Although the kelp beds are separated from the Project Area and any proposed construction activities by approximately 130 m, take specific care to avoid operation of any marine vessels or equipment near the kelp beds west of the Project Area to protect the kelp from potential effects from marine vessel propellers.

- To minimize in-water work and avoid exposure of unarmoured fill to tidal inundation, install fill below the high tide line using a stepwise technique and limit infilling each day to a shoreline length that enables completion of all fill stages (including final riprap armouring) during a given low tide period. See **Appendix B** for detailed drawings showing the various steps involved in installing the proposed fill.
- During intertidal construction work, including those shallow rock reefs that are to be situated within the intertidal zone, do not place construction material directly into the water. Establish the fill location for a minimum of 1 hour above the tide level at the commencement of works, and delay placing the leading edge of fill from the water level for 1 hour.
- Place all fill in such a way to prevent creating temporary tidal pools or areas in which fish and marine organisms could become trapped by periods of tidal inundation. If tidal pools or areas of entrapment are created, immediately stop work to remedy the area before continuing with infilling.
- During falling tides, monitor for and immediately salvage any fishes or other mobile marine organisms from any natural tidal pools that may otherwise be affected by construction. Complete salvages using hand nets and/or seine nets if required and relocate any salvaged species to an unaffected area outside the Project Area.

5.10.1 Pacific Herring

- If spawning Pacific herring are observed at any time during construction, the Owner, Contractor, and EM shall be notified immediately. Work timing and activities may be modified accordingly to avoid adverse effects to spawning herring. If construction must occur during the herring spawning season (typically March – April), daily pre-construction spawning observations conducted prior to commencement are recommended.
- If herring eggs are observed on construction equipment, materials, or natural substrate within the Project area, the EM will establish an exclusionary buffer around the location of the eggs. The construction equipment/materials are to remain undisturbed until eggs hatch and larvae emerge, and the buffer is removed. The size and shape of the buffer will depend on various factors, including: foreshore topography and substrate, the type of construction activities to occur next to the buffer, and the requirements for movement of personnel and equipment past the buffer within the Project area. The buffer shall be removed and/or construction equipment/materials be cleared for use following confirmation by the Owner, EM, or their designate that the eggs have hatched. If eggs are observed on the hull of a barge or vessel, it will be towed from the work area and moored until the eggs hatch and larvae emerge.

5.10.2 Marine Lifeform Salvage

The successful contractor is responsible for developing a Marine Salvage Plan, directing, and overseeing the salvage works – including providing personnel (including QEP), and equipment.

A marine lifeform salvage will be conducted in fill footprint areas immediately prior to fill placement, including construction of offsetting habitat within the intertidal, when placement in the dry during low tide periods is not feasible or practicable. Species to be targeted with salvage efforts will be crabs (Dungeness and red rock) and will be completed using crab trapping techniques on a soak time basis. If the contractor determines a need to install temporary/permanent structures below the intertidal zone, a SCUBA salvage will be required. The need for a SCUBA salvage will be determined after the review of the contractor's

Marine Access Plan and construction plan overview (to be provided by the successful contractor once the contract is awarded). Any salvaged species will be relocated to an unaffected area outside the construction zone (i.e., at least 500 m away from any active marine construction activities). Fin fish will not be targeted by the salvage because they are highly mobile and likely to move out of the works area once work commences.

This salvage work will need to be undertaken in accordance and compliance with applicable permits for fish salvage.

The EM will record the following information and report it to DFO:

- Date, capture methods, number, and location of each salvage effort
- Number of each species captured during each salvage effort
- Locations that salvaged marine life are released
- Total number of each marine life species released during all salvage efforts.

If trapped fish (finfish or invertebrates) are observed but the chosen method for salvage proves ineffective for their capture or release, halt construction, develop and implement an appropriate alternative capture or mitigation method (e.g., different salvage methods; adaptations to construction methods).

5.10.3 Marine Mammal Monitoring Plan

Marine mammals, primarily harbour seals, are known to frequent the Project location. The risk of marine mammal interactions with the Project is considered low as all barges and tugs will be stationary while construction is taking place. In addition, the work will be occurring along a busy foreshore area (i.e., existing railway line corridor, with frequent marine traffic) and is not adjacent to any at-risk marine mammal transiting or foraging areas.

5.11 Freshwater Habitat Management

The following steps ensure that required culvert extension works will not result in harmful disturbance to fish habitat. The Contractor shall adhere to environmental protection measures outlined in other subsections within **Section 6.0**.

- Isolate the culvert outlet from flow. Install a culvert block and dewatering system on the upstream side using a combination of polyethylene sheeting and sandbags, road plate(s), or other alternative method.
- While the isolation is in place, monitor freshwater levels of the up-gradient watercourse to ensure they do not rise beyond the existing natural high-water mark. When the water levels rise to the high-water mark, temporarily resume the flow or use an additional pump to move the excess water and avoid upland flooding. Ensure the main pump is 3 inches and the backup pump is 3 inches. Place pumps in secondary containment and have spill kits easily accessible. Conduct work at periods of low flow during times of limited precipitation and low tides when the work area will be above the tide water height.
- Confirm that all water discharged to/from the Project Area complies with relevant regulations. Environmental protection measures associated with discharging water are outlined in **Section 5.5.3**.
- For all non-fish-bearing watercourses that are dry at the time of construction, affix culvert extensions during low tide periods.

5.12 Sensitive Habitat Features and Species

Kelp bed habitat along the Project Area (**Figure 5.4**) will be monitored, by the EM, to verify no impacts to the kelp beds will result from construction of the Project. The kelp beds will be deemed to not be adversely affected by operation of the Project following the completion of the monitoring program if:

- Kelp habitat overall size (m²) and position are determined to be the natural variability of reference conditions as measured for the offsetting monitoring that is part of the authorization.

The baseline size of the kelp habitat will be measured during an infield assessment, which will be completed prior to Project Construction. Should the kelp bed habitat be deemed to be undergoing adverse changes a result of Project construction, additional offsetting will be implemented as part of the Offsetting Plan, **Section 6.7**.

To minimize the effects of project construction on Kelp beds, the following best management practices will be implemented:

- Install a floating silt curtain within the marine environment around the kelp bed to contain sediment produced during in-water work.
- Avoid placing the barge over the kelp beds to decrease marine shading on the area.

The EM shall be notified immediately if other sensitive species or encroachment on sensitive habitats are observed during construction, and the EM may identify additional mitigation as appropriate to the activity and sensitive feature encountered.

Bull Kelp Location



Legend

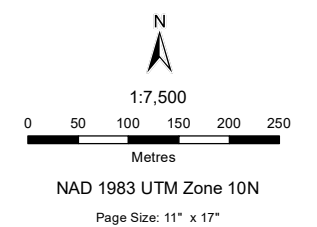
- CEMP Zone
- Approximate Location of Kelp Forest
- Proposed Track Extension
- Existing CP Railway
- CP Right-of-Way
- High Water Mark
- Low Water Mark
- Parcel Boundary

Notes

1. All mapped features are approximate and should be used for discussion purposes only.
2. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

Sources

- Contains information licensed under the Open Government Licences - Province of British Columbia
- Basemap: ESRI World Imagery



5.13 Fuel Management

All fuel-related activities will follow mitigation measures to prevent accidental fuel releases. At a minimum, the Contractor must implement the following practices:

- Employ the measures identified in A Field Guide to Fuel Handling, Transportation and Storage (Government of British Columbia 2002a) to reduce the risk of spills/leaks from vessels and secondary equipment.
- Keep all equipment and vehicles in good working order with no leaks, excess oil, or grease and complete daily checks, recording results on each piece of equipment prior to operation.
- Complete all refuelling with a spill kit in the immediate vicinity, and train personnel in the use of spill kits onsite. Make spill kits readily available onsite at all times and keep them well stocked with a list of materials included in each kit included in the kit. Keep spill kits closed with a safety seal affixed to indicate if the kit has been used or tampered with. If used, restock as soon as possible. Train all personnel in the use of and the locations of the spill kits in case of a release onsite.
- Identify high-risk locations where spills are probable and maintain spill kits capable of handling 110% of the largest potential spill at these locations through the duration of the Project. Locate personal protective equipment at the top of the spill kit to ensure easy access for the spill responder.
- Store all fuel and perform all refueling activities at least 50 m from any watercourse or wetland, where possible.
- Keep all fuel storage containers in secondary containment with a capacity 110% greater than the storage container and inspect them at least weekly to ensure that containment capacity is maintained and visibly flagged and protected from any accidental machine or vehicle strikes.

Any release must be reported to the EM and the Contractor as outlined in **Section 8.3**.

5.14 Use of Fuels, Lubricants, and Hydraulic Fluids

Activities related to construction work require the use of machinery that uses fuels, lubricating oils, and hydraulic fluids. The following measures must be implemented as applicable to protect the water quality:

- Employ the measures identified in A Field Guide to Fuel Handling, Transportation and Storage (Government of British Columbia 2002a) to reduce the risk of spills/leaks from vessels and secondary equipment.
- Follow the BC Guidelines for Industry Emergency Response Plans (Government of British Columbia 2002b) in case of a spill.
- Keep absorbent pads on hand during refuelling and use them to prevent contaminants from entering any drainage, groundwater, or water bodies.
- Keep all vessels and equipment clean and in working order to reduce risk of spills and leaks into the marine environment.
- Plan activities near water so that materials such as paint, primers, blasting abrasives, rust solvents, degreasers, or other chemicals do not enter the waterbody.
- Encapsulate foam material so it cannot break up and be released into the water.
- Clean all machinery working in the foreshore should in advance, confirm it is free of contaminants, and in good working condition. Maintain spill kits in accessible locations onsite and train all Site personnel in spill response.
- Do not use tires as fenders.

5.15 Solid Waste Management

Waste management for the site may trigger application legislation including the following: BC Hazardous Waste Regulation, BC Spill Reporting Regulation, BC *Workers' Compensation Act*, and federal TDG Regulations.

The Contractor will need to consider the end destination of all products and materials brought onto the construction site. This will include hazardous wastes such as fuels and lubricants and their empty containers following use, as well as used oily rags and used spill kit products, but also non-hazardous construction wastes and general refuse (e.g., wood, cigarette butts, coffee cups, water bottles). Hazardous waste generated could include waste petroleum products (engine oils, lubricants) from machinery and equipment, spent batteries, solvents, cleaning agents, and other chemical-containing materials.

The Contractor shall ensure that debris and waste material resulting from the Project is contained, collected, and disposed of at suitable upland locations using standards, practices, methods and procedures to a good commercial standard, conforming to applicable law and using that degree of skill and care, diligence, prudence and foresight which would be reasonably and ordinarily expected from a qualified, skilled and experienced person engaged in a similar type of undertaking under the same or similar circumstances.

The Contractor shall prepare a Waste Management Plan to deal with such wastes that includes the following minimum requirements:

- Provide a figure identifying specific locations for waste collection and sorting,
- Adhere to a list of best practices that meet all applicable legislation with respect to the handling, transportation, and disposal of all materials related to this Project (waste or otherwise)
- Plan for the storage and handling of hazardous wastes including providing separate labelled container(s) for potentially hazardous waste such as oily rags and hydrocarbon absorbent pads
- Identify all hydrocarbon products and other hazardous wastes potentially present during Project activities should make available the associated Workplace Hazardous Materials Information System and Safety Data Sheets to all team members
- Collect all recyclable or compostable materials should separately from general waste as per Metro Vancouver requirements.

5.16 Mitigation Contingency Measures

During construction, the EM will verify the effectiveness of measures to avoid or mitigate harm to fish, fish habitat, wildlife (including birds and marine mammals) and other relevant environmental values. Should the EM identify that implemented or deployed measures are ineffective, in that they do not or are not expected to achieve their objective(s), contingency measures to improve their effectiveness must be implemented.

Contingency measures may include the following:

- Adjust or retrieve, maintain, and redeploy ineffective measures (e.g., maintain a turbidity curtain to improve the effectiveness in limiting sediment dispersal from the work site, if a turbidity curtain is warranted and feasible)
- Implement other measures that are more suitable for achieving objectives
- Make changes to the methods or timing of construction activities to better achieve objectives.

If the EM identifies that monitoring methods are insufficient to appropriately measure the effectiveness of mitigation measures as they relate to objectives, the following contingency measures must be taken:

- Change the frequency or spatial distribution of monitoring (e.g., water quality monitoring).
- Replace or recalibrate devices used for monitoring.
- Replace or add alternative monitoring methods.

6.0 MITIGATION MEASURES PROPOSED FOR PROJECT COMPONENTS

The following sections describe the proposed mitigation measures specific to each of the main construction components.

It is expected that the environmental management commitments made below will address the management of all potential construction-related environmental impacts generated by the construction activities, techniques and phasing proposed by the selected Contractor.

Spill prevention and readiness has been described in **Section 0** of this document. Emergency response in the event of a spill is described in **Section 8.3**. These mitigation measures will apply to all aspects of construction as outlined below. As a component of spill readiness, all refuelling will occur above the high high-water mark of any watercourse or the marine environment.

6.1 Zone 1 Access

The work in Zone 1 is anticipated to be completed within 60 days. This work involves placement of 10,682 cubic metres (m³) of fill above the high-water mark and 9,214 m³ below the high-water mark for a total of 19,986 m³ (**Table 6.1**). To accomplish this, 2 barges per day will transport the material to Zone 1. These barges will access Zone 1 from the west and travel along the shore. Equipment will be brought to Zone 1 via rail and possibly via a to-be-constructed Parkland Refinery road.

Table 6.1 Volume of Material Handled in the Project

	Zone 1	Zone 2	Zone 3
Track length (m)	613	427	680
Fill (riprap and rockfill) above high-water mark (m ³)	10,682	335	15,295
Fill (riprap and rockfill) below high-water mark (m ³)	9,214	0	12,428
Length of retaining structure (m)	-	31	-
Length of bridge structure (m)	-	4	-

6.1.1 Land Access

If the option to construct the Parkland Refinery access road (**Figure 5.1**) is selected, the following mitigation measures shall be followed:

- Follow the vegetation clearing mitigation measures:
 - Establish clearing boundaries to what is required for site access and clearly demarcate them to avoid encroachment on adjacent natural or vegetated areas. Retain a minimum of 15 m buffer around any watercourses that may cross the road.
 - Conduct clearing within the least-risk timing window.
 - Retain a QEP to conduct a survey for protected bird nests prior to vegetation removal.
 - Remove all cleared material from the site and compost where possible.
 - Follow the vegetation management guidelines presented in **Section 5.9**.
- Follow the culvert extension mitigation measures presented in **Section 6.6.1**.
- Follow the grading and temporary road building mitigation measures:

- Identify and clearly limit grading and cuts or fills and ensure they are not exceeded.
- Install ESC measures (e.g., silt fences) parallel to access road to prevent sediment-laden water from entering the Burrard Inlet.
- Regularly sweep paved surfaces, especially at entrance of the access road, to prevent sediment from accumulating.
- Follow the road access mitigation measures:
 - Install ESC measures (e.g., silt fences) parallel to access road to prevent sediment-laden water from entering the Burrard Inlet.
 - Install and maintain ESC measures (e.g., filter bags) in catch basins along the access route.
 - Restrict access to site to designated routes.
- Conduct work during Port Authority standard work hours only.
- Regularly monitor mitigation measures to ensure effectiveness.

6.1.2 Marine Access

The following mitigation measures shall be followed for barge access and use of the marine access road during construction:

- Check for tide conditions to avoid grounding.
- Stock all barges with sufficient spill response kits and replenish the kits immediately following use.
- Minimize the disturbance to the marine foreshore from the temporary access to the working pad.
- Install ESC measures (e.g., silt fences) where soils are disturbed to prevent sediment from moving offsite.
- Follow mitigation measures outlined in **Section 6.1.1** for the marine access road.
- Regularly monitor mitigation measures to ensure effectiveness.

6.2 Zone 2 Access

In Zone 2, 335 m³ of fill will be placed above the high-water mark, while no fill below the high-water mark will be required (**Table 6.1**). Access to Zone 2 will be via land only; access will involve construction of a new road to access the track from the Parkland Refinery. Land access to Zone 2 will follow the mitigation measures outlined in **Section 6.2**.

6.3 Zone 3 Access

The work in Zone 3 is anticipated to be completed within 90 days. This work involves placement of 15,295 m³ of fill above the high-water mark and 12,428 m³ below the high-water mark for a total of 27,723 m³ (**Table 6.1**). To accomplish this, 2 barges per day will transport the material to Zone 3. Similarly to marine access in Zone 1, these barges will access Zone 3 from the west and travel along the shore, avoiding the petroleum loading jetty. Equipment will be brought to Zone 3 via rail and Parkland's roadways. Mitigation measures for land and marine access will follow mitigation measures outlined in **Sections 6.1.1** and **6.1.2**.

6.4 Laydown and Staging Areas

The linear nature of the Project Area does not provide a single point for laydown and staging areas for equipment and materials. The temporary laydown and staging areas are expected to be developed along CP's right-of-way within and potentially beyond the immediate Project areas. Proposed work pads on the Burrard Inlet foreshore have been integrated into the Project design.

The construction and preparation of the temporary laydown and staging areas includes the following activities:

- Vegetation – clearing, grubbing and general soil grading
- Water management – if needed, temporary modifications to existing culverts and drainage pathways
- Maintenance of areas and modifications throughout construction activities.

6.4.1 Mitigation for Preparation and Use of Laydown and Staging Areas

To ensure minimal environmental degradation, the following mitigation measures shall be followed during the preparation and use of temporary laydown and staging areas:

- Clearly demarcate the limits of vegetation removal.
- Limit vegetation clearing to what is required for site access and complete within the window of least risk.
- Complete raptor using a QEP.
- Maintain vegetative buffers at 15 m from the top of bank of any watercourse crossing.
- Treat invasive vegetation per standard CP protocols.
- Clearly identify the limits of grading and cuts/fills.
- Install a silt fence parallel to the proposed road where there is potential of offsite migration to adjacent watercourses.
- Monitor installed silt fence regularly for effectiveness.

6.5 Material Placement

The proposed rail expansion requires the widening of the existing embankment along the Burrard Inlet. A well-graded, engineered fill will be applied to the existing embankment. Once the fill is placed, slope protection will be applied in the form of riprap. Restrictions on access and working area, in addition, active rail operations have been considered in the overall approach to completing this work. The material will be placed along the embankment footprint and will be applied in the zoned approach described above. Once the fill is applied and extends beyond the high high-water mark, it is anticipated that construction equipment will use the newly constructed embankment as a construction pathway to administer additional engineered fill to the embankment until a desired elevation is achieved.

The construction of the new embankment will incorporate the following activities:

- Place engineered structural fill and riprap.
- Maintain the newly constructed construction pathway while the pathway is in use.

6.5.1 Mitigation for Installation of Embankment Material (Zone 1 and 3)

To ensure environmental effects are minimized or eliminated, the following mitigation measures shall be followed:

- Closely monitor placement of material to ensure compliance with proposed extents into the Burrard Inlet.
- Place material during the most favourable conditions and give preference to work in the dry. Coordinate placement activities based on tides where possible.
- Install a floating silt curtain within the marine environment to contain sediment produced during in-water work.
- Use only pre-approved rock fill (e.g., clear crush) and confirm the fill is free of sediment. Do not use minus rock fill, which could contribute unwanted sedimentation into Burrard Inlet if exposed to the water.
- Complete aquatic life salvage (of applicable species) within the footprint of the new embankment material.
- Install a barrier near the base of the new embankment material to exclude re-entry of applicable species.

6.6 Structures

Several structure installations or modifications have been identified during the design of the rail expansion. Specifically, culverts extensions are required within the Project Area. Also, a retaining wall will be needed within the Parkland area.

The following section identifies the required structures and provides mitigation measures for the anticipated construction methodology.

6.6.1 Culverts

A total of 18 culverts within the Project Area will be modified during construction to accommodate the extension of the embankment into the Burrard Inlet. The culverts will be extended by connecting a secondary segment and a neoprene gasket to ensure a watertight fit. The following construction activities are anticipated for the installation of each culvert extension.

- Water conveyance – temporary diversion may be required during the installation of the culvert extensions.
- Preparation of the work area to ensure proper alignment of culvert extension may include:
 - Removal of material within work area
 - Addition of material to work area
 - Grouting foundation installation within or near the culvert extension.
- General maintenance of the extended culvert will be required during general construction activities.

6.6.1.1 Culvert Extension Mitigation

The following mitigation measures shall be implemented to support the installation of the culvert extensions.

During Installation:

- Conduct water testing to ensure compliance with all applicable water quality numerical standards and permit/FAA requirements.
- If water diversion is required during the culvert extension, conduct the following:
 - Install isolation barriers upstream of work.
 - Apply screens to pump intakes.
 - Confirm the outlet hose does not impede rail operations.

During Operation:

- Monitor inlets for debris accumulation and any other issues that may affect flow.

During Work Completion:

- Remove upstream isolating barriers with the guidance of the onsite QEP.
- Remove all temporary equipment.

6.6.2 Retaining Wall

A relatively small section of retaining wall is required within the Parkland area. Construction details are to be provided by the selected Contractor. Piles may be used at this location.

The following activities are anticipated for the preparation and installation of the retention wall:

- Work area preparation
- Installation of applicable material and infrastructure for the retaining wall.

6.6.2.1 Retaining Wall Mitigation

The following mitigation measures shall be used for the retaining wall preparation and installation:

- Implement erosion and sediment controls measures as applicable during construction activities.

6.7 Habitat Offsetting

CP has proposed measures to offset residual Harmful Alteration, Disruption, and Destruction of fish habitat. Habitat offsetting measures proposed include; rocky reefs, subtidal benches, enhanced sandflats, and an intertidal marsh bench. In addition, on-site restoration is proposed where possible. The sections below present the mitigation measures to be followed during habitat offsetting.

6.7.1 Offshore Habitat Offsetting

To complete habitat offsetting, CP has proposed the creation of a habitat complex to the east of the Project at Berry Point in Burrard Inlet. Materials used for the construction of the reefs will be delivered to the site via barge and placed using a clamshell or other similar barge-mounted equipment. Creation of the offshore reefs may require the storage of materials or equipment at the site.

The following mitigation measures shall be implemented during construction of the offshore reef:

- Ensure all material is free of sediment prior to placement.
- When possible, install the reefs during favourable tides and within the subtidal zone.
- Follow the mitigation measures described in **Section 6.1.2** for barge access.
- Prior to and during in-water construction activities, monitor for the presence of marine mammals. Stop work if any free-ranging marine mammals are observed in the vicinity, and reinstate work only after the mammals have not be observed for more than 30 minutes.

In addition, BMPs outlined in **Section 5.0** shall be followed where applicable.

6.7.2 Site Restoration

The Project site riparian area will be converted into rail right-of-way and will be devoid of vegetation.

The following mitigation measures shall be implemented during site restoration:

- Place materials in existing laydown areas.
- Store all equipment above the high high-water mark.
- Follow applicable BMPs presented in **Sections 5.13 and 5.14** for equipment used in restoration.
- Follow applicable BMPs presented in **Section 5.5.2** to minimize erosion and sediment runoff during planting
- Implement mitigation measures listed in **Section 6.8** for restoration of temporary works.

6.8 Removal of Temporary Works

Following the completion of construction, all temporary structures (access roads, laydown and staging areas, and work pads) will need to be decommissioned, removed, and restored. The sections below present the mitigation measures to be followed during removal of temporary works.

6.8.1 Access Roads and Laydown and Staging Areas

Removal of access roads and laydown and staging areas will involve removing culvert extensions and solid waste from the Project Area, breaking up compacted soils, regrading and restoring the disturbed areas, and removing solid waste from the Project Area.

The following mitigation measures shall be implemented during the removal of access roads and laydown and staging areas:

- Sweep paved surfaces, especially at access entrances and laydown areas, to prevent sediment from accumulating.
- Follow BMPs presented in **Sections 5.13 and 5.14** for equipment used in breaking up the soil.
- Ensure that sufficiently stocked spill response kits are always available onsite and replenish the kits immediately following use.

- Follow BMPs outlined in **Section 5.5.2** to minimize erosion and sediment runoff when breaking up the soil and removing culvert extensions (e.g., retain any silt fences or silt curtains) and to stabilize exposed soils.
- Isolate flowing water prior to removing culvert extensions.
- Regrade and stabilize disturbed areas to promote drainage and stability.
- Seed exposed areas with an approved native grass seed mix congruent with the local ecology.
- Place all solid waste (e.g., garbage, construction waste, and non-biodegradable materials) in appropriate, labelled containers and dispose of the waste offsite.
- Conduct work during VFPA standard work hours only.

6.8.2 Work Pads

Work pads will be constructed in the Project Area. The number of work pads needed will be determined by the construction Contractor. Following the completion of construction, these work pads will be decommissioned and removed primarily via barge, but land removal is also possible. Removal of work pads will require excavating and storage of materials on a barge, removing the pads from the Project Area, and regrading the disturbed areas. The Contractor shall implement the following mitigation measures:

- Remove work pads during favourable tide conditions.
- Follow BMPs presented in **Sections 5.13 and 5.14** for equipment used to remove work pads.
- Ensure sufficiently stocked spill response kits are always available onsite and replenish the kits immediately following use.
- Follow BMPs outlined in **Section 5.5.2** to minimize erosion and sediment runoff when removing work pads (e.g., install silt curtains around the excavation area) and to stabilize exposed soils.
- Sweep paved surfaces, especially at access entrances, to prevent sediment from accumulating.
- Regrade and stabilize disturbed areas to promote drainage and stability.
- Seed exposed areas with an approved native grass seed mix congruent with the local ecology.
- Place all solid waste (e.g., garbage, construction waste, and non-biodegradable materials) in appropriate, labelled containers and dispose of the waste offsite.
- Conduct work during VFPA standard work hours only.

7.0 ARCHAEOLOGICAL AND CULTURAL RESOURCES

Within BC, all pre-1846 archaeological sites and many types of historic sites are protected under the BC *Heritage Conservation Act*, RBC 1996, c. 187, which states that an individual or corporation must not “damage, excavate, dig in or alter, or remove any heritage object” from a heritage site except as authorized by a permit issued under Section 12 of the HCA.

The Contractor must train all onsite Project personnel in the cultural importance, recognition of, care of, and the Archaeological Chance Find Procedure that has been developed for the Project (**Appendix C**) in the event that an unrecorded archaeological sites and artifacts are identified during construction. If these resources are encountered during construction activities, the Contractor must immediately stop work, notify CP’s representatives, and comply with the Archaeological Chance Find Procedure. CP must immediately notify engaged Indigenous communities and the BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development, Archaeology Branch.

8.0 EMERGENCY RESPONSE PLAN

The goal of this plan is to identify the potential hazards onsite, develop systems for preventing accidents including training, provide mechanisms for minimizing risks, loss and damage from any incidents, and provide an incident management structure to guide response activities in the event of an accidental release.

The Contractor shall ensure that all personnel are aware of the plan, have been trained in the plan, and are capable of implementing the plan in the event of an emergency. Prior to initiation of physical activities, the emergency contacts will be updated.

8.1 Emergency Communication

Table 8.1 lists the emergency contacts for the Project. During construction, the Contractor will be responsible for maintaining a current emergency contact list.

In the event of an emergency, the initial reporting shall be to the Contractor’s Superintendent, who will immediately assume the role of Incident Commander and will communicate the incident as required.

Table 8.1 Emergency Contacts

Contact Name	Contact Details
Viterra-Cascadia Capacity Expansion Project	
Location	CP Mile 122.93 and 124.96
Hospital	Burnaby Hospital 3935 Kincaid St, Burnaby, BC Non-emergency: 604-434-4211
Ambulance	911 Non-emergency: 604-872-5151
Burnaby Police	911 Non-emergency: 604-649-9999
Fire	911 Non-emergency: 604-873-7000
VFPA Operations Centre	604-665-9086
Local Authorities (Provincial Emergency Coordination Centre/MOE)	1-800-663-3456
Emergency Water Problems – City of Burnaby	604-294-7200
CP Calgary Network Management Centre	1-800-795-7851
CP Police Services	1-800-716-9132
Project Manager	TBD
Site Supervisor	TBD
Site Foreperson	TBD
Canadian Coast Guard	
Air or Marine Emergency	1-800-567-6111
Marine Pollution – Incident Report	604-666-6011
Vessel Traffic Services – Canadian Coast Guard	604-666-6011
Environment Canada	
Emergency Reporting – Oil or Chemical Spills – 24 hours	604-666-6100
BC ENV	604-582-5200
DFO	
Fish Kills or Destruction of Habitat	604-666-3500
Weather Information	
Weather One on One Marine	1-900-565-6565
Workplace Health and Safety	1-800-263-8466
Forest Fire Reporting	1-800-663-5555
Power Outages and Emergencies	1-888-769-3766
RCMP Coastal Watch	1-888-855-6655
Industry Emergency Contacts	

Contact Name	Contact Details
BC One Call	1-800-474-6886
Emergency	911
BC Hydro	1-800-224-9376
FortisBC	1-800-663-9911
ICBC	
Toll Free	1-800-910-4222
Other	
Food Poisoning and Food Safety	604-666-3350
Rescue Coordination Centre	1-800-567-6111
WorkSafe BC	1-800-621-7233
Telus	1-800-663-0333

8.2 Environmental Emergency Plan

The Project Area will contain various dangerous goods, hazardous wastes, or hazardous chemicals for use in the day-to-day construction work. The materials onsite will all be labelled as per Workplace Hazardous Materials Information System or the TDG Act and will be stored in an approved area of the Project Area. These materials are expected to potentially include, but may not be limited to, the following:

- Diesel
- Gasoline
- Propane
- Various lubricants.

The Contractor shall review and update this inventory prior to the onset of construction, append Safety Data Sheets to these mitigation measures for the inventory, and amend as new products are brought onsite or old products are withdrawn from use onsite.

To mitigate the potential for spills onsite, the Contractor shall adhere to all requirements of **Sections 0 and 5.14**, and store hazardous substances in appropriate containers and storage areas as per regulatory requirements. Any release shall be reported to the EM, who will determine the course of action required to mitigate and clean-up any release.

8.3 Spill Response Plan

In the event of a release of any deleterious substances (i.e., hydrocarbon products) onsite, the following procedures shall be implemented:

- Ensure safety
 - Ensure that personnel are safe from the release, as well as the public, equipment, property, and environment are at no other immediate risk due to the release.
 - Wear personal protective equipment to manage the release.
 - Take a step back and re-evaluate the situation. Do not rush.

- Before entering a spill area, ensure you are adequately protected with knowledge. (i.e., check Material Safety Data Sheet for spilled product).
- Notify people in the immediate vicinity of the incident.
- If the spill is a flammable material, ensure there are no ignition sources in the area.
- Remove source
 - Act quickly to reduce the amount of product spilled and the environmental effect where possible.
 - Close valves, shut off equipment, or plug any holes/leaks as appropriate.
 - Stop the flow at its source.
- Secure the area
 - Limit access to the spill area.
 - Prevent unauthorized entry into the Project Area.
- Contain the spill
 - Prevent migration of the spill offsite, into any water bodies, or into any drainage structures (i.e., storm sewers).
 - Use sorbent materials (i.e., booms or pads) to contain the spill, or where appropriate soil berms to contain it.
 - Locate spill kits onsite within 100 m of any hazardous material storage area and be sure they are readily accessible.
 - If necessary, use a dyke or any other method to prevent the migration of the material.
 - Attempt to minimize the contamination onsite.
- Notify and report
 - Notify CP immediately of any spills, regardless of size, by calling 1-800-716-9132.
 - Notify the Provincial Emergency Coordination Centre (1-800-663-3456), as required (see **Table 8.2** below).
 - Provide details of the spill to any other external agency, including engaged Indigenous communities, once the spill has been contained or stabilized.
 - Complete the internal incident report.

Table 8.2 Spill Reporting Matrix

Substance	Quantity ¹	Internal Reporting Requirements	External Reporting Requirements
Any Spill	Any amount in aquatic habitat	EIR	EMBC, DFO, ENV, VFPA
Oil and Waste Oil	>100 litres	EIR	EMBC
	Any amount off CP/VFPA property	EIR	MOE and Local Authority
Oil with >50 ppm PCB (PCB Wastes)	>25 kilograms or litres	EIR	EMBC
Flammable or Non-flammable Gas	10 kilograms	EIR	EMBC
Toxic or Corrosive Waste	>5 kilograms or litres	EIR	EMBC
Hazardous Waste containing PAHs	>5 kilograms or litres	EIR	EMBC
Pesticides and Herbicides	5 kilograms or litres	EIR	EMBC

Notes: EIR = Environmental Incident Report; EMBC = Emergency Management BC; PCB = polychlorinated biphenyl; PAH = polyaromatic hydrocarbon; > = greater than

¹ Amounts are based on Spill Reporting Regulation of the *Environmental Management Act*.

9.0 POST-CONSTRUCTION FOLLOW-UP

Following construction, CP will restore the Project Area and any disturbed areas outside the Project Area. Restoration activities will include permanently stabilizing disturbed areas to prevent soil erosion, replanting with native vegetation, enhancing ecosystem productivity, and preserving aesthetic values.

Following construction activities, CP will implement a multi-year post-construction annual monitoring program to ensure that:

- Construction activities have been completed in accordance with this CEMP
- Project offsetting and habitat enhancement activities (e.g., replanting) meet federal and provincial permit requirements.

The post-construction monitoring will be conducted by a QEP, as directed by CP. The QEP will prepare monitoring reports that identify deficiencies, if any. CP will address any deficiencies as needed.

10.0 CLOSURE

This work was performed in accordance with the Contract (Number 5600019939) between Hemmera, a wholly owned subsidiary of Ausenco Engineering Canada Inc., and Canadian Pacific, dated February 11, 2020. This report has been prepared by Hemmera, based on fieldwork conducted by Hemmera, for sole benefit and use by Canadian Pacific. In performing this work, Hemmera has relied in good faith on information provided by others and has assumed that the information provided by those individuals is both complete and accurate. This work was performed to current industry-standard practice for similar environmental work, within the relevant jurisdiction and same locale. The findings presented herein should be considered within the context of the scope of work and Project terms of reference; further, the findings are time sensitive and are considered valid only at the time the report was produced. The conclusions and recommendations contained in this report are based upon the applicable guidelines, regulations, and legislation existing at the time the report was produced; any changes in the regulatory regime may alter the conclusions and/or recommendations.

If there are any questions, please do not hesitate to contact the undersigned by phone at 604.669.0424.

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Hemmera Envirochem Inc.



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Biologist

Report reviewed by:
Hemmera Envirochem Inc.



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Project Manager

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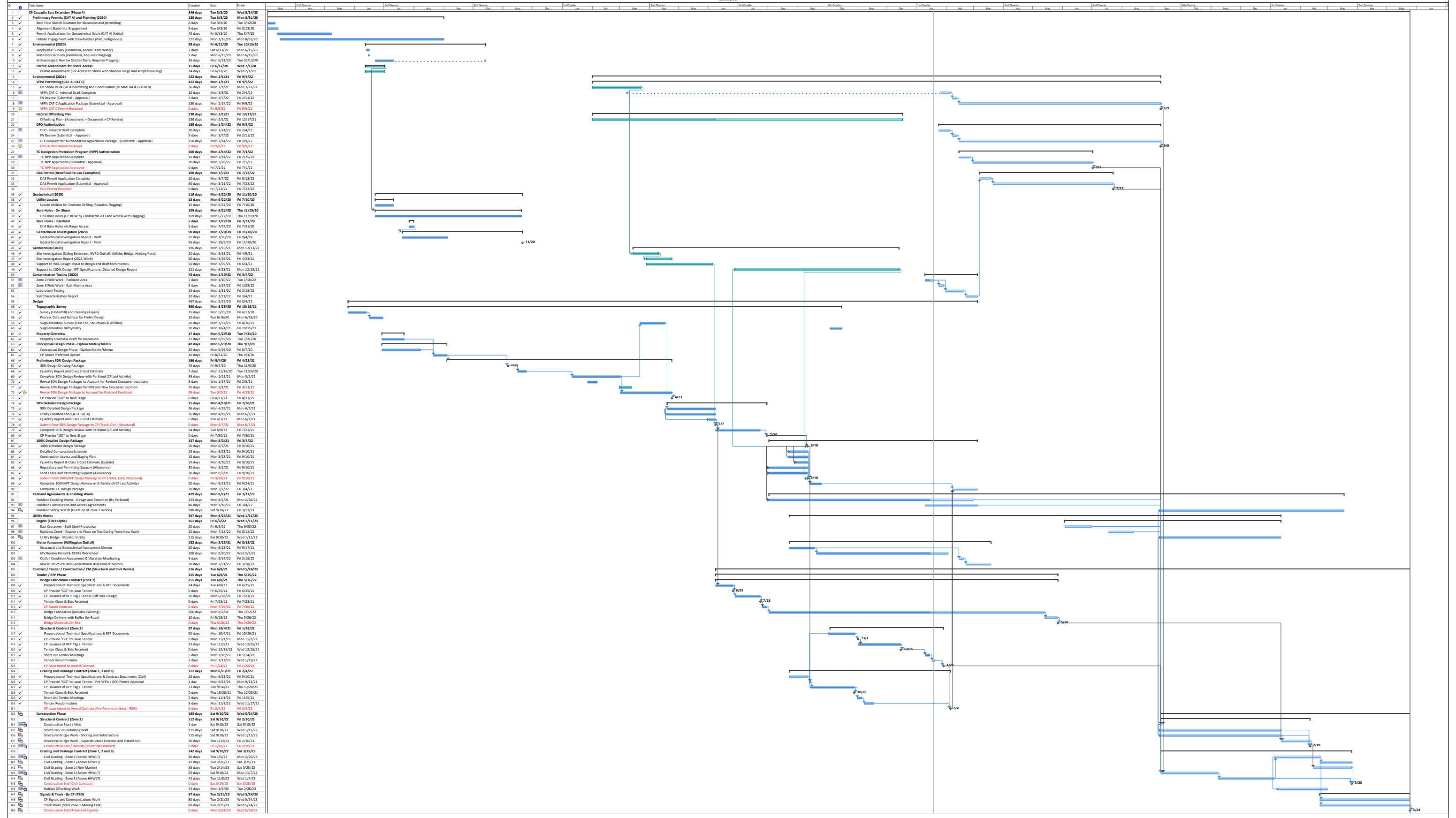
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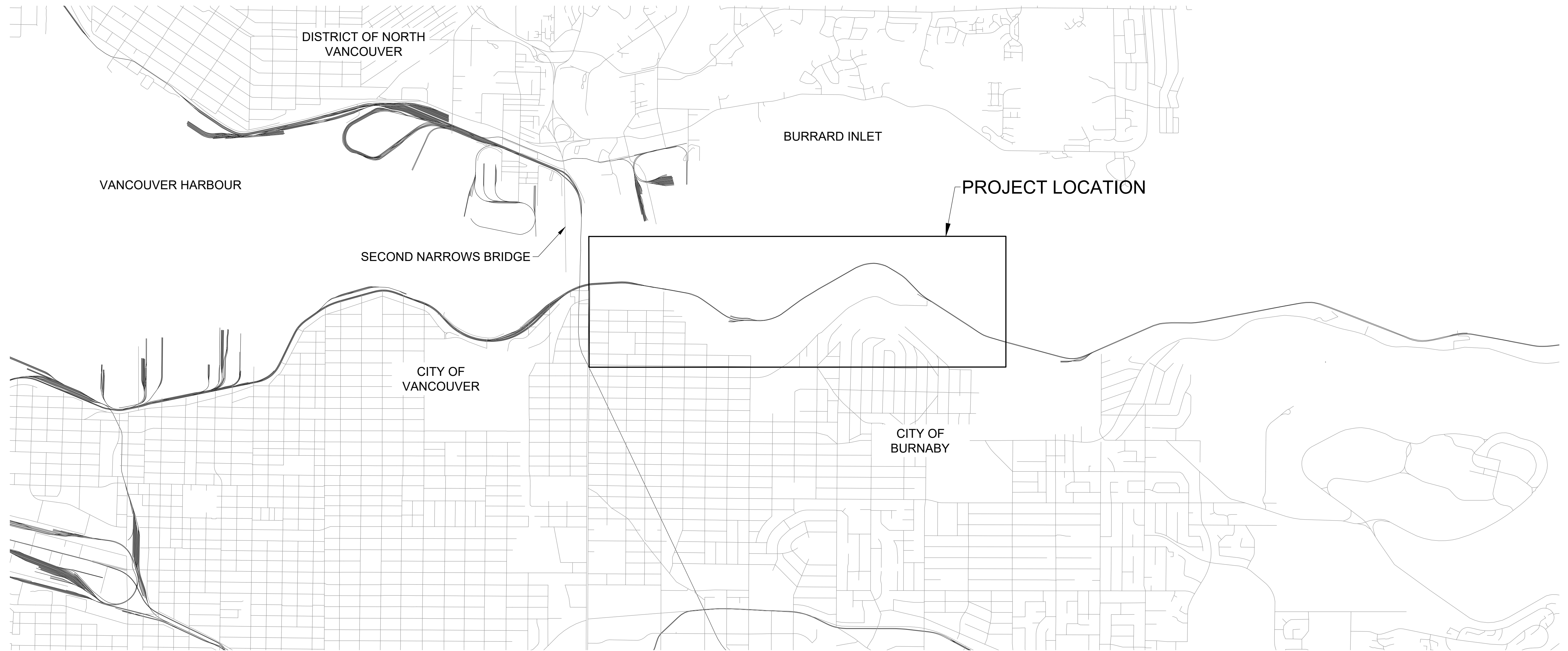
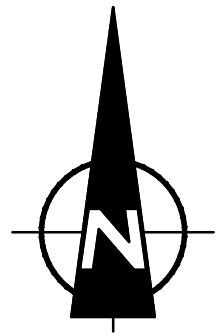
APPENDIX A
Detailed Project Construction Timeline



APPENDIX B

Detailed Project Drawings

CASCADIA EAST EXTENSION - PHASE 4
PROPOSED K09 EXTENSION
WESTERN REGION - VANCOUVER DIVISION
REISSUED FOR 30% DESIGN REVIEW



MILE 123.07 TO MILE 124.17 CASCADE SUBDIVISION
EXTENSION



ENGINEERING PROJECTS - WEST



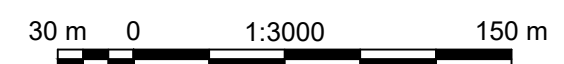
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MARCH 19, 2021

NOT FOR CONSTRUCTION



SITE LOCATION PLAN



	ZONE 1 (11+140 TO 11+753)	ZONE 2 (10+713 TO 11+140)	ZONE 3 (10+000 TO 10+713)
TRACK LENGTH (ft)	2,011	1,401	2,339
FILL (RIPRAP AND ROCKFILL) ABOVE HWM (m3)	11,566	335	15,687
FILL (RIPRAP AND ROCKFILL) BELOW HWM (m3)	9,915	0	13,024
LENGTH (ft) / TYPE OF RETAINING STRUCTURE	NONE	328 TWall	NONE
LENGTH (ft) / TYPE OF BRIDGE STRUCTURE	NONE	43 CANTILEVER UTILITY BRIDGE	NONE

K09 CAPACITY MEASUREMENTS		
FROM DUMPER TO EXISTING SWT PT DERAIL (ft)	FROM EXISTING SWT PT DERAIL (MILE 124.174) TO 10ft WEST OF PROPOSED SWT PT DERAIL (MILE 123.141) (ft)	TOTAL CAPACITY (ft)
4,168	5,427	9,595

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METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE NOTED

DESIGNED BY: T.J. DATE: 19-03-21
 CHECKED BY: J.C. DATE: 19-03-21
 HATCH PROJECT No: H362379
 DWG SCALE(FULL SIZE): 1:3000

PROFESSIONAL SEALS

No.	DATE	REVISION	BY
C	19-03-21	REISSUED FOR 30% DESIGN REVIEW - ZONE MAP INCLUDED	T.L.
B	29-01-21	REISSUED FOR 30% DESIGN REVIEW	T.L.
A	13-11-20	ISSUED FOR 30% DESIGN REVIEW	T.L.

ENGINEERING PROJECTS - WEST

VANCOUVER DIVISION MILE 123.07 TO 124.17 CASCADE SUBDIVISION



**CASCADIA EAST EXTENSION - PHASE 4
PROPOSED K9 TRACK EXTENSION
SITE LOCATION PLAN**

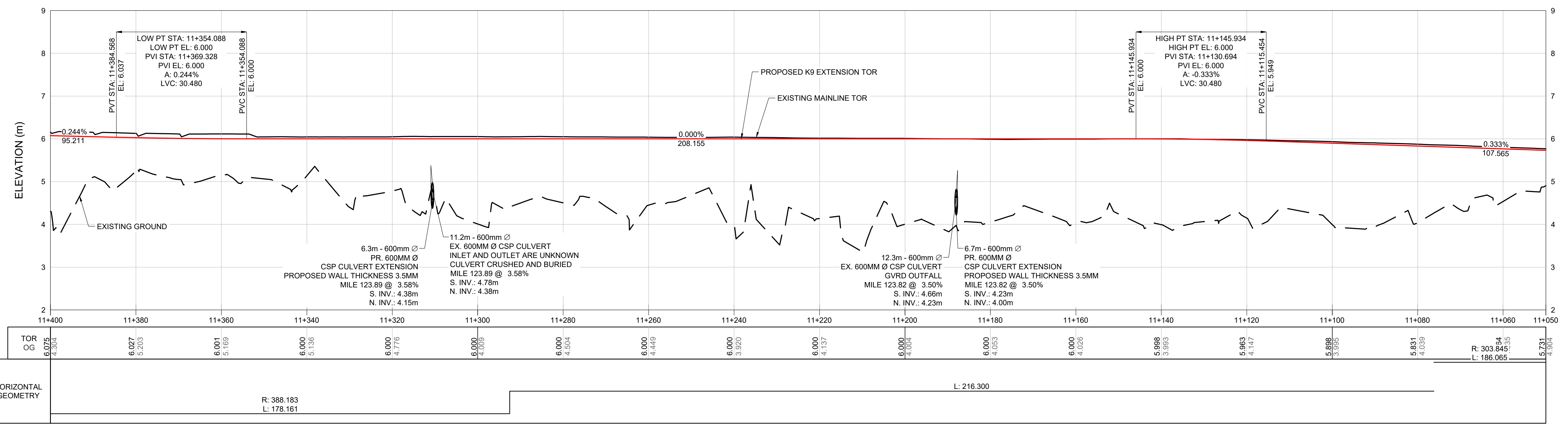
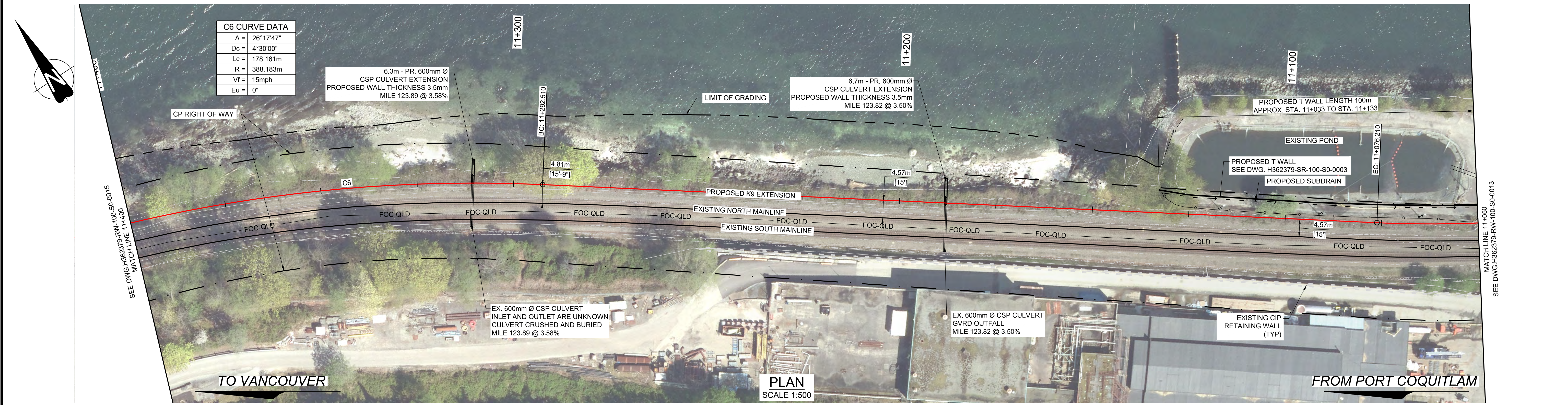
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MANAGER - DESIGN:	DATE:	SCALE:
M.FAVREAU DIR. PROJECT SERVICES WEST	PLAN No. H362379-GA-100-S0-0001	Rev. C

DRAWING LIST			
PLAN NO.	DESCRIPTION	REVISION	DATE
H360165-GA-100-S0-0000	COVER SHEET	C	19/03/2021
H360165-GA-100-S0-0001	SITE LOCATION PLAN	C	19/03/2021
H360165-GA-100-S0-0002	DRAWING LIST	C	19/03/2021
H360165-GA-100-S0-0003	ABBREVIATIONS, LEGEND, AND NOTES	B	29/01/2021
H360165-RW-100-S0-0001	PROPOSED K9 TRACK EXTENSION, TYPICAL FILL SECTION	B	29/01/2021
H360165-RW-100-S0-0011	PROPOSED K9 TRACK EXTENSION, PLAN AND PROFILE STA. 10+000 TO 10+350	C	19/03/2021
H360165-RW-100-S0-0012	PROPOSED K9 TRACK EXTENSION, PLAN AND PROFILE STA. 10+350 TO 10+700	B	19/03/2021
H360165-RW-100-S0-0013	PROPOSED K9 TRACK EXTENSION, PLAN AND PROFILE STA. 10+700 TO 11+050	B	19/03/2021
H360165-RW-100-S0-0014	PROPOSED K9 TRACK EXTENSION, PLAN AND PROFILE STA. 11+050 TO 11+400	C	19/03/2021
H360165-RW-100-S0-0015	PROPOSED K9 TRACK EXTENSION, PLAN AND PROFILE STA. 11+400 TO 11+764.421	C	19/03/2021
H360165-RW-100-S0-0016	PROPOSED CROSSEOVERS, PLAN AND PROFILE	C	19/03/2021
H360165-RW-100-S0-0017	PROPOSED PARKLAND TRACKS, PLAN AND PROFILE	A	13/11/2020
H360165-CV-100-S0-0001	PROPOSED K9 TRACK EXTENSION, TYPICAL CULVERT SECTION	B	29/01/2021
H360165-CV-100-S0-0003	PROPOSED K9 TRACK EXTENSION, RAINBOW CREEK BOX CULVERT AND SECTION	B	19/03/2021
H360165-SR-100-S0-0001	PROPOSED K9 TRACK EXTENSION, BRIDGE GENERAL ARRANGEMENT & SECTIONS	A	13/11/2020
H360165-SR-100-S0-0002	PROPOSED K9 TRACK EXTENSION, BRIDGE ELEVATION VIEWS	A	13/11/2020
H360165-SR-100-S0-0003	PROPOSED K9 TRACK EXTENSION, T WALL SECTION	A	13/11/2020

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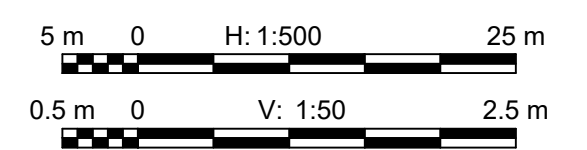
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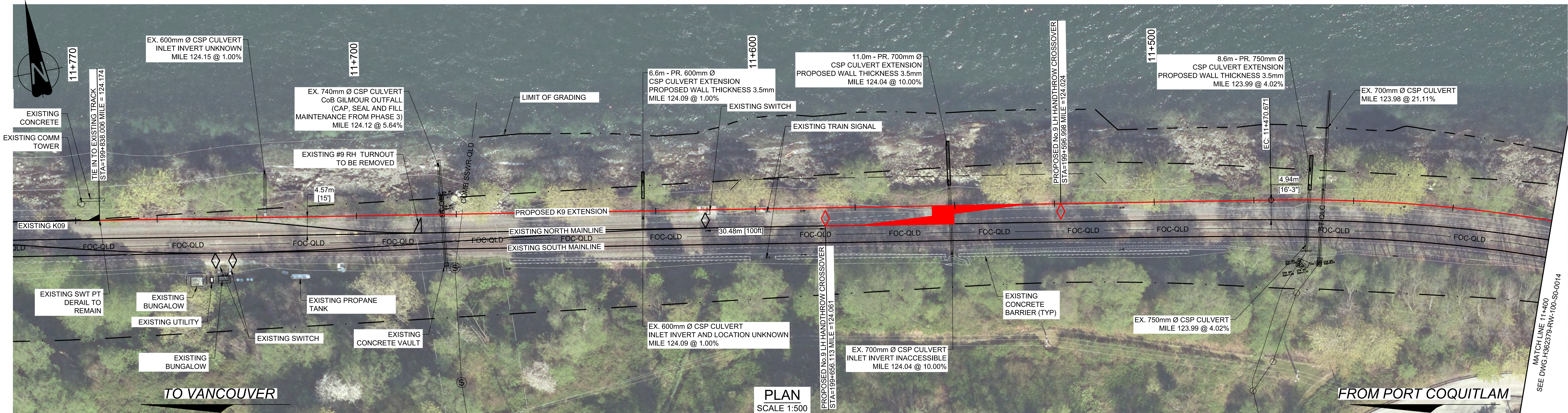
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PROFILE
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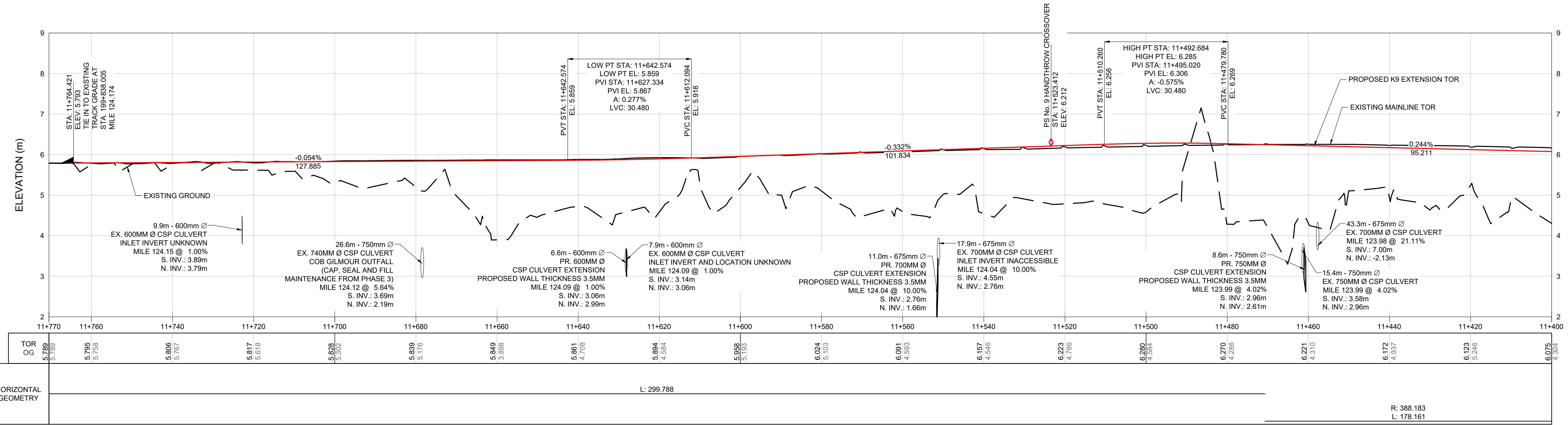


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<p>METRIC DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE NOTED</p> <p>DESIGNED BY: T.J. DATE: 19-03-21 CHECKED BY: J.C. DATE: 19-03-21 HATCH PROJECT No: H362379 DWG SCALE(FULL SIZE): 1:500</p>	<p>PROFESSIONAL SEALS</p>		<p>ENGINEERING PROJECTS - EAST</p>	<p>VANCOUVER DIVISION MILE 123.07 TO 124.17 CASCADE SUBDIVISION</p> <p>CASCADIA EAST EXTENSION - PHASE 4 PROPOSED K9 TRACK EXTENSION PLAN AND PROFILE STA.11+050 TO 11+400</p>																													
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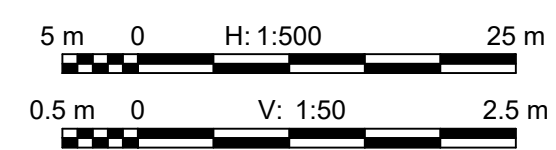


PLAN
SCALE 1:500



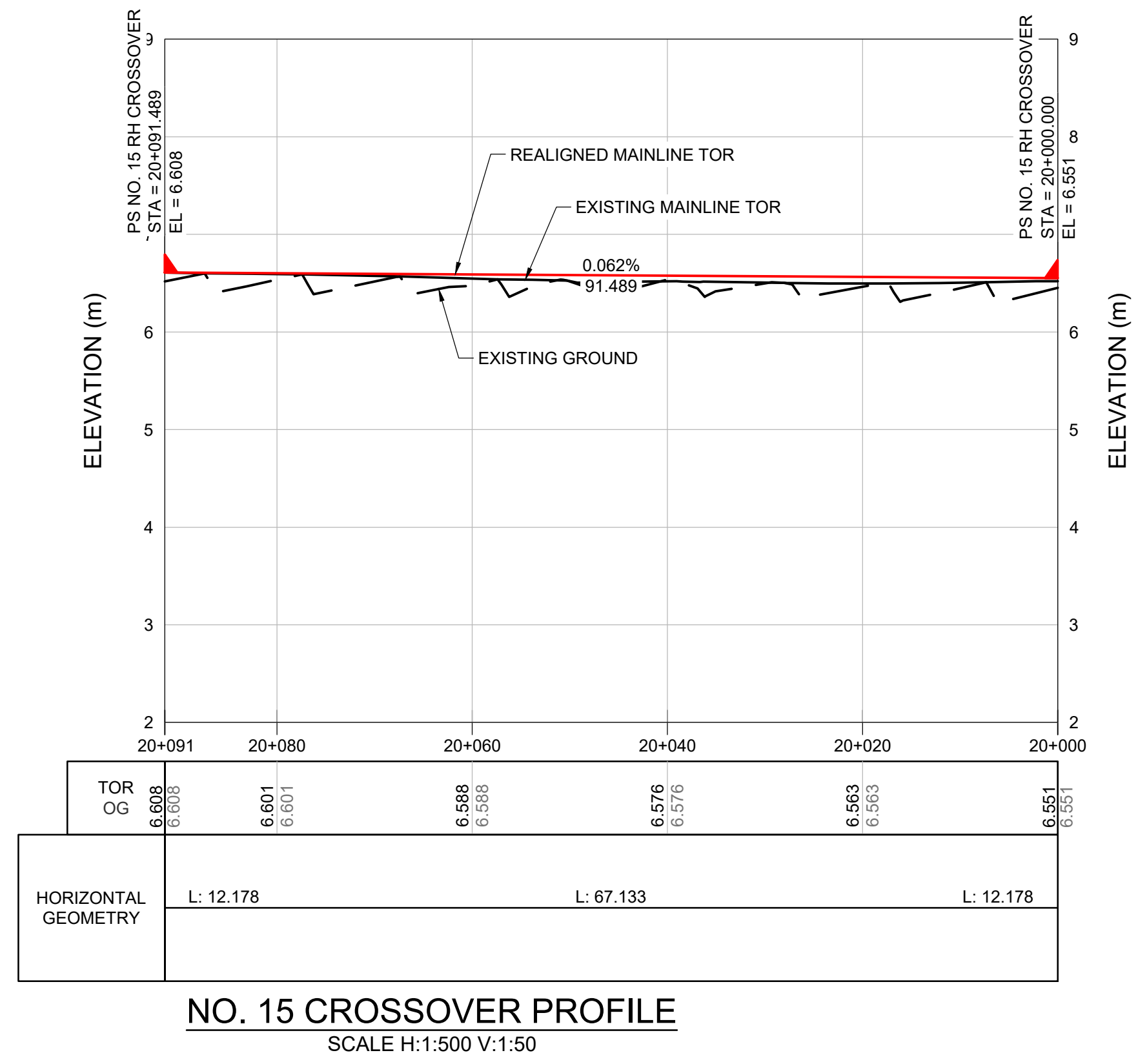
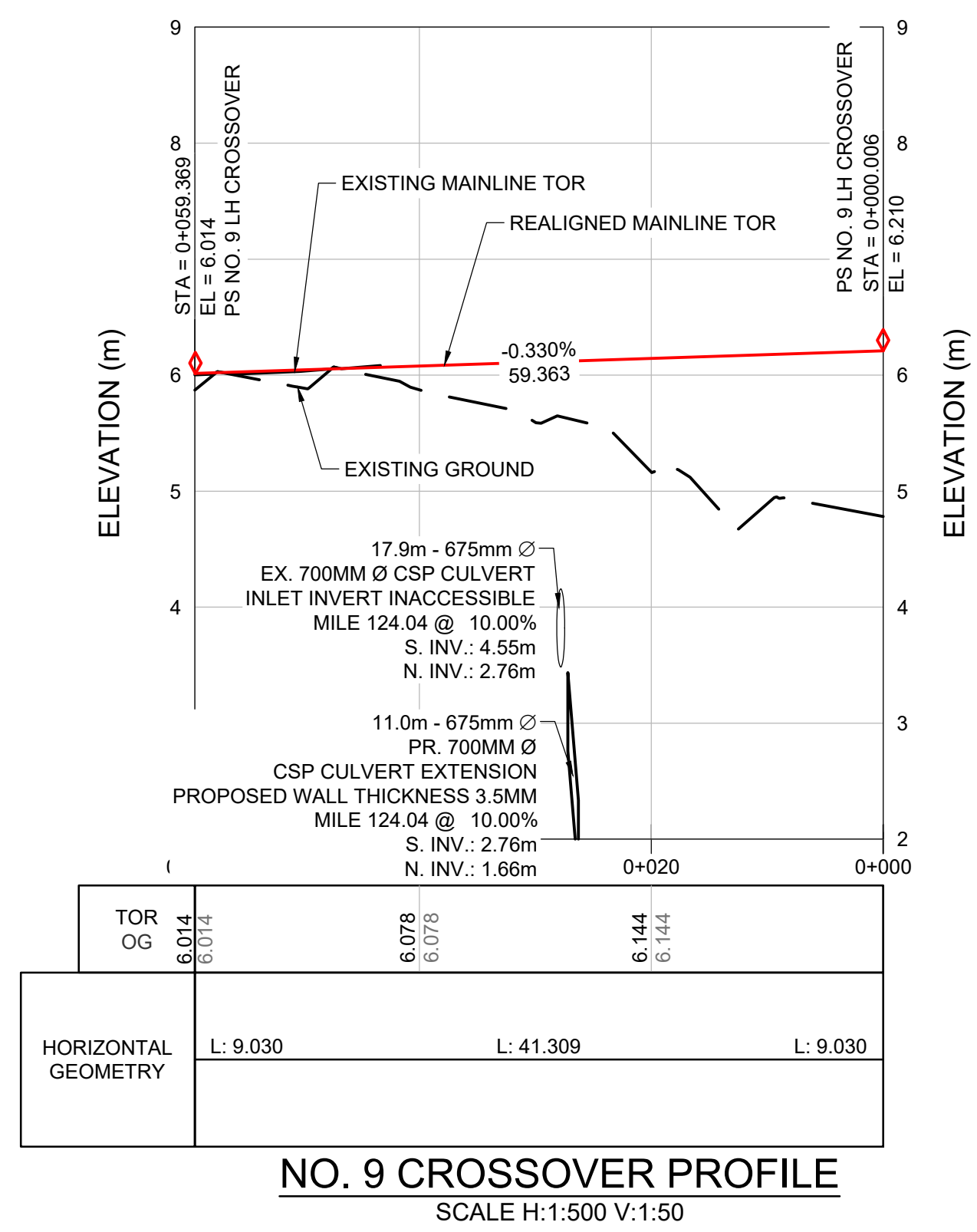
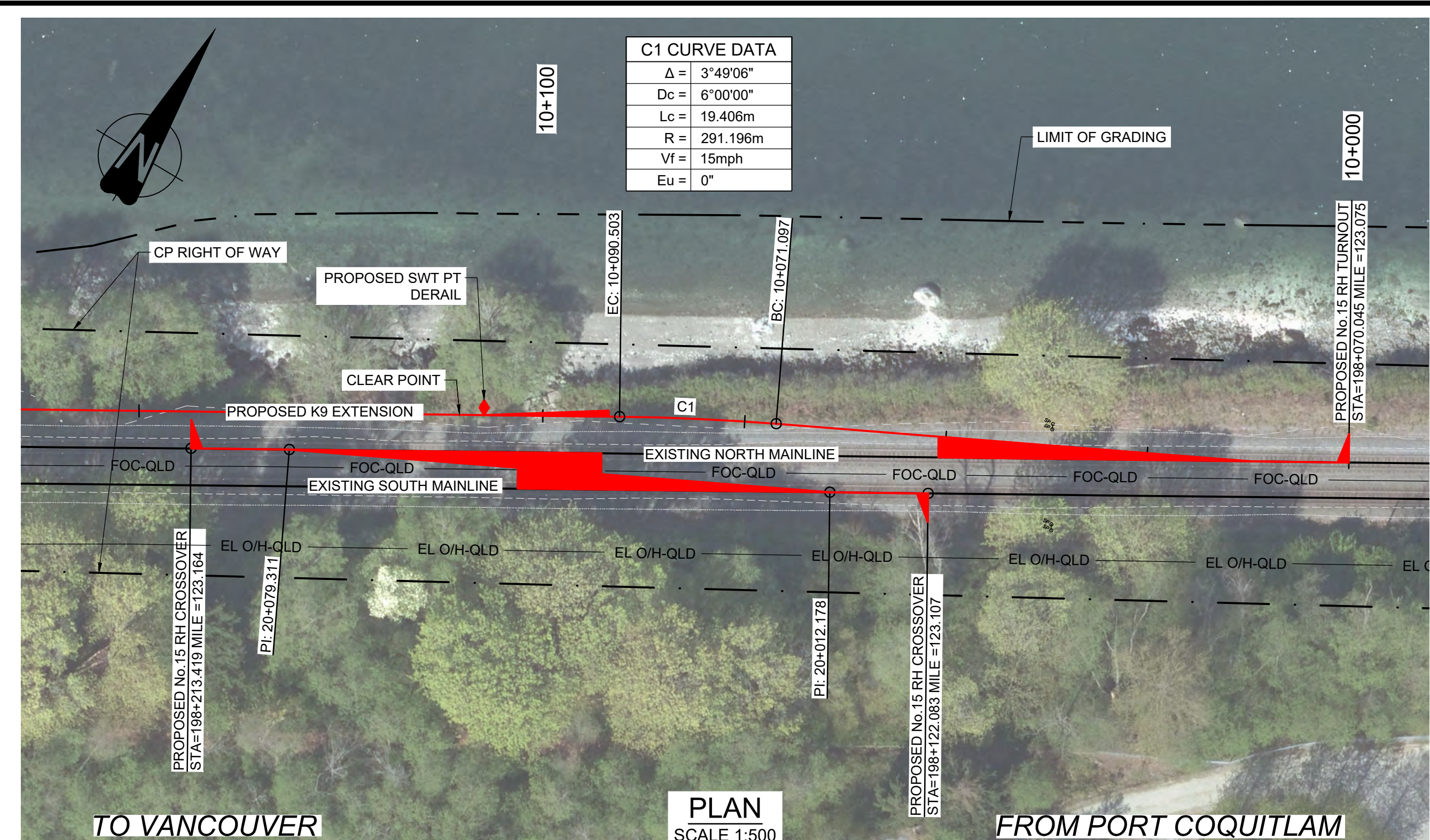
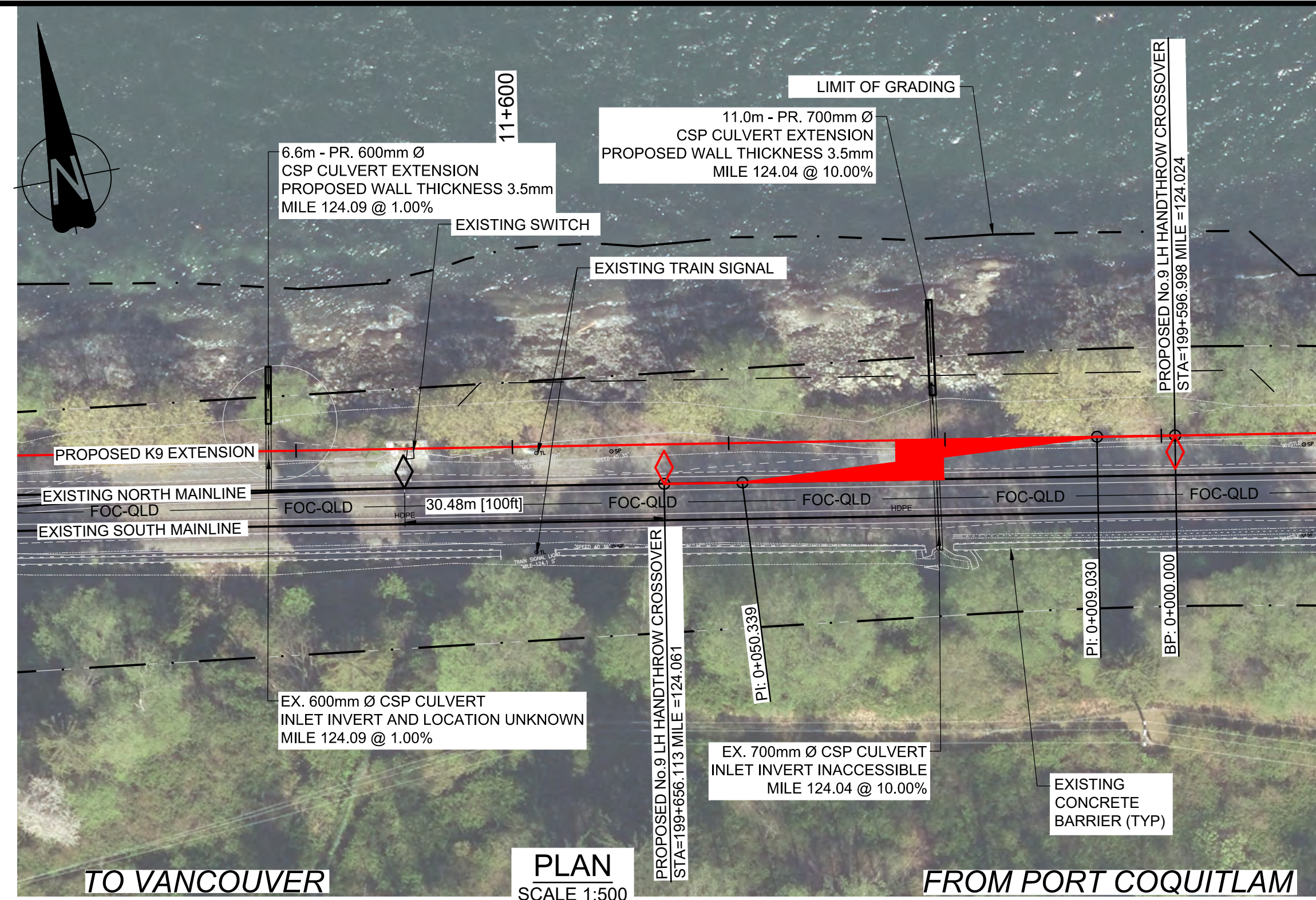
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NOT FOR CONSTRUCTION

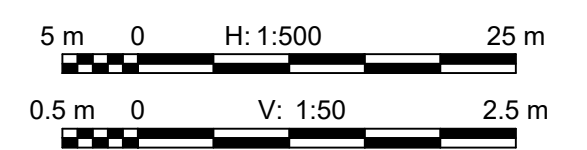


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 Drawing Name: C:\pwworking\kim79037\dwg\h362379-RW-100-S0-0011 - 0016.dwg

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NOT FOR CONSTRUCTION



Mar 17, 2021, 4:31 pm
 Login name: KIM79037
 Drawing Name: C:\pwworking\kim79037\dwg\H362379-RW-100-S0-0011 - 0016.dwg

HATCH

METRIC
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DESIGNED BY: T.J. DATE: 19-03-21
 CHECKED BY: J.C. DATE: 19-03-21
 HATCH PROJECT No: H362379
 DWG SCALE(FULL SIZE): 1:500

PROFESSIONAL SEALS

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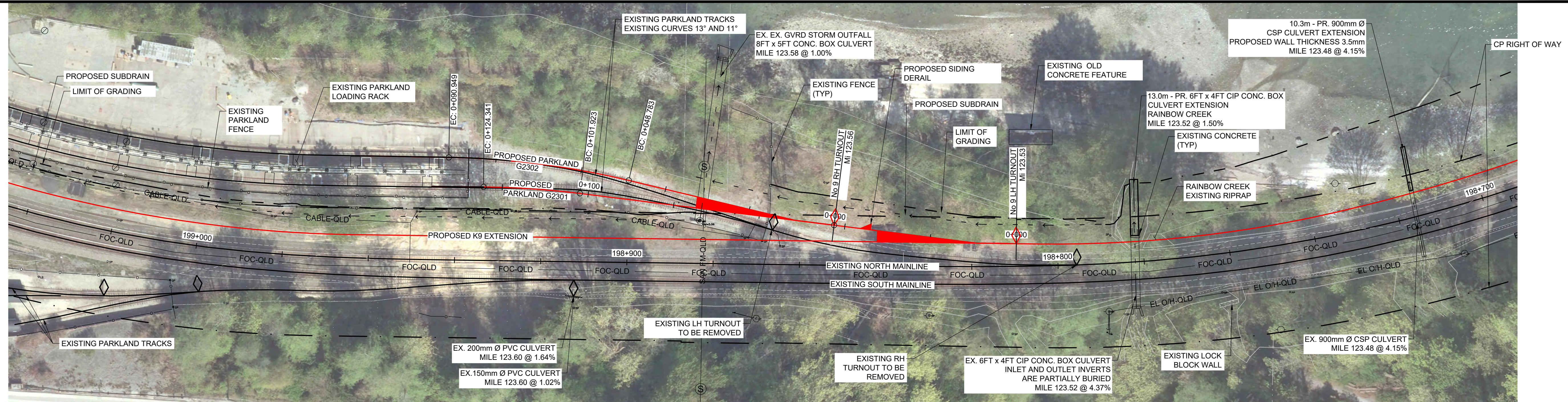
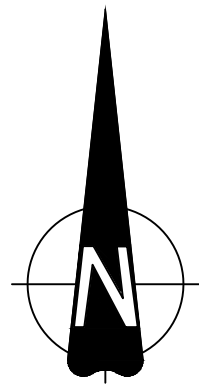
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ENGINEERING PROJECTS - EAST

VANCOUVER DIVISION MILE 123.07 TO 124.17 CASCADE SUBDIVISION

**CASCADIA EAST EXTENSION - PHASE 4
PROPOSED CROSSOVERS
PLAN AND PROFILE**

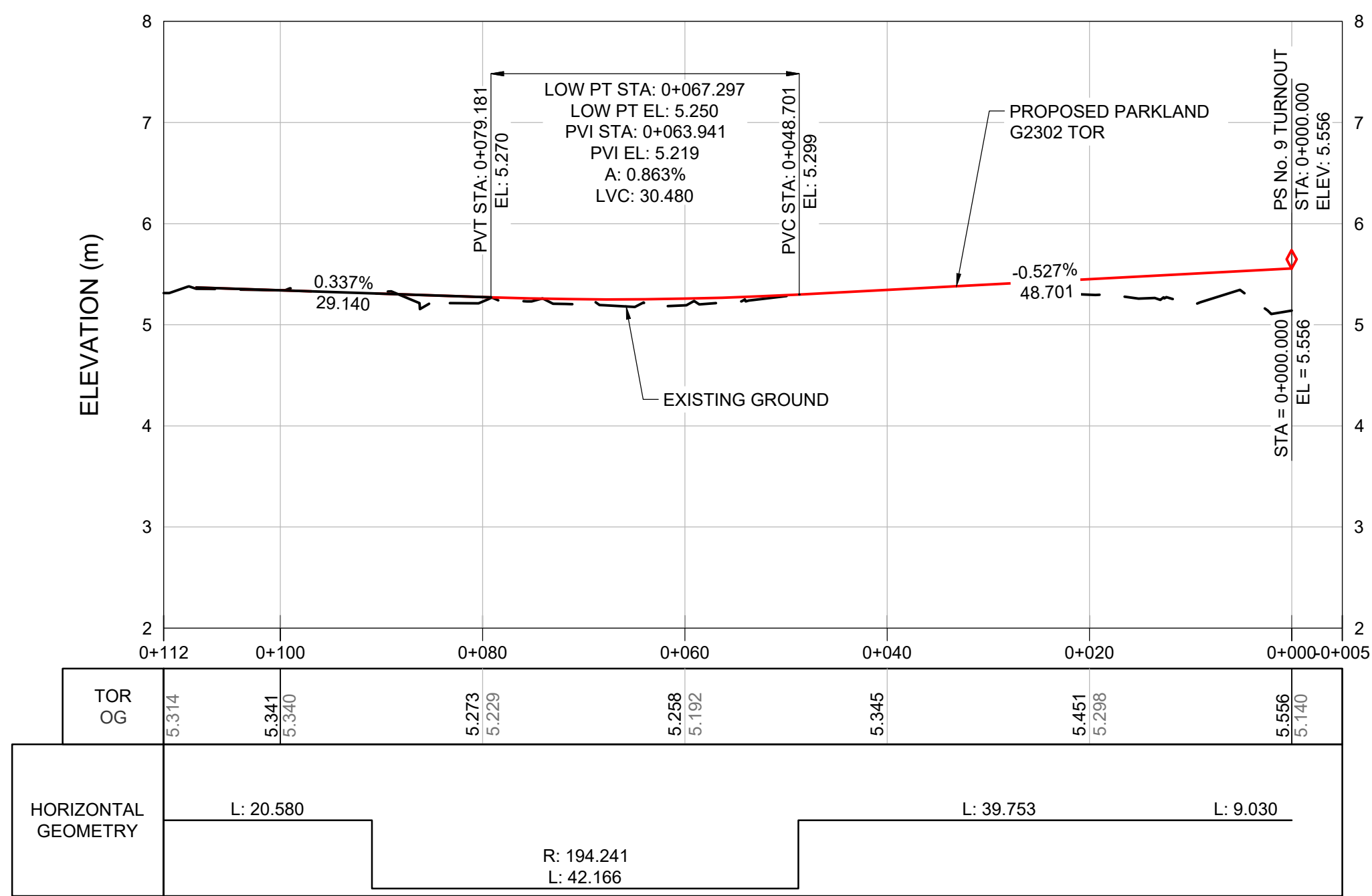
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 CHK BY: KMM
 OFFICE FILE: H362379-RW-100-S0-0016
 SCALE: 1:500
 DATE: 19-03-21
 Rev. C



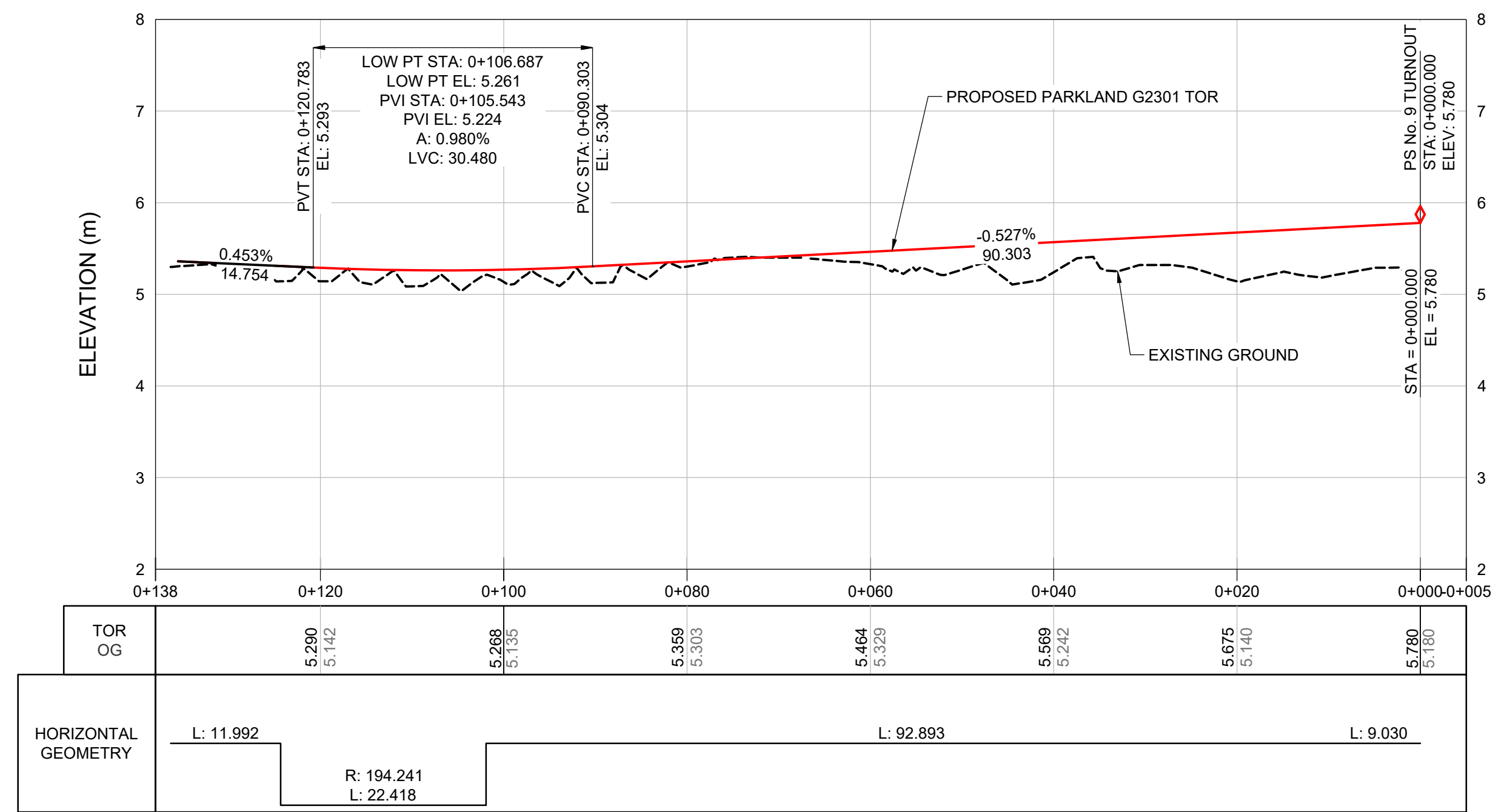
TO VANCOUVER

PLAN
SCALE 1:500

FROM PORT COQUITLAM

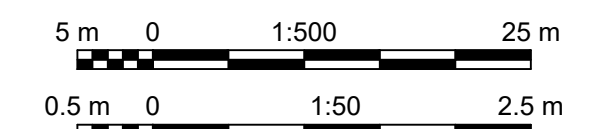


PROPOSED PARKLAND G2302 PROFILE
SCALE H:1:500 V:1:50



PROPOSED PARKLAND G2301 PROFILE
SCALE H:1:500 V:1:50

NOT FOR CONSTRUCTION



Mar 17, 2021, 4:33pm Login name: KIM79037
 Drawing Name: C:\pwworking\hatch\kim79037\0693336\H362379-RW-100-S0-0017.dwg

HATCH

METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES
UNLESS OTHERWISE NOTED

DESIGNED BY: T.J. DATE: 13-11-20	DRAWN BY: S.K. DATE: 13-11-20
CHECKED BY: J.C. DATE: 13-11-20	PROJECT MANAGER: K.M.M. DATE: 13-11-20
HATCH PROJECT No: H362379	DWG SCALE(FULL SIZE): 1:500

PROFESSIONAL SEALS

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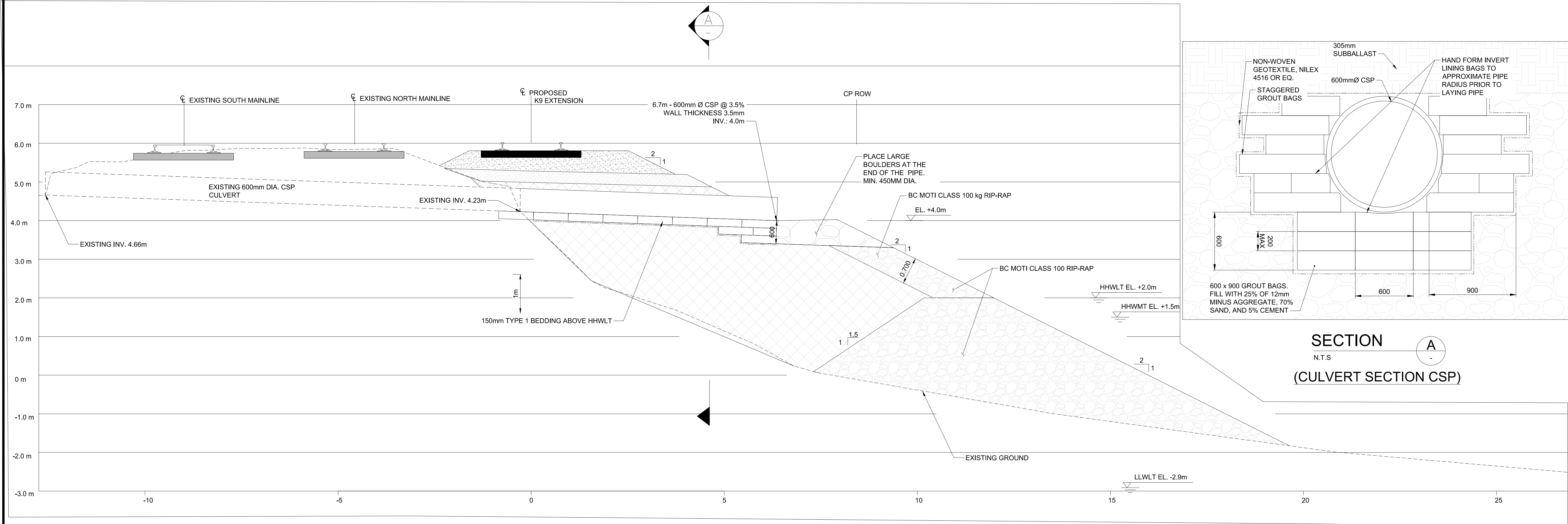
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ENGINEERING PROJECTS - EAST

VANCOUVER DIVISION MILE 123.07 TO 124.17 CASCADE SUBDIVISION

**CASCADIA EAST EXTENSION - PHASE 4
PROPOSED PARKLAND TRACKS
PLAN AND PROFILE**

DWG. BY:	CHK BY:	OFFICE FILE:
MANAGER - DESIGN:	DATE:	SCALE:
M.FAVREAU DIR. PROJECT SERVICES WEST	13-11-20	H362379-RW-100-S0-0017
Rev.	A	



STA. 11+053.594 CULVERT 8 - TYPICAL SECTION

NOT FOR CONSTRUCTION

Mar 17, 2021, 4:38pm Login name: KM79037 Drawing Name: C:\pwworking\hatch\10663829\H362379-CV-100-S0-0001.dwg

LEGEND:

- GRANULAR FILTER
- 200mm MINUS ANGULAR ROCKFILL (QUARRY RUN)
- RIP-RAP (BC MOTI CLASS 100 kg)
- SUB-BALLAST

0 1 2m
1:50

HATCH

METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES
UNLESS OTHERWISE NOTED

DESIGNED BY: T.I.	DRAWN BY: T.I.
DATE: 29-01-21	DATE: 29-01-21
CHECKED BY: J.C.	PROJECT MANAGER: K.M.M.
DATE: 29-01-21	DATE: 29-01-21

HATCH PROJECT No: **H362379** DWG SCALE(FULL SIZE): **1:50**

PROFESSIONAL SEALS

No.	DATE	REVISION	BY
B	29-01-21	REISSUED FOR 30% DESIGN REVIEW	T.I.
A	13-11-20	ISSUED FOR 30% DESIGN REVIEW	T.I.

No.	DATE	REVISION	BY
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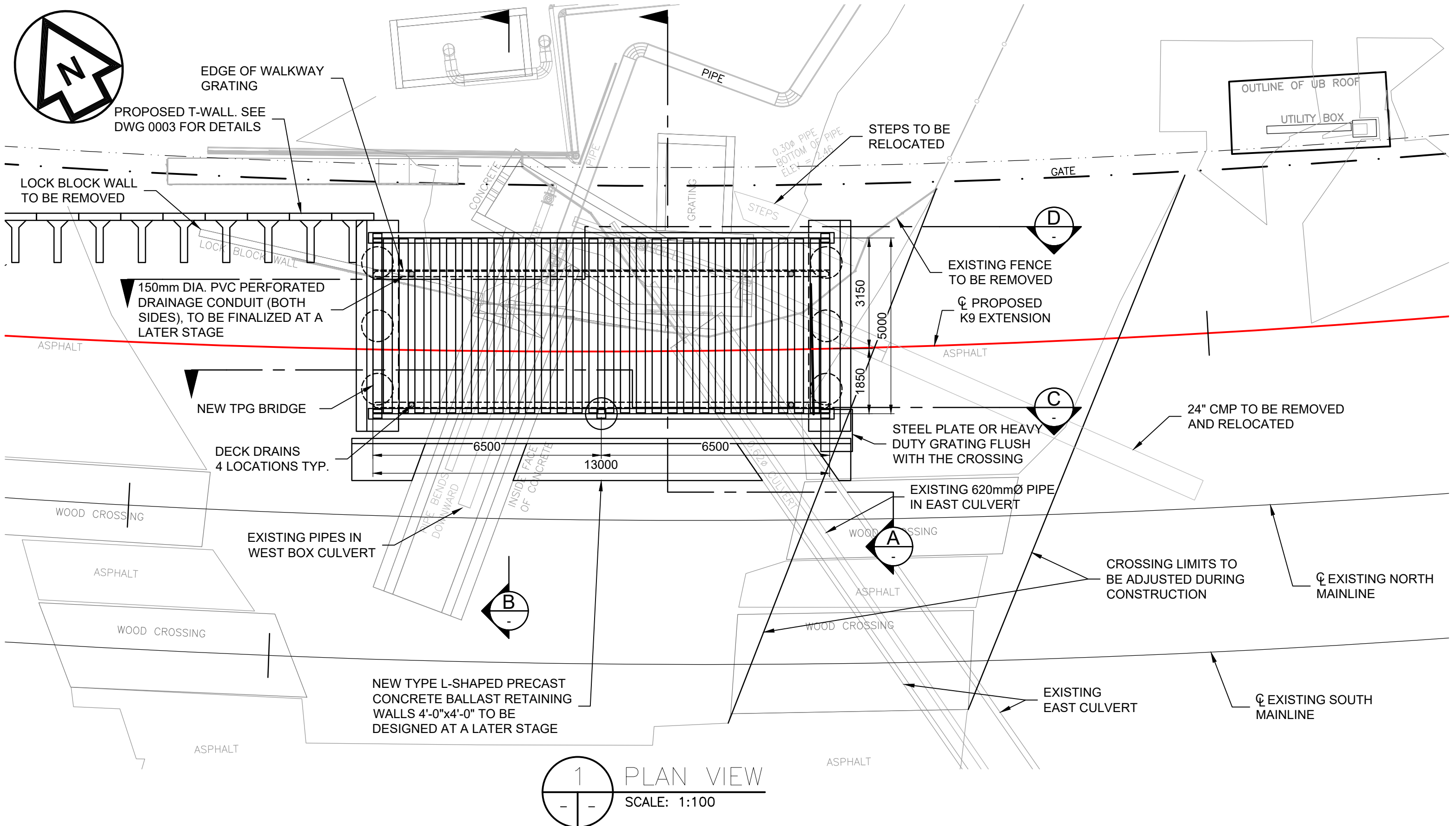
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ENGINEERING PROJECTS - WEST

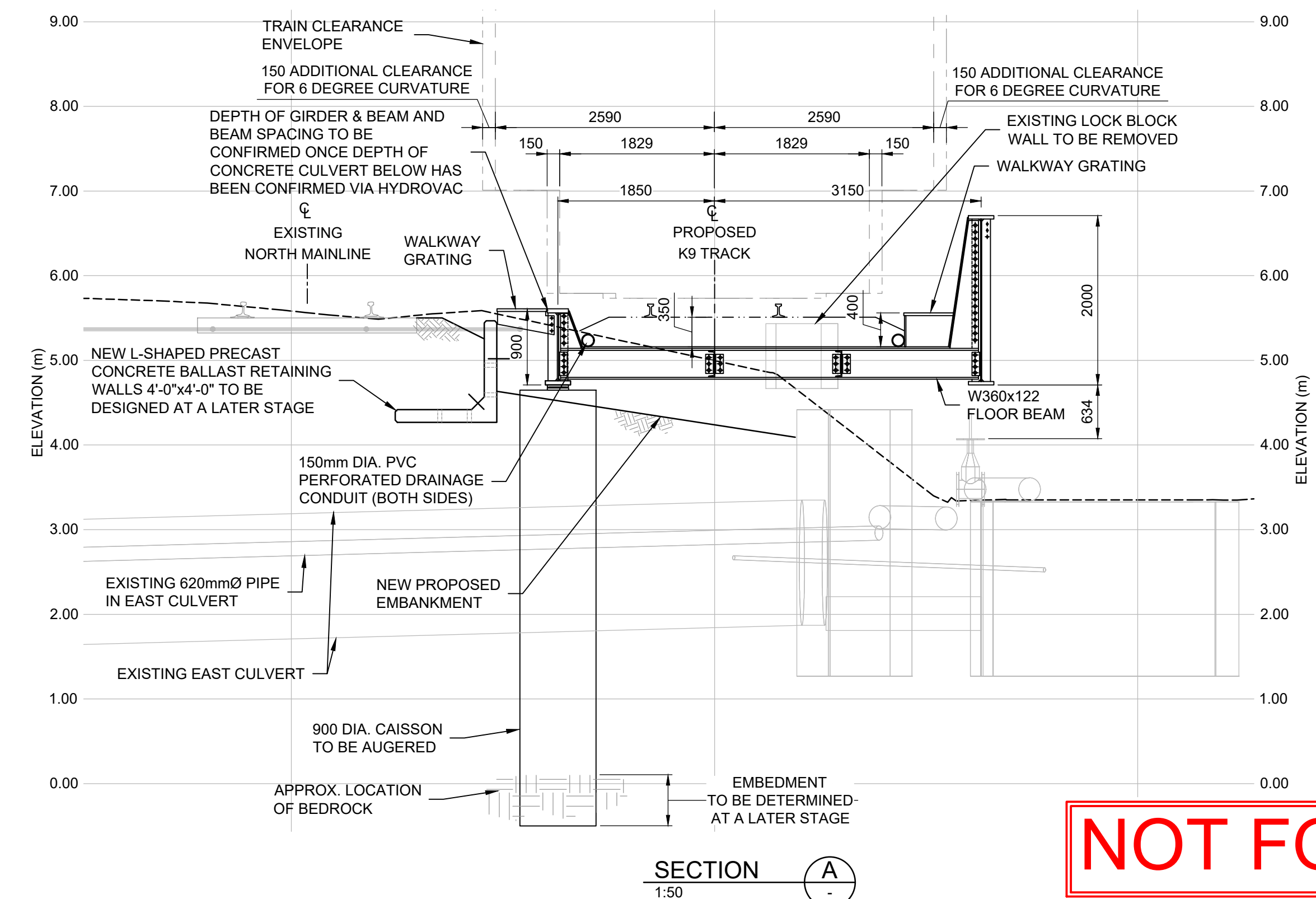
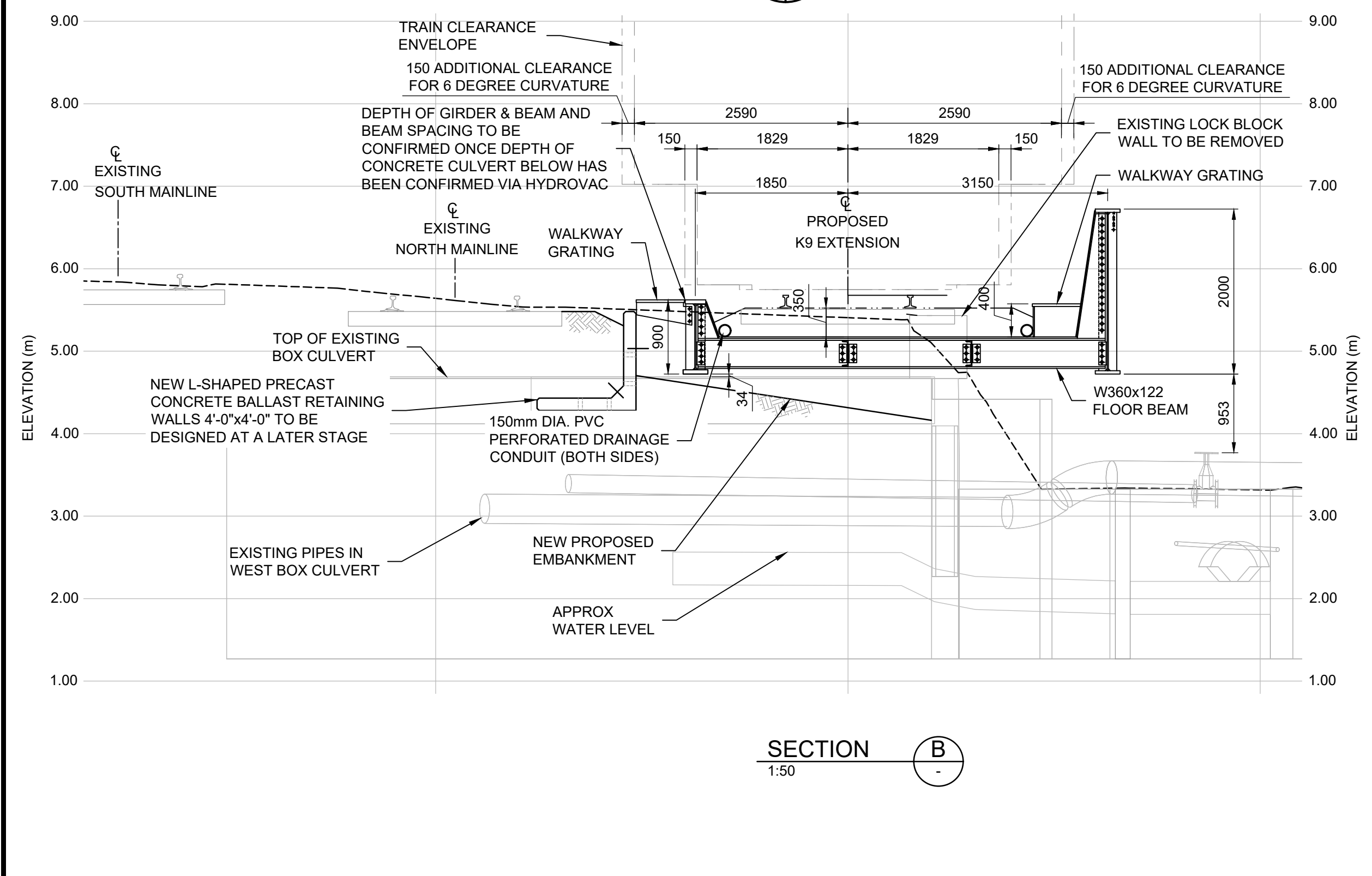
VANCOUVER DIVISION MILE 123.07 TO 124.17 CASCADE SUBDIVISION

**CASCADIA EAST EXTENSION - PHASE 4
PROPOSED K9 TRACK EXTENSION
TYPICAL CULVERT SECTION**

DWG. BY:	CHK BY:	OFFICE FILE:
MANAGER - DESIGN:	SCALE:	DATE:
M.FAVREAU	PLAN No.	H362379-CV-100-S0-0001
DIR, PROJECT SERVICES WEST	Rev.	B



- GENERAL NOTES:**
- LIVE LOAD: COOPER E90 + DIESEL IMPACT.
 - DESIGN COMPLETED IN ACCORDANCE WITH AREMA, CHAPTERS 8 AND 15 AS WELL AS CP REDBOOK OF TRACK AND STRUCTURES REQUIREMENTS 2019.
 - TRACK ALIGNMENT AND BASE OF RAIL AS SHOWN ON HATCH TRACK DRAWINGS FOUND IN THE CURRENT DRAWING PACKAGE.
 - NEAREST CROSSING: MILE POINT 123.71 OR 123.73
 - DIMENSIONS AND DETAILS ARE TO BE VERIFIED IN THE FIELD.
 - UTILITIES SHALL BE LOCATED AND CONFIRMED PRIOR TO CONSTRUCTION.
 - EXISTING STRUCTURES SHALL REMAIN IN PLACE UNLESS OTHERWISE NOTED.
- RAIL BRIDGE SPECIFICATIONS:**
- STRUCTURAL STEEL: CAN/CSA-G40.1 GRADE 350AT CAT. 5 FOR WEB PLATES AND FLANGES OF MAIN GIRDERS AND BEARING STIFFENERS; CAT. 3 FOR LIFTING BEAMS; GRADE 350A FOR DIAPHRAGMS, STIFFENERS, DECK PLATES AND ALL OTHER BRIDGE COMPONENTS.
 - CONCRETE: C.S.A. A23.1 AND A23.2-2014
 - REINFORCING STEEL: C.S.A. CAN3-G30.18-2014
 - WELDING: C.S.A. W59-18 AND AWS D1.5
 - GALVANIZATION: A.S.T.M. A123
 - METALLIZING: C.S.A. G189-1996
 - PAINTING: SEE PAINTING SPECIFICATION
 - HIGH STRENGTH BOLTS: ASTM A3125, M22 TYPE 3
 - ANCHOR BOLTS: ASTM F1554, GRADE 105 OR EQUIVALENT
 - NEOPRENE PADS: CONFORM TO AREMA CHAPTER 19 SECTION 1.6, ELASTOMERIC PADS, DUROMETER 60.



NOT FOR CONSTRUCTION

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HATCH

METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES
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DESIGNED BY: A.K. DATE: 13-11-20	DRAWN BY: R.G. DATE: 13-11-20
CHECKED BY: S.R. DATE: 13-11-20	PROJECT MANAGER: K.M.M. DATE: 13-11-20
HATCH PROJECT No: H362379	DWG SCALE(FULL SIZE): 1:50

PROFESSIONAL SEALS

No.	DATE	REVISION	BY
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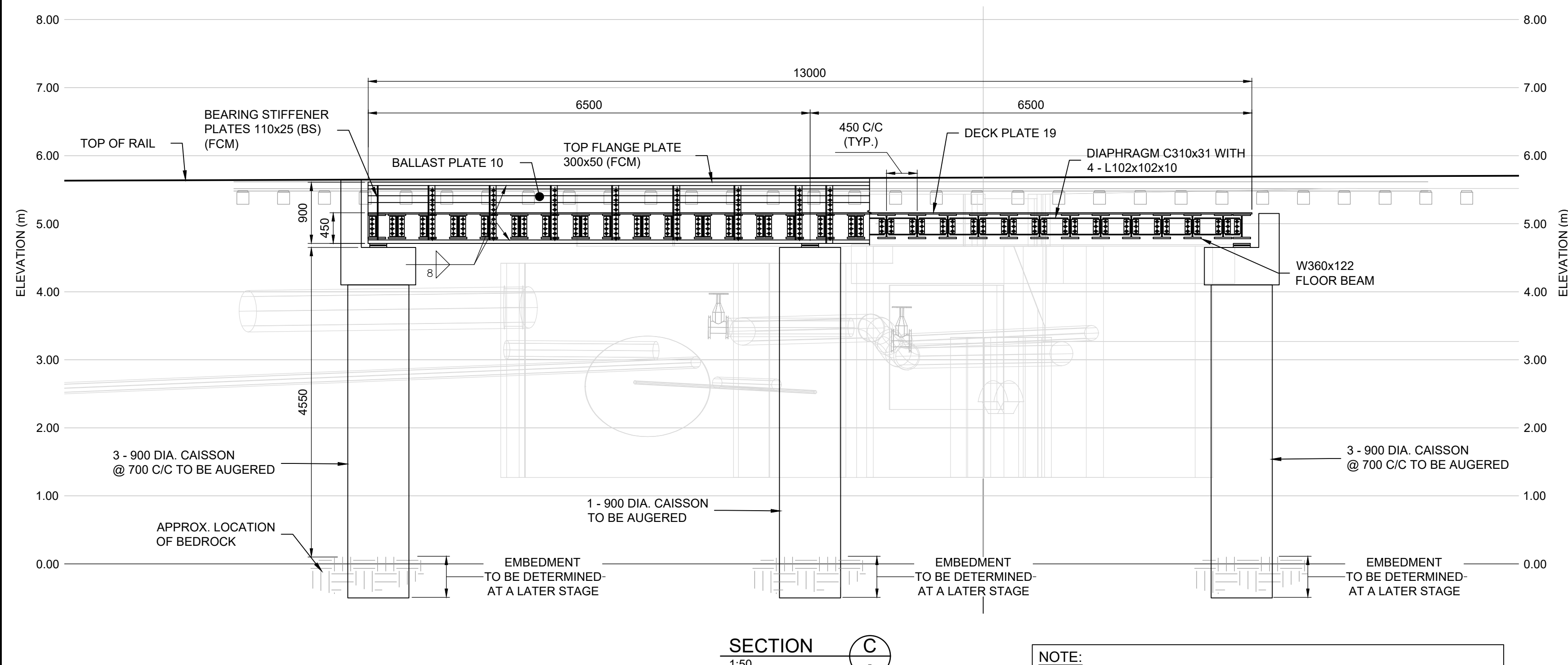
VANCOUVER DIVISION MILE 123.07 TO 124.17 CASCADE SUBDIVISION

**CASCADIA EAST EXTENSION - PHASE 4
PROPOSED K9 TRACK EXTENSION
BRIDGE GENERAL ARRANGEMENT & SECTIONS**

DWG. BY:	CHK BY:	OFFICE FILE:
MANAGER - DESIGN:	DATE:	SCALE:
M.FAVREAU DIR. PROJECT SERVICES WEST	13-11-20	H362379-SR-100-S0-0001
Rev.	A	

GENERAL NOTES:

1. FOR NOTES AND SPECIFICATIONS SEE DRAWING 0001.



NOTE:
ABUTMENT AND PIER CONFIGURATION TO BE CONFIRMED AT A LATER STAGE.

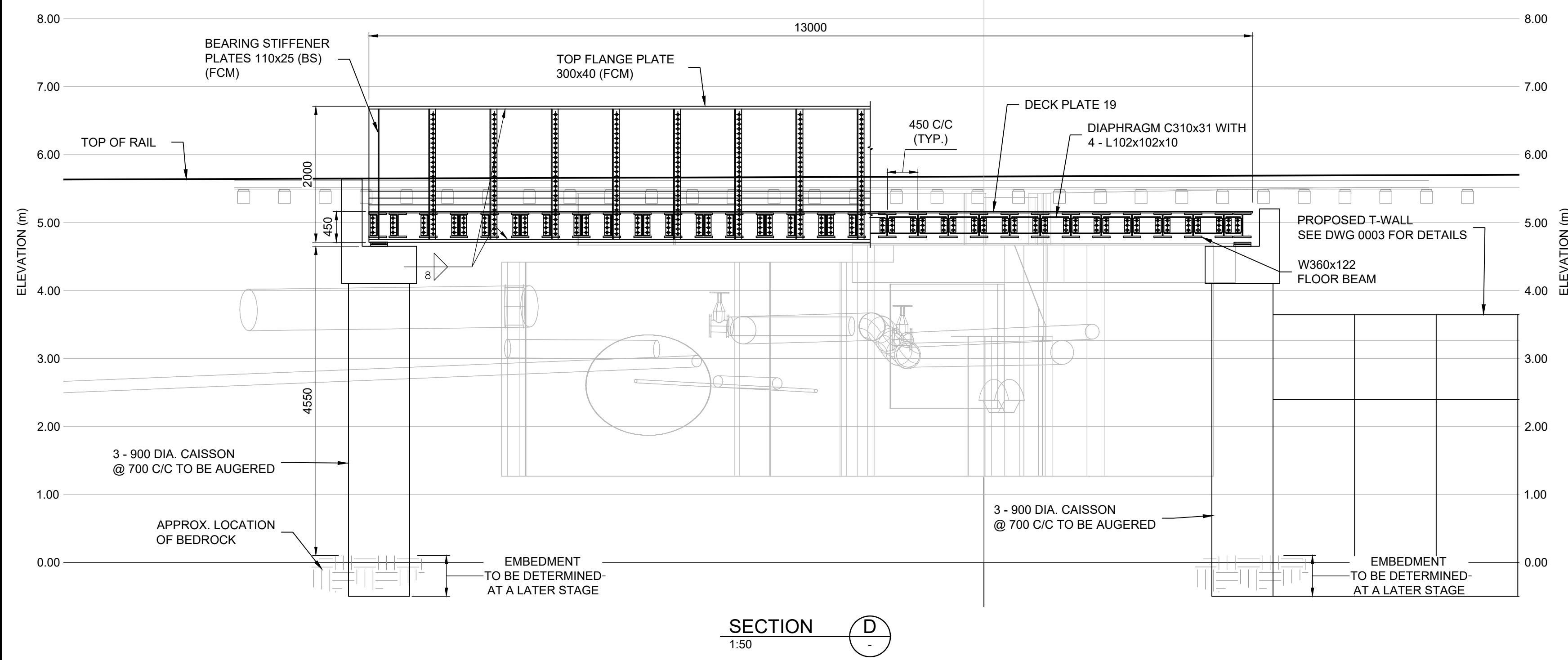


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WEB PLATE:	" - "	AREA=	" - "
BTM FLANGE PLATE:	" - "	AREA=	" - "
Sx-x TOP=	" - "	Ix=	" - "
Sx-x BTM=	" - "		

	END REACTION (kN)	SHEAR STRESS (MPa)	BENDING MOMENT (kN.m)	BENDING STRESSES TOP FLANGE (MPa)
DEAD LOAD	" - "	" - "	" - "	" - "
LIVE LOAD E90	" - "	" - "	" - "	" - "
IMPACT (43.38%)	" - "	" - "	" - "	" - "
TOTAL GROUP "A"	" - "	" - "	" - "	" - "
ALLOWABLE STRESSES BENDING & SHEAR	" - "	" - "	" - "	" - "
RATIO: WORKING/ALLOW.	" - "	" - "	" - "	" - "

$$\frac{\Delta LL + I}{SPAN} = \frac{1}{"-"}$$

ALLOWABLE STRESS RANGE FOR FATIGUE CATEGORY "B" FOR N>2,000,000 CYCLES
 $S_{Rfat} = 110.30 \text{ MPa}$

MAXIMUM DESIGN STRESS RANGE AT BOTTOM FLANGE TO WEB WELD AT MIDSPAN.
 $" - " < S_{Rfat}$

TABLE of STRESSES

MAIN GIRDER LENGTH 13.0m SPAN(c/c brgs)

TOP FLANGE PLATE:	" - "	AREA=	" - "
WEB PLATE:	" - "	AREA=	" - "
BTM FLANGE PLATE:	" - "	AREA=	" - "
Sx-x TOP=	" - "	Ix=	" - "
Sx-x BTM=	" - "		

	END REACTION (kN)	SHEAR STRESS (MPa)	BENDING MOMENT (kN.m)	BENDING STRESSES TOP FLANGE (MPa)
DEAD LOAD	" - "	" - "	" - "	" - "
LIVE LOAD E90	" - "	" - "	" - "	" - "
IMPACT (43.38%)	" - "	" - "	" - "	" - "
TOTAL GROUP "A"	" - "	" - "	" - "	" - "
ALLOWABLE STRESSES BENDING & SHEAR	" - "	" - "	" - "	" - "
RATIO: WORKING/ALLOW.	" - "	" - "	" - "	" - "

$$\frac{\Delta LL + I}{SPAN} = \frac{1}{"-"}$$

ALLOWABLE STRESS RANGE FOR FATIGUE CATEGORY "B" FOR N>2,000,000 CYCLES
 $S_{Rfat} = 110.30 \text{ MPa}$

MAXIMUM DESIGN STRESS RANGE AT BOTTOM FLANGE TO WEB WELD AT MIDSPAN.
 $" - " < S_{Rfat}$

SPAN WEIGHT
 " - " Kg (" - " LBS)
 NOT INCLUDING BEARINGS OR WALKWAY.

NOT FOR CONSTRUCTION

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 Drawing Name: C:\pwworking\kim79037\p0693864\H362379-SR-100-S0-0002.dwg

HATCH

METRIC
 DIMENSIONS ARE IN METRES AND/OR MILLIMETRES
 UNLESS OTHERWISE NOTED

DESIGNED BY: A.K. DATE: 13-11-20	DRAWN BY: R.G. DATE: 13-11-20
CHECKED BY: S.R. DATE: 13-11-20	PROJECT MANAGER: K.M.M. DATE: 13-11-20
HATCH PROJECT No: H362379	DWG SCALE(FULL SIZE): 1:50

PROFESSIONAL SEALS

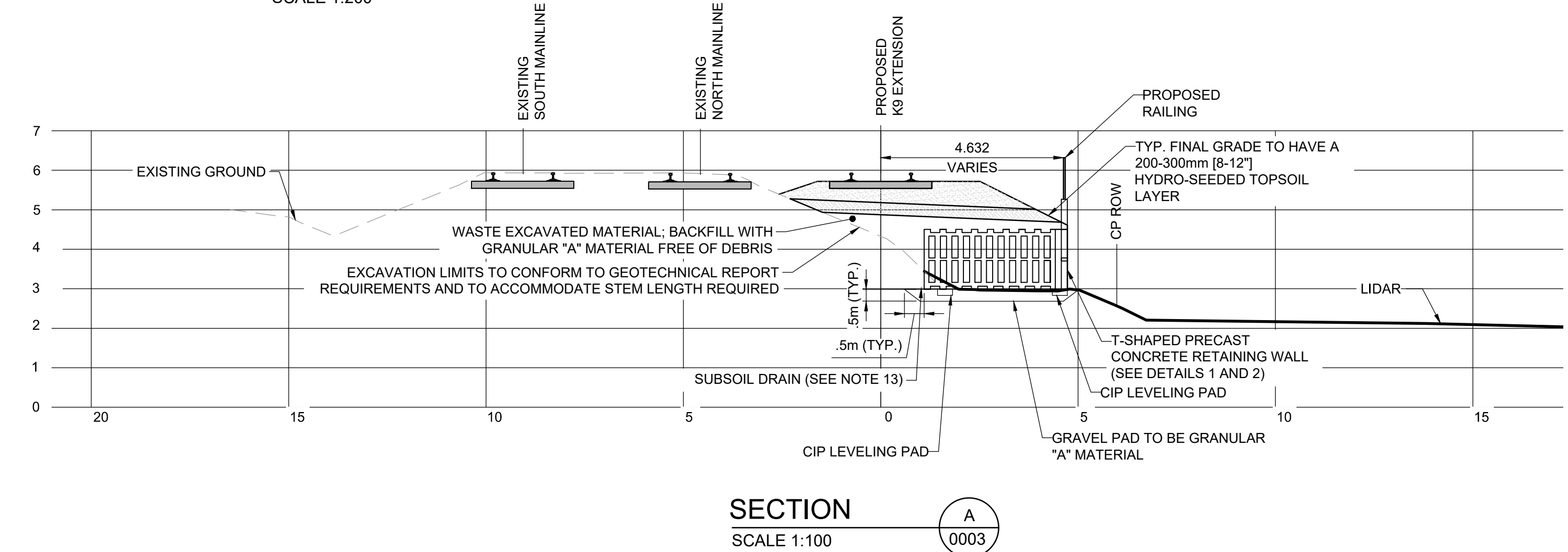
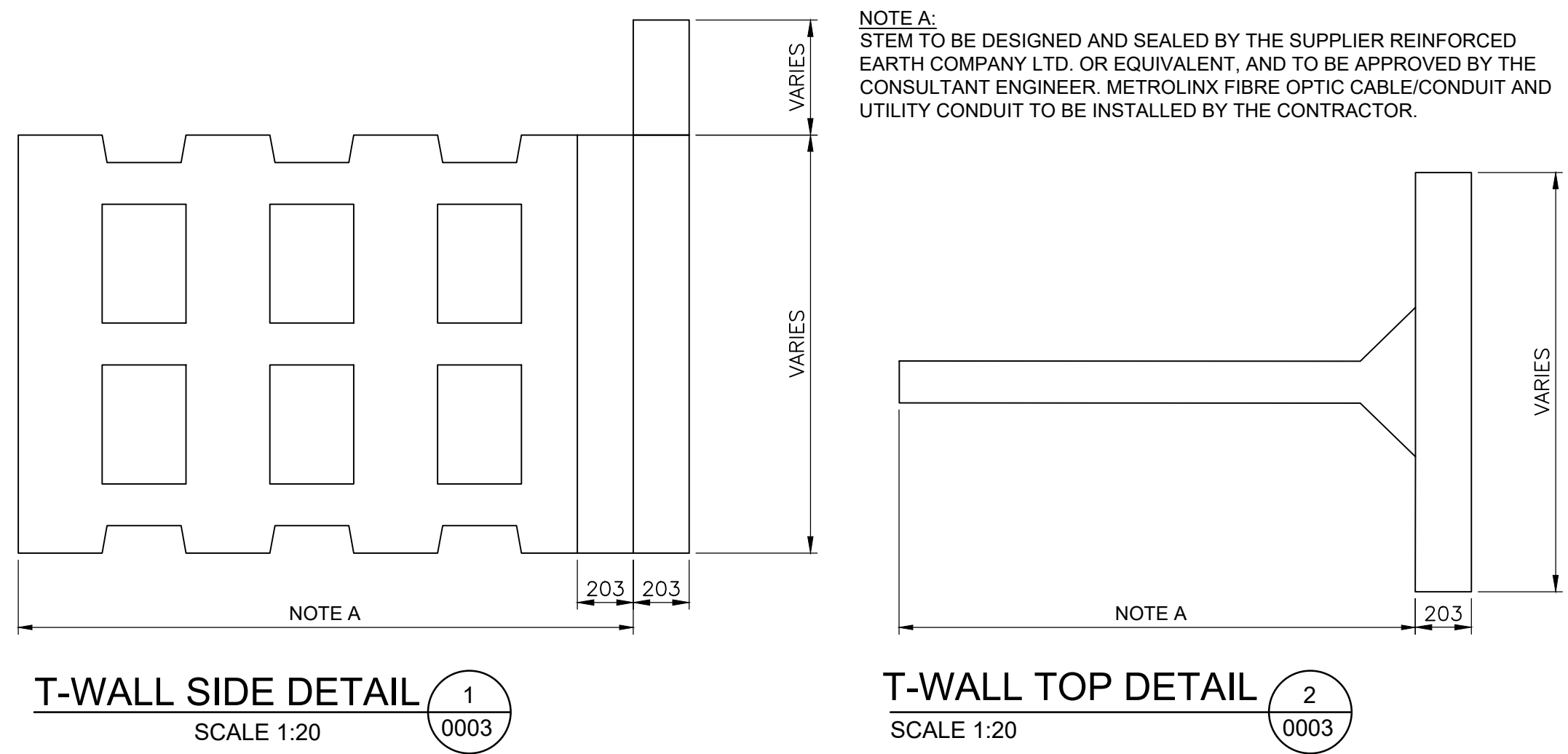
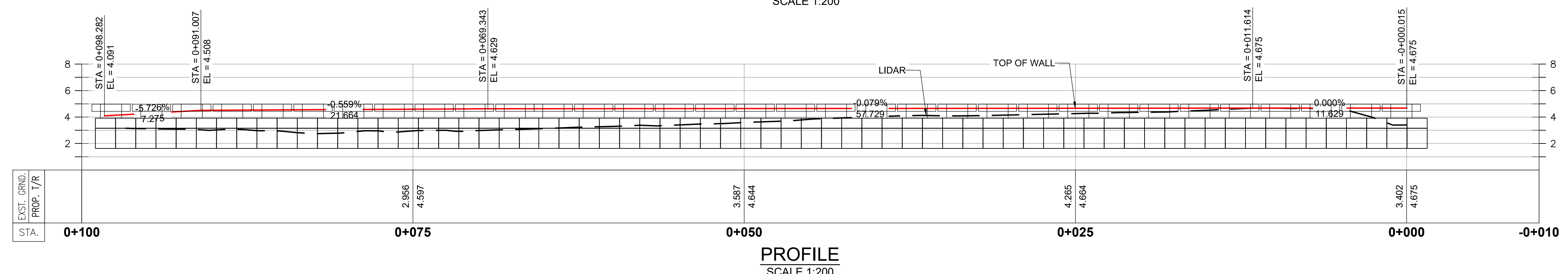
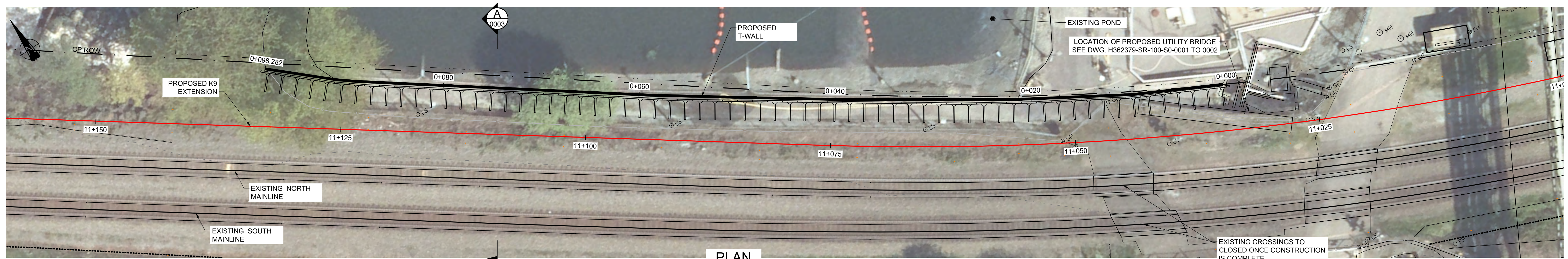
No.	DATE	REVISION	BY
A	13-11-20	ISSUED FOR 30% DESIGN REVIEW	R.G.



VANCOUVER DIVISION MILE 123.07 TO 124.17 CASCADE SUBDIVISION

**CASCADIA EAST EXTENSION - PHASE 4
 PROPOSED K9 TRACK EXTENSION
 BRIDGE ELEVATION VIEWS**

DWG. BY:	CHK BY:	OFFICE FILE:
MANAGER - DESIGN:	DATE:	SCALE:
M.FAVREAU DIR. PROJECT SERVICES WEST	H362379-SR-100-S0-0002	Rev. A



- NOTES:**
- DESIGN AND WORKMANSHIP: AREMA (LATEST EDITION) CHAPTER 8 AND/OR 15 AND "METROLINX GENERAL GUIDELINES FOR RAILWAY BRIDGES AND STRUCTURES" (LATEST EDITION).
 - T-WALL SHALL BE DESIGNED FOR A SERVICE LIFE OF 100 YEARS. THE GEOMETRY SHOWN IN THIS SET OF DRAWINGS IS AN ILLUSTRATION ONLY, FINAL CONFIGURATION IS AS PER THE DESIGNER AND MANUFACTURER RETAINED BY CP RAIL.
 - RAILING SHALL BE OF HSS 48.3 O.D. X 3.81 CLASS C IN ACCORDANCE WITH C.S.A. STD G40.20 AND G40.21.
 - MISC. STRUCTURAL STEEL SHALL BE OF 300W IN ACCORDANCE WITH CAN/CSA-G40.21-M98.
 - ALL STEEL MATERIAL TO BE HOT DIPPED GALVANIZED IN ACCORDANCE WITH CAN/CSA-G184-98.
 - DESIGN LOAD FOR RAILING AS PER AREMA.
 - LIVE LOAD COOPER E-90, FOR BOTH PERMANENT WALLS AND TEMPORARY SHORING.
 - DEAD LOAD FOR EXISTING MATERIAL IS 21 kN/m².
 - CONTRACTOR TO LOCATE ANY EXISTING UTILITIES BEFORE COMMENCEMENT OF THE WORK. CONTRACTOR TO PROTECT UTILITIES DURING CONSTRUCTION. FOR FIBRE OPTIC RELOCATION, SEE CIVIL DRAWINGS.
 - CONTRACTOR IS RESPONSIBLE FOR ADHERING TO SAFE EXCAVATION PRACTICES AND TEMPORARY SHORING DESIGN, ENSURING THE EMBANKMENT STABILITY IS MAINTAINED DURING AND AFTER CONSTRUCTION, CONSIDERING EXISTING LOADS AND CONDITIONS.
 - T-WALL SYSTEM IS TO BE DESIGNED BY REINFORCED EARTH COMPANY LTD. OR EQUIVALENT AND TO BE APPROVED BY THE CONSULTANT ENGINEER.
 - CONTRACTOR TO DESIGN AND INSTALL TEMPORARY SHORING WHERE REQUIRED. DESIGN TO BE APPROVED BY THE ENGINEER. THE POSITION OF THE TEMPORARY SHORING IN THIS DRAWING IS AN ILLUSTRATION ONLY.
 - CONTRACTOR TO PLACE SUBSOIL DRAIN BEHIND THE WALL, AT THE BASE OF THE GRANULAR FILL MATERIAL, THROUGHOUT THE LENGTH OF THE WALL. SUBSOIL DRAIN TO DRAIN OUT OF THE WALL AT A MINIMUM SLOPE OF 0.3%.
 - CONTRACTOR TO INSTALL AT LEAST 900mm GEOTEXTILE BETWEEN VERTICAL JOINTS TO AVOID LEAKING OF MATERIAL.

NOT FOR CONSTRUCTION

Mar 17, 2021, 4:20pm Login Name: KIM79037 Drawing Name: C:\pwworking\kim79037\0693864\H362379-SR-100-S0-0003.dwg

<p>METRIC DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE NOTED</p>	DESIGNED BY: T.I. DATE: 13-11-20	DRAWN BY: T.I. DATE: 13-11-20	PROJECT MANAGER: K.M.M. DATE: 13-11-20	PROFESSIONAL SEALS	<p>ENGINEERING PROJECTS - EAST</p>	VANCOUVER DIVISION MILE 123.07 TO 124.17 CASCADE SUBDIVISION
	CHECKED BY: J.C. DATE: 13-11-20	HATCH PROJECT No: H362379	DWG SCALE(FULL SIZE): 1:500	THIS DRAWING WAS PREPARED FOR THE EXCLUSIVE USE OF CANADIAN PACIFIC CLIENT AND IS ISSUED PURSUANT TO THE HATCH-CP ENGINEERING SERVICES AGREEMENT AND RELEVANT PURCHASE ORDER BETWEEN CLIENT AND HATCH CORPORATION (PARTY), UNLESS OTHERWISE AGREED IN WRITING WITH CLIENT OR SPECIFIED ON THIS DRAWING. HATCH DOES NOT ACCEPT AND ASSUME ANY AND ALL LIABILITY OR RESPONSIBILITY ARISING FROM ANY USE OF OR RELIANCE ON THIS DRAWING BY ANY THIRD PARTY OR ANY MODIFICATION OR REVISION OF THIS DRAWING BY CLIENT, AND BY THIS DRAWING IS CONFIDENTIAL AND ALL INTELLECTUAL PROPERTY RIGHTS RESERVED OR REFERENCED IN THIS DRAWING REMAIN THE PROPERTY OF HATCH.		MANAGER - DESIGN: M.FAVREAU DIR. PROJECT SERVICES WEST

APPENDIX C

Archaeological Chance Find Procedure

ARCHAEOLOGICAL CHANCE FIND PROCEDURE

CP Cascadia East Extension Project

Contact List of Important Names & Telephone Numbers

Proponent <i>Contact if archaeological resources or human remains are identified</i>	<i>Prime contact:</i>
	<i>In-field contact:</i>
Contractor <i>Contact if archaeological resources or human remains are identified</i>	<i>Prime contact:</i>
	<i>In-field contact:</i>
Consulting Archaeologist <i>Contact if archaeological resources or human remains are identified</i>	<i>Prime contact:</i> Ewan Anderson, Terra Archaeology Limited 250-361-7911 ewan@terraarchaeology.com
	<i>In-field contact:</i> Shana Morin, Terra Archaeology Limited 604-346-6467 shana@terraarchaeology.com
Archaeology Branch <i>Contact if archaeologist is unreachable</i>	250-953-3334
Police/RCMP local non-emergency number <i>Contact only if human remains are identified and archaeologist and Archaeology Branch are unreachable</i>	Burnaby RCMP: 604-646-9999

Please note that email should be used as a secondary point of contact for records and follow up, after the matter has been discussed over the phone with the appropriate parties.

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1 Introduction

The proposed Cascadia East Extension (Cascadia Phase 4) Project is located in the City of Burnaby, adjacent to the Parkland Refining Terminal and Confederation Park (Figure 1). The proposed 1.6 km long project consists of construction of a third track parallel to the existing tracks, and may also include associated turnouts, signals, and controls and shoreline infilling (Figure 2).

A pre-construction archaeological assessment was completed by Terra Archaeology Limited (Terra) and included a field survey with Skwxwú7mesh Úxwumixw staff on June 22, 2020, and subsurface testing on August 20, 2020, during very low tide.

Archaeological site DhRr-895, which consists of an isolated surface lithic collected on June 22, is located with the potential shoreline infilling zone (Figure 2). Subsequent subsurface testing was completed on August 20 with negative results. Potential construction impacts in this location consist of capping and filling, and the potential for additional archaeological remains to be discovered during construction is considered to be very low. Therefore, no archaeological monitoring is recommended during construction.

This document outlines how to appropriately manage unanticipated or “chance” archaeological finds made during project construction. The processes described below enable the proponent to manage impacts to protected archaeological sites concurrently with project construction activities. The objective of the Chance Find Procedure is **to ensure appropriate and respectful treatment of cultural heritage remains while maintaining project construction timelines.**

This document is intended to be used as an in-field resource. The project proponent and contractor should become familiar with the processes described below and the types of archaeological remains likely to be encountered in the project area (Appendix A).

An emergency contact sheet is provided on the cover page so that the appropriate people can be quickly contacted if necessary.

Any cultural materials which pre-date AD 1846 may be automatically protected by the *Heritage Conservation Act* of British Columbia. It is illegal to collect or remove any cultural remains from an archaeological site unless authorized to do so by a permit issued under Section 12.2 or 12.4 of the *Heritage Conservation Act*.

Portions of the project, including site DhRr-895, are located on lands under the jurisdiction of the Port Authority, a federal agency. Provincial *Heritage Conservation Act* permits are not required for alterations to cultural heritage remains on these lands.

Remember:

- This Chance Find Procedure (CFP) is one of several impact management recommendations made by a professional archaeologist, or is part of the proponent’s broader heritage management policies. Project managers should consult these additional documents before implementing this CFP.
- All on-site personnel involved in ground altering activities should be familiar with this policy, *including* the types of sites described in Appendix A *before* starting on-site work.
- This CFP, including the content in Appendix A, should be presented to all on-site personnel by a professional archaeologist familiar with the project, in collaboration with local First Nations.

2 First Nations Cultural Heritage

The project area is located within the asserted territories of the Kwikwetlem, Musqueam, Skwxwú7mesh, Stó:lō, and Tseil-Waututh nations, whose ancestors have lived here since time immemorial. Indigenous communities have a deep respect for and connection with their cultural heritage. The preservation and protection of the physical remains associated with their ancestors' lives – in the form of archaeological sites – is an integral part of that respect.

Within these nations' lands are hundreds, or even thousands, of archaeological sites, representing thousands of years of history and hundreds of generations' experiences on the land. Archaeological sites exist in many contexts, including those that are well-preserved and well-documented, and others which are heavily altered from modern land use, or entirely unrecorded. Regardless of the context, all archaeological sites represent significant connections between Indigenous communities and their lands and ancestors, and must be treated with the utmost respect.

Given the sensitive nature of cultural heritage represented by archaeological sites, First Nations expect all project proponents and their contractors to follow these Chance Find Procedures and consult with community leaders regarding archaeological resources within project areas.

3 Types of Archaeological Resources

Archaeological remains can be found in either a disturbed or intact context. Artifacts to watch for include stone tools, as well as bone, antler, and tooth artifacts. Black soil (with or without concentrations of shell), fire-altered rock, hearth features, aligned rocks, or the wet remains of organic materials can also represent archaeological sites. Detailed characteristics of archaeological sites typical to the region are described and illustrated in the Archaeological Site Identification Guide presented as Appendix A.

Any discovery of bones that constitute possible human remains demands attention. Tsleil-Waututh Nation's Ancestral Remains Policy is presented in Appendix B. The Archaeology Branch's Found Human Remains Policy is presented in Appendix C.

An outline of what do to if artifacts or human remains are encountered is provided in following sections.

4 Chance Finds Guidelines

For land-altering activities outside of known site areas it is important to note that work in the area of the discovery must stop immediately no matter what type of archaeological material or feature has been encountered by the proponent or their contractors.

4.1 Initial Action by Proponent and Contractors

1) Stop Work

If archaeological materials are believed to have been encountered, all work in the area of the discovery should cease and the site area safely secured. Do not move any soil from the vicinity of the site, including any spoil material.

2) Contact an Archaeologist

An archaeologist should be contacted as soon as possible. If possible, e-mail notification of chance finds should include photographs of the finds from several angles, from close-up (with an everyday object, such as a pen, for scale), and from a short distance away.

3) Seek Guidance from the Archaeologist

The archaeologist will provide guidance on further action. Where possible a solution will be arrived at over the phone, perhaps supplemented by digital images of the find forwarded to the archaeologist's office. If the archaeologist cannot determine the exact nature of the discovery, and/or it cannot be satisfactorily resolved over the telephone or by e-mail, a visit will be arranged so the site can be assessed and mapped. Prior to visiting the area of the discovery, the Archaeology Branch of the Ministry of Forests, Lands, Natural Resource Operations and Rural Development will be notified of the discovery.

4.2 Archaeological Site Management Options

If the archaeologist confirms that an archaeological site has been discovered, there are several management options. Proponents should work collaboratively with First Nations and the archaeologist to determine a management plan if a conflict with an archaeological site is identified. If a *Heritage Conservation Act* inspection, investigation, or alteration permit is not in place either for the development, or in connection with a known archaeological site, this must first be applied for and obtained. The archaeologist can prepare the application for the appropriate permit which must be signed by an individual representing the development prior to submission. Once the permit has been granted by the Archaeology Branch there are three main archaeological site management options:

Avoid	Mitigate	Protect
<p>If the boundaries of the site have been delineated, an attempt will be made to redesign the proposed development to avoid the site. It will likely be necessary to have a Heritage Inspection Permit in place to properly delineate site boundaries. Site avoidance is normally the fastest and most cost-effective management option for archaeological sites.</p>	<p>If it is not feasible to avoid the site through development redesign, it will be necessary to effectively sample it utilizing a systematic data collection program prior to its loss. This could include a systematic surface collection and/or excavation. Mitigative work is normally the most expensive and time-consuming management option.</p>	<p>It may be possible to protect the site through the installation of barriers during the time of the development and possibly for a longer term. This could include the erection of high visibility fencing around the site or covering the site area with a geotextile and then capping it with fill. The exact prescription would be site-specific.</p>

5 Possible Human Remains Identified

Procedures in the event of the discovery of human remains during development are covered in depth by the Tsleil-Waututh Ancestral Remains Policy (Appendix B) and an Archaeology Branch Policy Statement (Appendix C). A summary of these procedures is presented below.

5.1 Initial Action by Proponent and Contractors

1) Stop Work

Immediately cease all development activities in the area of the suspected human remains.

2) Contact an Archaeologist

An archaeologist should be contacted as soon as possible.

3) Seek Guidance from the Archaeologist

The archaeologist will provide guidance regarding further action.

5.2 Initial Action by Archaeologist

1) Contact Authorities

Archaeologist will contact the Archaeology Branch, and if warranted, municipal police or RCMP, and/or the Office of the Coroner.

2) Contact First Nations

Archaeologist will contact local First Nation community and inspect the site.

3) Plan Site Management

If the remains are deemed to be archaeological, the archaeologist will begin negotiations to appropriately manage them.

5.3 Human Remains Management Options

The handling of human remains believed to be archaeological in nature requires communication with, and cooperation of, the relevant First Nations groups. Generally, there are two possible courses of action that are followed. More detailed information with respect to the process is presented as Appendix C.

Avoid

The development project is redesigned to completely avoid the found human remains. An assessment should be made as to whether the remains may be affected by residual or accumulative impacts associated with the development, and properly addressed by a comprehensive management plan.

Exhume

Exhume the remains in a manner considered appropriate by the First Nation groups. This will involve the predetermination of a site suitable for the reburial of the remains. Certain ceremonies or procedures may need to be followed before development activities can resume in the area of the discovery.

First Nations' (Indigenous Peoples') ancestral remains are of the utmost importance to descendant communities. First Nations expect all developers and their contractors to follow specific cultural protocols any time ancestral remains are identified in development areas. In cases where no specific protocols exist, local First Nations should be involved in the development of a culturally appropriate and respectful ancestral remains management plan.

6 Legislation

Most archaeological sites including *any* site pre-dating AD 1846, all ancestral burials, indigenous rock paintings or carvings, and ship and aircraft wrecks older than 2 years are automatically protected under Section 13 of the *Heritage Conservation Act*. Whether these sites are recorded or not, they must not be altered in any way without a permit issued by the Archaeology Branch.

Other cultural heritage sites may be designated by a local government (e.g., historic buildings) or by agreement between the Province and First Nations. These sites are also protected from alterations of any kind without a permit.

Altering an archaeological site without a permit will result in:

1. Immediate stoppage of work, and/or
2. Penalties of up to \$1,000,000 or 2 years imprisonment.

Contact information for the Archaeology Branch can be found at the beginning of this document.

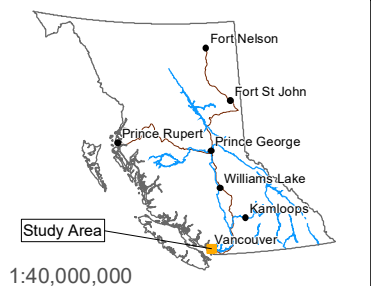
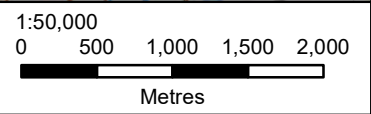


Figure 1. Location of Cascadia Phase 4 Project Area

Terra ID: 20-1347-002
 Client: CP Rail
 HCA Permit: 2018-0282
 Date Produced: 2020-09-28
 Coordinate System: NAD 1983 UTM Zone 10N
 Topographic Data Source: CanVec courtesy DataBC – 2017-12-15

- | | | | |
|--|---|--|----------------|
| | Study Area | | Power Line |
| | New Archaeological Site Boundary | | Pipeline |
| | Original Archaeological Site Boundary | | Trail |
| | Previously Recorded Archaeological Site | | Contour |
| | Building | | River/Creek |
| | Highway | | Waterbody |
| | Main Road | | Indian Reserve |
| | Secondary Road | | Wooded Area |
| | Railroad | | |

Service Layer Credits:



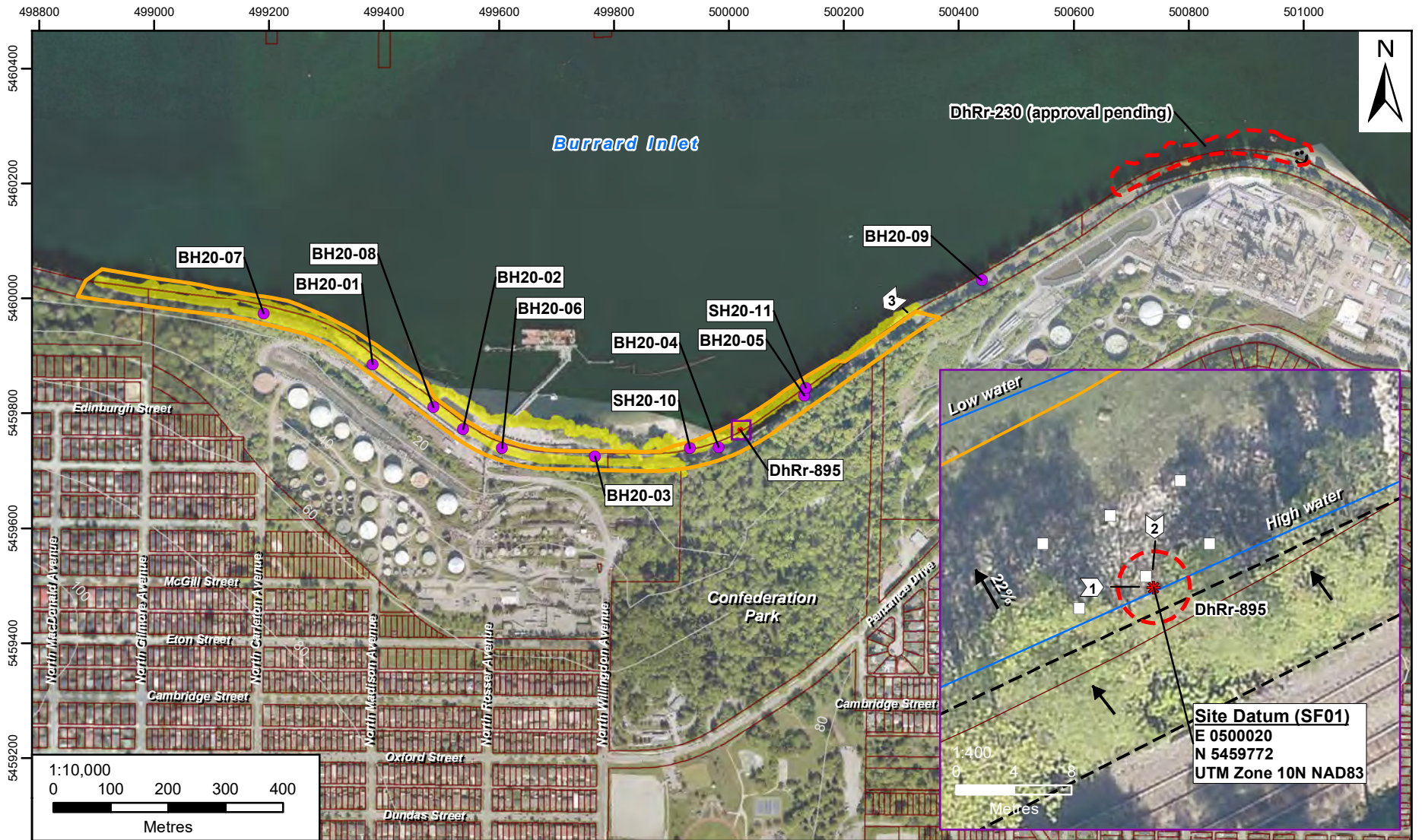


Figure 2. Cascadia Phase 4 Study Area and Archaeological Site DhRr-895

Terra ID:	20-1347-002
Client:	CP Rail
HCA Permit:	2018-0282
Date Produced:	2020-09-28
Coordinate System:	NAD 1983 UTM Zone 10N
Topographic Data Source:	CanVec courtesy NRCAN – 2019-07-24
Imagery Currency:	2018-04-26 and 2019-05-08
Temporary Site Number:	20-1347-002-T01
Borden Number:	DhRr-895
Date of Site Visit:	2020-06-22

- | | | |
|---------------------------------------|----------------------------------|----------------|
| Study Area | New Archaeological Site Boundary | Contour |
| Original Archaeological Site Boundary | Surface Find | CPR Embankment |
| Negative Shovel Test (0.35 x 0.35 m) | Direction of Slope | Water Line |
| Borehole | Cadastral Boundary | Photo Location |
| Survey Coverage | | |



Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

Appendix A: Site Identification Guide

A number of site types may occur in the area, including but not limited to:

- artifacts (lithics, bone, antler and teeth),
- midden (with or without shell),
- wet sites (basketry and wooden objects),
- marine harvesting (fishing weirs and clam gardens),
- cooking features (hearths and fire-altered rock),
- cultural depressions,
- mounds or cairns,
- painted or carved stone, and
- culturally modified trees.

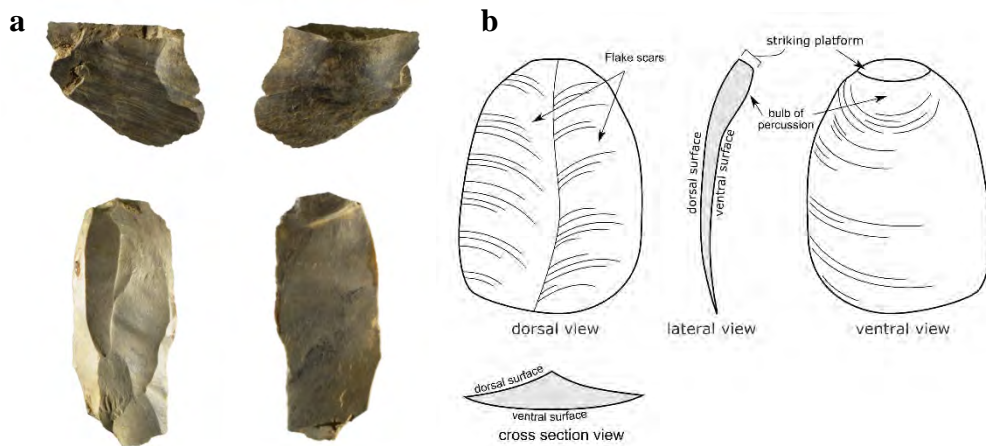
Characteristics typical of some of the sites that may be found in the project area are provided in the text and figures on following pages.

Artifact Scatters

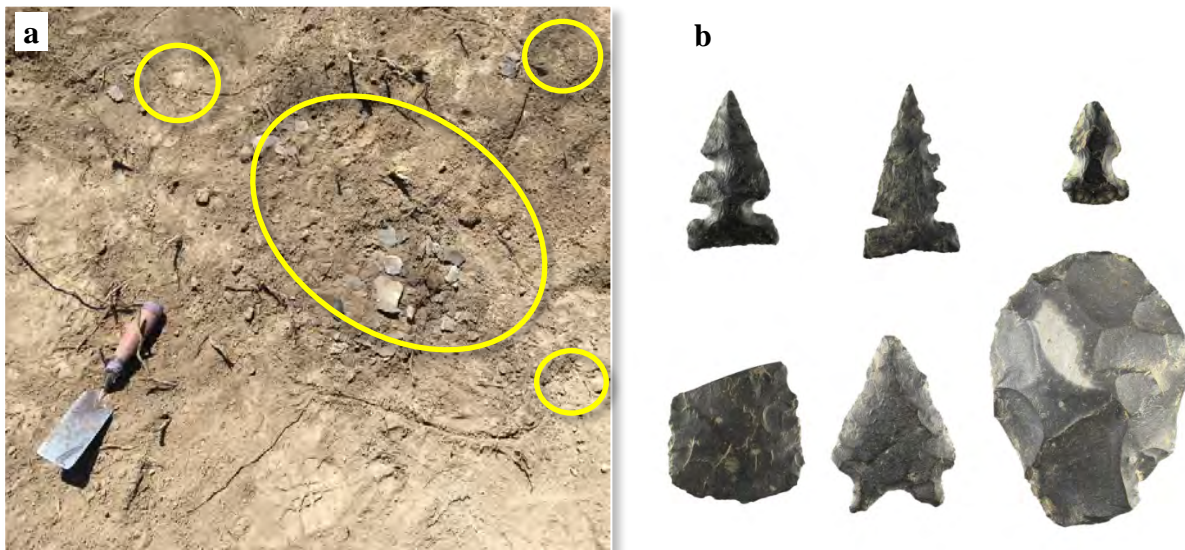
Lithic (stone) scatters from the production and maintenance of stone tools are the most common archaeological site type found in the region. Other materials which may be represented in artifact scatters include **bone**, **antler**, and **tooth**. Descriptions and illustrations are provided below and on the following pages.

Lithic Artifacts – What to look for:

- Small, thin, sharp pieces of stone that appear to be out of place with natural stone
- Glassy stone
- Stone that appears to have been chipped or formed
- An obvious bulb and curve on a thin piece of stone
- Stress ripples along the faces of flakes and scars
- Parallel striations from intentional grinding
- Intentional pecking



(a) Four views of a typical stone flake; (b) basic flake characteristics



(a) Lithic scatter uncovered during development; (b) formed flaked lithic artifacts



Pecked and ground stone artifacts

Bone, Antler, and Tooth Artifacts – What to look for:

- Obvious shaping
- Striations
- Graving/incising
- Unnatural perforations



Bone and antler artifacts

Midden

Middens are large accumulations of household waste, such as shell, bone, and other organic material. Midden appears as very dark (black) layers of soil, most commonly with significant concentrations of shell. In disturbed areas, midden appears in small pockets, while larger intact midden deposits may cover an area the size of a city block. Shell midden also facilitates the preservation of bone and antler artifacts.

Midden – What to look for:

- Black, greasy soil
- Dense accumulations of broken or whole shell
- Fire-altered rock (see next section) and burned bone or wood



(a) Crushed shell and dark soil in an auger test; (b) shell midden eroding from a root exposure.

Wet Sites and Marine Harvesting

Preserved organic remains are commonly found in areas that are waterlogged or seasonally underwater, or were waterlogged prior to modern development. Sites within current or former wetlands or intertidal zones have the potential to preserve wooden structures, such as fish traps, as well as basketry, cordage, and clothing. Clam gardens can be observed on beaches; these were constructed by building a rock wall at the low tide mark to allow for sediments to accumulate in the intertidal zone, which creates a flatter beach and an optimal environment for clams and other shellfish.

Wet Sites – What to look for:

- Rounded wooden stakes with roughly sharpened ends
- Weaved fibrous material such as basketry
- Twisted fibrous material such as cordage



(a) Sharpened fish weir stake from Fraser River Delta (Eldridge and Mackie 1993); (b) basket fragment recovered from a wet site.

Fire-altered Rock, Hearth Features, and Cultural Depressions

Fire-altered rock (FAR) results from the cultural use of fire during cooking, heating, and processing activities. FAR is often associated with other features including hearths and cultural depressions but can also be thinly scattered due to taphonomic processes or concentrated from dumping events away from the features from which they were first associated.

Fire-altered Rock – What to look for:

- Concentrations of roughly fractured rock from rapid heating and cooling
- Rock showing signs of burning or oxidation
- Reddening or blackening of surrounding matrix



Sorted piles of fire-altered rock excavated from a cooking feature.

Hearth Features – What to look for:

- Fire-altered rock
- Reddening or blackening of the matrix
- Charcoal
- Layering of the above elements
- A depression associated with the above elements



(a) Hearth feature uncovered during machine excavation; (b) hearth feature exposed in wall of archaeological excavation with fire-altered rock piled nearby.

Cultural Depressions – What to look for:

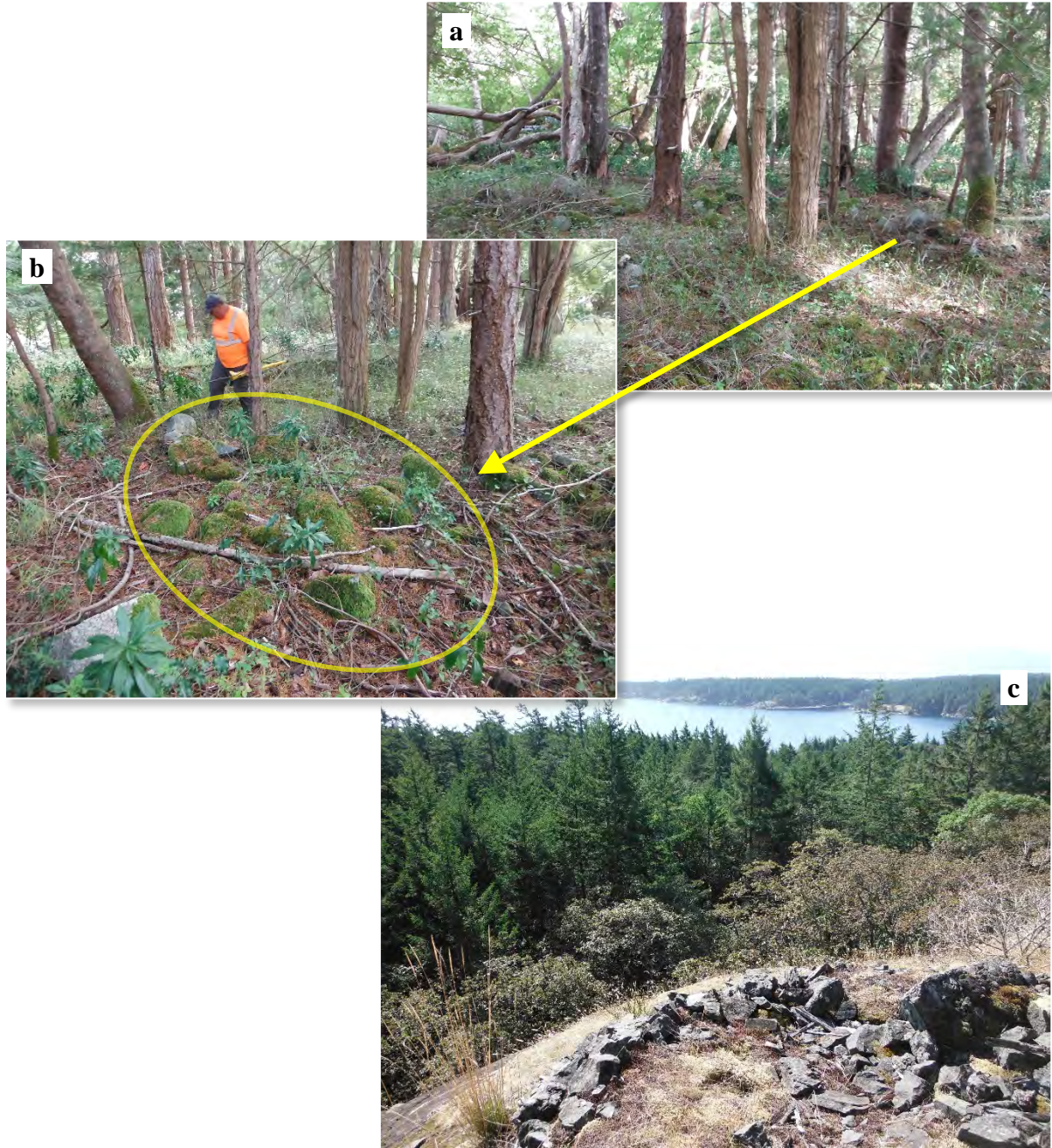
- Subtle to deep scours on the surface that are circular to rectilinear in shape
- A raised rim along the edge of a depression
- Depressions associated with artifacts and fire-altered rock
- Depressions associated with fire-reddening and blackening



a) Depressions associated with a pit house site; b) the edge of a pit house identified in an excavation unit; c) a cache pit depression in a forested environment; d) a cache pit exposed during development; e) a roasting pit exposed during development; f) a roasting pit exposed and excavated.

Cairns, Mounds, and Earthworks

Cairns are structures or piles of loose boulders and cobbles and may mark burials, significant spiritual sites or historical landmarks. Other types of structures signifying archaeological sites include mounds of soil which may mark burials, and earthworks such as defensive walls or ditches.



(a) A group of burial cairns built from large cobbles and boulders; (b) close-up of a burial cairn; (c) a semicircular rock blind overlook.

Culturally Modified Trees

Culturally modified trees (CMTs) have been altered by Indigenous people as part of their traditional use of the forest. They can be stripped of bark (leaving a characteristic scar), aboriginally logged, have kindling or pitch removal scars, or modified to mark a trail (blazes, arboglyphs).

CMTs – What to look for:

- On lodgepole pine trees, look for a 40–160 cm long and <20 cm wide scar which may have cut marks on the top or bottom of the scar face.
- On cedar trees, look for signs of bark stripping or plank removal or test holes.



(a) Evidence of cultural modification - plank removal scars on western redcedar (CMT Handbook 2001); (b) bark-stripped, lodgepole pine culturally modified tree typical in the interior of B.C.

Appendix B: Tsleil-Waututh Nation Ancestral Remains Policy



TSLEIL-WAUTUTH NATION

People of the Inlet



Tseil-Waututh Nation has approved a set of procedures regarding encountering ancestral remains; these steps are described below.

- **Stop Work.** Stop work procedures are expected to be enacted every time a burial of human bone is encountered. This includes disarticulated or scattered human remains, not only intact burials.
- **Contact.** Ensure that an appropriate TWN cultural, political, and staff representatives are on site in addition to the TWN archaeological monitor to ensure appropriate handling of ancestral remains.
- **Protect.** If it is necessary to remove ancestral remains from the ground, ensure that they are appropriately packaged and protected. In addition to standard archaeological packaging materials, this also entails wrapping the remains in a blanket and placing them in a cedar box lined with cedar boughs.
- **Relocate.** Ancestral remains can be temporarily relocated to a secure, safe facility that has been approved by TWN. Ensure that ancestral remains are to be transported as little as possible.
- **Secure.** After ancestral remains are located, TWN will work with the developer, Provincial agents, and professional archaeologists to ensure that the site is not further impacted or threatened by looters. TWN requires 24 hour surveillance and security on high profile sites.
- **Cultural Ceremony.** At the conclusion of the archaeological work at these cultural heritage sites, TWN insists that the location is cleansed with an appropriate ceremony by a designated TWN representative.
- **Reburial.** TWN encourages that the ancestral remains are reburied as close to their original placement as possible, but so that they will not be further disturbed (subject to agreement with other First Nations).

Contact Information

If ancestral remains are encountered, please contact one of the following individuals in the order provided, AS QUICKLY AS POSSIBLE:

1. Ginevra Toniello: office 604-924-4188, cell 778-227-4709
2. Michael George: office 604-924-4163, cell 604-356-8768
3. Ernie George: office 604-924-4183, cell 604-290-3777

Appendix C: Archaeology Branch Found Human Remains Policy

Issued: September 22, 1999

PURPOSE:

The purpose of this directive on found human remains is to provide guidelines to Archaeology Branch staff, archaeologists, other agencies and the public as to branch procedures for handling human remains that may be protected under the Heritage Conservation Act (1996, RSBC, Chap. 187), and to facilitate the respectful treatment of these remains.

MANDATE:

Pursuant to section 13(2)(b) of the *Heritage Conservation Act* (HCA), a permit is required under section 12 or 14 before a person can undertake any actions affecting a burial place of historical or archaeological value, human remains or associated heritage objects.

AUTHORITY:

The Director of the Archaeology Branch and the Manager, Permitting and Assessment Section, have been authorized to exercise the powers of the Minister to issue permits under sections 12(2) and 14(2), as well as ministerial orders under section 14(4) where necessary for emergency conservation purposes.

POLICY STATEMENT:

Upon notification of the discovery of human remains that are not of forensic concern, the Archaeology Branch will take steps to facilitate the respectful handling and disposition of those remains within the limits of existing funds and program priorities.

PROCEDURES

The following procedures will normally apply in cases where human remains are discovered fortuitously through various land altering activities such as house renovations, road construction or natural erosion; or during archaeological studies conducted under an *HCA* permit:

1. Fortuitous Discoveries

In cases where the branch has been notified that human remains have been discovered by chance, the following procedures should normally apply:

- the Coroner's Office and local policing authority should be notified as soon as possible.
- the Coroner's Office should determine whether the matter is of contemporary forensic concern. The branch may provide information and advice that may assist in this determination.
- if the Coroner's Office determines the reported remains are not of forensic concern, the branch will attempt to facilitate disposition of the remains.
- if a cultural affiliation for the remains can be reasonably determined, the branch will attempt to contact an organization representing that cultural group.
- if remains are determined to be of aboriginal ancestry, the branch will attempt to contact the relevant First Nation(s).
- generally, if remains are still interred and are under no immediate threat of further disturbance, they will not be excavated or removed.
- if the remains have been partially or completely removed, the branch will facilitate disposition.

Archaeological Chance Find Procedures

- if removal of the remains is determined to be appropriate, they will be removed under authority of a permit issued pursuant to section 12 or 14, or an order under section 14 of the *HCA*, respecting the expressed wishes of the cultural group(s) represented to the extent this may be known or feasible.
- if circumstances warrant, the branch may arrange for a qualified physical anthropologist or an archaeologist with training in human osteology to provide an assessment of the reported remains in order to implement appropriate conservation measures.
- analysis should be limited to basic recording and in-field observations until consultation between the branch and appropriate cultural group(s) has been concluded.

2. Permitted Archaeological Projects

In cases where human remains are encountered in the course of a permitted project, the Archaeology Branch should be contacted as soon as possible.

- the remains are to be handled in accordance with the methods specified in the permit, respecting the expressed wishes of the cultural group(s) represented, to the extent that these may be known or feasible.
- if the permit does not specify how remains are to be handled and if the cultural affiliation of the remains can be reasonably determined, the field director or permit-holder should attempt to contact an organization representing that group. The permit-holder or field director should advise the branch of the organization contacted, and any wishes expressed by that organization.
- the branch, in consultation with the appropriate cultural group(s), will determine disposition of the remains.
- analysis should be limited to basic recording and in-field observations, until consultation between the branch and appropriate cultural group(s) has been concluded.