VANCOUVER FRASER PORT AUTHORITY
CONTRACT NUMBER: #20-0173

PRELIMINARY DESIGN REPORT FOR THE FRASER SURREY PORT LANDS TRANSPORTATION IMPROVEMENTS

GREATER VANCOUVER GATEWAY PROGRAM

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GREATER VANCOUVER GATEWAY PROGRAM

FRASER SURREY PORT LANDS

REPORT (FINAL)

PROJECT NO.: 20M-00758-00
CLIENT REF:#20-0173
DATE: MAY 14, 2021

WSP
SUITE 1000
840 HOWE STREET
VANCOUVER, BC, CANADA V6Z 2M1

T: +1 604 685-9381
F: +1 604 683-8655
WSP.COM

May 14, 2021

Vancouver Fraser Port Authority
Senior Construction Project Specialist
Vancouver Fraser Port Authority
100 The Pointe, 999 Canada Place
Vancouver, B.C. V6C 3T4

Attention: Vinil Reddy, M.Sc., MBA, PMP, P.Eng., ENV SP

Dear Vinil:

Subject: Fraser Surrey Port Lands Transportation Improvements - Preliminary Design Report
Client ref.: #20-0173

WSP is pleased to submit our Preliminary Design Report (PDR) for your review and consideration. The PDR presents the WSP Team's preliminary design, rationale, and plans for improving road network to serve current and future transportation needs through the Fraser Surrey Port Lands Transportation Improvements Project. The report also includes all technical memorandums provided by various disciplines.

We appreciate collaborating with you and many other stakeholders at VFPA and FSPL on this assignment and look forward to your feedback.

Yours sincerely,

Cozmin Radu
Manager, Transportation
Engineering, BC

WSP ref.: 20M-00758-00 DESIGN CRITERIA-FSPL_R0

SUITE 1000
840 HOWE STREET
VANCOUVER, BC, CANADA V6Z 2M1

T: +1 604 685-9381
F: +1 604 683-8655
wsp.com

REVISION HISTORY

FIRST ISSUE

18 December 2020	DRAFT PRELIMINARY DESIGN REPORT			
Prepared by	Reviewed by	Approved By		
Kelly Yang, EIT	Robert Livingston, P.Eng.	Valentino Tjia, P.Eng.		

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29 April 2021	PRELIMINARY DESIGN REPORT			
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Kelly Yang, EIT	Valentino Tjia, P.Eng.	Valentino Tjia, P.Eng.		

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Kelly Yang, EIT	Cozmin Radu, P.Eng.	Cozmin Radu, P.Eng.		

SIGNATURES

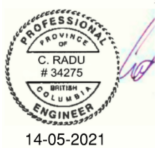
PREPARED BY

May 14, 2021

Kelly Yang, EIT, ENV SP
Junior Engineer, Transportation West

Date

APPROVED[1] BY



May 14, 2021

Cozmin Radu, M.Sc., P.Eng.
Manager, Transportation Engineering BC

Date

[1] Approval of this document is an administrative function indicating readiness for release and does not impart legal liability on to the Approver for any technical content contained herein. Technical accuracy and fit-for-purpose of this content is obtained through the review process. The Approver shall ensure the applicable review process has occurred prior to signing the document.

CONTRIBUTORS

CLIENT

VFPA, Land Operations and Security	Marcus Siu, P. Eng. Tony Benincasa Dennis, Bickel, P.Eng.
VFPA, Engineering	Vinil Reddy, P.Eng.

WSP

Geotechnical, Pavement Design	Shawn Lapain, P.Eng
Geotechnical	Lalinda Weerasekara, P.Eng.
Utilities and Drainage	Rob Moore, P.Eng.
Environmental	Michael Taylor, BLA, MRM Marina Makovetski, P.Ag.
Sustainability	Nicole Montgomery, M.Sc., LEED AP BD+C
Asset Management	Neil Forrest

SUBCONSULTANTS

Electrical (PBX)	Julian Vasques, P.Eng. and Rob Grant, P.Eng.
Geomatics (Geoverra)	Kent Watson, LSIT

TABLES

FIGURES

APPENDICES

EXECUTIVE SUMMARY

The WSP Team has completed a Preliminary Design Report for the Fraser Surrey Port Lands Transportation Improvements (FSPL-TI) Project, located in the City of Surrey.

The Vancouver Fraser Port Authority (VFPA) is working with the consulting team (WSP Team and its subconsultants) to deliver the FSPL-TI Project to a preliminary engineering design level. The site currently has one major thoroughfare within the Project Site called the Robson Road-Timberland Road North Corridor that serves major port tenants within the Fraser Surrey Port Lands (FSPL).

VFPA Engineering proposes to realign this Corridor to improve the road network and ease congestion in the area by moving majority of traffic from Timberland Road North to Timberland Road South. The primary benefit of moving majority of traffic is to avoid delays caused by frequent stop-go traffic operations caused by existing rail crossings on Timberland Road North. The realigned road Corridor, called **Robson Road-Timberland Road South Corridor**, also provides the benefit of removing the separation between the IDC Yard and DP World Fraser Surrey's (DPWFS) Container Yard, thereby improving operational efficacy for DPWFS and FSPL overall. The FSPL-TI Project involves the implementation of several transportation-related improvements involving Geotechnical, Rail, Transportation, Utilities and Drainage, Electrical, and Environmental elements.

In this PDR, the following terms will be used to describe the existing and proposed road Corridor as part of the FSPL-TI Project:

- **FSPL:** Fraser Surrey Port Lands is an industrial area situated alongside Highway 17 at Tannery Road, bordering the municipalities of Surrey and Delta.
- **FSPL-TI Project**: the road improvements project outlined in this PDR located in FSPL.
- **Timberland Road North:** existing road within FSPL
- **Timberland Road South:** existing road within FSPL. This project will extend Timberland Road South such that this road will directly connect to Robson Road.
- **Robson Road-Timberland Road North Corridor:** existing road Corridor used as the main thoroughfare at FSPL consisting of Robson Road, Timberland Road North, and Timberland Wye Intersection.
- **Robson Road-Timberland Road South Corridor***:* proposed road Corridor as part this Project and will function as the new main thoroughfare at FSPL by disconnecting Timberland Road North. The existing Timberland Road South will be extended and connected directly to Robson Road. The Corridor consists of Robson Road, Timberland Road South, and Timberland Wye Intersection.

TOPOGRAPHIC SURVEY

A topographic survey was conducted to provide basis for the design of the new roadway alignment at the FSPL. A combination of conventional survey, GPS Real Time Kinematics (RTK), and terrestrial laser scanning was used to perform the topographic survey for the Project area.

GEOTECHNICAL INVESTIGATION

WSP undertook a geotechnical subsurface exploration to obtain soil and groundwater parameters along the proposed road alignment where previous test holes are absent; the exploration also provided a basis for gathering information related to long-term settlement caused by peat, organics and fine-grained materials, liquefaction potential, and post-seismic displacements. A design life of 20-year was considered and according to this design, the following pavement structure is recommended for new road sections required for the IDC Yard area:

Layer	Thickness (mm)
Hot Mix Asphalt	200
Granular Base Material	200
Granular Subbase Material	925

The following pavement structure along the Corridor where pavement rehabilitation is recommended up to the granular base layer:

Roadway	Elevator Road	Robson Road	Timberland Road South
Material Type		Depth (mm)	
Surface Course Layer	50	50	50
Lower Course Layer #1	50	100	100
Lower Course Layer #2	100	100	100
New Crushed Granular Base	200	200	200

At Elevator Road and Robson Road, mill and overlay of the existing asphalt pavement is required. We understand that this section of the road is planned for future upgrade. In the short-term, periodic rehabilitations using mill and resurfacing may be conducted since extensive pavement rehabilitations are not cost effective.

Pavement rehabilitation and road widening will be conducted on the existing Timberland Road South as this section of the Corridor is anticipated to remain for the during of the design service life. Partial ditch-infilling will be required along the west ditch of Timberland Road South as a result of widening the road. Given the depth of peat and groundwater level, excavation and replacement of peat in this section of the alignment is impractical and too costly. To reduce the potential differential settlements given the depth of peat and groundwater, we recommend ditch infilling to be carried out using light-weight fill.

AT-GRADE RAIL CROSSINGS

Railway Crossing Safety Assessments on nine grade crossings within FSPL were conducted and updates the previous Railway Crossing Assessments undertaken by WSP. At-grade rail signal designs are proposed to be completed for Crossings 75, 65, 57, and the new crossing at the IDC Yard. These crossings are owned by VFPA and will require the following crossing treatment:

Rail Crossing	Crossing Treatment
VFPA Crossing #75 (01)	Extend crossing surface by 0.5m, clear sightline areas, repaint double stop bars and railway crossing symbol, install FLBG with DTMF capability
VFPA Crossing #65 (02)	Extend crossing surface by 0.5m, repave crossing surface to be smooth and continuous repaint double stop bars and railway crossing symbol, install FLBG with DTMF capability
VFPA Crossing #57 (04)	Extend crossing surface by 0.5m, repave crossing surface to be smooth and continuous repaint double stop bars and railway crossing symbol, install railway crossing sign, advisory speed sign, install FLB with DTMF capability
New Crossing at IDC Yard	Install new crossing surface and extend by 0.5m, paint double stop bars and railway crossing symbol, install railway crossing sign and other signage as required, install FLBG warning system with DTMF capability

At-grade rail signal designs are proposed to be completed for Crossings 54 and 49. These Crossings are owned by SRY and from correspondence with SRY, they have indicated they can complete the design and installation of rail signal designs at these locations based on our Rail Safety Assessment. Note that further discussion between VFPA and Surrey or a Rail Crossing agreement will be required to get this process started.

Rail Crossing	Crossing Treatment
VFPA Crossing #54 (05)	Repaint railway crossing symbol and hatching pavement marking, install FLB with DTMF capability
VFPA Crossing #49 (Timberland Wye)	Install emergency notification signs, paint railway crossings, install FLBG warning system with DTMF capacity, install traffic signal interconnected with FLBG warning system

Crossings 51 and 50 are along VFPA's spur track on Timberland Road North and will be removed.

TRAFFIC ANALYSIS

A traffic analysis was conducted to obtain more information regarding the existing conditions and impact of changes on the proposed road network geometry of Robson Road-Timberland Road South Corridor. As well, specific impacts were assessed as a result of the implementation of the reservation system for DPWFS's container terminal entry. The results indicate

1 Removal of the originally proposed four (4) truck staging lanes to a single auxiliary lane is warranted as the reservation system minimises the peak demands. The single auxiliary lane with a wide 3-metre shoulder should still be provided in case of special events or lower service rates than usual at gates.

2 Removal of the originally proposed northbound to westbound left turn lane from Timberland Road South to Timberland Road North with provision is for a wider shoulder is recommended so traffic can pass the occasional left-turning vehicles.

3 A new traffic signal is warranted and should be considered at the Timberland Wye Intersection in conjunction with the addition of flashing lights, bells and gates that is planned at this railway crossing. Discussions should be held between the road authority and the railway to determine a mutually agreeable course of action.

4 Addition of a southbound right-turn lane length from Timberland Road to Timberland Road North will provide storage for vehicles when a train occupies the crossing.

ROADS

As discussed with stakeholders, one road alignment has been developed in which the preferred alignment connects to two existing roads, Timberland Road South and Robson Road, with a two-lane paved road that runs along the southern edge of the IDC Yard; the resulting Robson Road-Timberland Road South Corridor will function as the new main thoroughfare road.

The proposed realigned Robson Road-Timberland Road South Corridor is intended to maintain a two-lane traffic flow within FSPL. There are minimal roadway design changes to Timberland Road South and Robson Road as the intent is to improve the pavement and drainage conditions at these two locations. The realigned Robson Road-Timberland Road South Corridor requires securement of lease areas and potential land acquisitions of current lease holders within FSPL.

DRAINAGE

The drainage system shall be designed to meet the following servicing objectives, as per the City of Surrey Design Criteria Manual:

- A minor system, with a conveyance capacity up to the 1:5-year return period storm under free flow conditions, to minimize inconvenience of frequent surface runoff.
- A major system, with a conveyance capacity up to the 1:100-year return period storm, to provide safe conveyance of flows and to minimize damage to life and property.

A drainage analysis was completed for the post-development condition to size the proposed stormwater management facilities. The sizing is calculated based on the proposed pervious and impervious catchment area conditions in combination with the size of the catchment. It is recommended that the VFPA implement a site-wide solution with respect to resolving the issues of flooding of the FSPL site from the Fraser River. Raising this road as an isolated project is not economical or practical.

ENVIRONMENTAL

As the Project site is located within a historic and current commercial and industrial area, the following concerns have been considered and depending on the outcome, additional assessments and analyses may be warranted:

1 Ecological: An Environmental Overview Report (EOR) has been completed with the objective to conduct fisheries, wildlife and vegetation desktop information review and to identify additional field work and research required to support the preparation of the detailed environmental assessment (EA) report.

High-level potential project interactions are summarized below:

Project Activities	Potential Effect
- **Widening/realignment of existing roads** - **Construction of new roads**	- Disturbance/removal of terrestrial vegetation, shrubs, and trees - Direct mortality, physical injury or behavioural change to birds due to habitat disturbance or removal of nests - Direct/indirect effects to listed rare/sensitive vegetation species
- **Riparian area and in-stream work**	- Decrease in water quality due to sedimentation or mobilization of historical soil contamination - Disturbance/loss of riparian area of in-stream freshwater habitat - Direct mortality, physical injury, or behavioural change to fish due to in-stream works

A detailed EA Report is in development and will incorporate findings from recent site visits. The report will also include the information requirements identified and describe proximity to sensitive receptors as well as impacts to land, water, air, and community.

2 Potential Soil Contamination: Phase I and II Environmental Site Assessments (ESA) have been conducted. Phase I ESA has been completed to assess potential risk of encountering contaminated media during construction activities. Phase II ESA investigation has been completed to confirm the level of contamination as per initial findings from Phase I ESA.

3 Unknown Archaeological Sensitive Areas: An Archaeological Overview Assessment has been carried out by Wood on behalf of VFPA for the FSPL project with the understanding that the project objective is to realign and upgrade sections of Robson Road-Timberland Road South Corridor, including intersection reconstruction, road realignment, and construction of two VACS gates and associated utility, electrical, and communication works. Based on the results of this report and native, intact sediments encountered below the fill layer during geotechnical monitoring, it is recommended that no further archaeological assessment is required if construction impacts are conducted entirely within the existing fill or within any new fill added in addition to existing fill and additional archaeological investigation in the form of construction monitoring be undertaken where construction impacts are expected to extend into the native, undisturbed sediments underlying the imported fill.

An initial list of permits, approvals, and authorizations has been prepared to address the regulatory requirements and carrying out the project through construction.

The sustainability team has been engaged to understand the Envision certification level that may be achievable based on the current design of the FSPL-TI Project and understanding of operations at FSPL in the future.

Stakeholder consultation was conducted with both external and internal VFPA departments to address all possible stakeholder requests in the design with consideration for cost and feasibility.

A project schedule for the FSPL-TI Project and Class C cost estimate has been prepared for the construction of this project.

PROJECT AND ENVIRONMENTAL REVIEW (PER) SUBMISSION

The following table summarizes studies, reports, and memoranda that have been provided in support of the Project and Environmental Review (PER) submission for the FSPL-TI Project; these studies are also referenced in this PDR:

DISCIPLINE	STUDIES AND REPORTS
GEOTECHNICAL	- Geotechnical Report
RAIL	- Rail Crossing Safety Assessment
TRAFFIC AND ROADS	- Traffic Analysis Memorandum - Construction and Traffic Management Memo
DRAINAGE	- Preliminary Stormwater Management Plan
ENVIRONMENTAL	- Environmental Overview Report - Construction Environmental Management Plan - Biophysical Survey and Assessment Report - Vegetation Plan - Nesting Bird Survey Report - Species-at-Risk Assessment Report - Invasive Species Assessment Report - ESA Phase I and II Reports - Archaeological Overview Assessment Report - Envision Baseline Performance Assessment Report
FINANCIAL	- Financial and Life Cycle Cost Analysis
ASSET MANAGEMENT	- Preliminary Asset Management Plan

ABBREVIATIONS

Key abbreviations used in this document is listed below:

BC MoTI	British Columbia Ministry of Transportation and Infrastructure
BHP Billiton	Broken Hill Proprietary Billiton
BMP	Best Management Practice
BNSF	Burlington Northern Santa Fe Railway Company
CB	Catch Basin
CCME	Canadian Environmental Quality Guidelines
CN	Canadian National Railway
CP	Canadian Pacific Railway
CoS	City of Surrey
EOR	Environmental Overview Report
FSPL-TI Project	Fraser Surrey Port Lands Transportation Improvements Project
GCM	Government Control Monument
GHG	Green House Gas Emissions
GVG	Greater Vancouver Gateway 2030
GVRD	Grater Vancouver Regional District
IG	Indigenous Groups
ISI	Institute for Sustainable Infrastructure
MV	Metro Vancouver
PDR	Preliminary Design Report
RoW	Right of Way
SFPR	South Fraser Perimeter Road
SRY	Southern Railway of British Columbia
TMP	Traffic Management Plan
VACS	Vehicle Access Control System

1 INTRODUCTION

WSP Canada Inc. (WSP) and PBX Engineering (PBX) has prepared this Preliminary Design Report (PDR) for the Vancouver Fraser Port Authority (VFPA) for the proposed Fraser Surrey Port Lands Transportation Improvements Project (FSPL-TI Project or Project). This report includes an overview of the preliminary design work completed to date, implementation of stakeholder consultations, geotechnical findings, environmental assessment, costs and evaluation of road and rail operations.

The Project, located within City of Surrey, is bordered by the Timberland Wye forked intersection to the north, Fraser River to the west, Highway 17 or known as South Fraser Perimeter Road (SFPR) to the east, and Elevator Road to the south. Currently, there is one major thoroughfare within the Project site, Robson Road-Timberland Road North Corridor, that serves major port tenants within the FSPL including:

- DPWFS, who recently took over from Fraser Surrey Dock (FSD);
- FGT, which will be in full operation in 2022;
- Paper Excellence, formerly Catalyst Paper;
- Mainland Sand and Gravel;
- DBA TMS Transportation;
- Republic Services of BC;
- Western Cleanwood Preservers; and
- Interfor.

Another major port operator is Seaspan, who is not a VFPA's tenant, but its site is located within the FSPL. This main road also provides the only access to City of Delta's residents along Gunderson Road and Alaska Way.

A secondary access road, off Timberland Wye forked intersection, called Timberland Road South, provides access to Westran and CP, who operate the welding yard. It is our understanding that CP will vacate the site by April 2021.

1.1 PROJECT DESCRIPTION

The FSPL-TI Project is a part of the Greater Vancouver Gateway (GVG) 2030 Program. GVG 2030 is the Gateway Transportation Collaboration Forum's strategy for smart infrastructure investment in removing bottlenecks impeding the growth of trade, while addressing community impacts of good movement and population growth. Removing capacity constraints and freight bottlenecks will help grow the economy, create well-paying jobs and support liveable, green communities with improvements to safety, mobility and air quality. The FSPL-TI Project is one of the five projects that received funding in 2019 application intake for the Federal National Trade Corridors Fund (NTCF).

Robson Road-Timberland Road North Corridor acts as the central spine of the road network within FSPL. Efficient truck flow in the road network is of great importance due to the industrial purpose of the area, as well as providing connectivity with residents. There are recent developments in the area, including growth in container volumes at DPWFS and the planned opening of the Fraser Grain Terminal (FGT) in 2022, that pose future traffic operations challenges. In addition, planned future projects will impact the land use within the project area. The objective is to enhance a design that would solve the current traffic operations, while anticipating future land use changes within the project site.

1.2 PROJECT OBJECTIVES

The Project's main objective is to improve the road network within FSPL to ease congestion in the area. The Project will support VFPA's core mission to enable Canada's trade objectives through sustainable development that protects the environment as well as local communities. This project will provide several benefits to the port tenants, road

users, and rail operations such as improved public safety, more reliable commute times, reduced noise levels, reduced Green House Gas (GHG) emissions, reduced congestion, and improved freight capacity.

The full Project scope can be split in three main components as detailed below and includes the following transportation-related improvements:

1 **Upgrades to At-Grade Railway Crossings**

With extensive amounts of un-signalized railroad crossings along Timberland Road North, vehicles drivers experience stop-go movements as they approach crossings which add delays to already slow-moving traffic in the area. Upgrading the at-grade rail crossings at FSPL will improve the safety and efficiency of road users driving within FSPL:

- Upgrades to six at-grade rail crossings (five signalized crossings);
- Installation of one new at-grade crossing across the lead tracks to the IDC Yard; and
- Removal of two at-grade crossings along VFPA's spur line on Timberland Road North.

2 **Rehabilitation and Extension of Timberland Road South and Upgrades to Timberland Wye Intersection and Timberland Road North**

Realignment of the main thoroughfare with the introduction of Timberland Road South as the main access road within FSPL will enable most road users to avoid conflicts with at-grade rail crossings along Timberland Road North. The Project will also provide the long-term rail footprint in the area for trains servicing the planned future terminals. With majority of truck traffic being directed to the new road alignment, this eases up traffic flow on the existing Timberland Road North. Note that majority of the construction works for this project falls in this component:

- Constructing the Timberland Road South extension including ditch infilling, concrete curbing, median barriers, fencing, gates, crash attenuators, driveways, signage, and pavement markings (approx. 840 m long, 15,600 sq. m);
- Regrading the previously occupied CP lease area to facilitate drainage (approx. 5230 sq. m);
- Rehabilitating the pavement along the existing Timberland Road South, Timberland Road North, Timberland Wye Intersection, including localized road widening (approx. 660 m long, 8450 sq. m);
- Partially infilling the ditch west of the existing Timberland Road South to create a new westbound lane (approx. 580 m long, 3050 sq. m);
- Infilling the ditch at Timberland Road North to accommodate road widening (approx. 230 sq. m);
- Construction of a cul-de-sac (mill and overlay), gate, and driveway at Timberland Road North to disconnect general traffic and restrict public access from the remaining southern stretch of Timberland Road North (approx. 1720 sq. m);
- Installing new utilities, including storm and water infrastructure along Timberland Road South;
- Upgrading the Timberland Wye intersection into a four-leg intersection with new traffic signals to improve safety and optimizes traffic flow for new traffic patterns caused by the Robson Road-Timberland Road corridor realignment;
- Providing a dedicated truck auxiliary lane to change inbound container truck movements and eliminate obstructions to other road users through implementation of two Vehicle Access Control System (VACS) gates and an electronic queue management system. This will manage inbound truck traffic into DPWFS and streamline traffic flow (approx. 300 m long lane, two VACS gates);
- Implementing new streetlighting along Timberland Road South; and
- Installing and upgrading electrical and security infrastructure, including relocation of CCTV cameras and integrating camera feeds into the port authority's Operations Centre to improve oversight and enforcement, as well as safety and security.

3 **Pavement Rehabilitation and Pavement Markings along Robson Road**

Rehabilitation of Robson Road will address pavement and drainage issues which contribute to the overall operation of the road Corridor and maintenance costs at FSPL. Enhancement of pavement markings along Robson Road will allow for better lane usage. Re-aligning pavement striping on Robson Road to allow for a southbound truck queuing lane as opposed to the existing northbound truck queuing lane.

- Rehabilitating the pavement (profile mill and overlay) along Robson Road including new pavement markings (approx. 1320 m long, 17,460 sq. m);
- Installing median barriers, one new storm catch basin;
- Placing new pavement at Gunderson Road to widening the road (approx. 65 sq. m);
- Regrading gravel shoulders along Robson Road to promote drainage (approx. 2740 sq. m);
- Implementing new streetlighting along Robson Road; and
- Installing a fibre optic connection to existing BC MoTI infrastructure.

In this PDR, the following terms will be used to describe the existing and proposed road Corridor as part of the FSPL-TI Project:

- **FSPL:** Fraser Surrey Port Lands is an industrial area situated alongside Highway 17 at Tannery Road, bordering the municipalities of Surrey and Delta.
- **FSPL-TI Project**: the road improvements project outlined in this PDR located in FSPL.
- **Timberland Road North:** existing road within FSPL
- **Timberland Road South:** existing road within FSPL. This project will extend Timberland Road South such that this road will directly connect to Robson Road.
- **Robson Road-Timberland Road North Corridor:** existing road Corridor used as the main thoroughfare at FSPL consisting of Robson Road, Timberland Road North, and Timberland Wye Intersection.
- **Robson Road-Timberland Road South Corridor***:* proposed road Corridor as part this Project and will function as the new main thoroughfare at FSPL by disconnecting Timberland Road North. The existing Timberland Road South will be extended and connected directly to Robson Road. The Corridor consists of Robson Road, Timberland Road South, and Timberland Wye Intersection.

1.3 EXISTING CONDITIONS

The current Robson Road-Timberland Road North Corridor is primarily a 50km/h two-lane roadway under the jurisdiction of the VFPA that acts as the main thoroughfare within FSPL. Tannery Road is located at the north, Gunderson Road is located at the south end, and a total of nine separate at-grade rail crossings runs in between the two ends of the Corridor. The Robson Road-Timberland Road North Corridor is a through-route where all truck, passenger vehicle, and emergency vehicle traffic must use this route to travel in and out of the area. It also provides direct access to several tenant properties, including DPWFS, Paper Excellence, Seaspan Ferries, Mainland Sand and Gravel, and the old Western Cleanwood Preservers site.

Timberland Road South is a roadway that branches off Robson Road-Timberland Road North Corridor at the north end of the FSPL at a forked intersection known as Timberland Wye. It provides access to tenants including Westran, TMS Transportation, and CP.

Elevator Road, Alaska Way and Gunderson Road are 50 km/h roadways located on the south end of the FSPL. Various sections of these three roads are under the jurisdiction of the VFPA, the City of Surrey, and the City of Delta. They provide direct access to various tenant and private properties. The junction of these three roads form a roundabout or turnaround area for vehicles travelling into and out of FSPL.

Tannery Road is a 50km/h roadway under the jurisdiction of City of Surrey that is used by most traffic traveling in and out of FSPL. It provides connectivity to the north end of Robson Road-Timberland Road North Corridor, connects to Highway 17 via an interchange, and connects to 120th Street, a major municipal arterial route, to Pattullo Bridge for travel across the Fraser River.

Highway 17 is an 80 km/h urban expressway under the jurisdiction of B.C. Ministry of Transportation and Infrastructure (BC MoTI) that runs along the south shore of the Fraser River. It connects FSPL to other hubs of trade activity throughout the region, including connection to the Deltaport container terminal, regional highways for access to the Centerm and Vanterm container terminals, and Highway 1.

The general arrangement of the existing road network including the major Corridors is shown in **Figure 1** below**.**

Figure 1: Existing Roadway Network within FSPL

1.3.1 LAND USE

FSPL is a huge centre for international trade-related activities throughout the Port of Vancouver. The area produces approximately 4,000 external vehicle trips on a typical weekday, and 40% of which are trucks carrying commodities such as containers, steel, and forest products. Based on VFPA's Land Use Plan, much of the area is designated for port terminal use, with certain smaller areas dedicated to Industrial and Conservation uses. There are several recent developments happening in the area, including growth in container volumes at DPWFS and the planned opening of the Fraser Grain Terminal (FGT) in 2022.

The road network at FSPL also provides access to private residences within City of Delta, south of the site.

2 DESIGN OVERVIEW

2.1 GOVERNING CODES AND CRITERIA

The WSP Team has prepared a codes-and-standards-based technical Design Criteria document to provide guidance on the design limits (formal / published codes and standards only) to be applied as part of the preliminary design development. Refer to **Appendix A** for relevant discipline-specific codes and standards and design criteria for Geotechnical, Roads, Utilities, Stormwater Management, Electrical, and Rail disciplines. Key criteria will be highlighted in this PDR with references made to the full document where applicable.

2.2 BASE MAPPING

The survey area extents for this project are shown highlighted in red in **Figure 2** below.

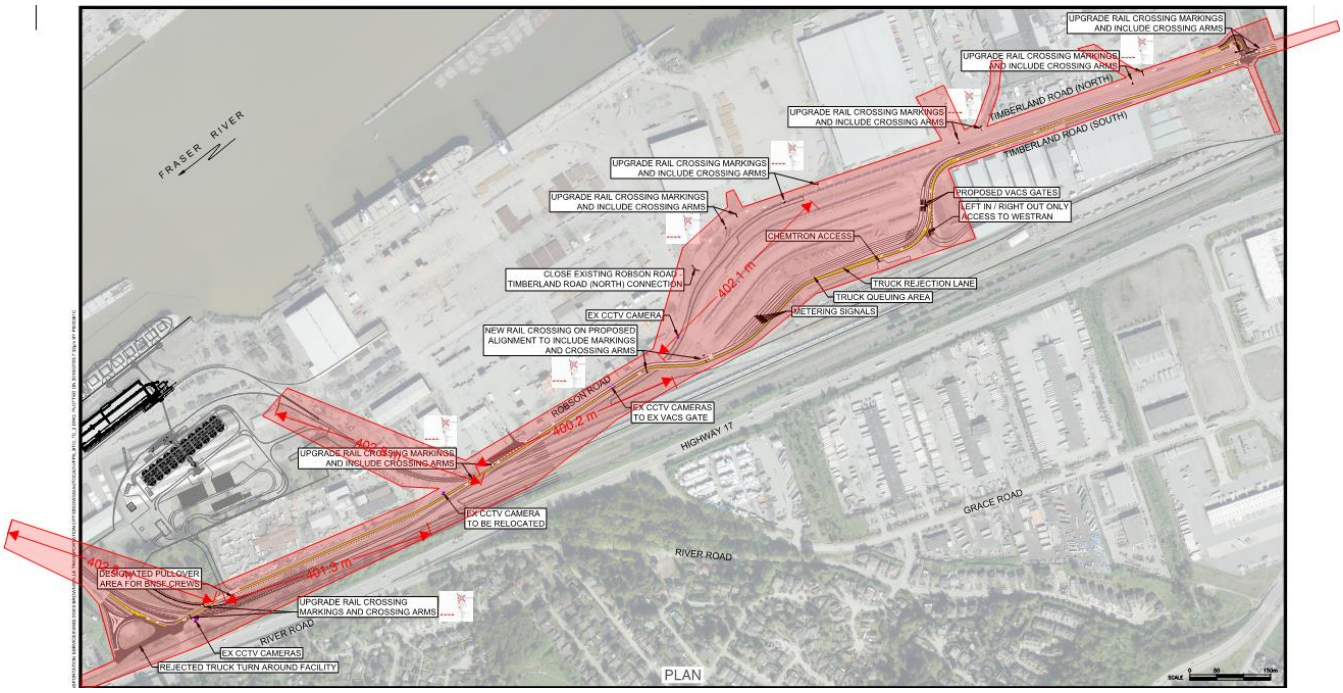


Figure 2: Extent of Topographic Survey

A topographic survey was conducted in June to August 2020 to provide basis for the design of the new roadway alignment at the FSPL. The Project survey area included the existing and proposed roadway as well as a locations of rail spur lines and tie-ins to existing access roads. The topographic survey included the following:

- Existing and future road alignments,
- Utility boxes, manholes, and catch basins,
- Existing trees / utility poles, and overhead wires,
- Fences,
- Property lines and right of ways from existing cadastral records,
- Existing buildings,
- Slopes,
- Roadway features including curb and gutter to produce full roadway sections,

- Vertical / horizontal changes, and
- Driveways, sidewalks, and other surface facilities.

The desktop analysis conducted at the outset of the Project consisted of compiling BC 1 Call, open source GIS data, and civic records at both municipal and provincial levels for known buried utilities. The team correlated this research with the utility site survey and identified existing property, right-of-way (RoW), and easement boundaries using Land Title and Survey Authority of British Columbia records.

A combination of conventional survey, GPS RTK, and terrestrial laser scanning was used to perform the topographic survey for the Project area. Survey was primarily conducted using conventional methodology and supplemented by terrestrial laser scanning in areas with dangerous traffic or areas with potential safety concerns. We observed invert elevations, alignment direction and location of utilities of

- Municipal infrastructure such as water, sanitary, and storm mains, and electrical / communications; and
- Third Party utility infrastructure such as telecommunications, Fortis gas infrastructure, and BC Hydro infrastructure.

2.2.1 GROUND SURVEY

All survey methodologies were related to a control network of survey points referenced to the provincial integrated Government Control Monument (GCM) coordinate system of UTM NAD83 (CSRS) 4.0.0.BC.1. GVRD Zone 10, elevations being geodetic and referenced to CVD28GVRD2018. The use of ground coordinates provides major benefits during construction as it provides more accurate measurement, compared to UTM NAD83 system. Project benchmarks and transformation parameters from UTM NAD83 system to a local ground coordinate system is as follows:

Horizontal: In StarNet, used both GCM'S 10H2595 + 92H0904

Vertical: In StarNet, held the following GCM as fixed elevations: GCM 10H2595 ELV = 2.892m

Scale Factor: 0.9996030 (PUB VALUE FOR 10H2595)

UTM to Ground:

SCALE ABOUT 0,0 @ (1/X OF 0.9996030) 1.00039715767)

THEN SHIFT BY -5000000 NORTHING

Ground to UTM:

SHIFT 5000000 NORTHING THEN SCALE ABOUT 0,0 @ 0.9996030

Location:
GCM 10H2595
Located in Surrey Docks
NE of Parking Lot and S of Alaska Way
at N end of Gunderson Slough

	UTM		LOCAL	
POINT	NORTHING	EASTING	NORTHING	EASTING
15	5447218.969	506095.322	449382.374	506296.322
20016	5449331.135	507258.973	451495.379	507460.435

2.3 GEOTECHNICAL

2.3.1 SUBSURFACE EXPLORATION

WSP undertook a geotechnical subsurface exploration between October 13 and 15, 2020 with the overall objective of obtaining necessary soil and groundwater parameters along the proposed road alignment where previous test holes were absent. Our geotechnical exploration was also accompanied by representatives from Indigenous Groups

(IGs) as well as Wood, who is the archeological consultant hired by VFPA. The specific objectives of WSP's subsurface exploration were to obtain information related to long-term settlement caused by peat, organics and fine-grained materials, estimate the liquefaction potential and post-seismic displacements, and obtain details of the current pavement structure to evaluate options for the future pavement design.

WSP's subsurface exploration consisted of 13 solid stem auger and 3 hollow stem auger test holes, with depths ranging from 6.1 m to 9.1 m. Standard Penetration Tests (SPTs) and Dynamic Cone Penetration Tests (DCPT) were carried out to obtain in situ relative density measurements for design purposes. A WSP field representative was at site during the drilling program to log the soil, observe groundwater conditions and retrieve representative soil samples for laboratory testing. Grab soil samples from the test holes were retrieved and sent to WSP's geotechnical laboratory in Langley, BC. Laboratory tests included moisture content measurements, particle size analysis and Atterberg Limit tests.

2.3.2 SURFICIAL GEOLOGY AND SOIL CONDITIONS

According to the existing Geological Survey of Canada Map 1486A published by Armstrong and Hicock (1976), the area is underlain by Salish Sediments (SAb) with peat up to 14 m thick; underlain by Fraser River Sediments (Fc), which is a mixture of sand and silt up to 2 m thick over interbedded fine sand and silt between 10 to 40 m thick; underlain by pre-Vashon or Vashon deposits. The western part of Robson Road is mainly underlain by Fraser River sediments consisting silty to silt clay loam up to 2 m thick, overlying deltaic and distributary sandy to silt loam channel fill. The near surface soil conditions are largely controlled by the site development activities. In general, the soil conditions encountered in previous and current geotechnical explorations are consistent with the surficial geology descriptions. A brief description of key soil units is provided below:

- **Topsoil, Asphalt and Road Base:** Asphalt thicknesses ranging between 55 mm to 200 mm thick were reported in test holes advanced by Thurber along Robson Road. In the recent WSP geotechnical exploration, asphalt thickness along Timberland Road South ranged between 100 mm and 150 mm. Fill comprising gravelly sand to sand and gravel was encountered below the asphalt or below the existing ground surface. In general, the thickness of the road base ranged between approximately 0.3 m to 1.7 m.
- **Sand (Possible Fill):** Sand was observed below the road base along Timberland Road South ranging from approximately 0.9 m to 5.5 m thick, generally increasing in thickness towards the south. Sand was also encountered within the IDC Yard ranging approximately 3 m to 5 m thick. Along Robson Road, thickness ranged between approximately 1.5 m to 2.5 m thick. In general, sand was described as loose to compact.
- **Peat:** The sand layer was underlain by peat along Timberland Road South, within the IDC Yard and Robson Road. Peat appeared to decrease in thickness from approximately 3.5 m to 0.7 m towards west along Timberland Road South, approximately 0.5 m to 1.5 m thick within the IDC Yard, and approximately 1.5 m thick along Robson Road. When encountered, peat was predominantly characterized as amorphous with moisture contents up to 434%.
- **Silt:** Silt with variable amounts of sand (i.e. some sand to trace sand) and clay (i.e., some clay to clayey) was underlying the peat layer at the north end of Timberland Road South. Silt was also encountered directly below the fill or sand layer, near the intersection of Elevator Road and Robson Road. In previous reports, this was identified as the "upper silt and clay layer", which sometimes extends to a depth of about 15 m. The silt layer is expected to be underlain by a sand and silty sand layer, underlain by glacial till deposits. These deep layers are not expected to impact the proposed construction.

Groundwater levels across the proposed alignment are expected to fluctuate seasonally in response to precipitation levels and may be influenced by fluctuations in the Fraser River. During the 2020 WSP subsurface exploration completed in October, groundwater seepage and test hole sloughing were observed between approximately 1.2 m to 2.1 m below the existing site grade (i.e., El.2.3 m to 1.7 m geodetic). Slight deeper or shallower groundwater levels have been observed in previous explorations.

2.3.3 SEISMIC CONSIDERATIONS

There are no specific seismic performance requirements given in applicable codes or standards for similar roads. According to the recommendations given in the CSA S6:19 for "Walls, Slopes and Embankments", for *Major Route* classifications, at least 50% of travel lanes should be available for use after a 1/475 return period earthquake. Note

that above recommendations have been included in CSA S6:19 for road sections supported by walls, slopes and embankments located outside the "Approach Embankment Interface Zone" (defined as the maximum of 20 m from bridge abutment or projected distance from a 2H:1V slope from the toe of the bridge abutment).

The current and previous seismic assessments indicated that saturated granular deposits are prone to liquefaction. These results are consistent with the previous seismic assessments and regional liquefaction hazard maps where the area is assigned a high likelihood of liquefaction.

Extensive liquefaction and cyclic softening will lead to settlements and lateral spreading displacements. For a design seismic event with a return period of 1 in 475 years, we expect the post-seismic settlement to range from **300 mm to 600 mm** depending on the ground conditions. The lateral spreading displacement may range from **less than 50 mm** near ground improvement zones to **about 300 mm** at locations where ground topography will induce localized ground cracks (e.g., adjacent to existing ditches).

In general, specific measures to mitigate soil liquefaction are not implemented for roads and rail tracks especially in relatively flat ground topography where the consequence of liquefaction is manageable. Compared to a road/rail supported on a steep fill embankment, slope or retaining wall, where the failure would lead to a catastrophic failure, settlement and cracks formed after an earthquake can be repaired relatively easily and quickly. Given the extent of liquefaction and shallow depth of potentially liquefiable soils, the cracks formed after an earthquake may be extensive such that it may not be possible to allow traffic on all lanes along the entire alignment. However, we expect at least 50% of the lanes to be open after 1/475-year return period event, which satisfies the requirements for a "Major Route". With some minor repairs and relevelling, we expect full traffic flow to be restored relatively easily. Additional restorations may be required at a later stage to bring the road to the same level of service as before. We consider it is not economically feasible or practical to undertake ground improvement to mitigate soil liquefaction to achieve an improved post-seismic service level.

2.3.4 PAVEMENT DESIGN

A preliminary pavement design was completed in accordance with 1993 AASHTO "Guide for the Design of Pavement Structures" as amended by BC MoTI – Pavement Structure Design Guidelines – Technical Circular T-01/15, BC Ministry of Transportation and Infrastructure (2015). A design life of 20-year was considered. According to this design, the following pavement structure is recommended for new road sections required for the IDC Yard area:

Table 2-1: Required Pavement Structure for New Construction

Layer	Thickness (mm)
Hot Mix Asphalt	200
Granular Base Material	200
Granular Subbase Material	925

Based on our understanding of the current project requirements from information collected from the field investigation, we consider Full Depth Asphalt Removal and Partial Depth Granular Replacement as potentially feasible options. If this option is selected, the following pavement structure is recommended.

Table 2-2: Recommended Pavement Rehabilitation Treatment

Roadway	Elevator Road	Robson Road	Timberland Road South
Material Type	Depth (mm)		
Surface Course Layer	50	50	50
Lower Course Layer #1	50	100	100
Lower Course Layer #2	100	100	100
New Crushed Granular Base	200	200	200

At Elevator Road and Robson Road, mill and overlay of the existing asphalt pavement is required. We understand that this section of the road is planned for future upgrade. In the short-term, periodic rehabilitations using mill and resurfacing may be conducted since extensive pavement rehabilitations are not cost effective.

At the eastern end of the Timberland Road South, thicker peat deposits are encountered at shallower depths. The main design concern in this section is the potential differential settlement caused by infilling of the ditch. Given the depth

of peat and groundwater level, excavation and replacement of peat in this section of the alignment is impractical and too costly.

To reduce the potential differential settlements, we recommend ditch infilling to be carried out using light-weight fill. Use of lighter weight materials on soft soils will reduce the additional loads acting on compressible material, thereby reduce the long-term settlement. Although many products available, white pumice is recommended since it is considered less sensitive to construction damage than red pumice which is susceptible to particle breakdown under heavy compaction efforts. The pumice shall be placed in loose layers varying between 150 mm and 300 mm thick. Using a light compaction equipment, pumice shall be carefully placed and compacted in accordance with supplier recommendations. To further reduce the differential settlements between infill sections and existing road, base and subbase shall be reinforced using geogrids. Other light-weight materials such as light-weight concrete, expanded polystyrene (EPS) and geofoam materials are not considered applicable for this Project considering the limited depth available for additional fill and other constructability issues.

WSP's geotechnical report can be found in **Appendix B**.

2.4 AT-GRADE RAIL CROSSINGS

With extensive amounts of un-signalized railroad crossings along Timberland Road North, vehicles drivers experience stop-go movements as they approach crossings which add delays to already slow-moving traffic in the area.

As part this this Project, Railway Crossing Safety Assessments on eight grade crossings within FSPL were conducted. The crossings within the Project site as shown in **Figure 3** are owned by VFPA and/or SRY and are located along the Canadian National (CN) Brownsville Spur which comes off Mile 117 of the Yale Subdivision. The crossing numbers noted below have been provided by VFPA Engineering.

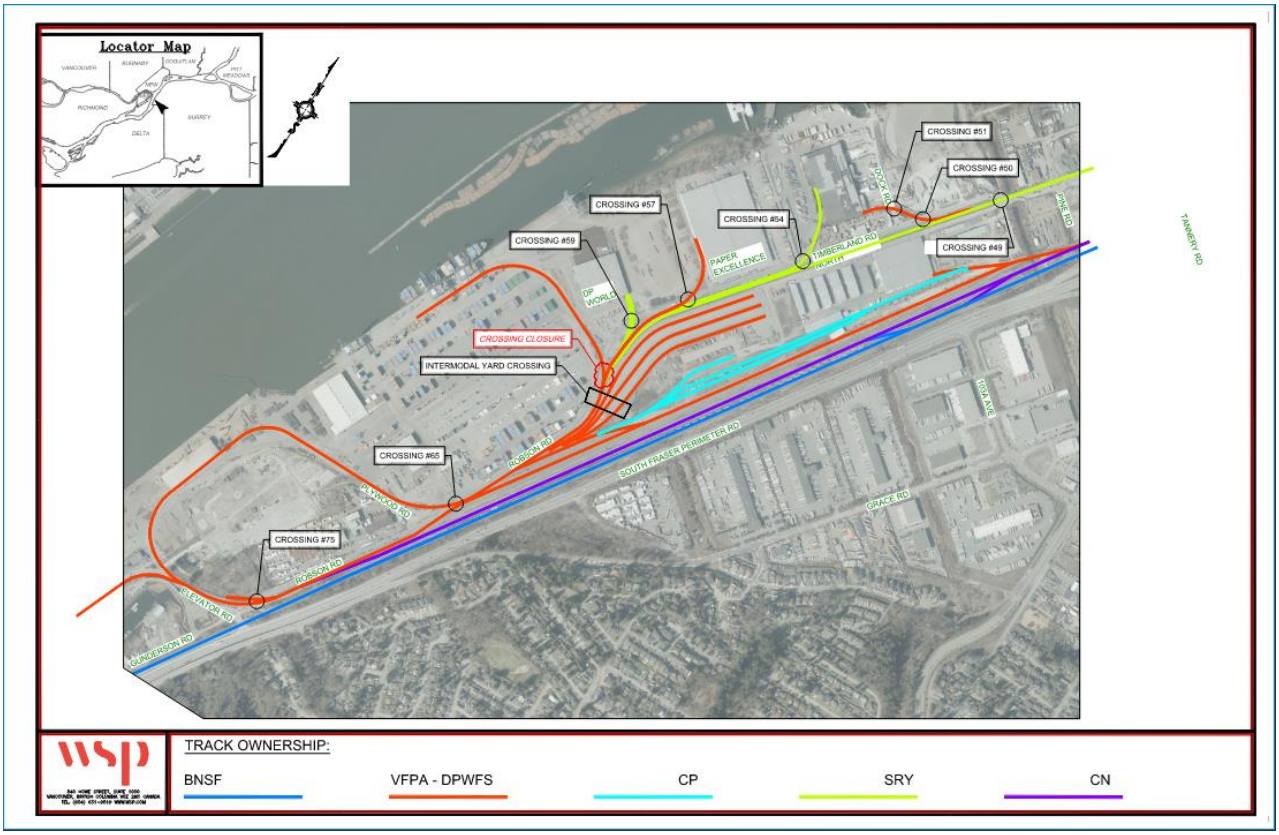


Figure 3: Existing At-Grade Crossings within FSPL

These Assessments aim to identify modifications to grading crossings since the previous inspection in 2015 and highlight any new or previously identified non-compliances still relevant to this Project.

2.4.1 RAIL SAFETY ASSESSMENT

The Railway Crossing Field Safety Assessments were undertaken on the 22nd and 23rd of July 2020 and updates the previous Railway Crossing Assessments undertaken by WSP (formally MMM Group) on the 5th of May 2015. The Railway Crossing Assessments were conducted following the guidelines of applicable requirements identified in the latest edition of Transport Canada's Grade Crossing Regulations (GCR) and Grade Crossing Standards (GCS).

Table 2-3 below outlines a summary of the eight Railway Crossing Safety Assessments: the existing crossing warning systems, the recommended crossing warning systems, and significant cost items for crossing upgrades. The complete report can be found in **Appendix C**. Note the parenthesized crossing numbers are referenced in the report and drawings.

Table 2-3: Rail Safety Assessment Results

Crossing		Existing Warning System	Recommended Warning System	Recommendation Reasoning	Other Significant Cost Items	Total Estimated Cost	Next Steps
VFPA CROSSING #49 (00)	Timberland Wye	FLB	FLBG	Vehicles cross the crossing at an angle less then 70 degrees	None	$606,800	Prepare and submit E4 for review by railway
VFPA CROSSING #75 (01)	Mile 117.63 Spur 22.82, 75 Robson Road	SRCS	FLBG	• Cross product Sightlines not met	• Crossing Surface Extension Mitigate Sightline Non-Compliance	$617,800	Prepare and submit E4 for review by VFPA
VFPA CROSSING #65 (02)	Mile 117.63 Spur 0.04, 65 Robson Road	SRCS	FLBG	• Cross product Crossing angle	• Crossing Surface Extension • Mitigate Sightline Non-Compliance • Repave Crossing Surface	$637,050	Prepare and submit E4 for review by VFPA
VFPA CROSSING #59 (03)	10203, 59 Timberland Road	SRCS	SRCS	AADT and rail traffic reduced from 2015	Mitigate Sightline Non-Compliance	$501,300*	Address priority safety issues (sightline non-compliance)
VFPA CROSSING #57 (04)	10203, 57 Timberland Road	SRCS	FLB	Sightlines not met	• Crossing Surface Extension Mitigate Sightline Non-Compliance	$518,350	Prepare and submit E4 for review by VFPA
VFPA CROSSING #54 (05)	10550 Timberland Road	SRCS	FLB	Sightlines not met	Mitigate Sightline Non-Compliance	$520,750	Prepare and submit E4 for review by railway
VFPA CROSSING #51 (06)	357 Dock Road	SRCS	SRCS	No rail traffic on spur	None	$3,100	Address priority safety issues (signage)
VFPA CROSSING #50 (07)	10610 Timberland Road	SRCS	SRCS	No rail traffic on spur	None	$ -	None

* This cost assumes for warning systems with gate if the sightlines cannot be met by removing fencing or obstructions then gates are required. However, manual flagging can be discussed with SRY as cost-effective solution.

2.4.2 AT-GRADE RAIL CROSSING AND SIGNAL DESIGN

At-grade rail signal designs are proposed to be completed for Crossings 75, 65, 57, and the new crossing at the IDC Yard. The signal design will include FLBG or FLB warning systems with Dual Tone Multi-Frequency (DTMF) to be consistent with the signalling system used at other VFPA container terminals such the South Shore Corridor. These crossings are owned by VFPA and will require the following crossing treatment:

Rail Crossing	Crossing Treatment
VFPA Crossing #75 (01)	Extend crossing surface by 0.5m, clear sightline areas, repaint double stop bars and railway crossing symbol, install FLBG with DTMF capability
VFPA Crossing #65 (02)	Extend crossing surface by 0.5m, repave crossing surface to be smooth and continuous repaint double stop bars and railway crossing symbol, install FLBG with DTMF capability
VFPA Crossing #57 (04)	Extend crossing surface by 0.5m, repave crossing surface to be smooth and continuous repaint double stop bars and railway crossing symbol, install railway crossing sign, advisory speed sign, install FLB with DTMF capability
New Crossing at IDC Yard	Install new crossing surface and extend by 0.5m, paint double stop bars and railway crossing symbol, install railway crossing sign and other signage as required, install FLBG warning system with DTMF capability

At-grade rail signal designs are proposed to be completed for Crossings 54 and 49. These Crossings are owned by SRY and from correspondence with SRY, they have indicated they can complete the design and installation of rail signal designs at these locations based on our Rail Safety Assessment. Note that further discussion between VFPA and Surrey or a Rail Crossing agreement will be required to get this process started.

Rail Crossing	Crossing Treatment
VFPA Crossing #54 (05)	Repaint railway crossing symbol and hatching pavement marking, install FLB with DTMF capability
VFPA Crossing #49 (Timberland Wye)	Install emergency notification signs, paint railway crossings, install FLBG warning system with DTMF capacity, install traffic signal interconnected with FLBG warning system

Crossings 51 and 50 are along VFPA's spur track on Timberland Road North and will be removed.

As all the assessed crossings are federally regulated and are governed by Transport Canada's Grade Crossing Regulations (GCR) and Grade Crossings Standards (GCS), the next steps for the crossings that require active warning protection is to complete E4 grade crossing drawings. The E4 grade crossing drawings will be developed in sufficient detail and submitted to the applicable Rail Authorities and the Canadian Transportation Agency for agreement execution, typically during 70% to 95% design. Track designs will be developed in accordance with relevant Transport Canada acts and regulations to meet Federal crossing standards.

2.5 TRAFFIC IMPACT

2.5.1 EXISTING TRAFFIC CONDITIONS

The Project was initiated due to significant amount of truck traffic can be observed on the Robson Road-Timberland Road North Corridor, impeding access to general traffic to port tenants in the area. The primary sources of congestions in this area are the following:

- Heavy inbound container trucks entering DPWFS' container yard in the morning prior to its opening created queuing along the main road Corridor. The queue also went around the turnaround area near Elevator Road, as well as IDC Yard and continued throughout the day. However, the queue for inbound container truck traffic has dissipated since DPWFS took over the operation from FSD and since 1 July 2020 and implemented an appointment-based reservation system.

- There is only one access to FSPL, which is through the Tannery Road Interchange. As vehicles travel southbound onto Timberland Road North, truck drivers must maneuver through sub-standard geometry at the Timberland Road Wye forked intersection, where an un-signalized railroad crossing exists immediately west of the intersection.
- With extensive amounts of un-signalized railroad crossings along the Timberland Road North, most truck drivers experience stop-go traffic movement as they approach the crossings, adding delay to already slow-moving traffic in the area.
- Inbound trucks entering Paper Excellence continue to block the main road due to placement of their existing truck pedestal.

As noted above, DPWFS has since implemented a reservation system (on 1 July 2020) for its container terminal entry, as well as adding a second shift. The first shift runs from 8:00 a.m. to 4:30 p.m. and the second shift from 4:30 p.m. to 1:00 a.m. with breaks from 12:00 p.m. to 12:30 p.m. and 8:30 p.m. to 9:00 p.m. This system allows trucks entering the site to do so within a 16-hour period in a day. With the new reservation system, only a limited number of trucks can arrive per 30-minute time window. This has reduced the time trucks spend waiting and reduced the number of queueing trucks waiting to enter the facility. As well, the second shift distributes the demand over a longer period which in turn means fewer trucks arriving per hour, resulting in fewer delays and queues compared to the single shift system. DPWFS has also stated that trucks arriving late are required to book another appointment. Trucks without an appointment are automatically rejected.

2.5.2 TRAFFIC ANALYSIS

A traffic analysis was conducted specifically to which included the analysis for the existing conditions and impact of changes on the proposed road network geometry of Robson Road-Timberland Road South Corridor. The intent of this traffic analysis was not to reassess the traffic conditions for the entire FSPL site, but rather specific impacts as a result of the implementation of the reservation system for DPWFS's container terminal entry. Refer to **Appendix D**: VFPA – Impact of Changes on Road Network Geometry Memorandum for a detailed discussion of the traffic analysis results and recommendations for the Robson Road-Timberland Road South Corridor.

There has been a significant amount of traffic studies conducted at FSPL previously. WSP has reviewed these reports and used them as a basis for the memorandum. The traffic studies are summarized in **Table 2-4** below.

Table 2-4: Previously Conducted Traffic Studies

DOCUMENT	AUTHOR	DATE
Transportation Impact Assessment – BHP Potash Export Facility at DP World Fraser	Mott MacDonald	September 2020
Brownsville Transportation Operations Study 1. ***Study Report*** 2. ***Operating Baseline Condition, Evaluation Metrics and Issue Identifications*** 3. ***Immediate to Short-Term and Short-to Medium-Term Scenario Assumptions*** 4. ***Traffic Operations Micro-Simulation Model Scoping and Development***	Parsons	 July 2019 February 2019 January 2019 January 2019
Fraser Grain Terminal Access Traffic Study	ISL Engineering	June 19, 2019
Fraser Grain Terminal VFPA Review – Traffic Analysis for Updated Rail Crossings	Stantec	August 17, 2018

Timberland Road North/South Wye Intersection – Road Safety Review FINAL Technical Memo	Creative Transportation Solutions Ltd.	May 25, 2016
FSPL Area-Wide Transportation Study – Baseline Assessment and Future Scenario Definition	Stantec	November 14, 2014

Based on our recent analysis, we conclude that

- Removal of the four (4) originally proposed truck staging lanes to a single auxiliary lane is warranted as the reservation system minimises the peaks demands. The single auxiliary lane with a wide 3-metre shoulder should still be provided in case of special events or lower service rates than usual at gates.
- Removal of the original northbound to westbound left turn lane from Timberland Road South to Timberland Road North with provision for a wider shoulder is recommended so traffic can pass the occasional left turning vehicles.
- A new traffic signal is warranted and should be considered at the Timberland Wye Intersection in conjunction with the additional of the flashing lights, bells and gates that is planned at this railway crossing. Discussions should be held between the road authority and the railway to determine a mutually agreeable course of action.
- Addition of a southbound right-turn lane length from Timberland Road to Timberland Road North will provide storage for vehicles when a train occupies the crossing.

The conclusions made from this traffic analysis have been incorporated into the roadway design as described in the subsequent section. Note that discussion with VFPA Land Operations is ongoing with regards to Westran's operations. Currently, trucks requiring access in Westran will stop on the side of Timberland Road South, where drivers exit the vehicle and walk across the road into Westran's administrative office. From there, once the driver is notified of which gate to enter, they will then drive to the appropriate entrance. This process poses safety risks for the driver and road users and exacerbates congestion for through-moving traffic in the area. VFPA Land Operations and Security has noted this operation will not be allowed to continue and is in the process of discussing alternative options with Westran.

2.5.3 CONSTRUCTION AND TRAFFIC MANAGEMENT

The construction of this Robson Road-Timberland Road South Corridor can be split into three main phases and will take approximately 12 months. Based on the interdependencies between various components of the Project and weather-dependent work, staging may generally be phased as follows:

STAGE	DESCRIPTION OF WORK	DURATION
Stage 1	Construction of the new extension of Timberland Road South	8 months
Stage 2	Rehabilitation and construction of the existing Timberland Road South including Timberland Wye Intersection	5 months
Stage 3	Rehabilitation and construction of Timberland Road North, Elevator Road, and Robson Road	2 months

The phases mentioned above have been developed to minimize impacts to the traffic flow along the existing road corridor, maintaining continuous access for tenants and private residences (Gunderson Slough); this phasing also considers upholding security measures to accommodate ongoing VFPA and tenant operations, including rail operations in the area. It is imperative that continuous access throughout the site is maintained for emergency vehicles as the only access point into FSPL is through Tannery Interchange/ Timberland Wye Intersection.

Traffic management or control plans will be developed in detail by the Contractor at each construction stage to account for the type of traffic control required for the work and any special circumstances that must be accommodated. Part of the Contractor's responsibility will be to include these plans and forward this information to the City of Surrey and City of Delta for approval in accordance to their bylaws and permitting.

A construction and traffic management memorandum describing anticipated staging activities, construction methods, and potential environmental and community impact is found in **Appendix E.**

2.6 ROADWAY

The existing Robson Road-Timberland Road North Corridor is the main thoroughfare road serving major port tenants and residents of Delta south of FSPL with a secondary access road off Timberland Wye forked intersection called Timberland Road South. The road Corridor is classified as a two-lane urban arterial undivided road with several roadside treatments ranging from curbed sidewalks and curbed boulevards to gravel shoulders.

As discussed with the stakeholders, one road alignment has been developed in which the preferred alignment connects to two existing roads, Timberland Road South and Robson Road, with a two-lane paved road that runs along the southern edge of the IDC Yard; the resulting Robson Road-Timberland Road South Corridor will function as the new main thoroughfare road. As mentioned previously, the primary benefit of moving majority of traffic is to avoid delays caused by frequent stop-go traffic operations caused by existing rail crossings on Timberland Road North. This road realignment also provides the benefit of removing the separation between the IDC Yard and DPWFS's Container Yard, thereby improving operational efficacy for DPWFS and FSPL overall.

The proposed realigned Robson Road-Timberland Road South Corridor is intended to maintain a two-lane traffic flow within FSPL. The design geometry and cross-section of the road Corridor have been developed with input from disciplines discussed in this report as well as extensive stakeholder input in consideration for future operations and improvements at FSPL. There are minimal roadway design changes to Timberland Road South and Robson Road as the intent is to improve the pavement and drainage conditions at these two roads.

The road Corridor design is split up into five sections and discussed in this section:

1 Gunderson Road, Elevator Road, and Robson Road,
2 New Timberland Road South,
3 Existing Timberland Road South,
4 Timberland Wye Intersection; and
5 Timberland Road North.

2.6.1 ROADWAY DESIGN CRITERIA

All roadway design elements are based on the latest edition of

- Transportation Association of Canada (TAC) Geometric Design Guide;
- City of Surrey Design Criteria Manual;
- TAC's Manual of Uniform Traffic Control Devices (MUTCD);
- Master Municipal Construction Documents (MMCD) Platinum Edition;
- Transport Canada's Grade Crossing Standards; and
- Transport Canada's and Standards Respecting Railway Clearances.

Refer to **Appendix A** for the roadway design criteria detailing the design guidelines used to develop the preliminary design of realigned Robson Road-Timberland Road South Corridor, comments to clarify technical rationale, and assumptions made.

2.6.2 ROADWAY DESIGN

2.6.2.1 GUNDERSON ROAD, ELEVATOR ROAD AND ROBSON ROAD

The southern section of the realigned Robson Road-Timberland Road South Corridor consists of Gunderson Road, Elevator Road and Robson Road.

The existing "roundabout" at Gunderson Road and Elevator Road will continue to serve residents of Delta and private business beyond the Project limit. Modifications at this area consist of milling and resurfacing the poor pavement to alleviate pavement cracking, patches, and potholes with additional pavement markings painted to provide clarity in the traffic flow. Minor widening is proposed at the southeast corner of the roundabout to facilitate easier northbound vehicle movement towards Robson Road. Profile grade raises are utilized in localized areas to meet minimum longitudinal grade requirements and eliminate existing ponding.

The design of Robson Road will remain as a two-lane road; however, the centreline has been shifted east to allow for a southbound truck queuing lane as opposed to the current northbound truck queuing lane. This shift was requested by DPWFS to provide the benefit of additional storage for bulk/steel trucks using the south gate or accessing other tenant sites such as FGT. At the intersection of Plywood Road, southbound traffic has been straightened to streamline vehicle movement east of the island.

A dedicated southbound right-turn lane is provided for container trucks accessing DPWFS container gate and is separated by concrete roadside barriers, creating a third lane on Robson Road. Barriers are proposed to prevent unauthorized vehicles from entering the facility and separate through traffic lanes.

2.6.2.2 NEW TIMBERLAND ROAD SOUTH

The mid-section of the realigned Robson Road-Timberland Road South Corridor consists of the new Timberland Road South roadway connecting Robson Road and the existing Timberland Road South complete with new pavement throughout.

It is noted that operations at the current IDC Yard will continue after the completion of this Project in 2022 and therefore the existing five rail tracks servicing this Yard will need to remain. Due to the constraints in this area, most notably the existing track switches that cannot be relocated, the new road alignment is situated between these existing switches. By aligning the new Timberland Road South across the rail crossing, a physical delineation between container truck and through traffic could not be achieved as roadside barriers cannot be placed. To resolve this, security surveillance has been proposed to ensure unauthorized vehicles from accessing DPWFS facility and is discussed in Section 2.7 Electrical and Communications in this report.

North of the rail crossing, Timberland Road South geometry continues as a two-lane road with a single inbound truck auxiliary lane and shoulder, which is separated by concrete roadside barriers. Initially, four auxiliary lanes were proposed to be provide truck staging in support of the truck operations for DPWFS as developed by Parsons. With the recently implemented appointment-based reservation system, the need for four auxiliary storage lanes has been reduced to one to maintain operation capacity. With the single auxiliary lane, a 3.0 m shoulder is proposed for truck-maneuvering in the event a vehicle breaks down in this lane. Security fencing is proposed along the west edge of Timberland Road South to prevent access into the IDC Yard.

The new Timberland Road South also provides a 3.6 m truck rejection lane for rejected inbound container trucks whereby drivers are required enter the general through southbound lane and to loop around the roundabout on Gunderson Road and Elevator Road before existing FSPL at Timberland Wye Intersection.

A three-legged intersection is proposed prior to tying the new road alignment to the existing Timberland Road South. This area provides

- Vehicle access to enter and exit the Westran property. Vehicles will enter from the southbound through lane and can only make a right-turn exit onto the northbound through lane;
- Two VACS gates and lanes for inspection of the inbound container trucks. Trucks using the outermost lane will merge to the single auxiliary lane as discussed previously after inspection; this lane is designated for inspection of oversized loads needing additional lane width;
- Emergency fire access into the IDC Yard will be provided with a sliding gate that will be opened during emergency situations by DPWFS operations staff; and

- Driveway access for BC Hydro maintenance of their electrical infrastructure with security fencing.

The new Timberland Road South alignment considered the proximity of the existing IDC Yard's end tracks to the south, Westran's tail tracks to the north, CP rail tracks to the east, and BC Hydro infrastructure to the east. Due to the tighter curvature required to meet these constraints and maintain sufficient horizontal clearance from the tracks, a 30km/hr advisory curve is proposed in this area and at the tie-in to the existing Timberland Road South; a 30km/hr speed limit allows the design to maintain minimum geometry requirements as prescribed by TAC while mitigating impedance and inefficiencies to traffic flow along this road. We understand a portion of the new Timberland Road South alignment will occupy CP's current lease area, who will be vacating area in April 2021.

2.6.2.3 EXISTING TIMBERLAND ROAD SOUTH

The new Timberland Road South alignment will tie into the existing two-lane Timberland Road South. The northbound and south bound through lanes are separated by a gore-marked median. Along the north edge of road is a proposed 3.6m shoulder to support future tenant and FSPL operations in this area; the shoulder transitions to an inbound container truck inspection lane as discussed previously. To develop the southbound shoulder, the existing west ditch will be partially infilled with light-weight fill; the remaining channel will be used to capture track drainage west of the Project limit. Roadway drainage that is currently flowing into the west ditch will be diverted through curbs and gutters, into catch basins, and conveyed through a closed pipe system. Drainage analysis of the west ditch and partial ditch infill requirements are mentioned in Section 2.3 Geotechnical and Section 2.7 Utilities and Drainage in this report.

The existing Timberland Road South is to be rehabilitated to the granular base layer as described in Section 2.3.4 and the road widening will involve placing new pavement. Profile grade raises are utilized in localized areas to meet minimum longitudinal grade requirements as noted in the design criteria and eliminate existing ponding. The extension of the roadway cross-section along this portion of the road Corridor meets the 4.27m horizontal rail clearance as required by Transport Canada. The existing east ditch south of Timberland Wye Intersection will remain and capture road drainage.

2.6.2.4 TIMBERLAND WYE INTERSECTION

As outlined in the Traffic Memo, a new traffic signal is warranted at the existing Timberland Wye to develop a four-legged intersection. The new signal would help clear the stop-controlled approach of traffic which has historically caused delays whenever a train approaches the Timberland Wye Crossing. As well, traffic analysis has confirmed the northbound to westbound left-turn lane from Timberland Road South to Timberland Road North, which was initially proposed by Parsons, can be removed without significant impact on traffic condition in the area.

To support the design of the intersection and accommodate a proposed southbound right-turn lane onto Timberland Road North, the following modifications are proposed at Timberland Wye intersection:

- **North Leg:** the shift in the existing Timberland Road centreline requires the northbound through lane to be widened. The widened lane connects to the existing lane prior to reaching Pine Road intersection. Concrete roadside barriers are placed on the west edge of the road to delineate traffic vehicles from the SRY track running west of Timberland Road and protect the FLB&G structure.
- **East Leg:** the existing driveway access to TMS Transportation property is widened to support truck ingress and egress due the change in laning configuration at the intersection.
- **South Leg:** as a result of the removal of the left-turn lane onto Timberland Road North, a 1.5m shoulder is provided north of the east ditch to allow through traffic to pass vehicles that are making a left turn at the intersection.
- **West Leg:** to accommodate southbound right-turning vehicles entering Timberland Road North, the existing curve immediately west of Timberland Road is widened. This modification requires the existing north ditch to be infilled.

2.6.2.5 TIMBERLAND ROAD NORTH

Once the proposed Robson Road-Timberland Road South Corridor is operational, Timberland Road North will continue to serve as the access road to the existing tenants and port operators that are located along that road. As part of this project, the work along Timberland Road North consists of upgrading at-grade crossings to meet federal standards as noted Section 2.4.1 and constructing a new cul-de-sac and driveway immediately north of VFPA

Crossing #59. The proposed cul-de-sac will restrict public access from the remaining southern stretch of Timberland Road North and allow DPWFS, the tenants in this area, to continue using VFPA Crossing #59 as a private crossing.

2.6.2.6 TIMBERLAND ROAD NORTH

Once the proposed Robson Road-Timberland Road South Corridor is operational, Timberland Road North will continue to serve as the access road to the existing tenants and port operators that are located along that road. As part of this project, the work along Timberland Road North consists of upgrading at-grade crossings to meet federal standards as noted Section 2.4.1 and constructing a new cul-de-sac and driveway immediately north of VFPA Crossing #59. The proposed cul-de-sac will restrict public access from the remaining southern stretch of Timberland Road North and allow DPWFS, the tenants in this area, to continue using VFPA Crossing #59 as a private crossing.

2.6.3 LEASE AREA IMPACTS

The realigned Robson Road-Timberland Road South Corridor requires negotiation with current lease holders within FSPL; there are three different types of property impacts that were assessed:

1 Permanent acquisition refers to areas where the Project limits will permanently encroach on the property and will therefore require permanent land to be returned to VFPA.

2 Temporary easements refer to areas of land that will be temporarily affected during construction stages. Temporary easements will be contingent on VFPA Real Estate securing all lease areas for the Project prior to the start of construction; if all lease areas can be secured, then it is expected temporary easements will not be required.

3 Where existing utility easements cross over VFPA owned land a permit may be required from the lease owner for any works in this area. Requirements should be confirmed with the easement owner.

Table 2-5 below shows a summary of lease areas impacted with calculated totals for the Project. This table does not include areas within VFPA's property as these areas are assumed to be already secured.

Table 2-5: Robson Road-Timberland Road South Corridor Property Impacts

	VFPA Lease Area ID	Lease Area Impacted (m^2)
Data Audit Industries	VFPA PLAN 2011-266	91
Parrish & Heimbecker	VFPA PLAN 2019-139	141
Telus	VFPA PLAN 2014-165	1168
Fortis BC	VFPA PLAN 2014-184	3548
CN	VFPA PLAN 2015-291	820
Metro Vancouver	-	873
CP	VFPA PLAN 2013-009	12,056
Republic Services of BC	VFPA PLAN 2018-115	64
DPWFS	VFPA PLAN 2019-109	42,447
Seaspan/ SRY	VFPA PLAN 2017-017, PLAN L2017-007	881
SRY with VFPA	VFPA PLAN 2015-275	163
RDM	VFPA PLAN 2014-070	197
City of Surrey	-	4631
Great Northern Railway	-	109

Refer to the Land Impact Plans in **Appendix F** for a breakdown of the areas impacted as a result of the FSPL-TI Project. Note these plans are still under review with VFPA Real Estate.

2.6.4 EXCAVATION DEPTHS FOR BELOW-GROUND INFRASTRUTURE

Anticipated excavations depths for below-ground infrastructure varies at different road sections based on the pavement structure and type of below-ground infrastructure to be installed. A summary of the range of excavation depths for pavement construction is shown below in Table 2-6 and shown in Drawings 20M-00758-00-C-009 and 20M-00758-00-C-010 Typical Sections.

Stationing	Road Section along Robson Road-Timberland Road South Corridor	Anticipated Excavation Depth for Pavement Structure, Measured Below Ground
1+000 to 1+520 and 1+780 to 2+005	Robson Road	50 mm
1+570 to 1+605	Robson Road	50 mm to 1225 mm
2+035 to 2+120	Robson Road/IDC Yard	1375 mm
2+180 to 2+440 and 2+667 to 2+690	Timberland Road South at IDC Yard	1375 mm
2+770 to 3+105 and 3+165 to 3+330	Timberland Road South	450 mm to 1350 mm
3+370 to 3+450	Timberland Road South	450 mm to 1350 mm

Foundations for chain-link fencing, gates, grade crossing warning systems, medians, overhead signage, signal poles, luminaire poles, camera poles, and metering kiosks spaced along the proposed Corridor will also require excavation depths of at least 450 mm below ground. Exact depths will be confirmed during the next design stage but are referenced in the following Drawings:

- 20M-00758-00-C-009 Civil Details;
- FSPL-E-0226 Elevation and Details – FSPL Signal Poles;
- FSPL-E-0462 Details – Lift Gate Layout;
- FSPL-E-0507 Service Pole and Cabinet;
- FSPL-E-0561 Details – Directional Drill Installation Under Railroad Tracks; and
- FSPL-E-0800 Details – Metering Kiosk.

Trenching depths for new storm and water infrastructure, electrical conduits, and the proposed fibre optic connection will also be confirmed during the next design stage.

Building foundation excavation is assumed to be 1000 m deep.

2.7 UTILITIES AND DRAINAGE

2.7.1 STORMWATER MANAGEMENT

Details of the stormwater management for the Project are provided in detail in the Preliminary Stormwater Management Plan; see **Appendix G**.

For the purpose of the stormwater management plan, the Project area has been divided into three sections.

Section 1 – (STA. 1+000 to STA. 2+005)

Extends along the existing Robson Road between Elevator Road and the IDC Yard track crossing. The proposed works in this section primarily consist of mill and overlay on the existing road alignment. There are existing catch basins and drainage pipes along this section, though some localised flooding issues have been observed historically.

Section 2 – (STA. 2+005 to STA. 2+665)

Extends from the IDC Yard track crossing to the new VAC gates, just south of Timberland Road South. This new section of road will include full depth construction and will require all new drainage infrastructure.

Section 3 – (STA. 2+665 to STA. 3+447)

Extends from the new VAC gates, along Timberland Road South to the 'Timberland Wye' junction and the Manson Canal. The proposed works in this section includes mill and overlay on the existing road alignment, as well as widening of the road to the north-west. Drainage along Timberland Road South currently drains directly into the existing ditches to the north-west and south-east, apart from some VFPA-owned catch basins at either end of this section. All flows from this section are diverted towards the Manson Canal.

The drainage system shall be designed to meet the following servicing objectives, as per the City of Surrey Design Criteria Manual.

a. A minor system, with a conveyance capacity up to the 1:5-year return period storm under free flow conditions, to minimize inconvenience of frequent surface runoff.

b. A major system, with a conveyance capacity up to the 1:100-year return period storm, to provide safe conveyance of flows and to minimize damage to life and property.

2.7.1.1 SITE DRAINAGE STRATEGY

A drainage analysis was completed for the post-development condition. The site catchment and relative drainage areas were calculated, and an analysis completed to size the proposed stormwater management facilities. The sizing is calculated on the basis of our appraisal of the proposed pervious and impervious catchment area conditions, in combination with the size of the catchment.

A summary of the proposed drainage strategy for each section is outlined below. Details of the proposed Stormwater Management Plan can be found on drawings 20M-00758-00-D-001 to D-005.

Section 1

It is proposed to utilise the existing VFPA-owned drainage assets to provide drainage for this section. This includes the existing catch basins, drainage pipes and culverts. Where small adjustments to the existing road alignment and curb are required, the position of catch basins shall be modified to suit.

It was determined that the existing catch basins are sufficient to capture surface runoff in a 1:5-year return period storm, provided that all the existing catch basins are still functional and cleaned. We are proposing to add one new catch basin on the east side of the road near STA 1+980.

VFPA have observed localized flooding along this section of Robson Road, particularly near to the junction with Elevator Road. Based upon our site observation in this area, we will re-grade between Robson Road and Gunderson Road to allow this section to drain towards the existing ditch to the north-west.

The Aplin & Martin Fraser Surrey Docks LP Stormwater Conveyance Assessment report (dated April 9, 2018) highlighted flooding of manholes near to STA. 1+600 for the 1:5-year return period event with high winter tides. This flooding is a result of the lower rim level of the manholes and insufficient capacity of the downstream sewers, which is worsened by the high tail-water resulting from the high winter tide levels at the outfall. The Aplin &Martin report recommends this existing sewer is to be upgraded from STA. 1+600 to STA. 1+100. Given that there is a future project planned and this Project will not increase the total flow into the existing storm sewers over the pre-development conditions, the downstream storm sewer will not be upgraded as part of this Project.

Section 2

It is proposed to provide curb and gutter with catch basins for this new section of road. The flow from the catch basins will collect into a new storm sewer, which will then connect into the existing VFPA storm sewer system.

By transforming the existing gravel surface to asphalt surface, it is discovered that the imperviousness of the catchment area will be increased from 30% to 85%.

Due to the increase in impermeable area for this section as a result of new road construction, additional storage will be required to match pre-development and post-development flows. We are proposing to utilize oversized pipes to detain the excessive runoff trigged by the change of surface material. A flow control manhole that regulates the release rate to the pre-development flow of 13.6 L/s will be installed at the downstream end of the proposed system, prior to the connection into the existing system. An oil water separator will also be placed just downstream of the flow control manhole.

The Aplin & Martin Fraser Surrey Docks LP Stormwater Conveyance Assessment report (April 9, 2018) shows that for the 1:5-year return period event with high winter tides, the system has no surcharged sections for the 1.968m-geodetic tide. For the 2.55m-geodetic tide the 1050mm section of pipe through the Paper Excellence yard is surcharged. Given that this Project will not increase the total flows into the existing storm sewer over the pre-development conditions, it is not proposed to upgrade this downstream storm sewer as part of this Project.

Section 3

It is proposed to provide curb and gutter with catch basins for this section of road. The flow from the catch basins will collect into a new storm sewer, which will run to the north-east towards Manson Canal.

The storm sewer will tie into an existing storm manhole on the south side the 'Timberland Wye' junction. The downstream conditions from this manhole are unknown, including the pipe size, inverts, material and outfall location. This information will be required to determine if this is a viable solution and if additional upgrades are required to meet the flow requirements.

Due to the increase in impermeable area for this section as a result of widened road, additional storage will be provided to match pre-development and post-development flows. It is proposed to oversize the proposed storm sewer to provide the required additional attenuation storage in the system.

A flow control manhole and oil water separator will be placed at the outlet of the new storm sewer, just prior to discharging into the Manson Canal.

2.7.1.2 FRASER RIVER FLOODING

The lowland areas around the FSPL are within the 500-year (or 1894 flood record) flood plain of the Fraser River, but it is protected by a dyke system. The system is intended to protect to the 1:500-year flood elevation of approximately 4.4 metres (including a 0.6 metre freeboard), but there are some known gaps.

The Northwest Hydraulic Consultants Ltd. Flood Protection Assessment Report (dated May 2018) reviewed the potential flood inundation at FSPL in relation to a new Potash Export Facility. The report showed extensive flooding across the whole site for the 200-year and 500-year events, including sea level rise and climate change to 2100.

Depending on the level of protection required, between 1 to 3m ground level increases would be the needed to raise the new road above the flood risk level. Given the large number of properties connecting directly off the road, this is not a viable solution.

It is recommended that the VFPA implement a site wide solution with respect to resolving the issues of flooding of the FSPL site from the Fraser River. Raising this road as an isolated project is not economical or practical.

2.7.2 UTILITIES

2.7.2.1 EXISTING UTILITIES

There are a significant number of existing utilities along Robson Road and Timberland Road South that will potentially be impacted by the proposed Project works. Utility owners include:

- VFPA;
- City of Surrey;
- Metro Vancouver;
- FortisBC;
- BC Hydro;
- Shaw; and
- Telus.

Information on the existing utilities across the Project site has been gathered from two primary sources:

- Utility plans and record drawings provided by VFPA for port owned assets across the FSPL site and
- BC 1 Call.

These records have been calibrated with the topographic site survey completed as part of this Project (see section 2.1 for details). This includes modifying the recorded location of existing utilities to correctly align with the location of as-surveyed surface assets, such as manholes, catch basins, hydrants and headwalls. No survey information was provided for the inverts of any storm pipework, and this additional information will need to be obtained in the next design phase where it is critical to the proposed stormwater system design.

Drawings 20M-00758-00-U-001 to U-005 show all the existing known utilities across the Project site.

2.7.2.2 IMPACTS ON EXISTING UTILITIES

A utility conflict matrix has been prepared to review the impacts of the proposed works on existing site utilities. A copy of this matrix can be found in **Appendix H**.

Overall, the impacts on existing utilities is low, with no significant relocations required. This assessment is based upon the assumption that existing utilities have been installed with standard cover requirements. This is greater than 1 m cover for all sanitary sewers, watermains, storm sewers and gas mains, with great than 0.6 m cover for all electrical and communication conduits. If it is found that these existing utilities are shallower than expected, than diversions or relocations may be required.

This is a more significant risk where full depth road construction is required. As such it is recommended that utility locates are undertaken where full depth construction is proposed to determine the depth of these existing utilities. The risk present from shallow utilities in the mill and overlay construction sections is much lower, as such it is not recommended to undertake further utility locates in these areas.

The new road remains at or very close to existing grade. As such there will only be a minimal increase in loading on existing utilities from additional backfill.

The primary impacts from the utility conflict matrix are summarized below:

- Along sections where mill and overlay of existing roadway is required small adjustments may be required to existing manhole lids to suit the revised road grades.
- Along sections of new full depth road construction, it is more likely that adjustments will be required to existing manhole lids to suit the revised road grades.
- Three existing fire hydrants (one owned by VFPA and the other two of unknown ownership) will be required to be relocated outside of the revised road alignment.

The potential most significant impact is where the proposed road crosses over an existing Metro Vancouver 1422 mm x 1752 mm sanitary box culvert at approximate STA. 2+190. From as-built drawings provided by Metro Vancouver the culvert is installed with shallow cover to the existing ground level. Utility locates will be required during the next design phase to confirm depth and location of this culvert. Additional mitigation may be required, such as a concrete protection slab over the top of the culvert where the new road is located, to prevent any damage construction or operation of the new road. This should be reviewed through engagement with Metro Vancouver in the next design phase.

During the next design phase, all third-party utility owners who are impacted by the works should be engaged with about the Project.

2.7.2.3 FIRE HYDRANT REQUIREMENTS

New fire hydrants are required to service the existing and proposed road which is being upgraded as part of this Project. The requirements for fire hydrant spacing along municipal roads is outlined in the City of Surrey Design Criteria Manual and documented in the Design Criteria for this Project.

The following fire hydrant servicing strategy is proposed:

- Along Robson Road the Project will utilise the existing fire hydrants, which satisfy the spacing and coverage requirements in all but one area. At Elevator Rd one new hydrant is proposed to provide sufficient coverage for this area.
- Along Timberland Road South it is proposed this section is serviced by existing fire hydrants along North and Timberland Road South. The spacing of these hydrants is such that they can service both roads across the rail tracks.

- Along the new section of road between Robson Road and Timberland Road South it is proposed to install two new hydrants to provider sufficient coverage to satisfy the Design Criteria. These hydrants will connect onto a new 200 mm watermain, which will tie into the existing VFPA water network. Two connections points are proposed to the north and south, both onto existing 200 mm PVC pipework. This will also create a ring main in the system, which is preferable for operational redundancy. During the next design phase, the available flow and head in the existing water system should be reviewed through hydrant testing.to verify it is sufficient to supply the two additional hydrants.

2.8 ELECTRICAL AND SECURITY

From the electrical scope perspective, the Project has three distinctive design tasks to provide the necessary infrastructure to complete the road improvements at the FSPL.

Surveillance System

Communication infrastructure required by VFPA to better manage normal operations along the roadway as well as emergencies. Our design will include the connection to the existing provincial network at Highway 17 – South Fraser Perimeter Road (SFPR).

Surveillance camera system and integration into the existing VFPA infrastructure.

DPWFS Access Control

Two VACS gates for the inbound container trucks accessing the terminal.

Intelligent Transportation System (ITS) infrastructure to support the VACS infrastructure.

Truck queuing system to control traffic flow into DPWFS.

Communication infrastructure to support the items below.

Street Lighting and Traffic Signals Design

Street lighting within the Project limits as per the standards of the authority having jurisdiction.

New traffic signal for the new four leg intersection at Timberland Road.

2.8.1 DESIGN CONSIDERATIONS

This Project represents a major undertaking, with direct implications for the performance of the commercial vehicle operations in the area. To demonstrate our team's understanding of the Project and comprehension of the broader issues and complexities, we have provided a brief overview below of the design considerations that will need to be discussed and addressed during the design process.

Fibre Network

The existing VACS and surveillance cameras, as part of DPWFS' VACS system, are connected to VFPA's network using cellular modems. These modems introduce cyber-security vulnerabilities and incur high monthly costs, which we understand needs to be addressed by this Project. To provide hard wired fibre connections, a new fibre backbone will need to be installed along the roadway and connected to the existing BC MoTI service vault housing the SFPR fibre network. This will require interconnection to MoTI infrastructure, as well as directional drilling under the rail line adjacent to SFPR. Our team has extensive working knowledge of the MoTI's SFPR system, as well as the coordination requirements for working with MoTI and directional drilling under rail tracks.

The intent of the design acts to upgrade the various electrical systems within the FSPL, including the tie-in into the VFPA's Canada Place operations. The design allows for the integration into the existing VFPA fibre trunk running parallel to the SFPR, from which, a 48-conductor single-mode (48C SM) branch fibre will extend along Robson Road. The tie-in to the existing VFPA fibre is to be located at the Elevator Road entrance from the nearest existing concrete communications vault on the SFPR. The fibre will then be routed north along Robson Road through new concrete vaults at various locations adjacent to the roadway; housing fibre splice closures in strategic locations. Further to this, concrete vaults will be placed to allow for directional drilling in locations with active rail crossings.

Splice closures within the concrete vaults will further distribute the 48C SM branch fibre into individual runs of 12C SM fibre to the Port's main terminal gate, metering lot, VACS zone, and control cabinets.

Once the fibre connection is established, the network architecture will need to be finalized with VFPA. The connection through the SFPR and Port Mann fibre network back to VFPA's core network switch at Canada Place will result in a 60+ km connection. This distance requires the use of extremely expensive network modules for the network switches. Based on our experiences from delivering the Deltaport VACS project (80+ km connection), we will recommend a network architecture that leverages one distribution switch for the DPWFS VACS system that will become a collector for all other switches. This architecture will reduce the quantity of network modules to the fewest possible while maintaining VFPA's standards in network redundancy.

Surveillance System

Fixed cameras will be located to provide 100% continuous coverage of the roadway. The camera coverage needs to be enough to allow operators to effectively monitor entrance areas, queuing area, VACS zone, and exit areas so that operations can be comprehensively observed, and issues and exceptions properly addressed. Fixed cameras will ensure operators continue to observe and record all activities in the area. These fixed cameras have also proven valuable for ICBC claims within Port property – proving driver fault for incidents such as gate hits. We have an excellent process for developing the necessary fields of view with Ops and Security. Pan-tilt-zoom (PTZ) cameras, will provide additional coverage, allowing the operators to zoom into specific areas of interest.

To provide enhanced coverage of the VACS zone, each lane has various dedicated fixed cameras oriented to capture the following:

- The operator of the vehicle;
- The operator's respective drivers license;
- The access gate and associate lane control signal head; and
- The driver interaction with the operator within the operator control booth.

The captured footage will be recorded to Network Video Recorders (NVRs) located within Canada Place and integrated into the Port's command and control system for remote, live monitoring.

Additionally, because the area is remote and is not expected to function 24-7, we will need to consider adequate security. For the 2901 Staging Area and Deltaport Truck Staging Area, our team designed a system that utilized infrared illuminators for after-hours surveillance. This enabled the Port to turn off unnecessary area lighting and still maintain adequate surveillance of the area. Finally, we have assisted VFPA in developing their standard for surveillance technology. Primarily working with the IS Department, these standards extend beyond the selection of manufacturer to also include means for remote power-cycling and unified administration controls. We were also responsible for the design of the custom rain-shrouds used on the PTZ cameras throughout the Port's property. These shrouds significantly increase the effectiveness of the cameras during inclement weather.

2.8.2 LIGHTING AND TRAFFIC SIGNALS

Lighting will be provided for the full extent of the new roadway. Increased lighting levels will be maintained in operations and high-traffic areas such as the main entrance gate and VACS zone.

To reduce infrastructure costs, the roadway lighting has been designed to primarily run on the south side of Robson Road thereby consolidating the conduit and cabling with the fibre optic system; however, in wider areas such as the metering lot, illumination will be provided on both the north and south sides of the roadway to provide adequate lighting coverage of the area.

LED fixtures have been utilized to reduce consumption costs while also improving fixture lifespan. These fixtures are the same used in the South Shore Corridor to provide standardized maintenance between areas. Lighting levels have been designed to achieve optimal illumination comparable to that of previous VFPA projects.

Street Lighting

For this Project, all roads are within VFPA jurisdiction. Similar to other VFPA projects, lighting levels will be as per the RP-8-18, table 11.1.

Table 2-6: Lighting Design Criteria

Roadway	Classification	Pedestrian Activity	Ave. Luminance	Ave. Uniformity Ratio	Max. Uniformity Ratio	Max. Veiling Luminance Ratio
Robson Road	Major	Low to none	0.6	3.5	6.0	3.0

(Based on RP-8-18, table 11.1)

All lighting along Robson Road and Timberland Road South will be shoulder mounted luminaire poles, similar to existing MoTI luminaires along the area. The luminaire fixtures will be Lighting Emitting Diode (LED) type. All luminaire poles will be 9m davit style pole. The design will follow the MoTI standards.

Intersections

As the new Timberland Road intersection will be within VFPA jurisdiction, the design of the intersection will follow the MoTI standards. All traffic signal equipment will be from the MoTI Approved Materials and Products (latest edition).

The new traffic signal intersection at Timberland Road will require full illumination as per RP-9-18, table 12-1.

Table 2-7: Intersection Design Criteria

Intersection	Functional Classification	Pedestrian Activity	Ave. Illuminance	Ave. Uniformity Ratio
Timberland Road	Major/Major	Low	18.0	3

(Based on RP-8-18, table 12-1)

VACS Area

The following table shows the lighting criteria for VACS areas:

Table 2-8: VACS Lighting Levels

Roadway/Area Name	Minimum Average Horizontal Illumination (lux)	Maximum Average to Minimum Uniformity Ratio (Avg/Min)
VACS Zone Transition Areas	30	3:1
VACS Zone	50	3:1

Based on TAC Guide for Design of Roadway Lighting, Chapters 15, 16

All lighting fixtures within the VAC areas will be Lighting Emitting Diode (LED) type. All luminaire poles will be 9m davit style pole. The design will follow the MoTI standards.

Wire Theft Deterrence

Within the VFPA jurisdiction, the following wire theft prevention strategies will be employed for this Project:

- Junction boxes between poles will be eliminated, where practical.
- Security bolts will be installed on junction box lids and pole hand-hole covers.
- Alarm monitoring will be included on all control cabinet and kiosk doors.

2.8.3 POWER DISTRIBUTION

Following further review of the site and as-builts drawings as well as obtaining information from BC Hydro regarding the capacity of some existing power services on site, we have determined that two power services would be required for this Project as follows:

1. **Power Service No. 1:**
   - There is an existing 120/240V, 10kVA BC Hydro power service at the intersection of Elevator Road and Robson Road that VFPA already uses to power a control cabinet and some additional devices. We have

determined that this service can also be utilized to provide power to some of the proposed roadway lighting. As such, we are anticipating that we do not need a new service from BC Hydro in this area and are aiming to use this existing service to provide power for a portion of this Project.

2 **Power Service No. 2:**

- There is an existing 347V/600V, 300kVA BC Hydro Pad Mounted Transformer (PMT) near the proposed VACS area for this Project. In discussions with BC Hydro, it appears that this transformer is only being utilized at approximately 35% which results in 200kVA of available power. Through our calculations for this Project, we will need approximately 50kVA of power which can be easily provided by this transformer. A new metering kiosk with a 100A, 347/600V will be installed adjacent to the existing PMT in order to provide power to the site equipment for this Project.

Backup Power

Backup power, through an Uninterruptible Power Supply (UPS) system, will be provided for all network equipment, system controllers, gates, surveillance equipment, and critical components to allow short-term continuous operation in the case of a power failure.

The design also includes a backup generator, automatic transfer switch and generator panel for the main electrical room.

Based on previous projects, in the event of power loss a signal will be sent from the primary UPS in the electrical room to the Programmable Logic Controller (PLC). The PLC will then hold open all gates in preparation for the power failure once the UPS runs out of battery life.

2.8.4 COMMUNICATIONS

2.8.4.1 NETWORK CONNECTIONS

All gate, camera, and vehicle detection locations will be connected locally via fibre to the central FSPL VACS electrical room, which serves as the main communication hub and fibre termination point. The network architecture envisioned for the Project employs the hierarchical internetworking model through the use of core and access network switches which are utilized as follows:

- Core Network Switches: these switches occupy the top of the network hierarchy and connect to the access network switches through fibre links. The core network switches will have redundant uplink connections to VFPA's main switches at Canada Place and EComm.
- Access Network Switches: these switches occupy the bottom of the network hierarchy and are used to connect end-devices to the network. They are mainly used at the camera pole locations to connect groupings of network cameras into the network. Access network switches will have a single fibre uplink to a core network switch.

There will be one core network switch within the FSPL network that will be the key connection to VFPA's network. This switch will be located in the main electrical room near the proposed pre-gate VACS zone. This switch will be connected to the existing fibre along SFPR and allow for the connection to both Canada Place and EComm main switches. Further discussions with VFPA's IS Department will be conducted to determine whether the core switch should also be interconnected to the core switches at any other VFPA zones.

All other switches within the FSPL network will have a single fibre uplink to the core network switch within the electrical room.

2.8.4.2 NETWORK FAILOVER

In the event of a failure of the primary fibre network to Canada Place and Ecomm, the FSPL network will become isolated. Similar to other VACS zones, the card access system and vehicle access gates will run autonomously; however, exception cases will need to be addressed locally by staff. As the primary servers reside at Canada Place, the intercoms and remote control of the gates will not be in operation during such an event. In addition, the surveillance cameras will be disconnected from the NVRs and will not record during the outage.

Further discussions will be held with VFPA's IS Department to review additional redundancy configurations using existing fibre infrastructure, including the possible connection to the core switches within other VFPA zones.

2.8.5 VACS ZONE

2.8.5.1 VACS ENTRANCE ISLANDS EQUIPMENT

The new VACS area access point will function similar to a VACS zone and shall be equipped with all standard VACS equipment, including Operator Control Booths (OCB), control kiosk, card reader cabinets, power cabinets, step-down transformers, cameras, intercoms, gates, traffic signals, lane use signs, static signs, and network infrastructure. Each entrance lane that is controlled by the VACS equipment is referred to as a VACS lane. The FSPL VACS consists of one primary entrance lane and one secondary entrance lane which are grouped as one zone within the overall VACS system which includes the VFPA South Shore, Deltaport and Westshore VACS zones.

The FSPL VACS gates will operate in a similar fashion to the new Deltaport VACS gates. The lanes will utilize card reader cabinets equipped with card readers, monitors, reservation keypads, interview cameras, and intercoms. Card reader cabinets will be dual height for use by both commercial and non-commercial vehicles. LED lane use signals will be installed at the front of each lane to allow for the opening and closing of individual lanes.

2.8.5.2 VACS SECONDARY ENTRANCE EQUIPMENT

The secondary gate for this Project would operate similar to the Deltaport VACS secondary lanes in order to allow approved vehicles to go through and deny entrance to denied vehicles. However, the difference in this application will be the secondary gate would remain in the open position at all times except when a denied vehicle is being processed. When a denied vehicle is processed at the primary entrance VACS gates, the secondary gate will come down and it will remain in the down position until the denied vehicle has exited. In addition, currently in the design there is a gap in the barriers at the main rail crossing where there is a possibility for a denied vehicle to cross over to the approved lane. As such, video analytics will be used at this location to determine if a vehicle crosses the lanes and an alarm will be generated into the command and control system for the operators to be notified.

2.8.5.3 SECURITY LEVELS

Similar to other VACS zones, security levels will be selectable to comply with the MARSEC levels and associated operations.

2.8.5.4 LANE MODES

The new FSPL VACS zone will include the ability to select the lane to process a certain type of vehicle (i.e. Cars Only and Trucks Only modes), process all vehicles, allow unrestricted access (Free Access mode), or to close the lane. This ability and detection of vehicles will be provided through the classification loops in each entrance lane.

2.8.6 ELECTRICAL ROOM

The FSPL-TI Project will incorporate an electrical room similar to the Deltaport VACS and Deltaport Truck Staging projects. The electrical room will be located near VACS main entrance area such that it provides easy maintenance access and efficient service distribution to the VACS areas. The electrical room will be sized and partitioned sufficiently to house all required network, communication and power distribution equipment. Additional space will be provisioned for future backup power equipment inside the electrical room.

The proposed electrical room will include the main disconnect circuit breaker for the BC Hydro main service as well as 347/600V and 120/208V distribution panels. A step down 45kVA, 347/600V – 120/208V transformer shall be installed in order to step down the voltage to the desired 120/240V for local powering of the electrical room. All equipment not in the proximity of the electrical room will be serviced by 347/600V distribution.

A full-height equipment rack will be installed in the electrical room for housing the network equipment, fibre patch panels, and UPS equipment. PLC and card access equipment will be installed on one of the electrical room walls for connection to the VACS lanes.

2.8.7 SECURITY

Surveillance for the area will include both fixed camera coverage for full time observational recording of the lot, as well pan-tilt-zoom (PTZ) coverage for live incident monitoring. Surveillance within the VACS zone will follow the

camera design of other zones and include PTZ and fixed coverage from both ends of the zone and fixed interview cameras. A single fixed camera will be used for monitoring the traffic signal and lift gate status of all VACS lanes.

Cameras will be recorded on VFPA's existing NVRs at Canada Place and will be stored to VFPA's existing storage array. Cameras will be allocated across multiple NVRs where possible to reduce the impact on recording of a specific location due to the failure of a single NVR. Depending on available capacity of the existing NVR servers, an additional server appliance may be required.

2.8.8 RAIL GATE MONITORING

Integrated into various cabinets along the Corridor, the Port's system will be connected to the rail pre-emption signals to determine the active status of the rail crossings. These cabinets each include a local PLC to receive a dry contact from the rail controller and relay the rail status to the Port's central command and control system to provide remote monitoring of the rail crossing activity. This information can also be displayed in the Port's PortVan eHub App. The rail crossing status between the truck queuing lot and the DPWFS main gate will also be used to limit the release of trucks from the queuing lot while the rail crossing is active.

2.8.9 VEHICLE METRICS

As part of this Project, dual loop detection locations will be provided at each rail crossing and connected to the control cabinets in close proximity to these locations that house PLC hardware. These loops will be able to determine speeds that the vehicles are travelling, estimated lengths of vehicles, quantities, and lane occupancy. These sets of loops are shown on the drawings and are located at each rail crossing for this Project. The above vehicle metrics will be able to be obtained and provided to the VFPA.

2.9 ENVIRONMENTAL

The Project site is located within historic and current commercial and industrial area. As an environmental review has been conducted in the previous stage, the following concerns have been considered as part of this Project and depending on the outcome, additional assessments and analyses may be warranted:

1 Ecological review and assessment,
2 Potential soil contamination affecting the design performance within the area, and
3 Unknown archaeological sensitive areas.

2.9.1 ECOLOGICAL REVIEW AND ASSESSMENT

An Environmental Overview Report (EOR) for the Project has been completed with the objective to conduct fisheries, wildlife and vegetation desktop information review and to identify additional field work and research required to support the preparation of the detailed environmental assessment (EA) report; information provided in the EA will be submitted and used to support VFPA's Environmental Review. As part of the submission, there are various studies and reports that are required to ensure that proposed works and activities within the Project area are carefully considered and that they fulfill their responsibilities under the Canada Marine Act and the Impact Assessment Act.

The EOR provided in **Appendix I** addresses some of the information requirements identified, however the desktop findings need to be verified in the field in order to produce the EA report. Currently the EOR includes the following:

- Summary of results from the desktop information review,
- Identification of potential timing window constraints;
- Assessment of potential project effects on identified environmental resources,

- Identification of federal and provincial listed species-at-risk including fish, vegetation, and wildlife; and potential existing invasive species types,
- Identification of potential permits and approvals required,
- Description of example mitigation measures, and
- Recommendations regarding additional information required for the detailed environmental assessment report.

High-level potential project interactions are summarized below:

Table 2-9: Project Activities and Potential Effects

Project Activities	Potential Effect
Widening/realignment of existing roads **Construction of new roads**	- Disturbance/removal of terrestrial vegetation, shrubs, and trees - Direct mortality, physical injury or behavioural change to birds due to habitat disturbance or removal of nests - Direct/indirect effects to listed rare/sensitive vegetation species
Riparian area and in-stream work	- Decrease in water quality due to sedimentation or mobilization of historical soil contamination - Disturbance/loss of riparian area of in-stream freshwater habitat - Direct mortality, physical injury, or behavioural change to fish due to in-stream works

An ecological investigation was conducted on 16 December 2020 in the presence of Indigenous Group and a biophysical assessment survey was conducted 20 April 2021. A detailed EA Report is in development and will incorporate findings from these site visits. The report will also include the following information requirements identified and describe proximity to sensitive receptors as well as impacts to land, water, air, and community:

- Biophysical survey,
- Description of vegetation,
- Birds and nesting,
- Species at risk at the site,
- Invasive species at the site,
- Potential interactions with the proposed plans, and,
- Mitigation measures and recommendations for management plans.

A Construction Environmental Management Plan (CEMP) has been completed and available in **Appendix J.** Information in the CEMP pertaining to heritage resources, public (municipal, stakeholders, community), Indigenous groups, and including potential effects from noise, vibration, light, dust emissions, or other deleterious discharges will be provided by others.

2.9.2 POTENTIAL SOIL CONTAMINATION

A Phase I Environmental Site Assessment (ESA) is required prior to the construction of the Robson Road-Timberland Road South Corridor to assess potential risk of encountering contaminated media during construction activities. A Phase I ESA report has been prepared in general accordance with

- Canadian Mortgage Housing Corporation (CMHC),
- Canadian Standards Association (CSA) standards Z768-01(R2012), and
- VFPA's Environmental Baseline and Exit Assessment requirements

and partial requirements from the BC Environmental Management Act (EMA), Contaminated Site Regulations (CSR) and associated protocols, procedures, and guidelines. This report is found in **Appendix K**.

WSP has completed the Phase II ESA investigation to confirm the level of contamination as per initial findings from Phase I ESA. The scope of work required for a Phase II ESA was completed in collaboration with our geotechnical field survey. This investigation followed CSA standards Z769-00(R2013). Intrusive field investigation was proposed for the central and eastern sections of the Project. Previous geotechnical investigation was conducted by another consultant (Thurber Engineering) at the remaining western section of the Project. The Phase II ESA report is found in **Appendix L.**

Note the Stage 1 Preliminary Site Investigation (PSI) and Stage 2 PSI requirements as per Section 58(1)(a) and (b) of the BC Contaminated Sites Regulation (CSR) acted as guides to the Phase I and II ESA.

2.9.3 ARCHAEOLOGICAL SENSITIVE AREAS

An Archaeological Overview Assessment (AOA) has been carried out by Wood on behalf of VFPA for the FSPL-TI Project with the understanding that the Project objective is to realign and upgrade sections of the road Corridor, including intersection reconstruction, road realignment, and construction of two VACS gates and associated utility, electrical, and communication works.

The results of the AOA indicate that, while there are no known archaeological sites within the proposed development footprint, the Project is situated in an area of high potential for undocumented archaeological resources at depth. Despite historic land alteration activities, the Project location is in proximity to several large and highly significant archaeological sites, shares landscape characteristics with other known sites in proximity, and has intact deposits underlying industrial fill.

Based on the results of this AOA and native, intact sediments encountered below the fill layer during geotechnical monitoring, it is recommended that:

1 No further archaeological assessment is recommended if construction impacts are conducted entirely within the existing fill or within any new fill added in addition to existing fill and
2 Additional archaeological investigation in the form of construction monitoring be undertaken where construction impacts are expected to extend into the native, undisturbed sediments underlying the imported fill.

Minimally, an archaeological field crew should be present for subsurface excavations below the depth of existing imported fill, particularly at the southern end of the Project area near Elevator and Robson Roads, where a buried soil was observed during geotechnical monitoring.

The full AOA report can be found in **Appendix M.**

2.9.4 ENVISION

Envision Certification is awarded by the Institute for Sustainable Infrastructure (ISI) based on their review of actions implemented and documented by members of the client, design, and contractor teams. The Envision team provided guidance during design to incorporate Envision requirements where possible into project design and documents and help set the foundation for the Project to achieve its sustainability goals through to completion. For this Project, Envision Version 3 (V3) which is the latest version will be used.

VFPA's intent in engaging the sustainability team this early in design process to is understand the certification level that may be achievable based on the current design of the FSPL-TI Project and understanding of operations at FSPL in the future. Several opportunities during the project planning stage were considered to strengthen the Project's case for considering and providing community benefits and reducing negative environmental impact that specifically contribute to credits in the Envision framework.

We have worked closely with VFPA and Project team to identify and discuss the early Envision credit opportunities that align with the Project priorities. The Envision team also collaborated with different disciplines to get a better understanding of issues and opportunities highlighted in Version 3 (V3). As the schedule for the work is fast and

poses a challenge, we ensured that there was early agreement and adoption on the Envision credit strategy and requirements so that they can be incorporated efficiently into the Project. We tackled this challenge by conducting Integrated Design Process workshops to help the team create a Sustainability Charter for the Project. Furthermore, we drew on our experience of working on Envision v3 projects to guide the team and answered any questions they had in a timely manner. Memo of their findings can be found in **Appendix N**.

ISI will engage a third-party Envision Verifier to review the Project's Envision application and make recommendations for award. As there is room for interpretation in the Envision credit requirements there is a risk that the verifier will have a different interpretation of the requirements and credit levels of achievement than the Project team. We employed key strategies to manage this risk:

- We incorporated a 10% buffer in the number of Envision points pursued so that any points lost during the verification process would not result in a lower award level.
- We assigned an experienced Envision Sustainability Professional (ENV SP) who has project experience in developing Envision V3 strategies and is retained by ISI as a project Verifier. Their role will be to oversee the team's work on the Project and complete quality control reviews of credit strategies and documentation.
- We are continuously collecting documentation of applicable work tasks undertaken within the Project timeline. This will help the completion of Project submission to ISI in future phases of the Project. As Envision V3 includes credits that are implemented and/or documented in detail design and construction, credit strategies, narratives and documentation have been limited to what is known and available at this design stage.

3 PERMITTING STRATEGY

A list of permits, approvals, and authorizations has been prepared to address the regulatory requirements for conducting site investigations (geotechnical and environmental) and carrying out the Project through construction. A matrix table summarizing the regulatory triggers, information requirements, and approximate review/approval timeline to track progress and compliance is shown below.

Table 3-1: Permits/Approvals/Authorization List

	PERMITS/ APPROVALS/ AUTHORIZATIONS
General	• Noise control (Noise control Bylaw, 1982, No. 7044). • Erosion and Sediment Control (Erosion and Sediment Control Bylaw 2006 No. 16138) • Soil Removal and Deposition (Surrey Soil Conservation and Protection Bylaw, 2007, No. 16389).
Environmental	• VFPA Project Environmental Review (PER) • Permit Authorizing an Activity Affecting Listed Wildlife Species Regulations under section 73 of the *Species at Risk Act (*for Streambank Lupine*)* • City of Surrey Permit for Project activities within Sensitive Ecosystems Development Permit Areas (i.e. Streamside Areas and Green Infrastructure Areas) • Erosion & Sediment Control (ESC) Permit for construction projects that have a disturbed area equal to or greater than 2,000 m • DFO Request for Review, potentially a Letter of Authorization under paragraph 35(2) of the *Fisheries Act* • Fish Salvage Permit • BC Water Sustainability Act notification • City of Surrey Sensitive Ecosystems Development Permit – Streams and Green Infrastructure • City of Surrey Hazard Lands Development Permit – Flood Prone Areas • *Canadian Navigable Waters Act* Notification / Permit may be required depending on proposed changes to any water crossings. • *Water Sustainability Act* Section 10 water use approval for construction phase of the work and the pumping of water out of excavations. • *Environmental Management Act* and Contaminated Site Regulation for movement and disposal of contaminated soils adjacent to the existing CP rail crossing on Harris Road. • Air quality compliance to Metro Vancouver regulations associated with construction equipment.

PERMITS/ APPROVALS/ AUTHORIZATIONS

Rail	• Agreement execution with Canadian Transportation Agency and Rail Authority (SRY) • Transport Canada E-4 Permit for Rail Crossing Improvements • Transport Canada E-10 Drawings for Utility Crossing underneath the Railway.
Roadway	• City of Surrey Traffic Obstruction Permit. • City of Surrey's Erosion and Sediment Control Permit.
Utilities and Drainage	• Metro Vancouver Notice of Work
Electrical and Communications	• BC Hydro Electrical Service Connection • BC MoTI fibre optic connection

It is important to maintain communication with the design team, City of Surrey, and various permitting agencies to ensure potential issues and/or timing anomalies are identified promptly and addressed as quickly as possible.

Written confirmation from the following authorities will be needed to provide consent to conduct works in proximity to establish connections to existing utility networks:

1. Telus,
2. Metro Vancouver,
3. Fortis BC,
4. City of Delta,
5. City of Surrey,
6. BNSF, and
7. BC MoTI.

This may include technical submissions for the works to ensure adherence to each authority's requirements; supporting documents will be prepared during the next design stage after consultation with each authority listed above.

4 PROJECT SCHEDULE

A project schedule for the FSPL-TI Project is shown below. VFPA has provided estimated milestone dates for design and construction complete which have been used as benchmarks in the schedule.

Schedule Summary

60% Detailed Design and Review	April 19, 2021 – June 11, 2021
90% Detailed Design and Review	June 14, 2021 – July 23, 2021
Permits, Coordination and Lease Agreements	March 16, 2021 – August 30, 2021
Issued for Tender	July 26, 2021 – August 20, 2021
Tendering and Construction Contract Preparation	August 31, 2021 – September 27, 2021
Construction (3 Stages), including Deficiencies Correction	October 11, 2021 – September 09, 2022
Project Closeout	September 12, 2022 – September 30, 2022

The complete Gantt Chart of the project schedule is presented in **Appendix O** details the anticipated dates of deliverables and intermediate submissions.

4.1 SCHEDULE ASSUMPTIONS

The following assumptions were included in the development of the project schedule:

- Third party utility agreements, lease negotiations/land acquisition, and City agreements/approvals in place prior to bid phase (requirements to be included within tender documents)
- Utility relocations include water, power, electrical distribution and gas lines along existing Timberland-Robson Road to be installed within Project site and under the railway as indicated in the plans. 3rd party utility design (BC Hydro and Fibre Optic) to occur as part of detailed design submission for early work.
- Schedule is based on a 5-day work week during design phase
- Schedule is based on a 5-day work week during construction
- Schedule activities based on latest design to date.
- Rail flaggers will be readily available for construction
- Local ready-mix concrete suppliers (no onsite batch plant required)
- Paving window is May to September (recommended)

5 STAKEHOLDER ENGAGEMENT

Stakeholder consultation was conducted with both external and internal VFPA departments. Recognizing that it was not possible to address all stakeholder requests in the design due to cost or feasibility, decision-making processes were established and communicated with stakeholders and VFPA to ensure all parties are in agreement with the FSPL-TI Project. **Table 5-1** below lists stakeholder meetings with various parties anticipated to be impacted by the Project. In addition to these meetings, regular communication via email correspondence was used.

Table 5-1: Stakeholder Meetings

STAKEHOLDER	DATE	PARTICIPANTS	DISCUSSION TOPIC
Westran	10 June 2020	VFPA, WSP, Westran	Understanding their current operations
DPWFS	15 October 2020	VFPA, WSP, DPWFS	Presenting Robson Road-Timberland Road South Corridor alignment and current design, discussing the main design elements of the Project, and confirming with VFPA Land Ops whether four truck staging lanes are still required (versus WSP's finding from traffic analysis).
BHP/ DPWFS	29 July 2020, 5 August 2020, 9 Sept 2020 and 21 Sept 2020	VFPA, WSP, DPWFS, BHP	Keeping road alignment to allow for future BHP development (tracks and sheds), discussing BHP's proposed sewer realignment and how its construction will impact FSPL-TI Project.
Metro Vancouver	02 March 2021	VFPA, WSP, Metro Vancouver	Presenting Robson Road-Timberland Road South Corridor alignment and current design, discussing the work over the Metro Vancouver's North Surrey Interceptor River Road Outfall Diversion and Manson Road Section Extension sewer lines.
SRY	Via Emails	VFPA, WSP, SRY	Confirming current and future track volumes and permit requirement for signal design.
City pf Surrey	22 January 2021	VFPA, WSP, City of Surrey	Presenting Robson Road-Timberland Road South Corridor alignment and current design, discussing the new signalized intersection at Timberland Wye, stormwater discharge into Manson Canal, and emergency response and access into and out of FSPL.
City of Delta	05 February 2021	VFPA, WSP, City of Delta	Presenting Robson Road-Timberland Road South Corridor alignment and current design and discussing emergency response and access into and out of FSPL.
VFPA Internal Departments	22 May 2020 (Initiation Meeting), 9 June 2020 (Real Estate), 6 July 2020 (Progress Meeting #1), 20 July 2020 (Environment), 22 October 2020 (Progress Meeting #2), 4 Nov 2020 (Land Operations), 5 Nov 2020 (Progress Meeting #3), 19 Nov 2020 (Progress Meeting #4) and 17 December 2020 (Progress Meeting #5), 14 January 2021 (Progress Meeting #6), 15 January 2021 (Information Systems), 26 January 2021 (Drainage), 28 January 2021		

6 RISK MANAGEMENT

There are many factors that can affect Project progress or schedule. Design risks can be defined "as an unforeseen event or activity that can impact the Project's progress, result, or outcome in a positive or negative way." How we manage these factors and identify potential risks are important aspects of overall project management. However, to properly manage risks, we need to assess them in two ways: ascertain the probability and then ascertain impact.

We recognize that projects are continuously evolving while identified risks are mitigated or diminish and new risks arise. We use a continuous and evolving Risk Management Plan that includes the following actions:

Identify:

We continually review, identify, and create written summaries of risk drivers that may include project risks, including safety, environmental, quality, utility, communication, schedule, and costs. We will include in our risk identification a Risk Register and workshop to establish an approach and categorize risk classification.

Assess & Analyze:

We assess the risks and analyze their potential impacts / probabilities. We use a Risk Matrix to help identify potential impacts and determine their severity.

Mitigate & Plan:

We develop mitigation and management strategies and plan for implementation –a written plan is an important tool.

Monitor & Control:

We monitor the strategies to limit risk and control the risk drivers when and where possible.

The impact of not managing risk could be tremendous, potentially leading to a significant delay in project completion and compromised end-product quality. WSP has identified the following risks within the Project, which are in-line with VFPA's seven points of project challenges and risk:

	RISK	POTENTIAL SOLUTIONS	RISK RATING
General	Permitting Coordinating with third-party stakeholders and implementing their criteria: Since the engagement on initial phase was only limited to port tenants and utility companies, any engagement with other stakeholders could create restrictions on design, which can increase construction costs. We may be required to obtain permits to work within their facilities or right-of-ways. The remaining of port tenants may potentially add more requirements to the design.	We will need to create a sound strategy for engagement that prioritizes and splits the engagement with stakeholders with the highest to moderate impacts. Discussions with third-party utility companies such as BC Hydro and Metro Vancouver has already been initiated to streamline project schedule and minimize potential delays.	Schedule Risk - High
	Weather Depending on the proposed schedule, weather conditions may present as a challenge to conduct adequate and valuable field investigations and paving works.	Scheduling investigation and staging construction work in such a way where disruptions caused by unfavourable weather events is the key. For example, paving works should be avoided in the winter months.	Schedule Risk - Low

	Indigenous Consultation: As required by Category C projects under VFPA Project and Environmental Review (PER) criteria, the Indigenous Consultation has the potential to impact schedule if any significant environmental or archaeological concerns are identified.	Continuous engagement with Indigenous Groups is important to resolve issues as they are identified.	Cost Risk - High
	Traffic Limiting disruption to traffic within FSPL will be a challenge. We understand that Robson Road and Timberland Road are busy Corridors for truck traffic. Additionally, the existing roads generally consist of two lanes; in some areas there is a truck pull-out lane. The drilling operations may impede traffic (e.g. single-lane alternative traffic, narrower lanes open to two-way traffic).	To minimize disruptions to traffic for vehicles travelling within or through FSPL, we recommend construction be split into two phases and staged in the following manner: 1. Construct the new Timberland Road South first and maintain existing traffic flow through Robson Road-Timberland Road North Corridor. 2. Perform work along the existing Timberland Road South and maintain existing traffic flow through Robson Road-Timberland Road North Corridor. Perform work along Robson Road and Elevator Road while providing flaggers to direct traffic. Both northbound and southbound travel shall always remain open.	Low
Geotechnical	Long-term Settlement We anticipate there may be long-term settlement based on the soil conditions we noted in our desktop review.	The most feasible solution will depend on factors such as the magnitude of the anticipated settlement, duration, service level acceptable to the stakeholders, anticipated maintenance effort, construction schedule, site constraints, site development history, depth and thickness of peat layers, groundwater level, etc. Depending on these factors, several remediation methods can be considered, which may include but not limited to, partial or full excavation and replacement of peat, geogrid reinforcements (e.g. “Spectra® Rail Railway Improvement System”) within the pavement structure, use of light-weight fill, and preloading.	Cost Risk - Medium

	Liquefaction and post-seismic displacements: Liquefaction and post-seismic displacements may also be an issue. Our previous experience shows alluvial deposits (sand and silt) are prone to liquefaction during a moderate to high intensity earthquake. This is consistent with regional liquefaction hazard maps where this area is identified as high risk of liquefaction. These soils are expected near the southern end of the proposed alignment and underlie the peat and organic silt layer along the northern of the proposed alignment. Extensive liquefaction will lead to settlement and lateral spreading, which in turn impact the post-disaster performance of the proposed infrastructure.	Specific measures to mitigate soil liquefaction are generally not implemented for roads and rail tracks if the consequences of liquefaction are deemed acceptable (for example, compared to a road/rail supported on a steep fill embankment, which the failure would result in a catastrophic failure). We will include details in the geotechnical report to estimate the expected level of damage, and such information can be included in a post-disaster recovery plan to determine the level of resources and time required to achieve intended functionality.	Low
	Buried utilities and existing infrastructure: Impact on buried utilities and existing infrastructure may be an issue. The raising of grade and other construction activities is likely to trigger additional settlement on buried utilities and other infrastructure. The RFP specifically identifies the existing Metro Vancouver sanitary main, although other utilities are also located proximity to the proposed development (e.g., FortisBC, Telus).	A settlement analysis will be used estimate the impact on these utilities and identify mitigation measures, monitoring and instrumentation requirements (if deemed necessary). The feasibility of the potential mitigation / remediation options will depend on factors such as the magnitude of the settlement, condition of the pipe, pipe material, expectations of the utility owner and construction details (e.g. if the sewer pipe is pile supported). Based on our previous experience with similar projects, implementing mitigation measures to limit the long-term settlement (e.g. use of light-weight fill) is more practical than remediating the pipe to accommodate additional settlement.	Cost Risk - Medium

Environmental and Permitting	<u>Unknown archeological sensitive areas</u> In British Columbia, archaeological resources are protected by the Heritage Conservation Act and impacts to sites require a permit. It is the responsibility of development proponents to manage impacts to archaeological sites. If the potential to encounter archaeological sites is high then, a Heritage Conservation Act (HCA) permit would be required for monitoring during ground disturbance activities. HCA permits can take three to six months to be issued and this could delay the work for other studies that would require archaeological monitoring for testing such as geotechnical and contaminated sites testing.		Schedule Risk - High
	<u>Soil Contamination</u> A previous environmental investigation report prepared by Hemmera Envirochem Inc. (Hemmera) for BHP Potash Export Facility indicated that soil and groundwater exceeded the applicable environmental standards at one of the adjacent to the Site lots (11060 Elevator Road). Hemmera also identified fill material of unknown quality at 11060 Elevator Road.	We have selected locations within the proposed Corridor to confirm or refute the presence of contaminants of concern identified by Hemmera at the adjacent lots. Based on the findings of Phase I ESA, Phase II ESA was conducted to investigative locations and potential contaminants of concern (PCOCs).	Cost Risk - High

7 FINANCIAL AND LIFE CYCLE COST

The VFPA is looking to understand the costs associated with maintaining the road right-of-way for the realigned Robson Road-Timberland Road South Corridor.

WSP has developed a 20-year program to cover annualised maintenance costs for typical operations, maintenance activities and provide life cycle costs for any non-cyclical replacement items such as pavements/sidewalks, lighting and electrical, and utilities (sewers/watermains).

The operational activities that are covered within the program include:

- Winter maintenance – snow clearance, de-icing, and sanding
- Summer maintenance – debris removal, pothole repairs, vegetation control, minor landscaping, and post winter sweeping.
- Sign Maintenance – Sign cleaning, sign face and sign-post replacements
- Line Painting
- Street Lighting/Traffic Signals – Signal cabinet maintenance, bulb changing, inspections, and cleaning

The non-cyclical renewal activities include repairs to pavement segments and curbs, and electrical cable and fibre-optic cable replacements.

The costs for the operations, maintenance and renewal activities have been developed using a mix of costs from the Class D estimates and costs sourced from municipal and provincial highway maintenance contracts. All summer and winter operational costs are in lane kilometres. The costs of the electrical and fibre-optic cables are calculated using unit rates from the estimates multiplied by the length of the road, whereas the renewal costs for pavements and curbs are a percentage allocation of the costs in the class D estimates.

The operational costs over the 20-year period have a 2% annual increase applied to them. The renewals in the program are based on the typical service life of assets.

The typical service lives of the assets are shown below:

- Pavement crack sealing - 5 years
- Major repairs to failed areas (30mm depth) – 8 years
- Major repairs to failed areas (50mm depth) – 12 years
- Pavement renewal for heavy traffic – 15 years
- Curb and Gutter Repairs (less than 1m) – 10 years
- Curb and Gutter Repairs (greater than 1m) - 15 years
- Electrical Cable Renewal – 15 years
- Fibre-Optic Cable Renewal – 15 years

Other assets such as water and storm mains have been included in the activity detail but are not included in the 20-year program due to their long service lives.

A Financial and Life Cycle Cost Analysis Report has been prepared which includes estimated construction costs with the anticipated life cycle operation, maintenance, and renewal. Refer to **Appendix P**. As well, Preliminary Asset Maintenance Plans is provided in **Appendix Q**; these plans detail the forecasted asset lifecycle and asset performance for the analysis period and recommendations for maintenance of the assets.

8 COST ESTIMATES

A Class C cost estimate has been prepared for the construction of this Project and detailed in **Appendix R**. The cost estimate is based on the information gathered during from recent research to update cost data from past cost estimates in order provide a reasonable representation of current market conditions.

For the purposes of Class C cost estimate RSMeans Data from Gordian® and WSP's in-house data base have been used to calculate the applicable unit rates.

8.1 LIST OF ASSUMPTIONS

Assumptions used in developing the Class C Cost estimate are as follows:

- All costs are in 2020 Q4 CDN dollars
- 15% Contractor Indirect cost has been applied to the unit rates
- Contingency of 30% has been assumed.
- Regulatory costs are 1.5% of construction cost based on the following allowances:
  - 1.0% Archeology Allowance
  - 0.5% Contaminated Soils Mitigation
- Soft costs are taken as 6% of construction costs based on the following allowances:
  - 2% Owner's Engineering
  - 3% Project Management and Contract Administration
  - 1% Permitting & Monitoring

8.2 SUMMARY OF RESULTS

Table 8-1 summarizes the Class C cost estimate for the FSPL-TI Project. See **Appendix R** for the full breakdown of costs.

Table 8-1: Cost Estimate Summary

Item	**Component**	
1	Infrastructure – Utility and Drainage	$2,995,500
2	Geotechnical	$417,000
3	Roadwork	$5,778,250
4	Rail Crossings	$4,205,898
5	Electrical and Security	$2,228,000
6	General Construction Conditions	$2,343,700
	Contingency, Regulatory, and Soft Costs	$6,738,132
	TOTAL	**$24,706,480**