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Case Study: Overcoming challenges and obstacles to remediate a former de-waxing facility in Richmond, BC

Stantec

PORT of vancouver

Agenda

1. About VFPA and the Port of Vancouver
2. Introduction to the project
3. Administrative considerations
4. Technical challenges
5. Solutions
6. Lessons learned

Fraser Wharves Remediation

About VFPA and the Port of Vancouver

Federal Port Lands and Waters

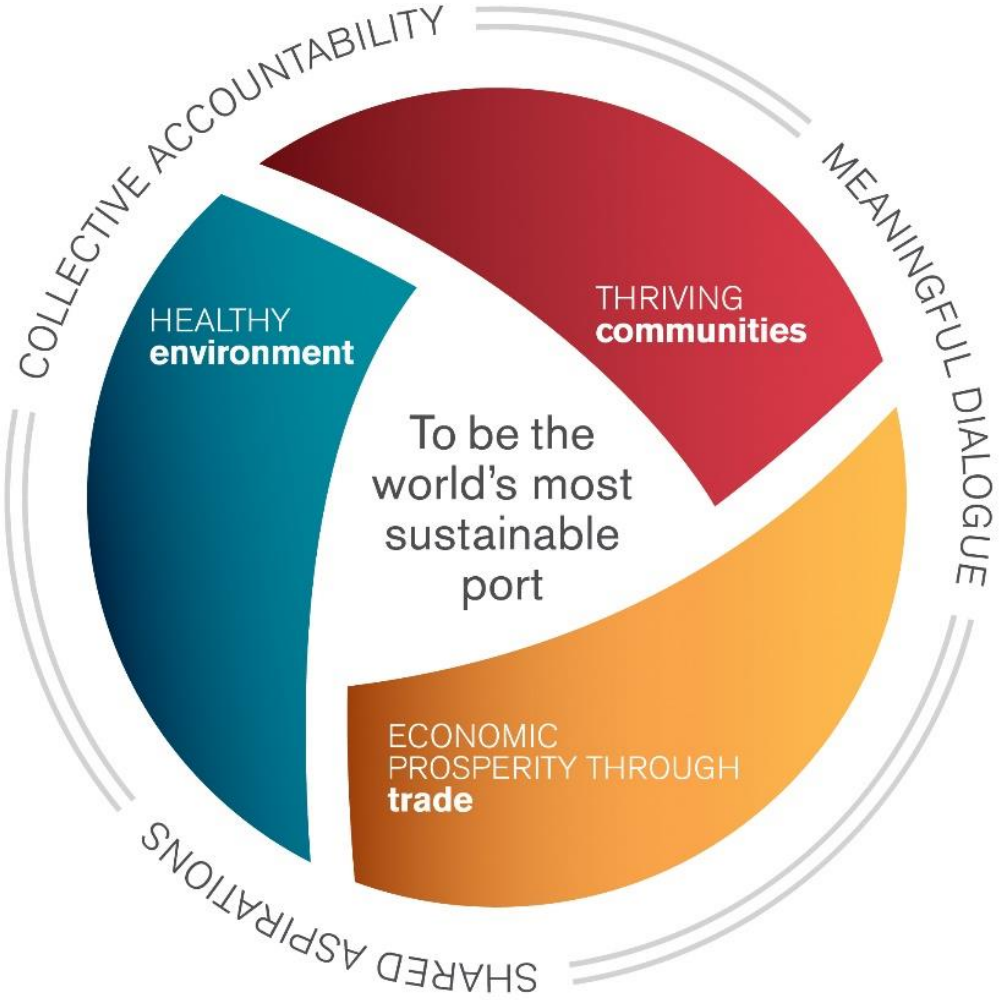
VFPA Mission and Vision

Mission

To enable Canada's trade objectives, ensuring safety, environmental protection and consideration for local communities

Vision

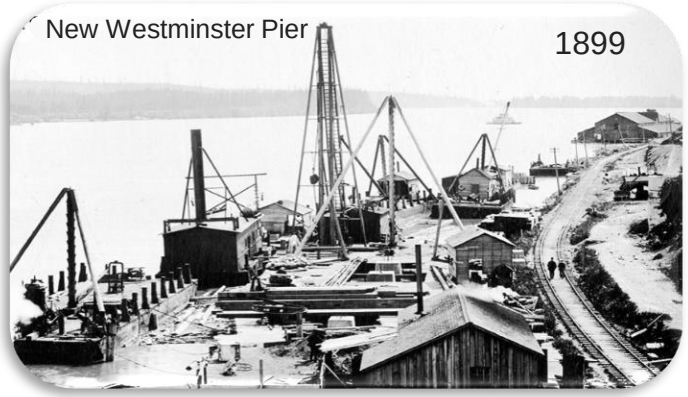
To be the world's most sustainable port

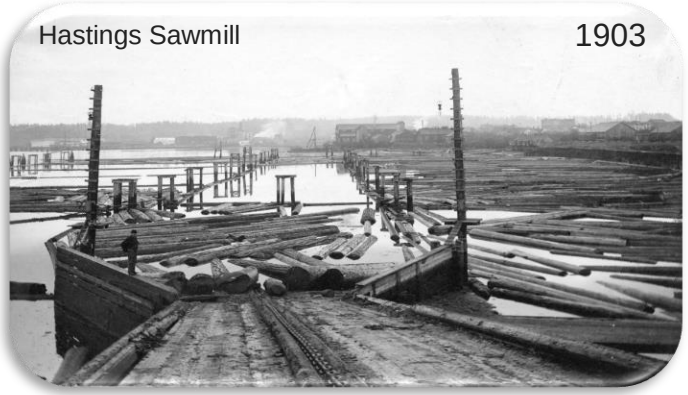


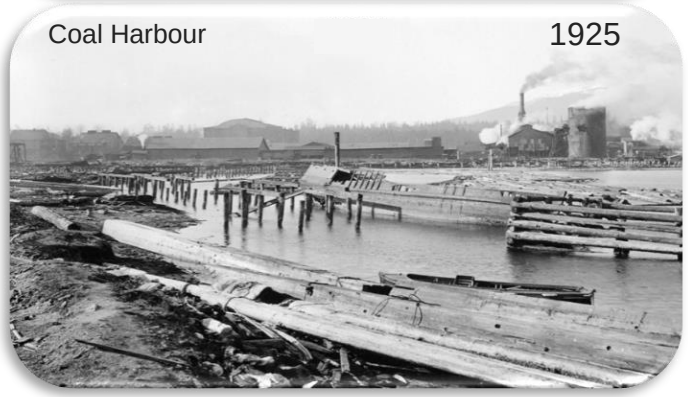
We manage a portfolio of lands with long-standing contamination issues

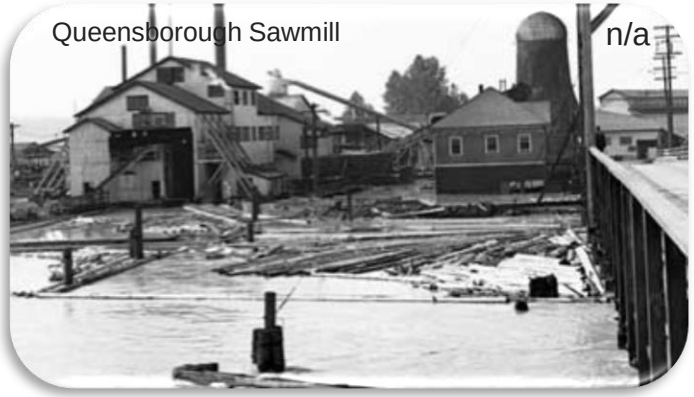
The following Acts guide contaminated sites work

- *Canada Marine Act*
- *Canadian Environmental Protection Act*
- *Fisheries Act*
- *Environmental Management Act of BC**







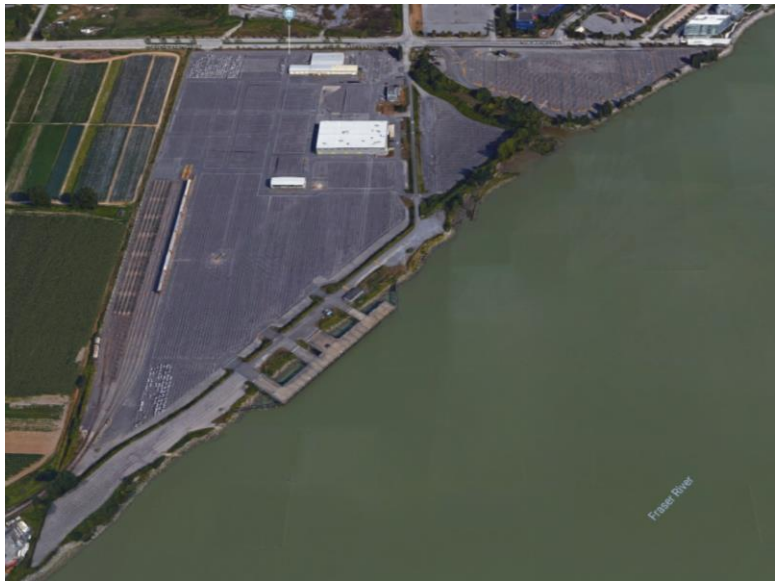


VPFA Priority Sites

Fraser Wharves Remediation

Project Overview

Fraser Wharves



Remedial Objectives

1) Make the site safe and attractive for tenancy
2) Reduce long-term liability
3) Minimize ongoing environmental O&M costs
4) Compliant with applicable laws and regulations

Project Description

The remedial strategy for the site was to remediate to two key AECs and use risk management to address the remaining AECs

- AEC 1: **Former De-waxing Area**
  Petroleum Hydrocarbons
  PAHs
  Metals
- AEC 2: **Underground Storage Tanks**
  Petroleum Hydrocarbons
  Metals

Project Description Con't

AEC 1

- Removal of LNAPL using a hydrovacuum
- Excavation and segregate 10 m3 of HW soils and 1700 m3 of IL quality soils
- Groundwater pump and treat
- Backfill and site restoration

AEC 2

- Removal of fuel system infrastructure
- Removal of 10,000 L single walled gasoline underground storage tank
- Excavation and segregate 200 m3 of IL quality soils
- Groundwater pump and treat
- Backfill and site restoration

Fraser Wharves Remediation

Consultation and Communication Considerations

Consultation and Communication Considerations

1. Aboriginal consultation
2. Union consultation
3. Tenant consultation and communications
4. Consultant – Client communications

Consultation and Communication Considerations

Aboriginal Consultation

- Timing is critical
- Allowing sufficient time is even more critical
- The questions are tough, they are relevant, and they may change your project

Consultation and Communication Considerations

Union Workers

- Maintain a safe workspace
- Be respectful
- Educate all members on changes to the workplace

Consultation and Communication Considerations

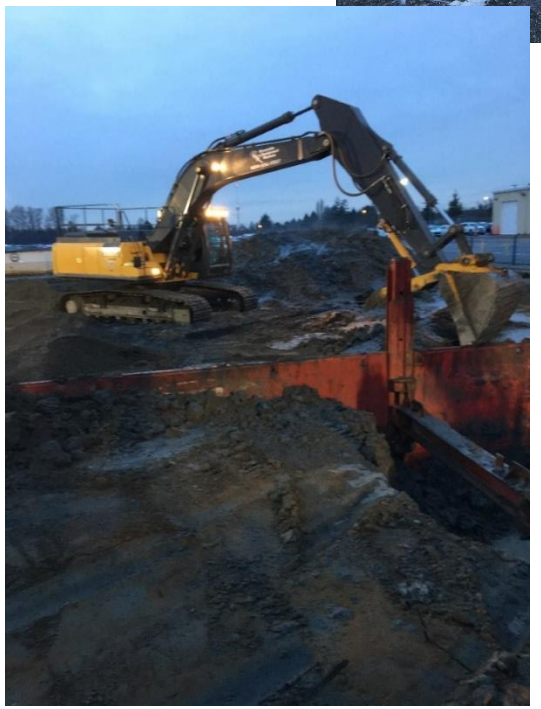
Active Site, Active Tenant

- Less than 1 week's notice of ship activity
- Loss of site productivity for 2 months
- Additional time for post-remedial activities

Consultation and Communication Considerations

Client Communications

- Winter schedule – low lighting conditions
- 36” storm water line
- Concrete footing with rebar reinforcement
- Septic tank / sands
- Unanticipated kerosene line
- Relocation of fire hydrant



Fraser Wharves Remediation

Technical Challenges

Technical Challenges

1. Site geology
2. Site hydrogeology
3. Groundwater conditions and chemistry

Technical Challenges – Issues Identified

Site Geology

- Lithology consists of fill, silt underlain by medium to coarse grain sand
- Sand layer encountered 2.1-3.1 meters below ground surface (mbgs)
- Project team identified requirement for shoring to excavate contaminated soils

Technical Challenges – Issues Identified

Hydrogeology

- Site adjacent to the Fraser River and is tidally influenced
- Depth to groundwater dependent on tide cycle
- Depth to groundwater ranged from 1.2-1.8 mbgs
- Highly porous material with high conductivity values
  ($K = 10^{-6}$-10^{-8} cm/s)

Technical Challenges – Issues Identified

Groundwater Conditions

Estimated Infiltration Rates

Infiltration Rates	Lateral Flow (m^3/day)	Vertical Upward Inflow (m^3/day)	Total Pit Inflow (m^3/day)
De-Waxing Area	2,421	3,100	5,531
Refueling Area	1,715	3,378	5,093

Note

- These are conservative estimates and are based on steady-state open excavations
- Estimates based on water levels observed in January 2013 during high-tide conditions
- Estimated depth of excavation for de-waxing area is 2.7 mbgs
- Estimated depth of excavation for refueling area is 1.8 mbgs

Groundwater Chemistry

- Groundwater COCs include petroleum hydrocarbons and dissolved metals
- Identified COCs in groundwater could be effectively treated using routine groundwater treatment systems
- Issues related to treating dissolved iron
- High flow rates

Technical Challenges – Issues Identified

Groundwater Chemistry

Dissolved Iron Concentrations versus Regulatory Criteria

Observed Range [Diss. Fe] (µg/L)	CCME Freshwater Aquatic Life – Long Term (µg/L)	CCME Marine Aquatic Life – Short Term(µg/L)	BC – Water Quality Guideline – FWAL (µg/L)	BC – Water Quality Guideline – MEAL (µg/L)	Metro Vancouver Sewer-use Bylaw (µg/L)
9,240 – 39,400	300	n/g	350 - 1000	n/g	10,000

Note

CCME – Canadian Council of Minsters of the Environment
FWAL – Freshwater Aquatic Life
MEAL – Marine / Estuarine Aquatic Life
n/g – No guideline

Fraser Wharves Remediation

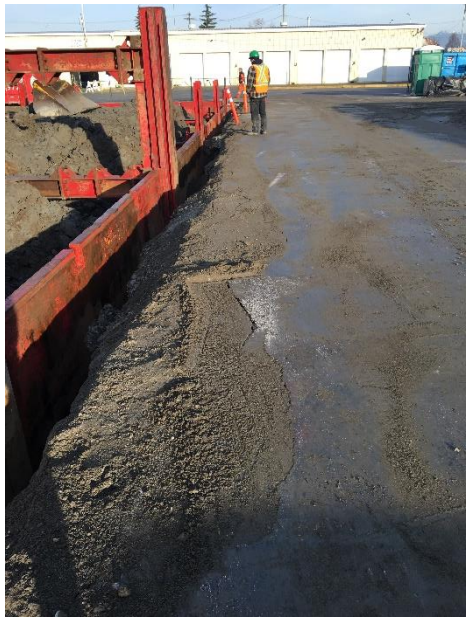
Project Solutions

Project Solutions

1. Slide-rail shoring system
2. Pre-confirmatory drilling
3. Timing of excavation
4. Water treatment system
5. Discharge of treated excavation water

Project Solutions

Slide-Rail Shoring System

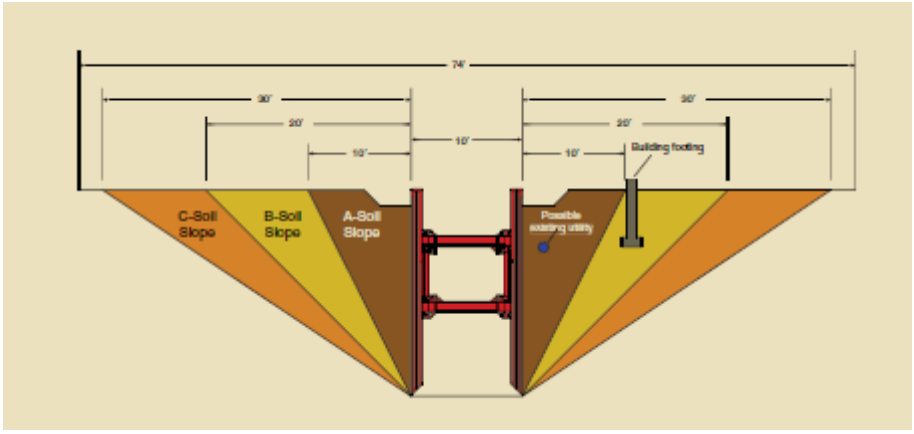


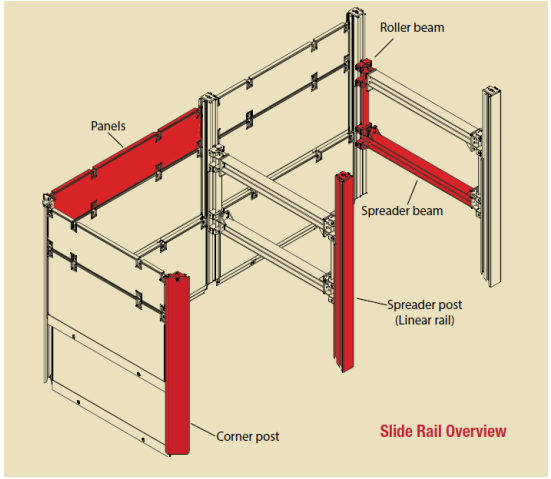
- Tervita proposed to utilize slide-rail shoring system
- Dig-and-push style trench shoring system
- Modular design to allow flexibility in shape and size

Project Solutions

Slide-Rail Shoring System

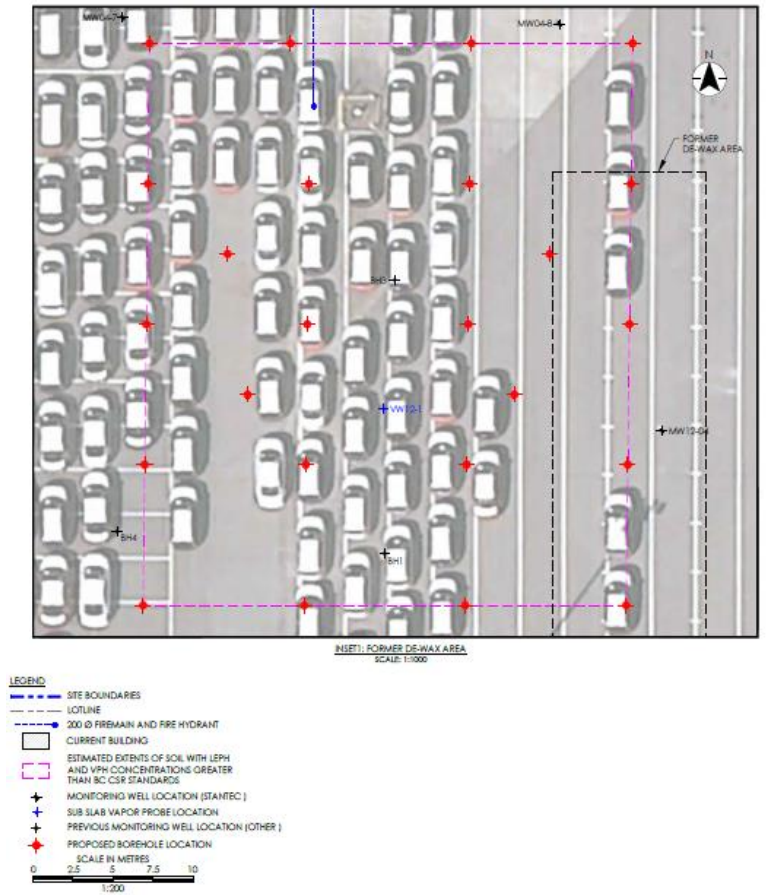
- The use of the slide-rail shoring system allowed the project team to solve the following issues
  - Geology – Fraser River “heaving” sands causing issues with preventing removal of all identified contaminated soils
  - Hydrogeology – shoring system will reduce the inflow of groundwater into the excavation to reduce loading on water treatment system
- Prevents the ability to collect confirmatory wall samples





Project Solutions

Pre-Confirmatory Drilling Program



- Completed grid-based drilling program (10m x 10m) to excavation depth and collected confirmatory soil samples
- Submitted soil samples for COC concentrations
- Allowed excavation to proceed using shoring system which would have prevented obtaining confirmatory wall samples

Schedule of Excavation and Water Discharge

The following factors were taken into account when scheduling excavation activities

- Timing of the tide cycle
- Presence of salt-wedge
- Weather forecast
- Ship arrival

Project Solutions

Water Treatment System

- Water treatment system designed to treat excavation water
- Tervita designed treatment system to include following components
  - Storage tanks
  - Baker tanks – sedimentation tank
  - Carbon vessels
  - Sand filters
  - Holding tanks
  - Discharge hose, including transfer pumps
- Treated water can be discharged into the Fraser River salt-wedge

Project Solutions

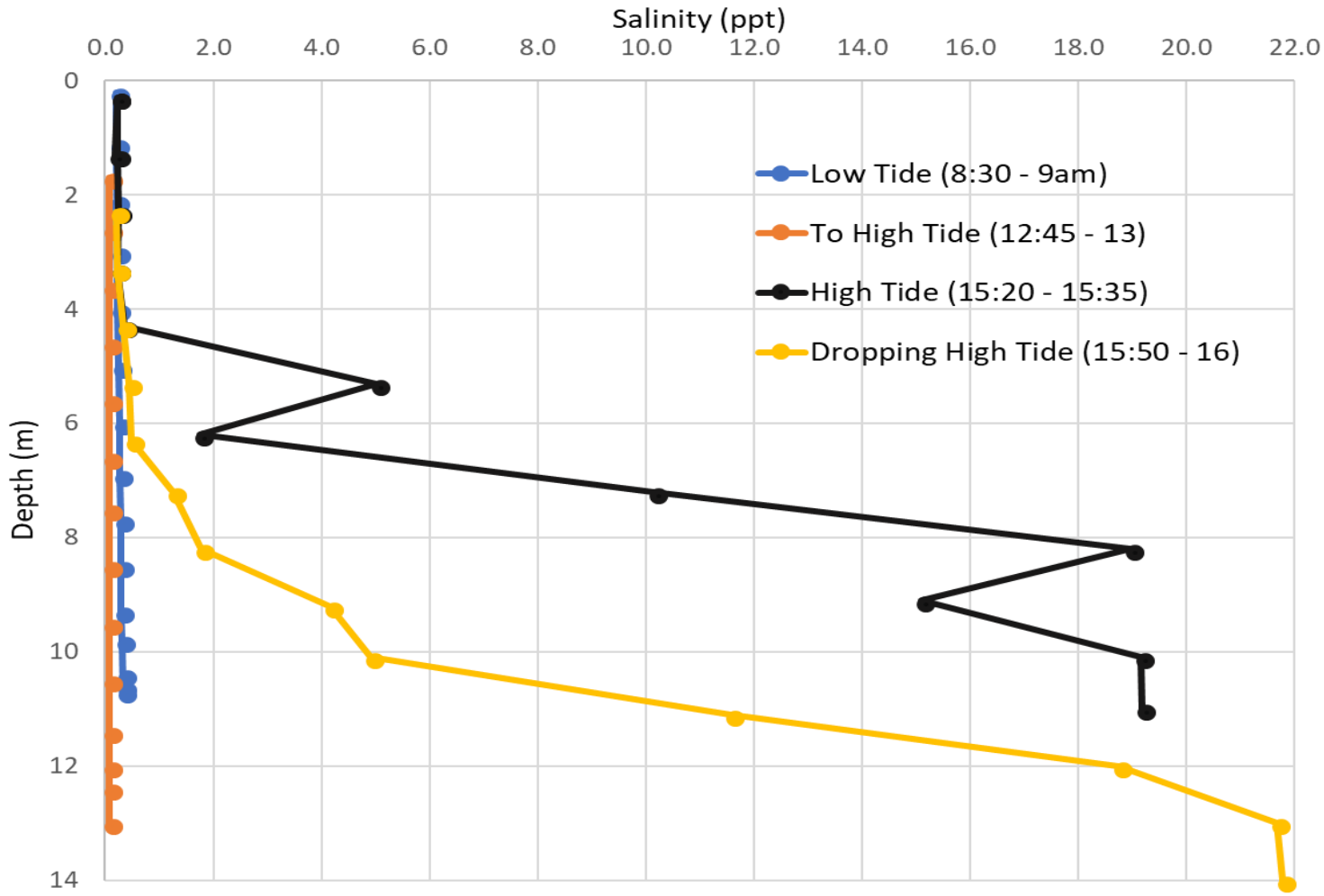
Discharge of Treated Excavation Water

- Treated water can be discharged into the Fraser River salt-wedge
- WQ was collected at depth to determine the nature and extent of the salt-wedge
- The salt-wedge was observed in the Fraser River associated with a high tide, and contribution of marine (saline) cold water at lower depths in the water column
- Results indicated that treated water can be discharged at depth (6 to 10 meters below the river surface) into the river coinciding with a time period of up to 5 hours following the high tide peak (+/- 0.5 hour)

Project Solutions

Analysis of Salt-Wedge

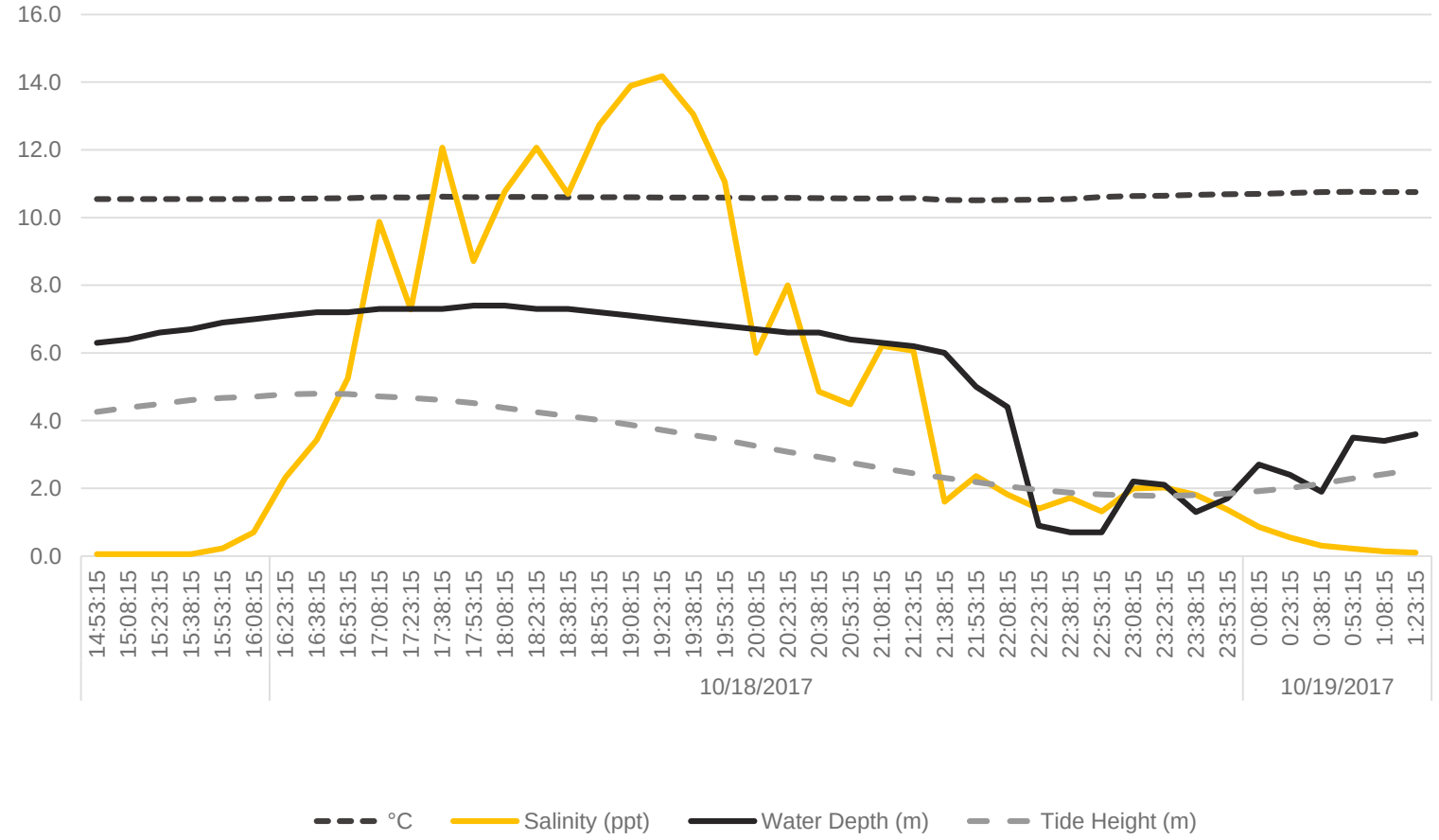
Stantec collected WQ across full tidal cycles to define the characteristics and timing of the salt-wedge.
Vertical salinity depth profiles at 4 different tidal periods on Oct 30, 2017



Project Solutions

Discharge of Treated Remediation Water

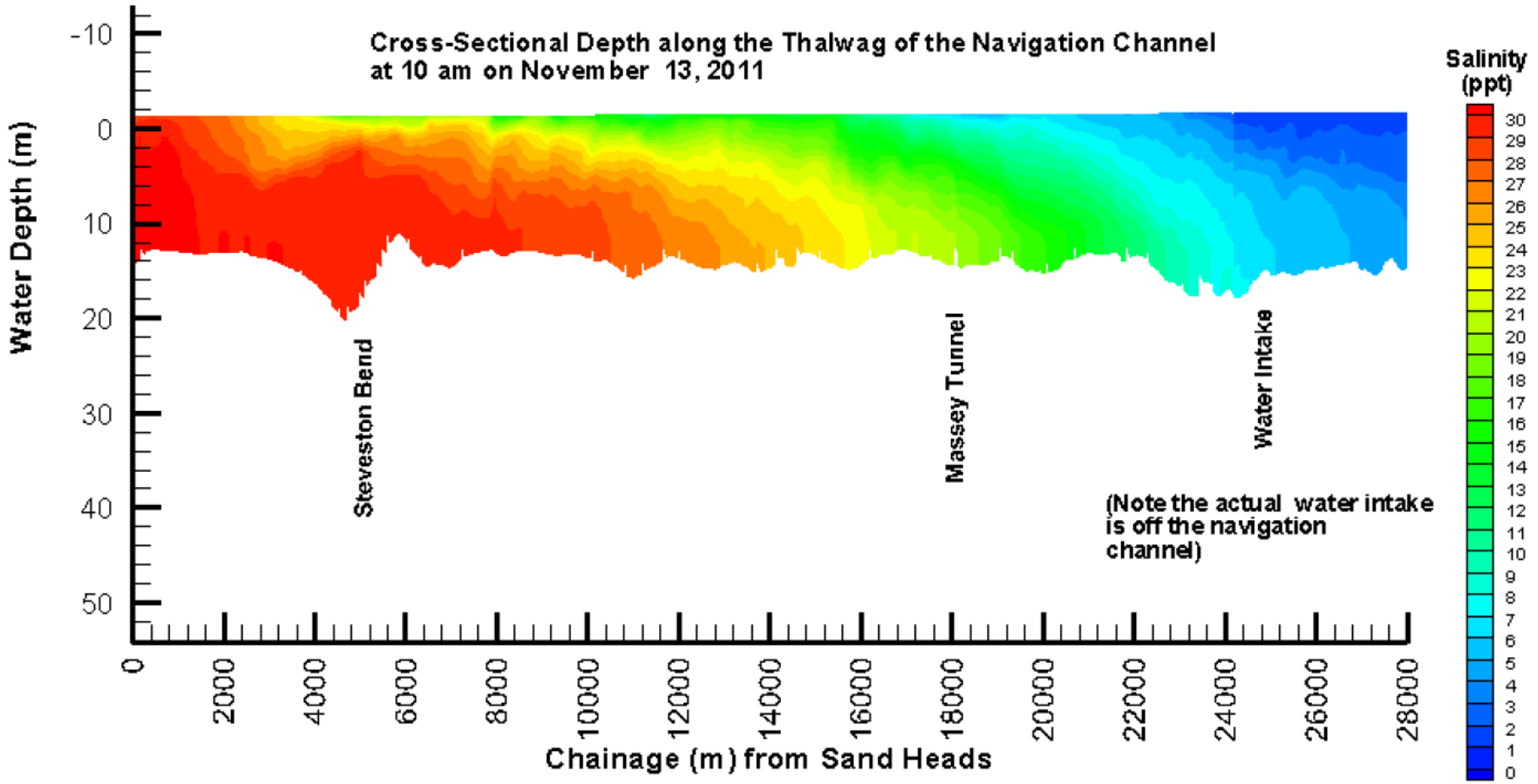
Results indicated that treated water can be discharged at depth (6 to 10 meters below the river surface) into the river coinciding with a time period of up to 5 hours following the high tide peak (+/- 0.5 hour)



Data logger placed 0.5 m from Fraser River channel bed – continuous recording across tide change

Project Solutions

Discharge of Treated Remediation Water



Lessons Learned

1. Communicate often, communicate early
2. Employ the slide rail shoring system
3. Complete pre-confirmatory drilling
4. Discharge of treated excavation water
5. Invest the time and money in advance

Questions & Comments

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