



# Emergency Response and Remediation of a Crude Oil Release in Abbotsford, BC

Andrea Leroux – Environmental Specialist, Trans Mountain  
Kristjana Zoras – Project Director, GHD

→ RemTech 2022





# Agenda

- Introduction
- Site Setting
- Stakeholder Consultation
- Response and Remediation Work
- Excavation Complexities
- Site Hydrogeology
- Dissolved Phase Groundwater Trends
- Groundwater Sample Results
- LNAPL Characteristics
- Next Steps
- Acknowledgements







*Aerial view of northern portion of Site*



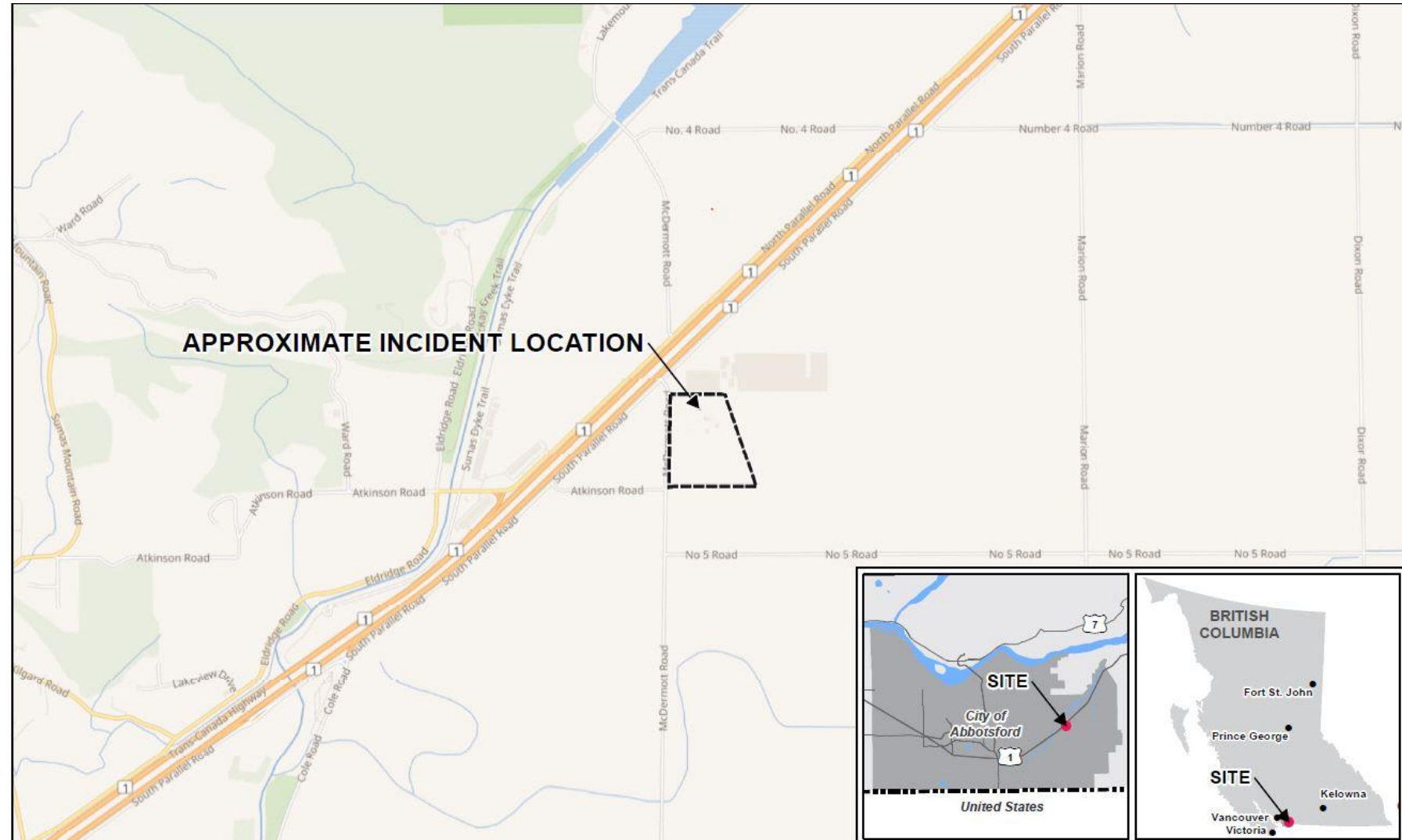
*Aerial view of southern portion of Site*

# Introduction

- June 12, 2020, a pipe fitting failed at the Trans Mountain ULC Sumas Pump Station
- ~ 150-190 cubic metres of crude oil was released to the environment
- Trans Mountain (TM) notified the Canada Energy Regulator (CER), local Indigenous groups, nearby municipalities, and other relevant provincial and federal regulators of the Incident

# Site Setting

- Within the Sumas Prairie, in the eastern portion of the City of Abbotsford
- Surrounding land is predominantly flat and the closest surface water body is 700 meters to the west (Sumas River)





# Site Setting

- Area A – Sumas Pump Station in the north portion of the property
- Area B – TM owned agricultural field to the south
- Culvert – Located between Area A (inlet) and Area B (outlet)



*Aerial view of pump station with approximate incident location*



# Stakeholder Consultation

- Notifications were made to regulators, potentially affected Indigenous groups, and stakeholders
- Site tours were arranged for interested parties
- TM established the Environment and Restoration Working Group (ERWG)
- ERWG meetings were held on a daily basis immediately following the release. Frequency was gradually reduced
- Written environmental updates continue to be provided to the ERWG on a regular basis



# Response and Remediation Work

## Air Monitoring

---



## Product Containment and Recovery

---



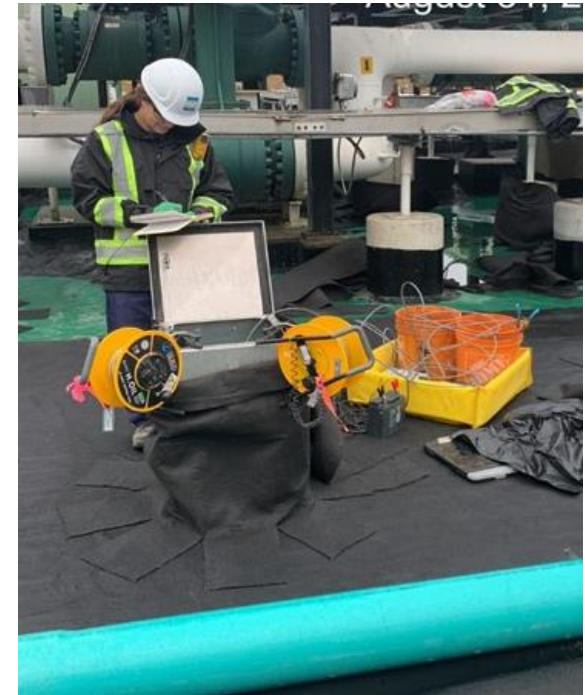
## Groundwater Investigation

---



## Light Non-Aqueous Phase Liquid (LNAPL) Recovery and Investigation

---





# Response and Remediation Work

**Soil Excavation – Area A**

---



**Soil Excavation – Area B**

---



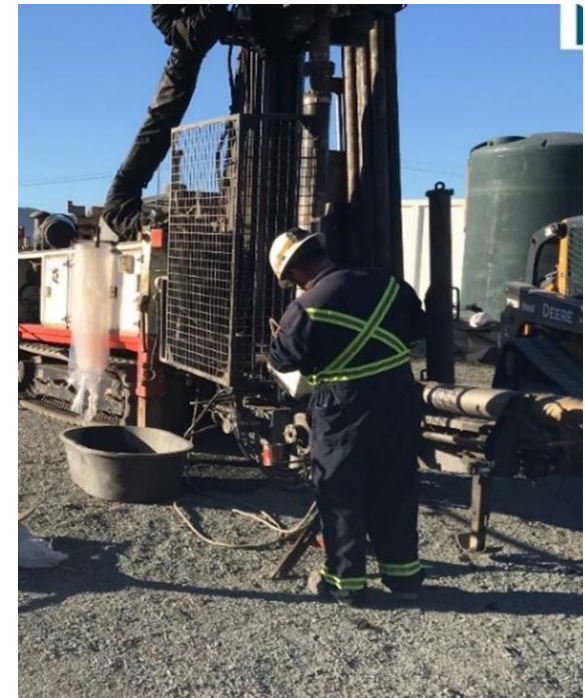
**Waste Management**

---



**Subsurface Soil Investigation**

---





# Excavation Complexities



**Excavation and product recovery around existing infrastructure**



**Working within complex geotechnical and facility restraints**



# Excavation Complexities



**Completing backfilling activities with limited access**



**Excavation and product recovery at a live pump station**



# Site Hydrogeology

- Groundwater flow direction has been observed to the east to east-northeast
- Groundwater table is typically located between 1.5 to 3.5 m below ground surface and varies seasonally
  - Decrease of 0.6 to 1.6 m between the wetter winter season and drier summer season
- Groundwater flow velocity is seasonally influenced, with a 120-130% increase observed from the drier summer season to the wetter winter season.
  - This is due to an increase in the groundwater elevations and horizontal hydraulic gradients during the wetter winter season.





# Dissolved Phase Groundwater Trends

Increased precipitation in winter months

Higher groundwater table contacts residual LNAPL

Pulse of increased dissolved phase concentrations

Migration due to increased groundwater flow velocities



- Seasonal groundwater elevation fluctuations create a dynamic flow system
- Various remediation efforts at the Site have influenced the behaviour of residual impacts and have reduced the extent of dissolved phase migration
  - PetroFix®
  - Biosparge system
- Since the installation of the biosparge system, dissolved phase concentrations have been steadily decreasing



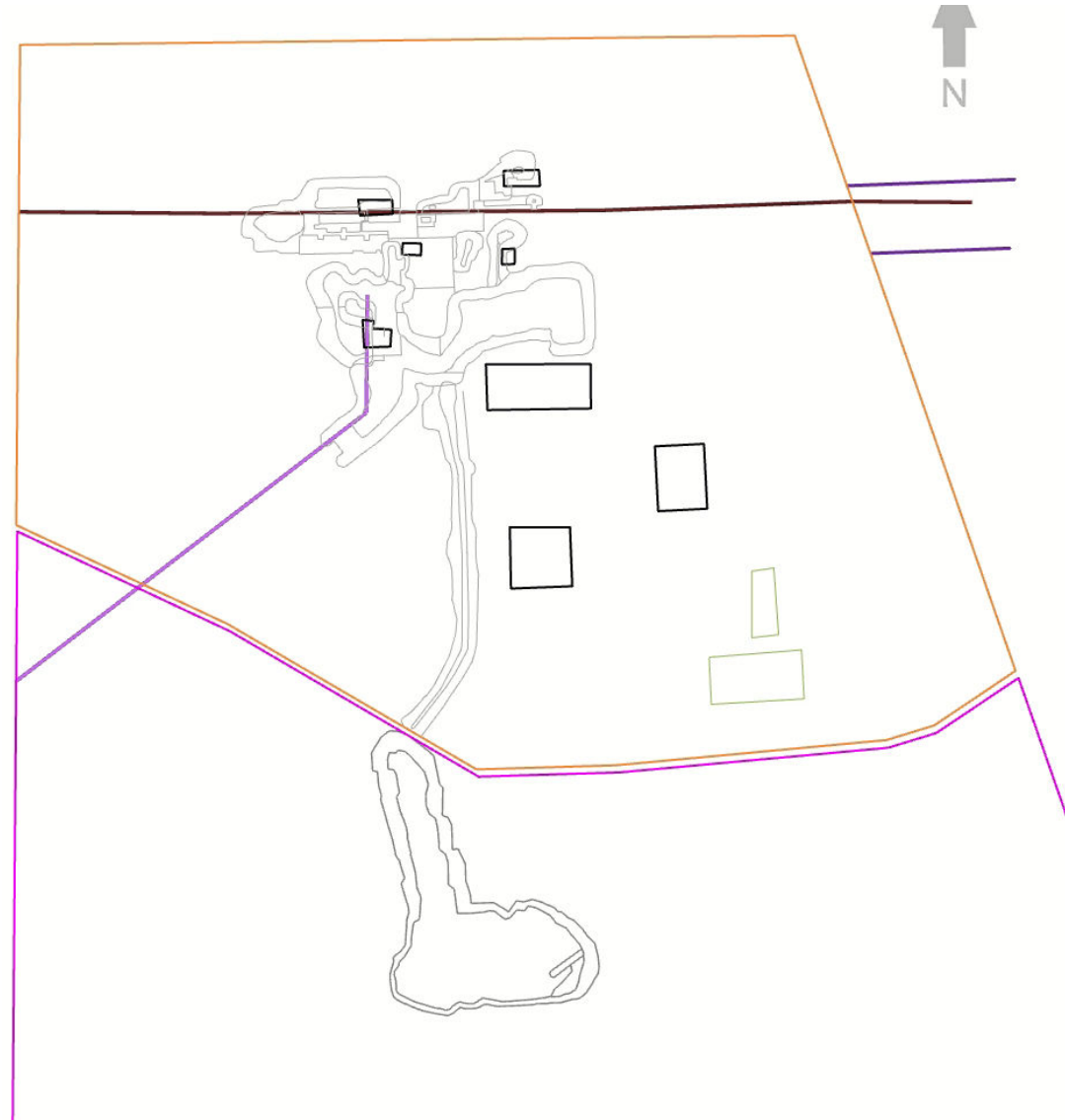
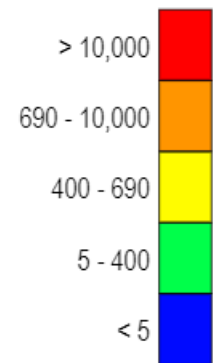
# Groundwater Sample Results

## Legend

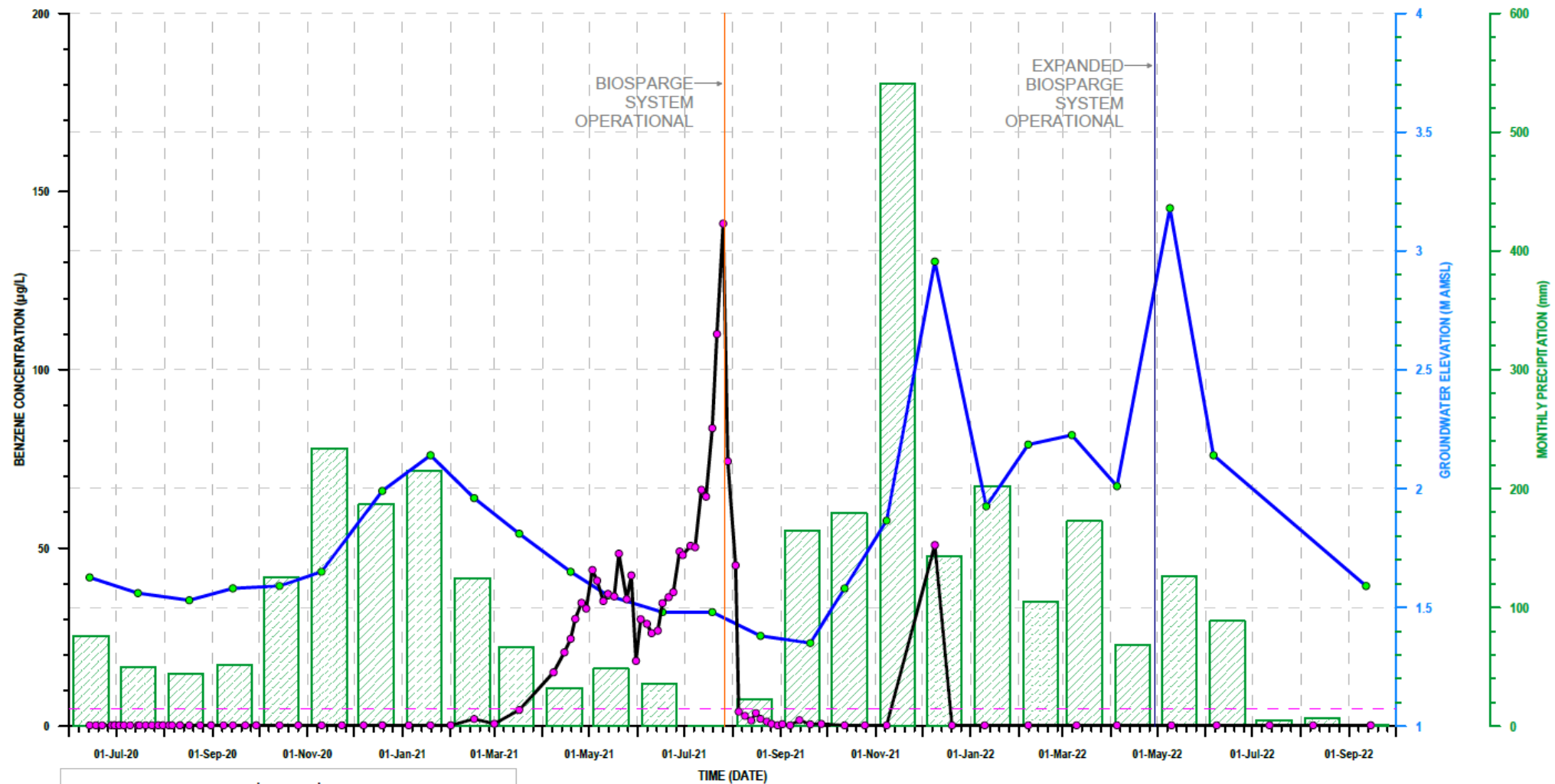
5x VERTICAL EXAGGERATION

- Area A
- Area B
- Pipeline
- ROW
- Pipeline

Benzene (ug/L)







\*Groundwater quality criteria for benzene is based on the following standards and guidelines:  
 -BC Contaminated Sites Regulation Schedule 3.2 - Generic Numerical Water Standards - Protection of Drinking Water (BC CSR DW)  
 -Health Canada Guidelines for Canadian Drinking Water Quality (GCDWQ)



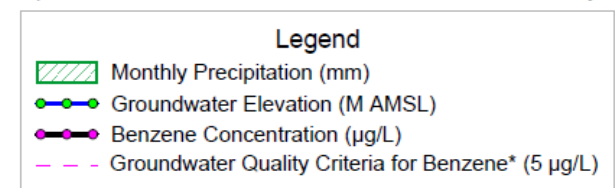
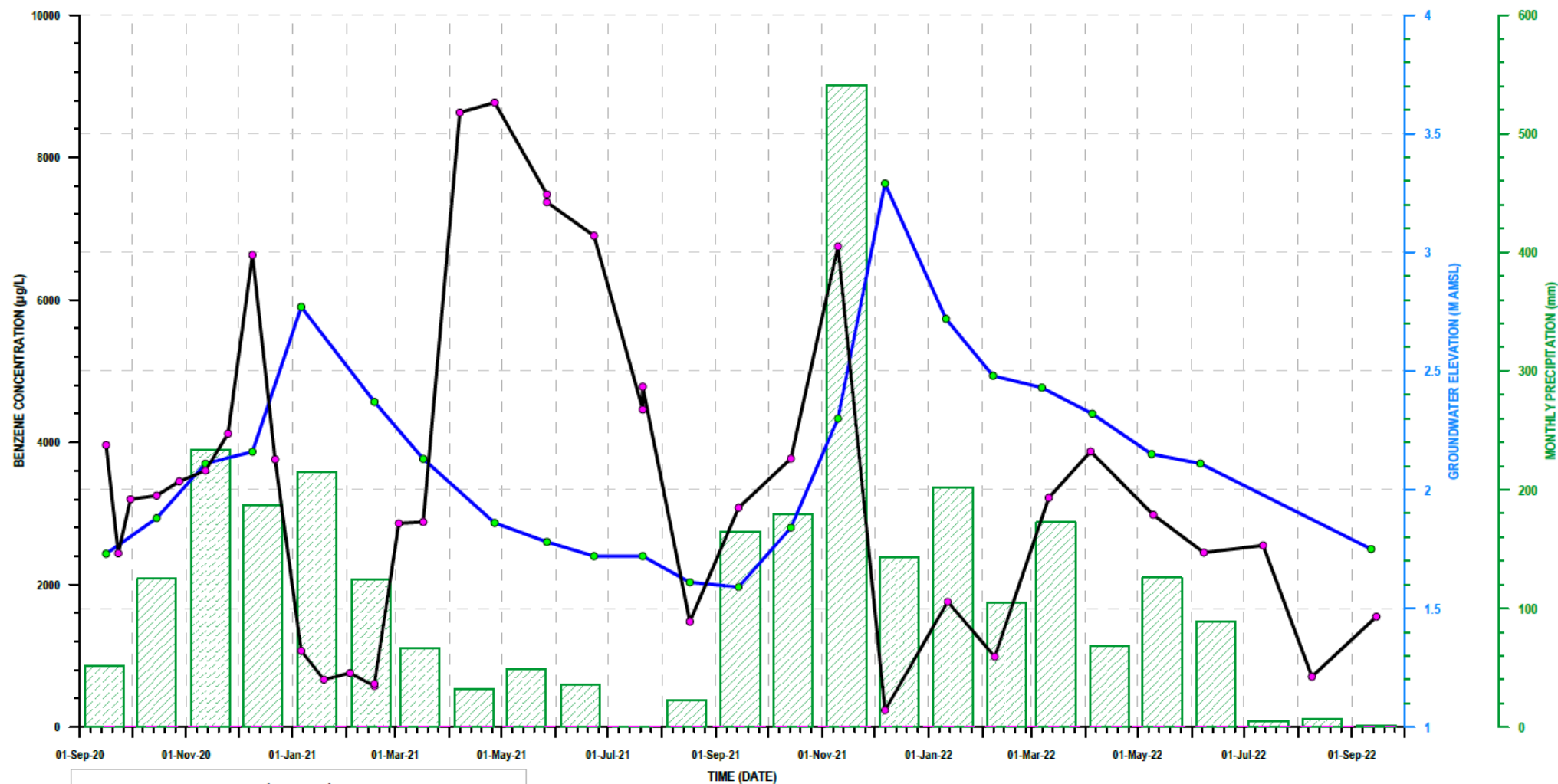
TRANS MOUNTAIN CANADA INC  
 3434 MCDERMOTT ROAD, ABBOTSFORD, BC  
 SUMAS STATION EOS RELEASE

**BENZENE CONCENTRATIONS, OBSERVED GROUNDWATER ELEVATIONS, AND MONTHLY PRECIPITATION VS. TIME**  
 BH-15

Project No. 11214739  
 Date September 2022

**ATTACHMENT A7**





\*Groundwater quality criteria for benzene is based on the following standards and guidelines:  
 -BC Contaminated Sites Regulation Schedule 3.2 - Generic Numerical Water Standards - Protection of Drinking Water (BC CSR DW)  
 -Health Canada Guidelines for Canadian Drinking Water Quality (GCDWQ)



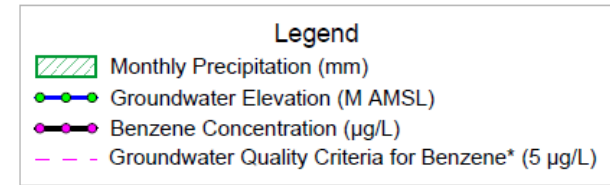
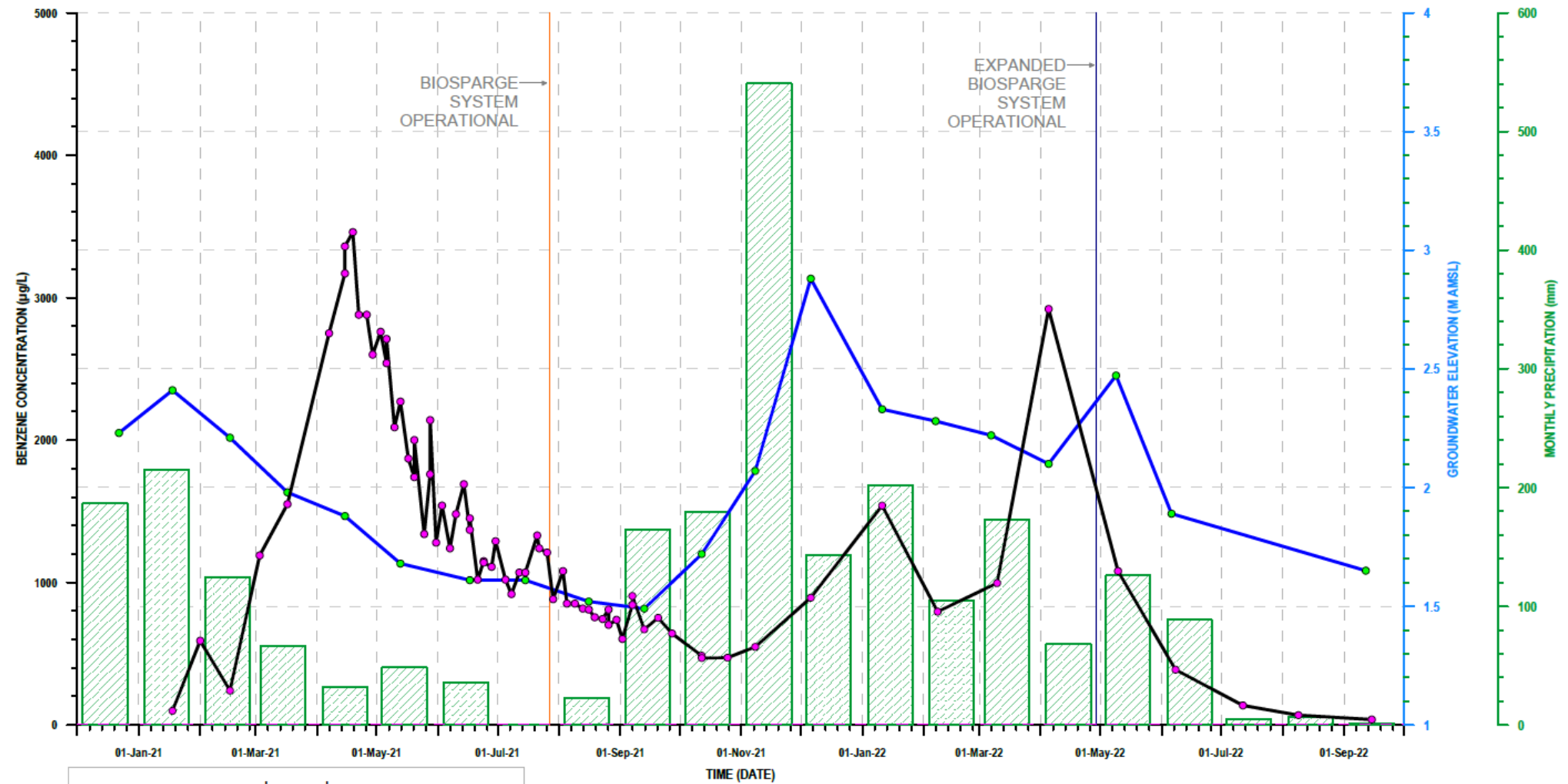
TRANS MOUNTAIN CANADA INC  
 3434 MCDERMOTT ROAD, ABBOTSFORD, BC  
 SUMAS STATION EOS RELEASE

**BENZENE CONCENTRATIONS, OBSERVED GROUNDWATER ELEVATIONS, AND MONTHLY PRECIPITATION VS. TIME  
 BH2R**

Project No. 11214739  
 Date September 2022

**ATTACHMENT A7**





\*Groundwater quality criteria for benzene is based on the following standards and guidelines:  
 -BC Contaminated Sites Regulation Schedule 3.2 - Generic Numerical Water Standards - Protection of Drinking Water (BC CSR DW)  
 -Health Canada Guidelines for Canadian Drinking Water Quality (GCDWQ)



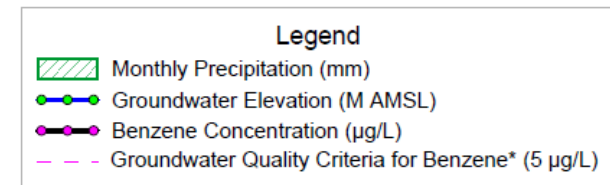
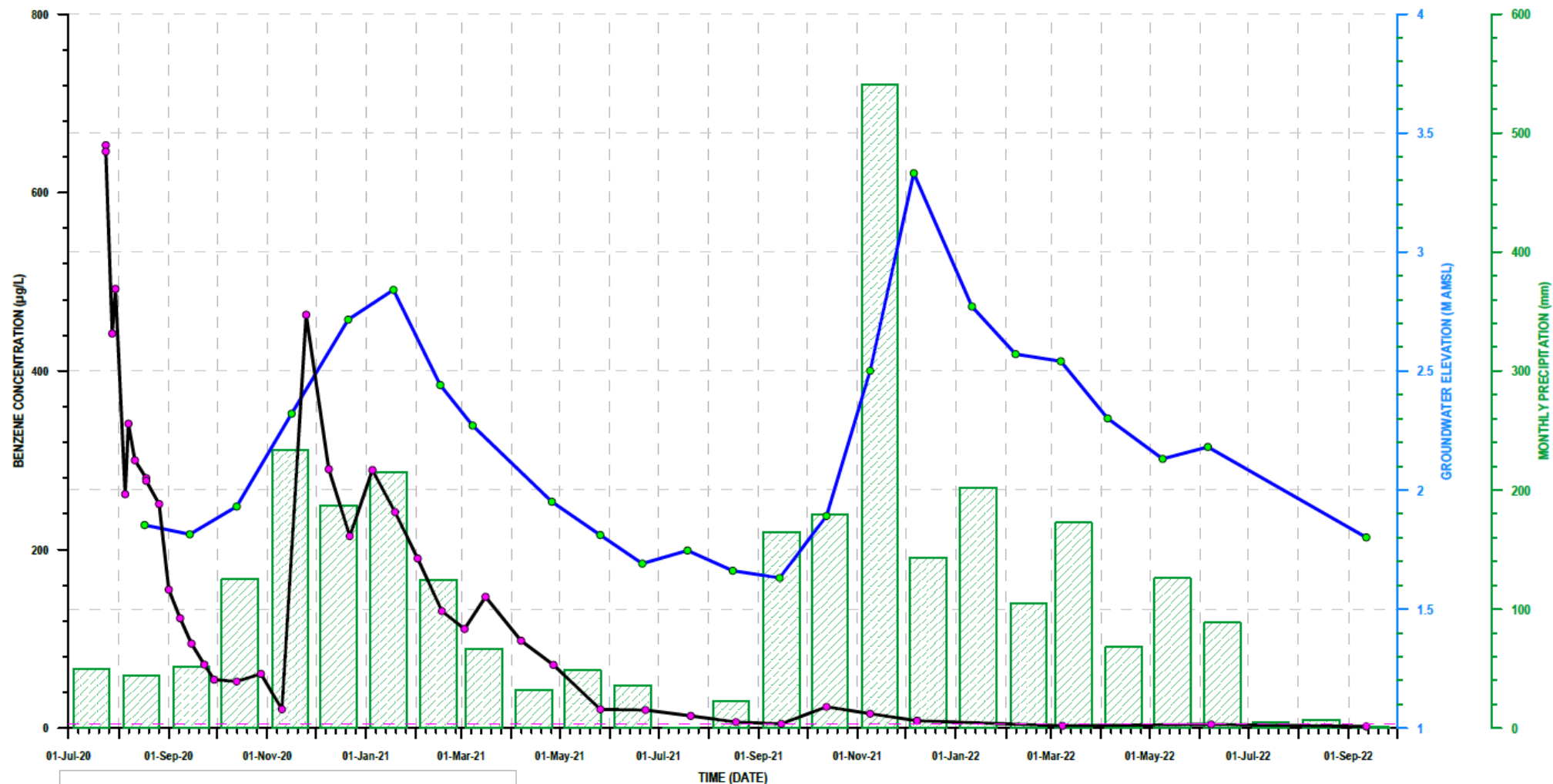
TRANS MOUNTAIN CANADA INC.  
 3434 MCDERMOTT ROAD, ABBOTSFORD, BC  
 SUMAS STATION EOS RELEASE

**BENZENE CONCENTRATIONS, OBSERVED GROUNDWATER ELEVATIONS, AND MONTHLY PRECIPITATION VS. TIME MW20-23**

Project No. 11214739  
 Date September 2022

**ATTACHMENT A7**





\*Groundwater quality criteria for benzene is based on the following standards and guidelines:  
 -BC Contaminated Sites Regulation Schedule 3.2 - Generic Numerical Water Standards - Protection of Drinking Water (BC CSR DW)  
 -Health Canada Guidelines for Canadian Drinking Water Quality (GCDWQ)



TRANS MOUNTAIN CANADA INC  
 3434 MCDERMOTT ROAD, ABBOTSFORD, BC  
 SUMAS STATION EOS RELEASE  
**BENZENE CONCENTRATIONS, OBSERVED GROUNDWATER  
 ELEVATIONS, AND MONTHLY PRECIPITATION VS. TIME  
 MW20-11**

Project No. 11214739  
 Date September 2022

**DRAFT**  
**ATTACHMENT A7**



# LNAPL Characteristics

## LNAPL Distribution

The inferred extent of remaining LNAPL is primarily in the centre of Area A (up to 5 m BGS) where excavation was not practical and extends east along the dissolved phase groundwater plume, upgradient of the migration control.

## LNAPL Mobility/Recoverability

Since March 2021, transmissivity testing results have not exceeded de minimis criteria. Since May 2021 (recovery end point), measurable LNAPL observations have decreased. LNAPL is largely present as immobile/unrecoverable residual.

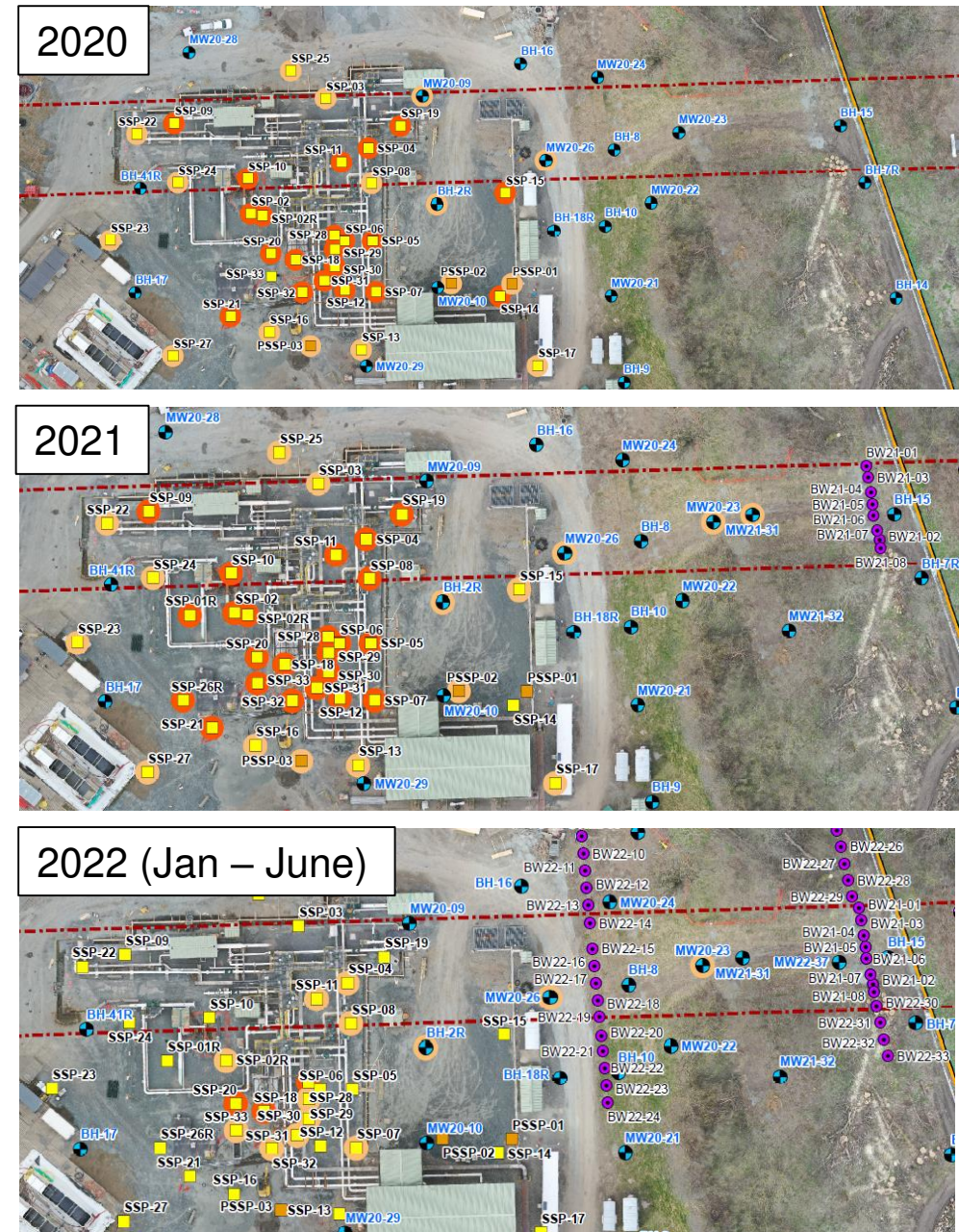
The fraction of the LNAPL body that might be recoverable is negligible and the activity would have no effect on residual LNAPL composition.

## LNAPL Body Stability

Site monitoring has demonstrated that the LNAPL body is stable (i.e., not expanding) and is actively degrading.

## Natural Attenuation

Results from NSZD testing conducted to date (CO<sub>2</sub> trap testing and temperature profiling) indicate that LNAPL is actively degrading at significant rates via NSZD processes.



# Next Steps

Additional work is being conducted to continue remediating and monitoring remaining impacts associated with the crude oil released at the Site.

---

## #01

### **Natural Source Zone Depletion**

Continue to monitor natural attenuation (NSZD) of LNAPL in Source Area and consider enhancing degradation rates with engineered systems.

---

## #02

### **Migration Control**

Continue to mitigate migration of dissolved phase groundwater impacts towards the Site boundary.

---

## #03

### **Monitor Area B Residual Impacts**

Continue to monitor dissolved phase groundwater impacts in Area B as they degrade (MNA).

---

---

## #04

### **Risk Assessment**

Conduct risk assessment to develop Site-specific remediation objectives for select COCs that remain at the Site at concentrations exceeding the generic remediation criteria.

---

## #05

### **Site Dynamics**

Continue refining understanding of site dynamics through refining the 3DV and a groundwater flow and contaminant transport model for the Site.

---

## #06

### **Stakeholder Engagement**

GHD and TM will continue engaging with interested parties by providing updates to and responding to stakeholders.

---



# Acknowledgments

## Stakeholders and Regulators

BC Ministry of Environment and Climate Change Strategy

BC Ministry of Agriculture

Canada Energy Regulator

Canadian Wildlife Service

City of Abbotsford

Emergency Management British Columbia

Environment and Climate Change Canada

First Nation Health Authority

Fraser Health Authority

Fraser Valley Regional District

Health Authorities 1-22

Health Emergency Management British Columbia

Indigenous Advisory and Monitoring Committee

Kwantlen First Nation

Leq'Áḷ:mel First Nation

Matsqui First Nation

OilPaw

Peters First Nation

S'ólh Téméxw Stewardship Alliance (STSA)

Seabird Island Band

Semiahmoo First Nation

Seven Generations Environmental Services Ltd.

Shxw'ow'hamel First Nation

Skawahlook First Nation

Soowahlie First Nation

Stó:lō Research and Resource Management Centre

Stó:lō Tribal Council

Sumas First Nation

Transportation Safety Board (TSB)

## Contractors

ALS Canada Limited

Badger Daylighting Ltd.

EnviroFlux LLC

First Response Inc.

Mud Bay Drilling Ltd.

Nucor Environmental Solutions Ltd.

Sequoia Environmental Remediation Inc.

Shaydyl Oilfield Consulting

Stantec Inc.





Q & A

