

# In-Situ Microbial Remediation of a Historical Crude Oil Release within a Wetland Jasper National Park, Alberta

October 16, 2025  
RemTech 2025 Presentation

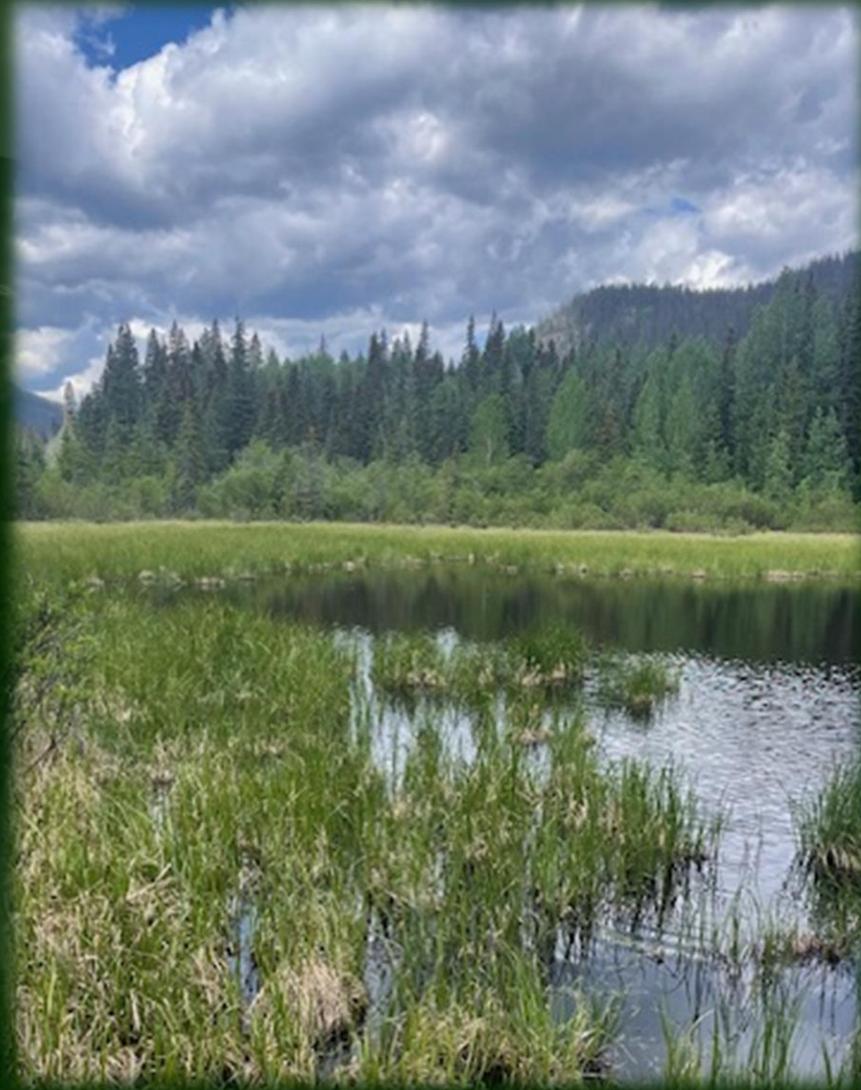
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Bringing Value to Compliance

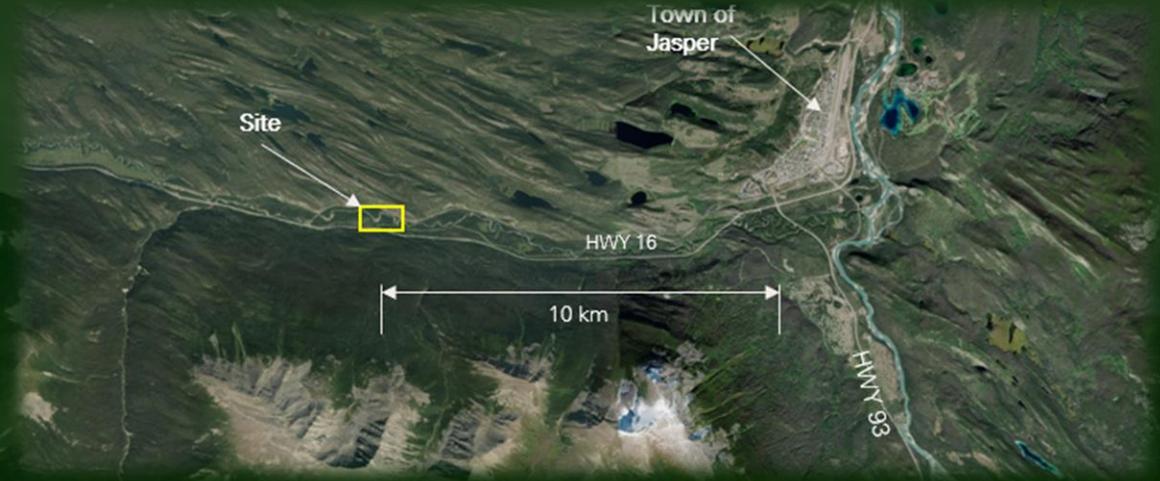
# Outline

- Introduction
- Background
- Site Setting
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- Site Characterization
- Remedial Design and Implementation
- Results
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- Acknowledgements



# Background

- The site is situated within Jasper National Park, approximately 8 km west of the Jasper townsite.
- In 1966, a crude oil release occurred when a rock dislodged during highway blasting, which ruptured the pipeline.
- Contamination was removed in accordance with the standards of the day.
- In 2021, residual contamination was discovered during pipeline maintenance activities.



# Site Setting

## Location & Access:

- The site includes areas on and off the Trans Mountain Pipeline Right of Way.
- Remote area with no road access.
- Access is further limited by high snow volumes, dense vegetation and waterbodies

## Ecological Features:

Marsh, fen, swamp, and forest habitats.

## Geological Characteristics:

Subsurface conditions vary and include sand, silt, clay, and peat.



# Regulatory Framework

- The site is federally regulated under the authority of both Parks Canada and the Canada Energy Regulator (CER).
- Applicable Guidelines:
- Federal CCME Guidelines are applied, including:
  - Groundwater: Benchmarks for Freshwater Aquatic Life
  - Soil: CCME Soil Quality Guidelines for Agricultural Land Use are used.
- Federal Interim Groundwater Quality Guidelines have been applied where CCME values are unavailable.
- Provincial guidelines are not considered, as the site is under federal jurisdiction.

# Site Characterization

## Contaminants of Concern:

BTEX, F1-F4, PAHs

## Depth of Impacts:

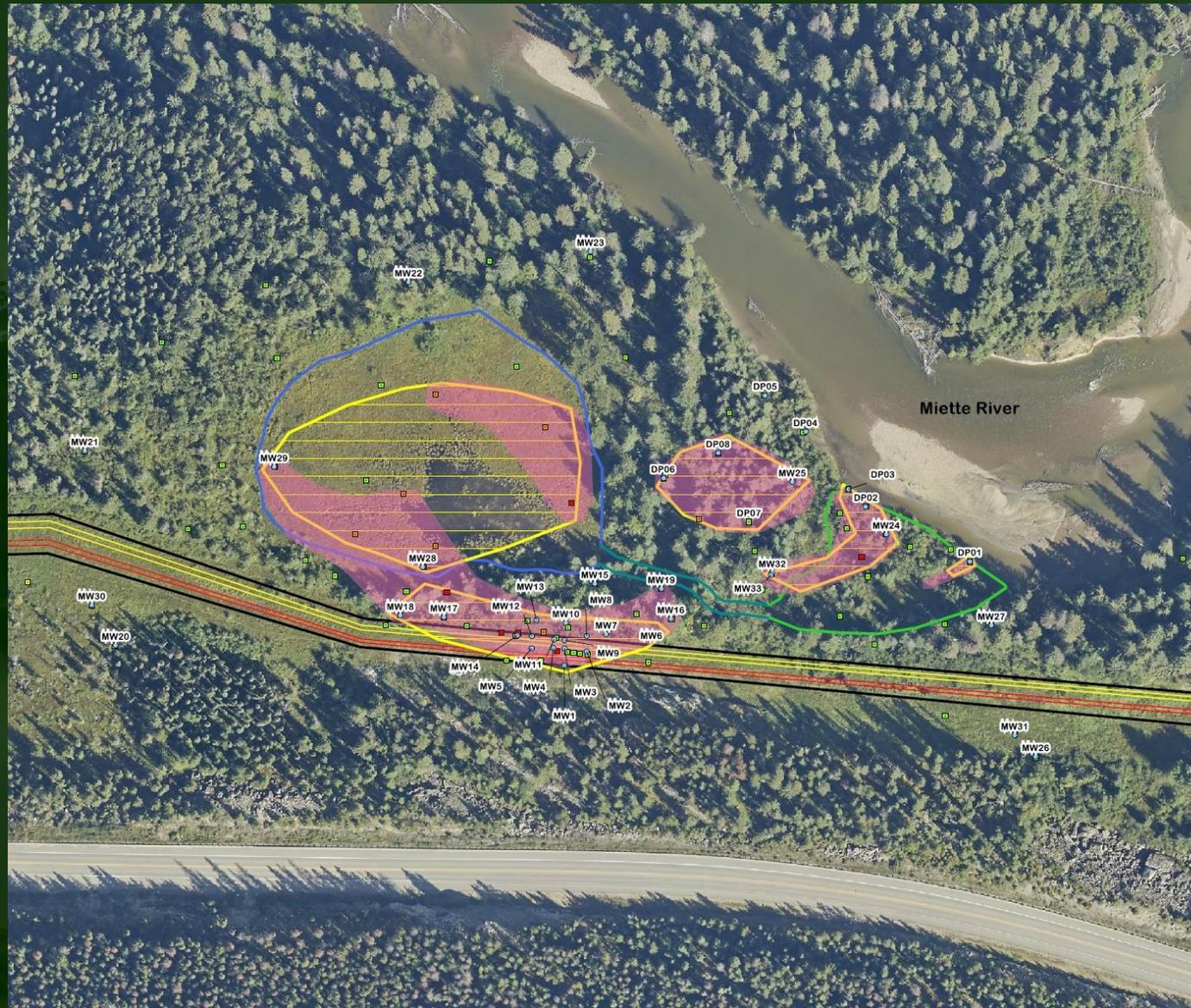
0 – 2 mbgs

Site Size: 3 HA

Impact Area: 0.8 HA (8000 m<sup>2</sup>)

## Distinct Geological Areas:

- ROW: clay/gravel fill
- Marsh: Peat
- Swale: Silty Sand
- Shrubby fen: Clay/Silt Sand
- Area adjacent to Miette River: Sand



### Legend

- Right of Way
- Marsh
- Shrubby Fen
- Swale
- Line 1
- Line 2
- Planned Bioremediation Application Areas
- Areas of Potential Environmental Concern
- MW24 Monitoring Well Labels
- Monitoring Well Location
- Borehole Below Guideline
- PHC and PAH Guideline Exceedance
- PHC Guideline Exceedance
- PAH Guideline Exceedance

Note: Air Photo Source  
Trans Mountain Corporation, 2019  
Retrieved April 2021

0 50 m



CLIENT & PROJECT TITLE

TRANS MOUNTAIN PIPELINE CORPORATION  
KP387 REMEDIAL ACTION PLAN  
JASPER, ALBERTA

DRAWING No.

Figure 8

DRAWING TITLE

Site Remediation Locations

| DRAWN | DATE       | CHECKED | DATE       | ENG | DATE |
|-------|------------|---------|------------|-----|------|
| JS    | 2023-07-17 | MO      | 2023-07-17 | --- | ---  |

| REV. No. | REVISION DESCRIPTION | BY | DATE | CHECKED | ENG. |
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# Remedial Option Assessment

- Remediation options were evaluated for viability and costs:
  - Monitored Natural Attenuation
  - Excavation and Disposal of Impacted Soil
  - In-Situ Chemical Oxidation
  - In-Situ Microbial Treatment
  - Reactive Barrier Installation
- Microbial treatment was selected as the preferred option:
  - Bench scale testing determined it was effective
  - Minimal site disturbance necessary
  - Minimal residual impacts remain behind
  - Cost less than most of the options considered, a small fraction of cost for excavation, disposal and site reclamation



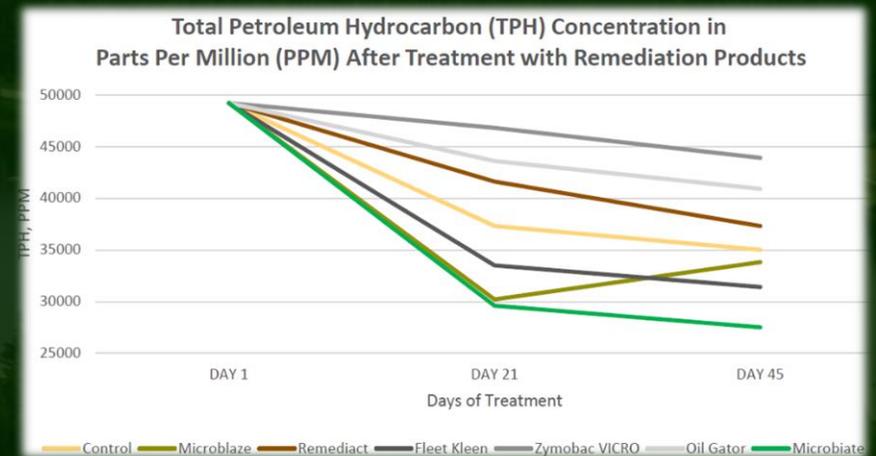
# BioNorth's Microbial Product



- Different microbial suppliers were considered
- BioNorth's Microbiate product was selected:
  - Only Canadian Microbiate supplier available
  - Microbiate Product developed in their Thunder Bay facility
  - Bacteria strains developed from naturally occurring in soil of Northern Canada
  - Microbiate contains six strains which degrade hydrocarbon impacts
  - Working temperature 0 ° – 49° C
  - Other products stop working in temperatures lower than 5°– 8° C, site is below this range most of the year
  - Low costs, high concentration of microbes

## Microbiate™ - Best-in-Class in All Categories

| Product                   | Working Temperature  | Moisture Required | Product Requirement Per M <sup>3</sup> | Price Per M <sup>3</sup> |
|---------------------------|----------------------|-------------------|--|--------------------------|
| Oil Buster PRP            | 5-35° C              | 20%               | ●                                      | \$\$\$                   |
| Oil Gator                 | 5-49° C              | 30%               | ●                                      | \$\$                     |
| Liquid Remediact          | 5-49° C              | 30%               | ●                                      | \$\$\$                   |
| Remediact Dry             | 10-32° C             | 30%               | ◐                                      | \$                       |
| Zymbac VICRO              | Not Available        | 30-40%            | ○                                      | Not Available            |
| Micro Blaze               | 8-48° C              | 30-40%            | ●                                      | \$                       |
| <b>BioNorth Solutions</b> | <b>0° C to 49° C</b> | <b>12 to 15%</b>  | ○                                      | <b>\$</b>                |



## Bench Scale Testing



- Site review by BioNorth determined the Site was a good candidate for microbial remediation based on:
  - Concentrations levels
  - pH, CO, EC levels
  - Naturally occurring nutrients in Marsh, Swale and Fen
- **Bench Scale Tested Conducted by BioNorth,**
  - Impacted soil and groundwater samples from site were tested
  - Column treatments were run for 45 days
  - Reductions of hydrocarbon concentrations range from 30 – 100%



# Microbial Treatment Impact Assessment

- Once the microbial treatment was selected, a **basic** impact assessment was conducted
- Required for most projects within a Canadian National Park
- Assessment considered:
  - Introducing invasive species
  - Soil and landforms
  - Surface water
  - Groundwater
  - Fish and fish habitat
  - Wetlands
  - Vegetation
  - Species at risk
  - Wildlife and wildlife habitat
  - Potential archaeological resources
  - Traditional Land Use and Indigenous Engagement
- Consultation with:
  - Parks Canada
  - Local Indigenous Groups
  - Canadian Energy Regulator



Parks  
Canada

Parcs  
Canada



Canada Energy  
Regulator

Régie de l'énergie  
du Canada



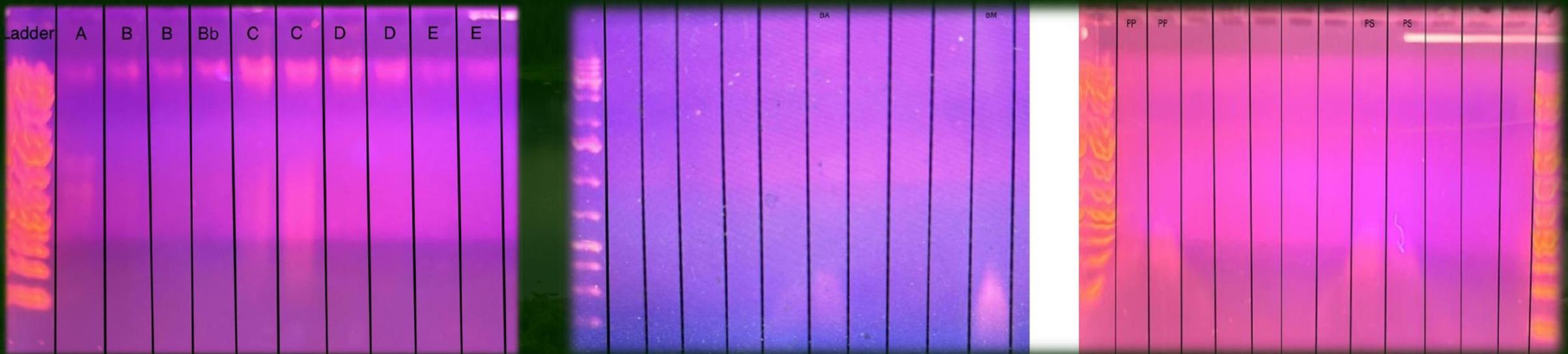
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# Microbial Treatment Impact Assessment

- Main Outcomes:

- Endorsed by local Indigenous groups supported the low disturbance, low impact remediation approach.
- Microbiate not evasive, strains same as naturally occurring at Site, determined through genetic analysis by BioNorth and confirmed by A&L Canada.
- One Microbiate strain, R15 was identified to potentially impact trout under stress conditions in particular, such as fish in captivity and rarely in wild fish.
  - Apply other five strains adjacent River, not R15
  - Monitoring groundwater and surface water to confirm microbes not migrating to River



# Microbial Treatment Impact Assessment - Mitigations

- Indigenous monitor onsite during injection
- Monitoring groundwater and surface water to confirm microbes not migrating to River
- No vehicle traffic to site to protect watercourses and Site, mitigation approach:
  - Helicopter used to transport equipment and supplies to and from Site
  - Foot traffic only to and from site
- No animal attractants left at Site overnight:
  - Food and waste
  - Gasoline fuels, attract bears



# Microbial Treatment Impact Assessment - Mitigations

- Hand equipment used to inject microbe treatment
- End-of-pipe fish protection screens for small water intakes in freshwater
- Spill kits and secondary containment for on site fuels
- Parks Canada Wildlife Flight Guidelines
- DFO Interim code of practice
- Equipment cleaning and disinfection for Whirling Disease



## Microbial Injection

- SIMPCW Resources was Project Partner
- 1st Injection, September 2024 - microbe injection across the Site.
  - Indigenous monitoring was onsite for injections, provided input along the injection.
  - Helicopter used to transport equipment and supplies to Site.
  - All equipment was operated by hand to minimize environmental impacts.
  - Microbes sensitive to pressure, application pressure set to  $\leq 1000$  psi.
  - Shallow impacts, 0 – 2 mbgs, ideal for hand equipment injection of microbe treatment for the four areas of the Site; ROW, Peat Area, Sand and Clay. Injection spacing and pressures varied based on area.
  - Soil and groundwater testing conducted 3 weeks after injection.
- 2nd Injection, June 2025 - microbe injection across the Site.
  - Higher pressure injection and closer spacing of injection points for areas with clay soil.
  - R15 strain added where to target remediation of PAH impacts. R15 was not injected to soil adjacent River.
  - Soil and groundwater testing conducted 5 weeks after injection.



# Remediation Area - ROW:

- Soil - clay/gravel fill
- $n - 0.3$
- $K \sim 1 \times 10^{-5}$  to  $1 \times 10^{-6}$  m/s
- No ground disturbance within 5m of underground pipelines
- Surface application was completed within 5 m of the pipe, and injection was completed outside of this distance



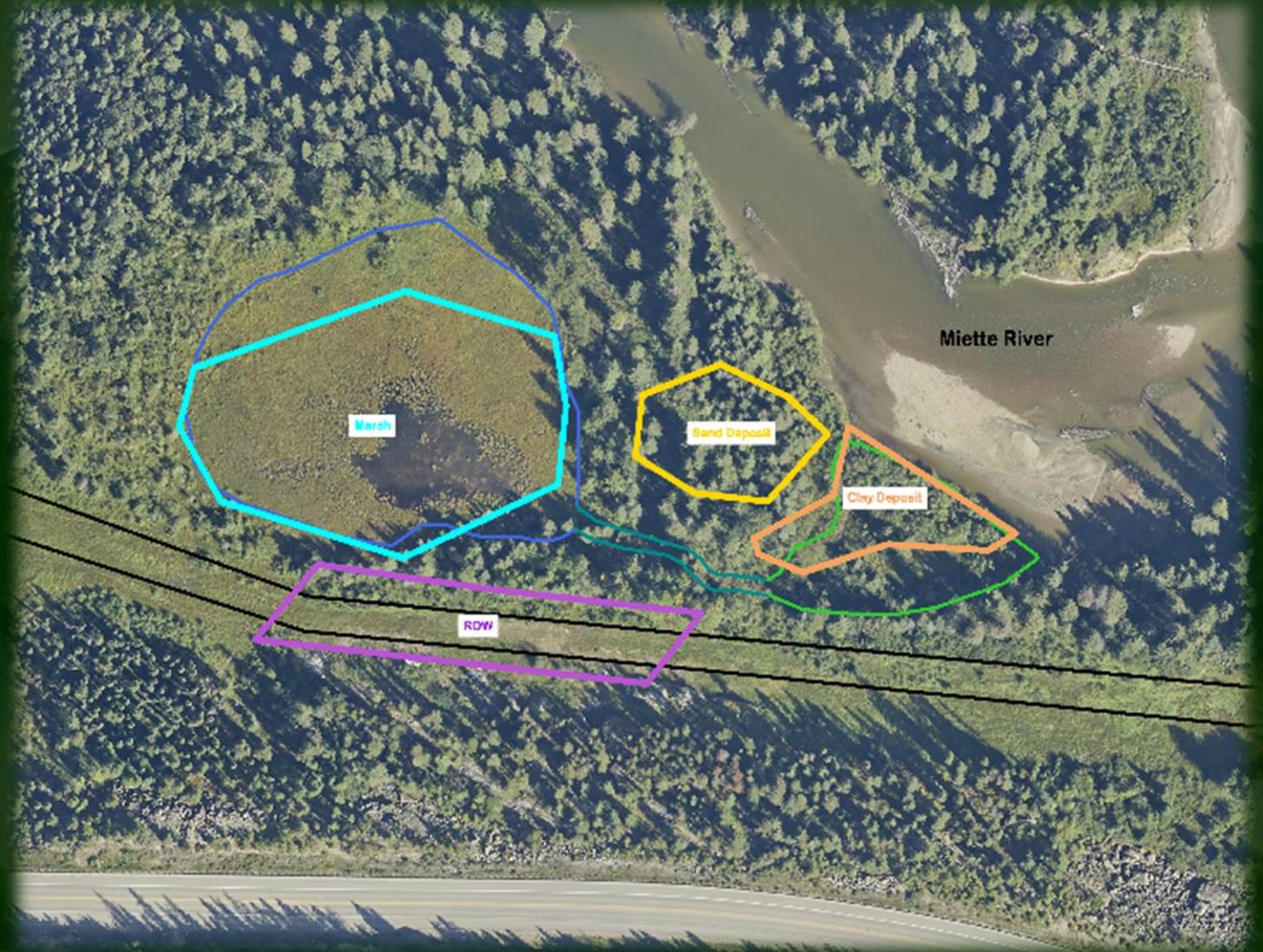
## Remediation Area - Marsh:

- Soil - Peat
- $n - 0.4 - 0.5$
- $K \sim 1 \times 10^{-5}$  to  $1 \times 10^{-4}$  m/s
- Microbe solution injected at low pressure with coarse spacing



## Remediation Area – Sand Deposit:

- Soil - Sand
- $n \sim 0.3$
- $K \sim 1 \times 10^{-4}$  to  $1 \times 10^{-5}$  m/s
- Microbe solution injected at low pressure with coarse spacing



## Remediation Area – Clay Deposit:

- Soil – Clay / Silt
- $n \sim 0.4$
- $K \leq 1 \times 10^{-7} \text{ m/s}$
- Microbe solution injected at higher pressure with finer spacing



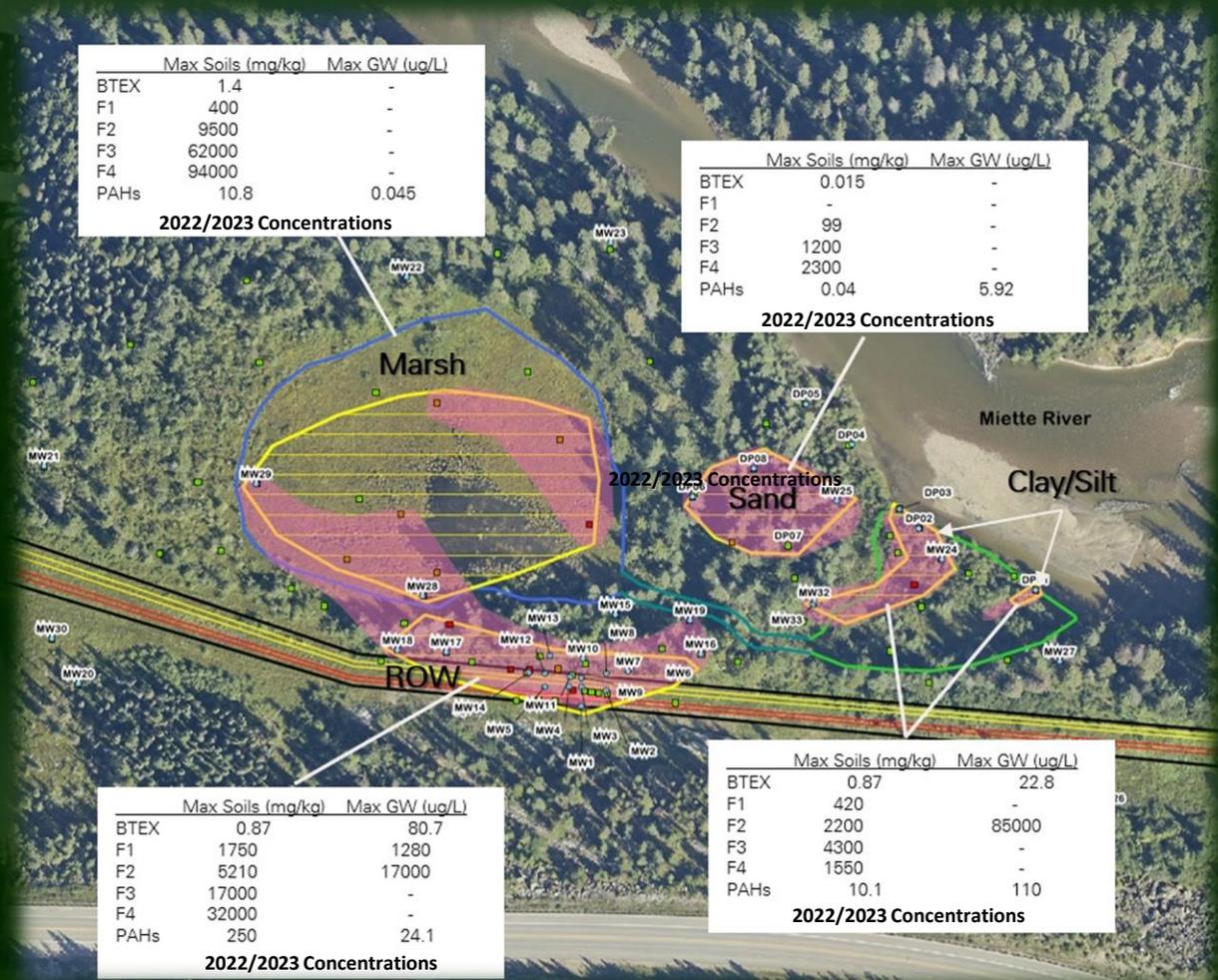
# Microbial Treatment

- 2024
  - 1<sup>st</sup> Injection – September 2024, was delayed because of July wildfire
  - Soil and Groundwater Sampling – October 2024
  - Evaluation of Results – November 2024
- 2025
  - Planning 2025 Injections – January 2025, adjustment/improvement of application considered
  - 2<sup>nd</sup> Injection – June 2025
  - 1<sup>st</sup> 2025 Soil and Groundwater Sampling – July 2025
  - Evaluation of Results – July / August 2025
  - 2<sup>nd</sup> 2025 Soil and Groundwater Sampling – September 2025



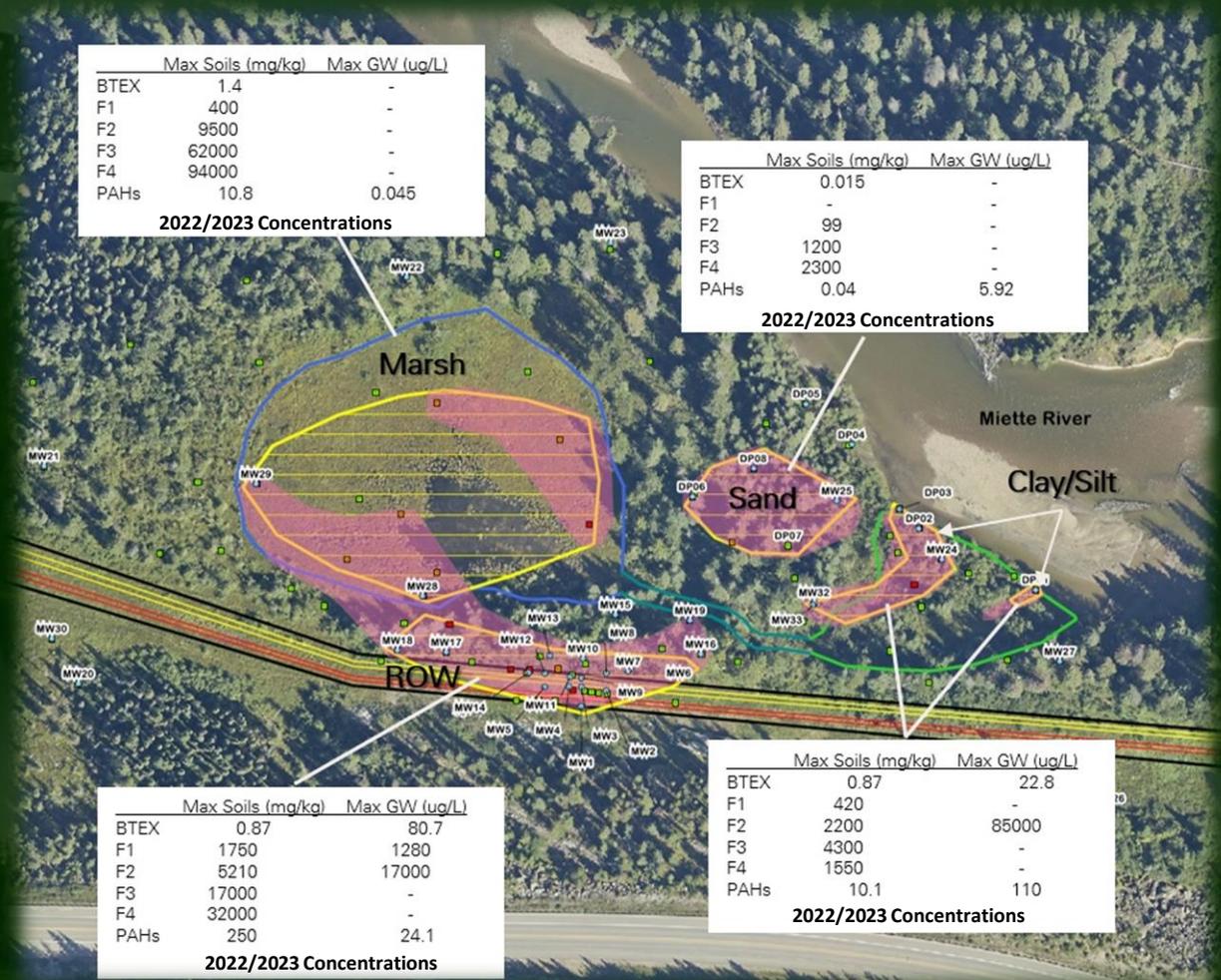
# October 2024 Results, 3 Weeks Following 1<sup>st</sup> Injection

- 30 – 80 % reduction (60% Average) of hydrocarbon (BTEX, F1-F4) impacts observed across Site.
- Most Reductions observed in Marsh and Sand Areas
- No significant reduction observed at the Clay area
- No significant reduction in PAHs observed



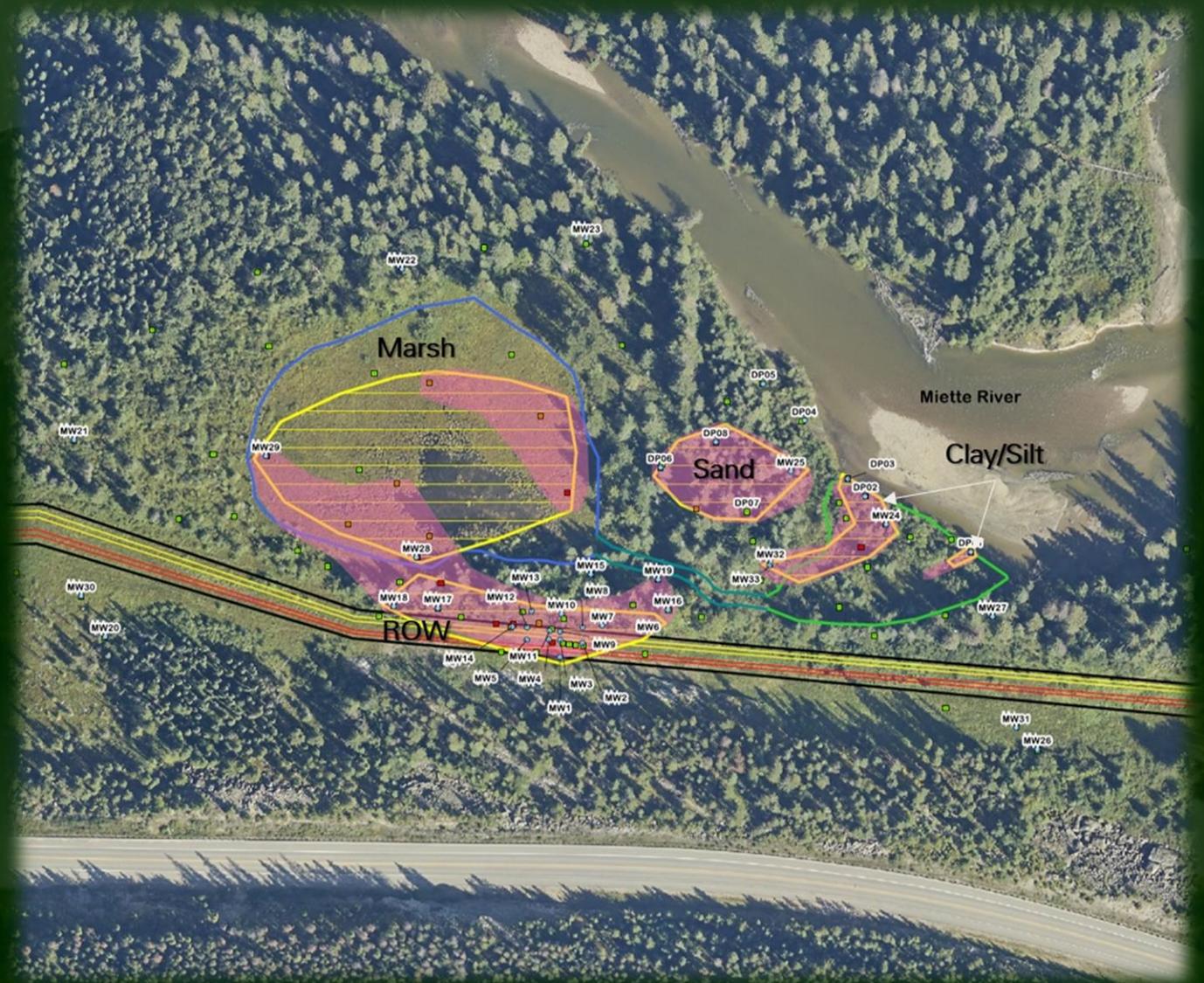
## 2<sup>nd</sup> Injection – June 2025

- Injected 2<sup>nd</sup> round over entire Site
- Applied higher injection pressure and fine spacing in Clay areas to increase microbe contact with impacts.
- Increased R15 % to address PAH impacts at ROW and Clay areas but avoided applying adjacent River.



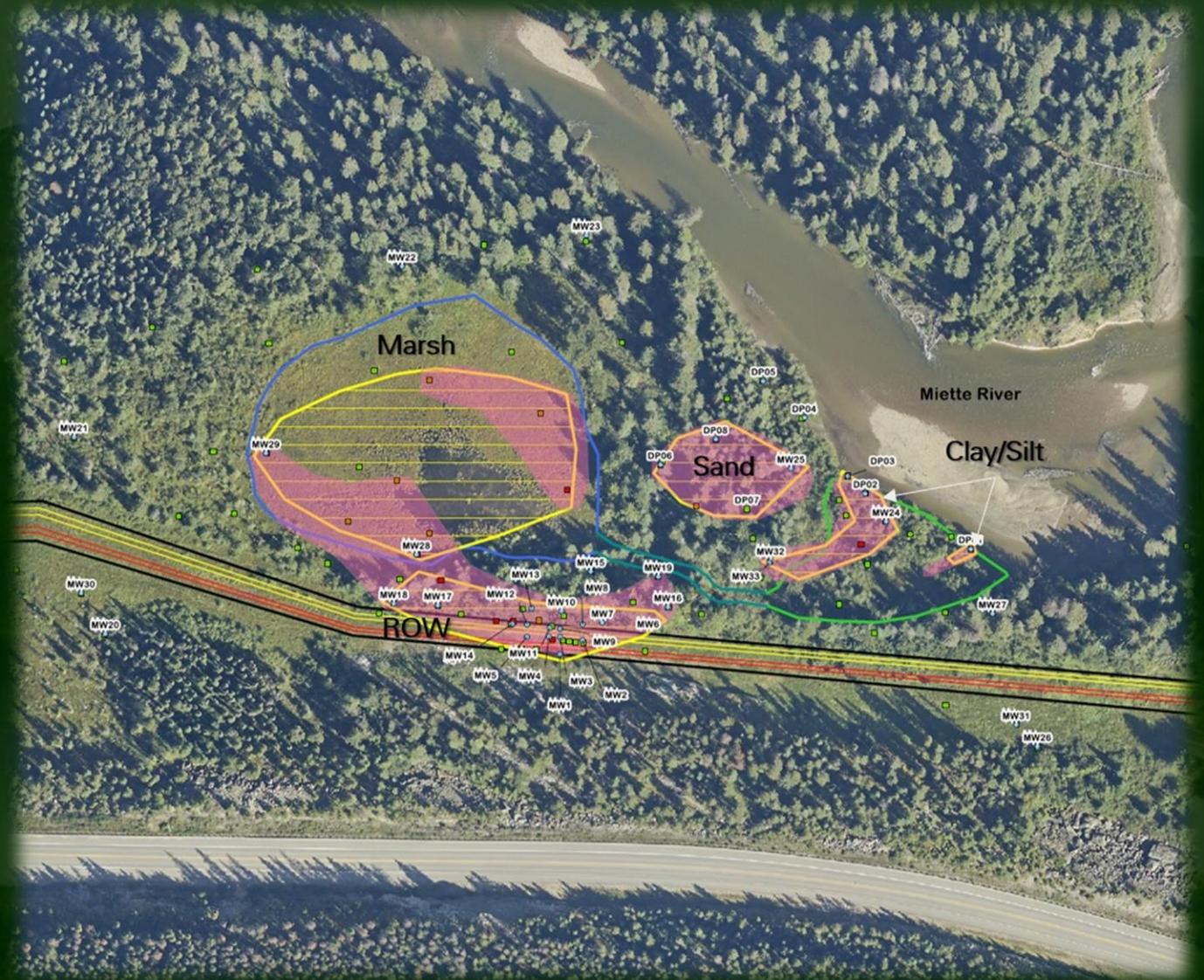
## July 2025 Results, 5 Weeks Following 2<sup>nd</sup> Injection

- Continued concentration (BTEX, F1-F4) reductions, 50% to 100%.
- In Clay areas, hydrocarbon impacts reduced 40% – 100%, indicating success of higher-pressure injection and closer injection point spacing.
- PAH concentrations, most samples had 40% to 100% concentration reductions. 30% of PAH samples had no change compared to 2024 showing success of increasing R15%
- 70% of Site now remediated to CCME Guidelines.
- Addition of R15 resulted in reduced PAH concentrations



# Sept 2025 Results, 3 Months Following 2<sup>nd</sup> Injection

- 30 to 100% reduction in PHCs in soil, lowest reduction at one location at ROW and one location at Clay area
- 20 to 100% reduction in PAHs in soil in most locations, except one location on ROW and one location at Clay area, few locations had increases of naphthalene and pyrene
- 20 to 90% reduction of PAHs in groundwater, except at ROW, increases of naphthalene and pyrene in Sept 2025 in a few locations
- Confirmed, addition of R15 resulted in reduced PAH concentrations
- Another 5 – 10% remediated





# Summary

- Microbiate proved effective at remediating site impacts:
  - Initially had significant reductions with high concentrations (e.g. 60,000 mg/kg to 5000 mg/kg in one month)
  - Continued to see 30 – 60% reductions as concentrations decrease, can see less dramatic reductions with lower concentrations
    - R15 required for PAHs impacts
- Application approached depended on hydrogeologic conditions (e.g. peat vs clay)
- Ecologically sensitive sites typically restrict use of mechanized equipment, more manual approach needed and are effective



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# Next Steps

- Continue soil and groundwater monitoring in 2026
- One more microbe treatment:
  - Consider subsurface injection at ROW, ground disturbance plan, daylighting pipelines by hand
  - Clay areas, same approach with high pressure injection and fine spacing
  - Customizing nutrient and amendments where nutrients are naturally low. i.e. ROW
  - Customizing nutrient and amendments as concentrations continue decreasing, may be needed to achieve site closure
- Microbe treatment shows promise for complete Site remediation. If not, will consider other options in select areas.



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# Acknowledgements

