



Imperial Norman Wells Aquatics Effects Monitoring Plan (AEMP)



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Imperial



Canada Energy
Regulator

Régie de l'énergie
du Canada

Imperial hires 3rd
Party TRSA



Developed and
Execute the AEMP
Provide data and
insight, not advocate

TRS Advisian is a
Partnership between
the Tłegóhtł Got'ınę
Government and
Worley Consulting

TRSA to provide
AEMP results to
SLWB and Imperial

SLWB mandates the AEMP through issuance of the
water licence

Imperial must complete the program.
The proponent pays but a third party does the work -
impartiality.

Stakeholders

Public

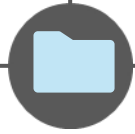
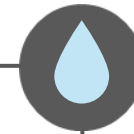
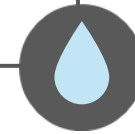
Protect public confidence, verify the program and
results. It's their job to accept or deny the results and
defend that to the public.

AEMP Timeline

2000 – 2013

AEM (Aquatics Effects Monitoring) Imperial hired Golder.

Fish Studies, Toxicity Testing, Water Sampling, Benthic Invertebrates, Fish Habitat Study



2015

AEMP Community Working Group #2.

2017

3 - water sampling events (Spring, Summer and Fall based on AEMP V1 Plan.

2019

Submitted 2018 annual report to SLWB, Imperial hired University Professor Dr Munkittrick, 3 water sampling events (Spring, Summer and Fall), and AEMP V3 submitted incorporating Munkittrick's comments.

2014

AEMP (Aquatics Effects Monitoring Program) Beginning. Imperial hired Worley/TRSA, and Community Working Group #1.

2016

AEMP Community Working Group #3, and AEMP V1 Plan submitted.

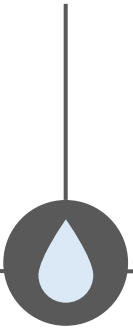
2018

AEMP V2 Plan submitted, 3 water sampling events (Spring, Summer and Fall), and submitted 2017 annual report to SLWB.

AEMP Timeline

2020

Submitted 2019 annual report to SLWB, and 3 water sampling events (Spring, Summer and Fall) based on AEMP V3



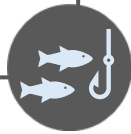
2021

Submitted 2020 annual report to SLWB, 3 water sampling events (Spring, Summer and Fall) based on AEMP V3, and SLWB hired 3rd party to review V3



2022

Submitted 2021 annual report to SLWB, 4 water sampling events (Winter Spring, Summer and Fall) based on AEMP V3, Started Passive Sampling Devices (PSD) trial. Started small fish trial. Submitted AEMP V4, and working group #4 meeting



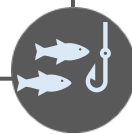
2023

Submitted 2022 annual report to SLWB, 4 water sampling events (Winter Spring, Summer and Fall) based on AEMP V4, installed PSD. Completed small fish study, and working group #5 meeting.



2024

Submitted 2023 annual report to SLWB, 4 water sampling events (Winter Spring, Summer and Fall), installed PSD, and completed small fish study.



2025

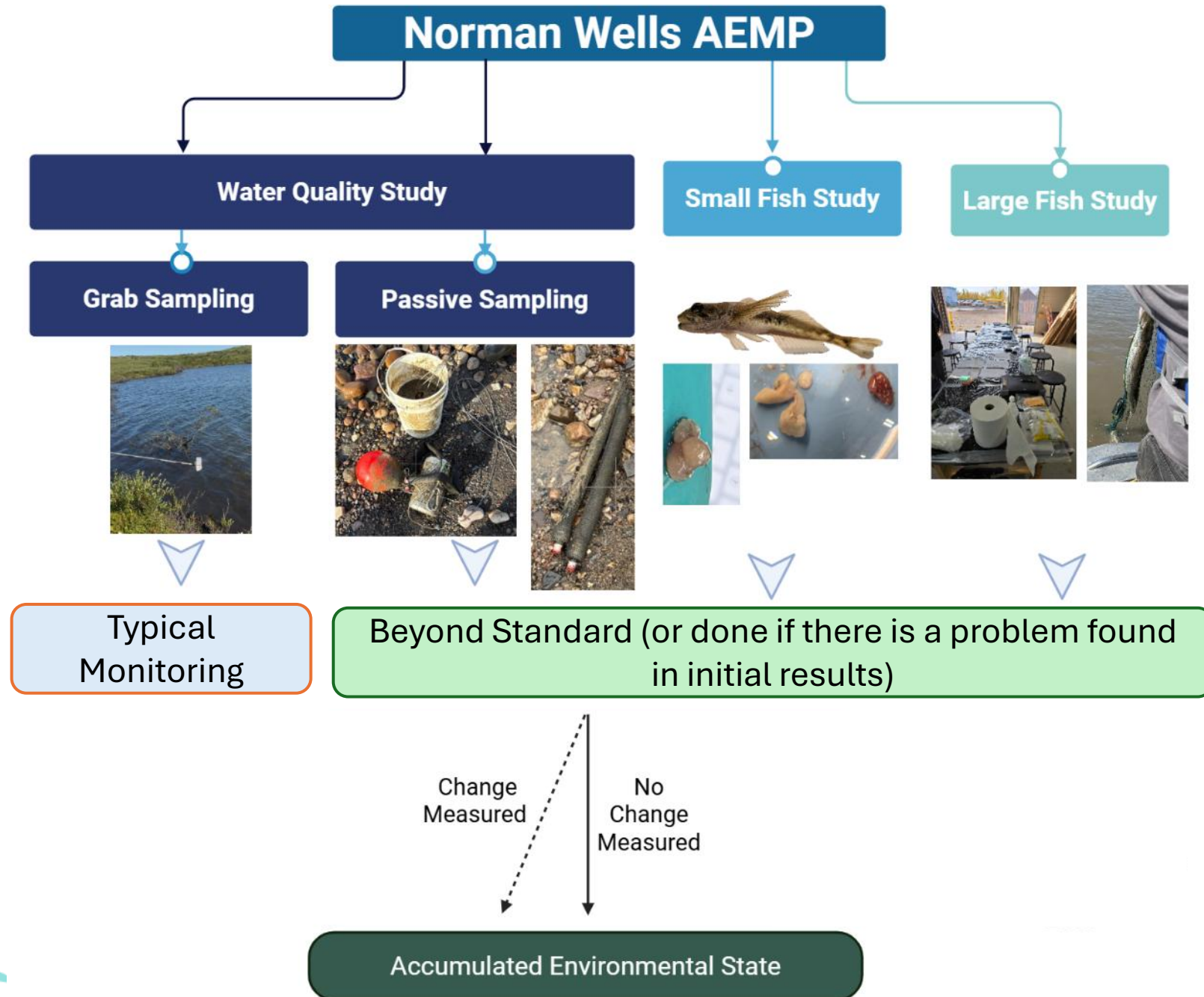
Submitted 2024 annual report to SLWB, 4 water sampling events (Winter Spring, Summer and Fall), installed PSD, completed small fish study, AEMP technical session, and piloted large fish trial in FGH.



2026

Planned to submit 2025 annual report to SLWB, 4 water sampling events (Winter Spring, Summer and Fall), install PSD, completed small fish study, and complete large fish study.





AEMP Goals

Are routine or past activities at Imperial's Norman Wells site adding substances to the environment that could harm the aquatic environment by changing its Accumulated Environmental State?

What the program is looking for:

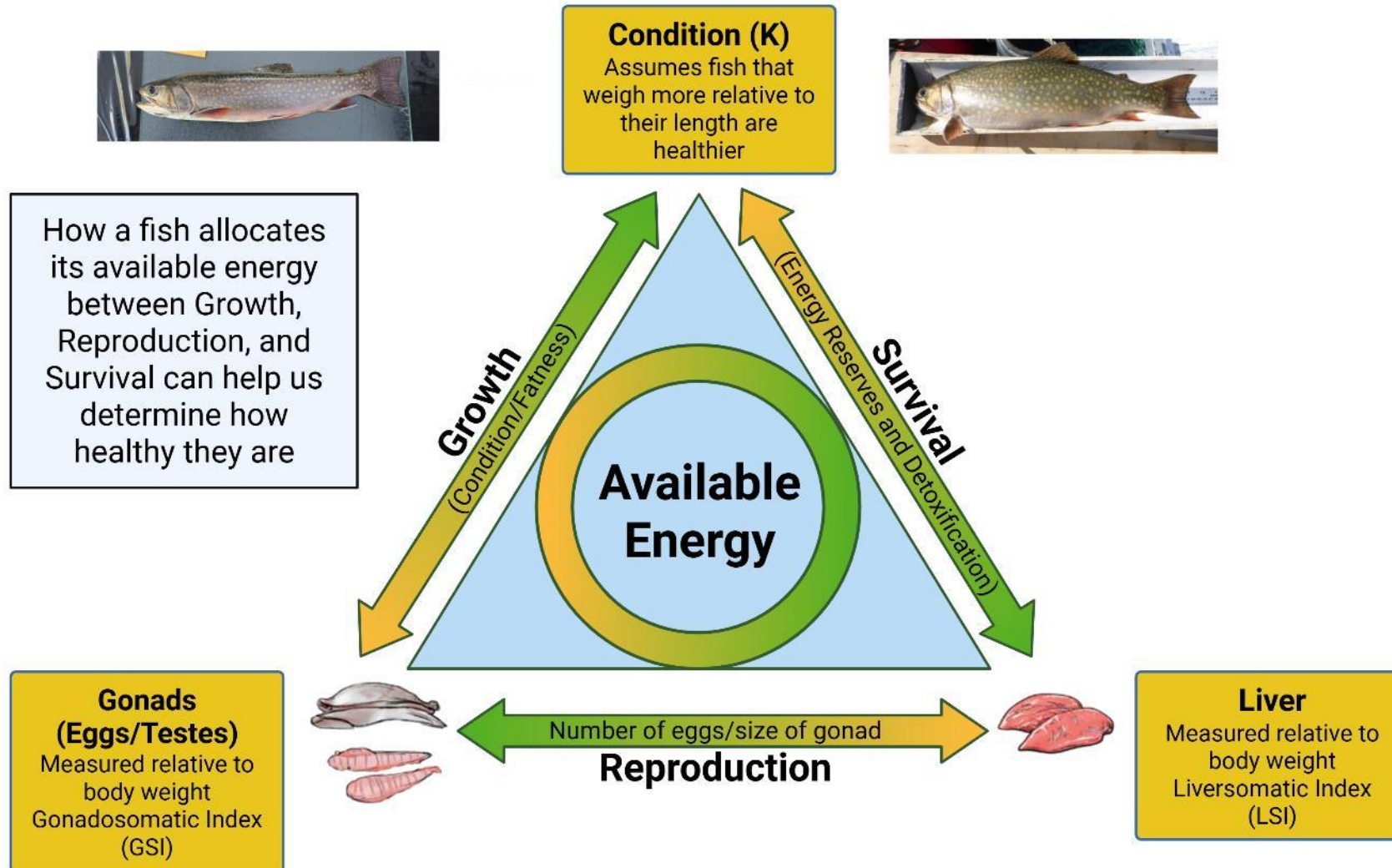
- Changes in water quality over space (relative to NWO) and time (from start of program)
- Changes in small fish health metrics and tissue chemistry over space and time
- Large fish health metrics - pending

What the program cannot answer:

- Ecological changes related to climate change, impacts from other sources, or natural variations
- Unanswered questions related to historical concerns (e.g. what happened to the herring?)
- Future changes to the operation or closure process (but it can inform)
- Risk to environmental or human health (but it can inform)

This is a monitoring program so only looks at a few metrics looking for change. It is not a wider environmental study. Other environmental work at NWO can inform AEMP findings.

Fish Health Assessment (Ask the Fish)



Traditional Health Measures

- Parasite presence and number
- Visual internal and external exam
 - discoloration, injuries, and abnormalities
- Edible tissue quality
 - Meat texture, colour, and smell
 - Liver quality in loche

Large Fish Study

Whitefish (Crookedback) and Loche Target Species

New for 2026

- Community-Based Monitoring Approach
- Tulit’a, Norman Wells, and Fort Good Hope

- Annual Fish Collection

- Fall (August/September) for Whitefish (crookedba
- Winter (November/December) for loche

Integrated Fish Health Assessment

- Elders and Aquatic Biologists assess together
- Inform youth and other community members



Tissue Analyzed	Field Measurements	Laboratory Analysis
Whole body	Weight Length	Used by community
Liver	Weight	Liver protein content Metals, PAHs (Loche liver only)
Gonad (Eggs/Testes)	Weight Fecundity (egg count)	Used by community
Fillet	Meat quality	Metals and PAHs
Stomach	Description of type of food and amount	Discarded
Otolith/Fin Clip	None	Fish Age

2025 Large Fish Study Pilot

- **Pilot Outline**

- 3 days in Fort Good Hope with Working Group
 - Day 1 – Pre-sampling meeting
 - Day 2 – Fish dissections at the school
 - Students, Elders, community members, Imperial, and TRSA
 - Day 3 – Post-sampling meeting



- **Fish Collected**

- Coney (Inconnu) and Whitefish
 - 3 fish from each species assessed for fish health and samples sent for analysis (hydrocarbons and metals)

- **Results**

- Coney (Inconnu) and Whitefish were in good condition
- Community-Based Monitoring approach is recommended

Tissue Analyzed	Mean Length	Mean Weight	Mean Condition	Total PAHs
Coney (Fillet)	710 mm	4033 g	1.12	19.1 ng/g
Whitefish (Fillet)	534 mm	2363 g	1.33	22.5 ng/g

Small Fish Study

Slimy Sculpin Target Species



Fall Sampling in Bosworth Creek each year

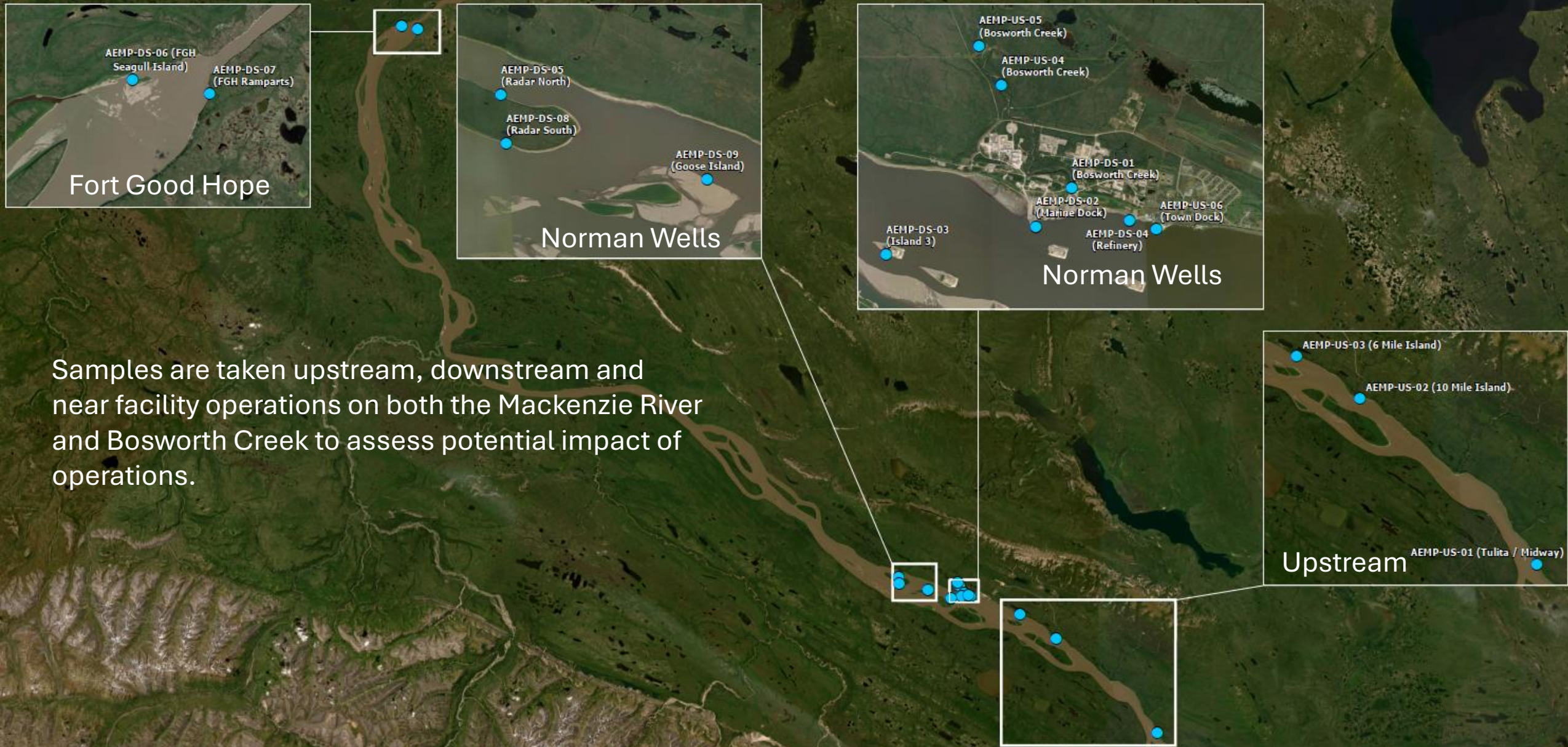


Harvest Tissue and Assess Health

Tissue Analyzed	Field Measurements	Laboratory Analysis
Liver	Weight	Liver protein content
Gonad (Eggs/Testes)	Weight	Discarded
Fillet	Not measured	Metals
Whole body	Weight Length	Polycyclic Aromatic Hydrocarbons (PAHs)



Water Monitoring Locations



Water Quality Results

- Hydrocarbons – oil-related compounds like benzene
 - are all **lower than we can measure -> lower than drinking water or fish health values**
- Polycyclic Aromatic Hydrocarbons (PAHs) – hydrocarbon-related compounds that can come from oil or chemicals but also exist naturally in soils and can come from burning wood (forest fires)
 - New techniques (SPMDs) can detect these in very small concentrations.
 - All results are **lower than safe drinking water or fish health values**
- Metals
 - Some (aluminum and iron) exist in the water naturally at values above standard fish health and drinking water guidelines
- General indicators (salts, pH, ions)
 - No real changes



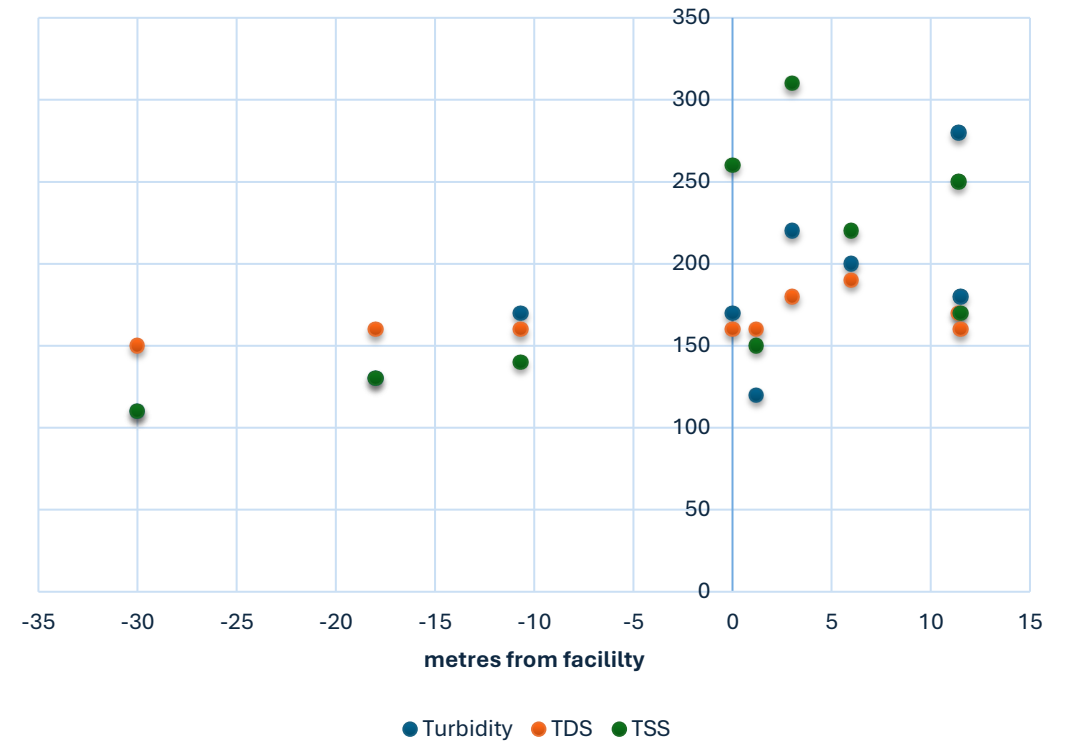
Water Quality Results

Things we are watching

Mackenzie River - Increase in turbidity and TSS (sediments) near and downstream, total metals increasing in a similar way

- Total metals stick to sediments.
- Dissolved metals generally no trend

Turbidity, TSS, TDS



The Program Can Detect Change
There are some changes in chemistry observed
Nothing noted of immediate concern



Mahsi