

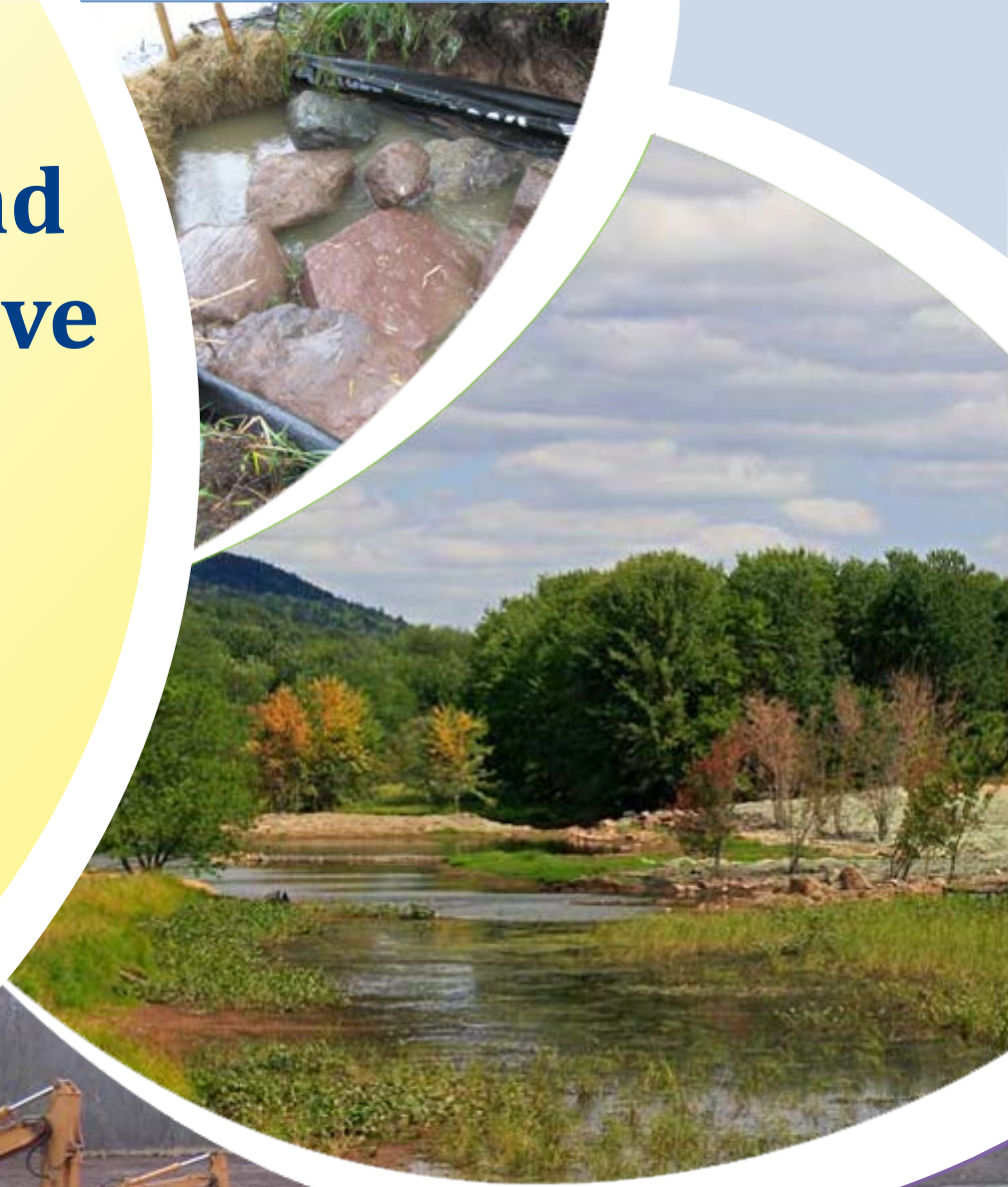
Dutch Point Wetland Restoration Initiative

Remediation Technologies
Symposium 2013,
Banff, Alberta

October 16 - 18, 2013

FUNDY Engineering

Serving Our Clients' Needs First



Presentation Overview



- Introduction to Fundy Engineering
- Introduction to Canaport™ LNG_{LP}
- Overview of Wetlands Impacted
- NBDENV Wetland Policy
- Dutch Point Historical Site Description
- Wetland Restoration Engineering
- Wetland Restoration Construction
- Post-Construction Photographs and Results

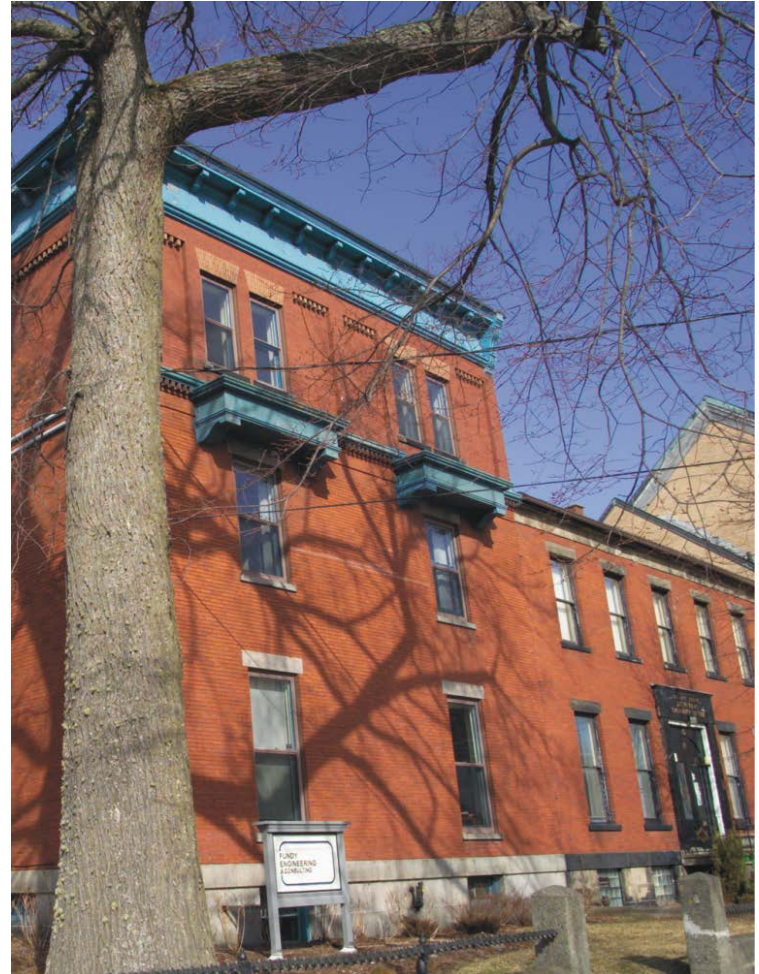
Introduction to Fundy Engineering



- Full-service, multi-disciplinary engineering consulting company
- Incorporated in 1989
- Offices in Saint John, NB; Charlottetown, PEI; and Halifax, NS
- Employs over 35 professional engineers, scientists, technical and support personnel
- Completed greater than 10,000 projects
- Strategic Partnership with Summit Liability Solutions



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Canaport™ LNG_{LP}



Canaport™ LNG_{LP} is a state-of-the-art receiving and regasification Terminal in Saint John, NB

Maximum send out of 28 million cubic meters of Natural Gas a day

Able to supply 20% of natural gas needs in northeast US and Canada's needs

Several wetlands were impacted during construction, which CLNG were committed to compensate for



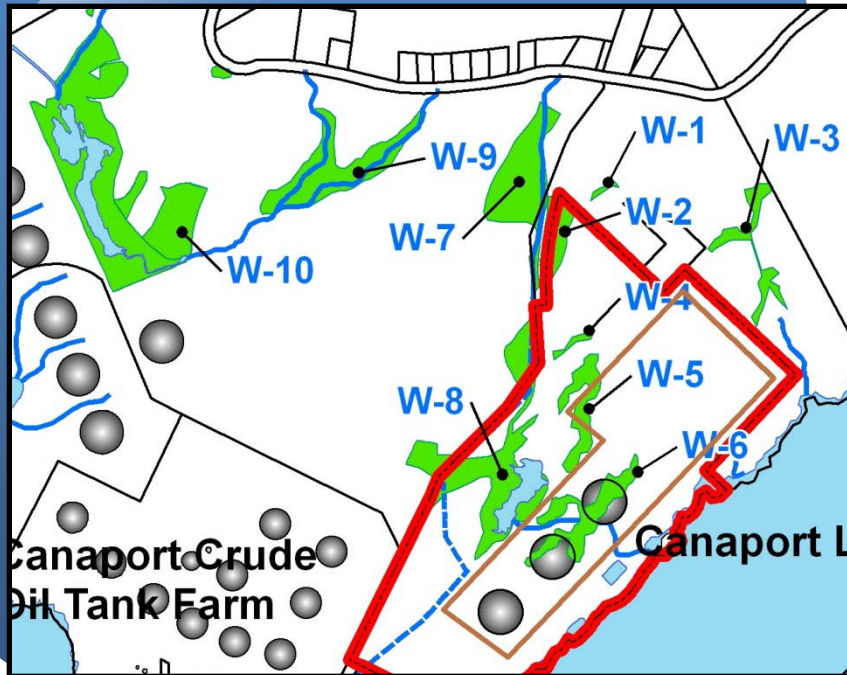
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Canaport
LNG_{LP}

Wetlands Impacted



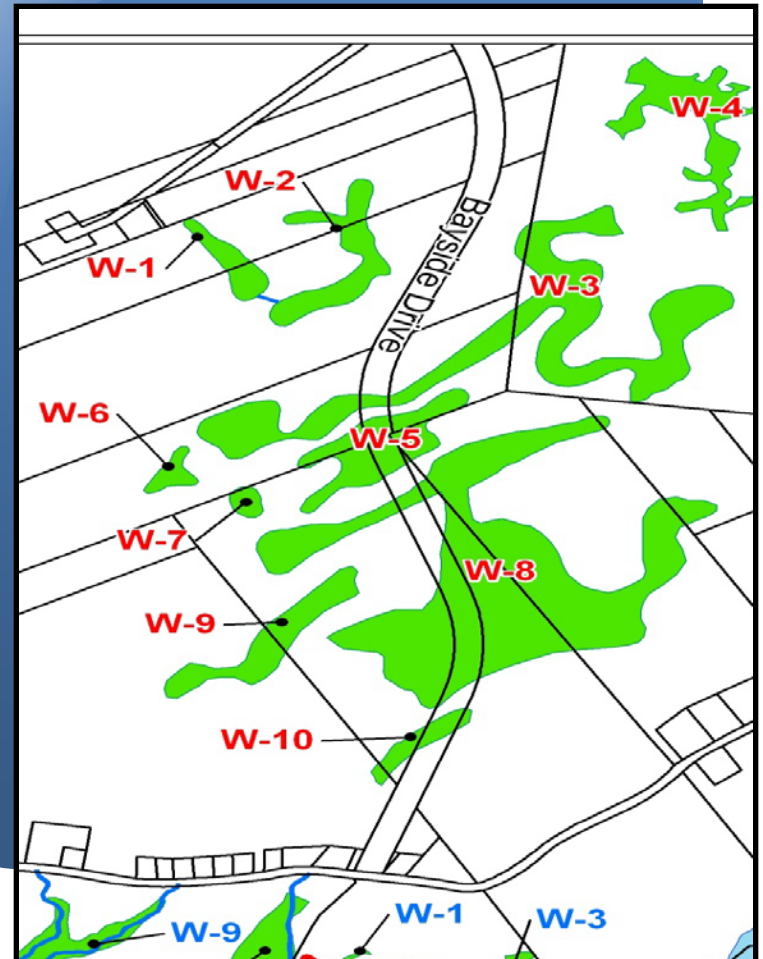
Wetlands Impacted at the Terminal



Total Compensation Required:

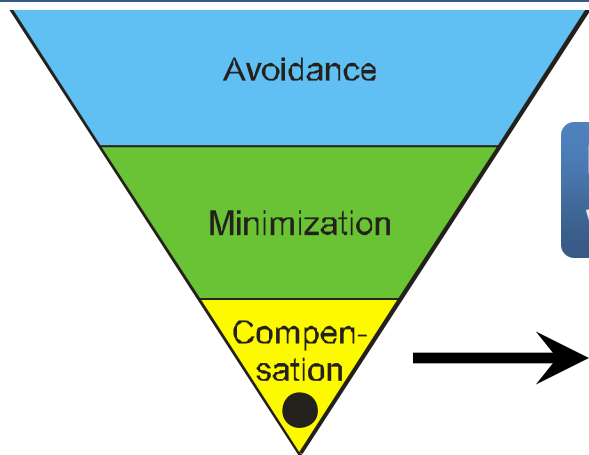
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Wetlands impacted as a result of the construction of a secondary access road for construction traffic

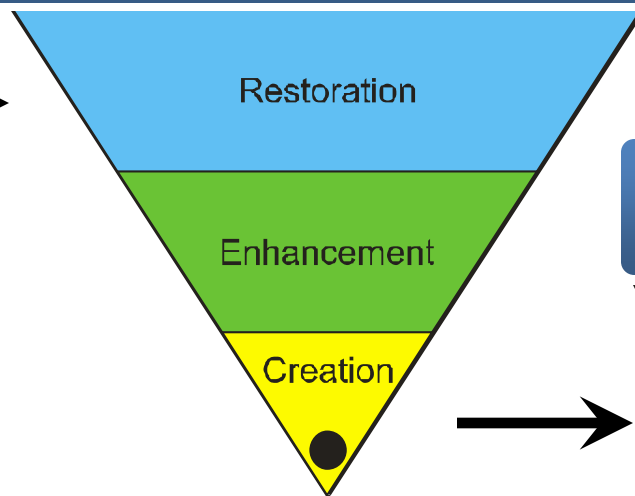


New Brunswick Department of the Environment Wetland Policy

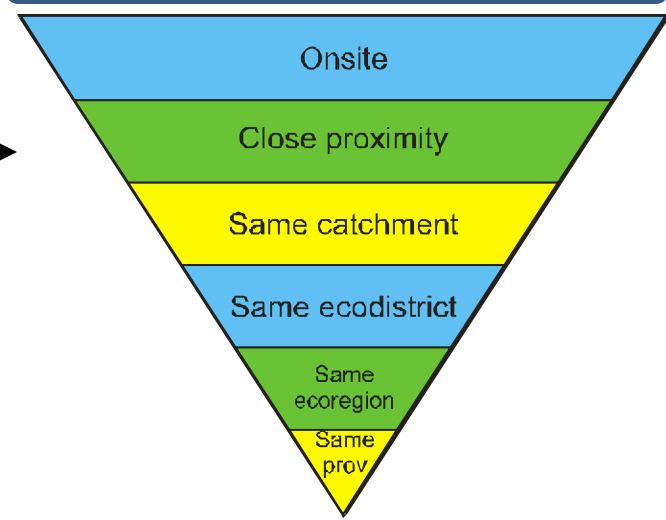
NBDENV Wetland Hierarchy



Preferred wetland action if wetland is impacted



Preferred location of wetland compensation



Historical Site Description



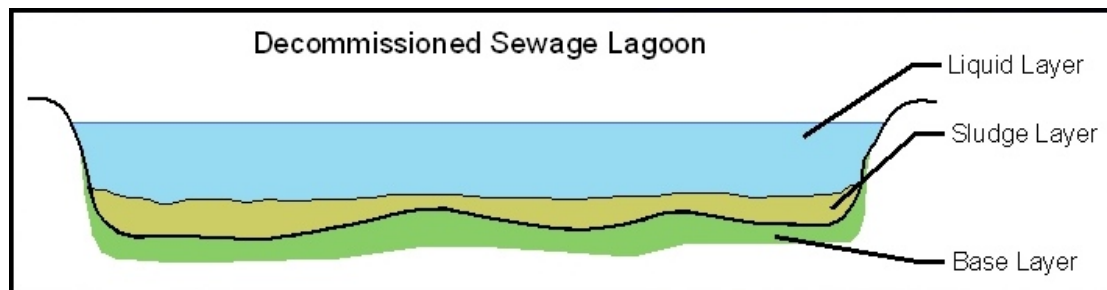
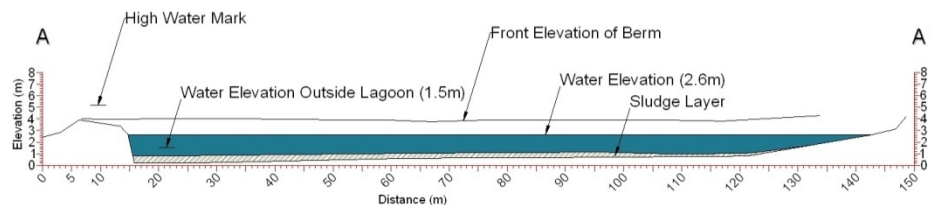
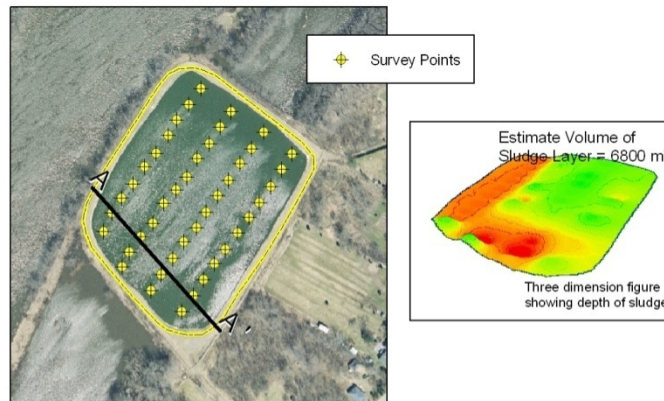
- < 1970's backwater area (bogan) in Hampton
- Sewage treatment lagoon built in the mid 70's
- Sewage lagoon decommissioned in 2008
- Site impacts included sludge, metals, hydrocarbons, berm walls, fencing, etc



Baseline Environmental Assessment



Sludge Survey



- Sludge thickness of 0.3 to 1.5 m
- Hydrocarbon "Hot Spot"
- Arsenic, lead, copper
- Grain size analysis of underlying soil material (fine grained)
- Risk-based tools used to determine the receptor pathways
- On-site encapsulation modeled, and deemed acceptable risk



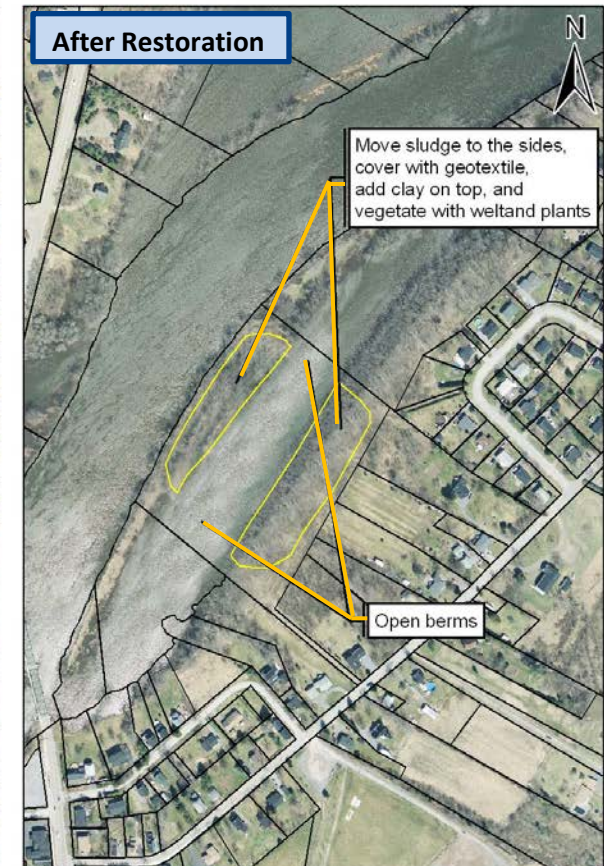
Wetland Restoration Engineering



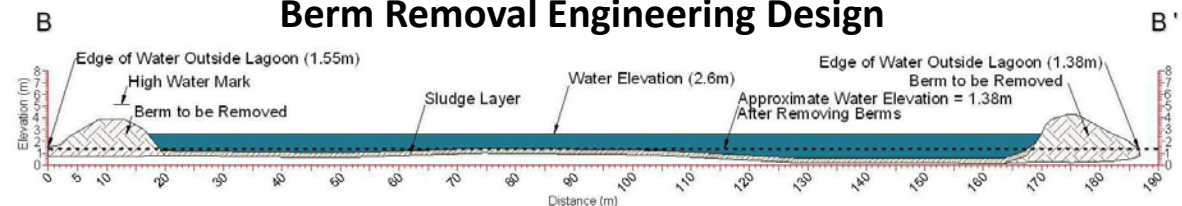
8.98 ha of habitat, including fragmented and fish habitat, was restored.

Potential environmental threats were cautiously delineated, stabilized and risk-managed.

Water and soil quality have improved considerably according to ongoing environmental sampling.



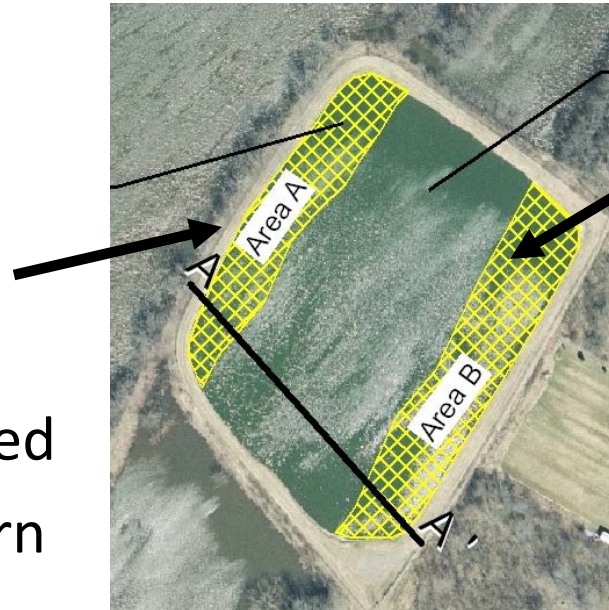
Berm Removal Engineering Design



Wetland Restoration Construction



- Dewater lagoon
- Sludge within lagoon to be relocated to Areas A & B
- Encapsulate sludge
- Re-grade area and hydro seed
- Remove northern & southern berm wall



Approximately
4000 m³ of
sludge to be
relocated to
Areas A & B



3 Restoration Phases



Phase I: Lagoon Dewatering & Sedimentation Stabilization



Phase II: Berm Grading & Cutting



Phase III: Hydro seeding & Native Plant Re-vegetation



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Site Photographs after Restoration 1 YR



The former Dutch Point Wastewater Treatment Lagoon now naturally blends in to the surrounding landscape since the restoration initiative that was completed.



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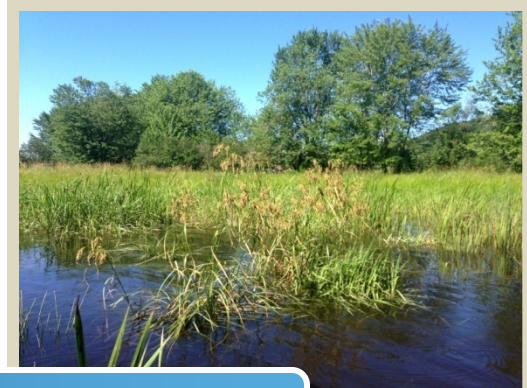
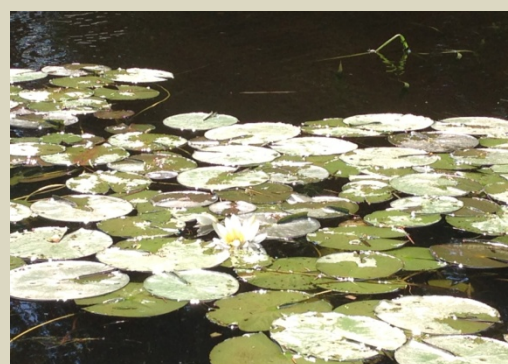
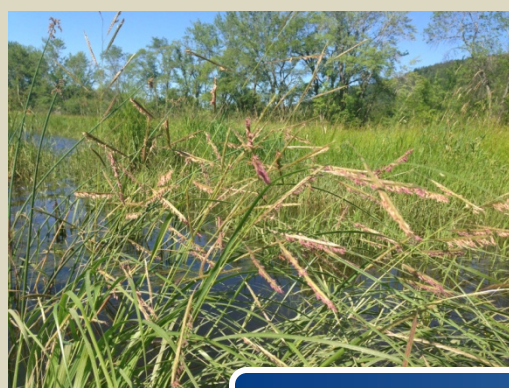
Site Photographs after Restoration 3YR



Restored Wetland / Former Lagoon



Entrance to the restored wetland
/ former lagoon



Wetland Vegetation Re-establishing

Comparison of Sample Results

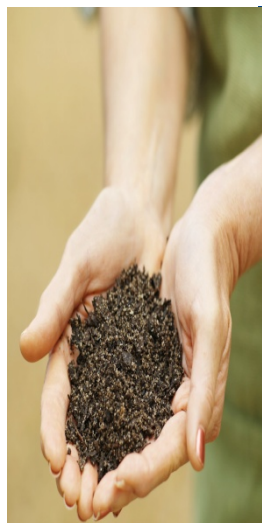
Post Decommissioning vs. Post Rehabilitation (1 YR)

WATER



Parameter	Criteria (µg/L)	Post Decommissioning (µg/L)	Post Rehabilitation (µg/L)
Cadmium	0.017	0.3	↓ ND
Copper	2 to 4	7	↓ ND
Lead	1 to 7	8.4	↓ 1.4
Zinc	30	33	↓ 5

SOIL



Parameter	Criteria (mg/kg)	Post Decommissioning Max Value (mg/kg)	Post Rehabilitation Range (mg/kg)
*Arsenic	6	10	↑↓ 5 to 16
Copper	35.7	190	↓ 7 to 32
Lead	35	72.7	↓ 8.6 to 14.2
Mercury	0.17	0.59	N/A
Zinc	123	367	↓ 44 to 67

*Arsenic is also present in background soils

In Summary



- Impacted site was remediated and transformed into 8.98 ha of wetland (\$32K/ha)
- Water quality, soil quality and habitat have significantly improved to date (after 1 year)
- Further monitoring required (*i.e.*, 3 and 5 year) to measure full benefit of remediation & restoration

