Appendix E
Public Open House #1 Documentation

Notice of Open House

Public Notice

Boat Harbour Remediation Project

Open House
August 1st
Pictou Landing Fire Hall
2 pm–7 pm

The Boat Harbour Remediation Project is holding public consultations as part of the federal environmental impact assessment process.

Drop in to learn more about the project, including:

- anticipated timeline
- what's been done so far
- overview of the assessment process
- proposed cleanup approach
- how to stay involved

boatharbour@novascotia.ca

novascotia.ca/boatharbour

Boat Harbour Remediation Project
Nova Scotia Lands
PO Box 186
Halifax, NS B3J 2N2

NOVA SCOTIA

Display Panels

Open House

Boat Harbour Remediation Project

Please sign-in at the registration table upon arrival

Please feel free to approach any team member to discuss the project

Please share your thoughts with us by completing a comment form to ensure your input is captured

www.novascotia.ca/boatharbour

GHD

NSLands
nova scotia lands

WELCOME!

The purpose of this event is to discuss the Environmental Impact Assessment (EIA) for the Boat Harbour Remediation Project

Today we will:

- Provide information on the Boat Harbour Remediation Project and associated EIA
- Outline the EIA process and anticipated timelines for completion
- Present information on the existing conditions in Boat Harbour
- Discuss the process for remediation
- Collect your views, ideas and concerns about the project

A summary report will be available following today's Open House by visiting

www.novascotia.ca/boatharbour

Thank You For Joining Us

Background

Boat Harbour, known as A'se'k in Mi'kmaq, was originally a tidal estuary connected to the Northumberland Strait. It is currently used for the treatment of wastewater from the Northern Pulp Mill at Abercrombie Point. The Harbour began receiving industry wastewater in 1967 and was isolated from the ocean through construction of a dam.

Maw-Lukutinej Waqama'tuk A'se'k

"Let us work together and clean up Boat Harbour"

Pictou Landing First Nation

In 2015, in consultation with Pictou Landing First Nation (PLFN), we established that the vision for the future of Boat Harbour is to return it to tidal. That is our remediation objective.

Background

Nova Scotia Lands (NS Lands) is the proponent for the Project. NS Lands is a provincial Crown corporation whose mandate includes remediating Crown-owned properties.

GHD was retained to help complete the planning and design of the Boat Harbour Remediation Project.

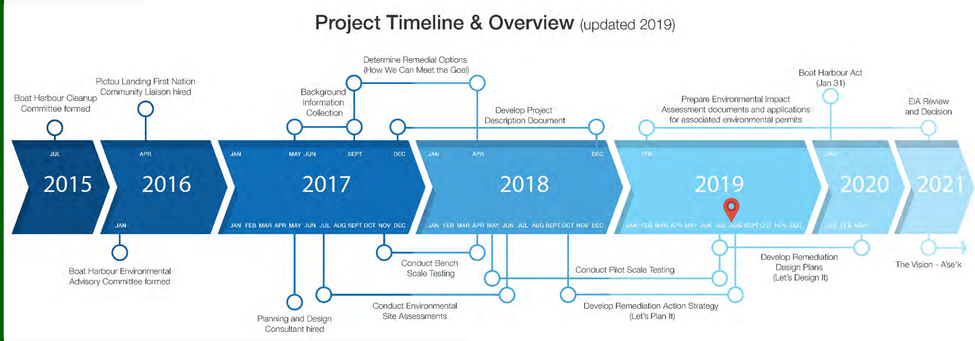
Our Goal

We will remediate Boat Harbour and restore to a tidal estuary.

A solution is being developed that will be:

- Identified and assessed using a collaborative approach
- Founded on proven technologies
- Evaluated with openness and transparency
- Protective of human health and the environment

What's Been Completed?



- Developed a Remedial Objective
- Conducted Bench Scale Testing
- Conducted Pilot Scale Testing
- Completed Baseline Studies
- Consulted with PLFN and Agencies
- Completed Environmental Site Assessments
- Determined Remedial Options
- Developed a Remedial Action Strategy

Consultation and Engagement

Consultation Objectives

Enhance public awareness and the communication of project information

Provide multiple consultation opportunities

Collect input and demonstrate consideration of issues raised

Pictou Landing First Nation

- **Boat Harbour Clean-up Committee (BHCC)**
- **Boat Harbour Environmental Advisory Committee (BHEAC)**
- **Community Information Sessions**
- **Informal Focus Groups**
- **Employment and Business Opportunities**

Public Consultation to Date

NS Lands has held three public meetings with the broader community in October 2016, April 2018, and May 2018.

At these meetings, Project concepts and plans were presented and discussed with a focus on pilot scale testing activities.

How does government play a role?

Canadian Environmental Assessment Agency

The Canadian Environmental Assessment Agency (CEAA) will coordinate the process, review the EIA results, and make a decision. They will approve or reject the project as proposed, based on the predicated environmental effects.

NSLands
nova scotia lands

As the proponent, NS Lands represents the province of Nova Scotia who are responsible for cleaning up Boat Harbour.

Other Agencies

Other federal and provincial agencies will provide expertise on the studies and requirements for remediation, as well as related approvals.

- Environment and Climate Change Canada
- Fisheries and Oceans Canada
- Health Canada
- Indigenous Services Canada
- Infrastructure Canada
- Transport Canada

- Environment
- Lands and Forestry
- Office of Aboriginal Affairs
- Transportation and Infrastructure Renewal

What needs to be done?

Returning Boat Harbour to tidal requires removing infrastructure and industry contaminants from Boat Harbour. This process includes:

- **Decommissioning and/or repurposing the existing infrastructure**
- **Removing and managing contamination**
- **Removing the causeway and building a new bridge**
- **Removing the existing dam to restore Boat Harbour**

It is expected that cleanup will take 4-7 years

Complete/ Nearing Completion | **In Progress** | **Pending**

Scientific and Technical Planning

- Develop remedial objectives, with the vision to return Boat Harbour to a tidal estuary
- Conduct studies to determine the extent of contamination and evaluate environmental baseline conditions
- Conduct studies to ensure that human health and the environment are protected
- Develop and assess remediation solutions in order to propose methods for the cleanup

Regulatory Phase

- Regulatory review and consultation
- Conduct Environmental Impact Assessment
- Indigenous /Public Consultation and Engagement

Clean Up Phase

- Permits and Approvals and Contractor Selection
- Remediation Implementation
- Environmental management and monitoring

What is an EIA?

What is an Environmental Impact Assessment (EIA)?

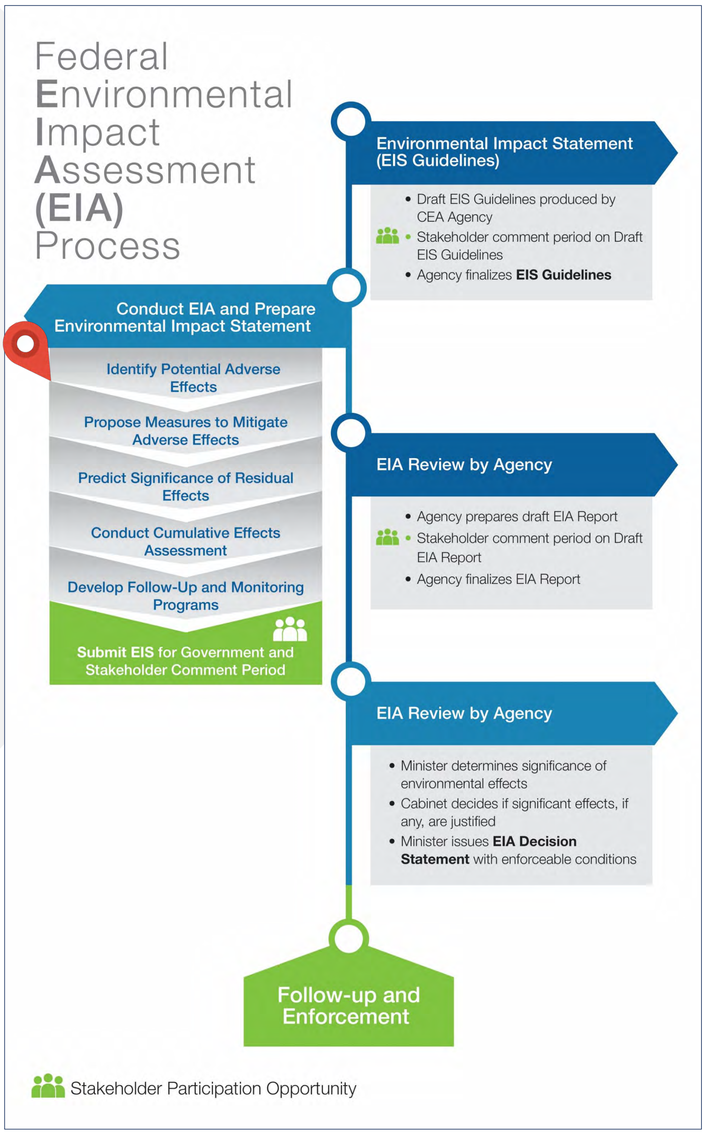
It is a planning and decision-making tool. The objectives of an EIA are to minimize or avoid environmental effects before they occur and incorporate environmental factors into decision making.

Why is an EIA being completed?

To understand how the cleanup will impact and protect human health and the environment. Before remediation can take place, the EIA must be approved by the government of Canada.

What is examined in an EIA?

- Environmental effects and cumulative environmental effects and their significance
- Public and PLFN comments
- Mitigation measures and follow-up requirements
- Solutions to carry out the project
- Changes to the project caused by the environment
- Results of any relevant regional study and any other relevant matters



What are the Areas of Environmental Impact?

What are the contaminants?

Contaminants found within the BHETF include metals (zinc, mercury, cadmium), PAHs (polycyclic aromatic hydrocarbons), and dioxins and furans found in water and sediments.

How much contamination is there?

At this stage, it is estimated that 1 million cubic metres of sediments will need to be removed and managed.

How far has the contamination spread?

Our studies have shown that contaminated sediments are confined to the active BHETF and wetlands. Lower concentrations of contaminated sediment have been found outside the dam structure, in the estuary. No contaminated sediment has been found beyond the estuary or in the Northumberland Strait.

How will we know if it is "truly" cleaned up?

We will be testing during and after the cleanup to ensure that the remediation was successful. The tests must satisfy the requirements of all regulators and will be made public.

Long-term monitoring will take place and results will be made available to the public.

Remedial reports will be available to the public on the Boat Harbour website

www.novascotia.ca/boatharbour

Contamination Sampling

To date, samples have been taken and tested from the following areas:

- Northumberland Strait
- Estuary
- Boat Harbour Effluent Treatment Facility
- Wetlands and surrounding lands

Sampling Categories

- ✓ Sediment
- ✓ Water
- ✓ Groundwater
- ✓ Surface soil
- ✓ Fish tissue and crustaceans
- ✓ Local wildlife tissue

Sampling Locations

Pilot Scale Testing

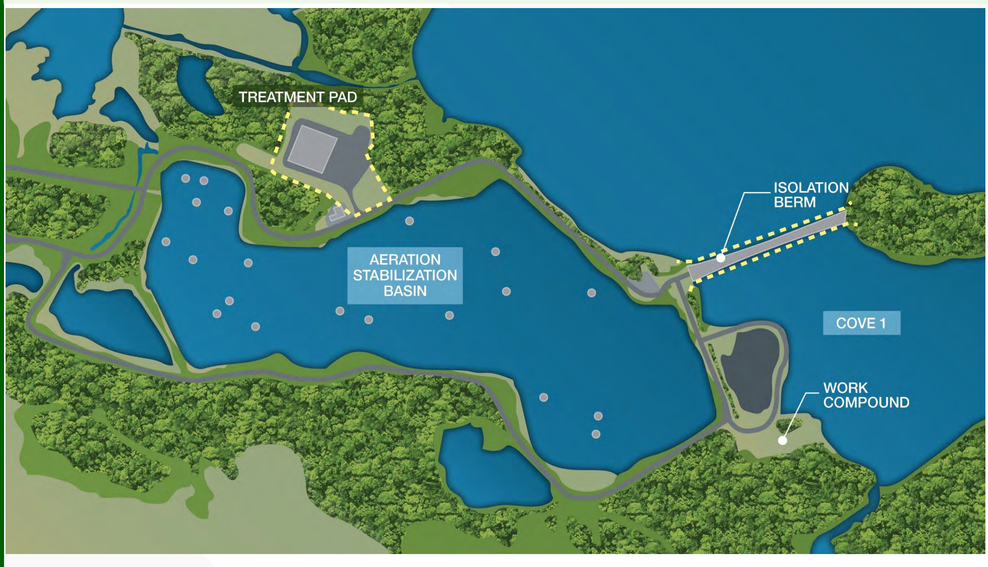
What is Pilot Scale Testing?

Pilot Scale Testing is a series of tests conducted before the full-scale remediation begins. It involves testing excavated material in both dry and wet conditions as well as dewatering of the sludge and treatment of the water.

Why is it completed?

Pilot Scale Testing helps to determine the most effective way to perform the clean up and to prove or disprove assumptions made during the planning phase.

Location



Sediment Management and Removal

Removal in the Dry

Removal in the Wet
(Hydraulic Dredging)

Water Treatment

Treatment Pad Area

Geotube Dewatering

Baseline Studies

The following baseline studies have been completed or are underway:

- ✓ Air Quality & Odour
- ✓ Greenhouse Gas
- ✓ Noise
- ✓ Light
- ✓ Meteorological
- ✓ Groundwater
- ✓ Surface Water
- ✓ Surficial & Bedrock Geology
- ✓ Geomorphology, Topography & Geotechnical
- ✓ Geologic Hazards
- ✓ Terrestrial Habitat & Vegetation
- ✓ Wetlands
- ✓ Mammals & Wildlife
- ✓ Marine Environment
- ✓ Fish & Fish Habitat
- ✓ Migratory Birds & their Habitat
- ✓ Species at Risk
- ✓ Economic & Social
- ✓ Archaeological/Cultural Heritage Resources
- ✓ Mi'kmaq Ecological Knowledge Study
- ✓ Contaminants of Concern and Characterization of Leaching Potential (Disposal Cell)

Have we missed anything in our Baseline Studies that you think should be examined?


Sean Landsman


Wikimedia

If you are interested in learning more about our baseline studies, ask us!
More information can also be found at the resource table or on the Boat Harbour website.

What are the decision making steps?

Complete / Nearing Completion

In Progress

Pending

What needs to be cleaned up and how will it be evaluated?

Determine what parts of the BHETF need to be cleaned-up and how the approaches will be evaluated

What are the different approaches we can use?

Determine all possible solutions for each part of the BHETF to be remediated

Are the approaches feasible?

Complete a preliminary evaluation of each approach to determine which to develop and consider as possible solutions

What would the solutions look like?

Prepare a design for each possible solution

Qualified Solutions

Evaluate each possible solution for each part of the BHETF to be remediated to identify Qualified Solutions

Verify Design Assumptions

Confirm design assumptions though pilot scale testing and discussions with technology suppliers and Regulators

Evaluate and Confirm Recommended Solutions

Identify the best option to cleanup each part of the BHETF considering environmental impact; comments; and permits and approvals

What are the Possible Solutions?

Each of the proposed solutions and alternatives have been examined using the following criteria:

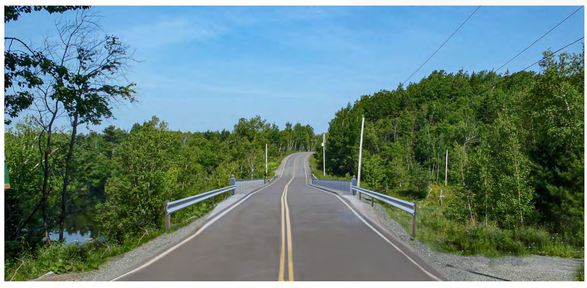
- **Health & Safety**
- **Compliance**
- **Social**
- **Technical**
- **Environmental**
- **Economic**

Bridge at Highway 348

Proposed Solution – Concrete Girder Bridge
Alternative – Steel Girder Bridge

South View

East View



Waste Management

Proposed Solution – Use Existing Disposal Cell
Alternative – Off-Site Disposal

Engineered Disposal Cell

Wetland Management

Proposed Solution – Ex-situ Remediation
Alternative – Natural Attenuation

What are the Possible Solutions?

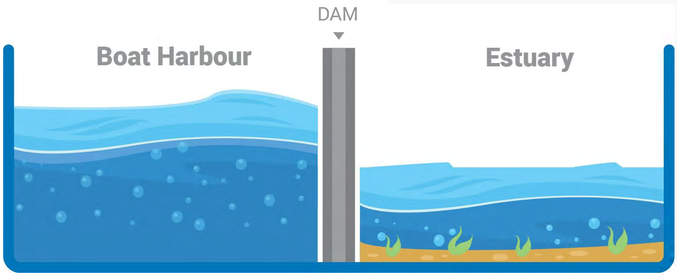
Infrastructure Decommissioning

Pipeline On Land
Alternative 1 – Clean, Inspect, Plug, and Abandon in Place
Alternative 2 – Clean, Fill, and Abandon in place
Alternative 3 – Complete Removal

Pipeline Underwater
Proposed Solution – Clean, Inspect, and Abandon in Place
Alternative – Clean, Fill, and Abandon in place

Treatment Buildings
Proposed Solution – Decommission and Demolition or Repurpose Where of Value

Dam
Proposed Solution – Decommission and Demolition



Remediation Approaches

Sediment Treatment
Proposed Solution – Removal in the Wet with Geotube Dewatering
Alternative 1 – Removal in the Wet with Clay Stabilization
Alternative 2 – Removal in the Dry with Geotube Dewatering
Alternative 3 – Removal in the Dry with Clay Stabilization

Bulk Water Management
Proposed Solution – On-Site Management Using Appropriate Technology Treatment System

Dewatering Effluent Management
Proposed Solution – On-Site Management Using Appropriate Technology Treatment System

Leachate Management
Proposed Solution – Off-Site Disposal
Alternative – On-Site Management Using Advanced Treatment

What's Next?

- Input from today's event will be considered by NS Lands
- Responses will be provided on the Boat Harbour website on September 6, 2019
- The Impact Assessment will be advanced with the proposed solutions
- Results will be presented at Open House #2 in Fall 2019

Don't forget to complete a comment form!

To ensure your views are considered, please submit your comments to NS Lands by:

August 16, 2019

How do I submit a comment?

- Complete a comment form today
- Submit a comment on the website *www.novascotia.ca/boatharbour*
- Email Us *boatharbour@novascotia.ca*
- Mail Us

Nova Scotia Lands
PO Box 186, Halifax, NS
B3J 2N2

Summary of Environmental Baseline Studies

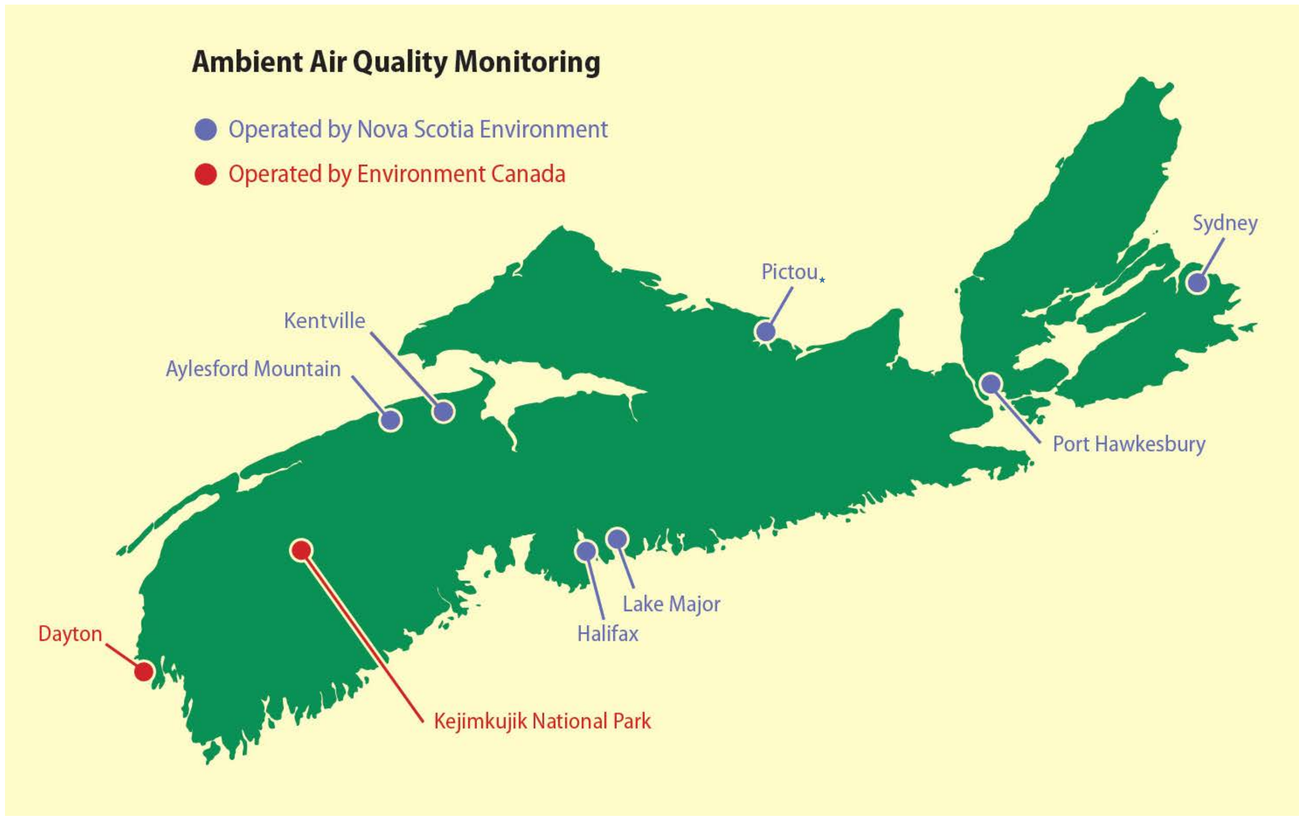
Boat Harbour Remediation Project

Baseline Studies Reference Booklet

Baseline Studies

Air Quality and Odour

- Ambient/existing air quality concentrations for the following contaminants and odorous emissions to be collected from existing monitoring data and compared to appropriate guidelines and standards:
  - Total suspended particulates (TSP)
  - Respirable particulates of less than 10 microns (PM10)
  - Fine particulates smaller than 2.5 microns (PM2.5)
  - Carbon monoxide (CO)
  - Sulphur oxides (SO_x)
  - Nitrogen oxides (NO_x)
  - Volatile organic compounds (VOCs)
  - Hydrogen sulfide (H_2S)
- Direct and indirect sources of air emissions to be identified; significant regional sources to be identified and discussed
- Project-specific Independent Ambient Air Monitoring and Evaluation Program being completed



Pictou (primary), Port Hawkesbury, and Lake Major Monitoring Station data utilized for study

Greenhouse Gas

- Greenhouse Gas (GHG) Mitigation Assessment calculated existing and anticipated carbon dioxide equivalent (CO2e) emissions, assuming continued operation of the Boat Harbour Effluent Treatment Facility (BHTF) for the 25-year period from 2018 to 2043, as follows:
  - Diesel – 28 tonnes CO2e (tCO2e)
  - Disposal Cell – 184,302 tCO2e
  - Electricity – 184,250 tCO

Baseline Studies

Noise

- Baseline Noise Monitoring (2017) indicates noise levels are within acceptable Nova Scotia Environment (NSE) Noise Guidelines levels
- Visual survey to identify and confirm existing noise and vibration sensitive receptors (e.g., residences, daycares, schools, hospitals) and existing historic buildings and structures that may be of concern for vibration impacts
- Pre-construction monitoring program to consist of sound measurements at 5 locations (worst-case sensitive receptors) over 2 days under calm weather conditions – project noise impacts to be compared against these measurements

Light

- Currently classified as "E2 – Rural" with low district brightness which is typical of rural areas

Meteorological

- Historical records of relevant meteorological information (e.g., total precipitation (rain and snow); mean, maximum and minimum temperatures; and typical wind speed and direction)

Baseline Studies

Groundwater

- Shallow groundwater occurs in two main zones:
  - silty glacial till overlying bedrock/where till is thin or absent
  - where thin or absent till occurs in the shallow bedrock
- Surface water and shallow groundwater provide the base flow to Boat Harbour
- Drinking water for PLFN and residences within the watershed from drilled wells
- No hydrogeological connection between deep groundwater and shallow groundwater/surface water flow regime

Surface Water

- 19 watercourses (2 ephemeral channels, 13 intermittent channels, 3 small permanent channels, 1 large permanent channel), 3 small drainage corridors
- 13 watercourses assessed, 6 of the identified watercourses were dry
- Water temperature average of 13.6°C
- Total dissolved solids average of 0.0779 grams per Litre
- Average pH of the combined watercourses of 6.94
- Specific conductance readings relatively stable with combined average 119.385 microSiemens per centimetre (µS/cm)
- Dissolved oxygen varied from stream to stream

Baseline Studies

Surficial and Bedrock Geology

- Mainly hummocky ground moraine composed of a mixture of gravel, sand, and mud of glacial origin, often with loose inclusions of waterlain sediment, and areas with silty till drumlins
- Depth from 2 – 25 m below ground surface with irregular topography (many local ridges and depressions)

Geologic Hazards

- Data regarding history of seismic activity in the area; isostatic rise or subsidence; and landslides, slope erosion and the potential for ground and rock instability, and subsidence during and following project activities to be collected from existing available public sources

Contaminants of Concern and Characterization of Leaching Potential (Disposal Cell)

- Contaminants of concern in dewatering effluent from geotubes include petroleum hydrocarbons, dioxins and furans, cyanide, and metals (i.e. chromium, copper, mercury, vanadium, zinc)

Geomorphology, Topography, Soil and Geotechnical

- Northumberland Lowlands physiographic region
- Imperfectly drained soils and subject to a wide range of climatic conditions
- Black spruce forests with Eastern Larch prevalent, jack pine throughout, and hardwood forests found in hillier areas; land primarily used for forestry
- Lowest average annual precipitation in Nova Scotia (1128 mm)
- Mostly low lying with some rolling hills, average elevation range 5 – 15 m above sea level
- Surrounding lands at slightly higher elevation, sloping south towards the East River, west towards Pictou Harbour, and north towards Northumberland Strait

Baseline Studies

Terrestrial Habitat and Vegetation

- Baseline assessments conducted from August 2017 to July 2018
- Habitat ranged from landscaped areas to well-drained drumlin hills comprised mostly of upland species (Eastern hemlock, large-toothed aspen)
- 7 main types of forest stands present: Softwood, Eastern Hemlock, Red Pine, Tolerant Hardwood, Intolerant Hardwood, Mixed, and Regenerating
- Dominated by Mixed forest stands, with Tolerant Hardwood stands most notably located along the steeps slopes of the Northern boundary and Eastern Hemlock stands dominating the western and eastern portions
- Regenerating forest stands more apparent in the southern sections, with patches of Red Pine found throughout
- Ages of the stands varied from overmature (mainly in the northern portions) to early successional
- Other terrestrial habitat types observed: Fallow Pasture Lands and Open Fields and Landscaped Areas
- More than 240 vascular and non-vascular species identified – 1 species at risk (SAR), 2 species of conservation concern (SOCC)
- Black ash (Wisqoq in Mi'kmaw) - Threatened under the federal Species at Risk Act and Nova Scotia Endangered Species Act; observed in localized areas to the south; believed to have been planted a few years ago (not naturally occurring)
- Heart-leaved foam flower (Tiarella cordifolia) (1 individual) in north - S2 (Atlantic Canada Conservation Data Centre (ACCDC)), Sensitive (Province)
- ACCDC identified Horned Sea-blight within 0.5 +/- 2 km of the site
- Appressed jellyskin lichen (Leptogium subtile) in limited quantities just outside eastern boundary - S3 (ACCDC), Sensitive (Province)
- Vegetation species observed are largely native species, with exotic species confined mainly in disturbed areas
- Species and communities of vascular and non-vascular plants encountered were typical given the eco-regional context, nutrient regimes, moisture regimes, and disturbance regime

Baseline Studies

Fish and Fish Habitat

- 6 watercourses included in benthic macro-invertebrate assessment
- Relatively low EPT (Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddis flies)) ratios were observed
- Diptera species (flies) made up 68.3% of all organisms collected
- Water temperatures at the BHTF site were within range for salmonid species
- The fairly neutral pH readings throughout the site (average of 6.94) within accepted tolerance range for Brook Trout
- Majority of watercourses lack appropriate physical habitat features to sustain populations of adult Brook Trout – select few may have adequate spawning or rearing habitat for portions of the year
- Relatively stable specific conductance throughout watercourses (average 119.385 µS/cm) – good for salmonids

Mammals and Wildlife

- Environmental baseline assessments were conducted from July to October 2017
- The softwood, hardwood, mixed forests, fields, wetlands and open water habitats present provide suitable habitat for many common mammal species, especially smaller ones (hare, red squirrel, meadow voles, shrew species)
- Evidence of white-tailed deer, black bear, Eastern coyote, striped skunk, snowshoe hare, North American porcupine, raccoon, muskrat and beaver, maritime garter snake, leopard frog, green frog, American bull frog, spring peeper, and American Toad
- Active trapping within the Project Area (beaver and muskrat harvesting for fur); no known hunting for larger game species

Baseline Studies

Wetlands

- Wetland field surveys were conducted from August to November 2017
- 25 wetland areas identified and assessed (3 marsh, 10 swamp, 11 marsh/swamp complexes, 1 marsh/saltmarsh complex)
- Total wetland area delineated approximately 86.24 ha
- Wetland function: most of the wetlands identified have a moderate or high value pertaining to sediment retention, and all wetlands have low potential for anadromous fish habitat. In general:
  - Hydrologic group function – Mostly Lower
  - Transition habitat group – Mostly Moderate or Higher
  - Water quality support group – Mostly Moderate or Higher
  - Wetland Condition – Mostly Moderate
  - Aquatic support group – Mostly Moderate
  - Wetland Risk – Mostly Moderate or Higher
  - Aquatic habitat group – Mostly Moderate or Higher
- Most in moderate condition, but moderately or highly prone to degradation
- Hydrologic functions considered lower
- Generalized score for aquatic habitat was mostly moderate or higher
- Moderate / higher in the transition habitat group, meaning contribute to a diversity of native birds, mammals, vascular plants, and pollinating insects
- Wetlands located further from the effluent treatment infrastructure observed to be in better condition than those in immediate vicinity

Baseline Studies

Marine Environment

- Pictou Road section of Northumberland Strait
  - Various marine species, including fish and shellfish, depend on the diverse habitat of Northumberland Strait; considered an important feeding and foraging area within the Atlantic Ocean
  - Sandy substrate provides significant foraging habitat for marine species (8 species at risk identified)
  - Considered to be a vital part of the local commercial fishing community
- Pipeline corridor
  - Habitat supports a variety of endofauna (polychaetes and bivalvia)
  - Observed endobenthic community consists of 48 different taxa
  - Epibenthic community taxa (e.g., mussels, Atlantic rock crabs, clams) identified

Baseline Studies

Migratory Birds and their Habitat

- Nearest Important Bird Area (IBA) approx. 32 km northeast (southeast coast of PEI, Highbank IBA)
- 2 Biologically Significant Areas for breeding terns in the vicinity: Pictou Bar Site of Ecological Significance (SES) (800 m north) and Ballast Island SES (1 km southwest)
- Fall bird migration survey (2017)
  - Line transect surveys: 74 species identified; 21 priority species – 1 SAR (Eastern Wood-pewee)
  - Diurnal vantage point watch count surveys: 52 species identified – no SAR; 5 SOCC (Semipalmated Plover, Least Sandpiper, Semipalmated Sandpiper, Willet, Greater Yellowlegs)
- Late winter and early spring bird survey (targeting raptor surveys) (2018)
  - 3 owl species (no priority species) detected during nocturnal owl surveys: Great Horned Owl, Barred Owl, and Northern Saw-whet Owl
- Spring migration monitoring (April 27 and May 14, 2018)
  - Line transect surveys: 66 species identified; 10 priority species – 1 SAR (Evening Grosbeak)
  - Diurnal vantage point watch count surveys: 42 species identified; 12 priority species – 1 SAR (Barn Swallow)
- Breeding bird point count survey and marsh monitoring (2018) – 2 rounds: June 6-7 (early breeders), July 26-28 (late breeders)
  - 81 species; 20 priority species – 4 SAR (Eastern Wood-pewee, Bank Swallow, Evening Grosbeak and Canada Warbler)
  - Marsh Monitoring Protocol: Sora was the only primary species observed
- Common Nighthawk survey (June 26, 2018)
  - 8 Common Nighthawks were observed


David Turgeon


Tony Varela

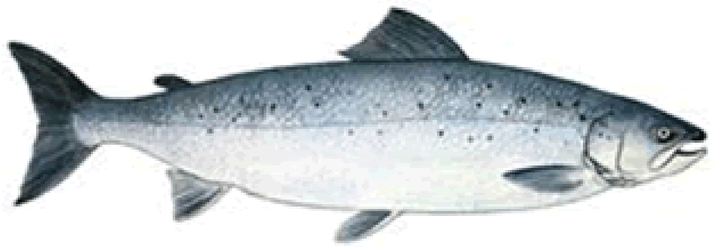

Brian Sullivan

Baseline Studies

Species at Risk

- Priority SAR floral species *(observed)*:
  - COSEWIC Threatened – Black Ash
- Priority SAR bird species *(observed)*:
  - SARA Endangered – Barn Swallow, Canada Warbler and Piping Plover
  - SARA Threatened – Common Nighthawk and Olive-sided Flycatcher
  - SARA Vulnerable – Bobolink and Eastern Wood-Peewee
  - COSEWIC Threatened – Bank Swallow and Wood Thrush
  - COSEWIC Special Concern – Evening Grosbeak
- Priority SAR Fish species (Pictou Road area of the Northumberland Strait, 2004) *(historical)*:
  - COSEWIC Endangered – (Rainbow) Smelt, Winter Skate, Atlantic Salmon, Striped Bass
  - COSEWIC Threatened – White Hake, American Eel
  - COSEWIC Special Concern – Smooth Skate, Thorny Skate


Garth McElroy




Ian Hearn

Baseline Studies

Economic and Social

- Surrounding land used for community living, water supply, sustainable forestry, and recreational activities
- Majority of community development is on IR24 of the PLFN, which comprises numerous residential and community facilities, including a health centre, a school, playground, church, gas station, Band Office, and a cemetery
- PLFN also has a secondary wastewater treatment plant with an outfall that extends approximately 286 m into the Northumberland Strait
- Land parcel to the east owned by PLFN is designated as a water supply area
- Some of the PLFN land south of Boat Harbour (IR37) is used for sustainable forestry activities. The forest is part of the Maritime Lowland Eco-region and has red spruce, hemlock, and pine. The woodland designated under the sustainable forestry activities is considered an important social resource given the historical and cultural importance of woodlands to the PLFN.
- Land around Boat Harbour is used for recreational activities, including hiking and walking, and off-road vehicle use
- Mi'kmaq Ecological Knowledge Study (MEKS) identified historical hunting, gathering, and aquatic recreation in the area
- Current use is limited mainly to fur-bearing creatures as species of harvest

Baseline Studies

Archeological / Cultural Heritage Resources

- Most of the Study Area for Boat Harbour Remediation is ascribed elevated (moderate or high) archaeological potential
- Shovel testing was conducted in areas of high and moderate archaeological potential
- 4 archaeological sites were identified and will be avoided:
  - James & Christina Sproull Site
  - Donald McArthur Site
  - Peter McArthur Site
  - A'se'k 1 Site: A small Pre-contact archaeological site identified during shovel testing - eastern edge of proposed footprint of Conceptual Pilot Treatment Pad Option

Mi'kmaq of Nova Scotia

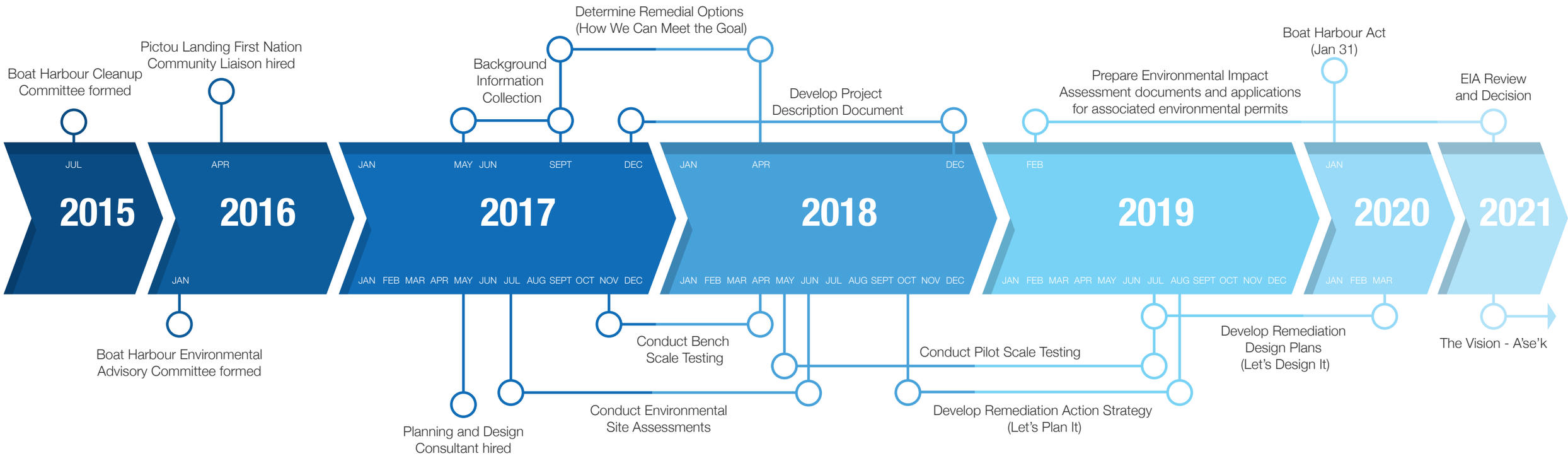
- Considers Mi'kmaq traditional land and resource uses, significant species, and existing ecological knowledge from land and water areas within the project Site
- Atlantic Salmon, American Eel, and Striped Bass are considered endangered, threatened, or species of special concern; the Mi'kmaq still rely on these species for sustenance and cultural ceremonies
- Deer, trout, salmon, bass, rabbit, mackerel, and smelts are considered to be the favoured hunting/fishing activities for Mi'kmaq and blueberry gathering is also common in the area

Infographics

- Overview and Timeline
- Boat Harbour Sludge Our Problem
- Ambient Air Monitoring Program
- Pilot Scale Testing

Boat Harbour Remediation Project

Project Timeline & Overview (updated 2019)



Boat Harbour Remediation Project

An Overview & Timeline (Updated 2019)

The Problem – What's in Boat Harbour?

Timeline: 2015 - 2017

The challenge was to figure out what the contamination is and how far it extends. In 2017, GHD was hired as the design engineer. We worked on site investigations, interviews, records searches and sampling water, soil and sediments. We now understand that the contamination is contained within the Boat Harbour Treatment Facility.

The Solution – What are the ways to clean it up?

Timeline: 2017 - 2019

Studies to figure out how to clean up Boat Harbour included:

Bench Scale Testing – in the lab, we figured out how the contaminated sludge behaves and can be treated. This helped inform options for the cleanup. Then we moved from the lab to the site with pilot scale work.

Pilot Scale Testing – In late 2018/early 2019 we looked at options to remove and treat the contaminated sludge and water in Boat Harbour. Wet dredging proved to be the best option, as dry excavation did not work since the underlying harbour bottom is too soft to support heavy equipment. Geotubes (large filter bags) worked well to get the water out of the contaminated sludge. Our method for on site water treatment worked well to treat water coming from Boat Harbour and the water that drained from the sludge through the geotubes.

Environmental Impact Assessment and Detailed Design

Timeline: 2019-2021

An Environmental Impact Assessment will be completed to predict how our project will affect, and how we protect, human health and the environment. The project is subject to a federal environmental impact assessment. This process is expected to be complete by early 2021. Indigenous and public consultation will continue as part of the environmental impact assessment process.

Detailed design of the project plans and development of the work packages for tender will also take place during this time period.

The Vision – A'se'k

Timeline: 2021 and beyond

Two companies will be hired, one for construction – to do the physical cleanup work and one for oversight- to ensue the cleanup is done well, according to the plans. We expect the cleanup will take about 4 to 7 years, starting at earliest in 2021. After the cleanup is complete, the bridge is built and the dam is removed, we expect Boat Harbour to return to a healthy harbour.

Boat Harbour Sludge – Our Problem

What is Boat Harbour contaminated with?

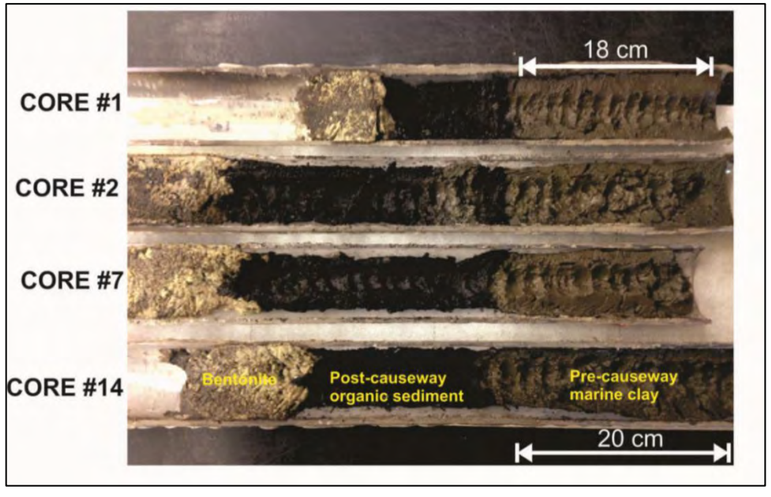
A layer of contaminated sludge has settled on top of the Boat Harbour bottom. This sludge has been accumulating since 1967. It has been sampled many times over the years. A full suite of testing was completed in 2017 which has confirmed the contaminants in the sludge. Over time, the contaminants have not changed.

We know the sludge contains:

- Dioxins and furans, the principle contaminants of concern are carcinogens and are residues of industrial processes
- Metals such as mercury, cadmium and zinc, which are residues of industrial processes
- Polycyclic aromatic hydrocarbons (PAHs), can be produced by incomplete combustion of fossil fuels in engines and boilers or from forest fires
- Total petroleum hydrocarbons (TPH), is a term used for any mixture of hydrocarbons that are found in crude oil and petroleum products
- Volatile organic compounds (VOCs), include human made residues from industrial processes and naturally occurring chemical compounds.

The contaminated sludge is generally less than a foot, or 30 centimetres, thick and is black in colour while the underlying marine sediment is brownish gray and is not contaminated.

The wetlands above Boat Harbour have also been impacted from the early years of Mill operations and contains contaminated sediments.



This image shows several core samples taken from Boat Harbour. The black contaminated sludge is noted as Post-causeway organic sediment; the brownish gray is the clean Pre-causeway marine sediment (clay); and, the bentonite is a clay product put in the core during sampling as a plug

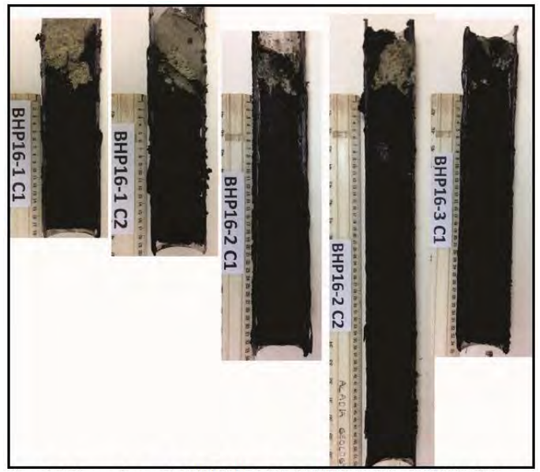
Boat Harbour Remediation Project

How Much Is There?

The contaminated sludge in Boat Harbour is of a soft, wet nature and is unevenly distributed along the harbour bottom. We have estimated the volume of material to be removed from Boat Harbour to be as much as 1,000,000 m^3. This number includes some of the marine sediment on the harbour bottom that will accompany removal of the contaminated sludge. To effectively remove the contaminated sludge, we need to take some of the marine sediment. Once the material is removed it will be treated, dewatered and its volume will be significantly reduced to about 500,000 m^3.

Sampling Procedure

All sampling followed scientific protocols based upon generally accepted procedures. These protocols were vetted with Dr. Ian Spooner, a geoscientist and sampling expert from Acadia University.



The Wetlands

Twenty-five wetland areas are near Boat Harbour and are identified as marsh and/or swamp complexes. One wetland of about 36 hectares, pictured below, is situated partially on IR37 lands near the existing settling ponds and was impacted by early years of effluent discharge. Remediation planning is considering either removal of all the impacted sediments or a risk-based approach which may involve removal of areas of higher contamination and monitoring and natural attenuation (treatment) for the balance of the wetland.

How Far Has The Contamination Spread?

Studies conducted in 2017 show that the contaminated sediments are, for the most part, confined to the active Boat Harbour Effluent Treatment Facility and within its shoreline. Lower concentrations of contaminated sludge have been found in the area outside the dam structure, in the estuary. The underlying marine sediment in the estuary is not contaminated. No contaminated sludge has been found beyond the estuary or out in the Northumberland Strait.

Our remediation will ensure we deal with all the contaminated sludge in Boat Harbour before we allow tidal waters to re-enter Boat Harbour.

Ambient Air Monitoring Program

What is an Ambient Air Monitoring Program?

Ambient air is the outdoor air we breathe. While air is something we want to be clean and clear, it's always a concern when it's not that way.

Air pollution occurs if there is a change in the composition of the ambient air caused by smoke, dust, gases, fumes, and odorous substances. We have some air pollution in our communities caused by industry and other sources. Our remediation project has the potential to impact the air when we disturb the water, in and land around, Boat Harbour. We need to know if it really does impact the air and how those impacts may affect us. For that reason, we have established an Ambient Air Monitoring program for the surrounding communities.

In 2017, over several months, we monitored air quality to see what the baseline conditions were before we started any remediation activity. Since then we have moved the air monitoring station to Cemetery Road, and have done some further baseline monitoring. Now we can monitor air quality when we start our pilot scale remediation work and compare it to the conditions monitored before we started remediation construction.

Monitoring air quality is always going to be a critical component of the Boat Harbour Remediation Project. The goal is to inform the public of air quality and potential exposures around the Boat Harbour site and to ensure the health and safety of the community and onsite workers. The program will ensure compliance with provincial and federal regulations, track air quality trends, evaluate how we are doing in maintaining air quality and support the development of an emission control program. We will collect air samples and look at various contaminants and the safe limits for those contaminants in the air. Data collected will be continually compared to appropriate provincial/federal guidelines, regulations and criteria to determine if concentrations of contaminants are within acceptable levels.

The Independent Ambient Air Monitoring and Evaluation Consultant Contract has been awarded to Stantec Consulting Ltd. Their work is independent of design and construction activities onsite. Their role is to ensure that site activity is controlled in a way that is protective of health and air quality for the surrounding communities.

Boat Harbour Remediation Project

What are we sampling for at the Cemetery Road Air Monitoring Station?

The air monitoring station on Cemetery Road will collect samples to be analyzed for the following

- Particulate matter, also called PM or soot, consists of microscopically small solid particles or liquid droplets suspended in the air. The smaller the particles, the deeper they can get into the respiratory system and the more hazardous they are to breathe. We will look at particulate matter less than 50 micrometers in diameter, less than 10 micrometers in diameter and less than 2.5 micrometers in diameter. To compare, a human hair has a diameter of between 50 and 100 micrometers.
- Metals in the particulate matter which may be harmful (lead, arsenic, cadmium, etc.)
- Volatile Organic Compounds (VOCs), which is anything with a smell or fragrance, even like a rose. There are several thousand chemicals, synthetic and natural, that are considered VOCs and we want to ensure that we are detecting those which may be harmful.
- Polycyclic Aromatic Hydrocarbons (PAHs), which are contained in gasoline and diesel exhaust from construction machinery. They also come from burning wood, furnace oil and cigarette smoke.
- Other compounds and chemicals, which we know exist in Boat Harbour sediments and water and which may become airborne because of our work.

Air Monitoring Station at Cemetery Road

Real-Time Monitoring at the Site

During pilot scale construction activities, we will collect instant air quality measurements around the perimeter of Boat Harbour. We will set up rigid reporting procedures that will include immediate actions required when air quality becomes poor based upon the results and regulated limits. This monitoring will consist of both the ambient air sampling and qualitative odour monitoring. Real-time air quality monitoring will be conducted at various locations around the perimeter of the onsite remediation activities during the pilot scale program. The air contaminants to be sampled for real-time perimeter monitoring include particulate matter, Hydrogen Sulfide (H2S), and Volatile Organic Compounds (VOCs).

How do we carry out Real-Time Monitoring?

Real-time air monitoring is done using handheld instruments and for our project will be carried out by two separate parties. First, we will have our Contractor and Design Engineer representative do monitoring around the actual work site to ensure that workers on site are protected from air impacts during the pilot scale work. Second, we will have Stantec, the Independent Air Monitor, also do real time monitoring around the work taking place in Boat Harbour, along with managing the air monitoring at the Cemetery Road station. Both levels of monitoring will help ensure the health and safety of the community and onsite workers. It will also inform our planning and design of air monitoring programs for the upcoming full-scale remediation of Boat Harbour.

Pilot Scale Testing

The pilot scale testing for the Boat Harbour Remediation Project finished in July 2019. The pilot work involved building a temporary barrier to isolate one cove in Boat Harbour and testing different methods of removing sludge. This work provided valuable information to continue the design and evaluation of the remedial solutions and on how to move forward with the full-scale remediation once the federal environmental assessment (EA) is complete.

Dredging in the dry

Removal of Contaminated Sludge

Ecodredge

Pilot scale work tested two ways of removing sludge from Boat Harbour, in the dry and in the wet. Dredging in the dry involved sealing off a small section of the cove, draining the water and removing sludge with an excavator operating directly on the harbour bottom. The pilot test found that this method is not effective. Except for a small part of the shoreline, the harbour bottom is not solid enough to support operation of heavy machinery.

We tested two different methods of dredging in the wet, using an Ecodredge (see photo) and an excavator equipped with a dredge head to remove contaminated sludge. In the first round of testing in fall 2018, we found that the Ecodredge was not able to remain level on the water using the stabilizers (legs) and as a result was not able to remove the sludge with the accuracy needed.

In the second round of testing in spring 2019, we used a different dredge head and a larger barge to provide more stability on the water's surface. We also had more accurate Global Positioning System (GPS) and other survey technology to help dredge the harbour more effectively. This equipment was able to remove the sludge to the accuracy needed and removed much less of the clean harbour bottom, showing us that full scale equipment must be able to be stable on the water and be equipped with real-time operating controls.

Second dredge head

Boat Harbour Remediation Project

Geotube dewatering

Dewatering Process

Once sludge was removed from the harbour bottom, it was pumped in to large filter bags called “geotubes” to be dewatered. Removing excess water from the sludge helps compact the contaminated material into solid form and creates less overall waste that must be disposed of. The dewatering process was successful, but we found it took longer than anticipated. This tells us the pace of the overall cleanup might be slower than we first thought, as the sludge will be added to the geotubes at a slower rate.

Water Treatment

Once water was drained from the sludge in the geotubes, it was tested and treated in an onsite treatment plant before being returned to the cove. The water was tested for contaminants, and the results show the onsite treatment plant was successful in cleaning the water. We also tested the treatment of bulk water from Boat Harbour. The onsite treatment plant effectively treated water pumped directly from the harbour.

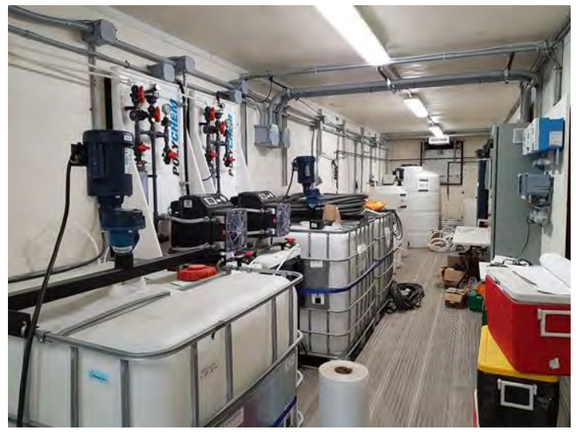
Air Monitoring

We hired an independent consultant to measure air quality at the pilot site and at a monitoring station in Pictou Landing First Nation. The consultant measured baseline air quality on a regular basis and monitored for real-time results when pilot scale activity was taking place. The results from pilot scale showed no negative impact from pilot activities on air quality onsite or in the nearby community. Air monitoring reports and results are available online at http://novascotia.ca/boatharbour

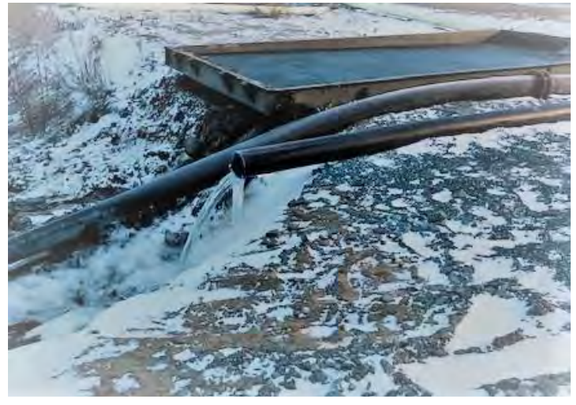
Lessons Learned and Next Steps

The pilot scale testing has helped us determine the best method and technology for removing and dewatering contaminated sludge from Boat Harbour. We gained a clearer sense of the impact on air quality and the time required for the dewatering process. We also learned lessons about the seasonal nature of the work. Originally, we expected being able to continue the fall pilot testing into early January, but because of freezing weather we had to stop testing in December.

The information and experience from pilot scale testing will help shape the full-scale remediation plan. Once the Environmental Assessment process is complete, we anticipate being able to start full-scale work as early as 2021.



Water treatment facility



Clear water leaving the treatment facility

Public Open House #1 Summary Report

Boat Harbour Remediation Project

Open House #1

Summary of Comments Received

Nova Scotia Lands (NS Lands) has initiated a study under the Canadian Environmental Assessment Act 2012 (CEAA 2012) to assess the various ways the Boat Harbour Effluent Treatment Facility (BHETF) and surrounding areas can be remediated. As part of the federal assessment process, NS Lands hosted a public open house at the Pictou Landing Fire Hall on August 1, 2019. Below is a summary of comments received and NS Lands' responses.

Comments on the Project

Attendees had the option of completing a hard-copy comment form, or submitting comments via email or regular mail. The comment period remained open for 15 days following the event.

Many of the participants at the open house indicated verbally to members of the Project Team that they were happy about the remediation of Boat Harbour and were looking forward to the project progressing.

Of the 17 comments received, six provided positive commentary on the remediation of Boat Harbour, indicating that they were pleased and encouraged about the clean-up and returning the Harbour back to tidal. Two comments indicated that the January 2020 date should be observed. One comment was received via email. The table below includes the comments received from attendees with comment responses provided.

Comment Sheet #	Public Comment	Response from NS Lands
1	Concerns on the long-term containment of the geotubes. The plan is to build on the existing area. With the added weight over time, will there be a threat to water table under Pictou Landing (Moodie Cove)?	The geotubes are used as a tool to remove the water from the sludge and help consolidate the sludge. Prior to placing the geotubes in the containment cell, the base liner and leachate collection system will be modified to improve the level of groundwater protection and facilitate rapid removal of dewatering effluent and leachate generated post-closure. These components together with the existing liner system will reduce risk to the water table beneath the containment cell. Groundwater near the containment cell flows towards Boat Harbour. Routine monitoring of the groundwater around the containment cell and around the existing Boat Harbour Effluent Treatment Facility (BHETF) has shown that the containment cell is performing effectively. Additional studies are being completed to document the groundwater flow around the containment cell and to develop a groundwater and surface water monitoring program for the long-term use of the containment cell. These measures combined will ensure that the groundwater surrounding Boat Harbour (including under Pictou Landing and Moodie Cove) are not impacted by the operation and long-term management of waste within the containment cell. As noted, once remediation is complete, a long-term maintenance and monitoring program will be implemented with appropriate reporting to regulators. Risks associated with the integrity of the containment cell will be actively and continually monitored in accordance with an established environmental monitoring plan.
1	Currently, the odours from Boat Harbour overnight force us to close windows or get sick. Summertime with high temperatures makes it difficult without open windows. Will this get worse?	The odour experienced is likely emanating from a combination of sources including industries operating in the area and the existing treatment facility. Once the BHETF stops receiving effluent from the Mill, the odour is expected to reduce. Once remediation is complete, odours from the site are expected to be drastically reduced or eliminated completely. Further studies will be completed on this topic during the next stage of the EIA and at the next Public Open House.

Comment Sheet #	Public Comment	Response from NS Lands
2	I am encouraged with the information I saw here and with the knowledge of the presenters. It is a complex cleanup. I am looking forward to a clean Boat Harbour which was a beautiful lagoon.	Thank you for providing your feedback. (No response required.)
3	Will this plan be needed again in 50 years to clean up the Strait from Amherst to Cape George?	The scope of the Boat Harbour Remediation Project is the BHETF and its environs. The sampling and monitoring program undertaken for the Boat Harbour Remediation Project has demonstrated that contaminated sediment from the BHETF is contained within the active and former BHETF including the estuary. There is currently no plan to clean up the Strait from Amherst to Cape George as this area is not impacted by the BHETF.
4	Boat Harbour is a good thing. Clean up is essential to the communities surrounding it. It must be cleaned up. It cannot be left laying there. Thank you.	Thank you for providing your feedback. (No response required.)
5	Shut it down on time and ship all the sludge to Lunenburg municipality and also Inverness municipality.	The proposed solution is to use the existing containment cell onsite as it is the only one in Nova Scotia that is approved to hold the sludge from Boat Harbour. As a result, it will not be moved to another municipality within Nova Scotia.

Comment Sheet #	Public Comment	Response from NS Lands
6	We have 2700 feet of pipeline on our property. When Boat Harbour closes down, what will happen to the pipeline?	Following closure, the pipeline and associated infrastructure will be decommissioned. There are three possible solutions to the decommissioning of the pipeline on land being considered: 1) Clean, inspect, plug and abandon in place 2) Clean, fill and abandon in place 3) Complete removal When the pipe is no longer in use, additional investigation is needed along the pipeline corridor to determine if there is any contamination in the surrounding soils. The entire pipeline will be included in this investigation. For the section of the pipeline between the East River and Highway 348, we are in consultation with Pictou Landing First Nation (PLFN) since a portion of the pipeline runs through an old burial ground. Once this consultation is complete, the final solution will be determined for this section of the pipeline. The portion of the pipeline running beneath Highway 348 will be removed.
7	All pipes should be removed. Alternative 3 - complete removal.	Refer to the response for Comment Sheet # 6. All 3 proposed solutions are being evaluated.
8	Honour the closure of Boat Harbour. Still bad it has to be stored on site (sludge) and monitored forever (not good).	Thank you for providing your feedback on honour of the closure of Boat Harbour. The responses to Comment Sheets # 1 and #14 are intended to address the concern about storage and monitoring of sludge contaminants.
9	It was informative but still not enough information to evaluate the total cost of the Project.	The amount set aside to recognize liability for the cleanup is currently about $252 million. This liability has been established based on the information we have available and the best measurement of related costs at a point in time. This liability is expected to change as further information is known and evaluated.

10	Very informative, spoke to NS Lands and GHD. They seem to have their plans well in hand. Boat Harbour must close on time even if the EIA is not complete. Funds must be provided for future monitoring of the sludge. Honour the Boat Harbour Act. Thank you.	The funding set aside to recognize liability for the cleanup, as noted in the response to Comment Sheet #9, includes post-closure maintenance and monitoring for a period of 25 years.
11	Issue: Pipeline where it enters the East River on the Abercrombie side has "concrete weight" on top of the pipeline to seemingly hold the pipe in place. From a recreational boater point of view, these concrete weights pose a hazard to boaters which if left there for the long-term should be removed.	The proposed solution is that the pipeline under the East River will be decommissioned, cleaned, inspected, plugged and abandoned in place. This has been determined as the most protective of the aquatic environment. The necessity of "concrete weight" to remain in place will be evaluated to ensure the safety of the aquatic environment.
12	I am very concerned about the impact of dredging up the toxic sludge will have on the environment and groundwater. I am skeptical it will be cleaned up to human/animal safe levels of environmental sustainability. I am hoping for the best, please don't let this community down.	The sludge and sediment will be removed from the infrastructure, freshwater wetlands and Boat Harbour in a manner and to regulatory criteria that are protective of human and ecological health. This will be an important consideration during dredging. A rigorous sampling program will be completed during remediation to ensure that the cleanup levels required by the regulators are actually achieved. All aspects of the remediation project are subject to rigorous regulatory, technical and scientific review. Aside from these reviews, the environmental assessment process also provides for substantive public input on developing final project plans.

Comment Sheet #	Public Comment	Response from NS Lands
13	Very thorough information. Hopefully the Harbour can be restored to a fully functioning ecosystem. We must trust the best science and best engineering to get this right. What is the cost?	We are committed to restoring Boat Harbour as effectively and efficiently as possible and ensuring it can be used by the community for generations to come. Project plans are subject to rigorous public, regulatory and technical reviews, including science academic advisors from four Nova Scotia universities. For the issue of cost, please refer to the responses to Comment Sheets 9 and 10.
14	I am very pleased that Boat Harbour is going to be cleaned up and brought back to the tidal estuary that it once was. My main concern is the containment cell on site. How will this be in the long term future of the area?	The proposed solution is to use the existing containment cell onsite. A containment cell is an engineered and proven way to ensure contaminants stay in a confined area. This technique is now used around the world for managing waste long-term. Proven technology ensures its efficacy and that it can be properly monitored. The existing containment cell will hold the waste securely, in a manner protective of human health and the environment. The existing liner and containment structures are effective in preventing contaminants from spreading into the ground, groundwater and surface water. This has been proven through routine monitoring programs required by Nova Scotia Environment. In addition, this was validated during GHD's site assessment. The existing containment cell will be refurbished with a new base liner. A leachate collection system will be added. These steps will result in a sound and safe solution for the containment of the waste long-term. Once remediation is complete, long-term maintenance and monitoring will be conducted and reported upon to regulators in accordance with a regulatory approved environmental management plan.

Comment Sheet #	Public Comment	Response from NS Lands
15	Land-based and water-based pipe remediation - consider complete removal as the Project has the funds available to complete this work now. Leaving in place should not be considered.	Following closure of the pipeline to effluent, the pipeline and associated infrastructure will be decommissioned. There are three possible solutions to the decommissioning of the pipeline on land currently being considered: 1) Clean, inspect, plug and abandon in place 2) Clean, fill and abandon in place 3) Complete removal The proposed solution for the pipeline under the East River is that it will be decommissioned, cleaned, inspected, plugged and abandoned in place. This has been determined as being the most protective of the aquatic environment. The section of pipeline running beneath Highway 348 will be removed. When the pipe is no longer in use, additional investigation is needed along the pipeline corridor to determine if there is any contamination in the surrounding soils. The entire pipeline will be included in this investigation. In addition, we are in consultation with PLFN since a portion of the pipeline runs through an old burial ground. Once this is complete, the final solution can be best evaluated.

Comment Sheet #	Public Comment	Response from NS Lands
16	What is the treatment process tested during pilot scale?	The pilot scale test work involved assessment of the efficiency and effectiveness of water-based and land-based dredging in removal of the sludge off the bottom of Boat Harbour; the effectiveness of geotubes in dewatering, containing and consolidation of waste; bulk water treatment technologies for the water in Boat Harbour; and treatment technologies for the dewatered effluent from the geotubes. The water-based dredging appears to be the most effective method of sludge removal off the bottom of Boat Harbour. The geotubes performed effectively in dewatering, containing and consolidating waste. For water management, a precipitation, coagulation, and adsorption-based process is the most likely treatment method. Coagulation and flocculation (clarification) involve the addition of polymers that conglomerate the small, destabilized particles together into larger particles such that they can be more easily separated from the water. The addition of lime, as well as polymers, will help contaminants settle out. The treatment process was tested and optimized through pilot scale testing.
17	Who now owns the Lighthouse Beach? Since ownership of approx. 90% of this once beautiful beach was in my family until the early 1970s, given up with the promise by the government that it would be placed with, protected and conserved the then Department of Conservation, I would be interested to know ownership remains with them.	The Lighthouse Beach is currently divided into three parcels of land. The parcel at the outer end of the beach at the light is owned by Nova Scotia Transportation and Infrastructure Renewal; the middle of the beach parcel is also owned by Nova Scotia Transportation and Infrastructure Renewal; and the parcel closest to Pictou Landing First Nation is owned by Indigenous Services Canada, so it is federal Crown land.

Next Steps

NS Lands would like to thank all the individuals who attended the Public Open House and provided comments for consideration.

A second Public Open House will take place in late 2019 to provide information on how the project is progressing. Information presented will include but is not limited to: a review of the EIA results of the preferred solutions, including potential environmental effects, recommended impact management measures, proposed monitoring requirements, and proposed approvals/ permits required for implementing the preferred solutions.

Comments on the Project are welcome at any time. All feedback received will be non-attributable and will be included as part of public record. Comments can be submitted through the following methods:

Project website | www.novascotia.ca/boatharbour

Email | boatharbour@novacotia.ca

Mail | Nova Scotia Lands, PO Box 186, Halifax, NS B3J 2N2