

Project Description

Boat Harbour Remediation
Planning and Design
Pictou Landing, Nova Scotia

Nova Scotia Lands Inc.





Executive Summary

The Boat Harbour Effluent Treatment Facility (BHETF), located in north central Nova Scotia on the Northumberland Strait, was constructed in 1967 and reconfigured several times since its construction. The use of the BHETF for the reception and treatment of effluent from the Kraft Pulp Mill must cease no later than January 31, 2020, in accordance with the *Boat Harbour Act*. Boat Harbour, known as A'se'k in Mi'kmaq, was originally a tidal estuary connected to the Northumberland Strait and is currently a closed effluent stabilization basin, operating under a lease agreement with the Province by the Kraft Pulp Mill owner. Once operations have ceased, the Province will remediate Boat Harbour, and lands associated with the BHETF, and restore Boat Harbour to a tidal estuary. This is the subject of this study, referred to as the Boat Harbour Remediation Project (the Project or BHRP), for which Nova Scotia Lands Inc. (NS Lands) is the Proponent. The primary representative for the purpose of the Project Description is Angela Swaine, Senior Project Manager, who can be reached by email at Angela.Swaine@novascotia.ca.

The main components of the BHETF include: the wastewater effluent pipeline (over 3 km in length) that runs from the Kraft Pulp Mill and extends eastward, below the East River of Pictou (East River), to the BHETF property; twin settling basins and an Aeration Stabilization Basin (ASB) west-southwest of Boat Harbour; and the stabilization lagoon (Boat Harbour). Effluent from Boat Harbour discharges through a dam (northeast of Boat Harbour) into an estuary before being released to the Northumberland Strait. Prior to the construction of the twin settling basins and ASB, effluent was routed by open ditch from the pipeline on the east side of Highway 348 to a natural wetland area (Former Ponds 1, 2, and 3) before being discharged into the stabilization lagoon.

Under current operating conditions, the Industrial Approval allows for up to 75,000 m³ of wastewater is discharged from the Kraft Pulp Mill to the BHETF daily. Wastewater is conveyed by the wastewater effluent pipeline and raw effluent ditch to the twin settling basins where partial removal of suspended solids occurs. One settling basin is used at a time (duty basin), while the other basin is dewatered and previously settled solids are removed from the basin and transported off-Site to the Kraft Pulp Mill for disposal. An automated nutrient addition system adds urea and diammonium phosphate to the effluent as it is conveyed through a second effluent ditch to the ASB. Floating aerators are used to aerobically treat the effluent within the ASB prior to discharge into Boat Harbour. The ASB discharge point to Boat Harbour (Point C) is governed by the discharge criteria specified in the BHETF Industrial Approval (IA) (No 2001-076657-A01). As the effluent flows through the dam from Boat Harbour into the estuary, it is monitored at Point D in accordance with the IA.

The 6.7 ha sludge disposal cell is located southeast of the ASB and has a total capacity of 220,000 m³ (waste). As shown on Figure 1, the sludge disposal cell is located on provincially-owned lands, and is surrounded by undeveloped mixed woodlands and Indian Reserve Lands (including IR37 to the south and IR24G to the east). Access to the sludge disposal cell is via a single lane gravel roadway off the ASB perimeter road. The sludge disposal cell is secured by a perimeter fence with an access gate in the northwest corner. The sludge disposal cell is operated under IA No. 94-032. Leachate generated in the sludge disposal cell is currently returned to the ASB via the decant and leachate collection systems. The existing leachate contains elevated concentrations of



select metals¹ as compared to criteria², including barium, cadmium, copper, lead, nickel, selenium, silver, and zinc. The Study Area for the Project spans from the effluent pipeline, described above, from the first standpipe on the mill property, through existing and historic BHETF lands, Boat Harbour and its banks, extending to the Northumberland Strait. The Study Area is shown on Figure 1 attached. Land ownership is comprised of private, federal, and provincial ownership. The total Site area is approximately 546 ha, of which 141 ha is Boat Harbour. The Site and surrounding properties are not zoned, according to the (Draft) Pictou County Land Use By-Law, dated May 6, 2014. The southern portion of the Pictou Landing First Nation (PLFN) land within the Study Area, however, is zoned as "Forest Management Area" and the northern portion, containing residences, is zoned "Residential", according to the Pictou Landing Band By-Law No. 1.

The nature and extent of contamination at the Site has been determined by GHD through the completion of Phase 1, 2, and supplemental Phase 2 Environmental Site Assessments, as well as a number of studies completed by others. Samples of the Kraft Pulp Mill raw effluent (collected both during production and while under routine maintenance) were compared to applicable Provincial or Federal surface water criteria, as well as Provincial or Federal human health criteria for drinking water. Results indicated both PCBs and dioxins and furans were below the applicable criteria, while metals exceed the marine criteria for barium, boron, cadmium, copper, lead, mercury, and zinc. Metals parameters reported to exceed the Provincial human health criteria were sodium and vanadium.

The BHETF contains approximately 1,000,000 m³ of unconsolidated contaminated sludge/sediment including approximately 385,000 m³ unconsolidated sludge/sediment within Boat Harbour. The sludge layer in Boat Harbour is an average of 20 cm thick, with thickness ranging from 10 cm to 1 m or more. Once consolidated through dewatering, the total dewatered sludge/sediment volume to be managed is estimated to be between 312,500 and 517,700 m³. It is estimated that sludge accumulates in Boat Harbour at a rate of approximately 4 mm per year under normal BHETF operation. The wetlands contain approximately 260,000 m³ of sludge and root mass with an estimated thickness of 0.3 m over the impacted wetland area. For Project planning and approval purposes, the proponent will seek approval for a total capacity of 660,000 m³, which represents the total air space available for the disposal of waste without expanding the footprint of the sludge disposal cell. The sludge is impacted with metals, polycyclic aromatic hydrocarbons (PAHs), and dioxins/furans (D&F). In addition to management of sludge/sediment, an estimated 5,700,000 m³ of water will need to be treated during remediation prior to discharge.

The remedial solution for the BHETF includes the following:

- Management of residual mill effluent within the BHETF
- Management and removal, treatment, and disposal of impacted sediments/sludge and dewatering effluent from former effluent ditch, twin settling basins, ASB, and Boat Harbour stabilization lagoon

¹ Sludge Disposal Cell – Boat Harbour Effluent Treatment Facility, 2015 Monitoring Report, March 2016.

² Criteria is most stringent value of NSE Tier 1 EQSs for Surface Water (Marine) and CCME Water Quality Guidelines for the Protection of Aquatic Life (Marine). For TEQ (dioxins and furans) based on NSE Tier 1 EQS for Groundwater (Potable Groundwater Values).



- Risk management and/or removal, treatment, and disposal of impacted sediments/sludge in the natural wetlands and estuary
- Risk management and/or removal, treatment and disposal of impacted soil and surface water
- Vertical expansion, modification, use and closure of the existing sludge disposal cell
- Decommissioning of BHETF infrastructure including the pipeline, causeway, dam, and support facilities
- Restoration of Highway 348 including construction of a bridge in the location of the existing causeway

Bench scale testing has been completed to assess and determine applicable treatment methods, and pilot scale testing is ongoing to refine treatment methods, production rates, and potential emissions during remediation. Detailed design of the remedial solution will be completed mid to late 2019. The proposed remediation activities are estimated to be completed in 5-7 years commencing at earliest in 2020.

The closure of the BHETF operations and remediation of BHETF will result in a significant reduction in emissions, discharges, and wastes compared to current operations. Under current conditions, up to 75,000 m³ of wastewater is conveyed to the BHETF daily [27 million m³ annually]. Through the treatment system solids are settled out in the settling basins, ASB and BH. It is estimated that approximately 5,400 m³ of sludge settled out in the ASB annually is transferred to the sludge disposal cell annually. It is also estimated that 4 mm of sludge accumulated on the floor of BH annually. Pretreated wastewater is discharged to the estuary at a rate equal to the inflow. During remediation approximately 1,000,000 m³ of unconsolidated contaminated sludge/sediment including approximately 385,000 m³ unconsolidated sludge/sediment within Boat Harbour will be removed, dewatered and placed in the sludge disposal cell. In addition to management of sludge/sediment, an estimated 5,700,000 m³ of water will need to be treated during remediation prior to discharge to the estuary. Post remediation it is estimated at less than 2,500 m³ of leachate will be generated per year.

Over a 25-year operating period the BHETF is estimated to generate 368,580 tonnes of carbon dioxide equivalent (CO₂e) from direct sources and energy indirect sources, while over the 25-year remediation and post-remediation period [comprised of 5-7 years remediation and 17-20 post remediation] the emissions generated are estimated to decrease by 85 percent to 53,500 tonnes CO₂e over the 25 year period.

Under the Nova Scotia *Environment Act*, Schedule A of the Environmental Assessment Regulations lists Designated Undertakings that will be subject to an Environmental Assessment. It has been determined by the Minister of Environment that the Project is a rehabilitation of an undertaking and is required to register as a Class II undertaking.

Under the *Canadian Environmental Assessment Act, 2012* (CEAA 2012), an environmental assessment may be required of designated projects. A designated project includes one or more physical activities that are listed in the Regulations Designating Physical Activities as well as any physical activity incidental to those listed physical activities. The current *Regulations Designating Physical Activities (which are subject to ongoing consultation and may change in the future)* includes the following Item that may apply to the proposed undertaking:



30. The expansion of an existing facility used exclusively for the treatment, incineration, disposal or recycling of hazardous waste that would result in an increase in hazardous waste input capacity of 50% or more.

The Project will involve the vertical expansion and refurbishment of an existing on-Site sludge disposal cell to accept sludge/sediment, construction and demolition debris, and industrial waste generated as a result of the proposed Project. The sludge disposal cell was constructed and approved in 1995 to accept the sludge from the BHETF. The sludge disposal cell has received approximately 188,000 m³ of unconsolidated sludge to date (estimated 129,000 m³ once fully dewatered) and has been assessed during the Phase 2 Environmental Site Assessment, as having functional integrity. It will require planned refurbishment for liner and leachate collection systems and vertical expansion to increase air space available for the disposal of wastes generated during remediation.

Refurbishment will be completed in two or more sequences to accommodate disposal of new waste and management of the existing sludge within the sludge disposal cell. The majority of the sludge will be pumped into geotubes located in the sludge disposal cell and will dewater by gravity over time, with the addition of optimizing chemicals (i.e., polymer, coagulant, lime). Mechanically excavated sludge would be placed in a dump truck and end dumped into the sludge disposal cell. End dumped sludge would be deposited in lifts of approximately 1-3 m, followed by compaction to maximize sludge disposal cell air space, and used to fill the gaps between the filled geotube bags. Leachate would be managed via the leachate collection system. During the remediation period, liner and leachate collection system performance will be monitored and the infrastructure will be maintained through routine cleaning. Once remediation of the BHETF is completed, including dam decommissioning, and all wastes are placed in the sludge disposal cell, the sludge disposal cell will be completed with final cover. The final cover contours will be designed to accommodate the final waste volumes, minimize precipitation infiltration through the cap, control the release of landfill gas, and accommodate end use. As part of sludge disposal cell closure, infrastructure for long-term monitoring and care of the sludge disposal cell will be constructed. This will include required groundwater and leachate monitoring wells, gas monitoring probes, surface water monitoring station, perimeter fencing, signage as needed and access road for long-term maintenance and inspection. A truck loading station will be constructed to facilitate off site disposal of leachate generated within the disposal cell at a licenced facility.

Accidents and malfunctions refer to events that are not part of any Project activities that have been proposed. Many accidents and malfunctions are preventable and their probability and impact can be severely limited by applying a precautionary approach during planning and design, developing thorough emergency response procedures, and ensuring mitigation measures are incorporated into standard operating procedures. Potential accidents and malfunctions that could occur during transportation of the remediated wastes to the sludge disposal cell include fuel and hazardous material spills, erosion and sediment control failure, mobile equipment accident, forest and/or site fires. With respect to accidents and malfunctions in relation to the management of the sludge disposal cell, implementation of standard operating procedures will ensure that emergencies, accidents and malfunctions and the potential for the environment to affect the project are addressed. The sludge disposal cell and associated infrastructure will be inspected on a regular basis and repairs completed as needed. Contingency plans and standard operating procedures



may address events/situations including, but not limited to, leachate seeps/leachate system failure/spills/ slope failure, natural disasters, and accidents and injuries. PLFN is a Mi'kmaq First Nation located at the mouth of Pictou Harbour on the Northumberland Strait of Nova Scotia. The Mi'kmaq people have a long-existing, unique, and special relationship with the land and its resources, which involves the use and conservation of natural resources and spiritual ideologies. PLFN has a long standing history of concern related to the effluent flowing from the Kraft Pulp Mill to Boat Harbour, known as A'se'k, that later became the site of the BHETF. PLFN was instrumental in negotiating with the Province of Nova Scotia to close the treatment facility, which was embodied in the *Boat Harbour Act* in 2015.

A Mi'kmaq Ecological Knowledge Study (MEKS) was conducted by Membertou Geomatics Solutions. The Study found that Mi'kmaq land and resource use was reported on the Project site, and that hunting and gathering were found to be the most common activities described as occurring. Within the broader Study Area, hunting, fishing, and gathering were the most commonly reported activities. All activities were recounted as taking place in the recent and long-term past. Current use is limited mainly to fur-bearing creatures as species of harvest. Recreational aquatic activities such as swimming and canoeing are reported as having been historically common in the waters surrounding PLFN in Pictou Harbour, Chance Harbour, Boat Harbour, and other local waters.

Archaeological assessment work was also carried out. The Project Study Area contains known and potential sites of significance and recorded archaeological sites in the Provincial registry. All aspects of the project planning carefully consider the known and potential sites with appropriate studies completed in any area where land disturbance has or will occur as part of the Project.

Through the proposed remediation Project, it is PLFN's hope that A'se'k be restored to allow the community to re-establish its relationship with the water and land of A'se'k. In this regard, the Project's effects on health, socio-economic conditions, and physical and cultural heritage as a result of changes caused through remediation activities are net positive in relation to PLFN.

Preliminary discussion of potential federal funding has taken place and a provincial submission has been filed with Infrastructure Canada for funding under the Investing in Canada Infrastructure Program (ICIP). In support of the funding submission, Climate Change Resilience and Greenhouse Gas Mitigation Assessments were completed.

Federal Permits may be required for implementation of the Project as follows:

- Fisheries and Oceans Canada: Approval under the *Fisheries Act* may be required for works that have the potential to result in serious harm to fish including decommissioning of the pipeline underwater, decommissioning of the dam, removal of sediments in the wetlands and estuary, and construction of the bridge at Highway 348.
- Transport Canada: Approval under the *Navigation Protection Act* may be required for decommissioning of the dam, and works within the marine environment such as sediment removal in the estuary, if needed. In addition, compliance with the *Transportation of Dangerous Goods Act* will be required for the movement of liquid and solid wastes off-Site.



- Environment and Climate Change Canada: The *Migratory Birds Convention Act* and the *Species at Risk Act* are applicable in relation to terrestrial flora and avian species and habitat protection for all Project activities.
- Indigenous Services Canada approval, in conjunction with Pictou Landing First Nation's consent by Band Council Resolution, is required for access to and the conduct of assessments, investigations and remediation activity, if any, on federal crown lands.

Environmental baseline studies were carried out to establish the physical and biological setting at the Site as part of the Environmental Assessment. The baseline study program was developed following a workshop with the regulatory agencies. Studies included: Land; Water; Terrestrial and Aquatic Ecosystems; Species at Risk Act (SARA) Listed Species; Terrestrial Habitat and Vegetation; Wetlands; Water Course/Aquatic Habitat; Mammals and Wildlife; Birds; Archeological/Cultural Heritage Resources; and Economic and Social.

The remediation activities proposed would effectively reduce or eliminate the potential for unacceptable risk of contaminants to ecological receptors by removing the exposure pathway. However, the remediation activities would cause potential short-term impacts to the existing habitat including, changes to fish and fish habitat, as defined in the Fisheries Act; marine plants, as defined in the Fisheries Act; and, migratory birds, as defined in the Migratory Birds Convention Act, 1994. It should be noted that as the proposed Project is the remediation of BHETF and subsequent return to a tidal estuary condition, the long-term changes to fish and fish habitat, marine plants, and migratory birds will be positive.

One of the main concerns with respect to potential short-term effects to the environment is related to placing and storing of the impacted dredged sediment. The expansion of the existing sludge disposal cell and the modifications to the leachate collection and sludge disposal cell liner system will allow for the controlled and effective management of the impacted sediment and materials that are classified as hazardous waste. Impact management measures will be implemented to reduce the potential impacts of the placement and storage of hazardous waste-bearing sediments.

Remediation of Boat Harbour has the potential to cause changes to federal lands, within the Province of Nova Scotia, but is not expected to cause interprovincial effects or any effects outside of Canada. With respect to changes to federal lands, while some of the project components are located within and will interact with Federal lands, the sludge disposal cell itself (which relates to the designated physical activity under the Regulation) is not located on Federal lands. Best management practices and monitoring programs will be implemented to mitigate the potential effects caused by the placement and storage of the impacted sediment in the existing sludge disposal cell to the nearby federal lands.

Remedial efforts to remove the impacted sediment and material to the placement and storage facility may have short-term impacts to the PLFN's community through increased noise, light and potentially odours. All of these possible negative aspects will be mitigated through techniques typical of construction and sludge removal projects and are anticipated to be effectively managed. The anticipated long-term environmental changes resulting from carrying out the Project on aboriginal peoples are positive, as the remediation of Boat Harbour will address the current sediment contamination and enable the return of Boat Harbour to a tidal estuary. This will allow the land to be re-established as an area used for traditional recreation, fishing, hunting and gathering,



as well as for physical, mental, spiritual and emotional purposes by the Mi'kmaq. The loss of A'se'k over 50 years ago was devastating to the community. The long-term storage of impacted sediment and material in the facility may not completely mitigate this issue but a clean Boat Harbour is a positive improvement over existing conditions.

The existing level of knowledge associated with the remediation of Boat Harbour is high within communities in Pictou County, Nova Scotia. The pipeline breach in 2014 and subsequent *Boat Harbour Act* in 2015, were well reported and a high level of engagement by various communities and groups occurred prior to and subsequent to the *Boat Harbour Act* proclamation.

As Chief of PLFN, Andrea Paul has the delegated authority of the Nova Scotia Mi'kmaq to speak on Boat Harbour. As such, engagement, consultation, and Mi'kmaq participation in the Project is focused on the PLFN community.

NS Lands has implemented a robust engagement program with PLFN since 2014. Engagement components include:

- Funding a full time Community Liaison Coordinator from PLFN, commencing in April 2016. The Community Liaison Coordinator is in the community full time with a focus on providing Project information and facilitating Project information flow. In November 2017, the Province funded two additional full time support staff to assist the Community Liaison Coordinator with the development and implementation of PLFN specific community activities focused on information and knowledge sharing between PLFN Band members, NS Lands, GHD, and the Independent Project Monitor for air quality.
- Establishing a Boat Harbour Clean-up Committee (BHCC), which is led by the NS Lands Project Leader and the Chief of PLFN and comprised of selected Band council members and PLFN community members as well as representatives from NS Lands and the Nova Scotia Office of Aboriginal Affairs. The BHCC typically meets on a monthly basis since May 2015. The Boat Harbour Steering Committee preceded the BHCC and began meetings in August 2014 with the objective of determining a timeline for closure of Boat Harbour to industrial effluent.
- Participation of the PLFN Community Liaison person and other members of the PLFN community in the Boat Harbour Environmental Advisory Committee (BHEAC). The BHEAC is led by NS Lands with participation of federal and provincial regulators and advisors, academia, NS Lands, and GHD. The BHEAC typically meets on a monthly basis since January 2016.

NS Lands initiated formal consultation with the Mi'kmaq of Nova Scotia under the August 31, 2010 Mi'kmaq-Nova Scotia-Canada Consultation Terms of Reference, which included the provision of the Remedial Options Decision Document for their review. NS Lands received formal correspondence from the Mi'kmaq of Nova Scotia, because of the consultation, on May 31, 2018.

NS Lands finalized and presented specific remedial options relative to each Project component to the Nova Scotia Executive Council on August 9, 2018. The remedial options presented to Executive Council considered the Remedial Options Decision Document, the positions laid out in the formal correspondence from the Mi'kmaq of Nova Scotia arising from the consultation, and the analysis of the Proponent Project Team. This Project Description incorporates direction subsequently received from Nova Scotia Executive Council.



Furthermore, GHD on behalf of NS Lands prepared a PLFN Engagement Plan, which outlines the proposed engagement activities including stakeholder management, engagement communications materials, in-person events, and reporting. Implementation of the PLFN Engagement Plan is a joint responsibility with NS Lands and PLFN Community Liaison, with technical support from GHD.

PLFN primary concerns are related to use of the existing sludge disposal cell, based on engagement/consultation activities completed to date.

During the planning, design, and regulatory processes relative to the approval of pilot scale testing activities, NS Lands has held three public meetings with the broader community in October 2016, April 2018, and May 2018. NS Lands has also engaged with industry stakeholders to explain and discuss Project direction and plans including Northern Pulp Workforce, Northern Pulp Executive, Northumberland Fishermen's Association, and Environmental Services Association Maritimes.

During preparation of the PD, two workshops were held with representatives from the following agencies to introduce the Project and discuss their roles in the Project going forward:

- Nova Scotia Office of Aboriginal Affairs
- Fisheries and Oceans Canada
- Canadian Environmental Assessment Agency
- Environment and Climate Change Canada
- Nova Scotia Environment
- Nova Scotia Transportation and Infrastructure Renewal
- Nova Scotia Department of Lands and Forestry
- Transport Canada
- Health Canada
- Indigenous Services Canada

This Project Description has been prepared to fulfill the requirements of subsection 8(1) of CEEA 2012, to submit a description of the designated Project to the Canadian Environmental Assessment Agency that includes information prescribed by applicable regulations (*Prescribed Information for the Description of a Designated Project Regulations*) to inform the decision on whether a federal environmental assessment of the Project is required.



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1. General Information and Contact(s)

1.1 Nature of the Project and Location

Boat Harbour, formerly known as A'se'k in Mi'kmaq, was originally a tidal estuary³ connected to the Northumberland Strait in Nova Scotia. The Province of Nova Scotia (Province) constructed the Boat Harbour Effluent Treatment Facility (BHETF) in 1967 to treat effluent from industrial sources including a chlor-alkali plant and a bleached kraft pulp mill. Its construction included reconstructing the natural tidal estuary into a closed effluent stabilization basin. The Kraft Pulp Mill owner is currently responsible for operating the facility under a lease agreement with the Province. The Province has committed to ceasing the reception and treatment of new effluent to the BHETF by January 31, 2020, in accordance with the *Boat Harbour Act*. Once operations have ceased, the Province will remediate Boat Harbour and lands associated with the BHETF, and restore Boat Harbour to a tidal estuary. As part of the restoration work, the existing causeway along Highway 348 and the dam will be removed and replaced with a bridge to permit boat access to Boat Harbour. This is the subject of this study, referred to as the Boat Harbour Remediation Project (Project or BHRP).

The main components of the BHETF include: the wastewater effluent pipeline (over 3 km in length) that runs from the Kraft Pulp Mill and extends eastward, below the East River of Pictou (East River), to the BHETF property; twin settling basins and an aeration stabilization basin (ASB) west-southwest of Boat Harbour; and the stabilization lagoon (Boat Harbour or BH). Effluent from Boat Harbour discharges through a dam (northeast of Boat Harbour) into an estuary before being released to the Northumberland Strait. Prior to the construction of the twin settling basins and ASB, effluent was routed by open ditch from the pipeline on the east side of Highway 348 to a natural wetland area (Former Ponds 1, 2, and 3) before being discharged into the stabilization lagoon.

The Study Area for the Project spans from the effluent pipeline, described above, from the first standpipe on the mill property, through existing and historic BHETF lands, Boat Harbour and its banks, extending to Northumberland Strait, and Pictou Landing First Nation (PLFN), located between Boat Harbour and Northumberland Strait. A plan showing the Study Area is provided on Figure 1.

The total Site area is approximately 546 hectares (ha) of which 141 ha is Boat Harbour. The BHETF contains approximately 1,000,000 cubic metres (m³) of unconsolidated contaminated sludge/sediment, including approximately 385,000 m³ unconsolidated sludge/sediment within Boat Harbour. The sludge layer in Boat Harbour is an average of 20 centimetres (cm) thick, with thickness ranging from 10 cm to 1 m or more. Once consolidated through dewatering the total dewatered sludge/sediment volume is estimated to be between 312,500 and 517,700 m³. The sludge is impacted with metals, polycyclic aromatic hydrocarbons (PAHs), and dioxin and furans (D&F). In addition to management of sludge/sediment, an estimated 5,700,000 m³ of water will need to be treated during remediation prior to discharge.

The remedial solution for the BHETF includes the following:

³ Partially enclosed coastal body of water, having an open connection with the ocean, where freshwater from inland is mixed with saltwater from the sea



- Management of residual mill effluent within the BHETF
- Management and removal, treatment, and disposal of impacted sediments/sludge and dewatering effluent from former effluent ditch, twin settling basins, ASB, and Boat Harbour
- Risk management and/or removal, treatment, and disposal of impacted sediments/sludge in the natural wetlands and estuary
- Risk management and/or removal, treatment and disposal of impacted soil and surface water
- Vertical expansion, modification, use and closure of the existing sludge disposal cell
- Decommissioning of BHETF infrastructure including the pipeline, causeway, dam, and support facilities
- Restoration of Highway 348 including construction of a bridge in the location of the existing causeway

This Project Description (PD) has been prepared with direction from the "Guide to Preparing a Description of a Designated Project under the Canadian Environmental Assessment Act, 2012", in accordance with the *Canadian Environmental Assessment Act* (CEAA 2012).

1.2 Proponent Contact Information

Nova Scotia Lands Inc. (NS Lands) is the Proponent for the proposed undertaking, which is titled Boat Harbour Remediation Project (the Project or BHRP). NS Lands is a provincial crown corporation whose mandate is to access and, where required, remediate and redevelop crown-owned properties. NS Lands' portfolio includes: Management of the Harbourside Commercial Park in Sydney, Nova Scotia; remediation and redevelopment of the remainder of the former Sydney Steel Plant property; and management of properties acquired by previous owners of the Sydney Steel Plant including tracts of land located in Sydney Mines, Sydney River, Grand Lake area, Catalone, Pictou, New Glasgow and Grand Narrows. These properties contain abandoned quarries, coal mines, and areas encroached upon by residential and industrial areas.

Project contact information is as follows:

Nova Scotia Lands
P.O. Box 186
1672 Granville Street
Halifax, Nova Scotia, Canada B3J 2N2

Ken Swain
Project Leader, Boat Harbour Remediation Project
Tel: (902) 403-9744
Fax: (902) 424-7710
Email: Ken.swain@novascotia.ca



The principal contact person for the purposes of this Project Description is:

Angela Swaine
Senior Project Manager, Boat Harbour Remediation Project
Tel: (902) 497-9847
Fax: (902) 424-7710
Email: Angela.Swaine@novascotia.ca

NS Lands has retained GHD to assist in the preparation of this PD. GHD have a number of specialists including environmental planners, biologist/ecologists, hydrogeologists, solid waste engineers, air and acoustic engineers, and surface water engineers.

1.3 Consultation during the Preparation of the Project Description

The existing level of knowledge associated with the remediation of Boat Harbour is high within communities in Pictou County, Nova Scotia. The pipeline breach in 2014 and subsequent *Boat Harbour Act* in 2015, were well reported and a high level of engagement by various communities and groups occurred prior to and subsequent to the *Boat Harbour Act* proclamation. As detailed herein, consultation with the public has been held during the planning phase of the Project and routine engagement and consultation has been held with the Aboriginal Groups since 2015. Specifics related to the activities and remedial efforts schedule will need to be communicated through the Environmental Assessment Phase, but it is recognized that the existing level of Project knowledge within the region is high.

Public

During the planning, design, and regulatory processes relative to the approval of pilot scale testing activities, NS Lands has held three public meetings with the broader community in October 2016, April 2018 and May 2018. At these meetings, general Project concepts and plans were presented and discussed by NS Lands along with a focused presentation and discussion on the pilot scale testing activities, schedule, and monitoring programs by NS Lands and the planning and design consultant. In addition, NS Lands has met regularly with industry stakeholders to explain and discuss Project direction and plans and has had discussions with the Northumberland Fishermen's Association to explain and discuss Project direction and plans.

Aboriginal Groups

NS Lands has implemented a robust engagement program with PLFN since 2014. Engagement components include:

- Funding a full time Community Liaison person from PLFN, commencing in April 2016. The Community Liaison is in the community full time with a focus on providing Project information and facilitating Project information flow. In November 2017, two additional full time support staff positions were funded to assist the Community Liaison with the development and implementation of PLFN-specific community activities focused on information and knowledge sharing between PLFN Band members, NS Lands, GHD, and the Independent Project Monitor for air quality.
- Establishing a Boat Harbour Clean-up Committee (BHCC), which is led by the NS Lands Project Leader and the Chief of PLFN and comprised of selected Band council members and PLFN



community members as well as representatives from NS Lands and the Nova Scotia Office of Aboriginal Affairs. The BHCC typically meets on a monthly basis since May 2015. The Boat Harbour Steering Committee preceded the BHCC and began meetings in August 2014.

- Participation of the PLFN Community Liaison person and other members of the PLFN community in the Boat Harbour Environmental Advisory Committee (BHEAC). The BHEAC is led by NS Lands with participation of federal and provincial regulators and advisors, academia, NS Lands, and GHD. The BHEAC typically meets on a monthly basis since January 2016.

NS Lands initiated formal consultation with the Mi'kmaq of Nova Scotia under the August 31, 2010 Mi'kmaq-Nova Scotia-Canada Consultation Terms of Reference, which included the provision of the Remedial Options Decision Document for their review. NS Lands received formal correspondence from the Mi'kmaq of Nova Scotia, because of the consultation, on May 31, 2018.

NS Lands finalized and presented specific remedial options relative to each Project component to the Nova Scotia Executive Council on August 9, 2018. The remedial options presented to Executive Council considered the Remedial Options Decision Document, the positions laid out in the formal correspondence from the Mi'kmaq of Nova Scotia arising from the consultation, and the analysis of the Proponent Project Team. This Project Description Document incorporates direction subsequently received from Nova Scotia Executive Council.

Furthermore, GHD on behalf of NS Lands prepared a PLFN Engagement Plan, which outlines the proposed engagement activities including stakeholder management, engagement communications materials, in-person events, and reporting. Implementation of the PLFN Engagement Plan is a joint responsibility with NS Lands and PLFN Community Liaison, with technical support from GHD.

Details of the engagement activities with Aboriginal Groups are provided in Section 6, below.

Agencies

Consultation with Federal and Provincial Agencies during preparation of the PD included regular BHEAC meetings as well as Regulatory Workshops.

The initial Regulatory Workshop was held on August 25, 2017 with representatives from the following agencies:

- Office of Aboriginal Affairs (Nova Scotia)
- Indigenous Services Canada (DISC)
- Fisheries and Oceans Canada (DFO)
- Canadian Environmental Assessment Agency (CEAA)
- Environment Canada and Climate Change Canada (ECCC)
- Nova Scotia Environment (NSE)
- Nova Scotia Transportation and Infrastructure Renewal (NSTIR)
- Nova Scotia Department of Lands and Forestry (NSDLF)
- Transport Canada (TC)
- Health Canada (HC)



A second Regulatory Workshop was held on December 6, 2017 with representatives from the agencies listed above.

1.3.1 Environmental Assessment Jurisdiction

Under the Nova Scotia *Environment Act*, Schedule A of the Environmental Assessment Regulations lists Designated Undertakings that will be subject to an Environmental Assessment. It has been determined by the Minister of Environment (Appendix A) that the Project is a rehabilitation of an undertaking and is required to register as a Class II undertaking. Whereas pulp mills are listed as a Class II undertaking in Schedule A, and the Project consists of rehabilitating pulp mill effluent and treatment areas; the following sections of the Regulations may be applied to the proposed undertaking:

3. Application of the regulations

(2) The Act and these regulations may apply to a modification, extension, abandonment, demolition or rehabilitation of an undertaking listed in Schedule "A" which was established either before or after March 17, 1995.

11. Class I and Class II undertakings

(3) If the Minister is of the opinion that any of the following is an undertaking, the Minister must classify the undertaking as either Class I or Class II and must advise the proponent in writing of the classification and, if not already registered, the requirement to register the undertaking in accordance with the Act and regulations:

(b) a modification, extension, abandonment, demolition or rehabilitation of an undertaking

1.3.2 Regional Environmental Study

This Project is not within a region that has been the subject of a regional environmental study.

2. Project Information

2.1 Project Purpose and Rationale

As noted in Section 1, the Project relates to the Province's commitment to ceasing the reception and treatment of new effluent to the BHETF by January 31, 2020 in accordance with the *Boat Harbour Act*. Once operations have ceased, the Province will remediate Boat Harbour and lands associated with the BHETF and restore Boat Harbour to a tidal estuary. As part of the restoration work, the existing causeway along Highway 348 and the dam will be removed and replaced with a bridge to permit boat access to Boat Harbour.

The main components of the BHETF include: the wastewater effluent pipeline (over 3 km in length) that runs from the Kraft Pulp Mill and extends eastward, below the East River, to the BHETF property; twin settling basins and an ASB west-southwest of Boat Harbour; and Boat Harbour. Effluent from Boat Harbour discharges through a dam (northeast of Boat Harbour) into an estuary before being released to the Northumberland Strait. Prior to the construction of the twin settling basins and ASB, effluent was routed by open ditch from the pipeline on the east side of



Highway 348 into natural wetland areas (Former Ponds 1, 2, and 3) before being discharged into the stabilization lagoon.

The Study Area for the Project spans from the effluent pipeline, described above, from the first standpipe on the mill property, through existing and historic BHETF lands, Boat Harbour and its banks, extending to Northumberland Strait, and PLFN, located between Boat Harbour and Northumberland Strait. A plan showing the Study area is provided on Figure 1.

Under current operating conditions, up to 75,000 m³ of wastewater is discharged from the Kraft Pulp Mill to the BHETF daily. Wastewater is conveyed by the wastewater effluent pipeline and raw effluent ditch to the twin settling basins where partial removal of suspended solids occurs. One settling basin is used at a time (duty basin), while the other basin is dewatered and previously settled solids are removed from the basin and transported off-Site to the Kraft Pulp Mill for disposal. An automated nutrient addition system adds urea and diammonium phosphate to the effluent as it is conveyed through a second effluent ditch to the ASB. Floating aerators are used to aerobically treat the effluent within the ASB prior to discharge into Boat Harbour. The ASB discharge point to Boat Harbour (Point C) is governed by the discharge criteria specified in the BHETF Industrial Approval (IA) (No 2001-076657-A01). As the effluent flows through the dam from Boat Harbour into the estuary, it is monitored at Point D in accordance with the IA.

The 6.7 ha sludge disposal cell is located southeast of the ASB and has a total capacity of 220,000 m³ (waste). As shown on Figure 1, the sludge disposal cell is located on provincially-owned lands, and is surrounded by undeveloped mixed woodlands and Indian Reserve Lands (including IR37 to the south and IR24G to the east). Access to the sludge disposal cell is via a single lane gravel roadway off the ASB perimeter road. The sludge disposal cell is secured by a perimeter fence with an access gate in the northwest corner. The sludge disposal cell is operated under IA No. 94-032.

Hydraulically dredged sludge from the ASB is directly discharged as a slurry into the sludge disposal cell on a routine basis, typically annually. In addition, dewatered sludge from the twin settling basins was reportedly transferred to the sludge disposal cell from 1996 to 1998. It is understood that prior to 2004, sludge material in the sludge disposal cell was pushed/dozed into a mound on the western portion of the sludge disposal cell which currently forms a solid mass. Hydraulically dredged sludge is placed in the eastern portion of the sludge disposal cell, which is currently under wet conditions. Based on a survey completed by GHD in 2016⁴, the sludge disposal cell contains approximately 180,000 m³ of waste; including approximately 51,000 m³ of sludge forming the western solid portion of the cell, and approximately 129,000 m³ of sludge/water in the eastern wet portion of the cell.

The sludge disposal cell was designed as a single cell with a total capacity of 220,000 m³ (waste) to facilitate placement of sludge to the top of the perimeter berm (elevation 12 m AMSL). The sludge disposal cell is lined with 0.6 m of clay-till, with a hydraulic conductivity of approximately 1x10⁻⁶ cm/s. The sludge disposal cell includes leak detection, leachate, and decanting collection systems. All collection systems are connected by a 0.3 m diameter PVC pipe gravity pipe and manhole system that discharges to the ASB.

⁴ Sampling and Analysis of Dredge Spoils Report - Final Boat Harbour Effluent Treatment Facility Sludge Disposal Cell, Pictou Landing, Nova Scotia (GHD, February 2016)



An overflow pond is located immediately east of the sludge disposal cell. The eastern berm of the sludge disposal cell includes two emergency overflow spillways to discharge excess surface water from the sludge disposal cell to the overflow pond. A catch basin, located within the overflow pond, discharges surface water from the pond to MH 4 and ultimately to the ASB.

Samples of the Kraft Pulp Mill raw effluent (collected both during production and while under routine maintenance) were compared to applicable Provincial or Federal surface water criteria, as well as Provincial or Federal human health criteria for drinking water. Results indicated both PCBs and dioxins and furans were below the applicable criteria, while metals exceed the marine criteria for barium, boron, cadmium, copper, lead, mercury, and zinc. Metals parameters reported to exceed the Provincial human health criteria were sodium and vanadium.

The total Site area is approximately 546 ha, of which 141 ha is Boat Harbour. The BHETF contains approximately 1,000,000 m³ of unconsolidated contaminated sludge/sediment including approximately 385,000 m³ unconsolidated sludge/sediment within Boat Harbour. The sludge layer in Boat Harbour is an average of 20 cm thick, with thickness ranging from 10 cm to 1 m or more. It is estimated that sludge accumulates in Boat Harbour at a rate of approximately 4 mm per year under normal BHETF operation. The wetlands contain approximately 260,000 m³ of sludge and root mass with an estimated thickness of 0.3 m over the impacted wetland area. The sludge/sediment in the BHETF, the estuary, and the natural wetlands is impacted with metals, PAHs and D&F. Preliminary screening also identified petroleum hydrocarbon impact in both the estuary and the wetlands, and PCBs in the wetlands. In addition to management of sludge/sediment, an estimated 5,700,000 m³ of water will need to be treated during remediation prior to discharge.

The remedial solution for the BHETF includes the following:

- Management of residual mill effluent within the BHETF
- Management and removal, treatment, and disposal of impacted sediments/sludge and dewatering effluent from former effluent ditch, twin settling basins, ASB, and Boat Harbour stabilization lagoon
- Risk management and/or removal, treatment, and disposal of impacted sediments/sludge in the natural wetlands and estuary
- Risk management and/or removal, treatment and disposal of impacted soil and surface water
- Vertical expansion, modification, use and closure of the existing sludge disposal cell
- Decommissioning of BHETF infrastructure including the pipeline, causeway, dam, and support facilities
- Restoration of Highway 348 including construction of a bridge in the location of the existing causeway

Bench scale and pilot scale testing were required as part of the BHRP in order to identify the best remedial technologies for the various remedial components. Bench Scale testing has been completed by GHD at an off-Site laboratory and included testing of various sediment/sludge dewatering and stabilization methods and water treatment methods. Results of the bench scale testing have informed the selection of the preferred remedial technology and pilot scale testing to be completed.



Pilot scale testing is currently being conducted on the BHETF property. As part of earlier works completed by the Proponent, a berm was constructed in the southwest portion of Boat Harbour to create a pilot test cell (known as Cove 1)⁵. Pilot scale testing includes construction of an additional berm in Cove 1 to divide the pilot test area into two parts to allow for testing of sediment/sludge excavation in the dry and in the wet. Excavated material will be dewatered and placed in the existing sludge disposal cell. Dewatering effluent will be treated using a variety of treatment methods. Dewatering effluent, whether treated or not, will be discharged into Cove 1. Prior to excavation, water within the pilot test will be tested and treated if needed prior to being pumped to the Boat Harbour stabilization basin to facilitate pilot scale testing of excavation in the dry. Pilot scale testing is being implemented under an Industrial Approval issued by NSE.

2.2 CEAA 2012 Designated Activity

Under the *Canadian Environmental Assessment Act, 2012* (CEAA 2012), an environmental assessment may be required of designated projects. A designated project includes one or more physical activities that are listed in the Regulations Designating Physical Activities as well as any physical activity incidental to those listed physical activities. The current *Regulations Designating Physical Activities (which are subject to ongoing consultation and may change in the future)* includes the following item that may apply to the proposed undertaking:

30. *The expansion of an existing facility used exclusively for the treatment, incineration, disposal or recycling of hazardous waste that would result in an increase in hazardous waste input capacity of 50% or more.*

The Project will involve the expansion of an existing facility (sludge disposal cell) to accept the non-hazardous waste, hazardous waste, construction and demolition debris, and industrial waste generated as a result of the proposed Project. The existing sludge disposal cell is approved to receive 220,000 m³ of sludge from the BHETF. During remediation of the BHETF, between 312,500 and 517,700 m³ of sludge waste (including clean underlying sediment and root mat) and 1,100 m³ of C&D debris is anticipated to be generated and disposed of in the existing sludge disposal cell. This volume includes the estimated 188,000 m³ of unconsolidated sludge (estimated 129,000 m³ of sludge volume once fully dewatered) previously placed in the sludge disposal cell as part of ongoing facility operations. The final volume to be disposed can only be determined once the remediation is completed, as it is dependent on risk management measures required, actual consolidation rates achieved through dewatering, the volume of root mat to be removed from wetlands requiring remediation, and the depth of underlying clean sediment removed in conjunction with dredging operations. For Project planning and approval purposes, the proponent will seek approval for a total capacity of 660,000 m³, which represents the maximum air space available for the disposal of waste without expanding the footprint of the sludge disposal cell. The total capacity being sought represents 200 percent expansion in capacity, while it is anticipated that the actual expansion would range between 43 and 135 percent capacity expansion. Waste and leachate management under current conditions are detailed in Section 2.1 above and remedial and post-remedial conditions are detailed in Section 2.3.1.

If the proposed undertaking is determined not to require an environmental assessment as a Designated Project under CEAA 2012, Section 67 would then be reviewed to determine its

⁵ Cove 1 remains hydraulically connected to Boat Harbour through three culverts installed in the Cove 1 berm.

applicability to the proposed undertaking. Section 67 is a process followed when a project is located on Federal Lands, but is not a Designated Project under CEAA 2012. Under CEAA 2012, a proposed activity must meet all three of the criteria shown in Figure 2.1 below (i.e., must be a physical activity, physical work, and on federal lands) in order to be considered as a project under CEAA 2012 whereby Section 67 would apply (i.e. not a Designated Project). Should the physical activity identified above be confirmed for this Project, CEAA 2012 defines a project as a physical activity that is carried out in Canada or on Federal Lands (i.e., Reserve Lands: IR 24, IR 24G, and IR 37). In this context, the Project would be a physical activity in relation to a physical work, located partially on federal lands, and therefore may be subject to the Federal EA process. This process would only be followed if the proposed undertaking is determined to not be a Designated Project.

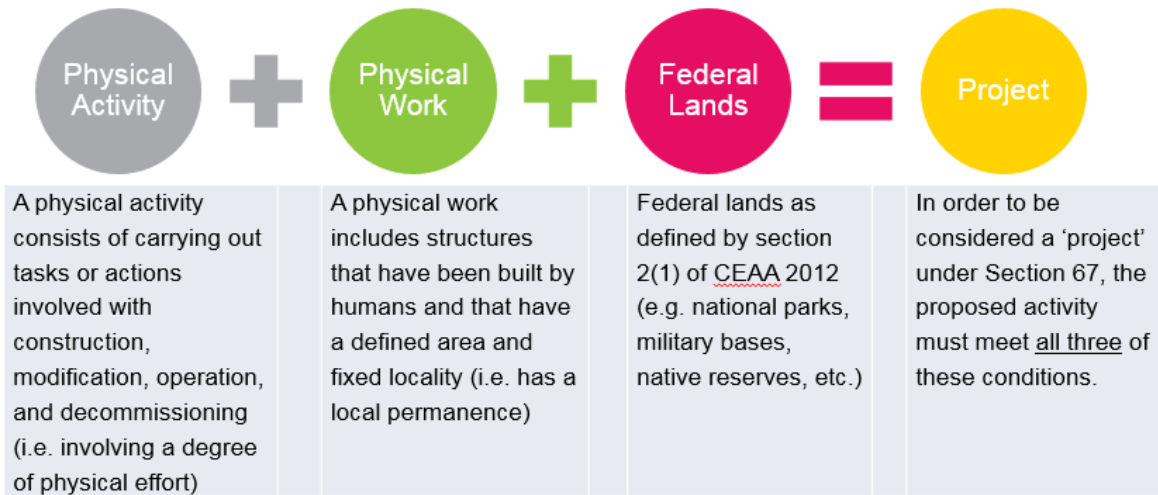


Figure 2.1 CEAA 2012 Designated Activity

2.3 Components and Activities

Following the stoppage of effluent flow from the Kraft Pulp Mill to the BHETF by January 31, 2020, the Project is to remediate the BHETF including returning Boat Harbour to a tidal estuary.

The remedial approach is divided into the following key components:

- Waste Management
- Infrastructure Decommissioning
- Wetland and Estuary Management
- Bridge at Highway 348

2.3.1 Waste Management

Remediation of the BHETF will generate the following industrial solid waste streams:

- Sludge waste generated from cleaning of the pipeline and remediation of the twin settling basins, ASB, stabilization lagoon and risk management measures applied to the wetlands and estuary



- Construction and demolition (C&D) debris generated from decommissioning/demolition of the BHETF buildings, causeway at Highway 348, dam, and pipeline
- Industrial waste generated from remediation activities (e.g., spent treatment media, remediated sludge, chemicals, etc.)

Section 2 of Appendix B outlines these activities in relation to Schedule 1: Disposal Operations for Hazardous Wastes, Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations. As detailed in Appendix B, a total of 56 samples were collected and analyzed to characterize the impacted sludge/sediment within the BHETF. Of the 56 sludge/sediment samples, 20 of the samples (35 percent) have a calculated toxic equivalent (TEQ) for D&F exceeding 100 picogram/gram (pg/g) [or nanogram/kilogram (ng/kg)], classifying the sample as hazardous material.

Solid waste generated during remediation will be disposed of in the existing 6.7 ha sludge disposal cell. Vertical expansion of the sludge disposal cell will be required to accommodate the waste; and the sludge disposal cell will be further modified to enhance the base liner system and leachate collection system and facilitate placement and dewatering of the sludge/sediment in a one step operation. Final contours for the sludge disposal cell have been designed to accommodate the maximum vertical expansion, minimize precipitation infiltration through the cap, control the release of landfill gas, and accommodate end use. The final landfill cover contours, as shown in Figures 3 and 4, will accommodate 660,000 m³ of waste, and allow for a 0.75 m thick low permeable final cover. The final cover will consist of a sand/grading layer, flexible membrane liner, sand drainage layer, and vegetated topsoil constructed to minimize infiltration and leachate generation. The final cover material will be modified to accommodate intended plantings such as short shrubs that would tie the sludge disposal cell visually into the surrounding tree line.

As previously noted, expansion of an existing facility to accept the non-hazardous waste, hazardous waste, construction and demolition debris, and industrial waste generated as a result of the proposed Project is required. The existing sludge disposal cell is approved to receive 220,000 m³ of sludge from the BHETF. During remediation of the BHETF between 312,500 and 517,700 m³ of sludge waste (including clean underlying sediment and root mat) and 1,100 m³ of C&D debris is anticipated to be generated and disposed of in the existing sludge disposal cell. This volume includes the estimated 129,000 m³ of sludge previously placed in the sludge disposal cell as part of ongoing facility operations. The final volume to be disposed can only be determined once the remediation is completed, as it is dependent on the findings of the risk management measures implemented, actual consolidation rates achieved through dewatering, the volume of root mat to be removed, and the depth of underlying clean sediment removed in conjunction with dredging operations. For Project planning and approval purposes, the proponent will seek approval for a total capacity of 660,000 m³, which represents the air space available for the disposal of waste without expanding the footprint of the sludge disposal cell. The total capacity being sought represents 200 percent expansion in capacity, while it is anticipated that the actual expansion would range between 43 and 135 percent capacity expansion. It is noted that in the Operations and Maintenance Manual⁶, the design capacity could be exceeded based on the physical properties of the waste

⁶ Nova Scotia Department of Transportation and Public Works Operational and Maintenance Manual, Boat Harbour Sludge Disposal Cell, Boat Harbour Treatment Facility, Boat Harbour, Nova Scotia (Jacques Whitford Environment Limited, September 1999)



materials and the recommended final elevations could be determined as part of the sludge disposal cell closure plan.

The following activities will be undertaken to prepare the sludge disposal cell for waste reception, waste placement and sludge disposal cell closure:

- **Sludge Disposal Cell Modifications:** Prior to the receipt of waste from remedial activities the leachate collection and sludge disposal cell liner system will be refurbished to facilitate waste placement and dewatering in a one step operation. The existing waste in the sludge disposal cell will be consolidated in the western portion of the sludge disposal cell to allow for improved leachate collection and liner systems to be installed in the eastern portion of the sludge disposal cell. The improvement will include removal of the existing leachate collection header and exposure of the clay liner. A new flexible membrane liner and geotextile liner system will be installed over the existing clay liner followed by leachate collection piping and aggregate drainage layer overlaid with a geotextile. The leachate collection piping will connect into the existing leachate conveyance infrastructure to convey dewatering effluent to the ASB. As filling of the eastern portion advances dewatered sludge from the western portion of the Site will be used to fill the voids between the geotubes for stability; and to maximize the air space available for waste. Once the waste is removed from the western portion of the sludge disposal cell, the liner and leachate collection system will be constructed in the western portion, permitting uniform filling of the remainder of the sludge disposal cell.
- **Waste Placement:** The majority of the sludge will be pumped into geotubes located in the sludge disposal cell and will dewater by gravity over time, with the addition of optimizing chemicals (i.e., polymer, coagulant, lime). The sludge disposal cell improvements to the leachate collection system will allow for the collection and conveyance of dewatering effluent to the ASB for treatment at the temporary wastewater management system. Geotubes will be stacked in place to create the desired sludge disposal cell shape and will be left in place for added stability following sludge dewatering. As noted above, dewatered sludge will be used to fill the voids between the geotubes. Mechanically excavated sludge would be placed in a dump truck and end dumped into the sludge disposal cell. End dumped sludge would be placed in lifts of approximately 1-3 m, followed by compaction to maximize sludge disposal cell air space, and used to fill the gaps between the filled geotube bags. Leachate would be managed via the leachate collection system. Other waste materials generated as part of remediation would be placed in the sludge disposal cell similar to the mechanically excavated sludge. During the remediation period, liner and leachate collection system performance will be monitored and the infrastructure will be maintained through routine cleaning.
- **Sludge Disposal Cell Closure:** Once remediation of the BHETF is completed, including dam decommissioning, and all wastes are placed in the sludge disposal cell, the sludge disposal cell will be completed with final cover. The final cover contours will be designed to accommodate the final waste volumes, minimize precipitation infiltration through the cap, control the release of landfill gas, and accommodate end use. The 0.75 m thick low permeable final cover will consist of a sand/grading layer, flexible membrane liner, sand drainage layer, and vegetated topsoil. The final cover material may be modified to accommodate intended plantings such as short shrubs that would tie the sludge disposal cell visually into the surrounding tree line. A surface water ditching and ponding system will be integrated with the final cover to control clean surface water runoff from the sludge disposal cell. As part of sludge disposal cell closure, infrastructure



for long-term monitoring and care of the sludge disposal cell will be constructed. This will include required groundwater and leachate monitoring wells, gas monitoring probes, surface water monitoring station, perimeter fencing, signage as needed and access road for long-term maintenance and inspection.

2.3.1.1 Leachate Management

Leachate generated in the sludge disposal cell is currently returned to the ASB via the decant and leachate collection systems. The existing leachate contains elevated concentrations of select metals⁷ as compared to criteria⁸, including barium, cadmium, copper, lead, nickel, selenium, silver, and zinc.

Under the selected remedial approach, dewatering effluent from geotubes will be collected and conveyed through to the ASB which will be converted to a wastewater equalization basin forming part of the temporary wastewater management system. The contaminant of concern in the effluent based on pilot and bench scale testing include petroleum hydrocarbons, dioxins and furans, cyanide, and metals (i.e., chromium, copper, mercury, vanadium, and zinc).

Following initial sludge dewatering and sludge disposal cell capping, there will be ongoing leachate to manage post remediation. The leachate quality will be impacted by leaching of both the existing waste and the dewatered sludge within the geotubes. Contaminants of concern will include those listed above for both existing leachate and dewatering effluent. The annual leachate generation rate is estimated to be less than 2,500 m³ per year based on using a flexible membrane liner and assuming approximately 1,200 mm of rainfall per year⁹.

The recommended leachate management option is off-site disposal. A storage tank with a capacity of approximately 20 cubic metres will store 3 days of generated leachate. A larger emergency storage tank may also be added to provide extra capacity in case of higher flow rates or other unpredictable circumstances to prevent unauthorized discharges to Boat Harbour. A truck loading station will be constructed to facilitate off site disposal at a licenced facility. It is estimated that one 10 cubic metre load will need to be removed per day to manage leachate.

2.3.1.2 Surface Water Management

During remediation, clean surface water runoff in the vicinity of the sludge disposal cell will continue to be diverted away from the sludge disposal cell and controlled by infiltration and overland flow. Water that comes in contact with the waste will be managed as leachate and conveyed by gravity to the decant and leachate collection systems.

As part of detailed design, a hydrological model will be developed to calculate peak flows and runoff volumes from the sludge disposal cell under various storm event conditions, and evaluate the size of perimeter ditches, culverts, the stormwater management pond, and any other stormwater infrastructure. Surface water conveyance infrastructure will be designed to accommodate a 25-year

⁷ Sludge Disposal Cell – Boat Harbour Effluent Treatment Facility, 2015 Monitoring Report, March 2016.

⁸ Criteria is most stringent value of NSE Tier 1 EQSs for Surface Water (Marine) and CCME Water Quality Guidelines for the Protection of Aquatic Life (Marine). For TEQ (dioxins and furans) based on NSE Tier 1 EQS for Groundwater (Potable Groundwater Values).

⁹ Based on a review of Lyons Brook weather station data for 1981-2010.



storm event, and the stormwater management pond will be designed to accommodate a 100-year storm event.

It is noted that the proposed location of the stormwater management pond is in the existing overflow pond area. This area may need to be remediated and therefore disturbed prior to the construction of the lined pond.

2.3.1.3 Landfill Gas Management

Landfill Gas (LFG) is produced by the biological decomposition of waste placed in a landfill. LFG composition is highly variable and depends upon a number of site-specific conditions including waste composition, density, moisture content, and age. LFG is typically comprised of methane (approximately 50 percent by volume) and carbon dioxide (approximately 50 percent by volume). LFG may also contain nitrogen, oxygen, and trace quantities of other gases (such as hydrogen sulphide and mercaptans).

Due to its composition, the presence of LFG may create explosive, suffocating, and toxic conditions. LFG management may be required to control potential impacts relating to the release of LFG to the atmosphere and migration of LFG through the soil surrounding the Site.

The release of LFG into the air may contribute to odours in the vicinity of the Site, and the addition of "greenhouse gases" into the atmosphere. LFG odours are primarily a result of the presence of hydrogen sulphide and mercaptans. These compounds may be detected by sense of smell at very low concentrations (0.005 and 0.001 parts per million for hydrogen sulphide and mercaptans, respectively). It is generally recognized that the impacts related to these compounds are nuisance odours.

LFG produced by the sludge disposal cell are anticipated to be predominantly methane and carbon dioxide as a result of the anaerobic decomposition of the organic fraction of the waste. The LFG production will be evaluated as part of the detailed design, and is expected to be small as compared to municipal solid waste due to the organic material being degraded and not readily biodegradable.

LFG will be managed using a passive venting system which allows the release of pressure build up within the closed cell. Installation of vents through the final cover of the sludge disposal cell will provide pressure release points; the location and depths will be confirmed using a calculated gas production rate determined during the detailed design phase. If required, the vents will be fitted with turbines to assist in venting.

2.3.2 Infrastructure Decommissioning

Pipeline on Land and Pipeline Under Water

The wastewater effluent pipeline conveys up to 75,000 m³ of wastewater from the Kraft Pulp Mill to the BHETF. The pipeline consists of approximately 2,305 m of 0.915 m diameter fiberglass reinforced plastic pipe buried on land and approximately 1,220 m of 1.1 m diameter high density polyethylene pipe buried below the East River. The pipeline is cleaned annually, with cleaning effluent discharged to the twin settling basins. The on land and under water portions of the pipeline will be decommissioned and abandoned in place.



Decommissioning includes cleaning of the pipeline and inspection. Cleaning the pipeline will remove any accumulated solid residue and other liquids that otherwise could pose an environmental risk/liability, and render the pipeline free of gross process residues. Cleaning will proceed from upstream to downstream prior to any BHETF remediation activities, so that all residue and waste will flow to the twin settling basins to be managed as part of remediation. Inspecting the pipeline will ensure that the pipeline has been adequately cleaned and that the integrity of the pipeline is sufficient to minimize differential settlement or ground subsidence due to the pipe collapsing. Finally, abandonment will consist of leaving the cleaned and inspected pipeline in place. The ends of the pipeline will be plugged with an appropriate cap (e.g., concrete plug). Similarly, pipeline ends at each manhole will be cut and plugged with an appropriate cap (e.g., concrete plug). Each manhole will be cut approximately one metre below grade and backfilled (both remaining void space and disturbed area). Disturbed areas will be graded to match existing hard surfaces and to achieve positive drainage.

Treatment Buildings

Numerous Treatment Buildings (including Electrical Building and Press Building), as well as small structures (including Mobile Building Adjacent to Press Building; Storage Shed; Air Monitoring Shelter; Mobile Building belonging to CTS Electrical; Silo and Electrical Building; Point A Building; and Point C Building) form part of the BHETF. Treatment Buildings and smaller infrastructure will undergo chemical sweep, cleaning, designated substance removal, if any, followed by demolition using mechanical means. Footing and foundations will be cut and buried. Only above-grade structures will be removed.

The remedial approach consists of decommissioning and demolishing each building/structure and transporting waste materials for disposal or recycling.

Prior to demolition, any hazardous materials will be abated and a chemical sweep and cleaning will be completed. All residual products will be containerized and packaged, transported, and disposed of in accordance with Provincial and Federal regulations. Any non-hazardous waste will be collected and disposed or recycled. Building surfaces will be cleaned, as needed, to remove any residues. Electrical connections will be de-energized and disconnected. Similarly, any buried services will be decommissioned, as needed.

Demolition will commence once each building has been decommissioned and has been released for demolition. Demolition will require the use of an excavator, with a standard bucket or potentially mechanical shears for cutting large structural elements and collapsing the structure for cleanup. For larger structures, such as the silo, demolition will be done with a more methodical process using a crane and taking the structure apart in pieces. Footings and foundations will be removed to a depth of 0.9 m below finished grade. The demolition waste will be stockpiled and placed in the sludge disposal cell in coordination with sludge disposal, to optimize sludge disposal cell capacity and stability. There may be an opportunity to re-purpose a specific building, which will require some modified approach to the decommissioning process.

Dam

The dam is used to regulate the water level in the Boat Harbour stabilization lagoon and is located north of the causeway at Highway 384 at the mouth of the estuary. The dam is a flat concrete slab structure with retaining walls supporting the earth embankments at both ends, the bottom elevation



of the slab is approximately at minus 0.92 m AMSL¹⁰ which is about the equivalent of low tide. The water levels are controlled by an adjustable weir/stop log arrangement within the dam structure. Under current operations, salt water intrusion of Boat Harbour occurs during high tide situations.

At completion of remediation activities within Boat Harbour, the BHETF and adjacent lands to the satisfaction of the regulators, the remedial approach involves the demolition of the dam structure and the rehabilitation of the estuary embankment slopes. The demolition of the dam structure will consist of using mechanical equipment to break the concrete structure into smaller components to be excavated and dumped into a dump truck for on-site disposal. The smaller elements of the structure will be demolished by hand, such as the timber screens and fences. The earthen berm connecting the dam to the banks will also be removed, as needed, to facilitate boat access to Boat Harbour.

Prior to demolition, all designated substances will be abated; and electrical connections fully de-energized.

One of the major items for consideration is the requirements for erosion control during and after construction. Demolition will commence once the remediation is complete and Boat Harbour is ready to be reinstated back to tidal conditions. A temporary cofferdam or similar will be installed between the dam and the mouth of the estuary to prevent the tidal influence on the decommissioning activities. Silt curtains will be installed in the water upstream and downstream of the dam decommissioning works to control the migration of silt generated as a result of the dam removal. Once the dam structure is removed, the channel will be dredged to match the channel shape and depth of the bridge (that will be installed to replace the causeway) to ensure the hydraulics are maintained throughout the channel.

2.3.3 Wetland and Estuary Management

Between 1967 and 1972, prior to construction of the twin settling basins and the ASB, effluent from the effluent pipeline was routed by open ditch from the pipeline on the east side of Highway 348 to a natural wetland area (Former Settling Ponds 1, 2, and 3) before being discharged into the stabilization lagoon. The impacted area in the wetlands is approximately 38 ha and contains approximately 260,000 m³ of sludge and root mass to be managed. Sludge and root mass in the wetlands is impacted with metals, petroleum hydrocarbons, PAHs, PCBs, and D&F.

Effluent from the BHETF discharges through the dam into the estuary before being released to the Northumberland Strait. The estuary area is approximately 7.6 ha in size and is located north of Highway 348 and the dam. The estuary is delineated to the south by the dam and north by the Northumberland Strait. Sludge/sediment in the estuary is impacted with metals, petroleum hydrocarbons, PAHs, and D&F. The native marine clay, which underlies the sludge, is not impacted to levels exceeding provincial and federal criteria and is not likely to require remediation, Surface water in the estuary is impacted with metals, petroleum hydrocarbons, and cyanide.

The wetlands and the estuary will undergo a risk-based remedial approach. The risk-based approach is a widely accepted scientific method to evaluate potential environmental impacts and to estimate if these impacts are likely to cause adverse health effects to humans or ecological receptors. The risk assessment process requires thorough evaluation of potential contaminants

¹⁰ Average Mean Sea Level (AMSL); Based on CGVD26 Datum



associated with a specific site or property, identification of human and ecological receptors that may use the property, and ways these receptors may be exposed to potential contaminants (e.g., direct exposure to soil, consumption of plants/wildlife, consumption of water, etc.). The primary benefit of using the risk-based approach is that it allows for a site specific evaluation of potential interactions between receptors and contaminants in the environment and focuses future cleanup activities or management programs on the areas of greatest concern. This approach also has the potential to minimize remedial efforts and unnecessary disturbances to sensitive environments that are unlikely to pose an adverse health effect, now or in the future. The risk assessment process will also identify risk management measures required to mitigate the risk. Risk management measures may include installation of a cap to prevent contact with the impacted sludge/sediment or removal of impacted materials. If removal is required, impacted sediments will be removed by excavation using land-based earthmoving equipment and/or dredged, and subsequently managed in the same manner as all other sludge/sediment removed from the rest of the Site. Organic material matching the former hydraulic regime will be brought on-Site as part of wetland restoration activities. The restoration phase will include, in addition to the infilling and regrading of wetlands, planting or seeding of native aquatic and terrestrial vegetation in the construction areas.

In areas where sludge is to be completely removed, remaining sediments will meet sediment quality standards established as outlined in the NSE Tier 1 Environmental Quality Standards (EQSs) for Sediment (Freshwater Sediment) and Canadian Council of Ministers of the Environment (CCME) Canadian Sediment Quality Guidelines for the Protection of Aquatic Life (Freshwater Probable Effects Level) or risk-based criteria that is protective of ecological and human health. The Human Health and Ecological Risk Assessment is expected to be completed in February 2019.

2.3.4 Bridge at Hwy 348

A causeway along Highway 348 crosses the downstream end of Boat Harbour. It is constructed with three 1500 mm diameter concrete culverts and two 3600 x 3000 mm concrete box culverts connecting Boat Harbour to the downstream dam. A water main running from the PLFN well field to the PLFN community is buried within the causeway. The causeway will be demolished/decommissioned using mechanical means and replaced with a Concrete Girder Bridge along the same alignment, to return Boat Harbour to tidal conditions and to allow for boat access to the harbour.

The new bridge structure will be approximately 34 m long, single span structure. The rail height on the bridge will be a 1050 mm high, concrete barrier system to meet the necessary requirements for pedestrians and architectural enhancements. The bridge design will incorporate a new support system for the water main, including galvanized steel brackets equally spaced at approximately 1.8 to 2.4 m across the bridge. The bridge will be constructed prior to dam decommissioning to allow sediment to be managed within Boat Harbour and prevent its migration downstream to the estuary or Northumberland Strait.

2.4 Emissions, Discharges, and Wastes

The closure of the BHETF operations and remediation of BHETF will result in a significant reduction in emissions, discharges, and wastes compared to the current operations. On January 31, 2020, the effluent will stop flowing to the BHETF and remediation will commence.



Under current conditions, up to 75,000 m³ of wastewater is conveyed to the BHETF daily [27 million m³ annually]. Through the treatment system solids are settled out in the setting basins, ASB and BH. It is estimated that approximately 5,400 m³ of sludge is settled out in the ASB and transferred to the sludge disposal cell annually. It is also estimated that 4 mm of sludge accumulated on the floor of BH annually. Pretreated wastewater is discharged to the estuary at a rate equal to the inflow.

During remediation approximately 1,000,000 m³ of unconsolidated contaminated sludge/sediment including approximately 385,000 m³ unconsolidated sludge/sediment within Boat Harbour will be removed, dewatered and placed in the sludge disposal cell. In addition to management of sludge/sediment, an estimated 5,700,000 m³ of water will need to be treated during remediation prior to discharge to the estuary.

Post remediation it is estimated that less than 2,500 m³ of leachate will be generated per year.

A Greenhouse Gas Mitigation Assessment (GHD, 2018) was completed in order to fully assess the anticipated greenhouse gas (GHG) reductions resulting from the Boat Harbour Remediation Project. Table 2.1 below puts the GHG emissions previously reported into a provincial, federal, and international context.

Table 2.1 Previously Reported GHG Emissions

GHG Source Description	Emissions (tonnes CO ₂ e/Yr)	Reduction
Project Emissions		
Baseline – continued operation of the BHETF for 25 years (GHD 2018)	368,580 over 25 years (average 14,743/year)	—
Project – during and post remediation total 25 year period (GHD, 2018)	53,500 over 25 years [52,859 CO ₂ e are from Direct Sources and 641 CO ₂ e are from Energy Indirect Sources] (average 2,140/year)	85% below baseline
Provincial Emissions		
1990 Nova Scotia (ECCC, 2018)	19,600,000	—
2016 Nova Scotia (ECCC, 2018)	15,600,000	20% below 1990
2020 Nova Scotia (Climate Change Nova Scotia, 2018) TARGET	17,600,000	10% below 1990
Canada-Wide Emissions		
2005 (ECCC, 2018)	732,300,000	—
2016 (ECCC, 2018)	704,300,000	4% below 2005
2030 (ECCC, 2018) TARGET	512,610,000	30% below 2005
Global Emissions		
2015 (PBL, 2017)	35,630,000,000	—

By 2014, the Province of Nova Scotia had already surpassed its 2020 GHG reduction target of 10 percent below 1990 emissions, and as of 2016, the Province has achieved a 20 percent reduction below 1990 levels, the most of any province in Canada. Nova Scotia is on track to reach a 24 percent reduction below 1990 GHG levels by 2020.



Federally, Canada GHG reduction target is 30 percent below the country's 2005 emissions or 512.61 million tonnes per year of CO₂ equivalents by 2030. As of 2016, Canada has achieved only a 4 percent reduction in GHG emissions below the 2005 levels, due primarily to reductions in Ontario, Quebec, and Nova Scotia. Nova Scotia has achieved the greatest percentage reduction in GHGs between 2005 and 2016 of any province or territory in Canada.

Globally, the Paris Agreement's (United Nations, 2015) long-term goal is to keep the increase in global average temperature to well below 2°C above pre-industrial levels, and to limit the increase to 1.5°C, since this would substantially reduce the risks and effects of climate change. Under this agreement, each country must determine, plan, and regularly report on the contribution that it undertakes to mitigate global warming but there is no mechanism that forces a country to set a specific target by a specific date, nor is there a single global GHG reduction target identified.

Based on GHD's assessment, operation of the BHETF contributes approximately 0.03 percent of Nova Scotia's annual emissions (1990). By the completion of the remediation Project, assuming Nova Scotia's GHG emissions remain at 2016 levels, the remediated BHETF contribution will drop to approximately 0.01 percent of the provincial emissions. While Nova Scotia's provincial GHG emissions are low compared to global totals, and represent only 2.2 percent of Canada's totals (as of 2016), the Boat Harbour Remediation Project will result in an absolute reduction in both local (Direct Emissions) and provincial (Energy Indirect Sources) GHG emissions, providing an overall net benefit, and help Canada achieve its GHG reduction targets.

2.5 Construction, Operation, Remediation, and Decommissioning Schedule

The Project is in the planning stages and will proceed through an EIA process under the Nova Scotia Environment Act and Environmental Assessment Regulations for waste management and wetland disturbance. The site is also subject to the Nova Scotia Contaminated Site Regulations. It is noted that, for the purposes of this remediation Project, construction, operation, and decommissioning phases are considered one in the same. Given this, the following represents the anticipated project schedule:

- Project Planning and Approvals: May 2015 – September 2019¹¹
 - Remediation Options Planning and Development: May 2015 – April 2018
 - Historical Document Review and Data Gap Assessment: May 2015 – July 2017
 - Design Requirements: August – September 2017
 - Option Assessment (including development and evaluation of remedial options, bench-scale testing, pilot scale testing): September 2017 – April 2018
 - Bench Scale Testing: November 2017 – March 2018
 - Pilot Scale Planning and Testing: April 2018 – February 2019
 - Environmental Planning and Development: July 2017 – May 2019

¹¹ Project Planning and Approvals end period represents the completion of the Project planning and design components. Regulatory approval will extend beyond this period based on environmental assessment process applied to the project. Environmental Assessment Approval expected between December 2019 and May 2021 as noted in bold within this section.



- Phase 1 ESA: July – November 2017
- Phase 2 ESA: September 2017 – June 2018
- Supplemental Phase 2 ESA: February – August 2018
- Human Health and Ecological Risk Assessment: September 2018 – February 2019
- PLFN Well Field Assessment: March – August 2018
- Remedial Action Plan Development: November 2018 – May 2019
- Environmental Impact Assessment:
 - Preliminary Draft Project Description: March - May 2017
 - CEAA notice to submit formal Project Description (PD): August 2018
 - PD submission to CEAA: December 2018
 - **CEAA determination: February 2018**
 - **Environmental Impact Assessment and Approval (estimated based on guidelines)**
 - ***NSE Class 2 Approval Only: February 2019***
 - ***Federal EA by Agency: March 2020***
 - ***Federal EA by Review Panel: May 2021***
- Regulatory Permitting, Planning, and Development: February – April 2019
- Remediation Tender Document: February – August 2019
- Construction Management and Oversight Consultant Tender: April – August 2019
- Implementation: Commencing in February 2020. Estimated duration is 5 to 7 years. It is noted that the implementation schedule may be pushed out by up to 2 years (2022-2029) depending on the environmental approval process applied to the Project and actual time required for approvals within the process
 - Conceptual Remediation Activities Implementation Schedule:
 - Solid Waste Management: Baseline and leachate collection system upgrades, waste deposited into sludge disposal cell: 2021-2025. Closure 2025-2026
 - Wetland Management: 2020-2025
 - Infrastructure Decommissioning: Pipeline: 2020; Treatment Buildings 2023; Dam: 2025
 - Remediation of dredging effluent: 2020-2024
 - Bridge at Highway 348: 2024-2025

2.6 Accidents and Malfunctions

Accidents and malfunctions refer to events that are not part of any Project activities that have been proposed. Many accidents and malfunctions are preventable and their consequences can be severely limited by applying a precautionary approach during planning and design, developing thorough emergency response procedures, and ensuring mitigation measures are incorporated into standard operating procedures. However, even with the implementation of best management



practices and preventative measures, accidents and malfunctions still have the potential to occur and create adverse effects to the environment and worker health and safety.

Potential accidents and malfunctions that could occur during transportation of the remediated wastes to the sludge disposal cell include:

- Fuel and Hazardous Materials Spills – Spills associated with Project activities may occur through failure of storage tanks, improper fuel transfer procedures, fuel/hydraulic line breaks or leaks, spillage or failure of storage containers, and/or mobile equipment and refueling truck accidents. Spills from an accident associated with the placement of hazardous waste bearing sediments may also occur. A worst-case scenario would be a transportation collision causing the entire amount of material being transported to be spilled into a water body. The effects of the spill would vary depending on the material spilled; diesel fuel and gasoline are toxic to aquatic life and would have the greatest impact to the environment.
- Erosion and Sediment Control Failure - There is the potential for earth moving activities to create erosion and sediment movement. The project would have robust measures in place but all systems have the potential for failure. Routine inspections of the measures in place would be completed and repairs done in a timely manner using local skilled resources. Releases can often have no consequences for aquatic habitats and be contained in short order. Releases of a larger scale and with the potential to affect watercourses would be reported to NSE and other agencies as required through a site management plan that is in place.
- Mobile Equipment Accident – There is the potential for vehicular accidents to occur throughout the duration of the Project. A worst-case scenario would be a severe accident causing injury or death. However, the majority of mobile equipment traffic will be limited to the BHETF site where guided traffic patterns, speed limits, right-of-way signage, and training will minimize the risk of accidents.
- Forest and/or Site Fires - A forest fire may occur through human or natural causes, while a site fire may occur due to an equipment failure and/or human error. Fires have the potential to directly affect the Project components and activities listed in Section 2.3. A worst case scenario is an extreme fire that results in worker injury or death and that causes significant damage to the environment, including habitat loss and direct mortality to wildlife.

With respect to accidents and malfunctions in relation to the management of the sludge disposal cell, implementation of standard operating procedures will ensure that emergencies, accidents and malfunctions and the potential for the environment to affect the project are addressed. The sludge disposal cell and associated infrastructure will be inspected on a regular basis and repairs completed as needed. The system design is robust and in accordance with provincial and federal standards associated with these types of facilities. It is expected that PLFN will have a role in the long term monitoring of the facility. Contingency plans and standard operating procedures may address events/situations including, but not limited to:

- Leachate seeps/leachate system failure/ spills/ slope failure
- Natural disasters, including storms and inclement weather/ power failure
- Accidents and injuries



3. Project Location

3.1 Description of Project Location

3.1.1 Coordinates

The coordinates of the effluent pipeline on the west bank of East River are: latitude 45°38'52" longitude 62°42'16".

The coordinates of the centre of Boat Harbour are: latitude 45°39'48" longitude 62°39'4".

The coordinates of the entrance to Boat Harbour at Pictou Landing Road are: latitude 45°40'12" longitude 62°38'23".

The coordinates of the entrance to Northumberland Strait are: latitude 45°40'32" longitude 62°38'20".

The coordinates of the existing sludge disposal cell are: latitude 45°39'17" longitude 62°39'24".

3.1.2 Site Map and Plan

The Study Area is shown on Figure 1.

3.1.3 Photographs of the Site

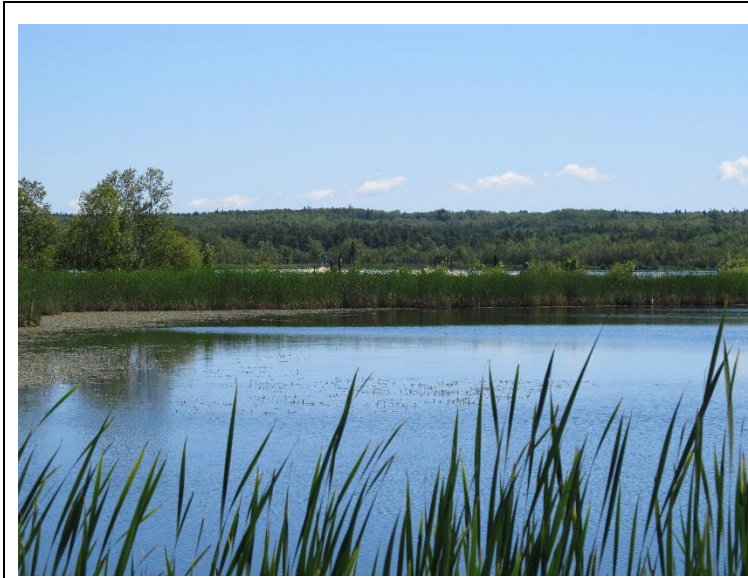
The following photographs are provided of Boat Harbour, and the surrounding area/BHETF, for the purpose of the Project Description.



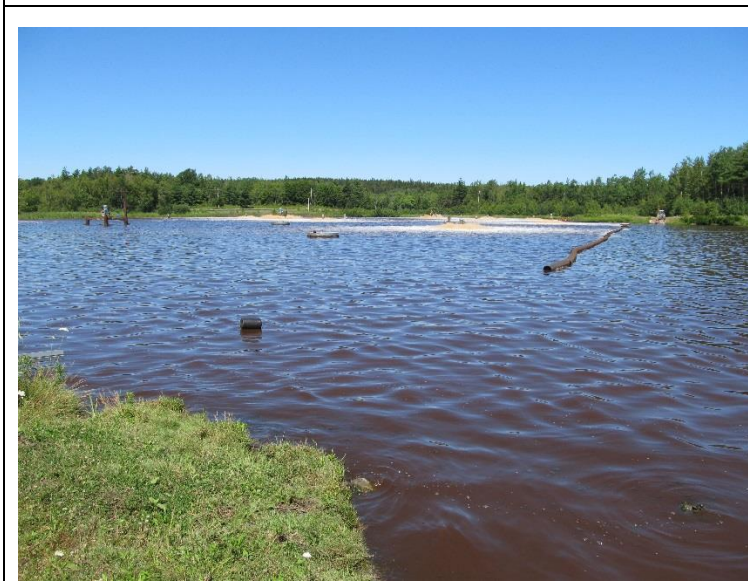
View across East River towards Kraft Pulp Mill, facing west



Raw Effluent Discharge, facing northwest



Former Settling Pond 1, facing east



Aeration Stabilizing Basin, facing northwest from road showing boom dividing aeration cells

	<p>Aeration Stabilizing Basin facing south from north road</p>
	<p>Cove 1 berm facing northeast</p>
	<p>Sludge Disposal Cell facing northwest</p>



Biologically treated effluent entering Boat Harbour at Point C Discharge Area, facing northeast



Settling Basins facing southeast from Press Building



View of Boat Harbour from Pictou Landing Road, facing southwest



Box culverts below Pictou Landing Road, facing southeast



View of Dam from Causeway
looking northeast towards
Northumberland Strait



View of the Estuary from the
dam, facing north

	<p>View of the Boat Harbour Estuary flowing to the Northumberland Strait, facing southwest</p>
	<p>View of the Boat Harbour Estuary flowing to the Northumberland Strait, facing northwest</p>

3.1.4 Proximity of the Designated Project

PLFN is located on the banks of Boat Harbour, within the Project Study Area, and is granted Indian Reserve Lands, which are federal crown lands. Approximately 485 residents reside within the PLFN lands. A Mi'kmaq Ecological Knowledge Study (MEKS) was conducted to identify land and resource use, which is of particular importance to the Mi'kmaq people, within the Study Area. The MEKS was completed in June 2018. Archaeological Assessment work was also completed including reconnaissance work and shovel testing in select areas to identify known and potential sites of significance. Results are discussed in Section 3.2.4.

3.2 Land and Water Use

The Study Area and property associated with the BHETF and pipeline corridor is identified by Service Nova Scotia and Municipal Relations (SNSMR) as being comprised of 34 parcels of land.



The following table identifies the Study Area land parcels and provides detail regarding their ownership and use.

Table 3.1 Ownership and Land Use

PID	Owner	Land Use
65090607	John Henry Simpson	Residential, Undeveloped, Part of Pipeline Corridor; No Pipeline Leasing Information Available
802702	NS Supply and Services (Province)	Undeveloped
961375	NS Supply and Services (Province)	Undeveloped
65014623	NS Department of Lands and Forestry (Province)	Undeveloped, Partially Cleared
961367	NS Supply and Services (Province)	Undeveloped, Part of Pipeline Corridor; No Pipeline Leasing Information Available
801407	Bernice Evelyn Pace	Undeveloped, Part of Pipeline Corridor; No Pipeline Leasing Information Available
65052607	N S Environment (Province)	Undeveloped
802611	Indian and Northern Affairs Canada	Residential, Commercial, Undeveloped
1045350	Indian and Northern Affairs Canada	Undeveloped
1045343	Indian and Northern Affairs Canada	Undeveloped, Part of Pipeline Corridor; No Pipeline Leasing Information Available
65073298	Indian and Northern Affairs	Residential, Commercial, Undeveloped
65073306	Indian and Northern Affairs	Residential, Undeveloped
65098022	Road Parcel Owner Undetermined	Road
65098188	Road Parcel Owner Undetermined	Road
65098378	Road Parcel Owner Undetermined	Road
65098865	Road Parcel Owner Undetermined	Road
801316	County of Pictou	Undeveloped, Part of Pipeline Corridor; No Pipeline Leasing Information Available
878454	Bart Brown	Undeveloped
801282	William James Palmer and Susan Mary Palmer	Residential, Undeveloped, Part of Pipeline Corridor. Pipeline Easement Dated 1966.



Table 3.1 Ownership and Land Use

PID	Owner	Land Use
801191	Her Majesty The Queen In Right of The Province of Nova Scotia	Undeveloped Forest And BHETF Settling Ponds And Basins, Aeration Stabilizing Basin, Sludge And Effluent Disposal Cells, Press And Electrical Buildings, And Silo; Part of Pipeline Corridor; Lands Expropriated In 1966; Leases Dated 1996, 2002, And 2011
801191	Pictou Landing Devel Corp	Undeveloped, Parcel 4 and 6 (since 1999)
878421	Pictou Landing Devel Corp	Undeveloped
65214264	Pictou Landing Devel Corp	Undeveloped
65214256	Owner Unknown	Undeveloped
801308	David Ross Rector	Undeveloped, Part of Pipeline Corridor; No Pipeline Leasing Information Available
801241	Chief Andrea Paul	Undeveloped, Part of Pipeline Corridor; Pipeline Easement Dated 1966
864504	Elizabeth Kennedy and D Raeburn Kennedy	Residential, NSP Easement
961284	NS Environment (Province)	Commercial, Part of Pipeline Corridor
961276	Sandra Elizabeth Kennedy and Sheldon George Kennedy	Residential, Resource Farm, NSP Easement
864538	Northern Pulp Nova Scotia Corporation	Commercial, Northern Pulp, Part of Pipeline Corridor
65103798	Road Parcel Owner Undetermined	Road

3.2.1 Zoning Designations

In general, the Site and surrounding properties are not zoned, according to the (Draft) Pictou County Land Use By-Law, dated May 6, 2014. The southern portion of the PLFN land within the Study Area; however, is zoned as "Forest Management Area" and the northern portion, containing residences, is zoned "Residential", according to the Pictou Landing Band By-Law No. 1. The total area of the Site is approximately 546 ha. Approximately half of the Site is water covered and most of the water features on the Site were formerly or are currently utilized as part of the wastewater effluent treatment process. GHD understands that the Site has operated as the BHETF since 1967 and has been reconfigured on several occasions.

3.2.2 Legal Description

In addition to Boat Harbour itself, Table 3.1 above identifies the Study Area land parcels included in the Project.

3.2.3 Existing Plans/Projects near the Project Site

Current projects near the Project Site are limited, with the exception of the development of a wastewater treatment facility for the Kraft Paper Mill. The initial plan would see mill waste water, up



to 75,000 m³ per day, handled through an activated sludge treatment system. The effluent would be aerated and settled in a large tank on the mill property. Treated effluent would then be sent to a new submerged marine outflow for discharge into the Northumberland Strait. The environmental assessment for this proposed project is ongoing.

3.2.4 Use of Aboriginal Lands

The PLFN is a Mi'kmaq First Nation located at the mouth of Pictou Harbour on the Northumberland Strait of Nova Scotia. The Mi'kmaq people have a long-existing, unique, and special relationship with the land and its resources, which involves the use and conservation of natural resources and spiritual ideologies regarding such. PLFN has a long standing history of concern related to the effluent flowing from the nearby mill to the lagoon, known as A'se'k, that later became the site of the BHETF. Furthermore, PLFN was instrumental in negotiating with the Province of Nova Scotia to close the treatment facility, which was embodied in the *Boat Harbour Act* in 2015. Historically, A'se'k was a gathering place where food, knowledge, and skills were exchanged between generations and amongst family groups. The land was traditionally used by the Mi'kmaq for refuge, recreation, fishing, hunting and gathering, as well as for physical, mental, spiritual, and emotional purposes. Through the proposed remediation Project, it is PLFN's hope that A'se'k be restored to allow the community to re-establish its relationship with the water and land of A'se'k. The relationship of PLFN to their traditionally occupied lands and waters, and the importance of continued engagement with PLFN in the planning and design phases of the proposed Project to restore A'se'k is recognized. First Nation engagement is an essential component of the overall Project and specifically, the EA process.

A Mi'kmaq Ecological Knowledge Study (MEKS) was conducted by Membertou Geomatics Solutions and completed in June 2018. The Study found that Mi'kmaq land and resource use was reported on the Project site, and that hunting and gathering were found to be the most common activities described as occurring. Within the broader Study Area, hunting, fishing, and gathering were the most commonly reported activities. All activities were recounted as taking place in the recent and long-term past. Current use is limited mainly to fur-bearing creatures as species of harvest.

Recreational aquatic activities such as swimming and canoeing are reported as having been historically common in the waters surrounding PLFN in Pictou Harbour, Chance Harbour, Boat Harbour, and other local waters.

Archaeological assessment work was also completed including reconnaissance work and shovel testing in select areas. The Project Study Area contains known and potential sites of significance and recorded archaeological sites in the Provincial registry. All aspects of the project planning carefully consider the known and potential sites with appropriate studies completed in any area where land disturbance has or will occur as part of the Project.

Numerous stories were also shared of dead fish floating on the water's surface shortly after pulp mill effluent began to flow through Boat Harbour. A high level of distrust of anything harvested in the area of Boat Harbour such as fish, plants, or game was reported. Stories were told of fish and animals exhibiting bumps or cancer. Returning Boat Harbour back to the way it used to be, before being utilized by the pulp mill, and before the pollution is reported as a strong desire among the PLFN community.



4. Federal Involvement

4.1 Federal Financial Support

Preliminary discussion of potential federal funding has taken place and a provincial submission has been filed with Infrastructure Canada for funding under the Investing in Canada Infrastructure Program (ICIP). There has been no set federal commitment to date.

A requirement of the ICIP submission has been to complete a Climate Change Resilience Assessment and a Greenhouse Gas Mitigation Assessment for the BHRP. These assessments have been completed by qualified assessors and included with the provincial submission to Infrastructure Canada.

In addition to the above two assessments, the following were included in the provincial submission for funding:

- Project Management Accountability Framework, based upon federal Treasury Board Secretariat's framework
- Project Risk Profile, based upon federal Treasury Board Secretariat's Risk Management Framework
- Project Socioeconomic Impact Analysis

4.2 Federal Lands

As noted above, PLFN is located on the banks of Boat Harbour, within the Project Study Area, and has been granted Indian Reserve Lands which are federal crown lands. While some of the project components are located within and will interact with Federal lands, the sludge disposal cell itself (which relates to the designated physical activity under the Regulation) is not located on Federal lands.

4.3 Federal Permits

As part of the BHRP, an oceanography assessment at the outlet of Boat Harbour is being completed. The assessment includes a review of available data from sources such as DFO, ECCC, and TC on oceanographic features. This data will be supplemented with bathymetric data collected downstream from the dam, including the harbour entrance. A hydrodynamic model is being prepared to determine tidal flow and hydraulic behavior within the estuary and Boat Harbour post remediation. The proposed 2D model will extend outside the Boat Harbour estuary and will provide accurate tidal signal and current velocity. Hydrodynamic modeling of potential loading of contaminated sediment at the outlet (during remediation and/or removal of the dam) is also being completed. The model will predict TSS (total suspended sediment) plume extent in the Northumberland Strait during dredging and decommissioning of the dam.

Fisheries and Oceans Canada approval will be required if a wider channel needs to be created to obtain water depth in Boat Harbour and the estuary for navigation. The *Fisheries Act* applies to both the freshwater and marine aspects of the Project.



The *Navigation Protection Act* would apply to the marine aspects of the Project, the berms, access roads, and exterior effluent pipeline, requiring TC approval. The marine and former marine portions of the estuary are not scheduled waters.

The *Migratory Birds Convention Act* and the *Species at Risk Act* are applicable in relation to terrestrial flora and avian species and habitat protection.

The *Transportation of Dangerous Goods Act* may apply to any offsite transportation of waste materials classified under this Act.

Indigenous Services Canada approval, in conjunction with PLFN's consent by Band Council Resolution, is required for access to and the conduct of assessments, investigations and any remediation activity on federal crown lands.

Table 4.1 below summarizes federal legislative and regulatory requirements that may be applicable:

Table 4.1 Federal Legislative and Regulatory Requirements

Project Activity	Activity Description	Applicable Legislation	Agency	Required Approval or Permit
Entire Project	All remediation activities	Canadian Environmental Assessment Act, 2012	CEAA	Environmental Assessment
Entire Project	All remediation activities	<ul style="list-style-type: none"> Migratory Birds Convention Act 	<ul style="list-style-type: none"> ECCC 	Permit
Entire Project	All remediation activities	<ul style="list-style-type: none"> Species at Risk Act 	<ul style="list-style-type: none"> ECCC 	Permit or Exemption
Bridge construction at Highway 348	Construction of a 34 m long, single-span concrete structure.	<ul style="list-style-type: none"> Navigation Protection Act Fisheries Act 	<ul style="list-style-type: none"> TC DFO 	<ul style="list-style-type: none"> NPA Opt Out Authorization for Work that May Result in Serious Harm to Fish
Waste Management	Handling and transportation of liquid and solid waste off-site	<ul style="list-style-type: none"> Transportation of Dangerous Goods Act 	<ul style="list-style-type: none"> TC 	Off-site transport of waste materials classified under this Act - carrier must comply with all applicable regulations
Infrastructure Decommissioning – Pipeline Underwater	Remove residue from pipe, cap pipe.	<ul style="list-style-type: none"> Navigation Protection Act Fisheries Act 	<ul style="list-style-type: none"> TC DFO 	<ul style="list-style-type: none"> NPA Opt Out Authorization for work that may result in serious harm to fish
Infrastructure Decommissioning - Dam	Removal of earthen berm connecting the dam to the banks.	<ul style="list-style-type: none"> Navigation Protection Act Fisheries Act 	<ul style="list-style-type: none"> TC DFO 	<ul style="list-style-type: none"> NPA Opt Out Authorization for work that may result in serious harm to fish



Table 4.1 Federal Legislative and Regulatory Requirements

Project Activity	Activity Description	Applicable Legislation	Agency	Required Approval or Permit
Sediment Management	Removal of sediment from wetlands and estuary	<ul style="list-style-type: none"> Navigation Protection Act Fisheries Act 	<ul style="list-style-type: none"> TC DFO 	<ul style="list-style-type: none"> NPA Opt Out Authorization for work that may result in serious harm to fish
Bulk Water Management & Dewatering Effluent Management	Water treatment and discharge of treated water to the estuary	To be Determined	<ul style="list-style-type: none"> ECCC 	Authorization for this specific discharge will need to be determined.
Leachate Management	Off-site hauling and disposal of leachate	<ul style="list-style-type: none"> Transportation of Dangerous Goods Act 	<ul style="list-style-type: none"> TC 	Carrier must comply with all applicable regulations

DISC has granted approvals for access to three Indian Reserve Lands adjacent to Boat Harbour during the planning period and further approvals will be required for the remediation implementation. NS Lands is working directly with DISC to meet associated regulatory approval and compliance matters.

4.4 Federal Scientific, Regulatory and Technical Advice

NS Lands has convened a BHEAC, meeting monthly since January 2016, comprised of representatives of the proponent, PLFN, academic scientific advisors from four Nova Scotia universities and federal and provincial regulators and technical advisors. Representatives with subject matter expertise from Environment and Climate Change Canada, Health Canada, Fisheries and Oceans Canada, Public Services and Procurement Canada and Indigenous Services Canada participate. Project plans, progress reports and planning proposals are regularly vetted through the participants and federal advice on science, regulatory and technical matters is actively solicited and incorporated in Project plans and Project direction.

5. Environmental Effects

5.1 Physical and Biological Setting

5.1.1 Land

A Phase 1 Environmental Site Assessment (ESA) was completed in 2017 in compliance with the CSA Z-768-01 standard that identified areas of potential environmental concern (APECs) based on previous site and adjacent site activities.

A Phase 2 ESA was completed between September 2017 and June 2018. The Phase 2 ESA included drilling 49 boreholes across the Site with 38 completed as monitoring wells. Groundwater samples were collected using low-flow methodology from all newly installed monitoring wells, as well



as from 13 existing monitoring wells. In addition to the boreholes, 40 surface soil samples have been collected across the site from depths shallower than one metre. Sediment samples were collected in the wetlands and open water bodies on the Site from 32 locations, and 14 surface water samples were collected from the various water bodies. For comparison to background conditions, an additional 10 soil samples, 10 sediment samples, and 5 surface water samples were collected from Chance Harbour Lake.

A Supplemental Phase 2 ESA was completed between February and August 2018. As part of the Supplemental Phase 2 ESA 19 sediment samples (plus QA/QC samples) were collected at 10 locations across the Site and at 5 locations from the Northumberland Strait, 2.5 km east of the Estuary, to assess background sediment conditions in a marine environment. A total of 20 surface soil samples were collected from shallow boreholes (advanced by hand using a shovel and a hand auger) and 14 subsurface soil samples were collected from 13 drilled boreholes. Groundwater samples were collected from 7 newly installed monitoring wells near the Boat Harbour stabilization lagoon and the Estuary using low-flow purging and sampling methods where possible. One surface water sample was collected from a stream to the east of the sludge disposal cell overflow pond. Five additional background surface water samples were collected from Chance Harbour Lake to confirm the background surface water conditions for the area.

Work is currently underway to review baseline data that exists with respect to air quality (AQ) and GHG. Baseline noise data is complete with assessment of data in progress.

5.1.2 Water

Hills surrounding Boat Harbour dominate the watershed topography with an elevation up to 60 m above mean sea level. Shallow groundwater occurs in two main zones: (1) the silty glacial till that overlies the bedrock or where the till is thin or absent; and (2) where thin or absent till occurs in the shallow bedrock. Surface water and shallow groundwater provide the base flow to Boat Harbour. Drilled wells in the area provide drinking water for both the PLFN and the residences within the watershed.

Video transect surveys have been completed along the alignment of the pipeline (below East River) to record and describe habitat (substrate, presence/absence of aquatic vegetation) as well as macrobenthos and fish presence. Sediment samples were collected to describe granulometry as well as endobenthic invertebrates. A bathymetric survey was also completed, along with conductivity, temperature, density-turbidity (CTD-Tu) profiling to obtain salinity, temperature and turbidity of the water for different tidal stages.

5.1.3 Terrestrial and Aquatic Ecosystems

5.1.3.1 SARA Listed Species

Prior to completion of biophysical studies within the Project Area, assessment of wildlife, including vegetation and habitat was completed based on the requirements outlined in the NSE *Guide to Addressing Wildlife Species and Habitat in an EA Registration Document* (NSE, Revised September 2009). Priority species, as defined by the Guide include:

- A SAR is any species which is listed as Endangered, Threatened or of Special Concern under the federal *Species at Risk Act* (SARA) (Government of Canada, 2002) and any species listed



as Endangered, Threatened or Vulnerable under the provincial Nova Scotia *Endangered Species Act* (NS ESA) (*Endangered Species Act*, 1998, amended 2010, c. 2, s. 99).

- A SOCC is any species listed as S1-S3S4 (provincial rarity rankings) by the Atlantic Canada Conservation Data Centre (ACCDC). Using the ACCDC provincial rarity rankings rather than the general status ranks was recommended by Mark Elderkin (Mark Elderkin, Pers. Comm., 2018).

This priority list of species was narrowed by broad geographic area along with input from Nova Scotia Department of Lands and Forestry. Priority SAR floral species included only black ash, and based on a review of the geographic area and discussions with Nova Scotia Department of Lands and Forestry, it was determined that targeted mammal field assessments for mainland moose, Canada lynx and SARA listed bat species were not required. Herpetile surveys were conducted in late spring to identify the potential presence of wood turtles, snapping turtles and Eastern ribbon snake. Priority SAR bird species included: SARA Endangered – Barn Swallow, Canada Warbler and Piping Plover; SARA Threatened – Common Nighthawk and Olive-sided Flycatcher; SARA Vulnerable – Bobolink and Eastern Wood-Pee-wee; COSEWIC Threatened – Bank Swallow and Wood Thrush; and COSEWIC Special Concern – Evening Grosbeak.

5.1.3.2 Terrestrial Habitat and Vegetation

Environmental baseline assessments were conducted from August 2017 to July 2018. During these field investigations, various terrestrial habitat types and plant species were observed within the Boat Harbour treatment facility site boundaries. Habitat types ranged from landscaped areas to well-drained drumlin hills comprised mostly of upland species such as Eastern hemlock and large-toothed aspen. Seven main types of forest stands are found within the Project Area and include: Softwood, Eastern Hemlock, Red Pine, Tolerant Hardwood, Intolerant Hardwood, Mixed, and Regenerating.

- Softwood dominant stands – These are dominated by coniferous species such as balsam fir, white and red spruce, Eastern hemlock, as well as white and red pines.
- Eastern Hemlock dominant stands – These stands are comprised mostly of Eastern hemlock, often with little understory. These stands often host small populations of shade-tolerant hardwood species such as yellow birch, and striped maple as well.
- Red Pine dominant stands – These areas appeared to have had forestry operations carried out in years past. These stands were mostly uniform age, and additional species were nearly absent in these areas evidence of woods roads used for harvesting was apparent.
- Tolerant Hardwood dominant stands – These stands are comprised mostly of hardwood species such as American beech, white ash, sugar maple, striped maple and yellow birch.
- Intolerant Hardwood dominant stands – These stands are comprised mostly of hardwood species such as large-toothed aspen, trembling aspen, red maple, white birch, and grey birch.
- Mixed forest stands – These stands are comprised of a mixture of coniferous and deciduous species. Red maple, white birch, trembling aspen, balsam fir, as well as white ash, yellow birch, Eastern hemlock, and red spruce were common in mixed forest locations.
- Regeneration forest stands – These areas have had vegetation removed previously through either natural or unnatural processes leaving these areas mostly bare of significant canopy



cover. Stands are commonly comprised of species including red maple, balsam fir, grey birch, speckled alder, white pine, and red oak (in areas previously burned).

The majority of the site is dominated by Mixed forest stands, with Tolerant Hardwood stands most notably located along the steep slopes of the Northern boundary and Eastern Hemlock stands dominating the western and eastern portions of the site. Regenerating forest stands are more apparent in the southern sections of the Project Area with patches of Red Pine found in various locations throughout the site. Ages of the stands varied from overmature to early successional. Overmature stands were noted mainly in the northern portions of the Project Area.

Other terrestrial habitat types observed within the Project Area included Fallow Pasture Lands, Open Fields and Landscaped Areas.

- Fallow Pasture Lands – These areas are often uniformly aged, comprising of tree species such as red spruce, yellow birch, apple trees, hawthorn, trembling and large tooth aspen, as well as fruiting shrub species with an herbaceous layer composed of various graminoid species, aster species, goldenrods, and raspberry.
- Open field – These areas are comprised mostly of herbaceous species such as aster, goldenrods, raspberry, rose, and various graminoid species.
- Landscaped Areas – These areas are typically mowed fields with planted white spruce trees scattered throughout the managed area.

Fallow Pasture Lands were located in areas where previous homestead foundations are located which are found scattered throughout the Project Area. The open field and landscaped areas are located mostly in the southern portion of Project Area in and around existing infrastructure such as the pipeline corridor, buildings and ASB.

Over 240 vascular and non-vascular species were identified during the botanical surveys completed during the terrestrial habitat surveys, wetland assessments and spring ephemeral surveys. Of these, only one species is classified as a species at risk (SAR) with another two species classified as species of conservation concern (SOCC). Black ash (*Fraxinus nigra*) is listed as Threatened under the federal *Species at Risk Act* and Nova Scotia *Endangered Species Act*. Black ash was observed in localized areas in the southern portion of the Project Area, and is believed to have been planted and not naturally occurring. Discussions with the Pictou Landing First Nation indicated that black ash (known as Wisqoq in Mi'kmaw) was planted in the area a few years ago. Heart-leaved foam flower (*Tiarella cordifolia*) was identified in the northern section of WL-10/WC-5. This species is listed as S2 by the Atlantic Canada Conservation Data Centre (ACCDC) and considered to be Sensitive by the Province. Only one individual was noted by biologists. The ACCDC identified Horned Sea-blight (*Suaeda calceoliformis*) within 0.5 +/- 2 km of the site, however none was discovered during the site surveys.

Lichen surveys were completed in November 2017. Appressed jellyskin lichen (*Leptogium subtile*) was observed in limited quantities just outside the eastern boundary of the Project Area. This species is listed as S3 by the ACCDC and considered to be Sensitive by the Province. The ACCDC did not identify any lichen species as occurring within 5 km of the Project Area.

In general, vegetation species observed are largely native species, with exotic species confined mainly in the disturbed areas of the site. The species and communities of vascular and non-vascular



plants encountered were typical given the eco-regional context, nutrient regimes, moisture regimes, and disturbance regimes.

5.1.3.3 Wetlands

Prior to the commencement of field work at the site, a desktop review of provincial databases, topographic mapping, Service Nova Scotia and Municipal Relations Property Online, information from background studies and available satellite imagery was completed. The locations of wetlands shown on the mapping was used to allow for ground-truthing during field work. Knowledge of the site topography and distribution of natural features also allowed the field work to be focused on areas with an elevated potential for wetlands and watercourses not shown on mapping.

Wetland field surveys were conducted from August to November 2017. The presence/absence of wetlands was evaluated in accordance with the U.S. Army Corps of Engineers Wetlands Delineation Manual and the Northcentral and Northeastern Interim Regional Supplement. The targeted surveys consisted of traversing the landscape using a set of evenly spaced transects (approximately 50 to 100 m apart) in search of areas showing typical wetland characteristics. For an area to be identified as wetland it must show positive indicators in all three areas of assessment in a test pit location. The areas of assessment used were: hydrophytic vegetation, hydric soils and wetland hydrology. A wetland boundary was determined between the upland and wetland test pit locations; this boundary was then extended around the exterior of the wetland. Wetland data and boundary points were recorded using a Differential GPS system, which has an accuracy of one to two metres depending on tree cover.

Identified wetlands were classified as per the Canadian Wetland Classification System (CWCS). A functional assessment for each wetland or group of wetlands was completed using the Wetland Ecosystem Services Protocol for Atlantic Canada (WESP-AC). WESP-AC is a combined desktop and field evaluation method designed to assess the condition and function of Nova Scotia's wetlands.

Twenty five wetland areas were identified and assessed during wetland surveys. Of these, three were identified as marsh, ten as swamp, eleven as marsh/swamp complexes and one as a marsh/saltmarsh complex. The total wetland area delineated in the Project Area is approximately 86.24 ha which represent 15.8 percent of the total Project Area (approximately 545.04 ha).

Regarding wetland function, it is difficult to pin-point definitive trends or parameters that are uniform throughout the site due to the abundance of wetland area within the Project Area, and wide range of wetland sizes encountered. Most of the wetlands identified have a moderate or high value pertaining to sediment retention, and all wetlands on site have low potential for anadromous fish habitat. After review of the wetland grouped function tables it is possible to generalize the wetland scores as follows:

- Hydrologic group function – Mostly Lower
- Water quality support group – Mostly Moderate or Higher
- Aquatic support group – Mostly Moderate
- Aquatic habitat group – Mostly Moderate or Higher
- Transition habitat group – Mostly Moderate or Higher



- Wetland Condition – Mostly Moderate
- Wetland Risk – Mostly Moderate or Higher

This data concludes that most of the wetlands at the BHETF are in a moderate condition but are moderately or highly prone to degradation due to their risk score, which is an average of the wetland's stress and sensitivity scores. The hydrologic functions of these wetlands are considered lower, and as many of the wetlands are associated with a watercourse, the generalized score for aquatic habitat was mostly moderate or higher. Scores were considered moderate or higher in the transition habitat group, meaning they provide support or contribute to a diversity of native birds, mammals, vascular plants, and pollinating insects. Wetlands located further from the effluent treatment infrastructure have been observed to be in better condition than those located within the immediate vicinity of effluent treatment infrastructure.

5.1.3.4 Watercourses/Aquatic Habitat

Prior to the commencement of field work at the site, a desktop review and site reconnaissance was conducted to identify the presence of fish habitat. During the fish and fish habitat field program, each water feature (i.e., linear watercourse, waterbody and wetland) identified was followed until it reached the Project boundary or dissipated. A representative reach of 150 m in length was used to complete the in-depth aquatic habitat assessment.

The aquatic habitat assessment consisted of using a fish and fish habitat form developed from the guidelines and parameters outlined by DFO and the United States Department of the Interior in association with the United States Fish and Wildlife Service pertaining to Atlantic Salmon (Marshall et al, DFO, 2014) and Brook Trout (Raleigh et.al, USFWS, 1982). The various habitat components included in the fish and fish habitat form consist of:

- Stream morphology (i.e., sinuous, regular meandering, irregular meanders, tortuous meanders, braided, or straight)
- Watercourse type (i.e., large permanent, small permanent, intermittent, ephemeral, or a combination of these)
- Riparian vegetation identification
- Habitat types encountered (i.e., riffle, run, pool, flat, rapid, snye)
- Bank type (i.e., vertical, sloped, undercut, man-made, eroded)
- Substrate size: Fines (<0.0625 mm), Sand and small gravel (0.065-3.0 cm), Large gravel (3.1-6.4 cm), Cobble (6.5-25.6 cm), Boulder (>25.6 cm), and Bedrock. These size classes generalized from the Wentworth scale of rock particulate sizes. Substrate matter is measured on its rolling edge.
- In-Stream cover (i.e., small woody debris, large woody debris, undercut banks, overhanging vegetation, unembedded boulder and cobble, and aquatic vegetation)
- Barrier observations: full, partial, temporary, or none
- Water quality parameters: pH, water temperature, dissolved oxygen (mg/L and percentage), total dissolved solids, salinity, and specific conductivity.



- Percent pools and pool quality
- Water velocity (m/sec)
- Transect measurements: Bank-full and wetted widths, wetted depth, bank height, and percent embeddedness.
- GPS information about where transect measurements were taken (UTM coordinates zone 20T)
- Weather information for the date assessed, and remarks on previous precipitation which may influence wetted widths and depths.
- Habitat suitability rationale based on the aforementioned parameters and general site information pertaining to spawning, rearing, overwintering, and overall habitat quality.

Field surveys of the watercourses on site were conducted in August and September 2017. A total of 19 watercourses were identified: 2 ephemeral channels, 13 intermittent channels, 3 small permanent channels, and 1 large permanent channel. Three small drainage corridors were also identified on site. Fish species were visually observed in two of the watercourses on site, but only one of the two encounters resulted in a positive species identification (Three-spined Stickleback).

Of the 19 watercourses identified, only 13 watercourses were assessed, as six of the identified watercourses were dry. Water temperatures at the BHETF site were within range for salmonid species, with an overall average temperature of 13.6°C, and extremes of 8.5°C and 18.5°C. Total dissolved solids were measured in grams per liter (g/L), with an overall average of 0.0779 g/L, and extremes of 0.049 g/L and 0.128 g/L. pH readings are considered to be fairly neutral throughout the site, as the calculated average pH of the combined watercourses was measured at 6.94, with the lowest pH reading identified as 5.64, which is still within the accepted tolerance range for Brook Trout (4.0 to 9.5), but outside of the optimal pH range (6.5 to 8.0). Specific conductance readings remained relatively stable throughout the assessed watercourses, with a combined average of 119.385 µS/cm, and extremes of 75 µS/cm and 196 µS/cm which is considered good for salmonids. Dissolved oxygen varied wildly from stream to stream at BHETF sites, this is in part due to the varied topography and canopy cover that exists on site.

A total of six watercourses were included in the benthic macro-invertebrate assessment due to their substrate makeup, channel accessibility, and flow. The order Diptera was far and away the most abundant found at the BHETF sampling sites, this order made up 68.3 percent of all organisms collected between all samples. Chironomidae was by far the most abundant family of species across all samples, and this family made up 81.5 percent of the order Diptera. The Chironomidae family of organisms thrives in areas with poor, moderate, or good water quality. The low levels of EPT family organisms may be an indicator of poor water quality throughout the watercourses on site.

The majority of watercourses at the BHETF site lack the appropriate physical habitat features to sustain populations of adult Brook Trout. A select few streams may have adequate spawning or rearing habitat for portions of the year, but no stream on site appeared adequate for year-round adult Brook Trout habitat.

Within the marine environment, various marine species, including fish and shellfish, depend on the diverse habitat the Northumberland Strait provides. The Northumberland Strait is considered to be an important feeding and foraging area within the Atlantic Ocean. Of particular note, is the sandy substrate of the Pictou Road section of the Northumberland Strait which provides significant foraging



habitat for some marine species with at least eight species at risk having been identified in that portion of the Strait. Due to the high productivity of the area, several commercial fisheries have developed. The Pictou Road section of the Northumberland Strait is considered to be a vital part of the local commercial fishing community, with several species holding commercial or intrinsic value.

5.1.3.5 Mammals and Wildlife

There are over 50 native species of mammals known to inhabit Nova Scotia. Typical larger forest mammals that inhabit the forests of Nova Scotia include white-tailed deer, black bear, red fox, porcupine, striped skunk, and raccoon. The habitat located within the Project Area (softwood, hardwood, mixed forests, fields, wetlands and open water) provide suitable habitat for many of these common mammal species, especially smaller mammal species such as hare, red squirrel, meadow voles, and shrew species. With respect to herptiles, there are approximately 25 species of reptiles and amphibians known to occur in Nova Scotia. Common species include the maritime garter snake, American bull frog, and leopard frog.

Environmental baseline assessments were conducted from July to October 2017. During those field investigations, various wildlife species were observed within the Boat Harbour treatment facility site boundaries. Evidence of white-tailed deer, black bear, Eastern coyote, striped skunk, snowshoe hare, North American porcupine, raccoon, muskrat and beaver mammal species were observed, in addition to the maritime garter snake, leopard frog, green frog, American bull frog, spring peeper, and American Toad which were also noted.

Based on discussions with Kim Strickland from PFLN, there is active trapping occurring within the Project Area with a focus on beaver and muskrat harvesting for fur. There is no known hunting in the area for larger game species such as white-tailed deer and black bear.

5.1.3.6 SARA Listed Species

The forest inventory identified at the BHETF lends itself to a variety of wildlife species, as conditions are varied throughout the site. Several wetland areas and wetland edge were considered adequate habitat for herptile species such as snakes, turtles, frogs, toads, and salamanders. Species identified in wetland areas included wood frog, red-backed salamander, yellow spotted salamander, ring-necked snake, and maritime garter snake. Other species such as bullfrog, pickerel frog, green frog, mink frog, spring peeper, and the American toad are all potential inhabitants of the wetland areas found at the BHETF.

Mammals such as the white-tailed deer, porcupine, striped skunk, and raccoon were all present in several areas of the BHETF, which is to be expected, as these species are considered habitat generalists, who utilize a variety of forest types and wetland areas. Other mammals identified at the BHETF include the black bear, coyote, red fox, and rodents such as the red squirrel, woodland jumping mouse, chipmunk, beaver, muskrat, and possibly groundhog.

There was no evidence of species at risk such as the mainland moose, or Canada lynx on site. Moose carcasses were noted in two areas on site, but these are believed to be Cape Breton moose, which were encountered and legally harvested somewhere else. Non-harvestable materials were then discarded along access trails at the BHETF. A section of lower jaw was absent at both carcass sites, which provides evidence that the lower jaw was likely sent to Nova Scotia Department of



Lands and Forestry (formerly Natural Resources) for population modelling which is consistent with responsible, lawful harvesting (A. Young, NSDLF, Pers. Comm., June 19, 2018).

Based on discussions with Kim Strickland from PFLN, there is active trapping occurring within the Project Area with a focus on beaver and muskrat harvesting for fur. There is no known hunting in the area for larger game species such as white-tailed deer and black bear.

5.1.3.7 Birds

Prior to the commencement of field work at the site, a desktop review was conducted to identify significant bird habitat. The nearest Important Bird Area (IBA), is approximately 32 km northeast of the Project Area on the southeast coast of PEI, Highbank IBA. Approximately 1.5 percent of the North American Great Cormorant population nest within the IBA; averaging 92 nests per year. Other species that nest within the colony include Double-crested Cormorants, Black Guillemots and Rock Doves. Two Biologically Significant Areas for breeding terns were identified within the vicinity of the Project Area: Pictou Bar Site of Ecological Significance (SES; approximately 800 m north of the Project Area) and Ballast Island SES (approximately 1 km southwest of the Project Area).

Baseline assessments for birds were completed from September 2017 through July 2018, and included:

- Fall migration monitoring (2017)
- Late winter and early spring bird survey (targeting raptor surveys) (2018)
- Spring migration monitoring (2018)
- Breeding bird point count survey and marsh monitoring (2018)
- Common Nighthawk survey (2018)

The fall bird migration survey consisted of 23 line transects and 2 vantage point watch count stations (i.e., one at the Boat Harbour lagoon and another at the outlet). Dedicated surveys were conducted from September to November 2017 for a total of eight visits within the Project Area. Line transect surveys were conducted in the morning, starting at sunrise, and the vantage point watch counts were conducted in the afternoon. All bird species encountered (by ear or sight) at each location during the surveys were recorded on standard bird monitoring field forms. These surveys yielded the following results:

- Line transect surveys: 1,932 individuals (including incidental observations) were observed, representing 74 species. In total, 21 priority species were observed during fall migration surveys, of which one was a SAR: Eastern Wood-pewee.
- Diurnal vantage point watch count surveys: a total of 798 individuals (including incidental observation), representing 52 species, were observed. No SAR species were identified during these surveys, however several SOCC were identified, including the Semipalmated Plover, Least Sandpiper, Semipalmated Sandpiper, Willet, and Greater Yellowlegs.

The same vantage point watch stations used during fall migration were also used for the late winter/early spring raptor surveys. Diurnal vantage point watch count surveys were conducted in the morning at two stations on March 1 and March 27, 2018. Each point was surveyed once per visit for a period of two hours. All birds observed, species and number of individuals, within an unlimited



radius, were recorded. During these surveys, technicians encountered a total of 287 individuals, representing 30 species. One SAR, Evening Grosbeak, was observed during these surveys.

Call playback survey methodology was used at seven pre-determined stations to listen for nocturnal owls on February 28 and March 26, 2018. Three owl species were detected during the nocturnal owl surveys: Great Horned Owl, Barred Owl, and Northern Saw-whet Owl. None of the species detected were priority species.

Spring migration monitoring was completed on April 27 and May 14, 2018, to determine the presence of priority bird species within the Project Area. Two survey methods were employed: Line transect surveys and diurnal vantage point watches. The same line transects, vantage point watch stations and methods were used for spring, as for fall migration surveys. These surveys yielded the following results:

- Line transect surveys: 710 individuals (including incidental observations) were observed, representing 66 species. In total, ten priority species were observed during spring migration surveys, of which one is a SAR: Evening Grosbeak.
- Diurnal vantage point watch count surveys: a total of 273 individuals (including incidental observation), representing 42 species. In total, twelve priority species were observed during spring diurnal vantage point watch counts, of which one is a SAR: Barn Swallow (*Hirundo rustica*).

Two rounds of surveys for breeding birds were conducted on June 6-7 (early breeders) and July 26-28 (late breeders), 2018, at 46 point count stations within Project Area. Survey station locations were identified using stratified random sampling, to ensure proper habitat coverage and an unbiased estimate of relative densities of species within the Project Area. Surveys began at, or within, half an hour of sunrise and were completed within four-and-a-half hours or by 10:00 a.m., whichever came first. During the breeding season, 1,382 individuals (including incidental observations) were observed, representing 81 species. In total, 20 priority species were observed during breeding bird surveys, of which four were SAR: Eastern Wood-pewee, Bank Swallow, Evening Grosbeak and Canada Warbler.

The Marsh Monitoring Protocol, developed by Bird Studies Canada, was used in conjunction with the breeding bird survey to determine species composition and relative abundance within the Project Area, specifically in the large wetlands that have open water and emergent vegetation on the. A total of six marsh monitoring stations were surveyed. Sora was the only primary species observed during the dedicated survey periods.

One visit to survey for Common Nighthawks was conducted within one-week of the June full moon, which occurred on June 28, 2018. Six call playback stations were placed within suitable breeding habitat for Common Nighthawks within the Project Area. A total of eight Common Nighthawks were observed during the Common Nighthawk survey that took place on June 26, 2018.

5.1.4 Archaeological/Cultural Heritage Resources

Historically, A'se'k was a gathering place where food, knowledge and skills were exchanged between generations and amongst family groups. The land was traditionally used by the Mi'kmaq for



recreation, fishing, hunting and gathering, as well as for physical, mental, spiritual and emotional purposes.

To date, studies have consisted of background research and site reconnaissance with a goal of identifying any exposed archaeological features or other areas of potential archaeological sensitivity.

Archaeological assessment work including shovel testing in select areas was also completed. The Project Study Area contains known and potential sites of significance, recorded archaeological sites in the Provincial registry and potential for more sites. All aspects of the project planning carefully consider the known and potential sites with appropriate studies completed in any area where land disturbance has or will occur as part of the Project.

5.1.5 Economic and Social

Land in and around the Project Area is used for community living, water supply, sustainable forestry, and recreational activities. The 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. One of the land parcels owned by PLFN to the east of Boat Harbour has been 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. The land around Boat Harbour is used for recreational activities, including hiking and walking, and off-road vehicle use.

The MEKS has identified historical hunting, gathering, and aquatic recreation in the Study Area. Current use is limited mainly to fur-bearing creatures as species of harvest.

5.2 Changes Caused by Carrying Out the Project

As per the Guide to Preparing a Description of a Designated Project under the Canadian Environmental Assessment Act, 2012, a proponent is required to describe any changes that may be caused as a result of carrying out the designated project to:

- Fish and Fish Habitat, as defined in the *Fisheries Act*
- Marine Plants, as defined in the *Fisheries Act*
- Migratory Birds, as defined in the *Migratory Birds Convention Act*

The sections below provide an overview of the potential changes to the environment caused by carrying out the project in relation to fish and fish habitat, marine plants and migratory birds. The remediation activities proposed would effectively reduce or eliminate the potential for unacceptable risk of contaminants to ecological receptors by removing the exposure pathway, however, it would cause potential short-term impacts to the existing habitat including, changes to fish and fish habitat, as defined in the *Fisheries Act*; marine plants, as defined in the *Fisheries Act*; and, migratory birds,



as defined in the *Migratory Birds Convention Act*, 1994. It should be noted that as the overarching proposed Project is the remediation of BHETF and subsequent return to a tidal estuary condition, the long-term changes to the environment (including fish and fish habitat, marine plants, and migratory birds) will be positive.

In relation to the portion of the overarching project that is subject to the Regulation Designating Physical Activities under CEAA2012, one of the main concerns with respect to potential short-term effects to the environment is related to placing and storing of the impacted dredged sediment within the existing sludge disposal cell. As detailed in Section 2.3.1 during remediation, the impacted sediment and materials will be removed from the natural environment and stored within the existing sludge disposal cell. The expansion of the existing sludge disposal cell and the modifications to the leachate collection and sludge disposal cell base liner system as detailed in Section 2.3.1 will allow for the controlled and effective management of the impacted sediment and materials that is classified as hazardous waste. The placement and storage of the impacted sediment in the nearby existing sludge disposal cell helps to facilitate a shorter timeline for remediation than if the waste needed to be removed to other facilities that are not yet designed or permitted. As a result, contaminants will be removed from environment sooner allowing for natural ecological process to be restored faster. Impact management measures will be implemented to reduce the potential impacts of the placement and storage of hazardous waste-bearing sediments. Impact management measures related to surface water quality will include conveying and directing surface water runoff from the sludge disposal cell to the overflow pond, which will be converted to a lined stormwater management pond and minimizing the potential for on-Site erosion and sediment loading to downstream water courses and water bodies.

Following the remedial program, groundwater monitoring and sampling will be completed in all monitoring wells. A minimum of two sampling events, one during seasonally high and one during low groundwater levels, will be completed. Based on the results of these sampling events, additional monitoring may be recommended.

5.2.1 Fish and Fish Habitat, as Defined in the *Fisheries Act*

As noted above, an aquatic habitat assessment was completed in August and September of 2017 for the Study Area. A total of 19 watercourses were identified: 2 ephemeral channels, 13 intermittent channels, 3 small permanent channels, and 1 large permanent channel. Three small drainage corridors were also identified on site. Of the 19 watercourses identified, only 13 watercourses were assessed, as six of the identified watercourses were dry.

Fish species were visually observed in two of the watercourses on site, but only one of the two encounters resulted in a positive species identification (Three-spined Stickleback). Although the water temperature and pH levels at the BHETF site were within the range acceptable to support salmonid species, the majority of watercourses at the site lack the appropriate physical habitat features to sustain populations of adult salmonid species, such as Brook Trout. In addition, due to areas with large amounts of contaminated sediments at the BHETF site that require remediation, the overall quality of fish habitat is anticipated to be poor.

With respect to potential effects from the sludge disposal cell, off-site deposition of fugitive dust, spills, and discharge of contaminated groundwater or surface water into waterbodies may cause effects to fish by introduction of contaminants that may interact with fish and fish habitat quality.



However, based on the proposed upgrades to the sludge disposal cell base liner system, the leachate collection system, and surface water management pond, limited interactions between water on site (sludge disposal cell) and surface water bodies with fish and fish habitat will occur. Best management practices during the operation of the facility will ensure limited effects from a fugitive dust and spills perspective. Further, as part of the remediation process, the DFO has noted that fish in Boat Harbour are likely to have genetic and/or tissue impairments and therefore may need to be removed and euthanized. Removing the fish at the BHETF site from the food chain would prevent the potential for bioaccumulation of contaminants in the predators of fish. If it is determined that the existing fish have to be removed and euthanized, the effect that the Project's activities, including the placement and storage of the impacted sediment would have on fish would be inconsequential.

The marine environment within the Study Area, consists of the Boat Harbour Estuary, which flows into the Northumberland Strait, which is directly adjacent to the Study Area. Various marine species, including fish and shellfish, depend on the diverse habitat the Northumberland Strait provides. The Northumberland Strait is considered to be an important feeding and foraging area within the Atlantic Ocean. Of particular note, is the sandy substrate of the Pictou Road section of the Northumberland Strait which provides significant foraging habitat for some marine species with at least eight species at risk having been identified in that portion of the Strait. DFO has noted an interest in the potential effect of the Project on the fishery in Northumberland Strait once the dam is removed, the level of "clean" to be reached through the remediation, the discharge rate during remediation, and sediment transport. Further assessments and consultation with DFO will occur to determine the extent of potential impacts to the surrounding marine environment and suitable impact management measures.

The remediation and restoration of BHETF site and subsequent return to a tidal estuary condition, will provide positive long-term changes to fish and fish habitat within the Study Area.

5.2.2 Marine Plants, Defined in the Fisheries Act

With respect to potential effects from the sludge disposal cell, off-site deposition of fugitive dust, spills, and discharge of contaminated groundwater or surface water into waterbodies may cause effects to marine plants by introduction of contaminants that may interact with marine plants. However, based on the proposed upgrades to the sludge disposal cell base liner system, the leachate collection system and surface water management pond, limited interactions between water on site (sludge disposal cell) and surface water bodies with marine plants will occur. Best management practices during the operation of the facility will ensure limited effects from a fugitive dust and spills perspective

From a broader perspective, other overarching project components may affect marine plants. Marine plants within the Boat Harbour Estuary have the potential to be directly impacted through Project activities, such as the possible dredging of the estuary. A Human Health and Ecological Risk Assessment is currently being completed to determine the necessity of dredging within the estuary. Marine plants growing within pipeline corridor that crosses the East River also have the potential to be directly impacted through decommissioning of the pipeline.

Where possible, best management practices will be implemented to mitigate potential effects to marine plants. Disturbed habitat will be monitored to ensure it is reestablished naturally or through the implementation of a vegetation planting plan, which would include efforts specifically targeted to



marine plants suited for tidal estuary conditions. This would be completed in consultation with DFO and other university research advisors to the Project.

Although there is a possibility for potential short-term impacts to marine plants, the proposed remediation of BHETF site, will address the sediment contamination, which will greatly improve the overall health of the marine habitat. Therefore, it is expected that the long-term effects of the Project will result in a positive change to marine plants within the Boat Harbour Estuary and the adjacent areas of the Northumberland Strait.

5.2.3 Migratory Birds, as defined in the *Migratory Birds Convention Act*

As stated in Section 5.1.3, the following baseline assessments for birds were completed from September 2017 through July 2018:

- Fall migration monitoring (2017)
- Late winter and early spring bird survey (targeting raptor surveys) (2018)
- Spring migration monitoring (2018)
- Breeding bird point count survey and marsh monitoring (2018)
- Common Nighthawk survey (2018)

The methods and results of the baseline assessments are discussed in detail in Section 5.1.3. There were high number of individuals and a variety of species of migratory birds including a number of priority species that were observed within the Study Area. Priority SAR bird species included: SARA Endangered – Barn Swallow, Canada Warbler and Piping Plover; SARA Threatened – Common Nighthawk and Olive-sided Flycatcher; SARA Vulnerable – Bobolink and Eastern Wood-Pee-wee; COSEWIC Threatened – Bank Swallow and Wood Thrush; and COSEWIC Special Concern – Evening Grosbeak.

To mitigate potential impacts to waterfowl and other migratory birds, the construction activities may be limited to late summer or early winter months. These seasonal periods are typically not considered sensitive spawning/breeding/nesting periods and also generally coincide with dry periods which would limit dewatering requirements.

Since construction activities would be planned to occur outside of sensitive spawning/breeding/nesting periods short-term effects to migratory birds are not anticipated. Furthermore, the long-term effects of the Project will potentially result in a positive change to the breeding and nesting habitat for migratory birds within Study Area.

Based on proposed construction and development method of the sludge disposal cell (vertical increase only), no vegetation removal is anticipated, thereby ensuring no effects to migratory bird habitat (i.e. removal of habitat).



5.3 Changes to Federal Lands and Interprovincial/ International Effects Caused by Carrying Out the Project

The following section discusses potential changes to the environment that may occur, as a result of carrying out the Project, on federal lands, in a province other than the province in which the project is proposed to be carried out, or outside of Canada.

While some of the project components are located within and will interact with Federal lands, the sludge disposal cell itself (which relates to the designated physical activity under the Regulation) is not located on Federal lands. With respect to potential effects from the sludge disposal cell, on Federal lands, in a province other than the province in which the project is proposed to be carried out, or outside of Canada, off-site deposition of fugitive dust, spills, and discharge of contaminated groundwater or surface water into waterbodies may cause effects. Based on the proposed upgrades to the sludge disposal cell base liner system, the leachate collection system and other associated infrastructure, limited interactions between federal lands and the sludge disposal cell are anticipated to occur. Best management practices and monitoring programs will be implemented to mitigate the potential effects caused by the placement and storage of the impacted sediment in the existing sludge disposal cell to the nearby federal lands. The sludge disposal cell and associated infrastructure will be inspected on a regular basis and repairs completed as needed.

As previously noted, PLFN is located on the banks of Boat Harbour, within the Project Study Area, and has been granted Indian Reserve Lands which are federal crown lands. It is expected that PLFN will have a role in the long term monitoring of the facility with abundant local resources being available (earthworks contractors for example) to assist in any issues that arise.

In addition, the anticipated long-term environmental changes resulting from carrying out the Project on PLFN lands are positive, as the remediation of Boat Harbour will address the current sediment contamination and enable the return of Boat Harbour to a tidal estuary. This will allow the land to be re-established as an area used for traditional recreation, fishing, hunting and gathering, as well as for physical, mental, spiritual and emotional purposes by the Mi'kmaq. Additional information related to effects of the Project on the federal lands that were traditionally occupied by PLFN is discussed in Section 5.4.

Indigenous Services Canada approval, in conjunction with Pictou Landing First Nation's consent by Band Council Resolution, is required for access to and the conducting of assessments, investigations and any remediation activity on federal crown lands. Indigenous Services Canada has granted approvals for access to three Indian Reserve Lands adjacent to Boat Harbour during the planning period and further approvals will be required for the remediation implementation. NS Lands is working directly with Indigenous Services Canada to meet associated regulatory compliance matters.

With respect to other project components, the Northumberland Strait, and the ocean within 12 nautical miles of the coast, is also federal land. An oceanography/marine survey will be undertaken as part of this Project to identify potential effects to coastal waters. Potential effects as a result of the Project to the Northumberland Strait and the ocean within 12 nautical miles including the demolition of the dam structure would be mitigated through the implementation of impact management measures. However, potential effects caused by the placement and storage of the



impacted sediment (which relates to the designated physical activity under the Regulation) are not anticipated due to the large distance between the sludge disposal cell and the federal land.

5.4 A Description of the Effects on Aboriginal Peoples

As noted in Section 3.2.4 and by the MEKS, the PLFN is a Mi'kmaq First Nation located at the mouth of Pictou Harbour on the Northumberland Strait of Nova Scotia.

The placement of liquid wastes in the wetlands and former saltwater estuary known as A'se'k was done without full and informed consent of the PLFN. Impacts of the loss of the area for gathering, harvesting and recreation was devastating to the community and its lasting use is highly negatively impactful on the social, economic and health aspects of the community.

Remedial efforts to remove the impacted sediment and material to the placement and storage facility may have short-term impacts to the community through increased noise, light and potentially odours. All of these possible negative aspects will be mitigated through techniques typical of construction and sludge removal projects and are anticipated to be effectively managed. Close communication with PLFN during this period will occur and a comprehensive air monitoring program will be completed for the community.

The loss of A'se'k over 50 years ago was devastating to the community. The secure management of the impacted sediment and materials may not completely mitigate this issue but a clean Boat Harbour is a positive improvement over existing conditions. See below for other positive aspects of the long-term management of the wastes in the vicinity of the community as opposed to farther afield. In community work over the long-term to monitor perceptions of the storage facility is planned and mitigation of potential impacts may be achieved through information sessions, healing sessions, involvement in the monitoring of the facility and increasing comfort level with the engineering safeguards and transparency with the environmental monitoring data. NS Lands recognizes that a long-term comprehensive process of community restoration will be needed after the placement and storage of impacted materials is complete.

The placement and storage of the wastes in the existing sludge disposal cell combined with effective management and a comprehensive long-term monitoring program will positively effect PLFN. The placement and storage of wastes in the nearby existing sludge disposal cell helps to facilitate a shorter timeline than if the waste needs to be removed to other facilities that are not yet designed or permitted. Significant economic benefits will occur during the removal and placement of the material in the sludge disposal cell through employment and use of local goods and services. After placement in the storage facility PLFN will have an ongoing role with long-term monitoring, habitat and species (marine plant, marine animal) restoration efforts in A'Sek, wetlands restoration, land development for economic purposes and other programs not yet envisioned in and around the storage facility.

The relationship of PLFN to their traditionally occupied lands and waters, and the importance of continued engagement with PLFN in the planning and design phases of the proposed Project to restore A'se'k is recognized. In this regard, the Project's effects on health, socio-economic conditions, and physical and cultural heritage as a result of changes caused through remedial efforts resulting in the placement and storage of hazardous materials are net positive in relation to PLFN and therefore the broader Mi'kmaq and indigenous communities in Nova Scotia.



6. Proponent Engagement and Consultation with Aboriginal Groups

6.1 Overview of Treaty Rights History

Traditional Lands

Historically, A'se'k was a gathering place where food, knowledge and skills were exchanged between generations and amongst family groups. The land was traditionally used by the Mi'kmaq for refuge, recreation, fishing, hunting and gathering, as well as for physical, mental, spiritual, and emotional purposes.

Treaty of 1760

In 1760, the British Crown entered into a treaty with the ancestors of the Pictou Landing First Nation. This treaty implicitly recognised the right of the ancestors to occupy, hunt, fish, gather and harvest on lands within their territory including lands at A'se'k.

Promises of Legal Protection for Land

In 1761, at a treaty ceremony, Lieutenant Governor Jonathan Belcher, later the first Chief Justice of Nova Scotia, assured the ancestors of the Pictou Landing First Nation that the laws of England would protect their rights and property. In the same year a Royal Proclamation was issued in Nova Scotia acknowledging that the ancestors of the Pictou Landing First Nation had made a claim to all land along the northeastern shore of Nova Scotia, including the area around A'se'k, and forbidding any settlement in the area. The Royal Proclamation of 1763 in Nova Scotia made it unlawful for the local government to grant any interest in land that had not been ceded or surrendered to the Crown in accordance with the Proclamation.

Failure of the Law to Protect Treaty and Aboriginal Rights to Land

Despite the treaty of 1760, the assurances given by Lieutenant Governor Belcher, the Royal Proclamation of 1761, the Royal Proclamation of 1763 and the fact that no land had been ceded or surrendered by the ancestors of the Pictou Landing First Nation, settlers began settling in the area around A'se'k beginning in 1777.

Indian Cross Point Burying Grounds

Soon all of the land in the area was the subject of a Crown grant except for roughly 30 acres (12.25 hectares) of land containing burial grounds of the ancestors of the Pictou Landing First Nation on the eastern shore of the East River a few kilometres from A'se'k.

Settlers soon made claim even to the Burying Grounds. In 1784 two chiefs granted a deed to one acre of the Burying Grounds directly to James Carmichael in a transaction that failed to comply with the surrender provisions of the Royal Proclamation of 1763.

In the meantime, the ancestors of the Pictou Landing First Nation continued to live in the area around A'se'k despite the Crown grants to settlers. For over fifty years they continued to occupy, hunt, fish and gather and harvest an area near A'se'k.



Without any recognized territory, the ancestors of the Pictou Landing First Nation petitioned the government to acquire lands from the settlers near A'se'k to be set apart for their exclusive use as had been done in other parts of the Province. Without any land base at all, many were destitute and relied on the Province for their subsistence. Subsequently, in 2014 the Province of Nova Scotia funded purchase of 25.5 acres of Burial Ground to be held as fee simple by PLFN. This was meaningful to PLFN in the interest of identification and protection of Indian Cross Point Burying Grounds.

50 Acres of Land

In 1864 the Province finally acquired 50 acres (20.23 hectares) of land near A'se'k (using "Indian money" from the sale of "Indian lands" in Cape Breton) and set it apart for the exclusive use and enjoyment of the ancestors of the Pictou Landing First Nation, who numbered 159 at the time.

Over time the Pictou Landing First Nation built homes and other buildings on their lands.

Plans for a Pulp Mill

In or around 1965 Scott Maritimes decided to build the Mill at Abercrombie Point several kilometres away from A'se'k on the western side of the East River; with effluent being treated at Boat Harbour. The decision to use Boat Harbour for effluent treatment was led by the Province of Nova Scotia. When completed the Mill would discharge up to 25 million gallons (95,000 m³) of wastewater per day as a by-product of the pulping process. Other local industry also discharged effluent into Boat Harbour.

6.2 The Impact Area

The PLFN is a Mi'kmaq First Nation located at the mouth of Pictou Harbour on the Northumberland Strait of Nova Scotia. PLFN has a long standing history of concern related to the discharge of untreated and later pre-treated effluent from the nearby Kraft Pulp Mill to Boat Harbour (A'se'k). Furthermore, PLFN was instrumental in negotiating a timeline with the Province of Nova Scotia to close the BHETF. The timeline to close Boat Harbour to effluent from industry on January 31, 2020 became enshrined in the *Boat Harbour Act*.

Through implementation of BHRP, it is understood that it is PLFN's hope that A'se'k be restored to allow the Band to re-establish its relationship with the water and land of A'se'k. With this in mind, the Boat Harbour Remediation Project Team recognizes the relationship of PLFN to their traditionally occupied lands and waters, and the importance of continued engagement with PLFN in the planning and design phases of the proposed Project to restore A'se'k. First Nation engagement is an essential component of the overall Project and specifically, the Environmental Impact Assessment process. All Project stakeholders are cognizant that without goals, objectives and a strategic plan, effective, efficient, and meaningful engagement with PLFN could not be carried out.

6.3 PLFN Community Engagement, Participation and Consultation

As Chief of PLFN, Andrea Paul has the delegated authority of the Nova Scotia Mi'kmaq to speak on Boat Harbour. As such, engagement, consultation and Mi'kmaq participation in the Project is focused on the PLFN community.



The PLFN engagement strategy was designed to establish a positive working relationship with PLFN based on mutual trust and respect; to enhance Nova Scotia Lands' Project Team and contractors' understanding of the PLFN community members' significant connection to the former tidal estuary (A'se'k); and, to identify the importance and potential impacts and benefits resulting from clean-up of the contaminated site.

Informal consultation (engagement) on the development of the remediation plans for the Project has been ongoing since early 2015. This is being carried out with direction from provincial guidance documents, including "A Proponent's Guide to Environmental Assessment", and Proponents' Guide: THE ROLE OF PROPONENTS IN CROWN CONSULTATION WITH THE MI'KMAQ OF NOVA SCOTIA (November 2012). Formal consultation was initiated by NS Lands with PLFN and the Mi'kmaq of Nova Scotia under the August 31, 2010 Mi'kmaq-Nova Scotia-Canada Consultation Terms of Reference in April 2018.

Engagement during Project planning is a joint effort between NS Lands, PLFN Community Liaison Coordinator, and GHD (the Project Team). On a broader perspective, engagement activities have regularly reached out to the entire PLFN community and to all NS Lands contractors and service providers who are involved in Project activities.

Engagement activities will be adapted as the Project progresses to best meet the interest of the PLFN community. The Project Team is cognizant that engagement is based on the principles of mutual respect, early engagement, openness and transparency and adequate time to review and respond to Project plans and emerging Project issues.

The Proponents' Guide on Crown Consultation identifies the following steps in the engagement process:

Step 1 - Notify Mi'kmaq Early in the Development Process – NS Lands initiated meetings with the PLFN community, which included formative discussions on remediation planning in late 2014 and convened the Boat Harbour Cleanup Committee (BHCC) in early 2015 following the enactment of the Boat Harbour Act. The BHCC meets monthly (on average) and includes representatives from Nova Scotia and the Pictou Landing First Nation and collaborates with and engages the community on planning for the cleanup work. It is anticipated that this committee will be active in the cleanup planning stage through to cleanup completion.

Step 2 – Provide as Much Information as Possible – The Project Team has initiated and supported extensive PLFN engagement activity as laid out in the following Section 6.6. PLFN Engagement, Participation and Informal Consultation Activities.

Step 3 – Meet with the Mi'kmaq Community(s) – As previously noted, PLFN Chief Andrea Paul is the delegated representative of the Nova Scotia Mi'kmaq regarding the Boat Harbour Remediation Project. As such, engagement, consultation and Mi'kmaq participation in the Project is focused on the PLFN community. Engagement with the PLFN community began in late 2014 and has continued frequently and regularly since that date.

In April 2018, all Nova Scotia Mi'kmaq communities were contacted pursuant to formal consultation requirements as laid out in the August 31, 2010 Mi'kmaq-Nova Scotia-Canada Consultation Terms of Reference. In formal correspondence, in addition to a summary of Project plans, the communities were provided with a copy of the Preliminary Project Description Document (GHD 2018). The



communities were asked to advise NS Lands whether they are interested in consultation on this Project; whether they have concerns, including the details of any asserted Aboriginal or Treaty rights that could be adversely impacted by this Project.

Step 4 – Complete a Mi'kmaq Ecological Knowledge Study (MEKS) - A Mi'kmaq Ecological Knowledge Study, or a Traditional Ecological Knowledge Study (TEKS), was developed by Membertou Geomatics Solutions with regards to the proposed Project. The MEKS was finalized in June 2018. The MEKS mandate considered land and water areas in which the proposed properties contained within the proposed Project are located and identified what Mi'kmaq traditional use activities have occurred, or are currently occurring within, and what Mi'kmaq ecological knowledge presently exists regarding the area. Membertou Geomatics Solutions noted that, to ensure accountability and ethical responsibility of the MEKS, the MEKS development has adhered to the "Mi'kmaq Ecological Knowledge Protocol, 2nd Edition". This protocol is a document that has been established by the Assembly of Nova Scotia Mi'kmaq Chiefs, which speaks to the process, procedures and results that are expected of a MEKS.

Step 5 – Address Potential Project-Specific Impacts - Section 6.6 PLFN Engagement, Participation and Informal Consultation Activities outlines many engagement activities for which the purpose was to consider PLFN concerns and issues on potential Project specific impacts. From a Project governance perspective, the Boat Harbour Cleanup Committee, meets monthly and includes an agenda covering Project concerns, issues and participation opportunities. PLFN community representatives also sit on the Boat Harbour Environmental Advisory Committee, which meets monthly to discuss scientific, technical and regulatory planning issues. This forum includes academic advisors and federal and provincial regulators and PLFN community representatives are an active voice at the table in discussing Project issues and potential impacts on the PLFN.

The impact of the use of the sludge disposal cell constructed adjacent to Boat Harbour for the long-term containment of the sludge from the Boat Harbour site appears to be the issue of most concern to the PLFN community members. Since 2017, the Project Team has been open and transparent about possibility of the selection of this site; the regulatory issues around its use; the risks associated with alternative sites; the engineering integrity of sludge disposal cells; and, specifically the performance and integrity of this sludge disposal cell. A comparative analysis of the use of this sludge disposal cell versus alternatives was presented and discussed with the Boat Harbour Cleanup Committee. The issues of use of this sludge disposal cell and the engineering integrity of sludge disposal cells were discussed at an open community meeting and at five separate focus groups with elders, youth, men, women, and a combined session.

The comparative analysis, the concerns of the PLFN community and the Project Team's analysis were considered in the executive direction set for the Project, which includes use of the sludge disposal cell constructed adjacent to Boat Harbour. This direction sees use of the sludge disposal cell for the containment of sludge removed from the Boat Harbour site with capping of the sludge disposal cell at Project completion. This direction also contemplates the direct involvement of the PLFN community in the long-term maintenance and monitoring of the sludge disposal cell by way of development and funding of a First Nations' entity for this activity. Notwithstanding that direction, the responsibility and accountability for the long-term maintenance and monitoring and for any future liabilities with respect to the sludge disposal cell will always rest with the Province of Nova Scotia.



Step 6 – Document the Engagement Process - The engagement process continues to be well documented by both NS Lands and the PLFN Community Liaison Coordinator.

Project Benefits to the PLFN Community - While there is not a Project specific Benefit Agreement, NS Lands has taken proactive measures to fund the direct participation and engagement of the PLFN community in the Project. These activities are laid out in Section 6.6 PLFN Engagement, Participation and Informal Consultation Activities. While the Project is not a resource development project with associated revenue sharing opportunities, NS Lands engagement, participation and informal consultation activities are intended to establish good will and positive relationships among Mi'kmaq, the government proponent and industry. The Project also strives to realize other beneficial outcomes, including training and skills development, direct participation in Project employment opportunities and other associated financial benefits.

Through PLFN engagement in the collaborative planning/decision making process, approaches for mutually beneficial Project implementation, including meaningful employment opportunities are continually identified. PLFN members have been involved in field programs for the environmental site assessment (ESA) and baseline studies (EBS) carried out by GHD. All consultants on the Project for the ESA and EBS programs provided opportunities for employment and shadowing through PLFN's community liaison contact for the BHRP. NS Lands has engaged four Nova Scotia universities to conduct applied research projects to assist with scientific assessments of the Boat Harbour site and in almost every project there has been PLFN community member participation in roles as field guides, project operational support or research assistants. From a procurement perspective, there is a requirement for all contractors and consultants interested in work on the Project to present a PLFN engagement plan and workplan as an evaluated component of their proposal submission.

This approach will continue through other phases of the Project.

6.4 List of Contacts

The following stakeholders make up the Boat Harbour Cleanup Committee (BHCC) and have been consulted to date. Additional stakeholders will be added to this list throughout the duration of the Project.

- Chief Andrea Paul, PLFN
- PLFN Council
- Michelle Francis-Denny, PLFN Community Liaison Coordinator, with assistants Sosep Hatfield and Tracy Denny
- Lucie Francis, PLFN
- Kim Strickland, PLFN
- Don Francis, PLFN Elder
- Will Prosper, PLFN Elder
- Sheila Francis, Native Women's Association
- Ken Swain, NS Lands



- Angela Swaine, NS Lands
- Jo Ann Fewer, NS Lands
- Donnie Burke, NS Lands
- Darren Lawless, NS Lands
- Justin Huston, NS Office of Aboriginal Affairs
- Ian Bower, NS Office of Aboriginal Affairs

6.5 Community Liaison Coordinator

Part of Nova Scotia Lands' engagement strategy includes a Community Liaison Coordinator (CLC) from PLFN being funded by the Project. The CLC has been active in a community liaison role full time since April 2016, with a focus on providing Project information and facilitating two way Project information flow. In addition to the full time CLC, two positions are being funded to assist the CLC in the coordination of community events and documenting engagement.

The CLC performs an important function of getting information out to the community and coordinating the response to any questions from information circulated. A Facebook page has been established for members of PLFN only. This is a primary means for information exchange. Reports, updates, meeting summaries, questions and answers and opportunities for training and employment are all posted to this page by the CLC. No one outside the PLFN community has access so it is a "safe place" to comment and ask questions. The CLC provides a quarterly summary to NS Lands regarding the postings, however all member comments and questions are kept anonymous, confidential to the CLC.

The CLC prepares a quarterly newsletter, called A'se'k News, for PLFN. It is a summary of recent activities and updates associated with the Project. Paper copies of the newsletter are delivered door to door to each home in PLFN. An electronic version is posted to the Facebook page.

NS Lands supports and funds a storefront space at the PLFN Band Office where the latest paper copies of information and reports on the Project are available. This is kept up to date by the CLC.

The CLC is also responsible to maintain a skills database (resumes) for community members and identify candidates for employment, training and mentoring opportunities.

6.6 PLFN Engagement, Participation, and Informal Consultation Activities

In addition to BHCC meetings noted above, several community dinners and open houses were held since 2015 to exchange information on Project plans and to answer PLFN community members' questions and to hear and address their concerns. The goal was, and is to continue, to gain a better understanding of the Project, suggestions for engagement strategies, potential interested stakeholders and any concerns and suggestions to be considered in plan development.

Two sessions noted below provided the Project Team with a better appreciation of the context for A'se'k and its history and importance to PLFN. The engagement strategy session was a valuable



exercise to discuss in open terms the positive and negative aspects of past communications programs and tools used with PLFN.

Table 6.1 Engagement Meetings

Cultural Awareness Session in PLFN June 15, 2017 Overview of Attendee List	PLFN Engagement Strategy Meeting June 16, 2017 Attendee List
Chief Andrea Paul, PLFN Michelle Francis-Denny, PLFN Barry Francis, PLFN Council Sheila Francis, Native Women's Association Don Francis (Elder) Sarah Francis (Elder) PLFN Community members (participating and presenting) Representatives from NS Lands Representatives from GHD Representatives from the Universities	Chief Andrea Paul, PLFN Michelle Francis-Denny, PLFN Barry Francis, PLFN Don Francis (Elder) Sheila Francis, Native Women's Association Ken Swain, NS Lands Angela Swaine, NS Lands Jo-Ann Fewer, NS Lands Christine Skirth, GHD Blair Shoniker, GHD Peter Oram, GHD
Engagement and Communications Outcomes and Asks	
<ul style="list-style-type: none"> • What does A'se'k mean to PLFN? • How was it used before it became part of the treatment system to manage effluent from the mill? • What are NS Lands' and GHD's roles? • What is the desired level of engagement? • What are some of the engagement tools and techniques that have worked well in the past? 	

The sessions noted above provided the Project Team with a better appreciation of the context for A'se'k and its history and importance to PLFN. The engagement strategy session was a valuable exercise to discuss in open terms the positive and negative aspects of past communications programs and tools used with PLFN.

A'se'k Socials

"A'se'k Socials" are a frequent face-to-face component in the PLFN Engagement Strategy throughout the course of the Project.

The primary purpose of these events is to meet with PLFN community members on a regular basis to discuss the Project to date, disseminate Project information and answer questions. To create a sense of comfort with the Project and Project staff, meetings are informal in structure, promoting a discussion oriented gathering and sharing of information rather than a formal presentation.

The A'se'k Socials are held at the PLFN Community Centre, or other locations as needed, monthly. Summary notes and questions and answers are prepared by the CLC Team and are posted to the Facebook page for viewing by community members.

Topics have and will continue to develop naturally over the course of the Project, so flexibility with monthly content is necessary and geared towards participant interests and concerns and where we are situated in the Project's life cycle. Examples of some topics to date include:

- Remediation Options for Boat Harbour

- Employment Opportunities
- Pilot Testing
- Sludge Disposal Cells
- Wetlands Remediation
- Contaminants in the Sediment
- Health and Safety for Workers on Site

Education Envisioning Workshops

Working with NS Lands, PLFN and the local school system, Educational Workshops are being planned to engage and empower youth to learn about the history of A'se'k and imagine the long-term potential of the Project and what it means for PLFN. Youth engagement empowers young people to have a voice in the decisions that affect them. It not only informs them about the Project, but these initiatives help develop leadership, community organizing and decision making skills and encourage young people to develop their full civic potential.



These workshops, held in classrooms within local schools or at the PLFN Community Center, will utilize a selection of youth engagement techniques such as in-class presentations, art-sessions, games, and other mediums of input gathering. Content will be developed and tailored for each age group to ensure information is relevant and techniques are appropriate to the specific age group.

Collaboration between NS Lands and PLFN is ongoing to determine the structure and scope of these workshops. Further clarity on the types of education engagement, frequency, audience and other variables are being developed.

Sludge Disposal Cell Focus Groups

A total of five focus group sessions were held in PLFN in September and October 2018. Separate sessions were targeted at elders, youth, men, and women, and one session was open to all. They were intended to explain how sludge disposal cells are constructed and operated. Each two-hour session included a presentation and time for questions and answers.

Employment and Mentoring Opportunities

As part of an effort to include community members in as many possible hands-on engagement experiences as possible, the Phased ESAs and Environmental Baseline Studies, as well as the independent applied research, scientific studies being carried out by four Nova Scotia Universities, provided an opportunity for PLFN community members to get hands-on experience in gathering samples as a form of further involvement, knowledge building, and career development.

The Project Team worked with PLFN to identify PLFN community members who have an interest in participating in sampling efforts with hands-on participation and/or coaching.

To date PLFN members have participated in the following activities:



- Advancement of boreholes and monitoring well installation
- Sample collection including soil, water and sediment
- Archeological shovel testing
- Surveying
- Wetland delineation and characterization
- Baseline biological monitoring

An Opportunities Fair was sponsored by NS Lands in March of 2018 to discuss future potential job opportunities on the Project for PLFN community members. The types of jobs that will be available were discussed as well as the willingness of NS Lands to sponsor training for community members wanting to ready themselves for the upcoming work.

On October 2, 2018, a job fair was hosted in PLFN by the pilot scale testing contractor, Sanexen Environmental Services Inc. Sanexen has committed to hiring PLFN community members to participate in the pilot scale testing work.

Direct employment opportunities realized by PLFN community members to date on the Project include:

- Field guides for GHD staff
- Boat and captain services for much of the in-water survey work
- Two PLFN summer students participated in scientific data collection alongside Acadia University students
- Participating in interviews for the MEKS
- Brush clearing services
- Catering services
- Heavy equipment operators during construction of the Cove 1 berm
- Heavy equipment operator and labourer during construction of the pilot works infrastructure
- Secondment to Stantec, the Independent Air Monitor hired by NS Lands to provide air monitoring services prior to and during the pilot work

Education and Training Opportunities

NS Lands has been working through the CLC to identify PLFN community members who are interested in training to ready themselves for positions that will be available during full scale remediation. To date NS Lands have supported tuition, accommodations, living allowances and child care expenses (in one instance) for 12 Safety Certified Labourers, one diploma in Environmental Health and Safety, one Earthmoving Operator and two Heavy Equipment Operators.

NS Lands will continue to support training opportunities as they arise.



Land Use Planning

NS Lands is currently supporting PLFN in funding the development of a Land Use Plan for the lands surrounding Boat Harbour. The Province intends to offer the existing treatment facility property to PLFN following remediation. There may be opportunities to support the future site use plans during remediation construction.

Executive direction for the Project has also approved the exploration of a Project investment in development of future site use features which may contribute to long term economic development opportunities in areas including indigenous ecotourism and experiences. The direction points to consideration of a model consistent with the development of the Open Hearth Park as an outcome of the Sydney Tar Ponds and Coke Ovens Remediation Project.

7. Consultation

7.1 Contacted Stakeholders

The existing level of knowledge associated with the clean-up of Boat Harbour is high within Pictou County. The pipeline breach in 2014 and subsequent enactment of the Boat Harbour Act in 2015 were well reported and a high level of engagement by various communities and groups occurred prior to and subsequent to the Boat Harbour Act proclamation. Specifics related to the activities and remedial efforts schedule will need to be communicated but it should be recognized that the existing level of Project knowledge within the region is high.

7.1.1 Public

During the planning and regulatory processes relative to the approval of pilot scale testing activities, NS Lands has held three public meetings with the broader community in October 2016, April 2018, and May 2018. At these meetings, while there was a focus on the pilot scale testing activities, the general Project concepts and plans were presented and discussed.

NS Lands has also met regularly with industry stakeholders to explain and discuss Project direction and plans and has had discussions with the Northumberland Fishermen's Association to explain and discuss Project direction and plans.

Table 7.1 Table of Contacted Stakeholders

Date	Stakeholder	Means of Consultation
October 18, 2016	Northern Pulp Workforce	Presentation and Discussion
October 19, 2016	Public Meeting	Presentation and Discussion
October 20, 2016	Northern Pulp Workforce	Presentation and Discussion
December 12, 2016	Northumberland Fishermen's Association	Telephone Conference
October 5, 2017	Environmental Services Association Maritimes	Conference Presentation
April 4, 2018	Public Meeting	Presentation and Discussion
April 24, 2018	Northern Pulp Executive	Coordination Discussion Meeting



Table 7.1 Table of Contacted Stakeholders

Date	Stakeholder	Means of Consultation
May 12, 2018	Northern Pulp Executive	Coordination Discussion Meeting
May 15, 2018	Public Meeting	Presentation and Discussion
May 18, 2018	Environmental Services Association Maritimes	Site Briefing and Tour
June 19, 2018	Northern Pulp Executive	Coordination Discussion Meeting
July 31, 2018	Northern Pulp Executive	Coordination Discussion Meeting
September 5, 2018	Northern Pulp Executive	Coordination Discussion Meeting
October 17, 2018	Northern Pulp Executive	Coordination Discussion by phone

7.1.2 Aboriginal Groups

As noted in Section 6, above, NS Lands has had a robust engagement program for over 3 years in the planning and Project development stage with PLFN. This engagement includes a Community Liaison Coordinator from PLFN being funded and in community full time with a focus on providing Project information and facilitating Project information flow.

7.1.3 Agencies

A meeting was held on August 25, 2017 with representatives from the following agencies to introduce the Project and discuss their roles in the Project going forward (e.g., approvals, requirements, etc.):

- Nova Scotia Office of Aboriginal Affairs
- Department of Indigenous Services Canada
- Fisheries and Oceans Canada
- Canadian Environmental Assessment Agency
- Environment and Climate Change Canada
- Nova Scotia Environment
- Nova Scotia Transportation and Infrastructure Renewal
- Nova Scotia Department of Lands and Forestry
- Transport Canada
- Health Canada

A second Regulatory Workshop was held on December 6, 2017 with representatives from the agencies listed above.



7.2 Consultation Plan

7.2.1 Aboriginal Groups

NS Lands initiated formal consultation with the Mi'kmaq of Nova Scotia under the August 31, 2010 Mi'kmaq-Nova Scotia-Canada Consultation Terms of Reference, which included the provision of the Remedial Options Decision Document for their review. NS Lands received formal correspondence from the Mi'kmaq of Nova Scotia, because of the consultation, on May 31, 2018.

NS Lands then developed and presented specific remedial options relative to each Project component to the Nova Scotia Executive Council on August 9, 2018. The remedial options presented to Executive Council considered the Preliminary Draft Project Description, the positions laid out in the formal correspondence from the Mi'kmaq of Nova Scotia arising from the consultation, and the analysis of the Proponent Project Team. The project description detailed herein incorporates direction subsequently received from Nova Scotia Executive Council.

Formal consultation, specifically community information sessions have been held with further planned for 2019. Community-wide information session as well as discrete focus groups for members of PLFN have been held to present detailed concept descriptions and approaches. The intention is to engage the PLFN community in a discussion around the proposed concepts and allow room for feedback and input before decisions are implemented.

These events have generally followed a format where relevant technical or historical content of each approach is outlined using visual aids. The aim is to build capacity for a greater understanding of the complexity of the Project and gather buy-in from the PLFN community on the next phase of the Project.

Comments, concerns, questions and answers were recorded by the Pictou Landing First Nation Community Liaison Coordinator's office at a variety of venues over the period April 2017 to October 2018. These venues included a meeting in April 2017 on remediation in general; A'se'k Socials, which are topic specific, two hour open community meetings; and meetings to discuss the various remedial options for project components, including the waste management option of the sludge disposal cell adjacent to the site being the destination for containment of the waste consolidated from the Project activities.

Over the period April 2017 to present, it became apparent that the most significant environmental concern of the Pictou Landing First Nation community members is the waste management aspect of use of the sludge disposal cell adjacent to Boat Harbour. The use of the sludge disposal cell adjacent to Boat Harbour was the specific subject of a community meeting in Pictou Landing First Nation in June 2018. Subsequently, Pictou Landing First Nation Chief and Council leadership made a decision to hold four focus groups separately with Youth, Elders, Men and Women to discuss this matter. The four focus group meetings were held separately in September and October 2018. In addition, a fifth focused meeting was held on October 30, 2018 to enable any PLFN community members who missed the focus group opportunities to be informed on the issue of waste management. These meetings were an opportunity for GHD and the NS Lands Project team to present information on how sludge disposal cells are constructed, how they function, and how they are managed, maintained and monitored as well as to discuss the design and integrity of the sludge disposal cell adjacent to Boat Harbour.



It is important to note that meetings and discussions on remediation planning have been ongoing, on at least a monthly basis, since early 2016. As GHD and the Project Team have developed a better understanding of the site, through Phase 1 and Phase 2 and Supplementary Phase 2 Environmental Site Assessment, the information provided to the community, and the understanding of the community, has evolved.

The community is regularly updated on remediation planning and afforded opportunities for site tours as well as other briefings on the progress of remediation planning. Although not an environmental issue, the community is interested and supported in their direct participation in employment and business opportunities associated with the remediation activity.

Additional community sessions will also be planned as required. Formal and informal consultation with Pictou Landing First Nation and the Mi'kmaq of Nova Scotia will continue through to and after completion of the remediation activity.

On May 17, 2018, Chief Andrea Paul wrote Ministers MacKenna (ECCC) and Philpott (ISC) with her concerns on the impact of a CEAA assessment on timely implementation of the remediation.

7.2.2 Public

One public consultation session was held in 2016 and two public consultation sessions were held in 2018 in the community of Pictou Landing. Additional sessions will be held in conjunction with public consultation requirements pursuant to environmental assessment paths. NS Lands has developed a website to post Project information as the planning and remediation progresses (<http://novascotia.ca/boatharbour>).

Public Consultation Sessions

The information presented at the public consultation sessions along with the comments and responses to questions and concerns raised are summarized in Appendix C.

Northern Pulp Workforce and Northern Pulp Executive Meetings

The Northern Pulp Workforce meetings were held in October 2016 with attendance mandatory for management and employees of Northern Pulp. The purpose of the meetings was to explain the basics of the remediation project and to situate the planning process in the context of the site characterization, the approach to the remediation at the time as well as the remediation objectives. Following a presentation at each meeting, there was opportunity for the attendees to ask questions of the project representatives.

The Northern Pulp Executive Meetings have been held on a regular basis since April 2018 with senior executive of Northern Pulp and the Boat Harbour Effluent Treatment Facility management. The purpose of these meetings is to coordinate on-site planning activities, including pilot scale testing, to ensure that ongoing operations of the facility are not impacted by planning activities and to ensure effectiveness in implementing health and safety and environmental management plans.



Environmental Services Association Maritimes

A breakfast meeting and Site tour were held on October 6, 2017; and was intended to brief industry association representatives on project plans and schedules and to provide general information on upcoming project procurement requirements.

Northumberland Fishermen's Association

On December 12, 2016, the Project representative was contacted by the Association representative, Ron Heighton, for an update on the Project. At that point in time, discussions focused on the planning process and the project objective of an effective cleanup with the outcome of returning Boat Harbour to a tidal estuary. As well, it was emphasized that in order to do so the Project would be required to be in compliance with the federal Fisheries Act. A written summary and a briefing to the Association Board of Directors, to be provided at the Association's request and convenience, was offered. The Association has not requested any additional information. Other representatives of the Northumberland Fishermen's Association attended the public meetings in 2018 and actively participated in the meeting discussions.

The Nova Scotia Department of Fisheries and Aquaculture, Coastal Secretariat, asked that the Project team prepare a Project Overview for distribution to their industry stakeholders. The Project Overview provided to them in April 2017 is provided in Appendix D.

8. Summary

The Boat Harbour Effluent Treatment Facility (BHETF), located in north central Nova Scotia on the Northumberland Strait, was constructed in 1967 and reconfigured several times since its construction. The use of the BHETF for the reception and treatment of effluent from the Kraft Pulp Mill must cease no later than January 31, 2020, in accordance with the *Boat Harbour Act*. Boat Harbour, known as A'se'k in Mi'kmaq, was originally a tidal estuary connected to the Northumberland Strait and is currently a closed effluent stabilization basin, operating under a lease agreement with the Province by the Kraft Pulp Mill owner. Once operations have ceased, the Province will remediate Boat Harbour and lands associated with the BHETF and restore Boat Harbour to a tidal estuary. This is the subject of this study, referred to as the Boat Harbour Remediation Project (the Project or BHRP), for which Nova Scotia Lands Inc. (NS Lands) is the Proponent. The primary representative for the purpose of the Project Description is Angela Swaine, Senior Project Manager, who can be reached by email at Angela.Swaine@novascotia.ca.

The Study Area for the Project spans from the effluent pipeline, described above, from the first standpipe on the mill property, through existing and historic BHETF lands, Boat Harbour and its banks, extending to the Northumberland Strait. Land ownership is comprised of private, federal, and provincial ownership. The total Site is approximately 546 ha of which 141 ha is Boat Harbour. The Site and surrounding properties are not zoned, according to the (Draft) Pictou County Land Use By-Law, dated May 6, 2014. The southern portion of the PLFN land within the Study Area; however, is zoned as "Forest Management Area" and the northern portion, containing residences, is zoned "Residential", according to the Pictou Landing Band By-Law No. 1.



The nature and extent of contamination at the Site has been determined by GHD through the completion of Phase 1, 2 and supplemental Phase 2 Environmental Site Assessments, as well as a number of studies completed by others. The BHETF contains approximately 1,000,000 m³ of unconsolidated contaminated sludge/sediment including approximately 385,000 m³ unconsolidated sludge/sediment within Boat Harbour. Once consolidated through dewatering, the total dewatered sludge/sediment volume to be managed is estimated to be between 312,500 and 517,700 m³. For Project planning and approval purposes, the proponent will seek approval for a total capacity of 660,000 m³, which represents the air space available for the disposal of waste without expanding the footprint of the sludge disposal cell. The sludge is impacted with metals, polycyclic aromatic hydrocarbons (PAHs), and dioxins/furans (D&F). In addition to management of sludge/sediment, an estimated 5,700,000 m³ of water will need to be treated during remediation prior to discharge.

The remedial solution for the BHETF includes the following:

- Management of residual mill effluent within the BHETF
- Management and removal, treatment, and disposal of impacted sediments/sludge and dewatering effluent from former effluent ditch, twin settling basins, ASB, and Boat Harbour stabilization lagoon
- Risk management and/or removal, treatment, and disposal of impacted sediments/sludge in the natural wetlands and estuary
- Risk management and/or removal, treatment and disposal of impacted soil and surface water
- Vertical expansion, modification, use and closure of the existing sludge disposal cell
- Decommissioning of BHETF infrastructure including the pipeline, causeway, dam, and support facilities
- Restoration of Highway 348 including construction of a bridge in the location of the existing causeway

Bench scale testing has been completed to assess and determine applicable treatment methods; and pilot scale testing is ongoing to refine treatment methods, production rates and potential emissions during remediation. The proposed remediation activities are estimated to be completed in 5-7 years commencing in 2020.

Under the Nova Scotia *Environment Act*, Schedule A of the Environmental Assessment Regulations lists Designated Undertakings that will be subject to an Environmental Assessment. It has been determined by the Minister of Environment that the Project is a rehabilitation of an undertaking and is required to register as a Class II undertaking.

Under the *Canadian Environmental Assessment Act, 2012* (CEAA 2012), an environmental assessment may be required of designated projects. A designated project includes one or more physical activities that are listed in the Regulations Designating Physical Activities as well as any physical activity incidental to those listed physical activities. The current *Regulations Designating Physical Activities (which are subject to ongoing consultation and may change in the future)* includes the following Item that may apply to the proposed undertaking:



30. The expansion of an existing facility used exclusively for the treatment, incineration, disposal or recycling of hazardous waste that would result in an increase in hazardous waste input capacity of 50% or more.

The Project will involve the vertical expansion and refurbishment of an existing on-Site sludge disposal cell to accept sludge/sediment from BHETF. The existing sludge disposal cell was constructed and approved in 1995 to accept the sludge from the BHETF. The sludge disposal cell has received approximately 188,000 m³ of unconsolidated sludge to date (estimated 129,000 m³ once fully dewatered) and has been assessed as having functional integrity. It will require planned refurbishment for leachate collection and vertical expansion to increase air space available for the disposal of wastes generated during remediation.

Pictou Landing First Nation (PLFN) is a Mi'kmaq First Nation located at the mouth of Pictou Harbour on the Northumberland Strait of Nova Scotia. The Mi'kmaq people have a long-existing, unique, and special relationship with the land and its' resources which involves the use and conservation of natural resources and spiritual ideologies. PLFN has a long standing history of concern related to the effluent flowing from the Kraft Pulp Mill to Boat Harbour, known as A'se'k, that later became the site of the BHETF. PLFN was instrumental in negotiating with the Province of Nova Scotia to close the treatment facility, which was embodied in the *Boat Harbour Act* in 2015.

A Mi'kmaq Ecological Knowledge Study (MEKS) was conducted by Membertou Geomatics Solutions. Archaeological assessment work was also carried out. The Project Study Area contains known and potential sites of significance and recorded archaeological sites in the Provincial registry. All aspects of the project planning carefully consider the known and potential sites with appropriate studies completed in any area where land disturbance has or will occur as part of the Project.

Through the proposed remediation Project, it is PLFN's hope that A'se'k be restored to allow the community to re-establish its relationship with the water and land of A'se'k. In this regard, the Project's effects on health, socio-economic conditions, and physical and cultural heritage as a result of changes caused through remediation activities are net positive in relation to PLFN.

Preliminary discussion of potential federal funding has taken place and a provincial submission has been filed with Infrastructure Canada for funding under the Investing in Canada Infrastructure Program (ICIP). In support of the funding submission, Climate Change Resilience and Greenhouse Gas Mitigation Assessments were completed.

Environmental baseline studies were carried out to establish the physical and biological setting at the Site as part of the Environmental Assessment. The baseline study program was developed following a workshop with the regulatory agencies. Studies included: Land; Water; Terrestrial and Aquatic Ecosystems; Species at Risk Act (SARA) Listed Species; Terrestrial Habitat and Vegetation; Wetlands; Water Course/Aquatic Habitat; Mammals and Wildlife; Birds; Archeological/Cultural Heritage Resources; and Economic and Social.

The remediation activities proposed would effectively reduce or eliminate the potential for unacceptable risk of contaminants to ecological receptors by removing the exposure pathway. However, the remediation activities would cause potential short-term impacts to the existing habitat including, changes to fish and fish habitat, as defined in the Fisheries Act; marine plants, as defined in the Fisheries Act; and, migratory birds, as defined in the Migratory Birds Convention Act, 1994. It should be noted that as the proposed Project is the remediation of BHETF and subsequent return to



a tidal estuary condition, the long-term changes to fish and fish habitat, marine plants, and migratory birds will be positive.

One of the main concerns with respect to potential short-term effects to the environment is related to placing and storing of the impacted dredged sediment. The expansion of the existing sludge disposal cell and the modifications to the leachate collection and sludge disposal cell liner system will allow for the controlled and effective management of the impacted sediment and materials that are classified as hazardous waste. Impact management measures will be implemented to reduce the potential impacts of the placement and storage of hazardous waste-bearing sediments.

Remediation of Boat Harbour has the potential to cause changes to federal lands, within the Province of Nova Scotia, but is not expected to cause interprovincial effects or any effects outside of Canada. With respect to changes to federal lands, while some of the project components are located within and will interact with Federal lands, the sludge disposal cell itself (which relates to the designated physical activity under the Regulation) is not located on Federal lands. Best management practices and monitoring programs will be implemented to mitigate the potential effects caused by the placement and storage of the impacted sediment in the existing sludge disposal cell to the nearby federal lands.

Remedial efforts to remove the impacted sediment and material to the placement and storage facility may have short-term impacts to the PLFN's community through increased noise, light and potentially odours. All of these possible negative aspects will be mitigated through techniques typical of construction and sludge removal projects and are anticipated to be effectively managed. The anticipated long-term environmental changes resulting from carrying out the Project on aboriginal peoples are positive, as the remediation of Boat Harbour will address the current sediment contamination and enable the return of Boat Harbour to a tidal estuary. This will allow the land to be re-established as an area used for traditional recreation, fishing, hunting and gathering, as well as for physical, mental, spiritual and emotional purposes by the Mi'kmaq.

In addition, Indigenous Services Canada approval, in conjunction with Pictou Landing First Nation's consent by Band Council Resolution, is required for access to and the conduct of assessments, investigations and remediation activity, if any, on federal crown lands.

NS Lands has implemented a robust engagement program with PLFN since 2014. Engagement components include:

- Funding a full time Community Liaison Coordinator from PLFN, commencing in April 2016.
- Establishing a Boat Harbour Clean-up Committee (BHCC), which is led by the NS Lands Project Leader and the Chief of PLFN and comprised of selected Band council members and PLFN community members as well as representatives from NS Lands and the Nova Scotia Office of Aboriginal Affairs. The BHCC typically meets on a monthly basis since May 2015. The Boat Harbour Steering Committee preceded the BHCC and began meetings in August 2014 with the objective of determining a timeline for closure of Boat Harbour to industrial effluent.
- Participation of the PLFN Community Liaison person and other members of the PLFN community in the Boat Harbour Environmental Advisory Committee (BHEAC). The BHEAC is led by NS Lands with participation of federal and provincial regulators and advisors, academia, NS Lands, and GHD. The BHEAC typically meets on a monthly basis since January 2016.



NS Lands initiated formal consultation with the Mi'kmaq of Nova Scotia under the August 31, 2010 Mi'kmaq-Nova Scotia-Canada Consultation Terms of Reference, which included the provision of the Remedial Options Decision Document for their review. NS Lands received formal correspondence from the Mi'kmaq of Nova Scotia, because of the consultation, on May 31, 2018.

Furthermore, GHD on behalf of NS Lands prepared a PLFN Engagement Plan, which outlines the proposed engagement activities including stakeholder management, engagement communications materials, in-person events, and reporting. Implementation of the PLFN Engagement Plan is a joint responsibility with NS Lands and PLFN Community Liaison, with technical support from GHD.

PLFN primary concerns are related to use of the existing sludge disposal cell, based on engagement/consultation activities completed to date.

During the planning, design, and regulatory processes relative to the approval of pilot scale testing activities, NS Lands has held three public meetings with the broader community in October 2016, April 2018 and May 2018. NS Lands has also engaged with industry stakeholders to explain and discuss Project direction and plans including Northern Pulp Workforce, Northern Pulp Executive, Northumberland Fishermen's Association, and Environmental Services Association Maritimes.

During preparation of the PD, two workshops were held with representatives from the following agencies to introduce the Project and discuss their roles in the Project going forward:

- Nova Scotia Office of Aboriginal Affairs
- Fisheries and Oceans Canada
- Canadian Environmental Assessment Agency
- Environment and Climate Change Canada
- Nova Scotia Environment
- Nova Scotia Transportation and Infrastructure Renewal
- Nova Scotia Department of Lands and Forestry
- Transport Canada
- Health Canada
- Indigenous Services Canada

This Project Description has been prepared to fulfill the requirements of subsection 8(1) of CEEA 2012, to submit a description of the designated Project to the Canadian Environmental Assessment Agency that includes information prescribed by applicable regulations ([Prescribed Information for the Description of a Designated Project Regulations](#)) to inform the decision on whether a federal environmental assessment of the Project is required.

9. References

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PBL Netherlands Environmental Assessment Agency (2017). Trends in Global CO₂ and Total Greenhouse Gas Emissions, 2017 Report. December 2017.



All of Which is Respectfully Submitted,

GHD

<Original signed by>

Blair Shoniker, MA., RPP

<Original signed by>

Peter Oram, P. Geo.

<Original signed by>

Christine Skirth, C.E.T., PMP

NS Lands

<Original signed by>

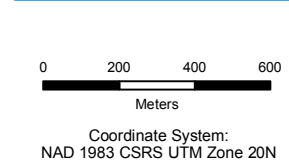
Angela Swaine, Senior Project Manager

<Original signed by>

Ken Swain, Project Leader



Source: Imagery ©2017 Google CNES / Airbus, DigitalGlobe, Landsat / Copernicus

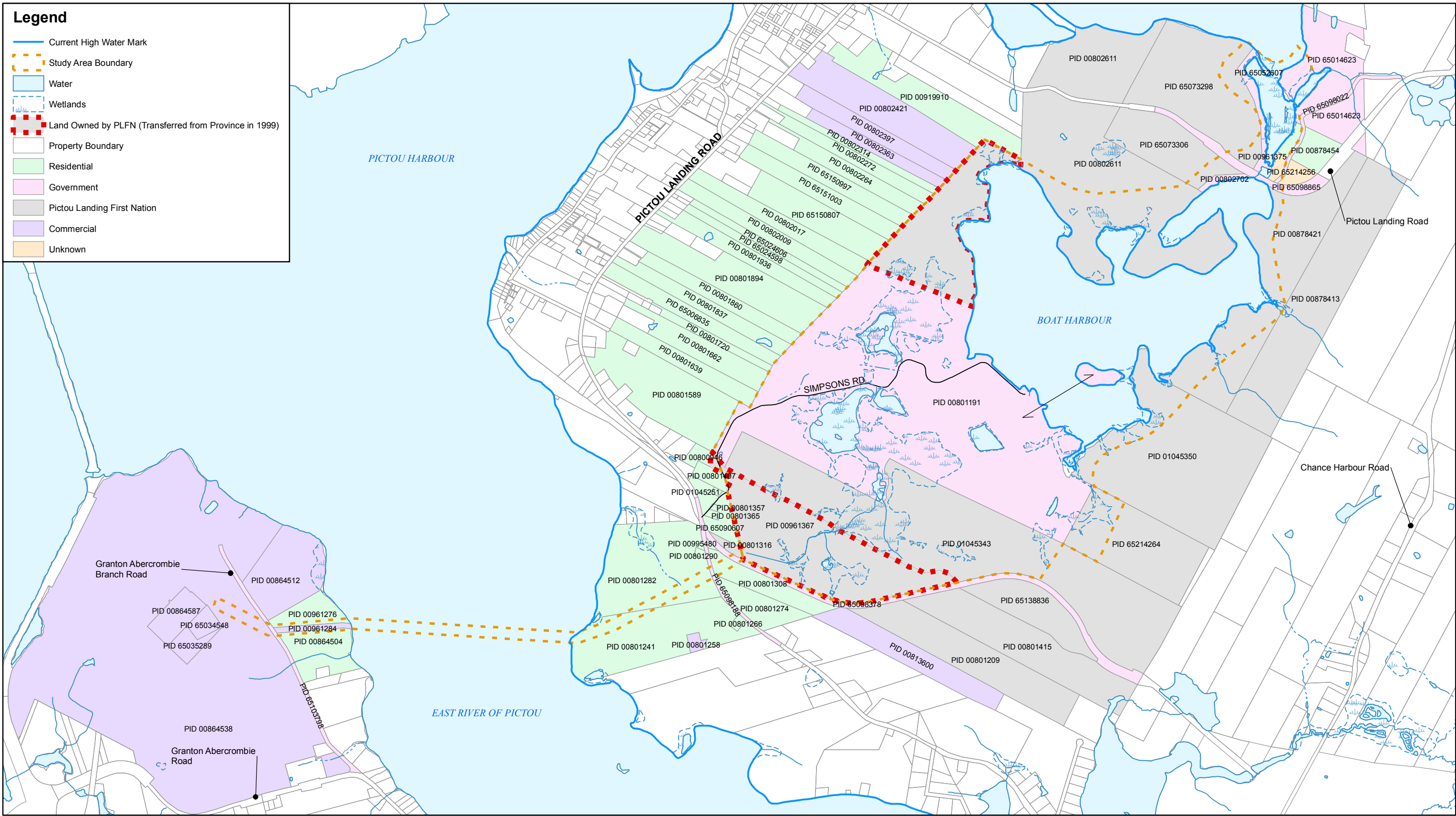


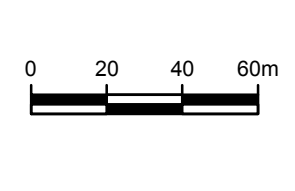
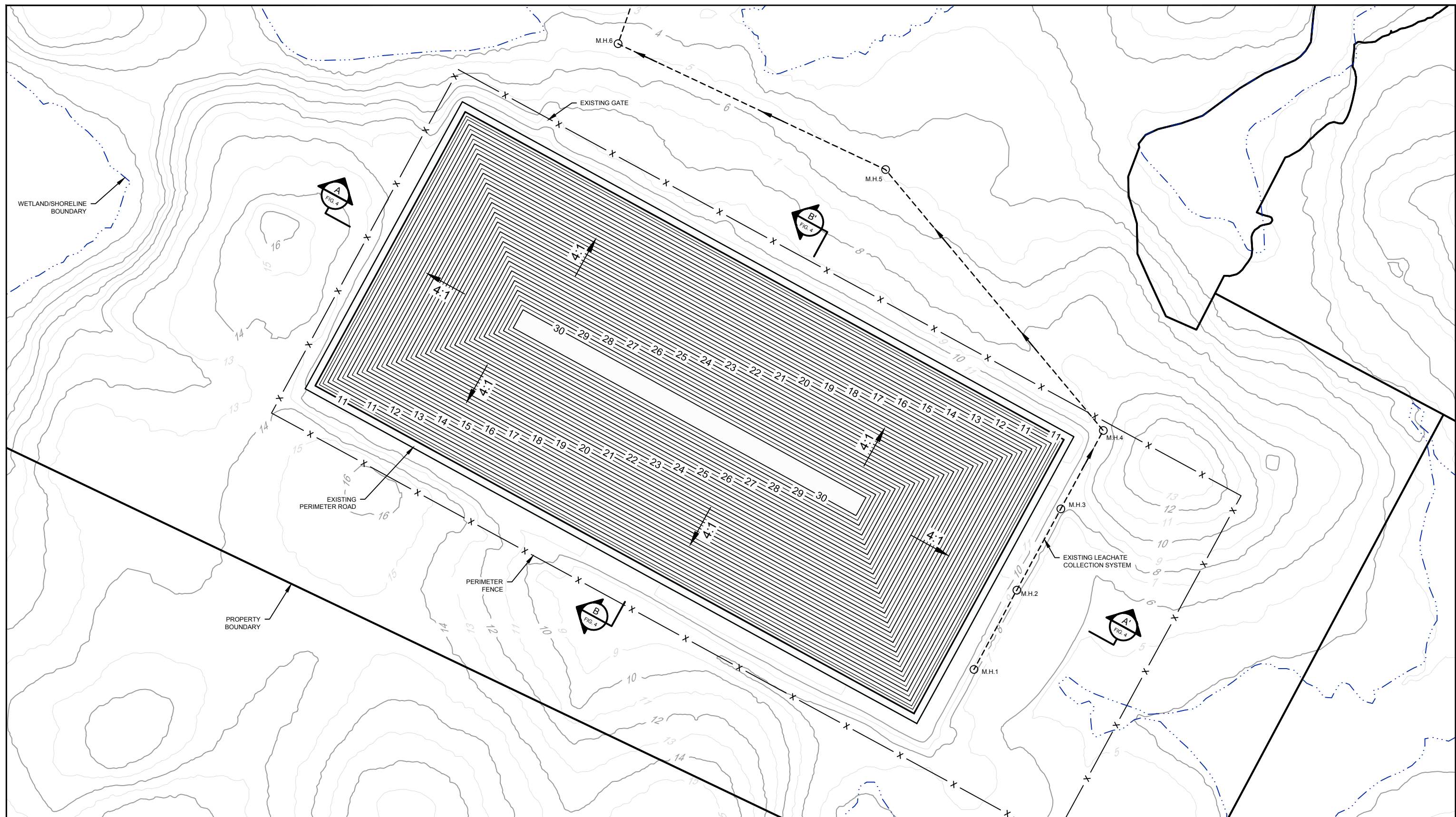
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BOAT HARBOUR, NS
PROJECT DESCRIPTION DOCUMENT

STUDY AREA

11148275-12
Dec 3, 2018

FIGURE 1



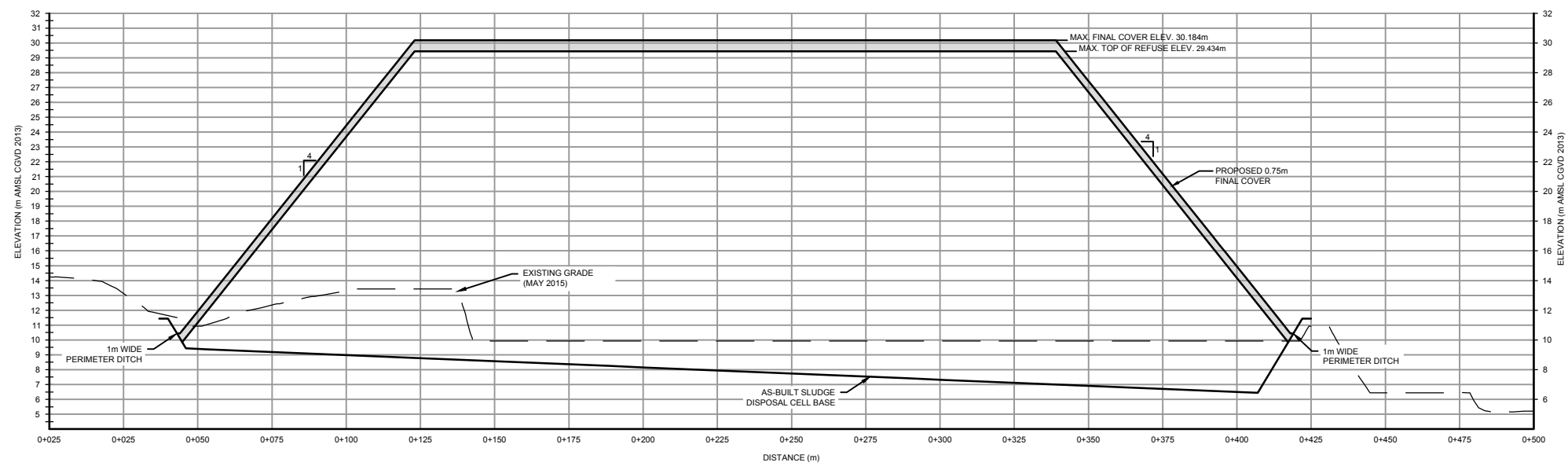


NOVA SCOTIA LANDS INC.
BOAT HARBOUR, NOVA SCOTIA
WASTE MANAGEMENT

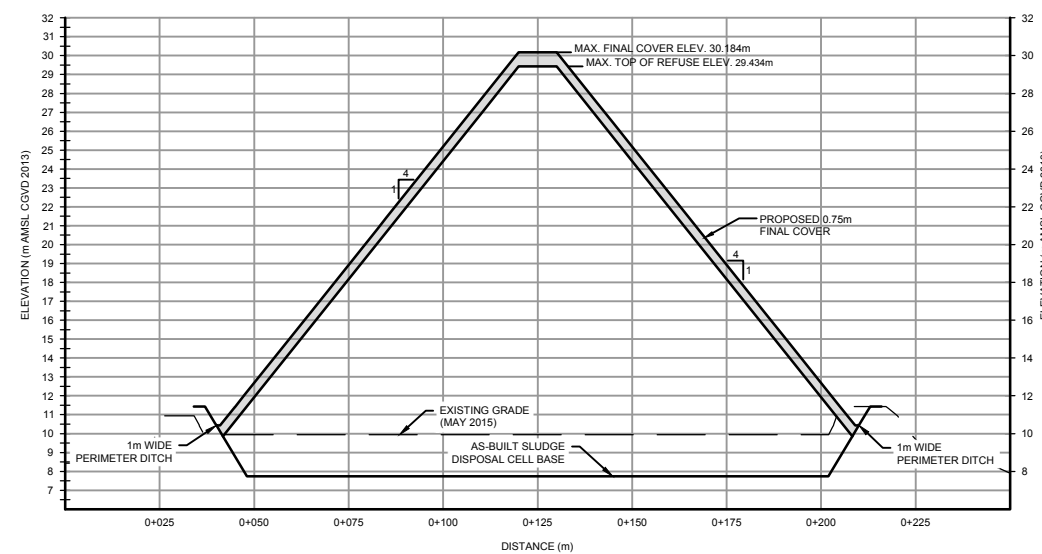
PROPOSED SLUDGE DISPOSAL CELL FINAL CONTOURS

11148275-15
Oct 3, 2018

FIGURE 3



SECTION A-A'
H=1:2000, V=1:400
FIG. 3



SECTION B-B'
H=1:2000, V=1:400
FIG. 3



NOVA SCOTIA LANDS INC.
BOAT HARBOUR, NOVA SCOTIA
WASTE MANAGEMENT

11148275-15
Oct 3, 2018

CROSS-SECTIONS - A-A' AND B-B'

FIGURE 4

Appendices

Appendix A
Evaluation of the Proposed Boat Harbour
Remediation Project – Nova Scotia Environment



**Environment
Office of the Minister**

PO Box 442, Halifax, Nova Scotia, Canada B3J 2P8 • www.novascotia.ca/nse

Our file number:
10700-40-53064

APR 26 2018

Ken Swain
Project Leader, Boat Harbour Remediation Project
Nova Scotia Lands
PO Box 430, Station A
Sydney NS B1P 6H2

Dear Mr. Swain:

Re: Evaluation of the Proposed Boat Harbour Remediation Project

I have reviewed the information provided by Nova Scotia Lands Inc. regarding the proposed Boat Harbour Remediation Project. I have determined that the project is a rehabilitation of an undertaking and is required to register as a Class II undertaking in accordance with the *Environment Act* and the *Environmental Assessment Regulations*.

If you have any questions regarding your project, please contact Helen MacPhail, Supervisor of Environmental Assessment at (902) 483-2696 or via email at helen.macphail@novascotia.ca.

Sincerely,

<Original signed by>

Iain Rankin, MLA
Minister of Environment

Appendix B

Application of Hazardous Waste Import-Export Regulation



Memorandum

April 30, 2018

To: Angela Swaine Ref. No.: 11148275

From: Christine Skirth/Sarah Weston/al/021 Tel: 613-297-7687

CC: Peter Oram, Blair Shoniker

Subject: Application of Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations to the Boat Harbour Remediation Project

1. Introduction

Paragraph 1, Section 1 of the Export and Import of Hazardous Waste Regulations defines "hazardous waste" as anything that is **to be disposed** of using a disposal operation set out in Schedule 1 and that also meets **at least one** of the six requirements outlined in Sections 2.1.1 to 2.1.6 of Environment and Climate Change Canada's Guide to Hazardous Waste and Hazardous Recyclable Material Classification.

The following document addresses how Schedule 1 and the six requirements apply to the Boat Harbour Remediation Project in relation to classifying hazardous waste.

2. Schedule 1: Disposal Operations for Hazardous Wastes

Codes D5 and D9 of Schedule 1 are disposal operations that will be utilized in the remediation of Boat Harbour:

Code D5 | Specifically engineered landfilling, such as placement into separate, lined cells that are isolated from each other and the environment.

In 1994, an Industrial Permit (94-032) was issued by Nova Scotia Environment (NSE), for the construction and operation of a sludge disposal cell located at the Boat Harbour Effluent Treatment Facility (BHETF or Site). The disposal cell is permitted to receive waste from the BHETF operation including but not limited to dredged sludge/sediment from the settling basins, aeration stabilization basin, and Boat Harbour stabilization lagoon. The waste resulting from the remediation of BHETF and potentially the estuary may be disposed of in the existing disposal cell or it may be trucked off-Site for disposal at an existing facility. The existing disposal cell has a design capacity of 220,000 m³ (waste only). The Operations and Maintenance Manual¹

¹ Nova Scotia Department of Transportation and Public Works Operational and Maintenance Manual, Boat Harbour Disposal Cell, Boat Harbour Treatment Facility, Boat Harbour, Nova Scotia (Jacques Whitford Environment Limited, September 1999)



notes that the design capacity could be exceeded based on the physical properties of the waste materials and the recommended final elevations could be determined as part of the disposal cell closure plan. Given the anticipated volume of waste that will be generated through remediation of the BHETF (500,000 to 600,000 m³), the final contours of the landfill would need to be modified to accommodate the waste and final cover.

Code D9 | Physical or chemical treatment not otherwise specified in this schedule, such as calcination, neutralization, or precipitation.

A precipitation, coagulation, and adsorption based process will be used for bulk water management and to treat dewatering effluent from the sludge/sediment dewatering process. Lime precipitation, coagulation and flocculation (clarification) via aluminum or ferric based products, and adsorption by activated carbon are among the most applicable low technology treatment systems. Lime precipitation is a proven technique for lowering the total suspended solids (TSS) (which will aid in reducing metals concentrations), chemical oxygen demand (COD), and toxicity. Coagulation and flocculation involve the addition of coagulants/polymers that conglomerate the small, destabilized particles together into larger particles such that they can be more easily be separated from the water. Iron and aluminum salts are among the most widely used coagulants. Coagulant aid polymers and/or acid may also be added to enhance the coagulation process. The last step of the bulk water treatment process following lime precipitation with the aid of appropriate flocculants is treatment by activated carbon.

3. Sections 2.1.1 to 2.1.6 - Six requirements of Environment and Climate Change Canada's Guide to Hazardous Waste and Hazardous Recyclable Material Classification

3.1 Section 2.1.1 Contaminants listed in Column 2 of Schedule 3

3.1.1 HAZ1 - Biomedical Wastes

Biomedical wastes will not be generated as part of this Project.

3.1.2 HAZ2 – Used lubricating oils in quantities of 500L or more, from internal combustion engines or gearboxes, transmissions, transformers, hydraulic systems or other equipment associated with such engines

Decommissioning of the BHETF will be completed by the Operator of the facility prior to the start of this Project. This will included a chemical sweep and draining of lubricants and oils from equipment reservoirs. A small quantity of lubricating oils may be used as part of the remediation of the BHETF and will be managed and disposed of by a licensed collector in accordance with applicable regulations.

3.1.3 HAZ3 – Used oil filters containing more than 6% of oil by mass

Decommissioning of the BHETF will be completed by the Operator of the facility prior to the start of this Project. This will included a used oil filter from equipment reservoirs. A small quantity of lubricating oils or



filters may be used as part of the remediation of the BHETF and will be managed and disposed of by a licensed collector in accordance with applicable regulations.

3.1.4 HAZ4 | Cyanide, or substances containing cyanide, in a concentration equal to or greater than 100 mg/kg.

Total cyanide was analysed in both soil and sediment samples collected from across the Site. Composite soil samples were collected from shallow hand-augered boreholes with a maximum sample depth of 1.15 mbgs and an average sample length of 0.15 m. Composite soil samples were collected from drilled boreholes using standard 0.6 m long split spoons with a maximum sample depth of 7.3 mbgs. Concentrations of total cyanide in soil were reported as below the laboratory detection limit of 0.5 mg/kg in all samples collected, which is below the HAZ4 referenced threshold of 100 mg/kg.

Composite sediment samples were collected from within the various wetlands and water bodies across the Site using a variety of methodologies, including percussion coring, gravity sampling, and grab sampling. Where possible, sediment samples were collected and analysed from two depths at each location with the upper sample collected from the overlying organic-rich sediment spanning a depth of approximately 0.0 to 0.5 mbgs and the lower sample collected from the underlying clay and silt material spanning a depth of approximately 0.0 to 0.5 mbgs. Concentrations of total cyanide in sediment were reported as ranging from below the laboratory detection limit of 0.5 mg/kg to 2.1 mg/kg in former settling pond 3, which is below the HAZ4 referenced threshold of 100 mg/kg. Sample locations are included in Figures 1, 2, 3, and 4.

HAZ4 is not applicable as cyanide at the prescribed threshold of 100 mg/kg is not present in any materials that will be treated and disposed of using operations D5 and D9 and will not be generated as any part of waste byproduct from these operations.

3.1.5 HAZ5 - Wastes that contain more than 2 mg/kg of polychlorinated terphenyls (PCT) or polybrominated biphenyls (PBB) described in Schedule 1 of the Act

As part of the Phase 2 Environmental Site Assessment (ESA), composite sediment samples were collected from within the various wetlands and water bodies across the Site using a variety of methodologies, including percussion coring, gravity sampling, and grab sampling. Where possible, sediment samples were collected and analysed from two depths at each location with the upper sample collected from the overlying organic-rich sediment spanning a depth of approximately 0.0 to 0.5 metres below ground surface (mbgs) and the lower sample collected from the underlying clay and silt material generally spanning a depth of approximately 0.5 to 1.0 mbgs.

Composite soil samples were collected from shallow hand-augered boreholes with a maximum sample depth of 1.15 mbgs and an average sample length of 0.15 m. Composite soil samples were also collected from drilled boreholes using standard 0.6 m long split spoons advanced using hollow-stem augers, with a maximum sample depth of 7.3 mbgs. Sample locations are included in Figures 1, 2, 3, and 4.

PCBs exhibited non-detect values in sample analysis. It is therefore unlikely that PCTs or PBBs would be found or involved in disposal operations D5 and D9.



3.1.6 HAZ6 | Wastes that contain, in a concentration of more than 100 ng/kg of 2,3,7,8-tetrachlorodibenzo-p-dioxin equivalent

- (a) total polychlorinated dibenzofurans that have a molecular formula $C_{12}H_{8-n}Cl_nO$ in which "n" is greater than 1; or
- (b) total polychlorinated dibenzo-p-dioxins that have a molecular formula $C_{12}H_{8-n}Cl_nO_2$ in which "n" is greater than 1.

As detailed in Section 3.1.5 above, sediment samples were collected within the various wetlands and water bodies across the Study area as part of the Phase 2 ESA. Samples were analyzed for dioxins and furans and toxic equivalency (TEQ) values for dioxins and furans were calculated. A summary of the analytical results for dioxins and furans and calculated TEQ is provided in Attachment A.

As part of the Project, waste may be generated through removal of sediments from the following areas:

- Former Raw Effluent Ditch (FRED)
- Twin Settling Basins (TSB)
- Aeration Stabilization Basin (ASB)
- Boat Harbour Stabilization Lagoon (BHSL)
- Former Settling Pond 1 (FSP1)
- Former Settling Pond 2 (FSP2)
- Former Settling Pond 3 (FSP3)
- Estuary (EST)
- Sludge Disposal Cell (SDC)

A summary of the number of samples, TEQ range, and number of samples that exceeded the TEQ prescribed threshold of 100 ng/kg are summarized in Table 3.1 below.

Table 3.1 Summary of TEQ samples, TQ range, and Number of Exceedances by Area

Sample Location	Number of Samples	TEQ range (pg/g)	Number of Samples exceeding 100 pg/g [= 100 ng/kg]
FRED	4	0.07 - 3.81	None
TSB	1	1.69	None
ASB	1	44.81	None
BHSL	10	0.15 - 624.72	4
FSP1	2	1.12 - 931.03	1
FSP2	14	0.01 - 673.83	3
FSP3	11	0.02 - 377.79	2
EST	9	0.02 - 60.98	None



Table 3.1 Summary of TEQ samples, TQ range, and Number of Exceedances by Area

Sample Location	Number of Samples	TEQ range (pg/g)	Number of Samples exceeding 100 pg/g [= 100 ng/kg]
SDC	4	0.02 – 105.82	1

Sediments requiring remediation will be removed and dewatered and dewatered sludge will be disposed of in the on-Site containment cell or at an off-Site facility licensed to receive the waste. Removal will be predominately completed in the wet with lessor quantities removed in the dry. Removal in the wet will involve dredging sludge/sediment from the ASB, BHSL, and EST under wet conditions, as well as excavating sludge from the TSB and FSP1, 2, and 3 under dry conditions. Removal in the wet will be completed through hydraulic dredging. The dredged sludge slurry will be subsequently pumped to a designated sludge management area (i.e., onsite disposal cell) into geotubes. The geotubes will be stacked in the disposal cell as their final resting ground or broken open to have the material trucked to an existing off-Site disposal facility that is permitted to accept the waste.

Polymers and/or coagulants will be added to the slurry prior to entering geotubes to produce flocculation of the fine-grained sediments and to promote dewatering. All dewatering effluent collected from the designated sludge management area will be managed and treated for the remaining COC to meet applicable criteria to facilitate discharge.

3.2 2.1.2 is included in at least one of classes 2, 3, 4, 5, 6, 8 or 9 of the TDGR

No waste in these classes of the TDGR will be generated or disposed of during this Project. Generated wastes will include sludge, native sediment, wastewater, and construction and demolition debris.

3.3 2.1.3 It is listed in column 2 of Schedule 4 of the Regulations and is included in at least one of classes 2, 3, 4, 5, 6, 8, or 9 of the TDGR

No wastes listed in column 2 of Schedule 4 of the Regulations will be generated or disposed of during this Project. No advanced oxidation involving chlorines or peroxide will be used as part of water treatment.

No waste in these classes of the TDGR are anticipated to be generated or disposed of during this Project.

3.4 2.1.4 It is listed in column 1 of Schedule 5 of the Regulations in a concentration equal to or greater than the applicable concentration set out in column 2 of that schedule

Table 3.2 below outlines contaminants concentration from samples collected as part of the Phase 2 ESA (see Section 3.1.5) that are also listed in column 1 of Schedule 5 of the Regulations. Based on their presence, they may be involved in disposal operations D5 and D9. The only contaminant in a concentration equal to or greater than the applicable concentration in column 1 of Schedule 5 is ammonia. These exceedance values are highlighted below.



Table 3.2 Soil and Sediment Contaminants Occurring at Boat Harbour and Contained in Schedule 5 of the Regulations

Parameter	Schedule 5 Criteria (mg/kg)	Concentration Range – Marine Sediment Samples (mg/kg)	Concentration Range – Freshwater Sediment Samples (mg/kg)	Concentration Range – Hand-Augured Soil Samples (mg/kg)	Concentration Range – Boreholed Soil Samples (mg/kg)
2-Chlorophenol	100	(<0.05) – (<6)	(<0.05) – (<5)	(<0.05) – (<0.3)	(<0.05)
Ammonia	100	(<0.32) – 2300	(<0.29) – 160	(<0.28) – 1.2	(<0.25) – 3.7
Dinitrophenol (2,4-Dinitrophenol)	100	(<0.1) – (<10)	(<0.1) – (<10)	(<0.1) – (<0.5)	(<0.1)
Ethylbenzene	100	(<0.025) – (<0.05)	(<0.025) – (<0.05)	(<0.025) – (<0.05)	(<0.025) – (<0.05)
Ethylene dibromide	100	(<0.025) – (<0.05)	(<0.025) – (<0.05)	(<0.025) – (<0.05)	(<0.025) – (<0.05)
Ethylene dichloride	100	(<0.025) – (<0.05)	(<0.025) – (<0.05)	(<0.025) – (<0.05)	(<0.025) – (<0.05)
Naphthalene	100	(<0.005) – 0.16	(<0.005) – 0.46	(<0.005) – 0.01	(<0.005) – (<0.01)
Nitrophenol (2-Nitrophenol)	100	(<0.1) – (<10)	(<0.1) – (<10)	(<0.1) – (<0.5)	(<0.1)
Nitrophenol (4-Nitrophenol)	100	(<0.1) – (<10)	(<0.1) – (<10)	(<0.1) – (<0.5)	(<0.1)
Phenol	100	(<0.1) – 6	(<0.1) – 6	(<0.1) – (<0.5)	(<0.1)
Polychlorinated biphenyls (PCBs)	50	(<0.01) – (<0.05)	(<0.01) – 0.66	(<0.05)	(<0.05)
Styrene	100	(<0.025) – (<0.05)	(<0.025) – (<0.05)	(<0.025) – (<0.05)	(<0.025)
Toluene	100	(<0.025) – 3.0	(<0.025) – 7.7	(<0.025) – (<0.05)	(<0.025)
Total Xylenes	100	(<0.05) – (<0.1)	(<0.05) – (<0.1)	(<0.05) – (<0.1)	(<0.05)
Notes:					
(<0.05) – parameter represents a non-detection at the reported detection threshold					
2300 – parameter exceeds Schedule 5 criteria					

Management and disposal will include dredging impacted materials that will be pumped into geotubes for dewatering/treatment. The geotubes will be stacked in the disposal cell as their final resting ground or broken open to have the material trucked to an existing off-Site disposal facility that is permitted to accept the waste. This procedure is detailed above in Section 2.1.1 HAZ6.

3.5 2.1.5 It produces a leachate containing a constituent set out in column 2 of Schedule 6 of the Regulations in a concentration equal to or greater than the applicable concentration set out in column 3 of that schedule

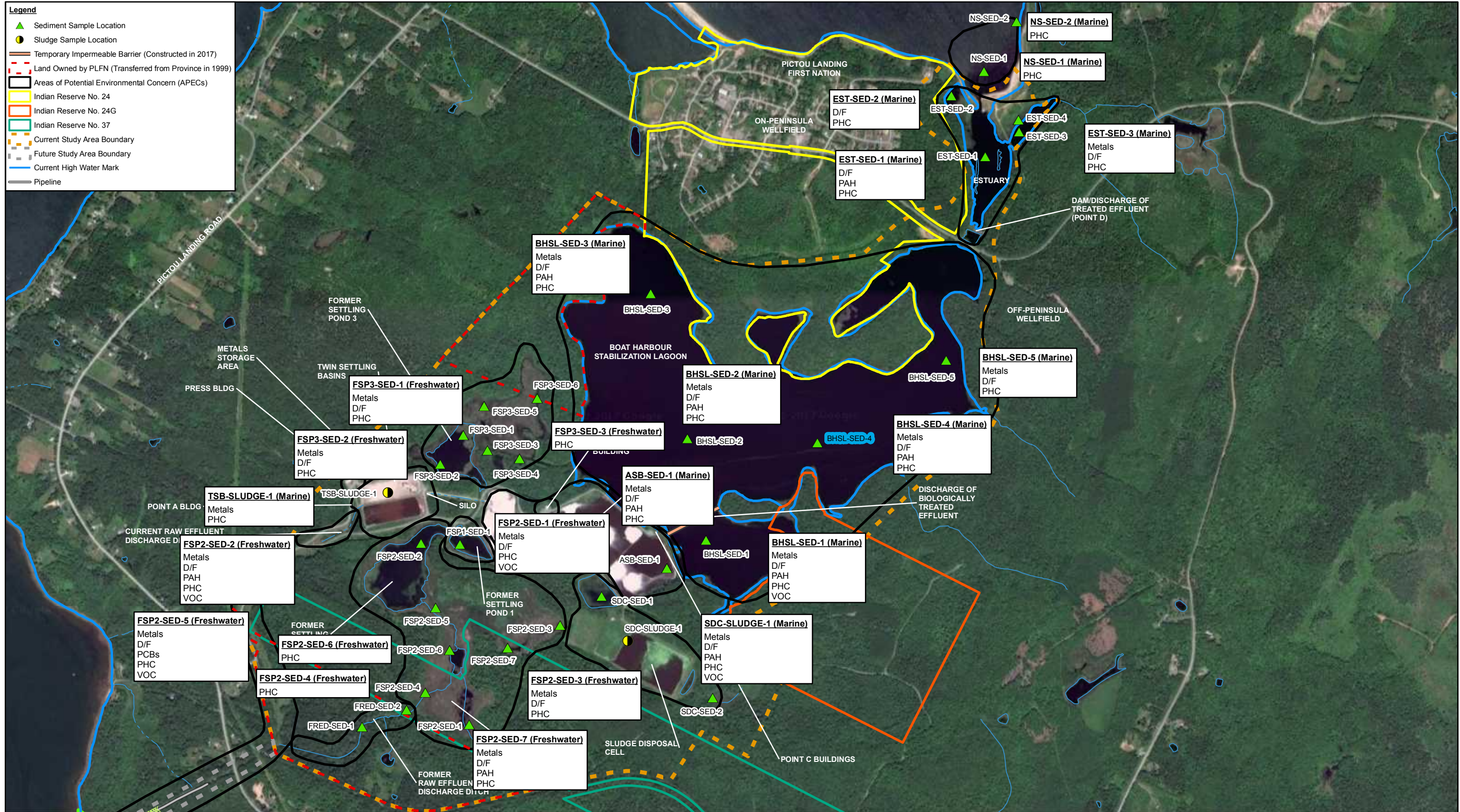
Toxicity characteristic leaching potential (TCLP) results indicate no exceedances of applicable concentrations set out in column 3 of Schedule 6 in materials involved in or produced by disposal operations D5 and D9. Analytical results containing these values are presented in Attachment A.

Sampling specifications are the same as outlined in Section 3.1.6, with sampling locations included in Figure 5.

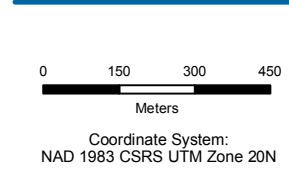


3.6 2.1.6 It is listed in column 2 of Schedule 7 of the Regulations, is pure or is the only active ingredient, and is unused

No wastes listed in column 2 of Schedule 7 of the Regulations will be generated or disposed of during this project work.



Source: Imagery ©2017 Google CNES / Airbus, DigitalGlobe, Landsat / Copernicus



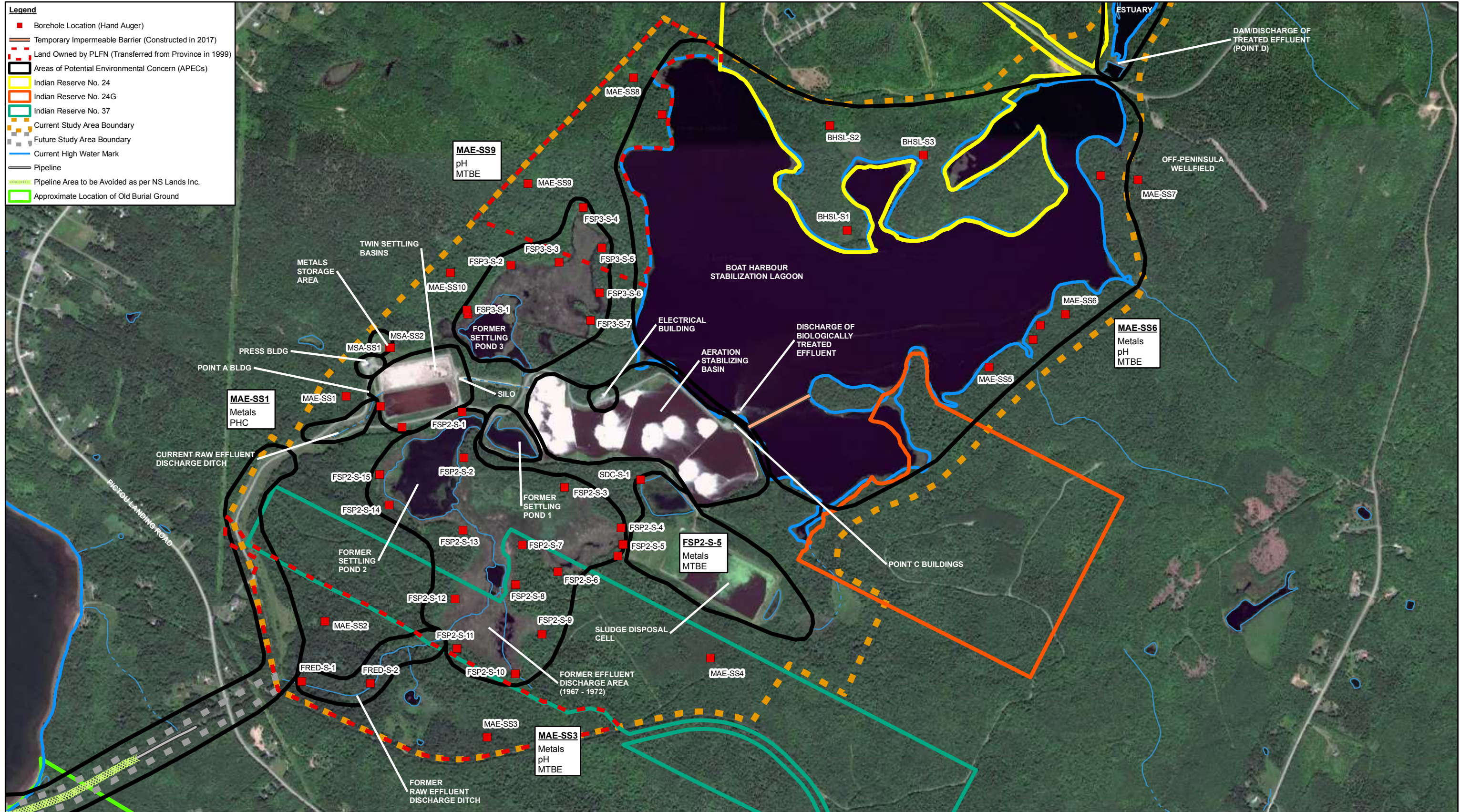
NOVA SCOTIA LANDS INC
BOAT HARBOUR EFFLUENT TREATMENT FACILITY, PICTOU LANDING, NS
PHASE II ENVIRONMENTAL SITE ASSESSMENT

11148275-12
Apr 10, 2018

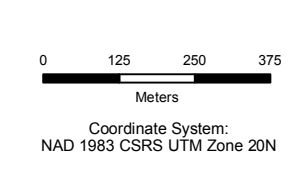
SEDIMENT SAMPLE LOCATIONS

FIGURE 1

- Legend**
- Borehole Location (Hand Auger)
 - Temporary Impermeable Barrier (Constructed in 2017)
 - - - Land Owned by PLFN (Transferred from Province in 1999)
 - ▭ Areas of Potential Environmental Concern (APECs)
 - ▭ Indian Reserve No. 24
 - ▭ Indian Reserve No. 24G
 - ▭ Indian Reserve No. 37
 - - - Current Study Area Boundary
 - - - Future Study Area Boundary
 - Current High Water Mark
 - Pipeline
 - ▨ Pipeline Area to be Avoided as per NS Lands Inc.
 - ▭ Approximate Location of Old Burial Ground



Source: Imagery @2017 Google CNES / Airbus, DigitalGlobe, Landsat / Copernicus



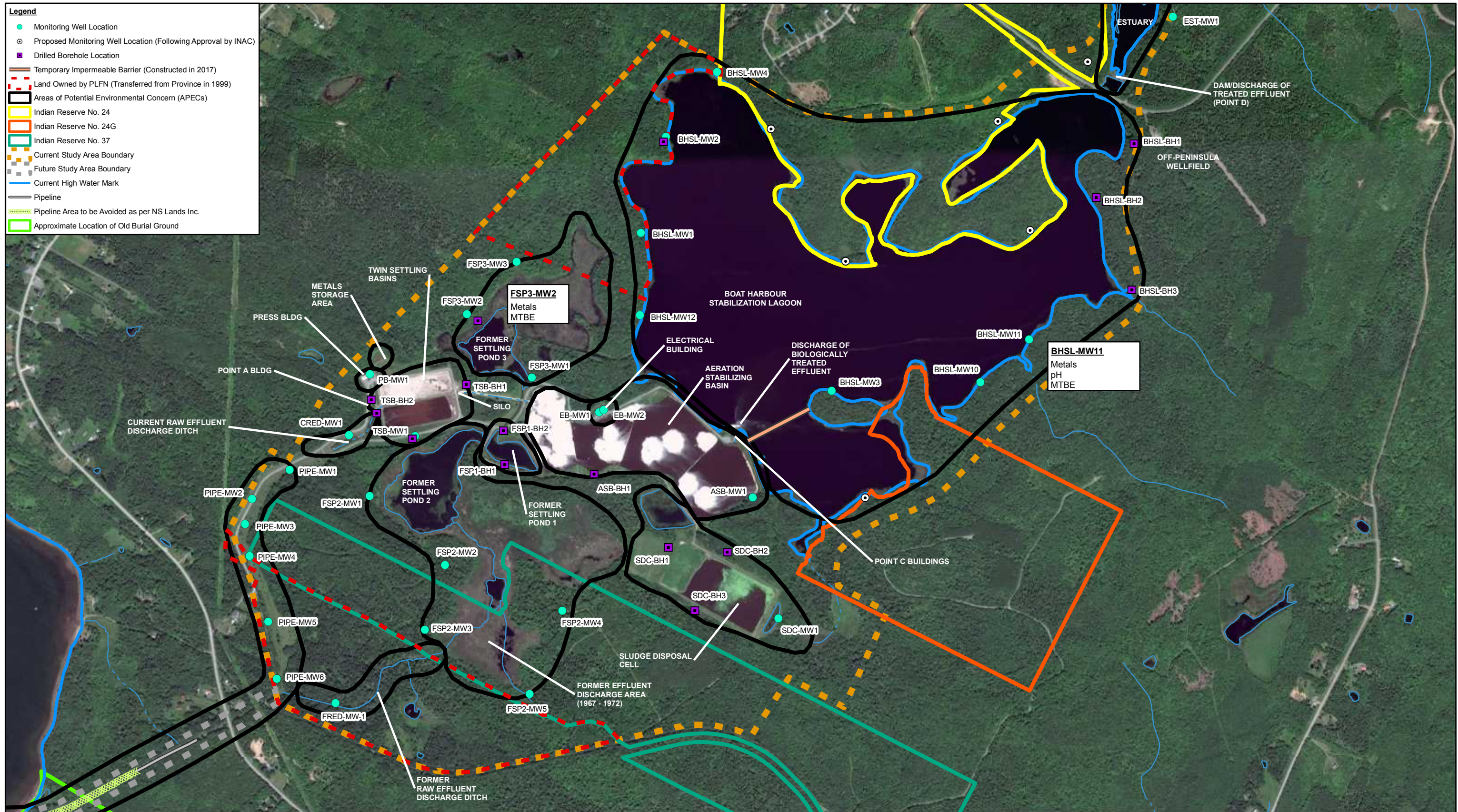
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 BOAT HARBOUR EFFLUENT TREATMENT FACILITY, PICTOU LANDING, NS
 PHASE II ENVIRONMENTAL SITE ASSESSMENT

BOREHOLE (HAND AUGER) LOCATIONS

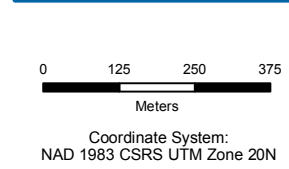
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FIGURE 2

- Legend**
- Monitoring Well Location
 - Proposed Monitoring Well Location (Following Approval by INAC)
 - Drilled Borehole Location
 - Temporary Impermeable Barrier (Constructed in 2017)
 - - - Land Owned by PLFN (Transferred from Province in 1999)
 - ▭ Areas of Potential Environmental Concern (APECs)
 - ▭ Indian Reserve No. 24
 - ▭ Indian Reserve No. 24G
 - ▭ Indian Reserve No. 37
 - Current Study Area Boundary
 - - - Future Study Area Boundary
 - Current High Water Mark
 - Pipeline
 - ▨ Pipeline Area to be Avoided as per NS Lands Inc.
 - ▭ Approximate Location of Old Burial Ground



Source: Imagery ©2017 Google CNES / Airbus, DigitalGlobe, Landsat / Copernicus



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BOREHOLE AND MONITORING WELL LOCATIONS

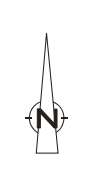
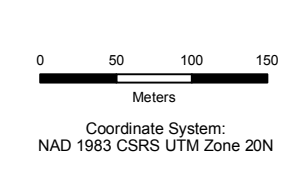
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FIGURE 3

- Legend**
- Background Borehole Location (Hand Auger)
 - ▲ Background Sediment Sample Location
 - Background Surface Water Sample Location



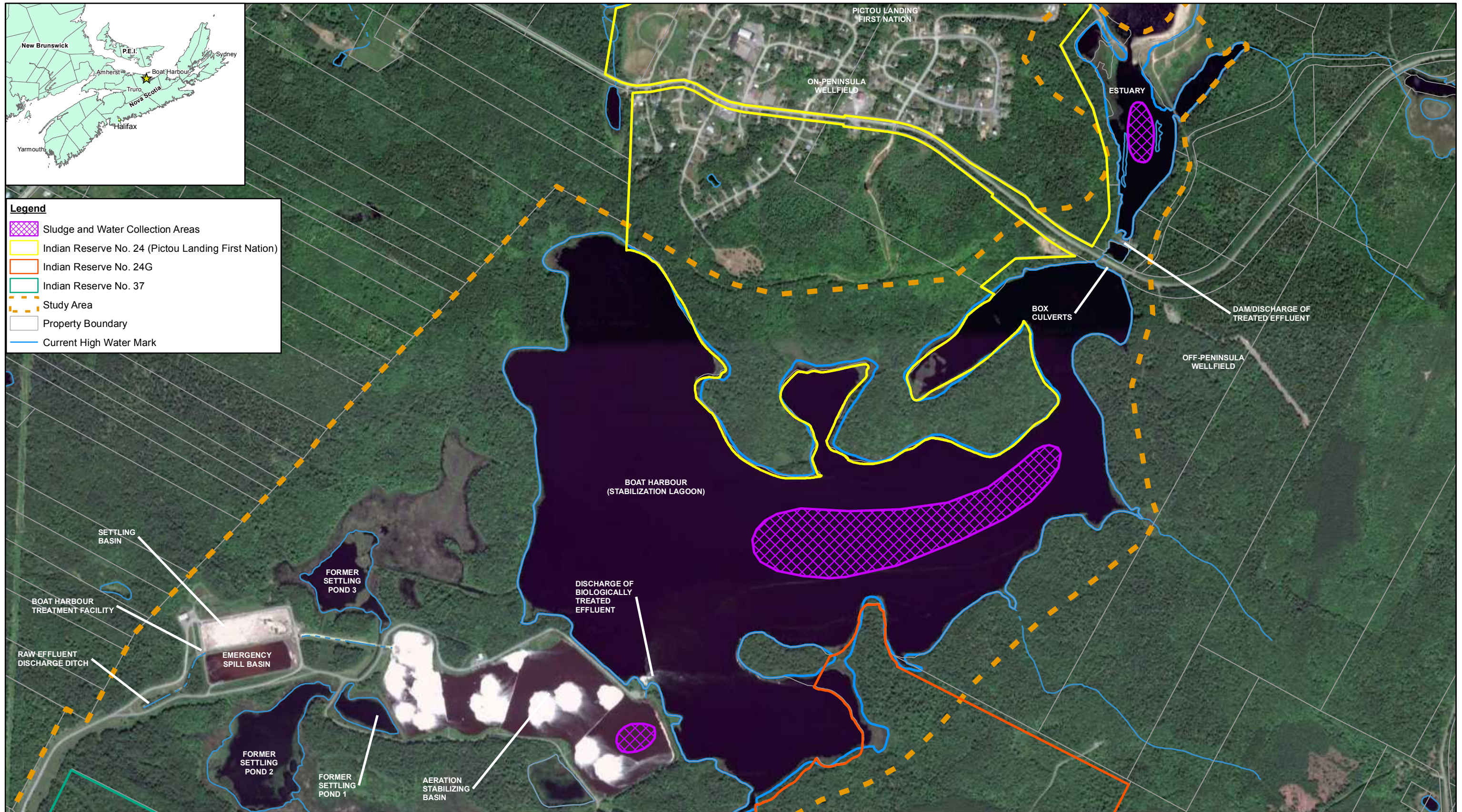
Source: Imagery ©2017 Google CNES / Airbus, DigitalGlobe, Landsat / Copernicus



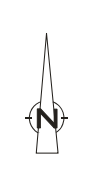
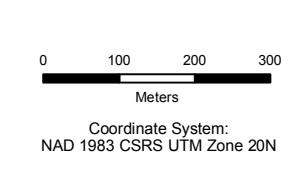
NOVA SCOTIA LANDS INC
 BOAT HARBOUR EFFLUENT TREATMENT FACILITY, PICTOU LANDING, NS
 PHASE II ENVIRONMENTAL SITE ASSESSMENT
BACKGROUND SAMPLE LOCATIONS
 CHANCE HARBOUR LAKE

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FIGURE 4



Source: Imagery ©2017 Google CNES / Airbus, DigitalGlobe, Landsat / Copernicus



NOVA SCOTIA LANDS INC.
BOAT HARBOUR, NOVA SCOTIA

PROJECT DESCRIPTION
PILOT SCALE SLUDGE AND WATER COLLECTION AREAS

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FIGURE 5

Attachment A

Calculation of TEQ for Dioxin and Furans

Calculation of TEQ for Dioxin and Furans
Boat Harbour Remediation Project
Nova Scotia Lands Inc.

Parameters	Ecological Screening Level	Ref	TEF ²	Dioxins/Furans Concentration (pg/g)															
				Sample ID															
				ASB-SED-1 (0.0-0.45m)		BHSL-SED-1-1 (0.0-0.12m)		BHSL-SED-1-2 (0.15-0.45m)		BHSL-SED-DUP		BHSL-SED-2-1 (0.0-0.3m)		BHSL-SED-2-2 (0.4-0.9m)		BHSL-SED-3-1 (0.0-0.3m)		BHSL-SED-3-2 (0.4-0.9m)	
Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ		
Dioxins																			
2,3,7,8-TCDD	See Total TEQ		1	8.43	8.43	86.7	86.7	ND(0.117)	0	ND(0.129)	0	69.7	69.7	0.0722	0.0722	46.3	46.3	ND(0.118)	0
1,2,3,7,8-PeCDD	See Total TEQ		0.5	1.74	0.87	7.06	3.53	ND(0.126)	0	ND(0.114)	0	5.78	2.89	ND(0.0695)	0	4.12	2.06	0.209	0.1045
1,2,3,4,7,8-HxCDD	See Total TEQ		0.1	0.955	0.0955	1.79	0.179	ND(0.115)	0	ND(0.164)	0	1.71	0.171	ND(0.0801)	0	ND(1.18)	0	0.239	0.0239
1,2,3,6,7,8-HxCDD	See Total TEQ		0.1	9.03	0.903	39.5	3.95	ND(0.115)	0	ND(0.173)	0	23.3	2.33	0.0892	0.00892	20.7	2.07	0.362	0.0362
1,2,3,7,8,9-HxCDD	See Total TEQ		0.1	5.09	0.509	19.1	1.91	0.181	0.0181	0.328	0.0328	12.6	1.26	0.195	0.0195	11.8	1.18	0.625	0.0625
1,2,3,4,6,7,8-HpCDD	See Total TEQ		0.01	51.3	0.513	48.3	0.483	4.98	0.0498	4.22	0.0422	47.2	0.472	3.08	0.0308	33.3	0.333	8.29	0.0829
Octa CDD	See Total TEQ		0.001	308	0.308	439	0.439	330	0.33	259	0.259	417	0.417	178	0.178	533	0.533	565	0.565
Furans																			
2,3,7,8-TCDF	See Total TEQ		0.1	303.00	30.3	2160	216	0.531	0.0531	0.71	0.071	1990	199	0.899	0.0899	1530	153	1.03	0.103
1,2,3,7,8-PeCDF	See Total TEQ		0.05	3.81	0.1905	16.6	0.83	ND(0.130)	0	ND(0.130)	0	14.8	0.74	ND(0.0718)	0	12.3	0.615	0.273	0.01365
2,3,4,7,8-PeCDF	See Total TEQ		0.5	4.65	2.325	17.8	8.9	ND(0.129)	0	ND(0.129)	0	14.2	7.1	ND(0.0709)	0	15	7.5	0.239	0.1195
1,2,3,4,7,8-HxCDF	See Total TEQ		0.1	1.56	0.156	3.71	0.371	ND(0.107)	0	0.139	0.0139	3.2	0.32	ND(0.0653)	0	3.3	0.33	0.323	0.0323
1,2,3,6,7,8-HxCDF	See Total TEQ		0.1	1	0.1	1.17	0.117	ND(0.104)	0	0.126	0.0126	1.22	0.122	ND(0.0642)	0	1.09	0.109	0.229	0.0229
2,3,4,6,7,8-HxCDF	See Total TEQ		0.1	0.768	0.0768	1.24	0.124	ND(0.117)	0	ND(0.123)	0	1.49	0.149	ND(0.0699)	0	1.98	0.198	0.188	0.0188
1,2,3,7,8,9-HxCDF	See Total TEQ		0.1	ND(0.272)	0	ND(0.632)	0	ND(0.128)	0	ND(0.135)	0	ND(0.149)	0	ND(0.0688)	0	ND(0.286)	0	0.156	0.0156
1,2,3,4,6,7,8-HpCDF	See Total TEQ		0.01	2.94	0.0294	4.55	0.0455	0.108	0.00108	0.164	0.00164	5.98	0.0598	ND(0.0891)	0	2.8	0.028	0.382	0.00382
1,2,3,4,7,8,9-HpCDF	See Total TEQ		0.01	0.433	0.00433	ND(0.527)	0	ND(0.130)	0	ND(0.136)	0	ND(0.561)	0	ND(0.100)	0	1.41	0.0141	ND(0.111)	0
Octa CDF	See Total TEQ		0.001	4.2	0.0042	9.66	0.00966	ND(0.110)	0	ND(0.117)	0	8.17	0.00817	ND(0.107)	0	8.45	0.00845	0.162	0.000162
Total TEQ	100	1			44.81		323.59		0.45		0.43		284.74		0.40		214.28		1.20

Notes:

pg/g, picograms per gram

TEF - Toxic Equivalency Factors

TEQ - Toxic Equivalency Units;

323.59 - Value exceeds the Designated Screening Level**2160** - Value represents the laboratory confirmatory value for the designated parameter; confirmatory values are provided by the lab in the event of co-elution interference in the original chromatographic column.

A value of "0" has been assigned to all values below the detection limit (i.e. ND (0.272), where the detection limit is in parentheses) for the purposes of calculating TEQ

^{1,2} - Values in accordance with "International Toxicity Equivalence Factor (I-TEF) Method of Risk Assessment for Complex Mixtures of Dioxins and Related Compounds", Pilot Study on International Information Exchange on Dioxins and Related Compounds, Committee on the Challenges of Modern Society, North Atlantic Treaty Organization, Report Number 176, August 1988, accessed at <http://laws-lois.justice.gc.ca/eng/regulations/SOR-2005-149/page-10.html#h-31> (April 12, 2018)

**Calculation of TEQ for Dioxin and Furans
Boat Harbour Remediation Project
Nova Scotia Lands Inc.**

Parameters	Ecological Screening Level	Ref	TEF ²	Dioxins/Furans Concentration (pg/g)															
				Sample ID															
				BHSL-SED-4-1 (0.0-0.2m)		BHSL-SED-4-2 (0.3-0.8m)		BHSL-SED-5-1 (0.0-0.3m)		BHSL-SED-5-2 (0.4-0.9m)		EST-SED-1-1 (0.1-0.7m)		EST-SED-1-2 (0.8-1.4m)		EST-SED-DUP		EST-SED-1-3 (1.5-1.8M)	
Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ		
Dioxins																			
2,3,7,8-TCDD	See Total TEQ		1	13.9	13.9	ND(0.124)	0	101	101	ND(0.114)	0	15.2	15.2	0.135	0.135	ND(0.107)	0	ND(0.114)	0
1,2,3,7,8-PeCDD	See Total TEQ		0.5	1.07	0.535	ND(0.122)	0	7.9	3.95	ND(0.111)	0	1.62	0.81	ND(0.102)	0	ND(0.179)	0	ND(0.170)	0
1,2,3,4,7,8-HxCDD	See Total TEQ		0.1	ND(0.309)	0	ND(0.156)	0	ND(0.808)	0	ND(0.113)	0	ND(0.536)	0	ND(0.110)	0	ND(0.140)	0	ND(0.149)	0
1,2,3,6,7,8-HxCDD	See Total TEQ		0.1	3.44	0.344	ND(0.153)	0	39.1	3.91	0.134	0.0134	7.16	0.716	ND(0.129)	0	ND(0.141)	0	ND(0.150)	0
1,2,3,7,8,9-HxCDD	See Total TEQ		0.1	2.28	0.228	ND(0.143)	0	20.2	2.02	0.162	0.0162	4.41	0.441	0.116	0.0116	0.178	0.0178	ND(0.134)	0
1,2,3,4,6,7,8-HpCDD	See Total TEQ		0.01	13.4	0.134	1.9	0.019	60.1	0.601	3.31	0.0331	22.2	0.222	1.93	0.0193	2.34	0.0234	ND(0.469)	0
Octa CDD	See Total TEQ		0.001	238	0.238	90.9	0.0909	859	0.859	181	0.181	310	0.31	112	0.112	128	0.128	24.4	0.0244
Furans																			
2,3,7,8-TCDF	See Total TEQ		0.1	709	70.9	0.386	0.0386	4910	491	0.735	0.0735	413.00	41.3	3.92	0.392	0.235	0.0235	ND(0.151)	0
1,2,3,7,8-PeCDF	See Total TEQ		0.05	4.95	0.2475	ND(0.113)	0	30.2	1.51	ND(0.116)	0	3.1	0.155	0.14	0.007	ND(0.185)	0	ND(0.192)	0
2,3,4,7,8-PeCDF	See Total TEQ		0.5	7.34	3.67	ND(0.116)	0	38.2	19.1	ND(0.119)	0	3.08	1.54	ND(0.112)	0	ND(0.184)	0	ND(0.191)	0
1,2,3,4,7,8-HxCDF	See Total TEQ		0.1	1.31	0.131	ND(0.113)	0	5.43	0.543	0.143	0.0143	1.17	0.117	ND(0.109)	0	0.166	0.0166	ND(0.109)	0
1,2,3,6,7,8-HxCDF	See Total TEQ		0.1	0.513	0.0513	ND(0.113)	0	1.32	0.132	ND(0.103)	0	0.471	0.0471	ND(0.106)	0	ND(0.134)	0	ND(0.106)	0
2,3,4,6,7,8-HxCDF	See Total TEQ		0.1	0.65	0.065	ND(0.121)	0	ND(2.30)	0	ND(0.111)	0	0.57	0.057	ND(0.119)	0	ND(0.150)	0	ND(0.119)	0
1,2,3,7,8,9-HxCDF	See Total TEQ		0.1	ND(0.164)	0	ND(0.132)	0	ND(0.949)	0	ND(0.120)	0	0.257	0.0257	ND(0.131)	0	ND(0.164)	0	ND(0.130)	0
1,2,3,4,6,7,8-HpCDF	See Total TEQ		0.01	2.55	0.0255	0.168	0.00168	8.07	0.0807	ND(0.184)	0	3.09	0.0309	0.206	0.00206	0.251	0.00251	ND(0.0992)	0
1,2,3,4,7,8,9-HpCDF	See Total TEQ		0.01	0.217	0.00217	ND(0.0725)	0	ND(1.59)	0	ND(0.129)	0	0.391	0.00391	ND(0.124)	0	ND(0.132)	0	ND(0.132)	0
Octa CDF	See Total TEQ		0.001	3.97	0.00397	ND(0.129)	0	15.1	0.0151	ND(0.125)	0	5.36	0.00536	ND(0.192)	0	ND(0.379)	0	ND(0.135)	0
Total TEQ	100	1			90.48		0.15		624.72		0.33		60.98		0.68		0.21		0.02

Notes:

pg/g, picograms per gram

TEF - Toxic Equivalency Factors

TEQ - Toxic Equivalency Units;

323.59 - Value exceeds the Designated Screening Level

2160 - Value represents the laboratory confirmatory value for the designated parameter; confirmatory values are provided by the lab in the event of co-elution interference in the original chromatographic column.

A value of "0" has been assigned to all values below the detection limit (i.e. ND (0.272), where the detection limit is in parentheses) for the purposes of calculating TEQ

^{1,2} - Values in accordance with "International Toxicity Equivalence Factor (I-TEF) Method of Risk Assessment for Complex Mixtures of Dioxins and Related Compounds", Pilot Study on International Information Exchange on Dioxins and Related Compounds, Committee on the Challenges of Modern Society, North Atlantic Treaty Organization, Report Number 176, August 1988, accessed at <http://laws-lois.justice.gc.ca/eng/regulations/SOR-2005-149/page-10.html#h-31> (April 12, 2018)

Calculation of TEQ for Dioxin and Furans
Boat Harbour Remediation Project
Nova Scotia Lands Inc.

Parameters	Ecological Screening Level	Ref	TEF ²	Dioxins/Furans Concentration (pg/g)															
				Sample ID															
				EST-SED-2-1 (0.0-0.3m)		EST-SED-2-2 (0.4-0.9m)		EST-SED-3-1 (0.0-0.2m)		EST-SED-3-2 (0.3-0.8m)		EST-SED-4-1 (0.2-0.5m)		EST-SED-4-2 (0.5-1.0m)		NS-SED-1 (0.0-0.15m)		NS-SED-DUP	
Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ		
Dioxins																			
2,3,7,8-TCDD	See Total TEQ		1	9.34	9.34	ND(0.102)	0	13.7	13.7	ND(0.112)	0	0.13	0.13	ND(0.120)	0	ND(0.121)	0	0.231	0.231
1,2,3,7,8-PeCDD	See Total TEQ		0.5	1.12	0.56	ND(0.102)	0	1.59	0.795	ND(0.174)	0	ND(0.0985)	0	ND(0.110)	0	ND(0.144)	0	ND(0.289)	0
1,2,3,4,7,8-HxCDD	See Total TEQ		0.1	0.311	0.0311	ND(0.105)	0	ND(0.522)	0	ND(0.107)	0	ND(0.111)	0	ND(0.106)	0	ND(0.114)	0	0.271	0.0271
1,2,3,6,7,8-HxCDD	See Total TEQ		0.1	5.15	0.515	ND(0.103)	0	6.46	0.646	ND(0.107)	0	ND(0.108)	0	ND(0.104)	0	ND(0.115)	0	0.26	0.026
1,2,3,7,8,9-HxCDD	See Total TEQ		0.1	2.97	0.297	0.156	0.0156	4.24	0.424	ND(0.0960)	0	ND(0.101)	0	ND(0.0972)	0	ND(0.103)	0	0.325	0.0325
1,2,3,4,6,7,8-HpCDD	See Total TEQ		0.01	10.1	0.101	2.65	0.0265	22.5	0.225	1.26	0.0126	0.791	0.00791	0.196	0.00196	0.93	0.0093	0.481	0.00481
Octa CDD	See Total TEQ		0.001	399	0.399	186	0.186	311	0.311	79.8	0.0798	33	0.033	6.54	0.00654	16.5	0.0165	11.4	0.0114
Furans																			
2,3,7,8-TCDF	See Total TEQ		0.1	293.00	29.3	ND(0.152)	0	359.00	35.9	ND(0.177)	0	4.36	0.436	0.429	0.0429	ND(0.190)	0	0.392	0.0392
1,2,3,7,8-PeCDF	See Total TEQ		0.05	2.66	0.133	ND(0.0975)	0	3.37	0.1685	ND(0.128)	0	ND(0.100)	0	ND(0.104)	0	ND(0.0973)	0	ND(0.319)	0
2,3,4,7,8-PeCDF	See Total TEQ		0.5	2.81	1.405	ND(0.100)	0	3.39	1.695	ND(0.128)	0	ND(0.103)	0	ND(0.106)	0	ND(0.0968)	0	ND(0.247)	0
1,2,3,4,7,8-HxCDF	See Total TEQ		0.1	0.746	0.0746	ND(0.0974)	0	1.16	0.116	ND(0.129)	0	ND(0.103)	0	ND(0.0667)	0	ND(0.101)	0	0.238	0.0238
1,2,3,6,7,8-HxCDF	See Total TEQ		0.1	0.294	0.0294	ND(0.0969)	0	0.449	0.0449	ND(0.126)	0	ND(0.103)	0	ND(0.0664)	0	ND(0.0987)	0	0.271	0.0271
2,3,4,6,7,8-HxCDF	See Total TEQ		0.1	0.364	0.0364	ND(0.104)	0	0.628	0.0628	ND(0.141)	0	ND(0.111)	0	ND(0.0716)	0	ND(0.111)	0	0.26	0.026
1,2,3,7,8,9-HxCDF	See Total TEQ		0.1	ND(0.117)	0	ND(0.113)	0	ND(0.252)	0	ND(0.155)	0	ND(0.120)	0	ND(0.0775)	0	ND(0.121)	0	0.248	0.0248
1,2,3,4,6,7,8-HpCDF	See Total TEQ		0.01	1.55	0.0155	0.214	0.00214	3.43	0.0343	ND(0.105)	0	ND(0.0918)	0	ND(0.0798)	0	ND(0.144)	0	0.235	0.00235
1,2,3,4,7,8,9-HpCDF	See Total TEQ		0.01	0.309	0.00309	ND(0.114)	0	ND(0.385)	0	ND(0.140)	0	ND(0.110)	0	ND(0.0957)	0	ND(0.109)	0	ND(0.251)	0
Octa CDF	See Total TEQ		0.001	2.18	0.00218	ND(0.150)	0	6.35	0.00635	ND(0.152)	0	0.12	0.00012	ND(0.0626)	0	0.683	0.000683	0.412	0.000412
Total TEQ	100	1		42.24		0.23		54.13		0.09		0.61		0.05		0.03		0.48	

Notes:

pg/g, picograms per gram

TEF - Toxic Equivalency Factors

TEQ - Toxic Equivalency Units;

323.59 - Value exceeds the Designated Screening Level

2160 - Value represents the laboratory confirmatory value for the designated parameter; confirmatory values are provided by the lab in the event of co-elution interference in the original chromatographic column.

A value of "0" has been assigned to all values below the detection limit (i.e. ND (0.272), where the detection limit is in parentheses) for the purposes of calculating TEQ

^{1,2} - Values in accordance with "International Toxicity Equivalence Factor (I-TEF) Method of Risk Assessment for Complex Mixtures of Dioxins and Related Compounds", Pilot Study on International Information Exchange on Dioxins and Related Compounds, Committee on the Challenges of Modern Society, North Atlantic Treaty Organization, Report Number 176, August 1988, accessed at <http://laws-lois.justice.gc.ca/eng/regulations/SOR-2005-149/page-10.html#h-31> (April 12, 2018)

**Calculation of TEQ for Dioxin and Furans
Boat Harbour Remediation Project
Nova Scotia Lands Inc.**

Parameters	Ecological Screening Level	Ref	TEF ²	Dioxins/Furans Concentration (pg/g)									
				Sample ID									
				NS-SED-2 (0.0-0.15m)		SDC-SED-2-1 (0.0-0.5m)		SDC-SED-2-2 (0.5-1.0m)		SDC-SLUDGE-1-1 (0.3-0.6m)		TSB-SLUDGE-1 (0.0-0.3m)	
				Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ
Dioxins													
2,3,7,8-TCDD	See Total TEQ		1	ND(0.0712)	0	ND(0.175)	0	ND(0.146)	0	27.4	27.4	0.272	0.272
1,2,3,7,8-PeCDD	See Total TEQ		0.5	ND(0.0862)	0	ND(0.230)	0	ND(0.132)	0	ND(2.01)	0	0.461	0.2305
1,2,3,4,7,8-HxCDD	See Total TEQ		0.1	ND(0.0968)	0	ND(0.168)	0	ND(0.108)	0	ND(0.630)	0	ND(0.301)	0
1,2,3,6,7,8-HxCDD	See Total TEQ		0.1	ND(0.0974)	0	ND(0.165)	0	ND(0.106)	0	11.6	1.16	0.57	0.057
1,2,3,7,8,9-HxCDD	See Total TEQ		0.1	ND(0.0871)	0	ND(0.236)	0	ND(0.0988)	0	5.69	0.569	0.623	0.0623
1,2,3,4,6,7,8-HpCDD	See Total TEQ		0.01	0.461	0.00461	4.76	0.0476	ND(0.610)	0	46.1	0.461	4.56	0.0456
Octa CDD	See Total TEQ		0.001	20.6	0.0206	136	0.136	5.68	0.00568	338	0.338	56.4	0.0564
Furans													
2,3,7,8-TCDF	See Total TEQ		0.1	0.114	0.0114	ND(0.109)	0	ND(0.119)	0	713.00	71.3	3.05	0.305
1,2,3,7,8-PeCDF	See Total TEQ		0.05	ND(0.116)	0	ND(0.145)	0	ND(0.172)	0	6.66	0.333	0.929	0.04645
2,3,4,7,8-PeCDF	See Total TEQ		0.5	ND(0.115)	0	ND(0.149)	0	ND(0.177)	0	8.07	4.035	1.05	0.525
1,2,3,4,7,8-HxCDF	See Total TEQ		0.1	ND(0.114)	0	ND(0.100)	0	0.0932	0.00932	1.83	0.183	0.479	0.0479
1,2,3,6,7,8-HxCDF	See Total TEQ		0.1	ND(0.111)	0	0.115	0.0115	ND(0.0972)	0	ND(1.21)	0	0.394	0.0394
2,3,4,6,7,8-HxCDF	See Total TEQ		0.1	ND(0.124)	0	ND(0.107)	0	ND(0.0898)	0	ND(0.632)	0	ND(0.210)	0
1,2,3,7,8,9-HxCDF	See Total TEQ		0.1	ND(0.136)	0	ND(0.116)	0	ND(0.0972)	0	ND(0.692)	0	ND(0.112)	0
1,2,3,4,6,7,8-HpCDF	See Total TEQ		0.01	ND(0.0917)	0	ND(0.739)	0	ND(0.358)	0	3.89	0.0389	ND(0.828)	0
1,2,3,4,7,8,9-HpCDF	See Total TEQ		0.01	ND(0.122)	0	ND(0.154)	0	ND(0.124)	0	ND(0.628)	0	ND(0.138)	0
Octa CDF	See Total TEQ		0.001	ND(0.125)	0	ND(0.150)	0	ND(0.108)	0	ND(6.35)	0	ND(1.70)	0
Total TEQ	100	1			0.04		0.20		0.02		105.82		1.69

Notes:

pg/g, picograms per gram

TEF - Toxic Equivalency Factors

TEQ - Toxic Equivalency Units;

323.59 - Value exceeds the Designated Screening Level

2160 - Value represents the laboratory confirmatory value for the designated parameter; confirmatory values are provided by the lab in the event of co-elution interference in the original chromatographic column.

A value of "0" has been assigned to all values below the detection limit (i.e. ND (0.272), where the detection limit is in parentheses) for the purposes of calculating TEQ

^{1,2} - Values in accordance with "International Toxicity Equivalence Factor (I-TEF) Method of Risk Assessment for Complex Mixtures of Dioxins and Related Compounds", Pilot Study on International Information Exchange on Dioxins and Related Compounds, Committee on the Challenges of Modern Society, North Atlantic Treaty Organization, Report Number 176, August 1988, accessed at <http://laws-lois.justice.gc.ca/eng/regulations/SOR-2005-149/page-10.html#h-31> (April 12, 2018)

Calculation of TEQ for Dioxin and Furans
Boat Harbour Remediation Project
Nova Scotia Lands Inc.

Calculation Table for Dioxins/Furans TEQ Concentrations in Freshwater Sediment

Parameters	Ecological Screening Level	Ref	TEF ²	Dioxins/Furans Concentration (pg/g)															
				Sample ID															
				BKGD-SED-1 (0.0-0.4m)		BKGD-SED-2 (0.0-0.4m)		BKGD-SED-3 (0.0-0.5m)		BKGD-SED-4 (0.0-0.4m)		BKGD-SED-DUP		BKGD-SED-5 (0.0-0.4m)		BKGD-SED-6 (0.0-0.4m)		BKGD-SED-7 (0.0-0.4m)	
Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ		
Dioxins																			
2,3,7,8-TCDD	See Total TEQ		1	ND(0.224)	0	ND(0.162)	0	0.182	0.182	ND(0.163)	0	ND(0.140)	0	ND(0.112)	0	0.45	0.45	ND(0.137)	0
1,2,3,7,8-PeCDD	See Total TEQ		0.5	0.484	0.242	0.321	0.1605	0.302	0.151	0.362	0.181	0.232	0.116	ND(0.144)	0	0.381	0.1905	0.453	0.2265
1,2,3,4,7,8-HxCDD	See Total TEQ		0.1	ND(0.364)	0	0.402	0.0402	0.308	0.0308	0.334	0.0334	0.231	0.0231	0.151	0.0151	0.209	0.0209	ND(0.465)	0
1,2,3,6,7,8-HxCDD	See Total TEQ		0.1	0.846	0.0846	0.691	0.0691	0.427	0.0427	ND(0.369)	0	0.392	0.0392	0.151	0.0151	0.253	0.0253	0.835	0.0835
1,2,3,7,8,9-HxCDD	See Total TEQ		0.1	1.11	0.111	1.08	0.108	0.819	0.0819	0.773	0.0773	0.653	0.0653	0.417	0.0417	0.342	0.0342	1.37	0.137
1,2,3,4,6,7,8-HpCDD	See Total TEQ		0.01	8.91	0.0891	7.1	0.071	6.15	0.0615	4.92	0.0492	3.98	0.0398	2.56	0.0256	2.17	0.0217	8.41	0.0841
Octa CDD	See Total TEQ		0.001	81.3	0.0813	78.6	0.0786	59.4	0.0594	57.7	0.0577	51.3	0.0513	45.6	0.0456	39.5	0.0395	92.6	0.0926
Furans																			
2,3,7,8-TCDF	See Total TEQ		0.1	3.09	0.309	1.11	0.111	0.949	0.0949	2.22	0.222	0.75	0.075	0.733	0.0733	0.872	0.0872	1.25	0.125
1,2,3,7,8-PeCDF	See Total TEQ		0.05	1.13	0.0565	0.764	0.0382	ND(0.507)	0	0.892	0.0446	ND(0.602)	0	0.347	0.01735	0.464	0.0232	1.06	0.053
2,3,4,7,8-PeCDF	See Total TEQ		0.5	1.05	0.525	0.796	0.398	0.667	0.3335	0.881	0.4405	0.646	0.323	ND(0.305)	0	0.378	0.189	1.43	0.715
1,2,3,4,7,8-HxCDF	See Total TEQ		0.1	2.14	0.214	ND(1.07)	0	1.18	0.118	1.54	0.154	1.34	0.134	0.562	0.0562	0.394	0.0394	2.56	0.256
1,2,3,6,7,8-HxCDF	See Total TEQ		0.1	0.94	0.094	0.654	0.0654	0.582	0.0582	0.772	0.0772	0.783	0.0783	0.309	0.0309	0.292	0.0292	1.29	0.129
2,3,4,6,7,8-HxCDF	See Total TEQ		0.1	1	0.1	0.655	0.0655	0.712	0.0712	0.778	0.0778	0.698	0.0698	0.215	0.0215	0.232	0.0232	1.09	0.109
1,2,3,7,8,9-HxCDF	See Total TEQ		0.1	ND(0.254)	0	ND(0.129)	0	ND(0.134)	0	ND(0.130)	0	ND(0.131)	0	ND(0.136)	0	ND(0.155)	0	ND(0.110)	0
1,2,3,4,6,7,8-HpCDF	See Total TEQ		0.01	4.74	0.0474	2.27	0.0227	2.81	0.0281	2.87	0.0287	2.89	0.0289	1.15	0.0115	0.658	0.00658	4.82	0.0482
1,2,3,4,7,8,9-HpCDF	See Total TEQ		0.01	0.461	0.00461	ND(0.305)	0	0.343	0.00343	0.372	0.00372	0.303	0.00303	0.162	0.00162	ND(0.132)	0	0.47	0.0047
Octa CDF	See Total TEQ		0.001	4.21	0.00421	2.23	0.00223	2.16	0.00216	2.66	0.00266	2.36	0.00236	ND(0.912)	0	ND(0.509)	0	5.02	0.00502
Total TEQ	100	1			1.96		1.23		1.32		1.45		1.05		0.36		1.18		2.07

Notes:

pg/g, picograms per gram

TEF - Toxic Equivalency Factors

TEQ - Toxic Equivalency Units;

323.59 - Value exceeds the Designated Screening Level

2160 - Value represents the laboratory confirmatory value for the designated parameter; confirmatory values are provided by the lab in the event of co-elution interference in the original chromatographic column.

A value of "0" has been assigned to all values below the detection limit (i.e. ND (0.272), where the detection limit is in parentheses) for the purposes of calculating TEQ

^{1,2} - Values in accordance with "International Toxicity Equivalence Factor (I-TEF) Method of Risk Assessment for Complex Mixtures of Dioxins and Related Compounds", Pilot Study on International Information Exchange on Dioxins and Related Compounds, Committee on the Challenges of Modern Society, North Atlantic Treaty Organization, Report Number 176, August 1988, accessed at <http://laws-lois.justice.gc.ca/eng/regulations/SOR-2005-149/page-10.html#h-31> (April 12, 2018)

Calculation of TEQ for Dioxin and Furans
Boat Harbour Remediation Project
Nova Scotia Lands Inc.

Calculation Table for Dioxins/Furans TEQ Concentrations in Freshwater Sediment

Parameters	Ecological Screening Level	Ref	TEF ²	Dioxins/Furans Concentration (pg/g)															
				Sample ID															
				BKGD-SED-8 (0.0-0.4m)		BKGD-SED-9 (0.0-0.4m)		BKGD-SED-10 (0.0-0.5m)		FRED-SED-1-1 (0.0-0.3m)		FRED-SED-1-2 (0.3-0.6m)		FRED-SED-2-1 (0.0-0.3m)		FRED-SED-DUP		FRED-SED-2-2 (0.3-0.6m)	
Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ		
Dioxins																			
2,3,7,8-TCDD	See Total TEQ		1	ND(0.100)	0	ND(0.110)	0	0.219	0.219	ND(0.104)	0	ND(0.110)	0	0.315	0.315	0.347	0.347	ND(0.104)	0
1,2,3,7,8-PeCDD	See Total TEQ		0.5	0.151	0.0755	ND(0.103)	0	0.993	0.4965	ND(0.110)	0	ND(0.0897)	0	ND(0.103)	0	ND(0.108)	0	ND(0.103)	0
1,2,3,4,7,8-HxCDD	See Total TEQ		0.1	0.186	0.0186	0.193	0.0193	1.43	0.143	ND(0.109)	0	ND(0.106)	0	ND(0.112)	0	ND(0.107)	0	ND(0.103)	0
1,2,3,6,7,8-HxCDD	See Total TEQ		0.1	0.253	0.0253	0.187	0.0187	2.52	0.252	0.134	0.0134	ND(0.106)	0	0.144	0.0144	0.116	0.0116	ND(0.104)	0
1,2,3,7,8,9-HxCDD	See Total TEQ		0.1	0.544	0.0544	0.371	0.0371	3.88	0.388	ND(0.0979)	0	ND(0.0951)	0	ND(0.153)	0	0.188	0.0188	ND(0.0929)	0
1,2,3,4,6,7,8-HpCDD	See Total TEQ		0.01	3.19	0.0319	2.99	0.0299	33.2	0.332	2.2	0.022	0.225	0.00225	1.86	0.0186	2.37	0.0237	0.633	0.00633
Octa CDD	See Total TEQ		0.001	50.2	0.0502	34.9	0.0349	181	0.181	68	0.068	2.96	0.00296	53.1	0.0531	67.6	0.0676	26.6	0.0266
Furans																			
2,3,7,8-TCDF	See Total TEQ		0.1	1.04	0.104	0.63	0.063	0.22	0.022	4.04	0.404	1.6	0.16	23.3	2.33	31.7	3.17	0.359	0.0359
1,2,3,7,8-PeCDF	See Total TEQ		0.05	0.423	0.02115	0.276	0.0138	2.46	0.123	0.126	0.0063	ND(0.104)	0	ND(0.212)	0	0.231	0.01155	ND(0.0999)	0
2,3,4,7,8-PeCDF	See Total TEQ		0.5	0.457	0.2285	0.318	0.159	2.86	1.43	0.133	0.0665	ND(0.104)	0	0.311	0.1555	0.283	0.1415	ND(0.0994)	0
1,2,3,4,7,8-HxCDF	See Total TEQ		0.1	0.895	0.0895	0.558	0.0558	5.37	0.537	ND(0.157)	0	ND(0.0872)	0	0.151	0.0151	0.126	0.0126	ND(0.100)	0
1,2,3,6,7,8-HxCDF	See Total TEQ		0.1	0.426	0.0426	0.279	0.0279	2.93	0.293	ND(0.0945)	0	ND(0.0848)	0	ND(0.0997)	0	ND(0.0983)	0	ND(0.0975)	0
2,3,4,6,7,8-HxCDF	See Total TEQ		0.1	0.361	0.0361	ND(0.229)	0	2.04	0.204	ND(0.106)	0	ND(0.0952)	0	ND(0.112)	0	ND(0.110)	0	ND(0.109)	0
1,2,3,7,8,9-HxCDF	See Total TEQ		0.1	ND(0.104)	0	ND(0.110)	0	ND(0.108)	0	ND(0.116)	0	ND(0.104)	0	ND(0.123)	0	ND(0.121)	0	ND(0.120)	0
1,2,3,4,6,7,8-HpCDF	See Total TEQ		0.01	1.49	0.0149	1.1	0.011	13.4	0.134	ND(0.385)	0	ND(0.0931)	0	1.66	0.0166	0.472	0.00472	0.106	0.00106
1,2,3,4,7,8,9-HpCDF	See Total TEQ		0.01	0.139	0.00139	0.116	0.00116	0.616	0.00616	ND(0.124)	0	ND(0.124)	0	ND(0.115)	0	ND(0.122)	0	ND(0.119)	0
Octa CDF	See Total TEQ		0.001	1.52	0.00152	1.04	0.00104	5.06	0.00506	0.56	0.00056	0.21	0.00021	1.55	0.00155	1.49	0.00149	ND(0.198)	0
Total TEQ	100	1			0.80		0.47		4.77		0.58		0.17		2.92		3.81		0.07

Notes:

pg/g, picograms per gram

TEF - Toxic Equivalency Factors

TEQ - Toxic Equivalency Units;

323.59 - Value exceeds the Designated Screening Level

2160 - Value represents the laboratory confirmatory value for the designated parameter; confirmatory values are provided by the lab in the event of co-elution interference in the original chromatographic column.

A value of "0" has been assigned to all values below the detection limit (i.e. ND (0.272), where the detection limit is in parentheses) for the purposes of calculating TEQ

^{1,2} - Values in accordance with "International Toxicity Equivalence Factor (I-TEF) Method of Risk Assessment for Complex Mixtures of Dioxins and Related Compounds", Pilot Study on International Information Exchange on Dioxins and Related Compounds, Committee on the Challenges of Modern Society, North Atlantic Treaty Organization, Report Number 176, August 1988, accessed at <http://laws-lois.justice.gc.ca/eng/regulations/SOR-2005-149/page-10.html#h-31> (April 12, 2018)

Calculation of TEQ for Dioxin and Furans
Boat Harbour Remediation Project
Nova Scotia Lands Inc.

Calculation Table for Dioxins/Furans TEQ Concentrations in Freshwater Sediment

Parameters	Ecological Screening Level	Ref	TEF ²	Dioxins/Furans Concentration (pg/g)															
				Sample ID															
				FSP1-SED-1-1 (0.2-0.7m)		FSP1-SED-1-2 (0.9-1.4m)		FSP2-SED-1-1 (0.15-0.40m)		FSP2-SED-1-2 (0.45-0.60m)		FSP2-SED-2-1 (0.0-0.4m)		FSP2-SED-DUP		FSP2-SED-2-2 (0.5-1.0m)		FSP2-SED-3-1 (0.0-0.3m)	
Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ		
Dioxins																			
2,3,7,8-TCDD	See Total TEQ		1	72.4	72.4	ND(0.102)	0	ND(0.0942)	0	ND(0.114)	0	64.1	64.1	68.7	68.7	ND(0.108)	0	7.97	7.97
1,2,3,7,8-PeCDD	See Total TEQ		0.5	4.28	2.14	ND(0.114)	0	ND(0.0859)	0	ND(0.0921)	0	3.11	1.555	3.69	1.845	ND(0.109)	0	0.814	0.407
1,2,3,4,7,8-HxCDD	See Total TEQ		0.1	1.47	0.147	0.167	0.0167	ND(0.0883)	0	ND(0.0855)	0	0.793	0.0793	1.03	0.103	ND(0.109)	0	0.261	0.0261
1,2,3,6,7,8-HxCDD	See Total TEQ		0.1	6.55	0.655	0.32	0.032	ND(0.0913)	0	ND(0.0883)	0	4.9	0.49	6.19	0.619	0.135	0.0135	4.26	0.426
1,2,3,7,8,9-HxCDD	See Total TEQ		0.1	3.78	0.378	0.574	0.0574	ND(0.107)	0	ND(0.0729)	0	2.98	0.298	3.55	0.355	0.146	0.0146	2.54	0.254
1,2,3,4,6,7,8-HpCDD	See Total TEQ		0.01	64.9	0.649	12.7	0.127	2.02	0.0202	0.293	0.00293	43.5	0.435	44.5	0.445	0.888	0.00888	9.3	0.093
Octa CDD	See Total TEQ		0.001	769	0.769	742	0.742	83.6	0.0836	2.61	0.00261	418	0.418	478	0.478	27.7	0.0277	253	0.253
Furans																			
2,3,7,8-TCDF	See Total TEQ		0.1	8160	816	0.445	0.0445	ND(0.0609)	0	ND(0.0872)	0	5790	579	5630	563	0.296	0.0296	438	43.8
1,2,3,7,8-PeCDF	See Total TEQ		0.05	39.3	1.965	0.177	0.00885	ND(0.0667)	0	ND(0.104)	0	27.4	1.37	29.3	1.465	ND(0.106)	0	3.68	0.184
2,3,4,7,8-PeCDF	See Total TEQ		0.5	69.3	34.65	0.153	0.0765	ND(0.0659)	0	ND(0.103)	0	50.7	25.35	53.5	26.75	ND(0.104)	0	4.46	2.23
1,2,3,4,7,8-HxCDF	See Total TEQ		0.1	6.06	0.606	ND(0.220)	0	ND(0.0893)	0	ND(0.0676)	0	4.04	0.404	4.88	0.488	ND(0.106)	0	0.716	0.0716
1,2,3,6,7,8-HxCDF	See Total TEQ		0.1	1.61	0.161	0.108	0.0108	ND(0.0878)	0	ND(0.0664)	0	0.86	0.086	1.16	0.116	ND(0.104)	0	0.206	0.0206
2,3,4,6,7,8-HxCDF	See Total TEQ		0.1	2.78	0.278	ND(0.0971)	0	ND(0.0956)	0	ND(0.0723)	0	1.58	0.158	2.1	0.21	ND(0.114)	0	0.235	0.0235
1,2,3,7,8,9-HxCDF	See Total TEQ		0.1	0.79	0.079	ND(0.117)	0	ND(0.0942)	0	ND(0.0712)	0	ND(0.232)	0	ND(0.343)	0	ND(0.112)	0	ND(0.136)	0
1,2,3,4,6,7,8-HpCDF	See Total TEQ		0.01	10.9	0.109	ND(0.360)	0	ND(0.0658)	0	ND(0.0717)	0	6.77	0.0677	10.7	0.107	0.125	0.00125	0.958	0.00958
1,2,3,4,7,8,9-HpCDF	See Total TEQ		0.01	1.94	0.0194	ND(0.125)	0	ND(0.0739)	0	ND(0.0805)	0	ND(0.885)	0	1.29	0.0129	ND(0.114)	0	ND(0.118)	0
Octa CDF	See Total TEQ		0.001	22.7	0.0227	ND(0.185)	0	ND(0.105)	0	ND(0.101)	0	16.8	0.0168	23	0.023	0.28	0.00028	1.49	0.00149
Total TEQ	100	1			931.03		1.12		0.10		0.01		673.83		664.72		0.10		55.77

Notes:

pg/g, picograms per gram

TEF - Toxic Equivalency Factors

TEQ - Toxic Equivalency Units;

323.59 - Value exceeds the Designated Screening Level

2160 - Value represents the laboratory confirmatory value for the designated parameter; confirmatory values are provided by the lab in the event of co-elution interference in the original chromatographic column.

A value of "0" has been assigned to all values below the detection limit (i.e. ND (0.272), where the detection limit is in parentheses) for the purposes of calculating TEQ

^{1,2} - Values in accordance with "International Toxicity Equivalence Factor (I-TEF) Method of Risk Assessment for Complex Mixtures of Dioxins and Related Compounds", Pilot Study on International Information Exchange on Dioxins and Related Compounds, Committee on the Challenges of Modern Society, North Atlantic Treaty Organization, Report Number 176, August 1988, accessed at <http://laws-lois.justice.gc.ca/eng/regulations/SOR-2005-149/page-10.html#h-31> (April 12, 2018)

Calculation of TEQ for Dioxin and Furans
Boat Harbour Remediation Project
Nova Scotia Lands Inc.

Calculation Table for Dioxins/Furans TEQ Concentrations in Freshwater Sediment

Parameters	Ecological Screening Level	Ref	TEF ²	Dioxins/Furans Concentration (pg/g)													
				Sample ID													
				FSP2-SED-3-2 (0.3-0.8m)		FSP2-SED-4-1 (0.1-0.5m)		FSP2-SED-4-2 (0.5-1.0m)		FSP2-SED-5-1 (0.1-0.4m)		FSP2-SED-5-2 (0.5-1.0m)		FSP2-SED-6-1 (0.2-0.5m)		FSP2-SED-6-2 (0.5-0.9m)	
Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ		
Dioxins																	
2,3,7,8-TCDD	See Total TEQ		1	ND(0.0856)	0	0.509	0.509	0.396	0.396	46.9	46.9	ND(0.137)	0	5.31	5.31	ND(0.111)	0
1,2,3,7,8-PeCDD	See Total TEQ		0.5	ND(0.0999)	0	ND(0.114)	0	ND(0.106)	0	ND(1.96)	0	ND(0.114)	0	0.409	0.2045	ND(0.113)	0
1,2,3,4,7,8-HxCDD	See Total TEQ		0.1	ND(0.0775)	0	ND(0.141)	0	0.107	0.0107	ND(2.13)	0	ND(0.118)	0	0.136	0.0136	0.125	0.0125
1,2,3,6,7,8-HxCDD	See Total TEQ		0.1	ND(0.0801)	0	ND(0.138)	0	ND(0.103)	0	ND(2.14)	0	ND(0.119)	0	0.453	0.0453	ND(0.111)	0
1,2,3,7,8,9-HxCDD	See Total TEQ		0.1	ND(0.0995)	0	ND(0.129)	0	0.137	0.0137	ND(1.92)	0	ND(0.106)	0	0.385	0.0385	0.167	0.0167
1,2,3,4,6,7,8-HpCDD	See Total TEQ		0.01	1.2	0.012	1.6	0.016	0.558	0.00558	21.5	0.215	2.83	0.0283	3.23	0.0323	0.459	0.00459
Octa CDD	See Total TEQ		0.001	18.1	0.0181	53.1	0.0531	17.2	0.0172	332	0.332	49.5	0.0495	66.9	0.0669	2.46	0.00246
Furans																	
2,3,7,8-TCDF	See Total TEQ		0.1	0.126	0.0126	13.5	1.35	64.9	6.49	1880	188	9.13	0.913	76.2	7.62	0.577	0.0577
1,2,3,7,8-PeCDF	See Total TEQ		0.05	ND(0.0982)	0	0.169	0.00845	0.232	0.0116	9.67	0.4835	ND(0.106)	0	0.603	0.03015	ND(0.128)	0
2,3,4,7,8-PeCDF	See Total TEQ		0.5	ND(0.0969)	0	ND(0.194)	0	0.27	0.135	18.5	9.25	ND(0.106)	0	0.747	0.3735	ND(0.127)	0
1,2,3,4,7,8-HxCDF	See Total TEQ		0.1	ND(0.0798)	0	ND(0.0865)	0	0.133	0.0133	ND(2.39)	0	ND(0.108)	0	0.553	0.0553	ND(0.0949)	0
1,2,3,6,7,8-HxCDF	See Total TEQ		0.1	ND(0.0784)	0	ND(0.0861)	0	0.112	0.0112	ND(1.04)	0	ND(0.105)	0	0.17	0.017	ND(0.120)	0
2,3,4,6,7,8-HxCDF	See Total TEQ		0.1	ND(0.0854)	0	ND(0.0927)	0	0.0858	0.00858	ND(1.17)	0	ND(0.118)	0	0.33	0.033	ND(0.135)	0
1,2,3,7,8,9-HxCDF	See Total TEQ		0.1	ND(0.0841)	0	ND(0.100)	0	ND(0.0811)	0	ND(1.28)	0	ND(0.129)	0	ND(0.129)	0	ND(0.148)	0
1,2,3,4,6,7,8-HpCDF	See Total TEQ		0.01	0.195	0.00195	0.364	0.00364	ND(0.209)	0	8.41	0.0841	0.153	0.00153	1.12	0.0112	0.129	0.00129
1,2,3,4,7,8,9-HpCDF	See Total TEQ		0.01	ND(0.0680)	0	ND(0.135)	0	0.0766	0.000766	ND(1.65)	0	ND(0.141)	0	ND(0.127)	0	ND(0.122)	0
Octa CDF	See Total TEQ		0.001	ND(0.103)	0	0.847	0.000847	0.447	0.000447	20.9	0.0209	0.166	0.000166	1.47	0.00147	ND(0.121)	0
Total TEQ	100	1			0.04	1.94	7.11			245.29		0.99		13.85		0.10	

Notes:

pg/g, picograms per gram

TEF - Toxic Equivalency Factors

TEQ - Toxic Equivalency Units;

323.59 - Value exceeds the Designated Screening Level

2160 - Value represents the laboratory confirmatory value for the designated parameter; confirmatory values are provided by the lab in the event of co-elution interference in the original chromatographic column.

A value of "0" has been assigned to all values below the detection limit (i.e. ND (0.272), where the detection limit is in parentheses) for the purposes of calculating TEQ

^{1,2} - Values in accordance with "International Toxicity Equivalence Factor (I-TEF) Method of Risk Assessment for Complex Mixtures of Dioxins and Related Compounds", Pilot Study on International Information Exchange on Dioxins and Related Compounds, Committee on the Challenges of Modern Society, North Atlantic Treaty Organization, Report Number 176, August 1988, accessed at <http://laws-lois.justice.gc.ca/eng/regulations/SOR-2005-149/page-10.html#h-31> (April 12, 2018)

Calculation of TEQ for Dioxin and Furans
Boat Harbour Remediation Project
Nova Scotia Lands Inc.

Calculation Table for Dioxins/Furans TEQ Concentrations in Freshwater Sediment

Parameters	Ecological Screening Level	Ref	TEF ²	Dioxins/Furans Concentration (pg/g)													
				Sample ID													
				FSP2-SED-7-1 (0.0-0.3m)		FSP2-SED-7-2 (0.4-0.9m)		FSP3-SED-1-1 (0.0-0.3m)		FSP3-SED-DUP		FSP3-SED-1-2 (0.3-0.7m)		FSP3-SED-2-1 (0.0-0.2m)		FSP3-SED-2-2 (0.2-0.5m)	
Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ				
Dioxins																	
2,3,7,8-TCDD	See Total TEQ		1	68.1	68.1	ND(0.109)	0	36.7	36.7	26.9	26.9	ND(0.107)	0	11	11	ND(0.102)	0
1,2,3,7,8-PeCDD	See Total TEQ		0.5	4.2	2.1	ND(0.101)	0	4.12	2.06	1.54	0.77	ND(0.0993)	0	ND(1.15)	0	ND(0.107)	0
1,2,3,4,7,8-HxCDD	See Total TEQ		0.1	0.88	0.088	ND(0.0799)	0	2.01	0.201	0.62	0.062	ND(0.102)	0	0.653	0.0653	0.136	0.0136
1,2,3,6,7,8-HxCDD	See Total TEQ		0.1	14.6	1.46	ND(0.0803)	0	3.72	0.372	2.33	0.233	ND(0.102)	0	1.61	0.161	ND(0.108)	0
1,2,3,7,8,9-HxCDD	See Total TEQ		0.1	7.81	0.781	ND(0.0718)	0	3.15	0.315	1.89	0.189	ND(0.0914)	0	1.43	0.143	0.339	0.0339
1,2,3,4,6,7,8-HpCDD	See Total TEQ		0.01	35.1	0.351	0.364	0.00364	21.9	0.219	19.8	0.198	0.386	0.00386	10.8	0.108	1.99	0.0199
Octa CDD	See Total TEQ		0.001	422	0.422	6.36	0.00636	345	0.345	297	0.297	4.55	0.00455	341	0.341	25.8	0.0258
Furans																	
2,3,7,8-TCDF	See Total TEQ		0.1	4050	405	0.264	0.0264	3180	318	2650	265	3.75	0.375	1160	116	1.95	0.195
1,2,3,7,8-PeCDF	See Total TEQ		0.05	22.7	1.135	ND(0.110)	0	20.8	1.04	15.2	0.76	ND(0.101)	0	6.97	0.3485	0.123	0.00615
2,3,4,7,8-PeCDF	See Total TEQ		0.5	35	17.5	ND(0.109)	0	34.1	17.05	27.2	13.6	ND(0.101)	0	12	6	ND(0.105)	0
1,2,3,4,7,8-HxCDF	See Total TEQ		0.1	4.55	0.455	ND(0.0885)	0	5.62	0.562	2.95	0.295	ND(0.101)	0	1.73	0.173	ND(0.102)	0
1,2,3,6,7,8-HxCDF	See Total TEQ		0.1	1.22	0.122	ND(0.0862)	0	3.05	0.305	0.826	0.0826	ND(0.0984)	0	0.748	0.0748	ND(0.0997)	0
2,3,4,6,7,8-HxCDF	See Total TEQ		0.1	2.01	0.201	ND(0.0967)	0	3.62	0.362	1.38	0.138	ND(0.110)	0	1.08	0.108	ND(0.112)	0
1,2,3,7,8,9-HxCDF	See Total TEQ		0.1	0.364	0.0364	ND(0.106)	0	1.76	0.176	0.204	0.0204	ND(0.121)	0	ND(0.318)	0	ND(0.123)	0
1,2,3,4,6,7,8-HpCDF	See Total TEQ		0.01	9.22	0.0922	ND(0.0773)	0	6.11	0.0611	4.9	0.049	ND(0.0903)	0	2.67	0.0267	0.431	0.00431
1,2,3,4,7,8,9-HpCDF	See Total TEQ		0.01	1.37	0.0137	ND(0.103)	0	0.963	0.00963	ND(0.251)	0	ND(0.120)	0	0.409	0.00409	ND(0.118)	0
Octa CDF	See Total TEQ		0.001	20.8	0.0208	ND(0.100)	0	9.93	0.00993	8.22	0.00822	ND(0.114)	0	4.22	0.00422	ND(0.120)	0
Total TEQ	100	1			497.88		0.04		377.79		308.60		0.38		134.56		0.30

Notes:

pg/g, picograms per gram

TEF - Toxic Equivalency Factors

TEQ - Toxic Equivalency Units;

323.59 - Value exceeds the Designated Screening Level

2160 - Value represents the laboratory confirmatory value for the designated parameter; confirmatory values are provided by the lab in the event of co-elution interference in the original chromatographic column.

A value of "0" has been assigned to all values below the detection limit (i.e. ND (0.272), where the detection limit is in parentheses) for the purposes of calculating TEQ

^{1,2} - Values in accordance with "International Toxicity Equivalence Factor (I-TEF) Method of Risk Assessment for Complex Mixtures of Dioxins and Related Compounds", Pilot Study on International Information Exchange on Dioxins and Related Compounds, Committee on the Challenges of Modern Society, North Atlantic Treaty Organization, Report Number 176, August 1988, accessed at <http://laws-lois.justice.gc.ca/eng/regulations/SOR-2005-149/page-10.html#h-31> (April 12, 2018)

Calculation of TEQ for Dioxin and Furans
Boat Harbour Remediation Project
Nova Scotia Lands Inc.

Calculation Table for Dioxins/Furans TEQ Concentrations in Freshwater Sediment

Parameters	Ecological Screening Level	Ref	TEF ²	Dioxins/Furans Concentration (pg/g)													
				Sample ID													
				FSP3-SED-3-1 (0.0-0.3m)		FSP3-SED-3-2 (0.3-0.7m)		FSP3-SED-4-1 (0.0-0.3m)		FSP3-SED-4-2 (0.3-0.7m)		FSP3-SED-5-1 (0.1-0.5m)		FSP3-SED-5-2 (0.5-0.8m)		FSP3-SED-6 (0.0-0.3m)	
Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ		
Dioxins																	
2,3,7,8-TCDD	See Total TEQ		1	0.296	0.296	ND(0.397)	0	ND(0.108)	0	ND(0.106)	0	ND(0.105)	0	ND(0.103)	0	ND(0.127)	0
1,2,3,7,8-PeCDD	See Total TEQ		0.5	ND(0.113)	0	ND(0.114)	0	ND(0.110)	0	ND(0.103)	0	ND(0.104)	0	ND(0.0926)	0	ND(0.115)	0
1,2,3,4,7,8-HxCDD	See Total TEQ		0.1	ND(0.124)	0	ND(0.113)	0	ND(0.115)	0	ND(0.108)	0	0.254	0.0254	ND(0.104)	0	ND(0.119)	0
1,2,3,6,7,8-HxCDD	See Total TEQ		0.1	0.255	0.0255	ND(0.268)	0	ND(0.116)	0	ND(0.108)	0	0.361	0.0361	ND(0.102)	0	ND(0.117)	0
1,2,3,7,8,9-HxCDD	See Total TEQ		0.1	0.142	0.0142	0.258	0.0258	ND(0.104)	0	ND(0.0967)	0	0.828	0.0828	ND(0.0948)	0	ND(0.109)	0
1,2,3,4,6,7,8-HpCDD	See Total TEQ		0.01	2.94	0.0294	2.67	0.0267	ND(0.201)	0	ND(0.337)	0	7.43	0.0743	0.445	0.00445	0.29	0.0029
Octa CDD	See Total TEQ		0.001	150	0.15	121	0.121	19.1	0.0191	34.9	0.0349	97.3	0.0973	15.8	0.0158	4.4	0.0044
Furans																	
2,3,7,8-TCDF	See Total TEQ		0.1	17.1	1.71	19	1.9	0.247	0.0247	0.441	0.0441	5.32 D 2.90	2.9	ND(0.108)	0	0.59	0.059
1,2,3,7,8-PeCDF	See Total TEQ		0.05	ND(0.112)	0	ND(0.144)	0	ND(0.112)	0	ND(0.101)	0	0.199	0.00995	ND(0.102)	0	ND(0.130)	0
2,3,4,7,8-PeCDF	See Total TEQ		0.5	ND(0.112)	0	ND(0.173)	0	ND(0.111)	0	ND(0.101)	0	ND(0.106)	0	ND(0.104)	0	ND(0.133)	0
1,2,3,4,7,8-HxCDF	See Total TEQ		0.1	ND(0.105)	0	0.117	0.0117	ND(0.101)	0	ND(0.0790)	0	0.288	0.0288	ND(0.0925)	0	ND(0.103)	0
1,2,3,6,7,8-HxCDF	See Total TEQ		0.1	ND(0.103)	0	ND(0.107)	0	ND(0.0987)	0	ND(0.0768)	0	ND(0.117)	0	ND(0.0921)	0	ND(0.103)	0
2,3,4,6,7,8-HxCDF	See Total TEQ		0.1	ND(0.115)	0	ND(0.120)	0	ND(0.111)	0	ND(0.0863)	0	ND(0.107)	0	ND(0.0992)	0	ND(0.111)	0
1,2,3,7,8,9-HxCDF	See Total TEQ		0.1	ND(0.126)	0	ND(0.132)	0	ND(0.121)	0	ND(0.0945)	0	ND(0.116)	0	ND(0.108)	0	ND(0.120)	0
1,2,3,4,6,7,8-HpCDF	See Total TEQ		0.01	ND(0.429)	0	0.601	0.00601	ND(0.103)	0	ND(0.0824)	0	0.848	0.00848	ND(0.100)	0	ND(0.102)	0
1,2,3,4,7,8,9-HpCDF	See Total TEQ		0.01	ND(0.119)	0	ND(0.131)	0	ND(0.138)	0	ND(0.110)	0	ND(0.115)	0	ND(0.120)	0	ND(0.122)	0
Octa CDF	See Total TEQ		0.001	ND(0.514)	0	ND(0.879)	0	ND(0.114)	0	ND(0.106)	0	5.14	0.00514	0.132	0.000132	ND(0.113)	0
Total TEQ	100	1			2.23		2.09		0.04		0.08		3.27		0.02		0.07

Notes:

pg/g, picograms per gram

TEF - Toxic Equivalency Factors

TEQ - Toxic Equivalency Units;

323.59 - Value exceeds the Designated Screening Level

2160 - Value represents the laboratory confirmatory value for the designated parameter; confirmatory values are provided by the lab in the event of co-elution interference in the original chromatographic column.

A value of "0" has been assigned to all values below the detection limit (i.e. ND (0.272), where the detection limit is in parentheses) for the purposes of calculating TEQ

^{1,2} - Values in accordance with "International Toxicity Equivalence Factor (I-TEF) Method of Risk Assessment for Complex Mixtures of Dioxins and Related Compounds", Pilot Study on International Information Exchange on Dioxins and Related Compounds, Committee on the Challenges of Modern Society, North Atlantic Treaty Organization, Report Number 176, August 1988, accessed at <http://laws-lois.justice.gc.ca/eng/regulations/SOR-2005-149/page-10.html#h-31> (April 12, 2018)

Calculation of TEQ for Dioxin and Furans
Boat Harbour Remediation Project
Nova Scotia Lands Inc.

Calculation Table for Dioxins/Furans TEQ Concentrations in
Freshwater Sediment

Parameters	Ecological Screening Level	Ref	TEF ²	Dioxins/Furans Concentration (pg/g)					
				Sample ID					
				SDC-SED-1-1 (0.0-0.3m)		SDC-SED-1-2 (0.3-0.7m)		SDC-SED-DUP	
Dioxins				Result	TEQ	Result	TEQ	Result	TEQ
2,3,7,8-TCDD	See Total TEQ		1	0.468	0.468	0.676	0.676	0.488	0.488
1,2,3,7,8-PeCDD	See Total TEQ		0.5	ND(0.118)	0	ND(0.113)	0	ND(0.103)	0
1,2,3,4,7,8-HxCDD	See Total TEQ		0.1	ND(0.109)	0	0.144	0.0144	0.101	0.0101
1,2,3,6,7,8-HxCDD	See Total TEQ		0.1	0.185	0.0185	0.264	0.0264	ND(0.137)	0
1,2,3,7,8,9-HxCDD	See Total TEQ		0.1	0.317	0.0317	0.419	0.0419	0.422	0.0422
1,2,3,4,6,7,8-HpCDD	See Total TEQ		0.01	5.54	0.0554	6.73	0.0673	5.9	0.059
Octa CDD	See Total TEQ		0.001	274	0.274	372	0.372	276	0.276
Furans									
2,3,7,8-TCDF	See Total TEQ		0.1	ND (30)	0	42.8	4.28	30.2	3.02
1,2,3,7,8-PeCDF	See Total TEQ		0.05	0.253	0.01265	0.37	0.0185	0.204	0.0102
2,3,4,7,8-PeCDF	See Total TEQ		0.5	0.348	0.174	0.493	0.2465	0.302	0.151
1,2,3,4,7,8-HxCDF	See Total TEQ		0.1	0.125	0.0125	0.181	0.0181	0.137	0.0137
1,2,3,6,7,8-HxCDF	See Total TEQ		0.1	ND(0.0967)	0	ND(0.107)	0	ND(0.0946)	0
2,3,4,6,7,8-HxCDF	See Total TEQ		0.1	ND(0.105)	0	ND(0.117)	0	ND(0.103)	0
1,2,3,7,8,9-HxCDF	See Total TEQ		0.1	ND(0.104)	0	ND(0.115)	0	ND(0.102)	0
1,2,3,4,6,7,8-HpCDF	See Total TEQ		0.01	0.24	0.0024	0.312	0.00312	0.269	0.00269
1,2,3,4,7,8,9-HpCDF	See Total TEQ		0.01	ND(0.110)	0	ND(0.114)	0	ND(0.104)	0
Octa CDF	See Total TEQ		0.001	ND(0.304)	0	ND(0.421)	0	ND(0.337)	0
Total TEQ	100	1			1.05		5.76		4.07

Notes:

pg/g, picograms per gram

TEF - Toxic Equivalency Factors

TEQ - Toxic Equivalency Units;

323.59 - Value exceeds the Designated Screening Level

2160 - Value represents the laboratory confirmatory value for the designated parameter; confirmatory values are provided by the lab in the event of co-elution interference in the original chromatographic column.

A value of "0" has been assigned to all values below the detection limit (i.e. ND (0.272), where the detection limit is in parentheses) for the purposes of calculating TEQ

^{1,2} - Values in accordance with "International Toxicity Equivalence Factor (I-TEF) Method of Risk Assessment for Complex Mixtures of Dioxins and Related Compounds", Pilot Study on International Information Exchange on Dioxins and Related Compounds, Committee on the Challenges of Modern Society, North Atlantic Treaty Organization, Report Number 176, August 1988, accessed at <http://laws-lois.justice.gc.ca/eng/regulations/SOR-2005-149/page-10.html#h-31> (April 12, 2018)

Attachment B
Toxicity Characteristic Leaching Procedure
(TCLP) Results

Toxicity Characteristic Leaching Procedure (TCLP) Results
 Boat Harbour Remediation Project
 Nova Scotia Lands Inc.

Parameters	Exceedance (Yes/No)	Units	Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations Schedule 6 Hazardous Constituents Controlled Under Leachate Test and Regulated Limits	Dewatered Sludge TCLP Results										
				Sample Collected From Estuary			Sample Collected from Boat Harbour Stabilization Lagoon				Sample Collected from Aeration Stabilization Basin			
				Concentration	Control/ None	Polymer Only	Lime and Polymer	Control/ None	Polymer Only	Lime, Polymer, and 2% PAC	Lime, Polymer, and 2% RemBind Plus	Control/ None	Polymer Only	Lime, Polymer, and 2% PAC
Percent Solids	n/a	%	n/a	47.7	36.5	34.8	16.4	34.0	24.6	25.9	10.0	18.5	20.2	19.9
TCLP Metals														
TCLP Aluminum	No	mg/L	n/a	0.538	0.521	0.48	0.412	0.532	0.645	0.37	0.233	0.285	0.481	0.216
TCLP Antimony	No	mg/L	n/a	ND (0.05)	ND (0.05)	ND (0.05)	0.00303 J	ND (0.05)	0.0045 J	0.00618 J	ND (0.05)	ND (0.05)	ND (0.05)	ND (0.05)
TCLP Arsenic	No	mg/L	2.5	ND (0.05)	ND (0.05)	0.00951 J	0.00407 J	ND (0.05)	0.00464 J	ND (0.05)	ND (0.05)	ND (0.05)	0.0108	0.00122
TCLP Barium	No	mg/L	100	0.230	0.305	0.293	0.784	0.656	0.803	0.943	0.626	0.667	0.765	0.718
TCLP Beryllium	No	mg/L	n/a	ND (0.025)	ND (0.025)	ND (0.025)	ND (0.025)	ND (0.025)	ND (0.025)	ND (0.025)	ND (0.025)	ND (0.025)	ND (0.025)	ND (0.025)
TCLP Cadmium	No	mg/L	0.5	0.000933 J	0.000897 J	0.000967 J	0.00363 J	0.00113 J	0.00343 J	0.00311 J	0.00102 J	ND (0.025)	0.00184 J	ND (0.025)
TCLP Calcium	No	mg/L	n/a	11.7 E	8.87	114 E	95.8	355 E	224 E	216 E	218 E	221 E	259 E	161 E
TCLP Chromium	No	mg/L	5	0.000106 J	ND (0.025)	ND (0.025)	ND (0.025)	ND (0.025)	ND (0.025)	ND (0.025)	0.000171 J	ND (0.025)	ND (0.025)	ND (0.025)
TCLP Cobalt	No	mg/L	n/a	0.00922 J	0.0114 J	0.00905 J	ND (0.05)	0.00261 J	0.000761 J	0.00219 J	ND (0.05)	ND (0.05)	ND (0.05)	0.0013 J
TCLP Copper	No	mg/L	n/a	ND (0.05)	ND (0.05)	ND (0.05)	ND (0.05)	ND (0.05)	0.0238	ND (0.05)	ND (0.05)	ND (0.05)	ND (0.05)	ND (0.05)
TCLP Iron	No	mg/L	n/a	1.04	15.5	10.6	4.02	8.72	0.538	0.150	0.749	1.7	0.422	0.101
TCLP Lead	No	mg/L	5	ND (0.05)	ND (0.05)	ND (0.05)	ND (0.05)	0.00971 J	ND (0.05)	ND (0.05)	ND (0.05)	ND (0.05)	0.00815 J	ND (0.05)
TCLP Magnesium	No	mg/L	n/a	51.9	44.4	38.3	19.4	16.7	23.5	25.9	7.62	8.34	8.86	8.42
TCLP Manganese	No	mg/L	n/a	4.49	4.29	4.78	4.66	8.41	4.81	5.31	6.1364	7.48512	6.46514	7.11874
TCLP Mercury	No	mg/L	0.1	ND (0.0002)	ND (0.0002)	ND (0.0002)	ND (0.0002)	ND (0.0002)	ND (0.0002)	ND (0.0002)	ND (0.0002)	ND (0.0002)	ND (0.0002)	ND (0.0002)
TCLP Nickel	No	mg/L	n/a	0.00826 J	0.011 J	0.00888 J	0.00848 J	0.0141 J	0.00551 J	0.00846 J	0.00558 J	0.00606 J	0.00296 J	0.00218 J
TCLP Potassium	No	mg/L	n/a	12.4	11.4	10.2	4.37	4.03	4.56	4.52	3.88	3.54	3.57	3.52
TCLP Selenium	No	mg/L	1	ND (0.1)	ND (0.1)	0.00442 J	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)	0.0131 J	ND (0.1)	0.000487 J
TCLP Silver	No	mg/L	n/a	ND (0.05)	ND (0.05)	ND (0.05)	ND (0.05)	ND (0.05)	ND (0.05)	ND (0.05)	ND (0.05)	ND (0.05)	ND (0.05)	ND (0.05)
TCLP Sodium	No	mg/L	n/a	1470	1490	1480	1480 E	1440 E	1400 E	1500 E	1420 E	1370 E	1360 E	1440 E
TCLP Thallium	No	mg/L	n/a	0.0113 J	0.00204 J	0.0116 J	0.00686 J	0.00872 J	0.0254 J	ND (0.1)	0.0044 J	0.00503 J	0.0212 J	0.00177 J
TCLP Vanadium	No	mg/L	n/a	0.000351 J	0.000885 J	0.000654 J	0.0219 J	0.00155 J	0.00604 J	0.0103 J	0.0121 J	0.00857 J	0.00879 J	0.00584 J
TCLP Zinc	No	mg/L	n/a	0.908	0.512	0.788	1.94	1.52	1.64	2.38	1.42	1.07	1.52	0.964
TCLP Cyanide														
TCLP Total Cyanide	No	mg/L	20	ND (0.01)	ND (0.01)	ND (0.01)	0.0089 J	ND (0.01)	ND (0.01)	0.0039 J	ND (0.01)	ND (0.01)	ND (0.01)	0.0046 J
Dioxins and Furans														
TEQ Sediment Result (Shown for Reference)	n/a	pg/g	n/a	2.07	2.55	2.63	230	343	110	160	509	374	270	319
TCLP - TEQ	No	pg/L	1500								1.63			
TCLP Total Petroleum Hydrocarbons														
TCLP Total Petroleum Hydrocarbons (C6-C10)	No	mg/L	n/a	ND (0.01)	ND (0.01)	ND (0.01)	ND (0.01)	ND (0.01)	ND (0.01)	ND (0.01)	ND (0.01)	ND (0.01)	ND (0.01)	ND (0.01)
TCLP Total Petroleum Hydrocarbons (>C10-C16)	No	mg/L	n/a	ND (0.02)	ND (0.02)	ND (0.02)	ND (0.02)	ND (0.02)	ND (0.02)	ND (0.02)	ND (0.02)	ND (0.02)	ND (0.02)	ND (0.02)
TCLP Total Petroleum Hydrocarbons (>C16-C21)	No	mg/L	n/a	0.0128 J	0.0190	0.0129 J	0.0476	0.005 J	ND (0.02)	ND (0.02)	0.062	0.05	ND (0.02)	ND (0.02)
TCLP Total Petroleum Hydrocarbons (>C21-C32)	No	mg/L	n/a	0.027	ND (0.02)	ND (0.02)	0.293	ND (0.02)	ND (0.02)	ND (0.02)	0.09	ND (0.02)	ND (0.02)	ND (0.02)
TCLP Total Petroleum Hydrocarbons - Modified - Tier 1	No	mg/L	n/a	0.0398	0.0190	0.0129 J	0.341	0.005 J	ND (0.02)	ND (0.02)	0.152	0.05	ND (0.02)	ND (0.02)

Notes:
 ND (x) - Not detected at reporting limit
 J - Estimated value
 E - Above Calibration Range
 PAC - Powdered Activated Carbon
 Lime - Calcium Hydroxide added to reach pH 8-8.5 Standard Units
 S.U. - Standard Units
 EST Polymer - 71301 at 600 ppm
 BH Polymer - 8186 at 1000 ppm and 7768 at 150 ppm
 ASB Polymer - 8186 at 1250 ppm and 7768 at 100 ppm

Appendix C

Public Consultation – Summary of Questions and Responses

Boat Harbour Temporary Barrier Construction Community Consultation

When: Wednesday, October 19, 2016

No. Attendees: 54 people from the community signed in, another six or so were present but had not signed in.

Materials Provided (Attached):

- Overview of Boat Harbour Remediation Project, broken down by project stream
- Fact Sheet providing Qs and As of temporary barrier construction planned for Boat Harbour

Overview:

- The Community Open House was advertised in the New Glasgow News, as well as on the radio in the two days leading up to -- and the day of -- the event.
- The community consultation session was well received. Many expressed their pleasure with the outreach to the community and appeared to support the temporary barrier construction in Boat Harbour. Similarly, there was much interest in remediation efforts and the planning around the remediation and the outcome of the project. Story boards were used to showcase the various aspects of the project and the hydrology and hydrogeology study results. Also included were images of Boat Harbour back in 1936 ... and a projection of what it will look like after it has been cleaned up and returned to a tidal estuary.
- Some were skeptical because of broken promises of past governments.
- There were also comments from attendees about being concerned that each side of the project would be competing for same funding dollars.
- There were a lot of questions about the province-mill process for building the replacement facility, which is a separate stream of the Boat Harbour Project. It was made clear that this was something outside the scope of the remediation project.
- There were general concerns expressed around the environmental impacts and reputation both of the Mill as an industry operator and Nova Scotia Environment as regulator.

Survey

Survey forms for written comment were made available to all attendees. Fifteen survey sheets were returned. The table below summarizes the comments received. Twelve of the fifteen responded “No” to the question of “Do you have any concerns regarding the constructions of the temporary barrier?”. Three respondents indicated “Yes” they have concerns. The table below indicates the concerns noted for those answering “Yes”.

Comment	Commenter
Definitely but based on your information your group will do the utmost to minimize side effects from building the barrier.	Local Councilor
No response.	Trenton Resident
Because it is only temporary.	Lower Road Resident

Boat Harbour Remediation Project Temporary Barrier Construction

Why do you need to barricade part of Boat Harbour?

To help us understand the best technical approach to carry out the remediation (cleanup), we intend to do some on-site studies ... known as pilot scale work. This work involves draining a cove and determining the best ways to safely handle, remove, and dispose of the contaminated material from the Harbour. This is especially important work because our goal is to return the Harbour to tidal.

How will the work be done?

Basically, the pilot scale work will be done in stages, with the first being the construction of the barricade. Once the cove is isolated with a water-tight barricade in place, additional phases will be added as project plans are advanced and government environmental approvals are received. This will include draining the isolated cove to determine the best approaches to use to remove the contamination and establish environmental control procedures for the cleanup.

When the work starts will the contamination get into the air?

Both human and environmental health are our primary concerns as we move forward with this and other studies. Odour, noise, dust and air quality will be closely monitored and reported. Environmental controls will be put in place as they are needed.

What material will be used to make the barrier?

That has not yet been decided and will depend on the proposals received from bidders. Whatever the barrier material will be, it will be impermeable (water tight) and will be wide enough to act as a work surface for the team and contractors conducting the pilot-scale study.

Where will the barrier be located?

The barrier will be located in the large cove farthest away from any community. (See map on back of this page.)

When do you plan to start the pilot?

In the coming months. The first step in placing the barrier across the mouth of the specified cove to isolate it from the rest of Boat Harbour. Next year we plan to assess different methods to drain or remove the water from the cove, and remove and treat the contaminated material that it contains.

Why is this pilot work important?

This work help us to determine the most effective technologies to use in the cleanup phase of the project. Part of the process will include examining sediment behavior, management, treatment, and its transport and eventual containment.

How long will the barrier be in place?

The barrier is expected to remain in place at least until the Remediation Project begins in 2020.



Project Location Plan Boat Harbour Berm/Barrier Construction Project

Reference: <https://gis8.nsgc.gov.ns.ca/NSCRS/>

Boat Harbour Remediation Project

Overview

The Boat Harbour Project is broken down into four streams of work. Three of the four streams are already underway, and the fourth stream will begin when the cleanup itself starts. The streams are scientific/technical studies (some studies completed; others underway), regulatory process, remediation, and socio-economic engagement and implementation. A snapshot of what each stream includes is provided below.

Remediation Planning is anticipated to be completed in 2019.

Scientific/Technical Planning Studies Underway		Regulatory Phase — Life of the Project Underway																							
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PUBLIC NOTICE

Boat Harbour Remediation Project

► Open House

Interested in learning more about plans to cleanup Boat Harbour and the next step in the process?

When: October 19, 2016

Where: Pictou Landing Fire Hall

Time: 6:00 pm to 8:00 pm

Boat Harbour Remediation Project
Plans for Pilot Testing
Community Consultation

When: Tuesday, May 15, 2018

No. Attendees: 53 people signed in (we believe everyone signed the attendance sheet)

Overview:

- The Public Open House was advertised on the Nova Scotia Government Facebook Page; in the Pictou Advocate on May 9, 2018; in The Chronicle Herald on May 15; and on the two New Glasgow radio stations (CKEC and CKEZ) from May 9 to May 15.
- The following handouts were made available:
 - Fact Sheet providing Qs and A's of plans for pilot testing infrastructure
 - Infographic #2 – Boat Harbour Sludge
 - Survey Sheet
 - Responses to Questions from the April 4, 2018 open house session
- NS Lands started with an overall update on where we are with project planning. A few general questions were taken and then the project team (NSL and GHD) mingled with community members around the story boards and answered individual questions.
- The session was well received. Few questions and comments came up regarding the plans for pilot testing. Similar to the April 4, 2018 public open house, there was much interest and focus on the planning for the overall remediation project. Story boards were used to showcase the various aspects of the overall project schedule and planning, as well as the plans for pilot testing.
- NS Lands indicated that future public open houses would be scheduled to discuss the overall project once the EA process for the project was further clarified.

Survey:

Survey forms for written comment were made available to all attendees. Eight completed survey sheets were returned.

Do you have any concerns regarding the plans for pilot testing?

One of the eight did not respond to the question of “Do you have any concerns regarding the plans for pilot testing?” Five respondents indicated “No” they did not have concerns, and two respondents indicated “yes” they have concerns. Of the five who

responded “no”, one person went on to list their concern which has been recorded in the table. The table below lists the concerns noted on the survey sheets. It is noted that all concerns noted under this question were not necessarily related to the plans for pilot testing.

Comment	Commenter
“The impact on the air when the sludge is removed from Boat Harbour.”	New Glasgow/Chance Harbour resident
“That the contents found won’t be made public and the financials won’t be shared with public as to the cost of clean-up.”	Address not given
“It is being done in isolation to its replacement. How can we undo all this if the replacement is wrong?”	Address not given

The table below indicates other comments/concerns noted by the respondents in regards the remediation project in general.

Comment	Commenter
“A long time coming. I do have concerns about the proposed effluent treatment facility.”	New Glasgow/Chance Harbour resident
“I feel as though the gov’t has no concern over environmental issues and thinks it can just make a mess and clean it up later and leave it for future generations to deal with.”	Address not given
“I’m impressed with plans to remediate Boat Harbour.”	Address not given
“Quite pleased with the way the project is being handled”	Pictou Landing resident
“All this info you have collected and will collect should be shared with Dept. of Envir. And Northern Pulp who are planning replacement facility.”	Address not given
“Could the air monitoring data be made public?” “If the water level needs to be reduced is it released into Pictou Harbour?”	Pictou resident
“Would like to have a tour of Boat Harbour.”	Pictou Landing resident

Responses to questions will be posted to the Boat Harbour Remediation Project web site: novascotia.ca/boatharbour/

Attachments:

- Fact Sheet providing Qs and A’s of plans for pilot testing infrastructure

- Infographic #2 – Boat Harbour Sludge
- Survey Sheet
- Responses to Questions from the April 4, 2018 public open house session
- Responses to Questions from the May 15, 2018 public open house session
- Newspaper Ad

Boat Harbour Remediation Project

Plans for Pilot Testing

Why is the pilot work important?

This work will help us to determine the most effective technologies to use in the clean-up phase of the project.

How will the pilot work be done?

The pilot scale work is being completed in stages, with each stage requiring approval by the Nova Scotia Department of Environment.

The first stage was completed with the construction of a temporary barrier to isolate Cove 1, approved and constructed in 2017.

The second stage includes construction of the infrastructure necessary to carry out the pilot testing. We talked about this at the April 4, 2018 Open House. This work will be done in July.

The third and final stage will be the actual pilot testing of methods recommended by the design engineer, based on studies completed in recent months. During this period, we will lower the water level in Boat Harbour by about 30 centimetres.

What will be pilot tested?

The pilot testing will involve testing of dredging in the wet, dredging in the dry, dewatering of the sludge and treatment of water. This will be accomplished by further dividing Cove 1 as indicated in the drawing on the reverse of this page.

What does removal of sediments in the dry involve?

A 1.1-hectare area will be segregated by the construction of separation berms, similar to those previously constructed for isolation of Cove 1. Water in this area will be lowered and the area will be used to test the effectiveness of removing sludge by excavation.

What does removal of sediments in the wet involve?

A 6.3-hectare area will be segregated using silt curtains. This area will be used to pilot test removing sludge by dredging.

What will you do with the sediments after removal?

Sludge removed either by wet or dry methods will be pumped to large fabric filter bags called geotubes. The geotubes will be located in a lined sludge processing area. Sludge removed "in the dry" will still have a high-water content. A polymer will be added to the sludge as it is being pumped into the geotubes to help the solids settle out. Solids will stay in the geotubes and the water that comes off will be collected and returned to Cove 1. At the end of testing, the dewatered sludge will be relocated to the existing sludge disposal cell on site.

Will you be testing water treatment options?

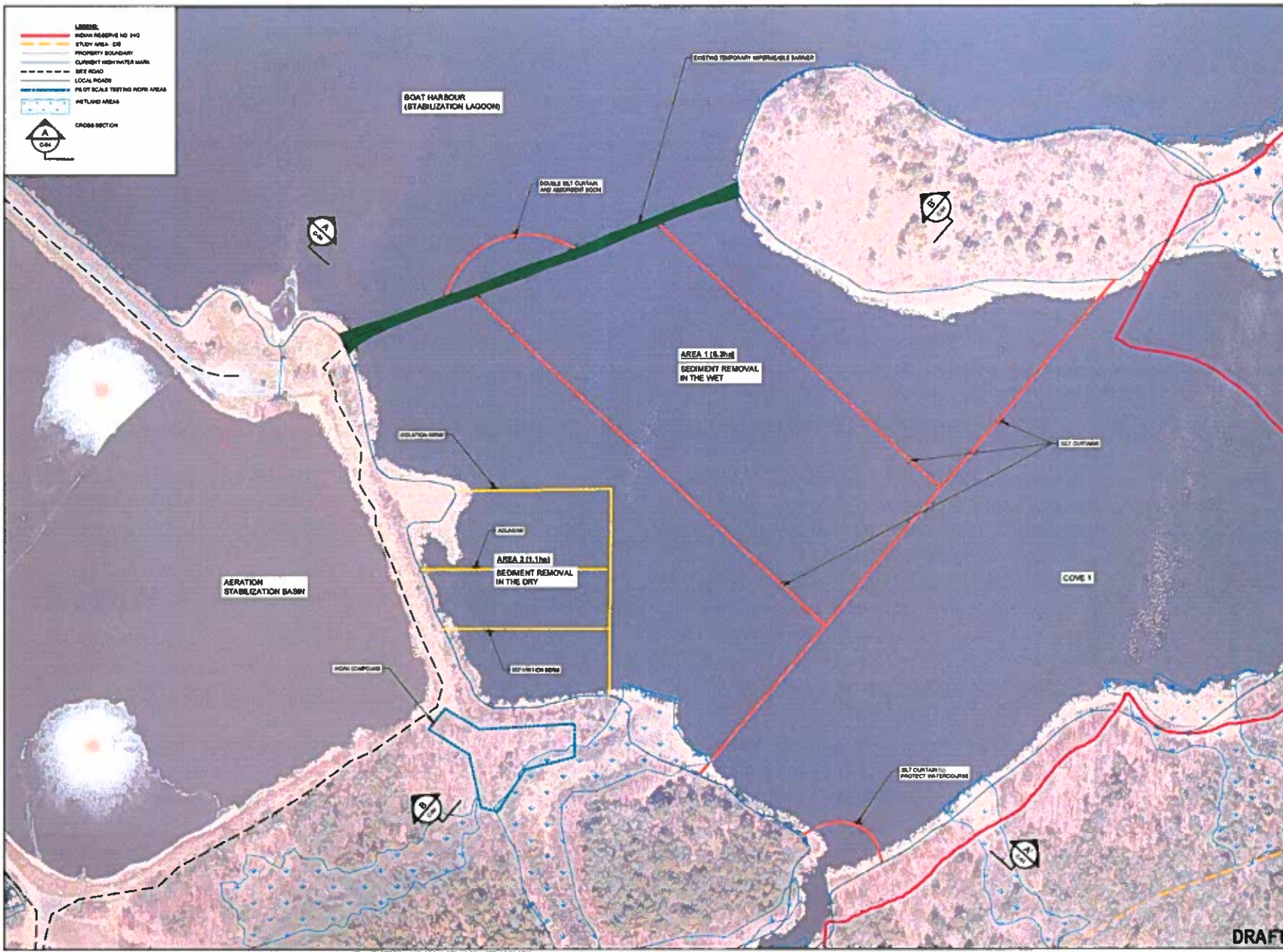
A small portion of the water that comes off the geotubes will be directed to a water treatment system to test treatment options for what we refer to as the "dewatering effluent", in other words the water that runs out of the filter bags when the solids settle out. Water from Cove 1 will also be collected to test treatment options for what we refer to as "bulk water", which is the water taken directly from Boat Harbour.


Are you testing for air emissions during this work?

Yes, part of the program involves testing air quality so we know what to expect and what mitigation to put in place during the large project.

When do you plan to start the pilot testing?

The actual pilot testing is expected to begin in August 2018, and continue into December 2018/January 2019.






GHD Limited
45 Abbey Boulevard
Cape Town - 8001
T 352 486 1268 F 352 486 2257 W www.ghd.com

Notes of Documents

We warrant that the data and design information herein is an outcome of professional services, is the property of GHD and will be treated as confidential for any other purpose without GHD's written authorisation. © 2014 GHD



0 10 20 30 40 50 60 70 80 90 100

Client
**NS LANDS - BOAT HARBOUR
REMEDATION PLANNING & DESIGN**

Project
**WP4 - IMPLEMENTATION OF
PILOT SCALE TESTING**

No.	REV.	DESCRIPTION	BY	DATE

No.	REV.	DESCRIPTION	BY	DATE
1				

No.	REV.	DESCRIPTION	BY	DATE

Role	Name	Design	Approved	Date
Client	K. PILLAY	Design	A. KESSEL	
Design	S. KESSEL	Design	C. BURTH	
Check		Design		
Project Manager	C. BURTH			APRIL 20, 2014

File: Boat Harbour - 1144275-10.dwg
Scale: 1:1000

Original Size: 1144275-10.dwg
File is 20mb on original
size of drawing
of sheets: 2/2

Project No: 1144275-10

Title: **DREDGING AND
EXCAVATION AREA**

Drawing No: **C-03**

Sheet 4 of 9

Boat Harbour Remediation Project



ABERCROMBIE POINT PULP MILL
PIPELINE CORRIDOR
EAST RIVER OF PICTOU

HWY 348

PICTOU HARBOUR

NORTHUMBERLAND STRAIT

Pictou Landing First Nation

Estuary

Settling Ponds
Wetlands
Treatment Pad
Aerallon Lagoon
A'se'k (Boat Harbour)
Cove 1 Berm (Isolated for the Pilot Scale work)
Existing Containment Cell

Active Boat Harbour Effluent Treatment Facility

Boat Harbour Sludge – Our Problem

What contaminants are in Boat Harbour?

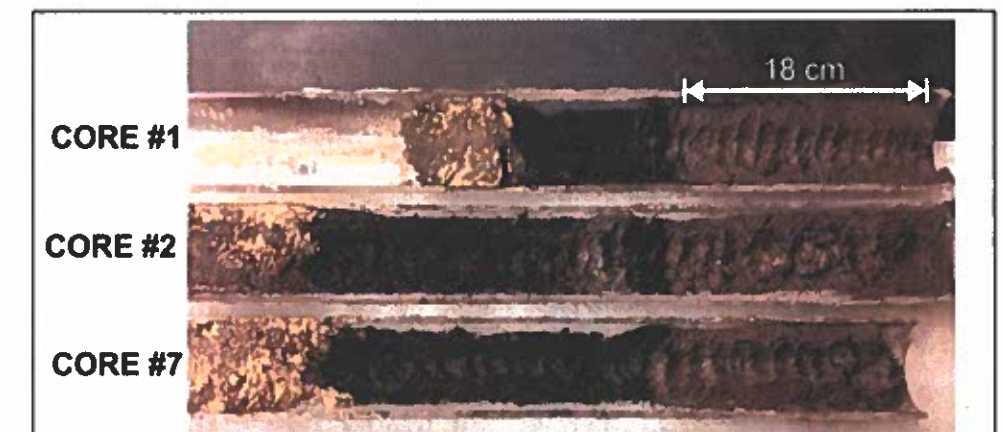
A layer of contaminated sludge has settled on top of the Boat Harbour bottom. This sludge has been accumulating since 1967. It has been sampled many times over the years. A full suite of testing was completed in 2017 which has confirmed the contaminants in the sludge. Over time, the contaminants have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

We know the sludge contains:

- Dioxins and furans, the principal contaminants of concern are carcinogens which are residues of industrial processes
- Metals such as mercury, cadmium and zinc, which are residues of industrial processes
- Polycyclic aromatic hydrocarbons (PAHs), which can be produced by incomplete combustion of fossil fuels in engines and boilers or from forest fires
- Total petroleum hydrocarbons (TPH), 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 centimeters, 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 clearly visible; the brownish gray is the clean Pre-industrial marine sediment and, the bentonite is a clay product put in the core during sampling as a plug - **Note:** The figure shows from left to right bentonite plug, black contaminated sludge, brownish gray pre-industrial marine sediment

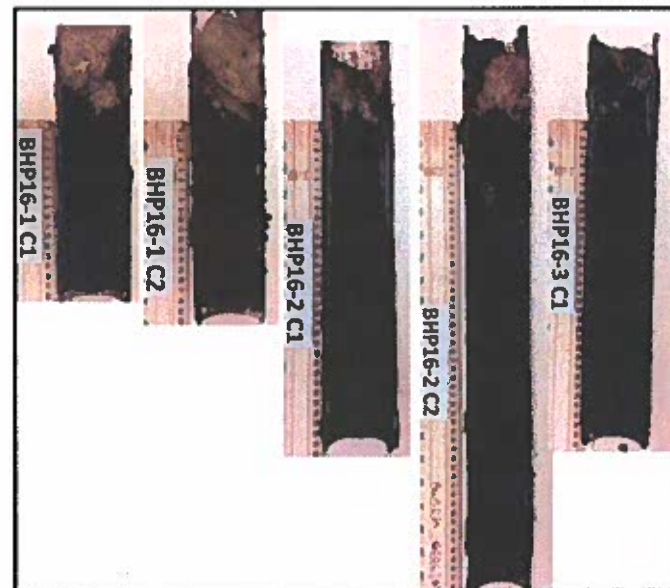
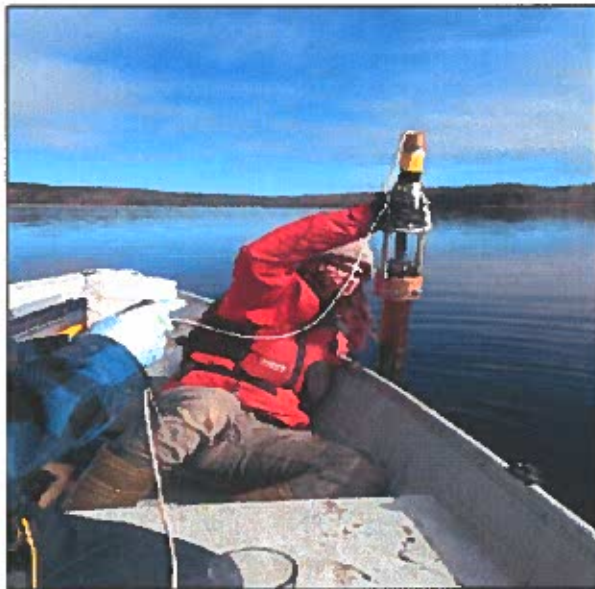
Boat Harbour Remediation Project

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 cubic meters. 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 cubic meters.

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 around Boat Harbour and are identified as marsh and/or swamp complexes. One wetland of about 36 hectares in area, pictured below, is situated near the existing settling ponds and was impacted by early years of effluent discharge. The 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 allowing 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 into 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.

Survey

Boat Harbour Remediation Project

(1) Did you find the Open House informative? Why or why not?

(2) How do like to receive information?

Social media

Website

Newsletters

Open House

Other

Please Specify: _____

(3) Would you be interested in participating on a community liaison committee regarding the remediation (cleanup) project? If yes, please provide your contact information:

Name: _____

Address: _____

Telephone: _____

E-mail: _____

(4) Do you have concerns regarding the plans for pilot testing?

Yes (Please note below) No

(5) Would you like to share your thoughts or comment on the plans to cleanup Boat Harbour ... or express other concerns?

NAME [please print]

HOME ADDRESS [please print]

Comments/Questions and Answers from April 4, 2018 Public Open House

Comment	Response
“At which point does the NS Lands need to include Federal government. Why not include them from pilot project?”	The federal government has been included in our planning for several years through the Boat Harbour Environmental Advisory Committee. In addition, through Nova Scotia Environment’s approval process, the seek advice from relevant federal agencies. Submission for federal funding is in process.
“I have concerns with water quality during the testing.”	Water will be tested to ensure it meets discharge criteria prior to discharge back into Cove 1. During the testing, the volume of water is expected to substantially decrease during the test period.
“My concerns are with the well water’s, the harbour water.”	Groundwater in the immediate area of the site has been tested has not been impacted due to the effluent treatment facility.
“Will pipe from Mill to Boat Harbour be removed.”	We are in the process of evaluating the options for the pipeline. Different stretches of the pipeline may be treated differently. For the most part, it will likely be cleaned and capped in place. The final determination has not yet been made.

Comment	Response
“With the clean up has there been testing done on the fish living in Boat Harbour???” “What will be done with the contaminated live fish once the dam is removed!!!”	We have found mummichogs and stickleback in Boat Harbour. They are pollution tolerant species. DFO has advised that these fish will likely have to be destroyed during remediation, prior to removal of the dam.
“Once more is decided it will be easier to form an opinion.” I’d like to see the continuous management info (should the waste be disposed of on-site) to be publicly accessible as well.”	Should the waste be disposed of on site, there will be a requirement for at least yearly monitoring reports. These reports will be publicly available.
“Cleanup plans still rudimentary.”	The planning process is long and intense. We want to make sure we get it right.
“I think you have to go the way you are going. Not rushing, checking things out before you start.”	
“There was a lot of focus on sediment in harbour but nothing communicated in regards to wetland where raw effluent was pumped prior to establishing a treatment system. Also would like	The April 4, 2018 open house was focused on the pilot testing infrastructure. More information will be coming on the wetland areas as we head into the open houses for the environmental impact assessment,

Comment	Response
to see a list of contaminants of concern and media affected.”	planned to start in June of 2018. This will also include contaminants of concern in affected areas.
<p>“I feel the info was well presented and as complete as possible. Cynicism and distrust are, unfortunately rampant.”</p> <p>“My significant concern is where the ‘treated’ waste will be permanently placed. Given the history of ‘Boat Harbour’ treatment facility, there is considerable mistrust.”</p>	The options for sludge transport and disposal are still under evaluation. In the next few months, we will have a better idea of what the preferred option is and we will be talking about this at our open house sessions to support the environmental impact assessment this summer. There will be monitoring programs in place during and following remediation, as required by regulators.
“Was concerned your engagement with PLFN has been downplayed. Expected to give us (PLFN) a plug about engaging the PLFN community to be ready for tenders. Got nothing.”	PLFN content will be incorporated into all tenders for the project.
“My concern is if they take sludge off site. Where will it go. How will they transport.”	The options for sludge transport and disposal are still under evaluation. In the next few months, we will have a better idea of what the preferred option is and we will be talking about this at our open house sessions to support the environmental impact assessment this summer.
“I believe Boat Harbour will be cleaned up from what we heard at this Open House. But will industry and government then go ahead and put the mill contaminants through a pipe to be put in the Northumberland Strait, thus making a greater mess.”	The remediation project has no influence on what happens with the replacement facility.
“I would like to suggest that more notice be given re meetings, in the perhaps and ad in the “Chronicle News”. I was only informed of the meeting tonight through a friend on FB. We don’t listen to local radio ECFM nor do we subscribe to the NG News. I heard that more people would have been interested to attend if they had been aware. There was a noticeable decrease in attendance tonight over the last meeting last year”	Noted. We will have more advanced and widespread notification for the open houses yet to come, including notification on the project web site.

Comments/Questions and Answers from May 15, 2018 Public Open House

Relating to Pilot:

Comment	Response
<p>A comment was made as to “The impact on the air when the sludge is removed from Boat Harbour.”</p>	<p>We have done some baseline monitoring to see what contaminants are in the air before starting our work. We have just awarded a Tender for independent air monitoring during our pilot work. This will help us determine what issues we may have with air quality and what options we have for mitigation. The program includes stop work orders if emissions are detected at levels approaching those of concern for human health.</p>
<p>A comment was made “That the contents found won’t be made public and the financials won’t be shared with public as to the cost of clean-up.”</p>	<p>We know what the Boat Harbour sludge is contaminated with. The Infographic presented at the open house discusses the contaminants found, including visuals.</p> <p>All estimates for the cleanup have been shared publicly to date. As we refine our cost estimates and start the remediation, we are required to report our spending and liabilities in the public accounts, subject to audit by the Auditor General. During the meeting, we also advised the attendees if they had questions on this that we could answer them.</p>
<p>A comment was made about the remediation that “It is being done in isolation to its replacement. How can we undo all this if the replacement is wrong?”</p>	<p>That is correct, the replacement project is a separate project. The Boat Harbour Act stipulates that on January 31, 2020, Boat Harbour will no longer be allowed to receive and treat effluent from the pulp mill. If there are issues with the replacement facility, it will be up to the mill owners to fix the problem. Boat Harbour is not a part of that solution.</p>

Relating to Larger Remediation Project:

Comment	Response
A comment was made that the remediation is “A long time coming. I do have concerns about the proposed effluent treatment facility.”	The proposed replacement facility is a project that is separate from the remediation; this team is not able to address those questions and concerns.
A comment was made that “I feel as though the gov’t has no concern over environmental issues and thinks it can just make a mess and clean it up later and leave it for future generations to deal with.”	The Province of Nova Scotia remains committed to the remediation of Boat Harbour and its return to a tidal estuary.
A comment was made that “I’m impressed with plans to remediate Boat Harbour.”	The Province of Nova Scotia remains committed to the remediation of Boat Harbour and its return to a tidal estuary. The Province’s plans are advancing well.
“Quite pleased with the way the project is being handled”	The Province of Nova Scotia remains committed to the remediation of Boat Harbour and its return to a tidal estuary. The Province’s plans are advancing well.
“All this info you have collected and will collect should be shared with Dept. of Envir. And Northern Pulp who are planning replacement facility.”	Any information we collect is available to the Nova Scotia Environment and, if relevant, to Northern Pulp.
<p>“Could the air monitoring data be made public?”</p> <p>“If the water level needs to be reduced is it released into Pictou Harbour?”</p>	<p>Air monitoring data will be made public.</p> <p>In order to reduce the water level in Boat Harbour, the water will be released at the same location it has been released for the past 50+ years, over the dam near the culverts at Highway 348.</p>

CH - May 15/18

Public Notice

Boat Harbour Remediation Project
Open House

Interested in learning more about plans for
upcoming pilot testing and the Boat Harbour
clean up?

When: May 15

Where: Pictou Landing Fire Hall

Time: 7 pm - 9 pm


NOVA SCOTIA

Boat Harbour Remediation Project
Construction of Pilot Testing Infrastructure
Community Consultation

When: Wednesday, April 4, 2018

No. Attendees: 45 people from the community signed in, another four were noted to be present but had not signed in.

Materials Provided (Attached):

- Meeting Agenda
- Overview of Boat Harbour Remediation Project, broken down by project stream
- Fact Sheet providing Qs and A's of construction planned for Boat Harbour pilot testing infrastructure
- Infographic #1 – Boat Harbour Remediation Project Timelines and Overview
- Survey Sheet
- Responses to Questions
- Newspaper Ad

Overview:

- The Community Open House was advertised in the Pictou Advocate on April 4, 2018, as well as on the two New Glasgow radio stations (CKEC and CKEZ) from March 30 to April 4, 2018 (18 spots per radio station).
- The community consultation session was well received. Few questions and comments came up regarding the construction of the pilot testing infrastructure. There was much interest and focus on the planning for the overall remediation project. Story boards were used to showcase the various aspects of the overall project schedule and planning, as well as the location of the pilot work infrastructure and the design drawings.
- There were general questions around the management of environmental impacts during clean up, what EA process the project would be subject to and what the remediation option will be.
- NS Lands indicated that future Open Houses would be scheduled to discuss the pilot scale works planned and to support the EA process.

Survey:

Survey forms for written comment were made available to all attendees. Twelve survey sheets were returned.

Do you have any concerns regarding the constructions of the pilot scale work areas?

Four of the twelve did not respond to the question of “Do you have any concerns regarding the constructions of the pilot scale work areas?” Four respondents indicated “No” they did not have concerns, and four respondents indicated “yes” they have concerns. The table below indicates the concerns noted for those answering “Yes”. It is noted that all concerns noted under this question were not related to the pilot infrastructure construction.

Comment	Commenter
“At which point does the NS Lands need to include Federal government. Why not include them from pilot project?”	Scotsburn Resident
“I have concerns with water quality during the testing.”	Scotsburn Resident
“My concerns are with the well water’s, the harbour water.”	Pictou Resident
“Will pipe from Mill to Boat Harbour be removed.”	Trenton Resident

The table below indicates other comments/concerns noted by the respondents in regards the remediation project in general.

Comment	Commenter
“With the clean up has there been testing done on the fish living in Boat Harbour???”	Scotsburn Resident
“What will be done with the contaminated live fish once the dam is removed!!!”	
“Once more is decided it will be easier to form an opinion.”	Little Harbour Resident
I’d like to see the continuous management info (should the waste be disposed of on-site) to be publicly accessible as well.”	
“Cleanup plans still rudimentary.”	Pictou Landing Resident
“I think you have to go the way you are going. Not rushing, checking things out before you start.”	Trenton Resident
“There was a lot of focus on sediment in harbour but nothing communicated in regards to wetland where raw effluent was pumped prior to establishing a treatment system. Also would like to see a list of contaminants of concern and media affected.”	New Glasgow Resident

Comment	Commenter
<p>“I feel the info was well presented and as complete as possible. Cynicism and distrust are, unfortunately rampant.”</p> <p>“My significant concern is where the ‘treated’ waste will be permanently placed. Given the history of ‘Boat Harbour’ treatment facility, there is considerable mistrust.”</p>	Hopewell Resident (identified on the survey form as an elected official)
<p>“Was concerned your engagement with PLFN has been downplayed. Expected to give us (PLFN) a plug about engaging the PLFN community to be ready for tenders. Got nothing.”</p>	Pictou Landing First Nation Resident
<p>“My concern is if they take sludge off site. Where will it go. How will they transport.”</p>	Pictou Resident
<p>“I believe Boat Harbour will be cleaned up from what we heard at this Open House. But will industry and government then go ahead and put the mill contaminants through a pipe to be put in the Northumberland Strait, thus making a greater mess.”</p>	Pictou Landing Resident
<p>“I would like to suggest that more notice be given re meetings, in the perhaps and ad in the “Chronicle News”. I was only informed of the meeting tonight through a friend on FB. We don’t listen to local radio ECFM nor do we subscribe to the NG News. I heard that more people would have been interested to attend if they had been aware. There was a noticeable decrease in attendance tonight over the last meeting last year”</p>	New Glasgow Resident

Responses to questions will be posted to the Boat Harbour Remediation Project web site: novascotia.ca/boatharbour/

AGENDA

Boat Harbour Remediation Project Construction of Pilot Testing Infrastructure

Pictou Landing Fire Hall

April 4, 2018

7:00 PM – 9:00 PM

7:00 PM – 7:15 PM **General Overview of Remediation Project Planning**

Ken Swain, NS Lands

7:15 PM – 7:30 PM **Construction of Pilot Testing Infrastructure**

Christine Skirth, GHD

7:30 PM – 7:45 PM **General Questions**

Ken Swain, NS Lands
Christine Skirth, GHD

7:45 PM – 9:00 PM **Open House/One-on-One Questions**

Boat Harbour Remediation Team
GHD (Design Consultant)

Boat Harbour Remediation Project

Overview

The Boat Harbour Project is broken down into four streams of work. Three of the four streams are already underway, and the fourth stream will begin when the cleanup itself starts. The streams are scientific/technical studies (some studies completed; others underway), regulatory process, remediation, and socio-economic engagement and implementation. A snapshot of what each stream includes is provided below.

Remediation Planning is anticipated to be completed in 2019.

Scientific/Technical Planning Studies Underway		Regulatory Phase — Life of the Project Underway																							
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Boat Harbour Remediation Project

Construction of Pilot Testing Infrastructure

Why is the pilot work important?

This work will help us to determine the most effective technologies to use in the cleanup phase of the project. Part of the process will include examining sediment behavior, management, treatment, and its transport and eventual containment.

How will the pilot work be done?

The pilot scale work is being completed in stages, with each stage requiring approval by Nova Scotia Environment.

- 1) The first stage was completed with the construction of a temporary barrier to isolate Cove 1, approved and constructed in 2017.
- 2) The next stage includes construction of the infrastructure necessary to carry out the pilot testing. This includes construction of a treatment laydown pad and dredging work compound.
- 3) The third and final stage will be the actual pilot testing of methods recommended by the design engineer, based on studies over the past number of months.

What is involved in the construction of the infrastructure?

The treatment pad will include the construction of a gated access area, containment berm, lined sludge dewatering pad and supporting pipelines. A chain link fence will also be installed to separate the area from the operational effluent treatment plant.

The dredging work compound will include the construction of an access road, drainage berm and gravel laydown pad.

Environmental controls will be put in place, as required. This may include measures to control surface water runoff and erosion and sedimentation control measures.

When do you plan to start the pilot testing?

Construction of the infrastructure is expected to begin in July 2018. The actual pilot testing is expected to begin in August 2018, and continue into December 2018/January 2019. We expect to have another public open house session in May 2018 to discuss what the pilot testing work will include, as part of Nova Scotia Environment's permitting process.

How are the overall remediation plans coming along?

GHD was hired as the design engineer in May 2017. They are just finishing up a rigorous site investigation. The nature and extent of contamination is now well understood. The contamination is fairly well contained within the treatment facility and Boat Harbour.

Bench scale testing has just been completed. This involved a series of laboratory tests to figure out how the sediment responds in the lab to various treatment options. This helps inform treatment methods to test during the pilot testing work. Planning for pilot testing is now underway, with a tender to construct the infrastructure described above expected in May 2018 and a second tender for pilot testing expected in June 2018. Pilot testing will inform the final remediation design.

The team is also working on finishing up baseline studies to support an environmental impact assessment that will be submitted this coming summer. We are on schedule to begin cleanup activities in 2020, after the effluent stops flowing.

A project website was recently launched:

<https://novascotia.ca/boatharbour/>



GHD Limited
 1118 Topsail Road
 Mount Pearl Newfoundland and Labrador A1N 5E7 Canada
 T 709 364 5353 F 709 364 5368 W www.ghd.com

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WSP Canada Inc.
 1 S. Acadia Lane Drive
 Dartmouth, Nova Scotia, Canada B3B 1X7
 T 902-835-9955 F 902-835-1645 www.wsp.com

Client
**NS LANDS - BOAT HARBOUR
 REMEDIATION PLANNING & DESIGN**

Project
**WP3 - PILOT SCALE
 SUPPORT FACILITIES**

2	ISSUED FOR 95% REVIEW	DA	AGM	2018/03/29
1	ISSUED FOR 50% REVIEW	DA	AGM	2018/03/02

No.	Issue	Drawn	Approved	Date

Drawn D.ABURUB Designer D.ABURUB

Drafting Check A.MILLIGAN Design Check A.MILLIGAN

Project Manager P.LEWIS Date 2018/23/02

This document shall not be used for construction unless signed and sealed for construction. Scale 1:5000

Original Size
ANSI D
 Bar is 20mm on original size drawing
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Project No. 171-10478

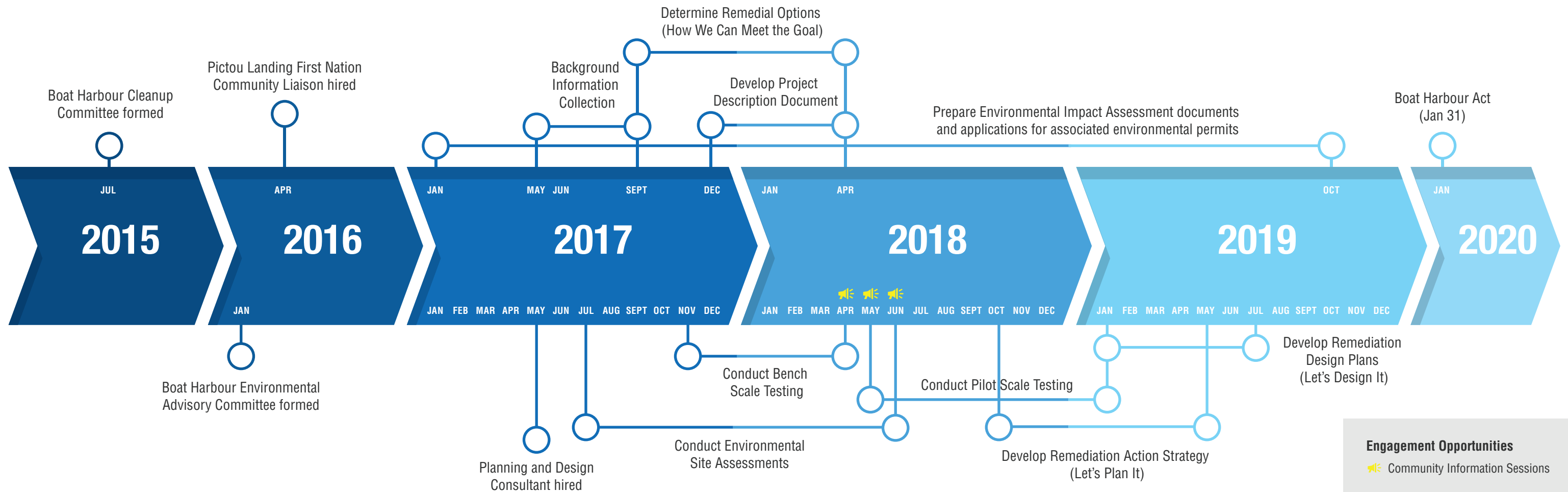
Title
SITE PLAN

Sheet No.
WP3-001

Boat Harbour Remediation Project



Project Timeline & Overview



Engagement Opportunities
 Community Information Sessions

Boat Harbour Remediation Project

An Overview & Timeline

The Problem – What's in Boat Harbour?

Timeline: 2015 - 2017

What the contamination is and how far it extends – that's the problem. Many studies on this have been done over the years. In 2017, GHD was named the design engineer. We worked on site investigations, doing interviews and records searches, taking samples of water, sediment and soil. The problem is now understood and seems to be contained to the treatment facility.

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

Timeline: 2017 - 2020

With the Problem well understood, we move to the Solution.

Studies to figure this out include:

Bench Scale Testing – In the lab, we figure out how the sediments behave and can be treated and cleaned. This helps inform options for the cleanup. Then we move from the lab to the real world with pilot scale work.

Pilot Scale Testing – Later in 2018, we will remove sediments from a cove on site and treat them. Different methods will be tested for removal and treatment, leading to the best cleanup option.

An **Environmental Impact Assessment** will be completed to predict how our cleanup will affect, and how we protect, human health and the environment. In doing so, we complete field surveys to determine what plants and animals are there and to understand the types of habitat on and near the site, and how our project might interact with them. We also look at existing noise, air quality and archaeological issues, and assess how our project will interact with them in any way.

In 2019 we will complete cleanup plans, get them approved and prepare tenders. By 2020 we expect to hire two companies, one for construction - to do the physical work in the cleanup and one for oversight - to ensure the cleanup is done well, according to cleanup plans. The earliest the cleanup can start is early 2020 when the effluent ceases to flow to Boat Harbour, or January 31, 2020.

The Vision – A'se'k

Timeline: 2020 and beyond

We expect the cleanup will take about 3 to 5 years starting in 2020. About \$133 million is set aside for it. That time and cost will be better established when the design is complete and approved. After the cleanup is complete, bridge built and dam removed, we expect Boat Harbour to return to be a healthy harbour.

Survey

Boat Harbour Remediation Project

(1) Did you find the Open House informative? Why or why not?

(2) How do like to receive information?

Social media

Website

Newsletters

Open House

Other

Please Specify: _____

(3) Would you be interested in participating on a community liaison committee regarding the remediation (cleanup) project? If yes, please provide your contact information:

Name: _____

Address: _____

Telephone: _____

E-mail: _____

(4) Do you have concerns regarding construction of the pilot scale work areas? Yes (Please note below) No

(5) Would you like to share your thoughts or comment on the plans to cleanup Boat Harbour ... or express other concerns?

NAME [please print]

HOME ADDRESS [please print]

Comment	Response
<p>“At which point does the NS Lands need to include Federal government. Why not include them from pilot project?”</p>	<p>The federal government has been included in our planning for several years through the Boat Harbour Environmental Advisory Committee. In addition, through Nova Scotia Environment’s approval process, the seek advice from relevant federal agencies. Submission for federal funding is in process.</p>
<p>“I have concerns with water quality during the testing.”</p>	<p>Water will be tested to ensure it meets discharge criteria prior to discharge back into Cove 1. During the testing, the volume of water is expected to substantially decrease during the test period.</p>
<p>“My concerns are with the well water’s, the harbour water.”</p>	<p>Groundwater in the immediate area of the site has been tested has not been impacted due to the effluent treatment facility.</p>
<p>“Will pipe from Mill to Boat Harbour be removed.”</p>	<p>We are in the process of evaluating the options for the pipeline. Different stretches of the pipeline may be treated differently. For the most part, it will likely be cleaned and capped in place. The final determination has not yet been made.</p>

Comment	Response
<p>“With the clean up has there been testing done on the fish living in Boat Harbour???”</p> <p>“What will be done with the contaminated live fish once the dam is removed!!!”</p>	<p>We have found mummichogs and stickleback in Boat Harbour. They are pollution tolerant species. DFO has advised that these fish will likely have to be destroyed during remediation, prior to removal of the dam.</p>
<p>“Once more is decided it will be easier to form an opinion.”</p> <p>I’d like to see the continuous management info (should the waste be disposed of on-site) to be publicly accessible as well.”</p>	<p>Should the waste be disposed of on site, there will be a requirement for at least yearly monitoring reports. These reports will be publicly available.</p>
<p>“Cleanup plans still rudimentary.”</p>	<p>The planning process is long and intense. We want to make sure we get it right.</p>

Comment	Response
<p>“I think you have to go the way you are going. Not rushing, checking things out before you start.”</p>	
<p>“There was a lot of focus on sediment in harbour but nothing communicated in regards to wetland where raw effluent was pumped prior to establishing a treatment system. Also would like to see a list of contaminants of concern and media affected.”</p>	<p>The April 4, 2018 open house was focused on the pilot testing infrastructure. More information will be coming on the wetland areas as we head into the open houses for the environmental impact assessment, planned to start in June of 2018. This will also include contaminants of concern in affected areas.</p>
<p>“I feel the info was well presented and as complete as possible. Cynicism and distrust are, unfortunately rampant.”</p> <p>“My significant concern is where the ‘treated’ waste will be permanently placed. Given the history of ‘Boat Harbour’ treatment facility, there is considerable mistrust.”</p>	<p>The options for sludge transport and disposal are still under evaluation. In the next few months, we will have a better idea of what the preferred option is and we will be talking about this at our open house sessions to support the environmental impact assessment this summer. There will be monitoring programs in place during and following remediation, as required by regulators.</p>
<p>“Was concerned your engagement with PLFN has been downplayed. Expected to give us (PLFN) a plug about engaging the PLFN community to be ready for tenders. Got nothing.”</p>	<p>PLFN content will be incorporated into all tenders for the project.</p>
<p>“My concern is if they take sludge off site. Where will it go. How will they transport.”</p>	<p>The options for sludge transport and disposal are still under evaluation. In the next few months, we will have a better idea of what the preferred option is and we will be talking about this at our open house sessions to support the environmental impact assessment this summer.</p>
<p>“I believe Boat Harbour will be cleaned up from what we heard at this Open House. But will industry and government then go ahead and put the mill contaminants through a pipe to be put in the Northumberland Strait, thus making a greater mess.”</p>	<p>The remediation project has no influence on what happens with the replacement facility.</p>
<p>“I would like to suggest that more notice be given re meetings, in the perhaps and ad in the “Chronicle News”. I was only informed of the meeting tonight through a friend on FB.</p>	<p>Noted. We will have more advanced and widespread notification for the open houses yet to come, including notification on the project web site.</p>

Comment	Response
We don't listen to local radio ECFM nor do we subscribe to the NG News. I heard that more people would have been interested to attend if they had been aware. There was a noticeable decrease in attendance tonight over the last meeting last year"	

Public Notice

Boat Harbour Remediation Project Open House

Interested in learning more about plans for upcoming pilot testing and the Boat Harbour clean up?

When: April 4, 2018

Where: Pictou Landing Fire Hall

Time: 7pm to 9pm

For more information visit
novascotia.ca/boatharbour



Appendix D
Information Prepared for Nova Scotia
Department of Fisheries and Aquaculture

Boat Harbour Remediation Project

OVERVIEW



April 2017

The Boat Harbour Project at a Glance

The project involves cleaning up Boat Harbour and returning it to a tidal estuary.

Boat Harbour is where the effluent treatment facility is located for the Northern Pulp Mill. The facility has been in existence since 1967, and while mostly used by the Mill, on occasion in the early years, other commercial and manufacturing companies in the area used the facility to treat their waste by-products.

Before 1967, Boat Harbour was a tidal lagoon next to Pictou Landing First Nation. This lagoon covered 350 acres, with a narrow entrance to the Northumberland Strait just east of the Pictou Landing First Nation community. Since 1967, Boat Harbour has been dammed off from the ocean and turned into a freshwater lake. This lake is part of the treatment facility, which includes the pipeline from the Northern Pulp Mill, settling ponds and an aerated stabilization basin. After 50 years of use, the entire treatment facility, including some adjacent areas, is contaminated. The contaminants are the source of some of the bad odours that are sometimes experienced around the Pictou Landing area.

The Boat Harbour Act

In 2015, Nova Scotia enacted the Boat Harbour Act, which legislates that the Northern Pulp Mill must stop using the Boat Harbour Effluent Treatment Facility by January 31, 2020.

The timeline provides about a three-year window to carry out remediation planning efforts, and, once the effluent stops flowing in 2020, about another four years to clean up the contamination.

Previous studies are being reviewed, and where necessary, additional studies will be undertaken to bridge the research gaps. This is to ensure there is detailed and current information about the Boat Harbour environment and the contaminants to help make sure design and implementation efforts will be successful, and Boat Harbour can once again become a tidal estuary.

How long will it take to return Boat Harbour to a tidal estuary?

Cleanup cannot begin until the Boat Harbour effluent treatment facility shuts down at the end of January 2020. After that, it is expected to take about four years before the area is clean and ready to be returned to tidal.

Returning to tidal involves replacement of box culverts with a new bridge and removal of the dam structure.

We will ensure that we understand, manage, and mitigate all impacts to wildlife and the environment to the best of our ability.

When Boat Harbour is returned to Tidal, how will it impact other animals and migration?

A number of studies are required before Boat Harbour can be returned to tidal. The studies will look at the animal life surrounding Boat Harbour and aquatic life presently existing in and around the area.

Study results will help to better plan our next steps to move us closer to returning Boat Harbour to tidal. Some of the questions that the studies will help us answer include:

- Do we need to remove any unhealthy organisms such as fish from Boat Harbour?
- How much time – and when is the best time – to capture and relocate beavers currently living in Boat Harbour, and where should they go?
- What do we need to monitor in the future to ensure Boat Harbour is returning to its previous healthy tidal environment?
- How big and how far has the contamination spread?

What are the contaminants in Boat Harbour?

Several chemical contaminants have been found in Boat Harbour. They form a layer on top of the natural harbour bottom. They include metals (zinc, mercury, cadmium), PAHs (polycyclic aromatic hydrocarbons), and dioxins and furans.

Are fish and seafood currently at risk from the contaminants in Boat Harbour?

We are working closely with DFO, NSE and Environment Canada to meet strict regulatory controls and do our utmost to reduce the chance of Boat Harbour impacting human, marine, and/or environmental health. We cannot return Boat Harbour to tidal until the contaminants are removed.

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

We are studying other waters close to Boat Harbour, including Little Harbour and Chance Harbour, to get some idea of what Boat Harbour might have been in its "clean" stage before it became part of the effluent treatment facility. A larger number of samples will need to be taken from the Harbour during the cleanup to try to make sure that it is restored completely to that "clean" stage.

In addition, a design engineer will evaluate various technical options to remove, treat, and dispose of contaminants from Boat Harbour and, in the process, will develop a detailed project description and associated environmental plans. These descriptions and plans will be the subject of an extensive environmental assessment process.

Before we can allow Boat Harbour to become tidal and open to the sea, the contractor doing the work will have to meet all criteria that ensures Boat Harbour is clean. All samples taken during the cleanup will also be made public. The criteria are regulated by government agencies such as Nova Scotia Environment, Environment Canada, and Fisheries and Oceans Canada. Once all criteria have been determined, this list will be made public.

Public Engagement

The Province is committed to having open and regular engagement with the various groups concerned about or impacted by the contaminants in Boat Harbour.

There is regular and ongoing interaction and engagement with Pictou Landing First Nation. Pictou Landing residents were recently provided with a project briefing and will form part of a citizens' advisory group, to be formed in the future, specifically related to Boat Harbour.

Further engagement opportunities will be arranged as the project advances.

"Maw-Lukutinej Waqama'tuk A'se'k"

"Let us work together and clean up Boat Harbour"



about GHD

GHD is one of the world's leading professional services companies operating in the global markets of water, energy and resources, environment, property and buildings, and transportation. We provide engineering, environmental, and construction services to private and public sector clients.

Peter Oram

Peter.Oram@ghd.com
902.334.1818

Christine Skirth

Christine.Skirth@ghd.com
613.297.7687

www.ghd.com