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Attention: Brian Hebert

RE: Boat Harbour Remediation Environmental Impact Assessment
Information Requirement (IR) 82 Analysis

Hive Engineering Limited (herein referred to as "Hive") has been retained by McKiggan Hebert Lawyers on behalf of Pictou Landing First Nation (herein referred to as the "Client" or "PLFN") to provide technical advice and analysis as it pertains to the ongoing Environmental Impact Assessment (EIA) being completed on the Boat Harbour Remediation Project.

This letter provides an analysis of a draft response for a specific Information Requirement (IR82) that came from Build Nova Scotia (BNS), intended for the Impact Assessment Agency of Canada (IAAC). IR82 is focused on the Boat Harbour containment cell, part of the overall Boat Harbour Effluent Treatment Facility (BHETF) that is proposed in the EIA Project Description to remain in perpetuity in its current location along the banks of Boat Harbour; the information requirement pertains to the consideration of alternative siting considerations for the containment cell.

Section 1 presents the background to IR82, which includes an overview of IR82 and a discussion of the key points to BNS's response to the information requirement. Sections 2 and 3 provide a discussion of areas that could be developed with a new waste containment cell (as opposed to the current location), including available crown land or private lands that could be considered for appropriation. Section 4 outlines the landfill siting criteria and how that applies to each of the existing Boat Harbour Cell, the Northern Pulp Nova Scotia (NPNS) waste cells, the Mount William

site and the Granton Site. Finally, Section 5 outlines possible mitigation options for each of the various siting restrictions and Section 6 discusses some additional siting criteria.

1.0 BACKGROUND

1.1 IR-82 Outline and Overview

The IAAC IR82 is summarized by the following excerpt from IR82:

"Applicable Environmental Impact Statement (EIS) Guidelines: Part 2 Section 2.2 and Part 2, Section 5.0 Reference to NS Lands Inc. EIS: Section 2.2.1.1 Identification of Alternative Means; Section 2.2.1.2.1 Waste Management; and Remedial Option Decision Document (GHD 2018), Section 4.

Context:

The EIS Guidelines require the proponent to identify and consider the effects of alternative means of carrying out the project, and to provide an analysis of alternative means of meeting the project purposes or objectives that considers environmental effects as per the Canadian Environmental Assessment Act, 2012 (CEAA 2012). The Agency's Operational Policy Statement on Addressing "Purpose of" and "Alternative Means" under CEAA 2012 states that the approach and level of effort applied to addressing alternative means is established on a project-by-project basis taking into consideration the level of concern expressed by Indigenous groups or the public. The EIS Guidelines also require the proponent to assess the effects of changes to the environment on Indigenous peoples, including potential impacts to Aboriginal and treaty rights, and to engage with PLFN, to obtain their views on potential adverse impacts of the project on potential or established Aboriginal or Treaty rights, in respect of the Crown's duty to consult, and where appropriate, accommodate them.

PLFN has informed the Agency and the proponent that they do not support the use of the existing containment cell as the permanent storage facility for the remediated materials. PLFN owns a 29.14 hectare land parcel, located approximately seven kilometres west of New Glasgow. PLFN identified this parcel as a potential alternative location for the containment cell and provided this information to the proponent for review.

This information is required to ensure that the assessment of alternative means was sufficient to allow the evaluation and the selection of the preferred alternative for waste management and increase the Agency's understanding of the potential effects of the Project, including potential impacts to Aboriginal and treaty rights.

IAAC Question:

Provide an analysis of the technical and economic feasibility of the alternative containment cell location proposed by PLFN. The analysis should consider factors such as environmental impacts, cost, regulatory requirements, timing, risk, public concerns, and impacts to PLFN. Sufficient information should be provided to support any assumptions or conclusions made in the analysis. Provide PLFN the opportunity to comment on the analysis and clearly demonstrate how comments were addressed."

BNS provided a response to IR82 that was in favour of the on-site containment cell remaining in its current location. The argument BNS presented was considered technically sound and was supported with appropriate, industry-standard engineering and scientific principles. The initial concern identified upon review of the Environmental Impact Statement (EIS) was pertaining to the lack of detail surrounding the selection of potential alternatives and the limited acknowledgment of PLFNs objections to the containment cell remaining on-site. The IR82 BNS response contained text to address these concerns. BNS also documented their understanding of the matter and the sequence of events as to how BNS observed PLFN's objection to the on-site containment cell.

In the Response to IR82, BNS has examined, in detail, one specific alternative to the on-site containment cell; the request from IAAC was specific for BNS to solely examine one specific location in Mount Williams, Parcel Identifiers (PIDs) 00865485, 00865469, 65170508 and 65170516. It was not the intent of PFLN to limit the analysis of alternative options to only one Site, but rather to demonstrate that with some additional assessment, an alternative location could be sourced. For example, PLFN had examined multiple properties that are within its own portfolio. The following table presents some of the properties in the PLFN portfolio that have some potential for development for a long-term waste disposal cell.

Table 1-1: Summary of PLFN Portfolio Properties

Site	Summary of Key Characteristics for Siting Considerations
Location: Thorburn, NS PID 00886655 Area: 127 hectares	• Proximate to residential dwellings and streams. • Close to transportation. • Poor constructability (hilly). • General zoning (wind turbine restrictions).
Location: Anderson Mountain, NS PIDs 00867036, 00966671 and 65016081 Area: 162 hectares	• Proximate to Dwellings Streams and Nearby Water Bodies. • Close to transportation. • Poor constructability (hilly). • High voltage power lines and corridor traverse through this site.

Site	Summary of Key Characteristics for Siting Considerations
	• General zoning (wind turbine restrictions).
Location: Mount William, NS PIDs 00865485, 00865469, 65170508 and 65170516 Area: 71 hectares	• Close to commercial developments, dwellings and middle river. • Some receptor streams and water bodies on-site to be managed. • Surrounded by industrial sites. • Relatively flat. • Property Identification Numbers (PIDs) 65170508 and 65170516 were not considered suitable. • PID 00801241 and 00865469 were considered suitable.
Location: Granton, NS PIDs 00865303 and 65170565 Area: 46.3 hectares	• Good location. Near existing Pictou Solid Waste. • Surrounded by industrial sites. • Relatively flat, but very narrow from maintaining a buffer zone around the active cell.

Sections 2.0 and Section 3.0 of this report discuss the fact that there are also multiple potential Crown Land and private properties, respectively, within a 50-kilometre radius of Boat Harbour that could be developed for a long-term containment cell.

1.2 NS Lands IR 82 Response - July 12, 2022

BNS had Nova Scotia Environment and Climate Change (NSECC) review the IR82 request. NSECC commented the following as it pertains to the Mount William Location:

"In accordance with Project goals, both on-site and off-site options could be carried out in a manner being protective of human health and the environment. However, due to the significant volume of truck traffic required to move remediated materials (i.e., estimated 63,000 loads), there is an inherent level of risk and increased environmental impacts associated with the alternative site proposed by the PLFN option that require significant mitigative measures or regulatory hurdles that may be insurmountable."

"From a regulatory requirement assessment, both a federal and a provincial Environmental Assessment would be required. From an approval or permission to construct and operate requirement, NS Lands has sought NSECC's technical assessment of the PLFN proposed site. It is attached as Annex 2. It points to a conclusion that there are specific regulatory requirements

around siting a hazardous disposal facility at this site. Requirements associated with an industrial approval to construct and operate such a facility indicate that this site is not suitable."

NSECC notes that both a Federal and a Provincial EA will be required. However, as noted with the EA work on Northern Pulp Nova Scotia (NPNS) submittals, one or the other will be required and it is our experience that, contrary to what was noted by NSECC, both a Federal and Provincial EA will not be required. Either the Federal Government will take the lead, or the Provincial Government will take the lead on the Environmental Assessment. Both sides will be stakeholders and provide review and comment; however, typically only one government entity will take the lead. To date, there have been no discussions of a joint review committee. In addition, there will be Provincial Approvals required, regardless of the containment cell being on-site or off-site.

Annex 2 notes that "NSECC will not issue a Waste Dangerous Goods Disposal Facility Approval until the Site has successfully undergone an Environmental Assessment."

In Annex 2, NSECC details that fact that there will be no approvals granted for alterations of the wetland located at Mount William; however, wetland alterations have occurred on multiple sites and for a variety of projects. Typically, the wetland alteration goes through an approval and compensation process whereby the removed wetland is replaced and/or compensated for elsewhere, typically at a ratio of 2:1, via direct wetland construction or with monetary compensation. In this case, the removed wetland on the proposed new cell location would, in part, have a 1:1 ratio for restoration (with the existing containment cell location becoming reclaimed wetland around Boat Harbour) and an additional 1x factor requiring either constructed or monetary compensation. As is done on multiple other projects, the surface water streams on the site could be diverted around any proposed facility or area under development. There is an application and approval process within NSECC to handle wetland alterations as well as watercourse divergence.

It is further noted that most arguments that NSECC makes against the proposed Mount William site apply to the existing location. For instance, the existing containment cell has the following concerns in common with the Mount William Site:

1. Located within one kilometre of residential and commercial buildings.
2. Located directly adjacent to surface water features and wetlands.
3. Groundwater potentially within the depths of the new liner system.

The BNS response further discussed their efforts to accommodate impacts to aboriginal and treaty rights for land use limitations:

"The EIS clearly provides detail on the efforts NSLands has undertaken to accommodate impacts to aboriginal and treaty rights for land use limitations arising from the long-term existence of the containment cell. The containment cell, occupying a footprint of approximately 10 hectares, will remain on provincially owned lands, will be perpetually monitored and will always be the responsibility of the province in terms of its safety and environmental performance."

It is understood that the containment cell will remain the responsibility of the Province in perpetuity. However, this situation is more complex than simply dealing with the containment cell. For instance, the socio-economic considerations associated with the original placement (i.e., environmental racism), whether deliberate or accidental, of the original BHETF at Boat Harbour. The containment cell remaining at this Site is a lingering monument to this incident, which is not perceived favorably by the PLFN community. The socioeconomic impact of the cell remaining in place is being underrepresented in this EIS so far.

"In addition, a Watercourse Alteration Approval would be required to site the containment cell. This approval process requires NSLands to consider viable alternative locations. Since there is an existing containment cell that could accept the waste for long term storage, this would be an impediment to obtaining a Watercourse Alteration Approval. From a regulatory requirement lens, the existing containment cell is the preferred option."

The existence of a suitable existing containment cell could be an impediment to getting wetland alteration approval. If the 10 hectares of land that the containment cell are placed on were given back to PLFN with the other 173 hectares, then the existing containment cell would no longer be a viable option and would not be an impediment to obtaining a wetland approval. Further, in its current state, the containment cell cannot receive the sediment without a complete upgrade to the liner system. So, as the containment cell sits at present, it is not a viable alternate location.

2.0 CROWN LAND

In order to assess the potential available Crown Lands for development of a containment cell, geoprocessing tools were used to conduct a spatial analysis in geographical information system (GIS). A GIS database was constructed containing Crown land, as well as additional habitat features to ensure the proposed location would be an area that would not significantly impact water supply and sensitive areas. To determine the area of interest, a 50-kilometre buffer was created around Boat Harbour, as it was determined that less than 50 kilometers would be an optimal distance from its current location to relocate the proposed containment cell (Figure 2-1). The initial results show a total of 1,376 different locations within 50 kilometers of Boat Harbour and the current location of the containment cell Note that the size of the proposed new containment cell location is approximately 12 acres; 448 locations are less than 12 acres in area, therefore, 928 locations are potentially available. Although there are over 900 parcels of Crown land available, some of this land contains potentially sensitive ecosystems. In order to determine which Crown land meets the guidelines, additional analysis was conducted.

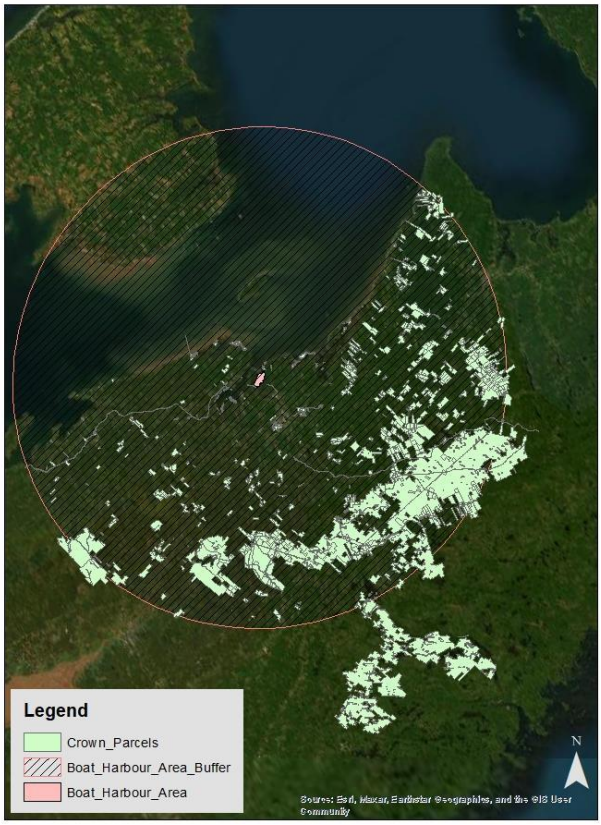

Figure 2-1: Crown land found within 50 km of Boat Harbour

The second GIS analysis selected parcels of Crown land that did not contain the following habitat features: streams, rivers, lakes, wetlands, old growth forests and protected areas such as parks and nature reserves, significant species/habitats and potable water wells. In addition, the surficial geology database was used to determine the type of material above the bedrock layer of the Crown land. This information is found in Table 2-1 in Appendix A, along with specifics about the results of the analysis. Considering the Crown Land with the aforementioned sensitivities, the number of available Crown land parcels dropped from 928 to 109 parcels. These parcels range from 12.5 to 237 acres in size. Figure 2-2 shows the Crown land identified with the habitat features used to determine suitability, while Figure 2-3 shows the Crown land with no

significant habitat or features identified. The specifics from the analysis of each of these parcels is found in Table 2-1 in Appendix A.

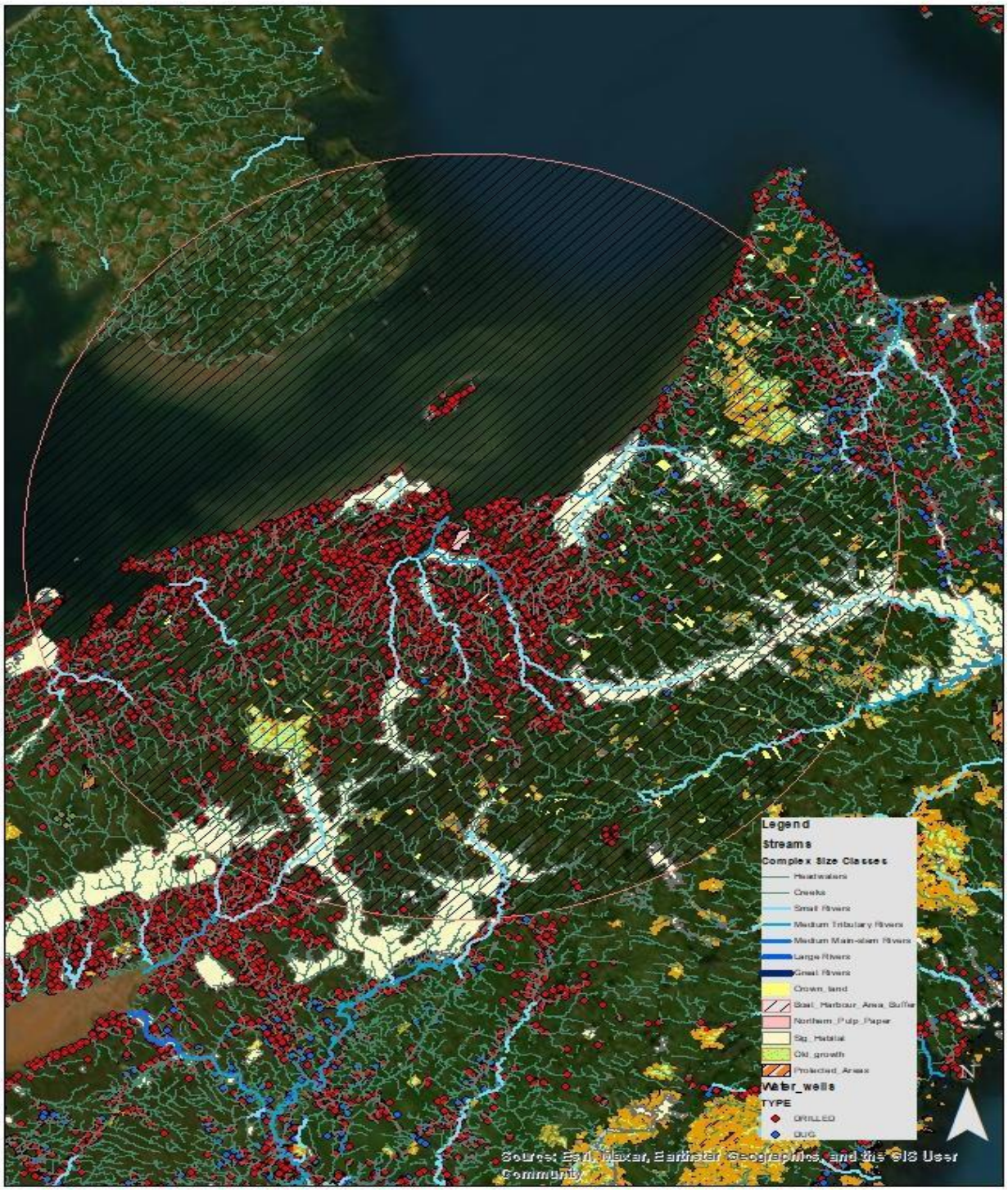

Figure 2-2: Showing the parcels of Crown land and habitat features used to determine suitability.

Figure 2-3: Crown land with no significant habitat features located within 50 km of Boat Harbour.

Based on the evaluation performed on the crown land parcels within the 50 kilometers search radius of Boat Harbour, the following were identified as having potential for further evaluation and assessment for development of a containment cell.

- 3 properties within 10 km;
- 11 properties between 10 km and 20 km;
- 23 properties between 20 km and 30 km;
- 37 properties between 30 km and 40 km; and
- 34 properties between 40 km and 50 km.

3.0 PRIVATE LAND

An examination of the Privately Held Land within a 50-kilometre radius of Boat Harbour was performed in order to assess potentially viable options for the placement of a new containment cell.

In order to assess which private lands could potentially meet the siting criteria, a combination of data sources were used to manually search through available sites. Service Nova Scotia's Property Online web application was used to determine appropriate land within the 50-kilometre radius. The SNS web application does not have the functionality to download spatial data to be applied in a GIS.

In order to compile a complete list of appropriate private land using the Property Online web application, the assessment relied on a visual screening of the sites. The GIS layer was consulted to rule out properties that had wetland or watercourse features, mapped habitat of significance, were adjacent to residential dwellings and/or were too small for development. The areas of land that were determined to be suitable after utilizing both the Property Online web application and GIS habitat feature layers are found in Table 3-1 of Appendix B. It should be noted that this list is not comprehensive; in order to have a complete list of suitable properties, the GeoNova files will need to be purchased to allow for a proper screening through GIS. Further, site suitability for depth to groundwater can only be assumed at this stage and would require detailed investigation to assess groundwater levels. This remains true for all mapped resources; detailed field investigations are required.

As shown in Table 3-1 of Appendix B, the properties are distributed based on distance as the crow flies from the Site as follows:

- 12 properties within 10 km;
- 7 properties between 10 and 20 km;
- 17 properties between 20km and 30 km;
- 16 properties between 30 km and 40 km; and
- 45 properties between 40 km and 50 km.

4.0 CONTAINMENT CELL LOCATION SITING ANALYSIS

4.1 Siting Criteria

The analysis of the cell suitability was based on the NSECC methodology applied for the proposed off- site containment cell in its Memorandum dated 29 March 2022 regarding the Boat Harbour Remediation Project IAAC Information Request 82 (the Memorandum).

For the purposes of this evaluation, the following sources were used to determine siting criteria:

- NSECC Municipal Solid Waste Landfill Guidelines
- Canadian Federal hazardous waste disposal requirements: National Guidelines for Hazardous Waste Landfills, PN 1365
- British Columbia (BC) Environmental Act Hazardous Waste Regulations: The Environmental Management Act (EMA) and The Hazardous Waste Regulation (HWR) under EMA.

The siting criteria used from the NSECC Municipal Solid Waste Landfill Guidelines (2004) include the following:

- Distance to groundwater from the lowest point of the leak detection system and bottom liner should be greater than one metre.
- Distance to permanent surface water/wetland from the Cell should be greater than 100 metres.
- Distance to other properties from the Cell should be 100 metres.
- Distance to buildings from the Cell should be 1,000 metres.

The siting criteria from the National Guidelines for Hazardous Waste Landfills, PN 1365, 2006 note the following:

- Prevention of Surface Water Contamination (Surface Water Isolation): An engineered hazardous waste landfill facility should be isolated from all surface water features, so that the contaminant travel time is based primarily on groundwater migration.
- Prevention of Contamination in Parks and Wildlife Areas (Including Places of Special Significance): There should be a sufficiently long travel time for contaminants from an engineered hazardous waste landfill facility to the nearest boundary of any National, Provincial or Municipal Park, wildlife area, ecological reserve or habitat of special significance, to prevent contamination.
- Prevention of Accidental Release of Contaminants (Groundwater Isolation): There should be a sufficiently long travel time for contaminants from an engineered hazardous waste

landfill facility to any unstable land form or any groundwater resource to prevent contamination including but not limited to vulnerable source water areas, critical surface water and groundwater recharge areas, surface water intakes, highly vulnerable aquifers, wellhead protection, areas or zones, and groundwater and surface water sources identified for future water supply.

- Prevention of Excessive Leachate Formation: The expected precipitation at the engineered hazardous waste landfill facility site should not be excessive. The Sites were not assessed to this criteria as they would be for all sites under consideration.
- Prevention of Contamination in Populated or Public Areas (Population Isolation): The site should not be near designated populated or public areas. The separation between an engineered hazardous waste landfill facility and populated areas should consider atmospheric, surface and groundwater times of travel.

The following list was taken from the siting criteria from the British Columbia (BC) Environmental Management Act, Hazardous Waste Regulations, B.C. Reg. 76/2022, March 30, 2022, Part 2 – Minimum Siting Standards for All Hazardous Waste Facilities:

- With a minimum separation depth of 3 metres of unsaturated soil material with a permeability less than 1 x 10^{-6} cm/s above a seasonally-high water table including the zone of capillary rise.
- A person must not locate a secure landfill within 300 metres of any non-intermittent watercourse or any other permanent waterbody.
- Distance to Potable Water Supply from the Cell: A person must not locate a secure landfill in a recharge area for an unconfined aquifer with one or more high-capacity wells (greater than 100 L/minute) or a significant number of lower capacity wells used for fish hatcheries, domestic, irrigation, industrial, municipal or livestock watering supply.
- A person must not locate a secure landfill where it (including the underlying dual liners) would be underlain by less than 5 metres of fine-grained unconsolidated material with a permeability of less than 1 x 10^{-6} cm/s over fractured or permeable bedrock formations (e.g. sandstone, limestone, dolomite).
- Within the boundaries of: (i)national, Provincial, regional or municipal park; (ii)wildlife management area; (iii)critical wildlife area or wildlife sanctuary; (iv)land acquired and administered under section 3 of the Wildlife Act(BC); (v)ecological reserve; (vi) bird sanctuary; and/or (vii) wildlife area.

The atmospheric precipitation over the containment cell criteria was omitted from the analysis as this criteria applied equally to all sites covered in this discussion.

4.2 Location Siting Analysis

4.2.1 Overview of Alternative Siting Considerations for the Boat Harbour Containment Cell

In addition to the siting criteria referenced in the previous section, it was assumed that all modern engineering and up-to-date guideline requirements for the construction of a hazardous waste storage facility would be fulfilled at each of the locations under assessment. Figure 4-1 shows the location of the four sites that were evaluated based on the criteria outlined in Section 4.1.

The containment cell conditions were compared to the NSECC Municipal Solid Waste Guidelines as a minimal requirement, and the comparison continued through the National Guidelines for Hazardous Waste Landfills and British Columbia Environmental Act Hazardous Waste Regulations. Figure 4-1 shows color coding that was applied to highlight the most suitable sites available based on the analysis. Red shading indicates that there are too many siting criteria exceedances for the site to be considered an acceptable location. Orange shading indicates that there are several siting criteria exceedances but that could be overcome, with additional land acquisition or augmented mitigation measures. Blue shading indicates that the site demonstrates a good fit for development of a containment cell.

Table 4-1 or Appendix C presents the detailed evaluation of each of the four sites discussed and how each of the siting criteria apply to their location and potential for development.

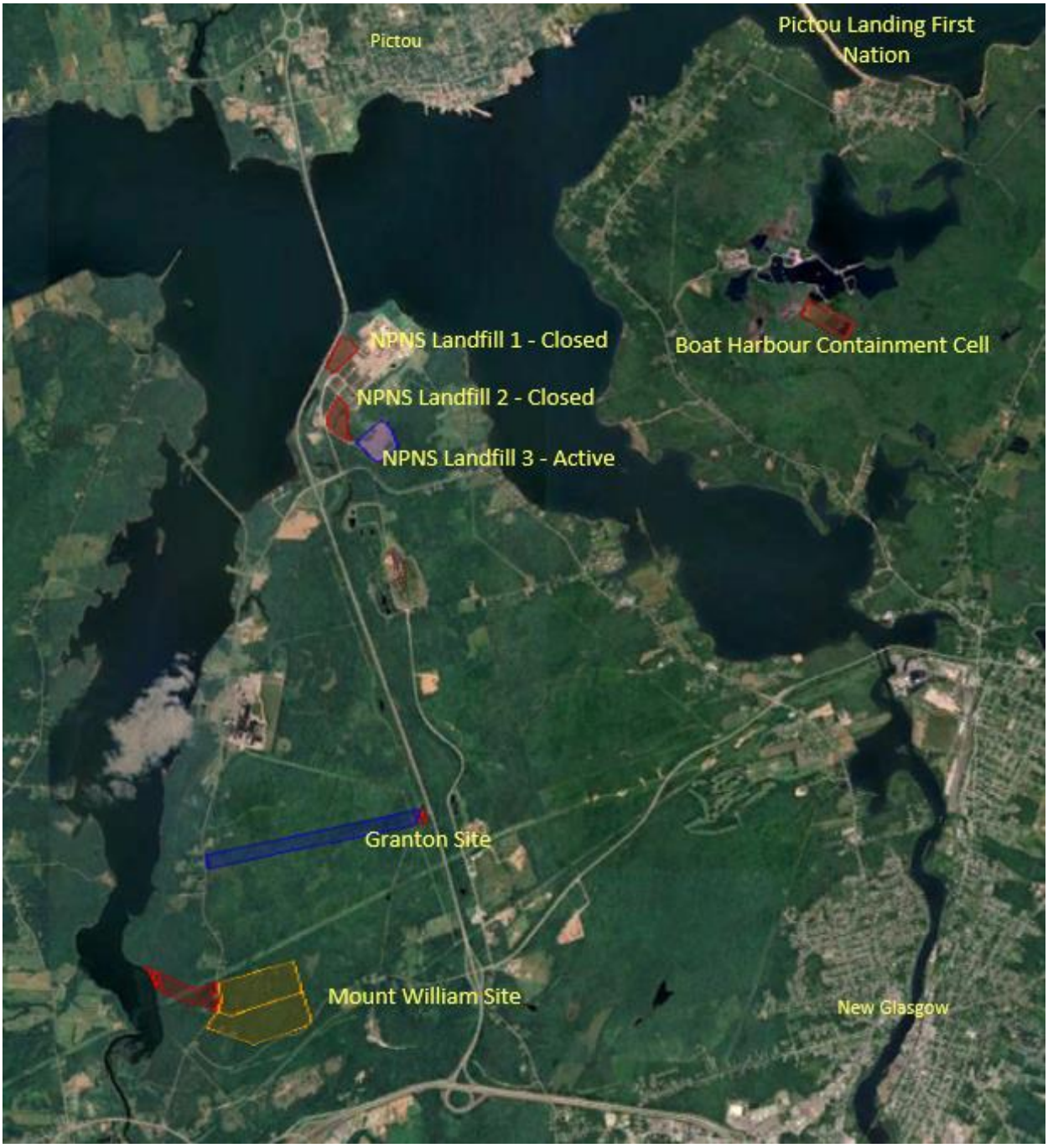

Figure 4-1: Assessed Possible Containment Cell Locations. Red – unfit; Orange - partial fit; and Blue - good fit.

The following sections discuss the potential siting considerations for the Boat Harbour containment cell including 1) its existing location, 2) NPNS Pulp Plant active waste cell, 3) Mount Willian and 4) Granton.

4.2.1.1 Existing Boat Harbour Containment Cell

The Existing Boat Harbour containment cell is located on the south shore of Boat Harbour and occupies approximately 10 hectares of land. The containment cell is presently under an Approval to Operate and is required to be monitored on a quarterly basis. The monitoring includes both groundwater and surface water around the Cell.

The cell contains waste material from the historical routine clean out of the various structures located at Boat Harbour and from NPNS. The waste and impacted materials, among other chemicals, have been identified as containing chlorinated dioxins and furans (D&F) at levels higher than 100 parts per billion expressed as dioxin toxicity equivalent (TEQ). The D&F-containing waste material are defined as "wastes containing dioxins" within the British Columbia Environmental Act Hazardous Waste Regulations. This definition captures wastes containing dioxins and furans that are not captured as toxic substances in class 6.1 of the Transportation of Dangerous Goods (TDG) Regulations. This distinction becomes important during the assessment of the various siting guidelines that NSECC used to refute the Mount Williams Location.

The PLFN off-peninsula well field is located approximately 2 kilometres from the active containment cell. Based on the AECOM *Nova Scotia Lands Inc., Boat Harbour Hydrogeology Assessment, Project Number 60446127 dated April 2016*, report, the 2015 well operating rates were reported as 82.1 m^3/day from PW9 and 86.7 m^3/day from PW10. This equates to a pumping withdrawal rate of 116.7 liters per minute (lpm). The 2016 AECOM Hydrogeology Assessment of the PLFN Well Field concluded that the off-peninsula well field would be considered safe provided the water levels in the pumping wells remained above sea level. There was concern, that if the pumping level in the wells dropped below sea level it could potential change the predicted estimated horizontal flow direction from east to west, to potentially west to east, drawing Boat Harbour water toward the pumping wells. The 2010 Dillon Groundwater Monitoring Program Report also noted *"If the water level in a well drops below sea level for an extended period of time sufficient enough to change the groundwater flow regime, these effects could be irreversible. Drawing saltwater or water from Boat Harbour into the wellfield is not desirable and could lead to deterioration in water quality."* Given that both assessments came to the same conclusion pertaining to the PLFN well field and its relationship to Boat Harbour, it is reasonable to conclude, for the purposes of this analysis, that the existing Boat Harbour Containment Cell is within the recharge area for the PLFN well field.

The existing waste containment cell has the following siting criteria exceedances:

- NSECC Municipal Solid Waste Guidelines

- Distance to groundwater from the lowest point of the leak detection system and bottom liner.
- Distance to permanent surface water/wetland from the Cell.
- Distance to other properties from the Cell.

- National Guidelines for Hazardous Waste Landfills
  - Prevention of Surface Water Contamination.
  - Prevention of Contamination in Parks and Wildlife Areas (Including Places of Special Significance).
  - Prevention of Accidental Release of Contaminants (Groundwater Isolation).
- British Columbia Environmental Act Hazardous Waste Regulations
  - With a minimum separation depth of 3 m of unsaturated soil material with a permeability less than 1 x 10^{-6} cm/s above a seasonally high-water table including the zone of capillary rise.
  - A person must not locate a secure landfill within 300 metres of any non-intermittent watercourse or any other permanent waterbody.
  - Distance to Potable Water Supply (greater than 100 L/minute).

4.2.1.2 Northern Pulp Nova Scotia - Pulp Plant Active Waste Cell

The NPNS Site has three landfill cells. Landfill Cell 1 and Landfill Cell 2 are both closed. Landfill Cell 3 is active and operating under an existing Approval from NSECC.

There were no siting criteria exceedances noted for the NPNS Active Waste Cell. Coupled with the existing Approval to Operate, this site is considered a viable candidate; however, it should be acknowledged that there are political and financial considerations that were outside the scope of this analysis.

4.2.1.3 Mount William

The Mount William sites are composed of four parcels identified by PIDs 00865485, 00865469, 65170508 and 65170516, located approximately 7.1 kilometers west of New Glasgow. The largest parcels (PIDs 00801241 and 00865469) are located on the east side of Granton Abercrombie Road and are approximately 75.0 acres (30.35 hectares) and 72.0 acres (29.14 hectares) in area, respectively. These properties are bound by Granton Abercrombie Road to the west, and Mount William Road and undeveloped parcels to the east. There is a wet area in the middle of PID 00865469, which has a drainage cut that discharges to the southwest, toward Middle River of

Pictou. In the southeast portion of PID 00865485 is its highest point, a hill with an approximate elevation of 48 meters above sea level. These properties are both completely undeveloped and entirely forested.

The other two parcels are located across Granton Abercrombie Road and are divided by a railway line. The parcels (PIDs 65170508 and 65170516) are approximately 27.0 acres (10.93 hectares) and 1.0 acres (0.41 hectares) in area, respectively. These properties are steeply sloped and are mostly graded to the west toward Middle River of Pictou from the highest point near the center of PID 65170508 (65 metres in elevation), the remainder of the parcel drains to the east toward Granton Abercrombie Road. At the western edge of PID 65170508, there is a commercial development (an SPCA office), which fronts Granton Abercrombie Road. There is a transmission line corridor that runs through PID 65170508. The parcel identified as PID 65170516 is bound to the west by Middle River of Pictou. These properties are both completely undeveloped and entirely forested.

The sites are accessible by Granton Abercrombie Road and Mount William Road. There is access to power and phone services via Granton Abercrombie Road and Mount William Road. There is no nearby water, sanitary or storm sewer infrastructure to service the site. The site is currently described as having General Zoning (only restrictions apply to Wind Turbine Development).

The Mount William Site was considered a marginally viable option for development of a waste containment cell. There were multiple exceedances to the siting criteria, however, it is believed that any exceedances to the siting criteria could be mitigated. A generic synopsis of possible mitigation measures are noted in Section 5.0.

The Mount William Site exceeded for the following:

- NSECC Municipal Solid Waste Guidelines
    - Distance to permanent surface water/wetland from the Cell.
    - Distance to buildings from the Cell.
- National Guidelines for Hazardous Waste Landfills
    - Prevention of Contamination in populated or public areas.
- British Columbia Environmental Act Hazardous Waste Regulations
    - A person must not locate a secure landfill within 300 m of any nonintermittent watercourse or any other permanent waterbody.

4.2.1.4 Granton

The Granton site is located approximately 8.4 kilometers southwest of Pictou and is composed of two parcels, identified by PIDs 00865303 and 65170565, with an approximate area of 107.0 acres (43.30 hectares) and 3.0 acres (1.21 hectares), respectively. These parcels are bordered to the west by Granton Abercrombie Road, to the east by Highway 106 and otherwise surrounded by forested parcel. These parcels are completely undeveloped and entirely forested. There is a high point in the southwestern portion of PID 00865303, which has an elevation of approximately 85 metres. The majority of the remainder of the parcel is graded to the east toward Highway 106. There is noted to be a wet area near the western boundary of PID 00865303, which runs into a brook that eventually discharges to the southwest into the East River of Pictou.

The site is accessible by Granton Abercrombie Road and Highway 106 via an unpaved access road. Power and phone services are available via Granton Abercrombie Road and there is also a transmission line corridor that passes through PID 00865303, which contains a high voltage transmission line. There is no nearby access to water, sanitary or storm sewer infrastructure to service the sites. The sites are currently described as having General Zoning (only restrictions apply to Wind Turbine Development).

The Granton site was considered to be somewhat a viable option for development of a waste containment cell. There were a few exceedances to the siting criteria, however, it is believed that any exceedances to the siting criteria could be mitigated. The size and shape of this site are a limiting factor for future development. In addition to the generic synopsis of possible mitigation measures noted in Section 5.0, this site would require some acquisition of properties to the north and south to expand the minimal buffer zones.

The Granton Site exceeded for the following:

- NSECC Municipal Solid Waste Guidelines
    - Distance to other properties from the Cell.
    - Distance to buildings from the Cell.
- National Guidelines for Hazardous Waste Landfills
    - No exceedances.
- British Columbia Environmental Act Hazardous Waste Regulations
    - No exceedances.

5.0 SITING CRITERIA AND MITIGATION MEASURES

The BNS response to IR82 has presented the impression that the negative impacts estimated with development of an off-site disposal site are too insurmountable to be considered viable.

However, with the right combination of mitigation, engineering and compensation, there are few siting issues that could not be overcome. It is acknowledged that there are limited financial resources for these projects and therefore some common sense approach should to be applied when considering a reasonable approach to mitigate pathway barriers. Table 5-1 presents some possible mitigation options for various siting criteria which apply to all four sites under consideration (i.e., the existing containment cell location, the NPNS Pulp Plant active waste cell, the Mount Willian site and the Granton site).

Table 5-1: Landfill Siting Criteria and Mitigation Options

Siting Criteria	Siting Value (Minimum Distance from Cell)	Possible Alternate Pathway or Option to Overcome Siting Value Exceedance
NSECC Municipal Solid Waste Landfill Guidelines		
Distance to groundwater from the lowest point of the leak detection system and bottom liner	1 metre	This can be mitigated by using clay or bentonite groundwater diversion cut off walls. This technique was used on the Sydney Coke Ovens site to contain and control the Site groundwater flow.
Distance to permanent surface water/wetland from the Cell	100 metres	This issue is difficult to mitigate. A compensation package could be considered.
Distance to Other Properties from the Cell	100 metres	This issue could be handled through appropriation of the adjacent properties to allow for a suitable buffer.
Distance to Buildings from the Cell	1000 metres	This issue could be handled through appropriation of the adjacent properties to allow for a suitable buffer.
Guideline: National Guidelines for Hazardous Waste Landfills		
Surface Water Isolation	An engineered hazardous waste landfill facility should be isolated from all surface water features so that the contaminant travel time is based primarily on groundwater migration.	Brooks can be re-aligned, under approval. Brook re-alignment often looks at improving fish habitat and stream morphology.

Siting Criteria	Siting Value (Minimum Distance from Cell)	Possible Alternate Pathway or Option to Overcome Siting Value Exceedance
Place of Special Significance Isolation	There should be a sufficiently long travel time for contaminants from an engineered hazardous waste landfill facility to the nearest boundary of any National, Provincial or Municipal Park, wildlife area, ecological reserve or habitat of special significance, to prevent contamination.	This issue is difficult to mitigate. Unfortunately, the Boat Harbour containment cell is directly adjacent to Boat Harbour, which is a wildlife area and ecological area of special significance.
Groundwater Isolation	There should be a sufficiently long travel time for contaminants from an engineered hazardous waste landfill facility to any unstable land form or any groundwater resource to prevent contamination including but not limited to vulnerable source water areas including, but not limited to, critical surface water and groundwater recharge areas, surface water intakes, highly vulnerable aquifers, wellhead protection, areas or zones, and groundwater and surface water sources identified for future water supply.	This can be mitigated by using clay or bentonite groundwater diversion cut off walls. This technique was used on the Sydney Coke Ovens site to contain and control the Site groundwater flow.
Population Isolation	The site should not be near designated populated or public areas. The separation between an engineered hazardous waste landfill facility and populated areas should consider atmospheric, surface and groundwater times of travel.	This issue could be handled through appropriation of the adjacent properties to allow for a suitable buffer.

Siting Criteria	Siting Value (Minimum Distance from Cell)	Possible Alternate Pathway or Option to Overcome Siting Value Exceedance
BC Environmental Act Hazardous Waste Regulations		
Atmospheric Precipitation over the Cell Area	Monthly and annual precipitation is greater than the evaporation and transpiration loss and the available soil water storage of the cover cap.	This criteria will almost always be exceeded in the Atlantic region. Properly designed overland flow diversion can compensate.
Distance to groundwater from the lowest point of the leak detection system and bottom liner	3 metres	This can be mitigated by using clay or bentonite groundwater diversion cut off walls. This technique was used on the Sydney Coke Ovens site to contain and control the Site groundwater flow.
Distance to permanent surface water/wetland from the Cell	300 metres	Brooks can be re-aligned, under approval. Brook re-alignment often looks at improving fish habitat and stream morphology. Constructions of berms can restrict and re-direct flow away from permanent water courses and wetlands.
Distance to Potable Water Supply from the Cell	Not in the overburden potable aquifer recharge area. Not near a well producing >100L/Min	This would be an insurmountable siting criterion for Boat Harbour. As noted in Section 4.2.1.1, there are certain circumstances where the PLFN well field and the containment cell could be within the same recharge zone. This criteria did not exceed or apply to the other sites assessed.
Distance to Bedrock from the lowest point of the leak detection system and bottom liner	5 metres	This will be site specific and can only be confirmed via drilling. Extra geosynthetic liners could be used to simulate glacial till thickness and potentially mitigate these criteria.

6.0 OTHER SITING CRITERIA

There were select siting criteria guidelines outlined in the NSECC response included with the BNS response to IR82. Upon review of the National Guidelines for Hazardous Waste Landfills and the British Columbia Environmental Act Hazardous Waste Regulations, there were some additional factors to be considered. Table 6-1 presents the additional siting criteria and how that applies to both Boat Harbour and the NPNS waste cells.

Table 6-1: Additional Guideline Comparisons

Guideline Application	Guideline Value	Existing Cell Analysis	Pulp Plant New Cell Analysis
NSECC Municipal Solid Waste Guidelines			
NA	NA	NA	NA
National Guidelines for Hazardous Waste Landfills			
Leachate Protection, soil thickness below the lower geomembrane	5 metres	Based on the NSECC well database the overburden thickness is 6.7 metres to 8.83 metres. It is assumed that it will allow for 5 m distance.	Based on NSECC well database the overburden thickness is 3.65 metres to 7.61 metres. It is assumed that it will allow for 5-metre distance.
British Columbia Environmental Act Hazardous Waste Regulations			
Surface Water Isolation	200-year Floodplain	This has not been investigated yet; however, assumed being out of the 200-year floodplain zone.	This has not been investigated yet; however, assumed being out of the 200-year floodplain zone.
Holocene Faults	Holocene faults are geological faults that have been active during the last 11,000 years. It is realized that geological faults are not always obvious or known, especially in areas where there has been little geological exploration	No Holocene active faults were noted on Map ME 1992-003.	No Holocene active faults were noted on Map ME 1992-003.

Guideline Application	Guideline Value	Existing Cell Analysis	Pulp Plant New Cell Analysis
Tsunamis	Tsunamis or tidal waves are usually the result of earthquakes at sea and therefore, only affect coastal waters. Low tidal areas and land close to long narrow fiords are especially prone to tsunamis. Facilities operating in such locations require protection by dikes or similar works to prevent washout.	Ground elevation is approximately 9 metres above sea level (masl), which could be exceeded by a tsunami. The containment cell is 2.6 km from the Atlantic Ocean Shoreline, but directly adjacent to Boat Harbour. Any swell in Boat Harbour as a result of a tsunami would impact the waste containment cell.	Ground elevation is approximately 33 masl, which is very unlikely to be exceeded by a tsunami, also located 800 m of the sea shoreline.
Slope Failure	Areas close to steep or unstable slopes are poor locations for a hazardous waste facility. A facility must be at least 100 m from any unstable slopes. A qualified geotechnical expert must be consulted if there are any questions about slope stability.	No unstable slopes were noted within 100 m distance. However, the proposed augmentations to the containment cell have noted that, should the remediation require additional containment capacity. This would greatly increase the risk of slope failure of the containment cell itself.	No unstable slopes were noted within 100-metre distance
Protected Wildlife Areas	Hazardous waste facilities may not be located in protected wildlife areas such as designated parks, wildlife preserves, or sanctuaries.	The waste containment cell is located in an area of ecological significance for PLFN.	No protected wildlife areas nearby

Table 6-1 provides more weight for the relocation of the hazardous waste off the Boat Harbour Area, based on the tsunami and wildlife protection requirements.

CLOSING

The information contained in this letter has been compiled to address questions raised by PLFN in their evaluation of the information surrounding IR82. Only the siting requirements for a long-term hazardous waste containment cell have considered. There have been no field visits or studies completed. Publicly available data sources and data submitted by others for the Boat Harbour Remediation Environmental Impacts Statement was utilized to address the concerns related to a specific Information Request (IR82). It was further assumed that constructional, operational, monitoring, closing and other requirements would be examined during the design and permitting stage.

It is believed that the information provided herein is suitable for your present needs. Should you have any questions or concerns, please contact the undersigned at any time.

Sincerely,

<Original signed by>

Steve Schaller, Eng.L.
Director of Environmental Services – Nova Scotia
Hive Engineering Limited

APPENDIX A

Table 2-1 Possible Crown Land Options

Appendix A: Table 2-1 Possible Crown Land Options
NS23.03.157
IR82 Analysis

FID	DNR_ ID	PID	Hectares	Acres	Unit	Unit Description	Thickness of Overburden	Distance to Site
173	1711	00960161	11.79802	29.15353	Hummocky Ground Moraine	Till (mixture of gravel, sand and mud of direct glacial origin) often sandy and stony; loose, inclusions of water lain sediment	2 to 20 m	7
379	1990	00927269	37.77184	93.33626	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	8
213	1773	00841668	6.87024	16.97673	Hummocky Ground Moraine	Till (mixture of gravel, sand and mud of direct glacial origin) often sandy and stony; loose, inclusions of water lain sediment	2 to 20 m	9
6120	22035	00925859	11.48342	28.37614	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	10
6318	22692	00925842	12.72221	31.43727	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	10
4075	13270	65004228	8.674456	21.43505	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	13
15719	1782	00844241	6.014434	14.86199	Residuum	Fragmented rock consisting of angular blocks and finer interstitial debris; overlain by thin, discontinuous veneer of till	1 to 4 m	14
291	1875	00873000	11.74688	29.02718	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	15
5470	20537	00918458 00918854	21.0108	51.91882	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	16
416	2039	01017938 00849786	40.08245	99.04589	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	16.5
396	2011	00961953	23.72075	58.61526	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	18
397	2012	00961953	23.91837	59.10359	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	18
170	1697	00804583 65190126	9.939886	24.56199	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	19
4174	13425	65196248 65085300	20.08907	49.64116	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	19
5758	20994	65165110	7.108998	17.56672	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	19
310	1904	00889345	58.57441	144.7405	Silty Till, Alluvial Deposits	Silty, compact, material derived from both local and distant sources	3 to 30 m	20
436	2061	01029537	22.01903	54.41021	Silty Till, Alluvial Deposits	Silty, compact, material derived from both local and distant sources	3 to 30 m	20
437	2062	01028851	12.00054	29.65399	Silty Till, Alluvial Deposits	Silty, compact, material derived from both local and distant sources	3 to 30 m	20
516	2150	01039296	20.78129	51.35169	Stoney Till Plain, Silty Till Plain	Stony, sandy matrix, material derived from local bedrock sources	2 to 20 m	20
517	2151	01039296	27.97852	69.13644	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	20

Appendix A: Table 2-1 Possible Crown Land Options
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IR82 Analysis

FID	DNR_ ID	PID	Hectares	Acres	Unit	Unit Description	Thickness of Overburden	Distance to Site
4106	13322	65056269	63.79241	157.6345	Bedrock	Bedrock of various types and ages; glacially scoured basins and knobs, overlain by thin, discontinuous veneer of till.	unknown	20
220	1786	00849257	19.24173	47.54734	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	21
341	1939	00901017	17.33122	42.82638	Bedrock	Bedrock of various types and ages; glacially scoured basins and knobs, overlain by thin, discontinuous veneer of till.	unknown	21
5460	20511	00889469 65203887 01036433 65176893	25.79707	63.74596	Stoney Till Plain	Stony, sandy matrix, material derived from local bedrock sources	2 to 20 m	21
5916	21624	65181232	13.84038	34.20033	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	21
7121	25207	00855551 65229197 00856252 65229205	46.6888	115.3705	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	22
6919	24739	911875	5.69612	14.07542	Silty Till, Alluvial Deposits	Silty, compact, material derived from both local and distant sources	3 to 30 m	23
619	2259	65009805 01043785	80.03711	197.776	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	24
5473	20538	65009805	76.45873	188.9336	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	24
418	2042	01027416	26.07514	64.43306	Glaciofluvial Deposits	Gravel, sand and silt, diamicton layers, poorly to well bedded, horizontal to angular beds, faulting and collapse features common	4 to 6 m	25
448	2075	01036128	20.07699	49.61132	Bedrock	Bedrock of various types and ages; glacially scoured basins and knobs, overlain by thin, discontinuous veneer of till.	unknown	25
590	2227	01042407	33.04502	81.65603	Stoney Till Plain	Stony, sandy matrix, material derived from local bedrock sources	2 to 20 m	25
183	1732	65199093 00819474 00818674 00822288 65199051 00819508 65199226	5.343905	13.20508	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	27
476	2106	01037480	34.7708	85.92051	Bedrock	Bedrock of various types and ages; glacially scoured basins and knobs, overlain by thin, discontinuous veneer of till.	unknown	27
5790	20456	01017920	29.16613	72.07108	Silty Till, Alluvial Deposits	Silty, compact, material derived from both local and distant sources	3 to 30 m	27
6145	22115	01037480	78.12219	193.0441	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	27

Appendix A: Table 2-1 Possible Crown Land Options
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IR82 Analysis

FID	DNR_ ID	PID	Hectares	Acres	Unit	Unit Description	Thickness of Overburden	Distance to Site
6143	22116	01037480 65123648 65123655	95.94741	237.0912	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	28
632	2276	00911347	10.9131	26.96685	Bedrock	Bedrock of various types and ages; glacially scoured basins and knobs, overlain by thin, discontinuous veneer of till.	unknown	29
462	2092	01037373	51.82442	128.0609	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	30
465	2095	00831552	32.2923	79.79602	Bedrock	Bedrock of various types and ages; glacially scoured basins and knobs, overlain by thin, discontinuous veneer of till.	unknown	30
480	2110	01037480	6.800805	16.80516	Bedrock	Bedrock of various types and ages; glacially scoured basins and knobs, overlain by thin, discontinuous veneer of till.	unknown	30
513	2147	01039056	39.72198	98.15515	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	30
514	2148	01039056	59.16629	146.2031	Stoney Till Plain	Stony, sandy matrix, material derived from local bedrock sources	2 to 20 m	30
6074	20835	65179350 65179343	12.3656	30.55606	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	30
7194	25469	65209660	25.64545	63.37129	Glaciofluvial Deposits	Gravel, sand and silt, diamicton layers, poorly to well bedded, horizontal to angular beds, faulting and collapse features common	4 to 6 m	30
244	1822	00857870	67.17254	165.987	Stoney Till Plain, Silty Till Plain	Stony, sandy matrix, material derived from local bedrock sources	2 to 20 m	31
5983	21622	65011033 65115263 65115230 01045434 01040823	65.41744	161.65	Bedrock	Bedrock of various types and ages; glacially scoured basins and knobs, overlain by thin, discontinuous veneer of till.	unknown	31
228	1803	00854042	28.64134	70.77429	Stoney Till Plain	Stony, sandy matrix, material derived from local bedrock sources	2 to 20 m	32
260	1838	00857870	21.57506	53.31312	Bedrock	Bedrock of various types and ages; glacially scoured basins and knobs, overlain by thin, discontinuous veneer of till.	unknown	32
649	2294	00911347 00899930	23.56744	58.23641	Bedrock	Bedrock of various types and ages; glacially scoured basins and knobs, overlain by thin, discontinuous veneer of till.	unknown	32
827	2585	01265644	17.29513	42.73719	Silty Drumlin	Siltier till, higher percentage of distant source material including red clay	4 to 30 m	32
831	2592	01265701	18.62604	46.02594	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	33
924	2701	01303197	17.3801	42.94715	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	33
275	1854	00857870	49.31134	121.851	Residuum	Fragmented rock consisting of angular blocks and finer interstitial debris; overlain by thin, discontinuous veneer of till	1 to 4 m	34

Appendix A: Table 2-1 Possible Crown Land Options
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FID	DNR_ ID	PID	Hectares	Acres	Unit	Unit Description	Thickness of Overburden	Distance to Site
669	2315	00911347	27.48647	67.92056	Bedrock	Bedrock of various types and ages; glacially scoured basins and knobs, overlain by thin, discontinuous veneer of till.	unknown	34
13666	22356	00856427	5.084127	12.56315	Stoney Till Plain	Stony, sandy matrix, material derived from local bedrock sources	2 to 20 m	34
191	1743	00827857	21.89	54.09137	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	35
192	1744	00827857	11.90013	29.40586	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	35
278	1857	00857870	20.61928	50.95134	Residuum	Fragmented rock consisting of angular blocks and finer interstitial debris; overlain by thin, discontinuous veneer of till	1 to 4 m	35
365	1974	00921650	10.69347	26.42415	Bedrock	Bedrock of various types and ages; glacially scoured basins and knobs, overlain by thin, discontinuous veneer of till.	unknown	35
400	2015	00962845	16.06763	39.70397	Stoney Till Plain	Stony, sandy matrix, material derived from local bedrock sources	2 to 20 m	35
937	2717	01303858 01200435 10070936	11.09575	27.41819	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	35
190	1742	00827857	12.28377	30.35386	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	36
194	1746	00827857	11.28482	27.88539	Stoney Till Plain, Silty Till Plain	Stony, sandy matrix, material derived from local bedrock sources	2 to 20 m	36
698	2346	01046242	81.55868	201.5359	Stoney Till Plain	Stony, sandy matrix, material derived from local bedrock sources	2 to 20 m	36
697	2345	01046242	5.73465	14.17063	Stoney Till Plain	Stony, sandy matrix, material derived from local bedrock sources	2 to 20 m	37
4105	13320	65054918	10.22422	25.2646	Stoney Till Plain	Stony, sandy matrix, material derived from local bedrock sources	2 to 20 m	37
6351	22858	65196313	27.35599	67.59813	Stoney Till Plain	Stony, sandy matrix, material derived from local bedrock sources	2 to 20 m	37
8109	4070	20418984	38.02036	93.95036	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	37
407	2022	00966820	26.39182	65.21561	Stoney Till Plain	Stony, sandy matrix, material derived from local bedrock sources	2 to 20 m	38
750	2438	01264811	14.59315	36.06046	Bedrock	Bedrock of various types and ages; glacially scoured basins and knobs, overlain by thin, discontinuous veneer of till.	unknown	38
751	2439	01264811	6.403213	15.82268	Bedrock	Bedrock of various types and ages; glacially scoured basins and knobs, overlain by thin, discontinuous veneer of till.	unknown	38
334	1931	00899674	26.79588	66.21406	Stoney Till Plain	Stony, sandy matrix, material derived from local bedrock sources	2 to 20 m	39
8114	4103	20419446	23.81928	58.85872	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	39

Appendix A: Table 2-1 Possible Crown Land Options
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FID	DNR_ ID	PID	Hectares	Acres	Unit	Unit Description	Thickness of Overburden	Distance to Site
770	2456	01264928	38.81162	95.90561	Bedrock	Bedrock of various types and ages; glacially scoured basins and knobs, overlain by thin, discontinuous veneer of till.	unknown	40
2787	7703	37532561	20.94157	51.74774	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	41
8097	4055	20419420	9.005424	22.25289	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	41
8431	4683	20419412	5.056154	12.49403	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	41
2780	7696	37531563	37.12301	91.73295	Bedrock	Bedrock of various types and ages; glacially scoured basins and knobs, overlain by thin, discontinuous veneer of till.	unknown	42
2977	7933	37582590	43.97502	108.6646	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	42
2981	7937	37582624	6.521669	16.11539	Stoney Till Plain	Stony, sandy matrix, material derived from local bedrock sources	2 to 20 m	42
5912	21615	00902213	38.92835	96.19405	Stoney Till Plain	Stony, sandy matrix, material derived from local bedrock sources	2 to 20 m	42
8176	4196	20419107	38.59328	95.36606	Residuum	Fragmented rock consisting of angular blocks and finer interstitial debris; overlain by thin, discontinuous veneer of till	1 to 4 m	43
424	2048	01028612 35171867	23.85778	58.95386	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	43.9
799	2497	01265586 10137081 10040533 01303726 01203413 01203421	30.56669	75.53194	Stoney Till Plain	Stony, sandy matrix, material derived from local bedrock sources	2 to 20 m	44
902	2678	01301803	16.20331	40.03926	Hummocky Ground Moraine	Till (mixture of gravel, sand, and mud of direct glacial origin) often sandy and stony; loose, inclusions of water lain sediment	2 to 20 m	44
6080	21942	37532033	8.871631	21.92228	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	44
6085	21948	10106326	66.05799	163.2329	Bedrock	Bedrock of various types and ages; glacially scoured basins and knobs, overlain by thin, discontinuous veneer of till.	unknown	44
554	2190	00901082	58.12412	143.6278	Stoney Till Plain, Silty Till Plain	Stony, sandy matrix, material derived from local bedrock sources	2 to 20 m	45
578	2214	00901082	9.559945	23.62314	Stoney Till Plain	Stony, sandy matrix, material derived from local bedrock sources	2 to 20 m	45
582	2218	00901082	62.24902	153.8207	Stoney Till Plain	Stony, sandy matrix, material derived from local bedrock sources	2 to 20 m	45
2520	7332	35171966	76.92226	190.0791	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	45

Appendix A: Table 2-1 Possible Crown Land Options
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IR82 Analysis

FID	DNR_ ID	PID	Hectares	Acres	Unit	Unit Description	Thickness of Overburden	Distance to Site
2522	7334	35171982	62.90767	155.4482	Bedrock	Bedrock of various types and ages; glacially scoured basins and knobs, overlain by thin, discontinuous veneer of till.	unknown	45
2786	7702	37532538	19.5004	48.18653	Stoney Till Plain	Stony, sandy matrix, material derived from local bedrock sources	2 to 20 m	45
2529	7341	35172055	42.30412	104.5358	Stoney Till Plain	Stony, sandy matrix, material derived from local bedrock sources	2 to 20 m	47
1040	2845	01314699	16.4321	40.6046	Stoney Till Plain	Stony, sandy matrix, material derived from local bedrock sources	2 to 20 m	48
1041	2846	01314699 01283753	5.254931	12.98522	Stoney Till Plain	Stony, sandy matrix, material derived from local bedrock sources	2 to 20 m	48
5388	20351	10101699	7.694407	19.01329	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	48
5693	20837	10105732	21.37712	52.82402	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	48
848	2615	01266139	21.7345	53.70712	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	49
959	2744	01304062	33.00801	81.56456	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	49
960	2745	01304062	14.96002	36.96702	Bedrock	Bedrock of various types and ages; glacially scoured basins and knobs, overlain by thin, discontinuous veneer of till.	unknown	49
2478	7289	35171586	40.5094	100.1009	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	49
2795	7711	37533967	91.96397	227.2479	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	49
549	2185	00901082	39.83794	98.44169	Stoney Till Plain	Stony, sandy matrix, material derived from local bedrock sources	2 to 20 m	50
2499	7311	35171800	19.57035	48.3594	Bedrock	Bedrock of various types and	unknown	50
2503	7315	35171842	29.59823	73.13882	Silty Till	Silty, compact, material derived from both local and distant sources	3 to 30 m	50
2856	7784	37540077	25.47878	62.95945	Stoney Till Plain	Stony, sandy matrix, material derived from local bedrock sources	2 to 20 m	50
6350	22857	20458956	48.61688	120.1349	Stoney Till Plain	Stony, sandy matrix, material derived from local bedrock sources ages; glacially scoured basins and knobs, overlain by thin, discontinuous veneer of till.	2 to 20 m	37

APPENDIX B

Table 3-1 Possible Private Land Options

Appendix B: Table 3-1 Possible Private Land Options
NS23.03.157
IR82 Analysis

PID	Address	Owner	Acres	Distance to Boat Harbour (kilometers)
65022147	Chance Harbour Rd	John Fraser estate in care of Elizabeth Rogers	38.9	0.32
878652	Pictou Landing	Linda and James Wilson	140	0.74
65205007	Pictou Landing Road	George Murray	60	1.00
65045403	361 Glen East Road	Steven and Catherine Nelson	24	5.75
877787	Pictou Landing Road	John Henry and James Anderson	90	6.02
65191249	No 106 Hwy, Central Caribou	Timothy Roxanne Canley	20	6.14
883231	Little Harbour Road, Little Harbour	Donald, Robert MacNeil	289.3	7.53
841726	No 376 Hwy, Lyons Brook	Florence Joyce Sutherland	45	7.95
65195596	No 376 Hwy, Lyons Brook	Hugh and Jean McCrane	35	8.19
841809	2663 Hwy 376, Lyons Brook	Vincent and Joan Highton	47	8.21
65007957	No 376 Hwy, Lyons Brook	Chic-Cho Forest Projects Ltd.	35	8.42
65189425	No 376 Hwy, Lyons Brook	Sean Francis MacDougall	40	8.53
841783	No 376 Hwy, Lyons Brook	Harold and Eileen MacNaughton	110	8.65
838573	Condon Road, Hardwood Hill	Gordon Robert Galvin	42.5	13.17
838516	Hardwood Hill Road	Gorden Galvin	67	13.50
906545	Gunn No 4 Road, East Branch	James and William Mackenzie	100	13.83
906644	Stellerton, Trafalgar Road	Gerald and Mary Romsa	65	14.42
65170268	Lamont Road, Egerton	Donald Francis Kyte, Deborah Anne Kyte	50	15.86
838078	Black River Road, Black River	Miller and Mackinnon Bros Lumber Ltd.	68	18.48
1036193	975 Woodburn Road, Kingshead	Gordon Hector MacLean	90	19.01
65229908	Stillman Road, Six Mile Brook	Sarah, Joan, Laura and Mary Robertson	65	20.77
65211328	Stillman Road, Six Mile Brook	Janet and David Hogan	50	20.97
920025	Shore Road, Lower Barneys River	Atlantic Star Forestry Ltd.	90	21.06
911982	Hopewell	Mara Lucis Balodis	100	21.86
920173	84 Narreys River Loop, Lower Barneys River	Margaret Kathern Duggins and Stephen Nelson Duggins	160	22.12
911826	Stellerton, Trafalgar Road	David Gray, Susan Santos	183	23.04
829317	Black River Road, Black River	Ray and Paula MacDonald	100	24.16
911917	412 Grant Road, Lorne	Lorne Resources Company Ltd.	75	24.17
858308	Stellerton, Trafalgar Road	Kathryn Humphreys	52	24.58
910604	Lorne Station Road	Edith Rose MacDonald	115	25.78
65213357	Barneys River Road	David Henry Anderson	97.54	25.94
911040	Stellerton, Trafalgar Road	Elmer and Peter MacKay	200	27.59
911115	Lorne, Pictou County	Joyce Findley, Denise Fraser	102.6	28.35
829630	Gunn No 4 Road, East Branch	James and William Mackenzie	100	28.64
856567	Matheson Road, Lansdowne	Albert and Kelly Marshall	120	28.92
810614	Matheson Road, Lansdowne	Middle River Contracting Ltd.	48	29.10
921312	White Hill Road	Lorne Resources Company Ltd.	300	29.99
65201501	Stewicke Road, Lansdowne	Lorne Resources Company Ltd.	110	30.21

Appendix B: Table 3-1 Possible Private Land Options
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PID	Address	Owner	Acres	Distance to Boat Harbour (kilometers)
830612	MacIntosh Road	Atlantic Star Forestry Ltd.	110	31.94
1200195	Dummaglass Road, Mcarras Brook	EJS Fishing Ltd.	84	34.19
1018316	Dryden Lake Road, Glengarry	Kim and Daniel Fraser	100	34.37
20346342	Mountain Road, East Earltown	Ferona Holdings Ltd.	50	35.67
20017042	No 326 Hwy, East Earltown	George Irving Child	30	36.32
20017018	2282 Hwy 326, Denmark	Tim Feeley	26	36.35
20017059	2315 Hwy 326, Denmark	Brian and Barbara Conrad	100	36.41
20017125	No 326 Hwy, Denmark	Robert and Marilyn MacLeod	80	36.71
1200641	6019 Hwy 245, Arisaig	Anne MacDougall-Croft, Stephen Dougall Croft	50	37.03
20281879	2245 Hwy 326, Denmark	Clifford Robert Doubleday	20	37.04
20017075	No 326 Hwy, Denmark	Heather Maccallam	25	37.64
20017067	No 326 Hwy, Denmark	W. Cory and Lillian Risley	100	37.84
20017000	No 326 Hwy, Denmark	Thomas Andrew	30	38.27
20028015	Jim Bailey Road, Waughs River	Toole Properties Inc	127	38.86
20028056	Balmoral Road, Balmoral	Thelma Hayman	20.1	39.07
20477790	Simon Cameron Road, Waughs River	3315033 Nova Scotia Ltd	100	40.46
20438065	Upper Kemptontown, Cross Road	Northern Timber NS Corp.	116	40.61
20436556	Simon Cameron Road, Waughs River	3315033 Nova Scotia Ltd	50	40.91
20438073	Upper Kemptontown, Cross Road	Northern Timber NS Corp.	250	40.94
20436564	Balmoral Road, Balmoral	Toole Properties Inc	100	41.00
20015400	No 311 Hwy, Earltown	Highland Pulp Ltd.	111	41.19
20448916	No 311 Hwy, Nuttby	Theresa and Jones Brooks	207	41.23
20027652	Simon Cameron Road, Waughs River	3315033 Nova Scotia Ltd	45	41.58
20027215	Simon Cameron Road, Waughs River	3315033 Nova Scotia Ltd	50	41.68
1202597	3725 Hwy 245, Maryvale	Edward A Watson, Janice C Walson	55	44.68
1202225	No 245 Hwy, Maligant Cove	Elizabeth Ann MacDonald	110	44.86
20478830	Old Nuttby Road, Nuttby	Douglas and Irene McRae	160	44.89
20311742	Pictou Road, East Mountain	Northern Timber NS Corp.	50	44.97
20029708	Kavanaugh Mill Road, West Earltown	Bluetree Resources Ltd.	148	45.13
20194916	Manganese Mines Road	Rhonda McCarron and Ronald Hoare	100	45.20
20344198	Old Pictou Road, Manganese Mines	Karen and Arne Johnson	30	45.36
20011748	Old Pictou Road, Manganese Mines	Prescott Johnson	30	45.37
20029757	No 311 Hwy West, Earltown	Bluetree Resources Ltd.	52	45.38

Appendix B: Table 3-1 Possible Private Land Options
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PID	Address	Owner	Acres	Distance to Boat Harbour (kilometers)
20011896	No 104 Hwy, East Mountain	Scott Johnson	74	45.41
20011771	Old Pictou Road, Manganese Mines	Dwane and Valerie Johnson	25	45.49
20311734	Pictou Road, East Mountain	Northern Timber NS Corp.	25	45.54
20015194	Old Nuttby Road, Nuttby	Douglas and Irene McRae	115	45.57
20015251	185 Wind Energy Road, Nuttby	Dexter MacRae	199	45.59
20265153	Old Pictou Road, Manganese Mines	Rhonda McCarron and Ronald Hoare	52.4	45.67
20440855	No 311 Hwy, Nuttby	Brian and Ryan Sullivan	50	45.72
20287959	Old Nuttby Road, Nuttby	Kim and David MacCallum	100	45.79
20029732	Old Nuttby Road, Earltown	Bluetree Resources Ltd.	175	45.80
20440863	No 311 Hwy, Nuttby	Tracy and Joanne Toole	50	46.02
20098562	Old Nuttby Road, Kavanaugh Mills	George Kimber	86	46.02
20098554	Old Nuttby Road, Kavanaugh Mills	Jorden Tucker	60	46.05
20098554	Old Nuttby Road, Kavanaugh Mills	Jorden Tucker	60	46.05
20072807	Old Nuttby Road, New Annon	Neil Jones Stevenson	21.8	46.06
20011706	Old Kempt Road, East Mountain	3255209 NS Limited	90	46.15
20287967	Old Nuttby Road, Nuttby	Phillip, David, Cathy Lynds	43.4	46.25
20440871	No 311 Hwy, Nuttby	Tracy and Joanne Toole	100	46.31
20098521	Old Nuttby Road, Kavanaugh Mills	Atlantic Star Forestry Ltd.	82	46.62
20098539	Old Nuttby Road, New Annon	J.D. Irving Limited	60	46.63
20477832	Old Nuttby Road, Kavanaugh Mills	Atlantic Star Forestry Ltd.	70	46.68
20477394	Old Nuttby Road, Kavanaugh Mills	Atlantic Star Forestry Ltd.	94.05	46.87
10060168	No 337 Hwy, Maligant Cove	Robert Kavanah Madden	71.07	46.93
20477402	Old Nuttby Road, Kavanaugh Mills	Atlantic Star Forestry Ltd.	100	46.94
20015285	Old Nuttby Road, Nuttby	Stephen and Brenda Ryan	100	47.07
20045522	Old Union Road, Greenville	Rhonda McCarron and Ronald Hoare	26	48.74
20151064	Old Union Road, Greenville	David and Alex MacKenzie	59.5	48.99
20098794	Truro Road, East New Annan	Jolyon and Maura Hunter	317	49.09

APPENDIX C

Table 4-1 Landfill Siting Criteria Analysis

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Appendix C: Table 4-1 Landfill Citing Criteria Analysis
NS23.03.157
IR82 Analysis

Citing Description	Citing Value	Existing Cell Boat Harbour Containment Cell Analysis	Northern Pulp Nova Scotia - Pulp Plant Active Waste Cell Analysis	Mount William	Granton
NSECC Municipal Solid Waste Guidelines					
Distance to groundwater from the lowest point of the leak detection system and bottom liner	1 metre (m)	Groundwater is in contact with the lowest point of the existing containment cell. This was confirmed from test pit logs and monitoring wells within and surrounding the Cell.	Static groundwater levels in surrounding wells, based on the NSECC well log database are from 7.61 m to 11 metres below ground surface (mbgs)	Well number 921513(on PID 00865469) has a static water level of 24 mbgs.	Well Number 790138 is on PID 00865303 and is noted to have a static water level of 9.14 mbgs and depth to bedrock of 10.35 mbgs.
Distance to permanent surface water/wetland from the Cell	100 m	Located within 30 m of Boat Harbour and surrounded by wetland features	Distance to the nearest mappable surface water to the west and south west at 300 m	There is a stream and mappable wetland on the 00865469 property and a stream on the 00865485.	There is a mappable wetland on the most eastern portion of the Site. This wetland could easily be left undisturbed and the remainder of the Site used for construction.
Distance to Other Properties from the Cell	100 m	50 m to PID 01045343 registered to Council of PLFN	There were no properties within 100 m of the waste cell that were not registered to NPNS.	It would be easy to maintain a 100m buffer from the proposed cell boundaries to the edge of the property line in all directions on PID 00865469.	The narrow nature of the site would make it difficult to maintain a 100 m buffer from the adjacent properties. It is possible to acquire portions of the adjacent properties to expand the effective work width on the eastern portion of the Site.
Distance to Buildings from the Cell	1000 m	Nearest residential buildings are within 1300 m along Pictou Landing Road	This cell construction possibly was already approved by NSECC and as such considered being not an exceedance.	There is a dwelling located to the west of PID 00865469. PID 00865485 has a dwelling located within 60m to the northeast.	The nearest dwelling is 40 m from the eastern property boundary.
National Guidelines for Hazardous Waste Landfills					
Prevention of Surface Water Contamination	An engineered hazardous waste landfill facility should be isolated from all surface water features, so that the contaminant travel time is based primarily on groundwater migration.	The cell is directly within the surface and groundwater hub, potable water recharge areas	This cell is reliably isolated from the surface water. It is greater than 300 m from the closets mapped watercourse.	Brook and stream realignment could be undertaken on property 00865469 to achieve this requirement. However, as the site sits, it does not meet this criteria.	There is a mappable wetland on the most eastern portion of the Site. This wetland could easily be left undisturbed and the remainder of the Site used for construction.
Prevention of Contamination in Parks and Wildlife Areas (Including Places of Special Significance)	There should be a sufficiently long travel time for contaminants from an engineered hazardous waste landfill facility to the nearest boundary of any National, Provincial or Municipal Park, wildlife area, ecological reserve or habitat of special significance, to prevent contamination.	The cell is directly within the place of significant importance for PLFN	This cell is located on the lands of NPNS and is not proximate to any of the citing value criteria.	There is mapped habitat of significance in the footprint and shoreline of Pictou Harbour.	An arm of Pictou Harbour is located 500m east of the Site.
Prevention of Accidental Release of Contaminants (Groundwater Isolation)	There should be a sufficiently long travel time for contaminants from an engineered hazardous waste landfill facility to any unstable land form or any groundwater resource to prevent contamination including but not limited to vulnerable source water areas including, but not limited to, critical surface water and groundwater recharge areas, surface water intakes, highly vulnerable aquifers, wellhead protection, areas or zones, and groundwater and surface water sources identified for future water supply.	The cell is directly within the surface and groundwater hub, potable water recharge areas	Groundwater can be reliably isolated	Well number 921513(on PID 00865469 has a static water level of 24 mbgs. Bedrock ranges in depth from 9 to 16 mbgs. Based on this information, it is plausible that groundwater can be isolated.	Well Number 790138 is on PID 00865303 and is noted to have a static water level of 9.14 mbgs and depth to bedrock of 10.35 mbgs.

Appendix C: Table 4-1 Landfill Citing Criteria Analysis
NS23.03.157
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Citing Description	Citing Value	Existing Cell Boat Harbour Containment Cell Analysis	Northern Pulp Nova Scotia - Pulp Plant Active Waste Cell Analysis	Mount William	Granton
Prevention of Excessive Leachate Formation	The expected precipitation at the engineered hazardous waste landfill facility site should not be excessive	Not assessed. Criteria would be similar for all sites under consideration.	Not assessed. Criteria would be similar for all sites under consideration.	Not assessed. Criteria would be similar for all sites under consideration.	Not assessed. Criteria would be similar for all sites under consideration.
Prevention of Contamination in Populated or Public Areas	The site should not be near designated populated or public areas. The separation between an engineered hazardous waste landfill facility and populated areas should consider atmospheric, surface and groundwater times of travel.	The cell is 1.7km from the PLFN community and is within traditional PLFN lands.	This cell is outside of populated or public areas	There is a dwelling located to the west of PID 00865469. PID 00865485 has a dwelling located within 60m to the northeast.	The nearest dwelling is 40 m from the eastern property boundary. There are a small cluster of dwellings in this area.
British Columbia Environmental Act Hazardous Waste Regulations					
With a minimum separation depth of 3 m of unsaturated soil material with a permeability less than 1 x 10-6 cm/s above a seasonally high water table including the zone of capillary rise	3 m	Less than 3 m	Static levels in surrounding NSECC database wells are from 7.61 m to 11 m	Well number 921513(on PID 00865469 has a static water level of 24 mbgs. Bedrock ranges in depth from 4 to 16 mbgs. Based on this information, it is plausible that groundwater can be isolated.	Well Number 790138 is on PID 00865303 and is noted to have a static water level of 9.14 mbgs and depth to bedrock of 10.35 mbgs.
A person must not locate a secure landfill within 300 m of any nonintermittent watercourse or any other permanent waterbody.	300 m	Located immediately adjacent to boat harbour and wetlands	Distance to the nearest surface water to the west and southwest is just over 300 m.	There is a stream and mappable wetland on the 00865469 property and a stream on the 00865485.	There is a mappable wetland on the most eastern portion of the Site. This wetland could easily be left undisturbed and the remainder of the Site used for construction.
Distance to Potable Water Supply from the Cell A person must not locate a secure landfill in a recharge area for an unconfined aquifer with one or more high capacity wells (> 100 L/minute) or a significant number of lower capacity wells used for fish hatcheries, domestic, irrigation, industrial, municipal or livestock watering supply.	Not in the overburden potable aquifer recharge area >100L/min well within watershed	The containment cell is 1.5 km from the PLFN community water supply. The containment cell bottom is within the overburden water table and is potentially within the recharge area for this water supply. Further there are 6 mapped well logs within the BHETF. The closest residential potable water well is 1.8km from the containment cell.	There are five mapped wells on the NPNS Property with one of them is 250 m from the active cell. Note that while these potable well logs are noted in the database, the NPNS waste disposal cell is in operation under an approval from NSECC.	Well number 921513 on PID 00865469 has a static water level of 24 mbgs. There is a second well log on PID 00865469, Number 800872. The static water level is not noted on this log.	Well Number 790138 is on PID 00865303 and is noted to have a static water level of 9.14 mbgs and depth to bedrock of 10.35 mbgs. There are an additional 7 wells located within 700m of the Site.
A person must not locate a secure landfill where it (including the underlying dual liners) would be underlain by less than 5 m of fine grained unconsolidated material with a permeability of less than 1 x 10-6 cm/s over fractured or permeable bedrock formations (e.g. sandstone, limestone, dolomite).	5 m	Based on the NSECC well database the overburden thickness is 6.7 m to 8.83m. It is assumed that it will allow for 5 m distance.	Based on NSECC well database the overburden thickness is 3.65 m to 7.61m. It is assumed that it will allow for 5 m distance.	Based on the well logs, the bedrock ranges in depth from 4 to 16 mbgs. It will be possible to get 5m between the lowest point of the leak detection system.	Well Number 790138 is on PID 00865303 and is noted to have a static water level of 9.14 mbgs and depth to bedrock of 10.35 mbgs. It will be possible to get 5m between the lowest point of the leak detection system.

Appendix C: Table 4-1 Landfill Citing Criteria Analysis
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Citing Description	Citing Value	Existing Cell Boat Harbour Containment Cell Analysis	Northern Pulp Nova Scotia - Pulp Plant Active Waste Cell Analysis	Mount William	Granton
Within the boundaries of: (I)national, Provincial, regional or municipal park; (ii)wildlife management area; (iii)critical wildlife area or wildlife sanctuary; (iv)land acquired and administered under section 3 of the Wildlife Act(BC); (v)ecological reserve; (vi) bird sanctuary; (vii) wildlife area.	NA	Site is not within the boundary of any designated areas.	Site is not within the boundary of any designated areas.	Site is not within the boundary of any designated areas.	Site is not within the boundary of any designated areas.

Note: NA – not applicable; NG- no guideline. Pt = precipitation falling on the surface of the closed secure landfill; Et = maximum possible loss of water from the surface of the closed secure landfill to the atmosphere by evaporation and by transpiration; Ws = available soil water storage in any month in the final cover of the closed secure landfill (maximum value is total available water storage capacity of the final cover).

Shading indicates citing criteria is not acceptable