6.3.4.3 Follow-up and Monitoring

Crews onboard the TSHD will monitor the vessel for evidence of bird collisions during night dredging activities. The Proponent will consult with CWS if the lighting issue becomes a problem for marine-related birds.

No additional follow-up or monitoring has been planned at this time.

6.3.5 Summary of Residual Environmental Effects Prediction

Residual environmental effects of the Project on Marine Mammals and Marine-related Birds in Sydney Harbour are summarized in Table 6.10.

TABLE 6.10 Environmental Effects Assessment Matrix: Marine Mammals and Marine-related Birds

Project Activity	Potential Environmental Effect Positive (P) or Adverse (A)	Mitigation	Evaluation Criteria for Assessing Residual Environmental Effects					
			Magnitude	Geographic Extent	Duration/ Frequency	Reversibility	Ecological/Socio-economic Context	Prediction Confidence
CONSTRUCTION AND COMMISSIONING								
Dredge and Dewatering	▪ Change in marine mammal habitat use and quality due to vessel noise (A) ▪ Change in marine mammal and marine-related bird habitat quality due to effects on food source (*i.e.,* marine fish and shellfish)(A)	▪ HADD Authorization for capital dredging at a compensation ratio to be determined by DFO-HPSD. ▪ Use of state-of-art dredging technology (suction dredging rather than bucket dredging) ▪ Other mitigation for marine species as noted in Sections 6.1 and 6.4.	1	2	1/1	I	2	H
Vessel Transportation	▪ Direct mortality of marine mammals due to collision (A) ▪ Change in marine mammal habitat use and quality due to vessel noise (A)	▪ Standard vessel operating procedures, including avoidance of whales and further reduction in speed if they are sighted. ▪ Project vessels to use fixed navigation routes.	1	2	1/1	R	2	H
OPERATION								
Marine Vessel Traffic	▪ Direct mortality of marine mammals due to collision (A) ▪ Change in habitat use and quality due to vessel noise (A)	▪ Standard vessel operating procedures, including avoidance of marine mammals and further reduction in speed if they are sighted. ▪ Project vessels to use fixed navigation routes.	1	2	1/1	R	2	H

TABLE 6.10 Environmental Effects Assessment Matrix: Marine Mammals and Marine-related Birds

Project Activity	Potential Environmental Effect Positive (P) or Adverse (A)	Mitigation	Evaluation Criteria for Assessing Residual Environmental Effects					
			Magnitude	Geographic Extent	Duration/ Frequency	Reversibility	Ecological/Socio-economic Context	Prediction Confidence

KEY

Magnitude:
1 = Low: Temporary disturbance of marine mammals and/or marine related birds or habitat limited to the Assessment Area with no permanent loss or degradation of critical habitat.
2 = Moderate: Permanent alteration of marine mammals and/or marine related birds or habitat limited to the Assessment Area with no loss of critical marine mammal habitat.
3 = High: Permanent alteration of habitat critical to the survival of marine mammal and/or marine related bird's species or loss of population or stock.

Geographic Extent:
1 = Environmental effects restricted to Project footprint.
2 = Environmental effects extend beyond the Project footprint but remain with Assessment Area.
3 = Environmental effects extend beyond Assessment Area.

Duration:
1 = Short term: Effects are measurable for <1 year.
2 = Medium term: Effects are measurable for 1 to 5 years.
3 = Long term: Effects are measurable for >5 years.

Frequency:
1 = Occurs once.
2 = Occurs rarely and at sporadic intervals.
3 = Occurs on a regular basis and at regular intervals.
4 = Continuous.

Reversibility:
R = Reversible.
I = Irreversible.

Ecological/Socio-economic Context:
1 = Area is relatively pristine or not adversely affected by human activity.
2= Evidence of existing negative environmental effects (*e.g.,* existing stream crossings).

Prediction Confidence:
Based on scientific information and statistical analysis, professional judgment and effectiveness of mitigation
L Low level of confidence
M Moderate level of confidence
H High level of confidence

6.4 Terrestrial Habitats and Wildlife

Terrestrial Habitats and Wildlife was selected as a VEC due to the potential for rare elements of indigenous biodiversity and rare habitats that harbor unique assemblages of plants and animals. The Terrestrial Habitats and Wildlife VEC encompass wildlife and vegetation with a focus on species of conservation concern or regulatory protection and potential effects on sensitive habitats such as wetlands.

This VEC includes all terrestrial mammals, birds and herpetiles considered to be rare in Canada and Nova Scotia that may interact with the Project, as well as habitat that is important to wildlife species. Rare species, by definition, are of interest and often warrant special consideration. Raptors (*e.g.,* eagles, hawks, falcons) are generally sensitive to anthropogenic disturbances, especially during their breeding period. Marine-related birds are discussed in Section 6.3.

Wetlands are incorporated into the Terrestrial Habitats and Wildlife VEC as an important feature of the landscape, performing many biological, hydrological, social/cultural, and economic production functions. Wetlands provide habitat for plant and animal species, many of which depend on wetland habitats for their survival. Hydrological functions of wetlands include erosion and flood control, contaminant reduction, and groundwater recharge and discharge. Wetlands support various forms of recreational activity, as well as subsistence production, such as harvesting of wildlife and plants, and commercial production, such as cranberry bogs, forestry, and peat extraction.

The overview of existing environmental conditions in the Assessment Area with regards to Terrestrial Habitat and Wildlife is present in Section 4.9.

6.4.1 Environmental Assessment Boundaries

Spatial and Temporal

The spatial boundary for assessment of Terrestrial Habitats and Wildlife includes terrestrial areas that the proposed Terminal will physically disturb (*i.e.,* the terminal footprint as described in the Project) as well as a buffer zone extending 500 m from these disturbed areas (in consideration of disturbance to wildlife) as well wetlands adjacent to the footprint where hydrology may be affected by construction activities. These areas are collectively referred to as the Assessment Area for Terrestrial Habitats and Wildlife.

Rare or sensitive wildlife and bird species could occur at any location within the spatial boundary. Birds are particularly sensitive to disturbance around nest sites. Noise and visual stimuli associated with construction activities around these sites can adversely affect the energy budgets of migrants, possibly increasing mortality rates.

The temporal boundary for Terrestrial Habitats and Wildlife varies depending on the component; rare plants are always present in their habitats and therefore the opportunities for Project interaction are continuous. Potential effects on plant habitation and soils caused by construction activities and vehicle movements may be more severe when the ground is soft (*e.g.,* spring); most wildlife are present in the study area year-round. Wildlife could, therefore, be affected by construction and operation for the duration of Project activities. Some mammal species are particularly sensitive to disturbance during certain times of year. Most bird species are migratory; however, some are considered resident. Temporal boundaries are therefore variable, as some species may be present year-round while others may occupy habitat in the vicinity of the Project only during a critical point in their life cycle. The breeding season (April to August for most species) is generally the most critical period for bird species, which are sensitive to habitat destruction and disturbance at this time, since eggs and nestlings cannot move from the source of disturbance. Potential adverse effects may result from destruction or permanent abandonment of the nest or increased predation during temporary abandonment.

Wetlands are a semi-permanent landscape feature, and may interact with the Project year-round. Specific Project activities may be short-term, but their effects on wetland habitat may persist throughout the year. As such, this assessment considers Project effects on a year-round basis.

Wetlands are most sensitive to physical and noise disturbance during Spring and early Summer when they are thawed and easily physically disturbed. At this time, birds and wildlife that use wetlands as breeding habitat are more susceptible to disturbance. Wetland wildlife habitat may also be more sensitive to construction activity in the Spring and early Fall when large numbers of migrating waterbirds feed and rest in productive areas. Wetlands are least sensitive to construction activity during winter, when the surface is frozen and most birds and herpetiles are not present.

Administrative and Technical

Rare plants are currently protected by law in Nova Scotia only if they are growing in a protected area such as a provincial park or are listed under the Nova Scotia *Endangered Species Act* or federal *Species at Risk Act*. Most rare species at most locations in Nova Scotia are not protected by law. However, the presence of rare vegetation is considered to be an environmental constraint under the environmental assessment process. The degree to which they pose a constraint depends on the rarity of the species and their sensitivity to the Project.

In Nova Scotia, all mammal species not designated as game animals or other harvestable wildlife under the provincial *Wildlife Act* and Regulations are protected at all times of the year. Three mammal species are protected under the Nova Scotia *Endangered Species Act*, including American marten (*Martes americana*), Canada lynx (*Lynx lynx*) and the mainland moose (*Alces alces)* population. Two Nova Scotia mammal species, the Gaspé shrew (*Sorex gaspensis*) and the southern flying squirrel (*Glaucomys volans*), are protected under the federal *Species at Risk Act* (*SARA*). Herpetiles have no legislative protection unless they are found in a protected area such as a provincial park or are listed as a rare or endangered species under either the federal *Species at Risk Act* or the Nova Scotia *Endangered Species Act*.

The *Migratory Birds Convention Act* (1994) is a federal law which protects migratory birds in Canada and the United States. The Act prohibits killing, injuring or harassing migratory birds without a permit. Jurisdiction for migratory birds is federal, due to the fact that migratory birds cross both provincial and international boundaries. The Act is administered by the Canadian Wildlife Service under the authority of the federal Minister of the Environment. The Act applies to migratory birds across Canada, whether located on federal or provincial lands.

In Nova Scotia, wetlands are protected by the *Environment Act* and the Activities Designation Policy as outlined in the Operational Bulletin Respecting Alteration of Wetlands (2006). The potential to alter wetlands, including direct and indirect impacts, require a Water Approval under the Activities Designation Regulation and according to the *Environment Act.* If the impact of the alteration to a wetland affects the function of 2 ha or more, a project is also subject to registration under the Environmental Assessment Regulations.

Most of the rare plant species of Nova Scotia cannot be reliably identified outside of the growing season and many species can only be reliably identified while in flower or fruit which may limit the time period during which they can be detected. A rare plant modeling exercise was carried out prior to conducting the field surveys in order to determine the optimal times to conduct rare plant surveys. Comprehensive vascular studies were conducted between June and August 2007.

The breeding status of most bird species of Nova Scotia, at particular sites, cannot be reliably determined outside their breeding season (during which they are actively defending territories, and are readily detectable by song and other behaviours). Information on the distribution and abundance of birds has been obtained mainly through the Maritimes Breeding Bird Atlas (MBBA) database (Erskine 1992), a review of the Atlantic Canada Conservation Data Centre data base (ACCDC 2003), and a breeding bird survey conducted in the study area in June 2007.

Information regarding the presence of wildlife at or near the proposed Project was derived from existing data sources as well as field surveys (refer to Section 4.9).

6.4.2 Residual Environmental Effects Evaluation Criteria

A significant residual adverse environmental effect occurs when the population of an otherwise secure species is sufficiently affected to cause a decline in abundance and/or change in distribution beyond which natural recruitment (reproduction and immigration from unaffected areas) would not return the population to its former level within several generations. A significant adverse effect on sensitive/critical wildlife habitat (including wetlands) is defined as any adverse environmental effect that results in an uncompensated, net loss of habitat function.

A significant residual adverse environmental effect on any species of special status is defined as one that results in any of the following:

- A non-permitted contravention of any of the prohibitions stated in Sections 32-36 of *SARA* (*i.e.,* it is an offense to capture, take, possess, collect and sell endangered or threatened species, as well as it is illegal to damage or destroy the residence, for example the next or den, of an endangered or threatened species), or in the case of wildlife species of Special Concern listed in Schedule 1 or *SARA*, where the Project activities are not in compliance with the objectives of management plans (developed as a result of Section 65 of *SARA*) that are in place at the time of relevant Project activities.
- An alteration of terrestrial habitat within the assessment boundaries, physically, chemically or biologically, in quality or extent, in such a way as to cause a change or decline in the distribution or abundance of a viable plant or wildlife population that is dependent upon that habitat such that the likelihood of the long-term survival of these populations within Nova Scotia is substantially reduced as a result.
- Direct mortality of individuals or communities such that the likelihood of the long-term survival of these rare, uncommon and/or non-secure population(s) with Nova Scotia is substantially reduced as a result.

6.4.3 Potential Interactions, Issues and Concerns

Table 6.11 below lists Project activities and physical works associated with the Project and ranks each interaction as 0, 1 or 2. These rankings are defined in Table 6.11 and are indicative of the level of interaction each activity or physical work will have with Terrestrial Habitats and Wildlife.

TABLE 6.11 Potential Project Environmental Effects to Terrestrial Habitats and Wildlife

Project Activities and Physical Works	Potential Environmental Effects	
	Change in Terrestrial Populations	Change in Habitat Quality and Quantity
Construction and Commissioning		
Dredge and Dewatering	0	0
Vessel Transportation	0	0
Construction of confined disposal facility	0	0
Site Preparation	2	2
Construction of land components	2	2
Operation		
Marine Vessel Traffic	0	0
Loading and Unloading Vessels/Trains	2	2
Site stormwater and wastewater Management	1	1
Equipment and Materials Storage	1	1
Maintenance/Repairs to Terminal	1	1
Maintenance Dredging	0	0

Note: Project-Environment Effects were ranked as follows:
0. No interaction. No substantive interaction contemplated.
1. Interaction will occur. However, based on past experience and professional judgment, the interaction would not result in a significant environmental effect, even without mitigation, or the interaction would clearly not be significant due to application of codified practices
2. Interaction may, even with codified mitigation, result in a potentially significant environmental effect and/or is important to regulatory and/or public interest. Potential environmental effects are considered further and in more detail in the EIA.

The measureable parameters used for the assessment of the potential environmental effect (*i.e.,* Change in Terrestrial Populations), and the rationale for their selection is provided in Table 6.12. The measurable parameters in the table below were used to conduct the environmental assessment for Terrestrial Habitats and Wildlife.

TABLE 6.12 Measureable Parameters for Terrestrial Habitats and Wildlife

Environmental Effects	Measurable Parameter	Rationale for Selection of the Measurable Parameter
Change in Terrestrial Populations	Loss of species of special status	Addresses the loss of species of special status (which are protected by law)
	Mortality of individuals	Addresses the concern of loss of individuals, including migratory birds during the breeding season
Change in Quantity and Quality of Habitat	Loss of sensitive habitat	These are habitats for many species
	Change in interior forest habitat	Creation of edge habitat

Project activities and physical works for the environmental effects assessment of Terrestrial Habitats and Wildlife were ranked in Table 6.11 for land based work. All Project activities and physical works associated with construction, commissioning and operation of marine works were rated as “0”, as these Project components will not interact with terrestrial wildlife populations or habitat in any substantive way and could not be significant. This includes dredge and dewatering, marine vessel transportation, CDF construction during the construction and commissioning phase and marine vessel traffic and

maintenance dredging during the operational phase of Project activities. The interactions between Terrestrial Habitats and Wildlife and the marine infrastructure will not be considered further, and the potential environmental effects of the marine based components during all phases of the Project are rated not significant. Potential interactions with Marine Mammals and Marine Related Birds are assessed in Section 6.3.

Interactions that occur but are not considered likely to result in any significant adverse environmental effects, even without the use of mitigation, are ranked as “1” and are thus rated not significant. This includes: equipment maintenance and storage; maintenance/repairs to the terminal; and site stormwater and wastewater management as part of operational activities. The interaction between Terrestrial Habitats and Wildlife and these activities can be mitigated with standard best management practices, or would be low enough in magnitude so as to not result in a significant adverse residual environmental effect on Terrestrial Habitats and Wildlife. Since maintenance and repairs and equipment and materials storage to not involve the loss of habitat, or directly threaten the sustainability of terrestrial populations, they have limited potential to adversely affect terrestrial populations. Any stormwater and/or wastewater discharge to wetlands would be required to meet regulatory requirements prior to discharge. Due to the implementation of effective mitigation measures, the environmental effects of the interactions rated as “1” are rated not significant.

Only those interactions ranked as “2” will be carried forward to the detailed environmental effects assessment analysis, as those interactions may result in adverse environmental effects that could be significant without mitigation. Project interactions with Terrestrial Habitats and Wildlife ranked as “2” include: site preparation; and construction of land components during construction and commissioning. Construction activity could affect Terrestrial Habitats and Wildlife in the study area in several ways. Some wetland habitat will be lost as a result of physical disturbance associated with construction activity. Activities such as clearing and grubbing, and grading of terrestrial habitats at the edges of wetlands could result in sedimentation of inundated portions of wetlands. Alteration of the drainage characteristics of the watersheds of wetlands as a result of construction can affect the hydrology of adjacent wetlands. Noise associated with construction of the terminal could disturb wildlife found in nearby habitats, if the habitats support species that are particularly sensitive to anthropogenic disturbance. The Terrestrial Habitats and Wildlife could be affected by accidental spills of fuel, lubricants, or hydraulic fluids during construction. Improper disposal of smoking materials could result in fires that could damage habitats.

During the operational phase of the Project, interactions ranked as “2” include loading and unloading vessels and trains. This is primarily due to associated noise and visual stimuli that has the potential to disturb wildlife found in nearby habitats and to potentially cause bird collisions with facility structures.

6.4.4 Analysis, Mitigation and Residual Environmental Effects Prediction

Site preparation, construction of land components and loading and unloading vessel trains have been rated as a “2” due to their potentially significant interactions and environmental effects to Terrestrial Habitats and Wildlife. Each of these Project components is discussed in the following sections, along with an assessment of their potential environmental effects. The section includes a discussion of mitigative measures which will be put in place to limit any residual environmental effects.

6.4.4.1 Construction and Commissioning

There are no rare mammal populations or sensitive mammal habitat (*e.g.,* deer wintering areas) found in or near the Assessment Area; consequently, the Project is not expected to have any adverse effects on them. Other mammals found in or near the Assessment Area could be affected by the Project. Project construction could result in the loss of habitat, habitat fragmentation, and disturbance of larger mammals and possible mortality of small mammals. Activity at the terminal may disturb sensitive mammals in adjacent habitats resulting in abandonment of otherwise suitable habitat. Installation of a security fence around the terminal will inhibit the movement of larger mammals to and from the Project property.

A number of activities associated with the construction phase could adversely affect mammal species as a result of habitat loss, noise, and related disturbance. Clearing and grubbing will result in the loss of forest cover that provides food and shelter for mammals. The Project footprint does not contain critical habitat for mammal species. Those that inhabit the area are relatively common; therefore the loss of habitat associated with the Project will not threaten the existence of local mammal populations.

Other construction activities such as grading and construction of land components will create visual, auditory and olfactory stimuli that may disturb mammals resulting in abandonment of habitat adjacent to the Project. None of the species recorded in the study area are particularly sensitive to anthropogenic activities.

Site construction can adversely affect herpetile populations by fragmenting habitat and removing or adversely modifying (*e.g.,* through siltation or change in hydrology) core habitat features such as breeding sites. Construction activity can positively affect herpetile populations through the possible creation of habitat such as road side ditch pools which can provide valuable breeding habitat for amphibian species and the creation of habitat edges which favours certain snake species.

The Project could adversely affect terrestrial birds in a number of ways. During the construction phase of the Project bird habitat will be lost as a result of clearing and grubbing of the terminal site. Birds in adjacent habitats may be disturbed by auditory and visual stimuli associated with construction activity.

Several rare plant species found in the Assessment Area are not present within the area where construction activity will occur. The patch of rare plants is located in an area of imperfectly drained abandoned pasture near the eastern property boundary (refer to section 4.9.1). This area is located 80 m east of the area to be cleared for Project construction. It is unlikely that clearing and grubbing of the site will directly affect these species. Additional measures will be included in the Project EPP such as flagging the sensitive sites to prevent unintentional trampling.

The Project site was carefully selected and configured, in part, to minimize conflicts with sensitive ecological features (*e.g.,* wetlands). The initial terminal layout avoided all large wetlands; as geotechnical information became available however; the terminal footprint was modified to avoid marine blasting, which forced encroachment on wetland habitat that was initially avoided.

Four of the eight wetlands found within the property boundary (refer to Figure 4.4) will be affected in some way by Project construction. Wetland 1, 4 and 8 will be partially infilled as a result of construction activity. It is anticipated that 2.5 ha or 96% of Wetland 1, 1.2 ha or 34% of Wetland 4, and 0.24 ha or 55% of Wetland 8 will be infilled. Wetland 2 (0.51 ha) will be completely filled by Project construction.

The hydrology of these wetlands is likely to be affected by construction. There will be less evapotranspiration of soil water and retention of rainfall will be impeded resulting in greater runoff. Site development will result in an increase in the peak rates of surface runoff. This could result in more frequent flooding of the wetlands. Development of the site could also result in sediment laden water entering the wetland. Heavy sediment deposition could result in smothering of wetland plant communities. Deposition of sediment could also change the trophic state of the wetland. Sediment deposition would increase the productivity of the wetland resulting in changes in plant community structure and species composition.

Noise, olfactory and visual stimuli associated with construction activity could disturb wildlife species that use the wetlands as habitat. The effects of the project on the hydrology of Wetlands 1, 4 and 8 can be mitigated in several ways which will be detailed in an EPP (see Section 2.0). Flow retention structures can be used to capture runoff from the site and promote infiltration into the soil as well as more even release of runoff. These structures will also be useful in capturing sediment eroded from the site. The areas cleared during Project construction should to the greatest extent practical are revegetated in order to restore some of the evapotranspiration potential lost as a result of removal of forest cover. Revegetation of the site will also minimize erosion. Wherever practical, native species should be used to replant the site. An alternative plan would be to rapidly establish a vegetation cover using grasses and legumes that are currently widespread in Nova Scotia and have not demonstrated a propensity to invade native habitats (*e.g.,* Purple Loosestrife, Dame's Rocket and European Alder-buckthorn tend to invade natural habitats). This vegetation cover would be supplemented with plantings of low shrubs such as blueberry, lambkill and sweet fern that could be used to develop a low maintenance ground cover. Care must be taken to minimize the potential for introductions of noxious weeds into local wetlands as a result of construction activity. Equipment such as bulldozers and excavators that will be working on the site should be cleaned before being transported to the site to reduce the potential for transfer of noxious weeds to the site.

Wetland avoidance was a prime consideration during the terminal design and layout. Reduction of wetland impacts (direct and indirect) will continue to influence detailed terminal design and mitigation strategies (*e.g.,* maintaining hydrology); however the loss of some wetland habitat will be unavoidable. The total area of wetland habitat lost to the Project is currently estimated to be approximately 4.5 ha. Standard practice in Nova Scotia is for proponents to provide compensatory habitat for loss of wetlands due to proposed Project activities. In general there is a provincial goal of no net loss of wetland function. As such, the Nova Scotia Environment and Nova Scotia Department of Natural Resources will be consulted to determine specific requirements with respect to compensation for the loss of wetland habitat from the Project area due to proposed activities.

Approximately 4.45 Hectares of wetland impact is currently proposed by the construction of the Sydport Container Facility. According to Nova Scotia Environment and Nova Scotia Department of Natural Resources requirements, these wetland losses must be compensated with replacement onsite.

Restoration Goals

The goal of the wetland compensation is to create new wetlands to occupy the ecological role and account for the loss (partial or full) of Wetlands 1, 4, and 8. Restoring the functions and values of the lost wetlands will be the critical factor in determining the final wetland compensation proposal.

Pending additional fieldwork, three options are available for wetland compensation at the site. One or a combination of all of these options will be necessary to compensate for the required 4.5 Ha of wetland loss. A successful wetland compensation project must include the three criteria that define a wetland: hydrology, hydric soils, and vegetation. Without successful sources for each of these criteria, the wetland will not achieve the project goals of restoring functions and values lost in the impacted wetland. Each proposal below details the proposed sources for each of the three criteria and discusses the types of wetlands to be created and enhanced.

Option 1 – Expansion of Wetland 6

With excavation and slight hydrological alteration, Wetland 6 could be expanded to create additional wetland area.

Proposed Hydrology Source – Groundwater and the existing wetland. According to a review of aerial photos, Wetland 6 appears to have a channelized flow into the South Arm. If groundwater is insufficient to provide hydrology to the wetland, the channel will be modified to provide water to the expanded wetland.

Proposed Substrate – Transplanted organic material from impacted wetlands onsite.

Proposed Vegetation and Wetland Type – The proposed wetland will be similar to Wetland 6 with emergent vegetation that is consistent with the existing wetland and other coastal wetlands on this property.

Option 2 – Expansion of Wetland 7

Although the topography is sloping towards the South Arm in this location, the creation of a long, narrow wetland along the contours is proposed. Existing Wetland 7 would be the northern edge of this created wetland area. If the proposed hydrology source is sufficient, this area could compensate for all of the wetland impact proposed in this project.

Proposed Hydrology Source – Existing Wetland 7 and groundwater. According to soils information available at the site, drainage is slow in this area and the upper soil horizons are frequently saturated. If this area was excavated to depths necessary to collect the water in the saturated zones, a wet meadow basin could be created at the site. In addition, according to the aerial photo, there appears to be a small drainage flowing through this area that, if controlled, could provide additional water to the created wetland.

Proposed Substrate – Transplanted organic material from impacted wetlands onsite. This material could also form an impermeable substrate that maintains the water in the created wetland.

Proposed Vegetation and Wetland Type – The proposed wetland will be a wet meadow basin similar to Wetland 2 with a potential for deeper areas and an emergent marsh. Vegetation will consist of sedges, bulrushes and other wetland grasses consistent with the impacted wetlands.

Option 3 – Expansion of Wetland 5

Wetland 5 appears to be draining into the South Arm along the southern edge of the project site. Depending on a more detailed survey in the area, this drainage could be restricted and would then back

up into wetland 5. With additional excavation and grading, additional wetland area could be created between Wetlands 5 and 3.

Proposed Hydrology Source – Existing Wetland 5, groundwater and drainage into South Arm. If the drainage from Wetland 5 into the South Arm can be located and a water control structure installed to back up water into the wetland, the hydrology criterion of the wetland creation will be satisfied. In addition stormwater runoff from the project could be directed to this expanded wetland complex.

Proposed Substrate – Transplanted organic material from impacted wetlands onsite

Proposed Vegetation and Wetland Type: Current information and aerial photos indicated that Wetland 5 is currently a shrub swamp. The created wetland area will mimic this wetland habitat and plants from the existing wetland can be transplanted to the new areas to encourage establishment of wetland vegetation.

A number of activities (*e.g.,* clearing and grubbing) associated with the construction phase of the Project could interact with sensitive bird species. During construction, potential effects include habitat loss and noise and related disturbance.

Clearing will result in the removal of trees and shrubs that provide nesting areas for a variety of bird species. This will result in the displacement of birds nesting in these areas. The effects of clearing are most severe when these activities are conducted during the period when most birds are breeding (April to August). Clearing at this time of the year can result in the direct mortality of eggs and unfledged nestlings. The killing of migratory birds or the destruction of their eggs or young is an offence under *the Migratory Birds Convention Act (MBCA).* Clearing will be conducted outside the breeding season where feasible in order to avoid destruction of nests and nestlings; if this is not feasible, alternative mitigation will be employed to ensure compliance with *MBCA* such as nest surveys and avoidance. Efforts will be made during detailed Project design to minimize the overall area to be cleared.

Sensitive terrestrial bird species encountered at or near the Project site during the field surveys included Boreal Chickadee and Bald Eagle. No direct evidence of Boreal Chickadee breeding activity was recorded during the field surveys however one Boreal Chickadee was observed in mature coniferous forest which would provide suitable breeding habitat, so there is some potential for this species to breed in the Project area. Boreal Chickadees nest in tree cavities and hollow branch stubs in coniferous and mixedwood forest. These habitat types are abundant in the general area. As such, the removal of coniferous and mixedwood forest during Project clearing is not expected to result in significant reductions in either Boreal Chickadee numbers or the availability of suitable nesting habitat for this species.

Most construction activities will generate noise or visual stimuli that can disturb nesting birds. Bald Eagles, Northern Goshawks and Boreal Chickadees are sensitive to disturbance around their nest sites. Nova Scotia Department of Natural Resources (NSDNR) published Special Management Practices for Eagles (Draft 2004). The management guidelines suggest that all land use, except when necessary to protect or improve the nest site, should be prohibited within 100 m of the nest. A secondary zone of protection extends 200 m from the nest; in this zone all land use activities that result in significant changes to the landscape should be prohibited. The Bald Eagle nest is approximately 220 m from the nearest terminal infrastructure. Boreal Chickadees are tolerant of the presence of

humans and anthropogenic activities and it is unlikely that construction activity will cause them to abandon nesting sites near the construction area. It is also noted that the proposed Project site is located in an industrial park with active industries on adjacent land parcels. Construction activity is therefore unlikely to have any adverse effects on the nesting of these species.

Clearing and grubbing of sites has the potential to create habitat edge which has both positive and negative implications for birds. Habitat edges often support a large number of bird species and high bird densities. However, edges also tend to attract generalist predators such as raccoons (*Procyon lotor*), red fox (*Vulpes vulpes*), coyote (*Canis latrans*), dogs *(Canis familiaris*), cats (*Felis domestica*), American Crows (*Corvus brachyrhynchos*), and Blue Jays (*Cyanocitta cristata*). The presence of high concentrations of predators and Brown-headed Cowbirds along habitat edges can result in areas becoming reproductive sinks in which large numbers of birds attempt to breed but have poor breeding success. The deleterious effects of edge habitat may extend 200 to 600 m into the forest interior (Yahner 1988; Canadian Wildlife Service 2004).

Clearing for the Project is not likely to create a net gain of additional edge habitat as the site is located along a coastal area that has been previously developed, therefore the site presently exhibits edge habitat. Project clearing could reduce the success of local breeders however the effect on regional and local bird populations is not considered to be significant and would be considered less than that associated with the clearing of a moderately sized clear-cut or agricultural field.

Measures to diminish the risk of introducing invasive species such as cleaning and inspecting construction equipment prior to transport and regularly inspecting equipment prior to, during and immediately following construction in wetland areas and in areas found to support Purple Loosestrife will be implemented at the site. Only native seed mixtures will be used to revegetate the site post construction.

Overall, with the implementation of the above mitigative measures including habitat compensation for lost wetland habitat, the residual environmental effect of construction and commissioning on Terrestrial Habitats and Wildlife is predicted to be not significant.

6.4.4.2 Operation

Noise and visual stimuli associated with loading and unloading of vessels and trains during operation of the terminal could cause disturbance of wildlife (*i.e.,* mammals and herpetiles) in habitats adjacent to the facility. Disturbance of wildlife associated with operational activities at the terminal is not expected to have significant adverse effects on wildlife found in the Assessment Area. These species are tolerant of anthropogenic activities and readily habituate to the presence of humans. The Assessment Area does not provide critical habitat for mammal or herpetile species.

During the operational phase of the Project birds in habitats adjacent to the terminal may be disturbed by activities at the terminal. Bird mortality rates could increase as a result of collisions with the structures (*e.g.,* cranes) caused by attraction to lighting at the terminal. Under conditions of poor visibility such as low cloud cover or fog, nocturnal migrating birds have difficulty navigating and may be attracted to bright lights. Under cloudy or foggy conditions water droplets in the air refract light creating an illuminated area around the lights. Birds that have lost their celestial navigation aids may enter these illuminated areas and become confused possibly resulting in collisions and/or exhaustion. Strong

unidirectional or rotating light sources are most likely to create this problem and red light can create more of a problem than white light. Flood lighting of structures has been demonstrated to cause bird mortality since the strong lighting traps birds close to the lighted structure. Navigational beacons may also affect birds since this lighting is positioned at higher altitudes where night migrating birds are more likely to encounter them. Solid or pulsing red navigation beacons have the strongest ability to hold birds while slow strobe lights have the weakest ability to hold birds.

Lighting at the facility will be not be pulsating and will be white unless otherwise directed by regulatory agencies. In addition, the proponent is committed to incorporating technically and economically feasible design criteria for lighting which would minimize potential effects to migrating birds. Design criteria being considered by the proponent are discussed in Section 2.12 and include use of full cut-off design fixtures to prevent light spill-over, and use of low intensity lighting where feasible.

With the implementation of the above measures, the residual environmental effects on Terrestrial Habitats and Wildlife associated with the operation phase are predicted to be not significant.

6.4.5 Follow-up and Monitoring

During the provincial permitting process, the Proponent, in consultation with NSE and NSDNR will develop a wetland compensation plan that will be implemented to ensure no net loss of wetland function. This will include a follow-up monitoring plan to monitor the effectiveness of wetland compensation project(s).

A follow up survey of the Bald Eagle nest near the site will be conducted to determine if the nest is still active. If the nest is active, the Proponent will consult with NSE and NSDNR to develop a specific mitigation plan.

6.4.6 Summary of Residual Environmental Effects Prediction

Analysis of existing data sources and the results of the field surveys suggest that it is unlikely that any rare mammal or herpetile species or sensitive mammal/herpetile habitat are present in the Assessment Area. As such, no significant Project related adverse residual effects on rare mammals/herpetiles or sensitive mammal/herpetile habitat are anticipated, provided general mitigation measures are followed.

Provided the recommended mitigative measures are implemented, no significant adverse residual environmental effects on bird species of concern are likely to occur. Table 6.13 provides a summary of the residual environmental effects and recommended mitigative action for bird species of concern.

Analysis of existing data sources, as well as the results of field surveys, indicates that six rare plant species are found in the study area but outside of the Project footprint. No adverse affects are anticipated to occur as a result of normal operation of the terminal. Mitigative measures developed for the various phases of the Project would help ensure that any adverse environmental effects would be non-significant.

Table 6.13 provides a summary of the residual environmental effects and recommended mitigative action for Terrestrial Habitats and Wildlife.

TABLE 6.13 Environmental Effects Assessment Matrix: Terrestrial Habitats and Wildlife

Project Activity	Potential Environmental Effect Positive (P) or Adverse (A)	Mitigation	Evaluation Criteria for Assessing Residual Environmental Effects					
			Magnitude	Geographic Extent	Duration/ Frequency	Reversibility	Ecological/Socio-economic Context	Prediction | Confidence
CONSTRUCTION AND COMMISSIONING								
Site Preparation (clearing and grubbing, grading)	▪ Habitat alteration (A) ▪ Sensory disturbance (A) ▪ Change in population (A)	▪ Minimize footprint ▪ Buffer eagle nest ▪ Avoid rare plant species ▪ EPP for construction (*e.g.,* erosion and sedimentation control) ▪ Minimize direct and indirect wetland impacts where possible ▪ Wetland compensation ▪ Clearing to be conducted in compliance with *MBCA*	2	2	1/1	I	2	M
Construction of land components (including road, rail, buildings)	▪ Sensory disturbance (A) ▪ Change in population (A)	▪ Revegetation with non-invasive species ▪ Buffer eagle nest ▪ EPP for construction (*e.g.,* erosion and sedimentation control)	2	1	1/1	I	2	M
OPERATION								
Loading and Unloading Vessels/Trains	▪ Sensory disturbance (A)	▪ Lighting design	1	1	3/4	R	2	M

KEY

Magnitude:
1 = Low: Temporary disturbance of wildlife or habitat limited to the Assessment Area with no permanent loss or degradation of critical habitat.
2 = Moderate: Permanent alteration of wildlife or habitat limited to the Assessment Area with no net loss of critical habitat.
3 = High: Permanent alteration of habitat critical to the survival of wildlife species or loss of population or stock.

Geographic Extent:
1 = Environmental effects restricted to Project footprint.
2 = Environmental effects extend beyond the Project footprint but remain with Assessment Area.
3 = Environmental effects extend beyond Assessment Area.

Duration:
1 = Short term: Effects are measurable for <1 year.
2 = Medium term: Effects are measurable for 1 to 5 years.
3 = Long term: Effects are measurable for >5 years.

Frequency:
1 = Occurs once.
2 = Occurs rarely and at sporadic intervals.
3 = Occurs on a regular basis and at regular intervals.
4 = Continuous.

Reversibility:
R = Reversible.
I = Irreversible.

Ecological/Socio-economic Context:
1 = Area is relatively pristine or not adversely affected by human activity.
2= Evidence of existing negative environmental effects (*e.g.,* previous clearing).

Prediction Confidence:
Based on scientific information and statistical analysis, professional judgment and effectiveness of mitigation
L Low level of confidence
M Moderate level of confidence
H High level of confidence

6.5 Atmospheric Environment

The Atmospheric Environment VEC includes three general topics: climate, air quality, and the acoustic environment. Atmospheric Environment is considered a VEC because it is one of the most important components of the environment, supporting the health and well-being of human as well as other ecosystem components. It is closely linked to the Land Use VEC (Section 6.6)

Climate is the average of weather and its variations over a long period of time, usually thirty years. Greenhouse gas (GHG) emissions can affect weather patterns with effects on global and local scales. GHG emissions such as carbon dioxide (CO_2) and methane (CH_4) are typically associated with fuel distribution, processing, and combustion. Effects upon the atmospheric environment are given in terms of carbon dioxide equivalents (CO_{2eq}).

Air quality refers to the composition of the air with respect to the presence of common pollutants. The five most common are sulphur dioxide (SO_2); nitrogen dioxide (NO_2); carbon monoxide (CO); particulate matter (PM); and ground-level ozone (O_3). Generated, directly or indirectly, as by-products of industrial activities and the burning of fossil fuels, these emissions have the potential to adversely affect air quality. Effects upon air quality are conventionally expressed in terms of these contaminants and changes in their concentration due to Project activities.

Many of the activities associated with the Project have the potential to generate noise (*e.g.,* the use of heavy equipment). For the most part, noise is a nuisance that detracts from the enjoyment of a quiet atmosphere. In severe cases, noise can cause sleep disturbance and health effects. It can disrupt the natural environment by disturbing wildlife and affecting habitat.

The overview of existing conditions for Atmospheric Environment is described in Section 4.3 (Climate), and Section 4.4 (Air Quality) and Section 4.5 (Ambient Noise).

6.5.1 Environmental Assessment Boundaries

To assess the effects of the Project on the atmospheric environment in the region, the following boundaries have been identified.

Spatial and Temporal

The spatial boundary for assessment of climate aspects of the atmospheric environment is the regional airshed potentially influenced by Project-related activities. Climate components assessed include temperature, precipitation, and winds.

The spatial boundary for the assessment of air quality is the approximate zone of influence of the construction and operational activities associated with the proposed Marine Terminal. The Project site is located in the Sydport Industrial Park. Potential air emissions are associated with the construction of the Project, including dredging, construction of the terminal and associated facilities, and the operation of the marine terminal and storage areas, container vessels and rail line loading and unloading, and supporting infrastructure. The spatial boundary for air emissions includes vessels while hotelling and train movements onsite but not in transit to and from site. The spatial boundary used for the atmospheric environment assessment on air quality will include the airshed and potentially sensitive receptors affected by air emissions resulting from the Project.

The spatial boundary for the assessment of the acoustic environment encompasses the Project site and the noise sensitive areas (NSAs) within and surrounding the Project site. Potential sound emissions are associated with the construction of the Project, including dredging, construction of the terminal and associated facilities, and the operation of the marine terminal and storage areas. The Assessment Area for the construction of the Project will include a distance of 10 km from the Project

site and 4 km from the Project site for the operation of the Project. Noise levels are expected to fall to background levels at the above distances. The spatial boundaries for the acoustic environment have also been developed in consideration of potential NSAs and surrounding topography, which affects the attenuation of sound. Spatial boundaries for noise include hotelling vessels and train movements onsite but not in transit to and from site.

The spatial boundaries for the Atmospheric Environment are collectively referred to as the Assessment Area for this VEC.

The temporal boundaries for assessment of all areas pertaining to the Atmospheric Environment include the construction and commissioning activities for each phase of Construction of the Project, (summer of 2009 to spring of 2010), and the subsequent Operation of the Project in the second half of 2010. The lifespan of this Project is indefinite.

Administrative and Technical

The administrative boundaries for the assessment of the atmospheric environment pertain mainly to regulatory limits on the release of air contaminants of concern and regulatory guidelines on noise levels. These standards are set by regulatory authorities to reflect environmental protection objectives, with the intent of being protective of air quality as well as human and environmental health. The relevant regulatory criteria are described below.

The technical boundaries are partially limited by the degree of detail available in the current phase of engineering design. Although there are a number of details not yet decided, the nature of the emissions of the proposed facility are sufficiently well enough known that conclusions can be made with confidence based on professional judgment and experience with similar facilities. Predictive modeling (in this case for noise emissions) contains inherent uncertainty; however the modeling is considered conservative and accurate for the purposes of predicting noise effects on sensitive receptors for this Project.

Climate

Climate change is a global issue; however, in a national or global context, Project-related emissions of GHG are very small. The Project is not expected to contribute measurably to climate change and will therefore not result in significant environmental effects on climate. Therefore, respecting the importance of climate change as a global issue, the assessment focused on mitigation and adaptive management strategies aimed at minimizing Project-related GHG. There are no set regulations for GHGs provincially or federally.

Air Quality

Air quality will be assessed in the context of Project-related emissions and ground-level concentrations for the air contaminants of interest. The Project-related air contaminants of interest include:

- particulate matter (PM, total suspended particulate (TSP) and dust);
- particulate matter less than 10 microns (PM_{10});
- particulate matter less than 2.5 microns ($PM_{2.5}$);

- sulphur dioxide (SO_2);
- nitrogen dioxide (NO_2); and
- carbon monoxide (CO).

Ambient air quality in Canada is primarily regulated by provincial governments. The federal government has set objectives for air quality which are taken into account by federal agencies in a project review. These objectives form the basis for the air quality regulations for several provinces, including Nova Scotia. For the most part, the Nova Scotia Maximum Permissible Ground-Level Concentrations correspond to the upper limit of the Maximum Acceptable category for air quality that are set under the Canadian *Environmental Protection Act (CEPA)*. Additional guidelines are under development by the Canadian Council of Ministers of the Environment (CCME); ultimately, this body will develop Canada-wide Standards that harmonize the regulations in all jurisdictions.

The current National Ambient Air Quality Objectives and the Nova Scotia Maximum Permissible Ground-Level Concentrations are presented in Table 6.14.

TABLE 6.14 Nova Scotia Air Quality Regulations (Environment Act) and Canadian Environmental Protection Act Ambient Air Quality Objectives.

Pollutant and Units (alternative Units in brackets)	Averaging Time Period	Nova Scotia	Canada			
		Maximum Permissible Ground Level Concentration	Canada Wide Standards	Ambient Air Quality Objectives Maximum		
				Desirable	Acceptable	Tolerable
Nitrogen dioxide µg/m^3 (ppb)	1 hour	400 (213)	-	-	400 (213)	1000 (532)
	24 hour	-	-	-	200 (106)	300 (160)
	Annual	100 (53)	-	60 (32)	100 (53)	-
Sulphur dioxide µg/m^3 (ppb)	1 hour	900 (344)	-	450 (172)	900 (344)	-
	24 hour	300 (115)	-	150 (57)	300 (115)	800 (306)
	Annual	60 (23)	-	30 (11)	60 (23)	-
Total Suspended Particulate Matter (TSP) µg/m^3	24 hour	120	-	-	120	400
	Annual	70 (geometric mean)	-	60	70	-
PM2.5 µg/m^3	24 hour, 98th percentile over 3 consecutive years	-	30 (by 2010)	-	-	-
PM10-2.5 µg/m^3		-	-	-	-	-
Carbon Monoxide mg/m^3 (ppm)	1 hour	34.6 (30)	-	15 (13)	35 (31)	-
	8 hour	12.7 (11)	-	6 (5)	15 (13)	20 (17)
Oxidants – ozone µg/m^3 (ppb)	1	160 (82)	-	100 (51)	160 (82)	300 (153)
	8 hour, based on 4th highest annual value, averaged over 3 consecutive years	-	65 {by 2010}	-	-	-
	24 hour	-	-	30 (15)	50 (25)	-
	Annual	-	-	-	30 (15)	-
Hydrogen sulphide µg/m^3 (ppb)	1 hour	42 (30)	-	-	-	-
	24 hour	8 (6)	-	-	-	-

Acoustic Environment

There are no provincial regulations for ambient noise; however the Nova Scotia Department of Environment (NSE) has developed a set of noise guidelines, *Guideline for Environmental Noise Measurement and Assessment*, with respect to sensitive receptors. These guidelines consist of the following limits:

- 1-hour L_{eq} of 65 dB_A between 7:00 and 19:00;
- 1-hour L_{eq} of 60 dB_A between 19:00 and 23:00; and
- 1-hour L_{eq} of 55 dB_A between 23:00 and 7:00.

The Cape Breton Regional Municipality also has a bylaw respecting noise in Cape Breton which includes general prohibitions on noisy activities which could be a nuisance, but does not include quantitative limits. The prohibitions stated in this by law will be taken into account during the construction and operation of the Project.

The proposed Project is located in the Sydport Industrial Park, near Edwardsville. The acoustic environment is characterized by background sound produced from natural sound sources and industrial noise sources associated with the operation of the existing marine terminal and related facilities. Natural sound sources can occur continuously, temporarily, and seasonally. These sounds can include the sounds from birds, wildlife, insects, wind, and storm events. Currently there is a moderate amount of industrial activity and human habitation in the immediate vicinity of the proposed Project site. The area currently has a marine terminal; approximately 70 residential dwellings are located 1 km away along Point Edward Highway, Hospital Road, and a few smaller residential roads.

The potential for noise to have an environmental effect on the acoustic environment is assessed on the basis of predicted sound pressure levels, frequency of occurrence, and the duration of the noise-related activities.

6.5.2 Residual Environmental Effects Evaluation Criteria

The significance criteria of environmental effects on the Atmospheric Environment are described below.

For a change in climate or GHG emissions, following the CEA Agency (2003) guidance, "the environmental assessment process cannot consider the bulk of GHG emitted from already existing developments. As well, unlike most project-related environment effects, the contribution of an individual project to climate change cannot be measured" (CEA Agency 2003). It is therefore recognized that it is not possible to assess significance related to a measured environmental effect on climate change on a project-specific basis. At the same time, it is recognized that global emissions of GHG and consequent changes to global climate are significant cumulative environmental effects, but the contribution will be small in a global context. Policies and regulations are being developed by the Government of Canada for regulating GHG emissions for specific sources or industry sectors.

Thus, instead of setting a specific significance criterion for environmental effects on climate change and determining whether and how it can be met, a change in climate or GHG emissions are considered by conducting a preliminary scoping of Project GHG emissions and by comparing the emissions to provincial inventories, as directed by the CEA Agency guidance (CEA Agency 2003).

A significant residual adverse environmental effect with respect to a change in air quality is one that would result in an exceedance of the Nova Scotia Maximum Permissible Ground-Level Concentration on a repeated or sustained basis.

The NSE Noise Guidelines are useful screening guidelines to determine if further investigation is warranted. In addition, an increase of 10 dB_A above existing noise levels for a sensitive receptor is considered significant because it represents a perceived doubling of the noise. Therefore, a significant adverse residual environmental effect on the acoustic environment is one that would result in an exceedance of the NSE Noise Guidelines, or noise levels greater than 10 dB_A above baseline, pre-Project, levels for sensitive noise receptors.

6.5.3 Potential Interactions, Issues and Concerns

The primary Project activities that could potentially interact, directly or indirectly, with Atmospheric Environment resulting in noise and air emissions are:

- site preparation activities including dredging, constructing a confined disposal facility, infilling, clearing, grubbing, and pile driving;
- construction activities;
- routine land-based operations of the terminal and associated facilities; and
- marine operations.

Environmental effects considered for the evaluation of Atmospheric Environment include:

- change in climate (GHG);
- change in air quality (CAC); and
- change in sound quality components.

Potential Project interactions with the Atmospheric Environment VEC are presented in Table 6.15.

TABLE 6.15 Potential Interaction, Issues and Concerns for the Atmospheric Environment

Project Activities and Physical Works	Potential Environmental Effects		
	Change in Climate	Change in Air Quality	Change in Sound Quality
Construction and Commissioning			
Dredge and Dewatering	1	1	2
Construction of confined disposal facility	1	2	2
Site Preparation (clearing and grubbing, grading)	1	2	2
Construction of land components (including road, rail, buildings)	1	1	2
Operation			
Loading and Unloading Vessels/Trains	2	2	2
Site stormwater and wastewater Management	0	0	0
Equipment and Materials Storage	1	1	2
Maintenance/Repairs to Terminal	1	1	1

Note: Project-Environment Effects were ranked as follows:
0 No interaction. No substantive interaction contemplated.
1 Interaction will occur. However, based on past experience and professional judgment, the interaction would not result in a significant environmental effect, even without mitigation, or the interaction would clearly not be significant due to application of codified practices
2 Interaction may, even with codified mitigation, result in a potentially significant environmental effect and/or is important to regulatory and/or public interest. Potential environmental effects are considered further and in more detail in the EA.

Project interactions and potential environmental effects have been ranked as “0”, “1”, and “2” for changes to climate, air quality, and sound quality in Table 6.15, based on anticipated quantities of emissions, project experience, and professional judgment. Some of the Project activities such as stormwater and wastewater management will result in zero or nominal emissions of air contaminants, GHG, or sound and are ranked as “0”. Other activities have measurable emissions but are not considered to have potential significant adverse effects; these are ranked as “1”. Some activities are anticipated to have emissions that could cause significant environmental effects or require some more in-depth analysis and discussion and these are ranked as “2”. The analysis presented below start with those activities that have been ranked as “0” and “1” in the Table 6.15. The interactions ranked 2 are considered in detail in the subsequent section for environmental effects assessment.

The assessment of changes in climate, air quality, and sound quality in the atmosphere requires knowledge of the constituents making up and present in the atmosphere, in magnitudes and as trends. This knowledge is established by measuring concentrations of GHG, air contaminants, and levels of sound in the atmosphere at strategic locations for extended or representative periods of time.

The specific constituents, described as measurable parameters that are used for the assessment of the environment effects are listed in Table 6.16.

TABLE 6.16 Measureable Parameters for Atmospheric Environment

Environmental Effects	Measurable Parameter	Rationale for Selection of the Measurable Parameter
Change in Climate	GHG emissions – CO_2, CH_4, and N_2O (in units of CO_2 equivalents, CO_{2eq})	This is a key consideration in the federal guidance document developed by the CEA Agency (2003) for assessing potential Project related environmental effects on climate. Respecting the importance of climate change as a global issue, the EA will focus on mitigation and adaptive management strategies to minimize Project-related GHG emissions.
Change in Air Quality	Ambient ground level concentrations of criteria air contaminants (CAC)	Regulatory objectives, guidelines, and/or standards exist provincially and federally for SO_2, NO_x, CO, PM, PM_{10}, $PM_{2.5}$, H_2S, and O_3.
Change in Sound Quality	A-weighted sound pressure levels in decibels (dB_A) for 1-hr L_{eq}	No federal regulations exist, however the province of Nova Scotia has published a set of Noise Guidelines, where the A-weighted decibel (dB_A) is the commonly used unit to evaluate the perception of sound by the human ear.

Construction and Commissioning

Climate and Air Quality

During construction of the proposed marine terminal and storage handling facilities, air quality could be affected by emissions associated with dredging and dewatering activities, construction of the confined disposal facility, site preparation, and during the construction of land based components.

Emissions of criteria air contaminants (CAC) and greenhouse gases (GHG) from dredging of the South Arm and terminal berth will result mainly from the operation of the dredging vessel. Similar emissions can be expected from the construction of the confined disposal facility or the construction of land based components due to operation of construction equipment. An interaction with the environment would be expected; however this interaction will be limited in duration and similar to other large construction projects; based on professional experience this interaction will not result in a significant environmental effect and has therefore been ranked as a “”1”.

There will be fugitive emissions of particulate matter (*i.e.,* dust) from the construction activities, including clearing, grading, and during the infilling of the confined disposal facility once the sand and silt mixture has dried. These activities will cause an interaction with the environment that may result in an environmental effect and are of concern to the public. They have therefore been ranked as a “2” in Table 6.15 and will be discussed in greater detail in the environment effects analysis section.

Acoustic Environment

Construction activities such as dredging and dewatering, construction of the confined disposal facility, site preparation (*i.e.,* clearing, grading, paving) and construction of various land components (including roads, rail lines, and buildings) have the potential to cause a change in sound quality and are of interest to the public and regulatory officials. Therefore these activities have all been ranked as a "2” and will be discussed in detail in the environment effects analysis section.

Operation

Climate and Air Quality

Climate and air quality may be affected during operation of the Project due to emissions of conventional air contaminants and GHG. It is anticipated that the sources of potential emissions from the operation of the Project will include:

- loading and unloading of vessels/trains;
- site stormwater and wastewater management;
- equipment and materials storage; and
- maintenance / repairs to terminal.

Of the above operation activities, that of site stormwater and wastewater management will not cause a change in climate or air quality and will not result in an interaction. As no interaction will occur, no significant environmental effect will result and therefore this operation activity has been ranked as "0". However, emissions of GHG and CAC could potentially result from equipment and materials storage through the operation of the rubber tire diesel gantries and during routine maintenance and repairs to the terminal. In this case an interaction will occur; however, based on professional experience this interaction will not result in a significant environmental effect and these operation activities have therefore been ranked as "1's".

The majority of emissions of CAC and GHG will result from emissions from the generation of power for vessel hotelling while at dock (maintenance of ship board living systems – ventilation, lighting, *etc.)* during loading and unloading, and during the loading and unloading of the rail cars. These activities will interact with the environment and have the potential to result in an environmental effect and have therefore been ranked as "2" in Table 6.15 and will be discussed in greater detail in the environmental effects analysis section.

Acoustic Environment

Noise generated from the operations of the Project will originate primarily from the loading and unloading of the marine vessels and rail cars, equipment and materials storage, and through regular maintenance and repairs to the terminal. A change in sound quality is not expected to result from site stormwater and wastewater management and this activity has been ranked as "0" as no interaction will occur.

Routine maintenance and repairs to the terminal have the potential to cause a change in sound quality and an interaction with the environment due to the periodic use of maintenance equipment. It is unlikely that this infrequent interaction would result in a significant environment effect and therefore has been ranked as "1". Vessel and train loading and unloading and equipment and materials storage however, will result in an interaction with the environment and these operation activities have been ranked as "2's" and will be discussed in detail in the environmental effects analysis section.

6.5.4 Analysis, Mitigation and Residual Environmental Effects Prediction

The following section examines those Project related environmental effects that have been rates as "2" and proposes mitigation measures as appropriate. These effects are related to changes in sound quality for all construction activities and for loading and unloading vessels/trains during operation. It also includes changes in air quality during construction of the CDFs and site preparation as well as loading and unloading of vessels/trains during operation. Change in climate is evaluated with respect to loading/unloading of vessels/trains.

6.5.4.1 Construction and Commissioning

Climate and Air Quality

Fugitive dust emissions from construction activities such as clearing, grubbing, infilling of the confined disposal facility, and similar earth-moving activities are temporary in nature and are dependent on many factors, such as the moisture in the soil, the level of activity at a particular location and meteorological conditions at the time of the construction activities. Traffic on paved and unpaved roads and construction material handling activities like screening, grinding, and excavating can also cause dust generation. Any potential dust generation would likely occur during periods of high winds or extreme dry periods and, as such, are expected to be of low frequency and short duration, and are readily controlled by standard dust control procedures.

Particulate matter can also be generated from combustion gases from on-site vehicles and the operation of construction equipment. These emissions will be temporary, localized, and similar to those routinely generated at other large construction sites. It is nevertheless understood that in the interest of industrial hygiene, and safety of on-site workers, efforts will be made to minimize fugitive dust emissions. Emissions of particulate matter, or dust, will be the focus of mitigationfor this Project. Emissions of other criteria air contaminants (CAC) are contained in equipment exhaust which can be reduced through regular equipment maintenance routines.

Dust emissions from site preparation during the operation of on-site vehicles and construction equipment and during the construction of the confined disposal facility will cause an interaction with the environment. However given proper mitigation, dust control, the likelihood that the interaction would cause a significant environmental effect is low.

There are several typical dust suppression measures that have been used on other construction sites that are appropriate for this Project. On paved roads, vacuum sweeping or flushing can be conducted periodically. As for unpaved roads, treatment with a dust suppressant (*i.e.,* water or calcium chloride), or sealing the roadway can be effective mitigation. Other associated transportation emissions can be mitigated by employing measures such as:

- restricting speed on roads;
- minimizing the distance between transfer points;
- tarping vehicles carrying fines;
- maintaining the vehicle body in a condition that prevents any leaks of aggregate material; and
- applying dust suppressant as needed to the material in the vehicle.

Another source of potential particulate emissions is material storage piles. In most cases, material

remains undisturbed in storage; however, some control measures may be required. These measures can include cleaning the area around the perimeter of the aggregate piles, preventing wind blowing dust away from deposits of frequently shifted rubble (*e.g.,* through moistening, protective walls, halting work during unfavourable weather conditions), shielding infrequently accessed dumps from wind exposure by covering with mats or tarpaulins, greening non-working faces of material piles with vegetation, and applying dust suppressant as warranted.

The specific types and frequency of dust control measures will be determined by site conditions and in response to any specific requests from regulatory officials and/or members of the public.

Acoustic Environment

Construction activities including dredging, construction of the confined disposal facility, site preparation, and construction of the land based facilities all have the potential to result in increase sound levels at sensitive receptors, but the operation of such equipment is expected to be intermittent, transient, and distributed over the construction site, rather than concentrated in one area. The largest expected sources of sound emissions during the construction of the Project include the channel and the berthing area, the pile driving during the construction of the confined disposal site and the operation of construction equipment during site preparation and construction of land components. The typical noise outputs at a distance of 15 m from the construction machinery commonly used for these activities are listed in Table 6.17. The level of activity on a construction site will vary with the various phases of construction.

TABLE 6.17 Equipment and Sound Power Levels - Construction

Construction Equipment	Typical Noise Level at 15 m (dBA)
Dredging*	66*
Earth-Moving	
Grader	85
Bull Dozers	82
Excavators	81
Front End Loader	79
Dump Truck	76
Backhoe	78
Compactor	83
Tractors	84
Materials Handling	
Crane	81
Paver	77
Roller	80
Stationary	
Air Compressors	78
Welders	74
Diesel Generators	81
Impact Equipment	
Pile Driver	101
On-Road	
Pick-up Truck	75

*Distance of 152 m (not 15 m) to reflect likely distance of dredge from nearest receptors.
Reference: US Department of Transportation 2006

To assess the potential effects of construction activities on the acoustic environment, sound pressure level modelling was conducted using CadnaA 3.7.124, a computer program capable of predicting noise

levels at specified receiver positions from a variety of noise sources. The Methods of the International Organization for Standardization (ISO) Standard 9613 – Attenuation of Sound during Propagation Outdoors (ISO 9613) – were included in the noise prediction model. The ISO 9613 noise model includes a number of conservative assumptions (*i.e.,* enhances sound propagation (*e.g.,* downwind propagation) under a mildly developed temperature inversion and relative humidity of 70 %).

Factors such as terrain conditions, types of vegetation and ground cover can all affect the absorption that takes place when sound waves travel over land. The land surrounding the Project site varies in elevation, affecting attenuation of the Project-related noise. Terrain data were used in noise modelling to accurately depict the local study area.

Ten noise sensitive receptors within and surrounding the Project area were chosen to assess the potential effects of the construction of the Project on the acoustic environment. The location of each noise sensitive receptor is presented in Figure H-1 in Appendix H.

For the purposes of noise prediction during the construction of the Project, two construction sub-phases were modeled, as not all construction activities are planned to occur simultaneously. The first consisted of the noise associated with the construction of the confined disposal site, including moderate impact pile driving along the terminal, channel and berthing area dredging, backfilling the marine terminal footprint using the dredged material, and clearing of the remaining portions of the Project site. The predicted evening and night time noise for this analysis consists of the sound produced by dredging and dewatering pumps only.

The second consisted of the noise associated with the actual construction of the land based components of the Project, including roads, buildings, and rail lines, which is currently planned to occur during day time hours.

The total predicted sound pressure levels at each of the ten receptors modeled during dredging and the construction of the confined disposal facility are presented in Table 6.18.

TABLE 6.18 Predicted Sound Pressure Levels for Construction - Dredging and Construction of the CDF

NSA	Predicted Sound Pressure Levels								
	Day Leq (1 hr)			Evening Leq (1 hr)			Night Leq (1 hr)		
	Base-line	Predicted	Total Predicted	Base-line	Predicted	Total Predicted	Base-line	Predicted	Total Predicted
1	51	29	51	48	27	48	46	27	46
2	51	38	51	48	38	48	46	38	47
3	44	52	53	40	43	45	36	43	44
4	49	52	54	41	40	44	37	40	42
5	51	56	57	48	46	50	46	46	49
6	51	49	53	48	44	49	46	44	48
7	51	38	51	48	34	48	46	34	46
8	51	48	53	48	45	50	46	45	49
9	51	44	52	48	43	49	46	43	48
10	51	29	51	48	28	48	46	28	46
Significance Criteria	65			60			55		

The sound pressure level contours within and surrounding the Project area during the day, evening, and night time periods are presented in Figures H-2, H-3, H-4 respectively, in Appendix H.

The total predicted sound pressure level results at each of the ten receptors modelled for the construction of the land-based components of the Project are presented in Table 6.19.

TABLE 6.19 Predicted Sound Pressure Levels for Construction - Land Based Components

NSA	Predicted Sound Pressure Levels (dBA)								
	Day Leq (1 hr)			Evening Leq (1 hr)			Night Leq (1 hr)		
	Base-line	Predicted	Total Predicted	Base-line	Predicted	Total Predicted	Base-line	Predicted	Total Predicted
1	51	26	51	48	48	48	48	48	48
2	51	30	51	48	48	48	48	48	48
3	44	51	52	40	40	40	40	40	40
4	49	53	54	41	41	41	41	41	41
5	51	56	57	48	48	48	48	48	48
6	51	50	54	48	48	48	48	48	48
7	51	37	51	48	48	48	48	48	48
8	51	47	52	48	48	48	48	48	48
9	51	39	51	48	48	48	48	48	48
10	51	24	51	48	48	48	48	48	48
Significance Criteria	65			60			55		

The sound pressure level contours within and surrounding the Project during the day time period are presented in Figure H-5 in Appendix H.

In summary, construction activities currently planned for the Project will produce a change in the acoustic environment leading to increased levels of noise. However, based on the noise prediction results presented in Tables 6.18 and 6.19, there was no exceedance of the NSE Noise Guidelines nor was there a substantial increase, greater than 10 dBA, in the sound pressure levels at each receptor. Therefore, it is concluded that the effect will be not significant. Noise and dust monitoring will be undertaken in response to complaints and response undertaken as necessary such as dust suppression and/or schedule modification to avoid noisy activities (*e.g.,* pile driving) during sensitive times.

6.5.4.2 Operation

Climate and Air Quality

The air quality in and surrounding the Project site will be affected by the operation of the proposed Project. Emissions of CAC and GHG will occur from operation activities including the operation of engines and cranes during the loading and unloading of vessels and trains. Use of a “cold dock” is currently planned where hotelling vessel auxiliary engines are connected to shoreside electric power acquired from the provincial power grid, while loading and unloading and including the use of electric cranes. Engine idling during the loading and unloading of train cars is not expected to result in substantial emissions of CAC or GHG and are to be located far enough away from nearby residents to not be of concern. These design features reduce the possibility that Project air emissions would result in any exceedance of the Nova Scotia Maximum Permissible Ground-level Concentration on a repeated

basis for any CAC or emissions of GHG.

The amount of GHG emitted, in CO_{2eq}, during a container ship hotelling event at the proposed marine terminal was calculated. The calculation assumed two large (8,000 TEU) and two small (4,000 TEU) container ships at dock each week using the equivalent energy of three auxiliary engines (small ship 938 KW; large ship 2500 KW) running off electric power from the provincial grid. It was assumed that one large container ship would be running off electrical power 68 hours a week and for one small container ship 36 hours a week. The estimated emissions equaled 49,731 T CO_{2eq} per year (Vancouver Port Authority 2004; Environment Canada 2008). The Nova Scotia provincial total of GHG emissions for 2005 equaled 22,700,000 T. This would suggest that the Project would be a low intensity emitter based on the calculated level of emissions.

According to the Container Ship Information Service, for every kilometer that a container ship carries one ton of cargo it emits a substantial amount less of CO_2 emissions that any other type of container transport (including rail, road, and air). For comparison purposes, the actual statistics found by the Container Ship Information Service for each transport method are presented in Table 6.20.

TABLE 6.20 Emissions of CO2 to carry one ton of cargo one kilometer

Container Transport Method	CO_2 Emissions (g)
Container Vessel	13
Rail Line	17
Road	50
Air	552

Reference: Container Ship Information Service

Given that mitigation practices will be implemented at the time of operation of the Project and the estimated amount of GHG released during a container ship hotelling event, the potential environmental interaction due operation activities will not result in a significant environmental effect.

Acoustic Environment

Operation activities including that of loading and unloading of vessels and trains vessel and equipment and materials storage will interact with the acoustic environment. However with proper mitigation such activities should not result in significant environment effects. Design mitigation features include the use of a cold dock, electric cranes, and electric refrigerator units.

Project operation noise was predicted using CadnaA to assess the potential effects on the noise sensitive receptors within and surrounding the Project area and to determine whether or not the interaction would cause a significant environmental effect. A list of the operation equipment and associated sound power levels that were incorporated into the operation prediction analysis are presented in Table 6.21.

TABLE 6.21 Equipment and Sound Power Levels - Operation

Operational Equipment	Sound Power Level (dB_A)
Refrigerator Units	85
Electric Cranes	95
Rubber Tire Gantries	112
Vessels	95
Rail Line (Line Source)	79

The number and type of operation equipment modelled in this stimulation was based on early engineering design and literature on typical equipment sound levels and is subject to refinement.

The total predicted sound pressure level results at each noise sensitive receptor modelled for the operation of the Project are presented in Table 6.22.

The results are based on each piece of operation equipment operating 24 hours a day seven days a week in order to obtain a credible worst case 1-hr L_{eq} and are therefore conservative. The model is based on a four berth, 1600 m long dock. The sound pressure level contours for the day, evening, and night time periods are presented in Figures H-6, H-7, and H-8, respectively, in Appendix H.

TABLE 6.22 Total Predicted Sound Pressure Levels for Operation

Receptors	Predicted Sound Pressure Levels (dBA)								
	Day Leq (1 hr)			Evening Leq (1 hr)			Night Leq (1 hr)		
	Base-line	Predicted	Total Predicted	Base-line	Predicted	Total Predicted	Base-line	Predicted	Total Predicted
3	44	41	46	40	41	44	36	41	42
4	49	38	49	41	38	43	37	38	41
5	51	42	52	48	42	49	46	42	47
6	51	43	52	48	43	49	46	43	48
7	51	32	51	48	32	48	46	32	46
8	51	41	51	48	41	49	46	41	47
Significance Criteria	65			60			55		

The results of the noise simulation indicate that there should be no exceedances of the NSE Noise Guidelines nor was there a substantial increase, greater than 10 dBA, in the sound pressure levels at each receptor. Therefore given the proposed mitigation, operation activities including the loading and unloading of vessels and trains, will not result in a significant environmental effect on the acoustic environment.

6.5.5 Follow-up and Monitoring

Follow-up and monitoring is required during the construction period of the Project to ensure that activities such as dredging and pile driving do not disturb residents living in Edwardsville. Specific mitigation measures should be implemented if sound pressure levels at the nearest noise sensitive receptor exceed the NSE Noise Guideline values. Monitoring should be conducted for dust and noise if complaints arise during the construction period and remedial actions should be taken as appropriate (*e.g.,* use of dust suppressant, evaluate opportunities for noise reduction).

During operation, a round of noise monitoring is advisable to establish baseline levels due to the terminal operation prior to any other development in the Sydport Industrial Park. This should include the characterization of ship noise, emergency equipment, and normal operating modes. This information will provide evidence on behalf of the proposed marine terminal in the event that further development in the area triggers complaints.

6.5.6 Summary of Residual Environmental Effects Prediction

The magnitude of emissions resulting from the construction and operation of the Project will be a small fraction of the Provincial total, and the possible effects to ambient air quality resulting from the Project are not expected to be discernible from current levels in the area. Any short-term, measureable environment effects to air quality from dust and noise are likely to be localized to the specific area being worked on during construction activities, and relatively localized to the Sydney area during operation. Noise modelling has demonstrated that significant effects will not be experienced in the Sydney area (closest noise sensitive receptor) as a result of Project-induced noise.

The specific types and application of dust and noise control measures will be determined by site activities and in response to any specific requests from regulatory officials and/or members of the public. A summary of the effects of the Project on the Atmospheric Environment during construction and operation and the proposed mitigations to reduce effects is provided in Table 6.23**.**

Based on a consideration of the magnitude, frequency, and duration of air emissions and sound emissions associated with the Project, the overall environmental effects of the Project activities independently or together on the atmospheric environment are rated as not significant.

TABLE 6.23 Environmental Effects Assessment Matrix: Atmospheric Environment

Project Activity	Potential Environmental Effect Positive (P) or Adverse (A)	Mitigation	Evaluation Criteria for Assessing Residual Environmental Effects					
			Magnitude	Geographic Extent	Duration/ Frequency	Reversibility	Ecological/Socio-economic Context	Prediction Confidence
CONSTRUCTION AND COMMISSIONING								
Dredge and Dewatering	▪ Noise from dredging (A) ▪ Air emissions from dredging vessel (A)	▪ Monitoring and response to any exceedance of NSE Guidelines	2	2	1/3	R	2	H

TABLE 6.23 Environmental Effects Assessment Matrix: Atmospheric Environment

Project Activity	Potential Environmental Effect Positive (P) or Adverse (A)	Mitigation	Evaluation Criteria for Assessing Residual Environmental Effects					
			Magnitude	Geographic Extent	Duration/ Frequency	Reversibility	Ecological/Socio-economic Context	Prediction Confidence
Construction of confined disposal facility	▪ Noise from pile driving and equipment operations (A) ▪ Dust emissions (A)	▪ Monitoring and response to any exceedance of NSE Guidelines (*e.g.,* scheduling to avoid sensitive times) ▪ Dust control measures	2	2	1/3	R	2	H
Site Preparation (clearing and grubbing, grading)	▪ Noise and emissions from construction equipment (A) ▪ Dust (A)	▪ Monitoring and response to any exceedance of NSE Guidelines (*e.g.,* scheduling to avoid sensitive times) ▪ Dust control measures as necessary	2	2	1/3	R	2	H
Construction of land components (including road, rail, buildings)	▪ Noise and emissions from construction equipment (A)	▪ Monitoring and response to any exceedance of NSE Guidelines (*e.g.,* scheduling to avoid sensitive times) ▪ Noise reduction measures as necessary	2	2	1/3	R	2	H
OPERATION								
Loading and Unloading Vessels/Trains	▪ Noise and air emissions from hotelling of the vessels and operation of the cranes and rail car (A)	▪ Cold dock ▪ Electric cranes	2	2	3/3	R	2	H
Equipment and Materials Storage	▪ Noise emissions (A)	▪ Use of electric cranes and refrigerators	2	2	3/3	R	2	H