channel in the Seaward Arm.

Results of the October 2008 geotechnical borehole investigation in the proposed dredge channel also indicated that contamination levels are considerably lower in the Seaward Arm than in the South Arm of Sydney Harbour. All sediment samples taken were within the applicable CCME Guidelines for Marine Sediment Quality for PCBs and DDT and were within the laboratory reportable detection limit for these substances. Of the nine sediment samples taken, only two presented levels of PAHs that exceeded CCME Guidelines for Marine Sediment Quality and only three of the nine samples exceeded CCME guidelines for TPH compounds.

It is notable that PCBs were not identified in any samples collected by LEC from the channel or within the South Arm during the sediment sampling program in January of 2008 or the geotechnical borehole program in October 2008. This is in contrast to the results presented in TSRI #93, where concentrations of PCBs ranged from 50 – 500 µg/g in the South Arm. The TSRI #93 report did not detect PCBs in the Seaward Arm; however, in the near shore area of the proposed channel, PCBs were detected at concentrations of 57 µg/g based on one sample). The more recent data collected by LEC is assumed to be the most representative of the current sediment quality in Sydney Harbour. In particular, the borehole sampling program tested sediments at a much greater depth than the sediments tested in Lee (2002), and as such, this data provides a better representation of the sediments that will be dredged during Project Construction. While the data from TSRI #93 provides historical context for sediment quality in Sydney Harbour, the more recent data from LEC will be the primary source of information for the effects assessment in the EA.

### 4.7.3 Biology of Sydney Harbour Sediments

Benthic life is highly dependent on sediment quality, and as a result, several benthic communities in Sydney Harbour have demonstrated some adverse effects from contamination.

The TSRI #93 program attempted to quantify the ecological risk and bioavailability of contaminants in Sydney Harbour. Sediments were analyzed for toxicity to *Amphiporeia virginiana* (a marine amphipod), *Vibrio fischeri* (a luminescent bacterium), and to indigenous bacteria. Sediment pore water was analyzed for sea urchin (*Lytechinus pictus*) fertilization inhibition. Clams (*Macoma baltica*) were exposed to sediments to determine any biological effects related to burrowing into contaminated sediments.

Samples from the South Arm were found to be toxic to marine amphipods, and toxicology results from this area show a highly significant correlation with PAH levels in the sediment. Sediments from the North West Arm and Seaward Arm were not found to be toxic to amphipods. All samples from South Arm and North West Arm were found to be toxic to bacterium in a Microtox test; only samples from near the mouth of the Outer Harbour were not found to be toxic in the Microtox test. In the sea urchin fertilization test, no samples produced toxic results. Tests on clams indicate that the contaminants in Sydney Harbour sediments have a sublethal toxic effect and can accumulate in this species.

The following are some of the key results of the bioavailability and toxicological tests performed on Sydney Harbour sediments under the TSRI #93 program:

- PAHs may be having widespread harmful effects on benthic animals, especially in South Arm;
- Sublethal toxicity tests support the view that adverse ecological effects are likely widespread throughout the harbour;
- Contaminants in Sydney Harbour sediment are bioavailable to amphipods, bacteria, and clams; and
- Flounder (a benthic fish) recovered from Sydney Harbour were observed to have liver lesions typically associated with contamination.

Uthe and Musial (1986; cited in Lee 2002) and King *et al*. (1993, cited in Lee 2002) reported elevated PAH concentrations in Lobster (*Homarus Americanus*) from Sydney Harbour while the TSRI #93 report also notes unpublished effects of PAH concentrations on winter flounder (*Pseudopleuronectes americanus*) in Sydney Harbour.

The TSRI #93 Report characterized benthic communities within Sydney Harbour (South Arm, North West Arm, and Outer Harbour) into five distinct groups, as follows:

- Central and Northeast portions of the South Arm: community having low abundance and number of species, occurring in areas showing highest PAH, PCB, and organic carbon loading. Species include *Cerianthus borealis* (burrowing anemone), *Nephtys incise* and *Ninoe nigripes* (polychaetes), *Cerebratulus* sp. (nermertean worm), *Phoronis architecta* (phoronid), and *Capitella capitata* (polychaete).
- Inner South Arm, Mouth of Sydney River: few organisms but common presence of *Nephtys incisa* (polychaete worm), *Cerianthus borealis* (burrowing anemone), occasional *Nassarius trivittatus* (whelk), and *Acteocina canaliculata* (bubble shell).
- Northwest Arm, and shallow west side of South Arm: Community including *Mediomastus ambiseta* (capitellid polychaete), *Ninoe nigripes*, *Nephtys incise*, and *Scolelepis squamatus* (polychaetes), *Cerianthus borealis* (burrowing anemone), and *Cerebratulus* (nermertean).
- Outer Sydney Harbour Channel: a diverse community occurring on sandy silty bottom, dominated by *Owenia fusiformis* (polychaete), including high abundance of several other benthic invertebrates.
- Either side of the Outer Harbour Channel: a diverse sandy bottom community, including *archiannelid*, *Tellina agilis*, *Nassarius trivittatus* (New England Dog Whelk) and *Aricidea catherinae* (polychaete).

The authors of TSRI #93 report that the occurrence of several year classes in Sydney Harbour suggests that complete die-offs may be spatially limited to the most contaminated parts of the harbour. Further, chronic oxygen depletion (due to organic loading) and high contamination levels likely contribute to reduced benthic communities in Sydney Harbour. The 2008 benthic video survey program did not examine microinvertebrates in Sydney Harbour, but did note the presence of some larger invertebrates. Along the proposed dredge channel, underwater video indicates the presence of burrowing sea anemone, rock crab, sea star, sea urchins, snail, hermit crab, and sponge, as well as several clam holes. Clams were abundant along every transect and sand dollars were abundant in some sections towards the seaward end of the proposed channel. Along the proposed terminal infill area, underwater video recorded the presence of snail, sea star, clam, burrowing sea anemone, rock crab, hermit crab, and barnacles. Some patches of sea snail and burrowing sea anemone were present; but in general, visible benthic macrofauna were not common in this area of the harbour. Along the eastern area proposed for a secondary contained disposal facility, the only visible macrofauna included burrowing sea anemone, rock crab, sand shrimp, and sea urchin. Of these species, only burrowing sea anemone was cited as being a common occurrence, and only in select areas, on the three video transects. Refer to Appendix E for results from the LEC Underwater Benthic Video Survey Summary Report.

Of particular concern for this assessment are the potential environmental effects of the Project on rock crab and lobster, which are the two primary commercial species in Sydney Harbour. The American lobster (*Homarus americanus*) is one of the most commercially important species in Nova Scotia. Lobsters are found in coastal waters from southern Labrador to the coast of Maryland. Along the east coast of Canada, lobsters make short-distance seasonal movements from relatively deep waters (15 m to 18 m) in winter to shallower waters (7 m to 9 m) in summer (Tremblay *et al*. 2001). Both juvenile and adult lobsters tolerate water temperatures ranging from -1°C to 30.5°C. However, water temperatures of less than 8°C to 10°C are required during winter for proper synchrony of molting and reproductive cycles. Lobster molting in the Sydney Bight area occurs from late June until at least mid-September. In most years, the peak probably occurs between late July and late August. Females typically have a two-year reproductive cycle. They mate in the soft-shell condition and extrude eggs 10-12 months later, usually in July-August. Females then carry the eggs externally until hatching in the following year. Lobster larvae are planktonic (free floating) for a period of 30 to 60 days before settling on the bottom and seeking shelter. Lobster can live to be 40 to 50 years old.

In the waters off Eastern Cape Breton lobsters take 5-8 years to reach the minimum legal size (MLS). Molting season is mid-to-late summer and results in increases in length of about 15% and in weight of about 50%. The size at which 50% of female lobsters are mature is estimated to be 73 mm carapace length (CL) off northern Cape Breton, 78 mm CL off the southern end of LFA 27 and in LFA 30, and 84 mm CL off southeast Cape Breton in the Iles Madame area (Lobster Fishing Area 29) (DFO 2004). Lobsters prefer any habitat where shelter is readily available such as rocky bottoms or on sand and mud where there are larger rocks for hiding. After settling to the bottom and for the first several years, lobsters remain in or near shelters to avoid predators. As they grow they move about and spend more time outside the shelter. When they reach the MLS they become new “recruits” to the fishery (DFO 2004). Anecdotal evidence from DFO and local fishermen indicates that lobster populations are concentrated around the near shore areas of Sydney Harbour; however, anecdotal evidence from fishermen also suggests that during the fall, lobster are also present in large numbers in the centre of the seaward arm of Sydney Harbour near the proposed dredge channel. Preliminary results from an experimental fishing study and a consultation with commercial fishers that was undertaken in the fall of 2008 suggest that this movement of lobsters into the channel may be part of an annual winter migration out of the harbour into the deeper waters of Sydney Bight (Hatcher *et al*. 2008).

Rock crab (*Cancer irroratus)* is commonly found in the near shore on a variety of substrate types, although they do prefer sandy bottom habitat. Rock crab are typically found in shallow water less than 20 m in depth. Rock crab presence ranges from Labrador to Florida. Molting occurs primarily in April and May. Egg extrusion appears to occur in late October. The eggs hatch in the following spring or summer into larvae that are planktonic (free-floating) for 5-8 weeks depending on the temperature. Commercial size is reached in about 5 years; maximum longevity was estimated at 8 years for rock crab off Southern New England (Tremblay and Reeves, 2000). Small rock crab are a common prey for lobster, and are sometimes fished to be used as lobster bait. Based on the benthic survey and anecdotal information from DFO and local fishermen, rock crabs are found throughout Sydney Harbour, including areas with silty bottom (Hatcher, pers. comm., 2008).

### 4.7.4 Summary of Sydney Harbour Benthic Community and Sediment Quality

The TSRI #93 report, along with JW sediment sampling and benthic video surveys, indicate that contaminant distribution In Sydney Harbour is not uniform, and that contamination levels are lowest in the Seaward Arm and highest in the South Arm.

In the proposed dredge channel, sediments are generally less contaminated, are generally sandy, with some boulders and cobbles, and provide habitat for a diverse benthic microinvertebrate community and a limited array of macroinvertebrates, the underwater video survey suggests only limited available habitat for juvenile lobster (*i.e.,* limited shelter habitat). PAH compounds are present in low levels in the channel. Metals are also present in this area, with some limited exceedances of CCME guidelines.

In the proposed terminal area, sediments are generally more contaminated, particularly with PAHs and metals. The levels of contamination in these areas have been shown to be toxic to some marine life. Sediments are finer grained than channel sediments, but there are areas of coarser material including boulder and cobble. The benthic microinvertebrate community in this area is characterized by *Medomastus ambiseta*, polychaetes, *Acteocina canaliculata*, *Cerianthus borealis*, and *Cerebruatulus sp*. Macroinvertebrates indentified in this region include rock and hermit crab, snails, and sea stars.

At the proposed secondary confined disposal site, the sediments are also contaminated. The seabed is predominantly silt and clay, with some boulder and cobble present. The benthic community is characterized as having low abundance and low number of species in this area. The levels of contamination in these areas have also been shown to be toxic to some marine life.

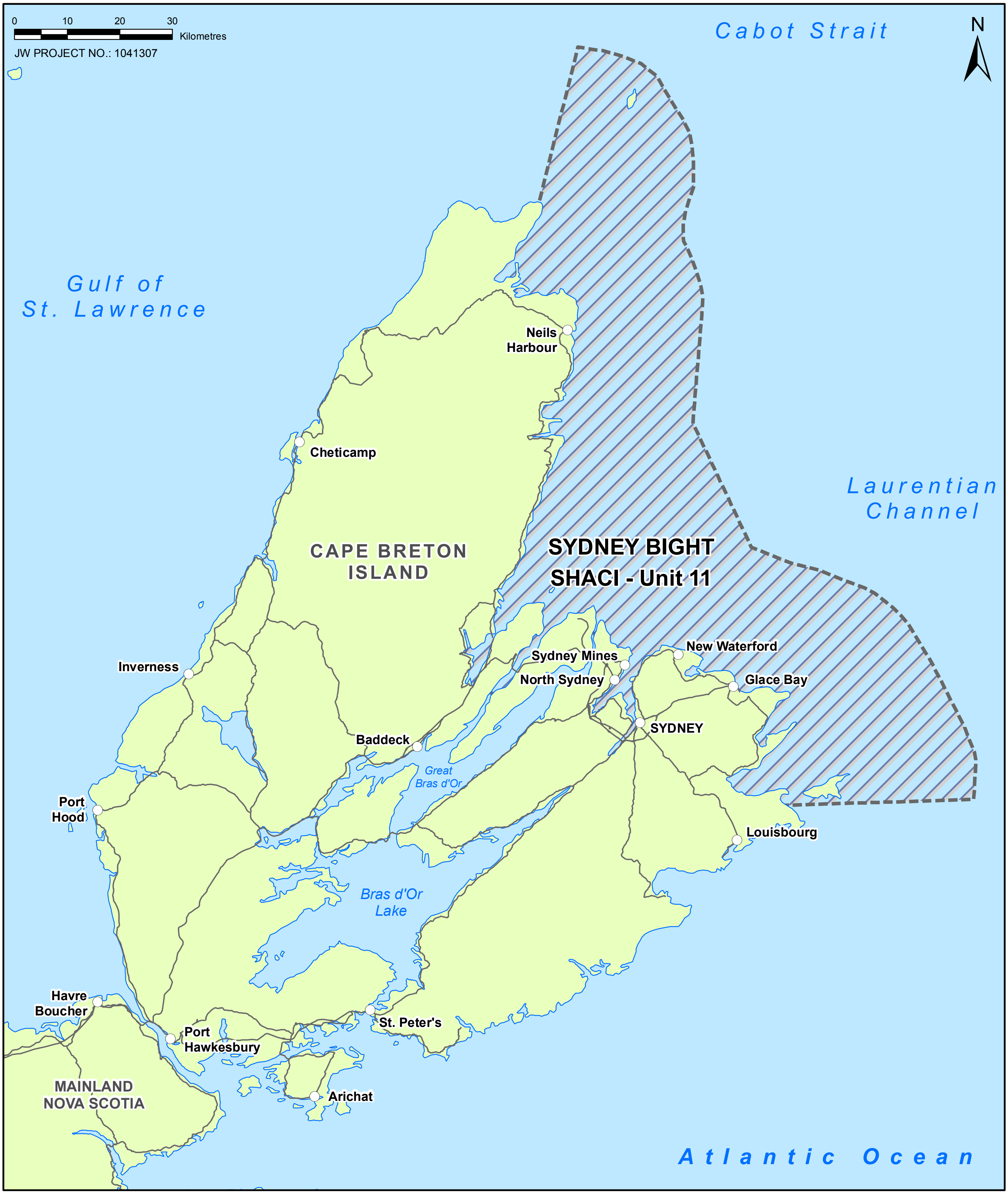
## 4.8 Marine Fish and Water Quality Existing Conditions

### 4.8.1 Marine Fish

Sydney Harbour and its approaches are characterized by a variety of marine habitat types, including rocky shore with macro-algae, pelagic, estuarine, sand, and soft-bottomed zones. Each of these areas provides habitat for a range of resident and migratory fish species. Over 80 marine fish species can be found in the marine waters just outside of Sydney Harbour (Schaefer *et al.* 2004), and many of these species could occur at least occasionally within the limits of Sydney Harbour.

Sydney Harbour is part of the coastal zone known as Sydney Bight (SHACI-Unit 11 - Significant Habitats, Atlantic Coast Initiative), which includes the coastal waters off Eastern Cape Breton Island, and extends from Scatarie Island to Cape North (Figure 4.3). Sydney Bight is an important spawning, nursery, and overwintering area for several finfish and invertebrate stocks. The marine invertebrates found in Sydney Bight include several important commercial species (*e.g.,* lobster, snow crab), as well as many that are little known or little studied. Marine invertebrates present in the Assessment Area are described in Section 6.1. Sydney Bight is also home to a diverse assemblage of finfish species. Some species migrate in and out of the area seasonally, using Sydney Bight as a spawning, nursing, or overwintering area. Others species pass through on their way to the Gulf of St. Lawrence, the Bras d'Or Lakes, or to the many rivers and streams that run into Sydney Bight (Schaefer *et al.* 2004). Other species are resident in the waters of Sydney Bight year round. There is substantial information available about the species fished commercially in Sydney Bight (*e.g.,* cod, redfish); however, much less is known about the many non-commercial fish present and their role in the Sydney Bight ecosystem. The commercial fish stocks of Sydney Harbour are described in Section 4.12.

Although Sydney Harbour is much different than the rest of Sydney Bight in terms of habitat types and oceanographic conditions (*i.e.,* estuary compared to open ocean), the harbour is very much linked ecologically with the fish and fish habitat in greater Sydney Bight (Schaefer *et al.* 2004; Hatcher *et al*. 2008); however, despite the large number and diversity of marine fish species present in Sydney Bight, only a handful of these species are common in Sydney Harbour.




| DATE: 31/10/2008 | Sydney Harbour Access Channel Deepening and the Proposed Sydport Container Terminal | FIGURE NO: Figure 4.3 |
|---|---|---|
| PREPARED BY: L. Kendell | | |
| LAURENTIAN ENERGY | **Sydney Bight** | Jacques Whitford |

The dominant demersal (*i.e.,* associated with the bottom) fish species found in Sydney Harbour are cunner (*Tautogolabrus adspersus*) and flounder (likely winter flounder -*Pseudopleuronectes americanus*)) (B. Hatcher pers. com. 2008). Cunner is a small, coastal species that is very common in rocky shore areas, particularly where macro algae are found. They are non-migratory and become dormant in the winter months, hiding under rocks and boulders (Scott and Scott 1988). Cunner is not fished commercially in Nova Scotia, although it is often caught by recreational fishers. The most common flounder species in Sydney Harbour is the winter flounder. Winter flounder are common in inshore waters and young are often found in estuaries (Scott and Scott 1988). They spawn in inshore waters. Winter flounder are fished commercially and recreationally although no major commercial fishery exists in Sydney Harbour.

Atlantic herring (*Clupea harengus*) and mackerel (*Scomber scombrus*) are the two most common pelagic fish species (*i.e.,* live in the water column off the seabed) present in Sydney Harbour. Atlantic herring are a small, abundant schooling species that are important ecologically as a forage species and for commercial value. Herring have a wide distribution across the Scotian Shelf, from coastal waters to a depth of 200 m (Scott and Scott 1988). Different herring stocks found on the Scotian Shelf migrate between specific feeding areas and spawning grounds dependent on season (Scott and Scott 1988). Herring are generally found closer to the bottom in winter, rising to the surface as the water warms in the spring. There is both an inshore and offshore spawning stock of herring on the Scotian Shelf, with most spawning activity occurring in the fall, with some observed in the spring and summer. Eggs are deposited on the bottom, where they adhere to gravelly substrate or macroalgaes until hatching (Scott and Scott 2008). DFO also lists Sydney Harbour as a potential herring spawning area (Schaefer *et al.* 2004).

Mackerel are highly migratory and seasonal visitors to the Scotian Shelf and Slope. Their distribution appears to be determined by their preference for water temperatures in the 9 to 12°C range (Scott and Scott, 1988). General migratory patterns show an inshore movement in spring for the summer and fall and an offshore movement to more temperate waters of the Shelf edge in the late fall (Scott and Scott 2008). Mackerel are a schooling species that feed on drifting zooplankton, such as amphipods, copepods and fish eggs by filtering them from the water with their gill rakers, and actively hunt small pelagic fish, crustaceans and mollusks (Scott and Scott 1988). Mackerel feed most actively at night near the surface and retreat to deeper waters during the day. Mackerel spawn in the summer months and the eggs are pelagic until hatching (Scott and Scott 1988). Mackerel spawning is not known to occur in Sydney Harbour.

In September of 2008, Jacques Whitford conducted experimental fishing in two watercourses draining into Barachois Creek near the proposed Project train trestle site. The watercourses included Barachois Brook and an unnamed watercourse referred to as Syd-1. Both watercourses were found to be tidal-influenced and indicative of an estuarine environment that can support estuarine-tolerant fish species. Fish catch results for these two watercourses are summarized in Table 4.10.

**TABLE 4.10 Fish Catch Results, Barachois Brook and Unnamed Brook (Syd-1), September 30-October 1, 2008**

| Fish Species | Barachois Brook | Unnamed Brook (Syd-1) |
|---|---|---|
| Mummichog (*Fundulus heteroclitus*) | 66 | 32 |
| Threespine stickleback (*Gasterosteus aculeatus*) | 10 | |
| Ninespine stickleback (*Pungitius pungitius*) | 1 | |
| American eel (*Anguilla rostrata*) | 1 | |
| Atlantic rock crab (*Cancer Innoratus*) | | 1 |
| Atlantic silverside (*Menidia menidia*) | | 1 |

The most prominent species was Mummichog, which are known to occur commonly in salt marsh flats, estuaries, and tidal areas, especially where there is submerged vegetation, as was found during the survey in both estuarine sites. Threespine and Ninespine sticklebacks were also caught. Sticklebacks inhabit salt, brackish and freshwater. They are tolerant of a range of water conditions (*e.g.,* salinity) and can be found in shallow, turbid waters not considered favourable by other species (Scott and Crossman 1998). Sticklebacks were identified to species level, with the majority of those observed being the Threespine stickleback. Both stickleback species were observed in the Barachois Brook; while the presence of the Ninespine stickleback was not confirmed in the unnamed tributary to Barachois Creek, it is anticipated to be present.

American Eels are a catadromous species (live in freshwater, spawn in saltwater) and as such can be found in lakes, streams, rivers, and estuaries (Scott 1967). The American eel has been designated a “species of special concern” by COSEWIC; while it has not been listed under *SARA* by DFO at this time, it is likely that it will be listed (and therefore be protected) in the future. Currently there is one individual commercially fishing eels in the upper reaches of Sydney Harbour (Barachois Creek area) (B. Hatcher, pers. comm., 2008).

A number of *SARA* listed fish species are found in Nova Scotian waters. However, the only *SARA* listed species that may occur in Sydney Harbour is the Atlantic wolffish (*Anarhichas lupus).* Adult Atlantic wolffish is known to occur in coastal areas of Nova Scotia and individuals are sometimes observed by SCUBA divers particularly in the spring months; however, their distribution in inshore waters is poorly known. Larger concentrations are known from hard bottom habitat of the offshore banks and slope waters (DFO 2000). While at one time it was common for fishermen in Sydney Harbour to observe Atlantic wolffish, in recent years sightings of this species have become very rare (Bruce Hatcher, pers. comm., 2008).

### 4.8.2 Marine Water Quality

Suspended sediment concentrations at the top and the bottom of the water column in Sydney Harbour are all below 10 mg/l during normal calm conditions. The main sources of suspended sediment in Sydney Harbour are the bluffs along the Seaward Arm of the Harbour and the various rivers that feed into the Harbour. The exposed bluffs of the Seaward Arm are constantly eroded by storm waves and this sediment is deposited into the water column. Sediments in sheltered areas are primarily from riverine deposits, which are limited in Sydney Harbour by the modest river discharge relative to tidal volume.

Freshwater inputs to Sydney Harbour are relatively low, and there has been strong vertical density stratification observed in the South Arm between Sydney River and the mouth of Muggah Creek. In the Northern half of the South Arm and in the Seaward Arm, the water column is generally well-mixed. Overall, measurements in the water column are generally consistent with that of an estuary where the tidal volume is much greater than the freshwater inflows (see Appendix D for summary of oceanographic conditions).

## 4.9 Terrestrial Habitats and Wildlife

Existing information on Terrestrial Habitats and Wildlife was complied through: an air photo review, ACCDC search, Provincial databases including the wetland atlas mapping and field surveys conducted by JW terrestrial ecologists in June 2006, June, July and August 2007, and September 2008.

### 4.9.1 Terrestrial Habitats

The existing onshore portion of the proposed terminal site consists of: diverse natural and human influenced upland habitats in varying stages of succession; wetland habitats; and coastal features. The marine influence and underlying sedimentary rock geology (*e.g.,* mudstones and limestone resulting in varying pH and calcium substrates) account for the 347 species of vascular plants and the various rare species encountered (see Table F-1, Appendix F). The majority of uncommon plant species including Northern Gentian (*Gentianella amarella*) (S1), Adder's Tongue fern (*Ophioglossum pusillum*) (S2S3), Loesel's Twayblade (*Liparis loeselii*) (S3), and Varigated Horsetail (*Equisetum varigatum*) (S3S4) were found in one area. The area consisted of imperfectly drained low turf vegetated open area, with likely calcareous influence, set in regenerating old pasture along the western edge of the property. The area has a mix of drier habitat and moist-to-wet habitat-loving plants of both exotic and native origins. Rare plants are discussed in greater detail in Section 4.9.3 below.

In the extreme southern and southwestern portion of the property, natural mixed forest was observed; the mixed forest retained the basic topography of natural woods and typical woodland assemblage of species despite the presence of many exotic species. Common tree species included Red Maple (*Acer rubrum)*, Balsam Fir (*Abies balsamea)*, Red Spruce (*Picea rubens)*, White Spruce (*Picea glauca)*, and Paper Birch (*Betula papyrifera)*. Not as common were White Pine (*Pinus strobus*), American Beech (Fagus *grandifolia*) and Sugar maple (*Acer saccharum*). Common shrubs included Possum Haw Viburnum (*Viburnum nudum*) and dominant ground vegetation included Wild-Lily-of-the-Valley (*Maianthemum canadense*), Clinton Lily (*Clintonia borealis*), Star Flower (*Trientalis borealis*), Dwarf Dogwood (*Cornus canadensis*), and Wild Sarsaparilla (*Aralia nudicaulis*). Mixed wooded areas were observed along the eastern edge of the property and in randomly dispersed islands among open regenerating old fields. Based on ground vegetation (*e.g.,* more weedy and exotic species) and flatter micro-topography, the forested islands were either grown on past cleared land or were heavily grazed at one time.

The central northern and northwestern portion of the property consisted of regenerating relatively open old field habitat. Soils in old field habitat are expected to vary between well drained to imperfectly drained. In addition the type of vegetation and distribution of vegetation varies across the property depending on the availability of moisture and the stage of succession. In the more northern portion of the property, dominant vegetation included shrubs such as Wild Roses (*Rosa virginiana* and *R. Carolina*) 10%, Common Apple (*Pyrus malus*) 2%, Speckled Alder 2%, and Narrow-Leaved Meadowsweet (*Spiraea alba)*, Rhodora (*Rhododendron canadense*), Serviceberry (*Amelanchier sps*.) each at 1%. The ground vegetation consisted of a variety of grasses: Tufted Vetch 10% (*Vicias cracca)*; and goldenrods (*Solidago canadensis*, S. rugosa) 6%; Virginia Strawberry (*Fragaria virginiana*) 3%; Black Knapweed (*Centaurea nigra*) 3%; and Tall Butter-Cup (*Ranunculus acris*) 1%. In the central part of this habitat larger young trees and Willows are taking over; the tree class at 10 m or more is dominated by: Paper Birch 20%, Trembling Aspen 10% (*Populus tremuloides),* understory White Spruce 20%, American Larch (*Larix laricina*) 2%, and Fire Cherry (*Prunus pensylvanica*) 1% or less. The shrub class was dominated by: White Spruce 10%, Possom Haw Viburnum 5%, Choke Cherry (*Prunus virginiana*) 2%, Red Rasperry (*Rubus idaeus)* 3%, and some Speckled Alder (*Alnus incana)*. The ground vegetation was dominated by some true forest species mixed with some more tolerant old field remnants and in one area consisted of: *Rhytadelphis sp.* moss 25%, Wild-Lily-of-the-Valley 10%, Rough-Leaved Goldenrod 10%, Bracken Fern (*Pteridium aquilinum*) 15%, Hawkweeds (*Hieracium aurantiacum, H. caespitosum*) 10%, Evergreen Wood Fern (*Dryopteris intermedia*) 5%, Wall Hawkweed 5%, Dwarf Red Raspberry (*Rubus pubescens*) 5%, and Parasol White-Top Aster 3%.

Coastal edge habitats vary from steeply eroding low cliff with sparse marine strand vegetation (*e.g.,* Sea Rocket (*Caklile edentula*) and Wild Radish (*Raphanus raphanistum*)) to sandy- gravelly strand to low dune edges at both the northeast and southeast ends of the property. At the dune edges, lower strand plants and higher dune plants like Quack Grass (*Elymus repens*), American beach Grass (*Elymus mollis*), Hooded Skullcap (*Scutellaria galericulata*), Field Sowthistle and Hedge Bindweed (*Calystegia sepium*) were observed. A complete list of plants observed on the Project site can be found in Appendix F.

### 4.9.2 Wetlands

Provincial wetland atlas mapping and field surveys conducted by JW terrestrial ecologists in June 2006, June, July and August 2007, and September 2008 were used determine the abundance, distribution and types of wetlands present on the Project property. Wetland habitats observed on the Project property included treed basin swamps, tall shrub basin swamps, tall shrub swamp semi-basin areas associated with small streams, dug out ponds and their wetland fringes, a freshwater Barachois pond on the southeastern end of the property, a saline-to-brackish Barachois wetland at the north east end of the property, and wet meadow wetland. Detailed field assessments were focused on wetland habitats which could reasonably be affected by Project activities. Wetland assessments were completed for wetland 1, 2, 4 and 8 (refer to Figure 4.4) and are discussed in the following sections.

**Wetland 1 Complex**

Wetland 1 Complex (1a and 1b) is approximately 2.7 ha consisting of a small pond, fringing tall shrub swamp, various forms of mixed wood treed swamp and tall shrub swamp with a small coastal outflow interface.


| | | |
|---|---|---|
| DATE: 11/02/2009 | Sydney Harbour Access Channel Deepening and the Proposed Sydport Container Terminal | FIGURE NO: Figure 4.4 |
| PREPARED BY: L. Kendell | | |
| LAURENTIAN ENERGY | **Terrestrial Habitats and Wildlife** | Jacques Whitford |

The eastern side of wetland 1a was well defined by an upland cloaked with coniferous (spruce and fir) dominated mixed forest and the western side was upland habitat dominated by deciduous trees including Trembling Aspen regeneration on old pasture or formerly cleared land. The wetland was dominated in the southern end by relatively firm bottomed, tall shrub swamp. Tree class vegetation was peripheral to the wetland on adjacent uplands. The dominant shrub was Speckled Alder to 35%. The diverse ground vegetation was dominated by Arrow-Leaved Tearthumb (*Polygonum saggitatum*) 20% Fowl-Manna-Grass (*Glyceria striata*) 15%, Sensitive Fern (1-25%, abundance increased towards the north) Hooded Scullcap (*Scutellaria galericulata*) 15%, Spotted Jewelweed 10%, Blue-Joint (*Calamagrostis Canadensis)10%*, Parasol White-Top Aster (*Aster umbellatus*) 7%, Lady-Fern (*Athyrium felix-femina*) 5%, Rough-leaf Goldenrod (*Solidago rugosa*) 5%, Wood ferns (*Dryopteris carthusiana* and *D. x bootii*) 5%, Northern Bugleweed (*Lycopus uniflorus*) 3%, Stalk-Grain Sedge (*Carex stipata*) 3% and bits of Soft Rush (*Juncus effusus*) and Necklace sedge (*Carex projecta*).

The northern end of the wetland consisted of tall shrub swamp wetland which graded into mixed wood treed swamp. The mixed wood treed swamp was dominated in the tree class by Red Maple 10%, White Ash (*Fraxinus americana*) 5%, and oddly with White Spruce (*Picea glauca*) 2% on higher mounds. In other areas White ash consisted up to 25%. The dominant shrubs were Speckled Alder 25%, and Black Holly 2%. Dominant ground vegetation consisted of Spotted Jewelweed 30%, Sensitive Fern 15%, Cinnamon Fern 10%, Arrow-Leaved Tearthumb 10%, Parasol White-top Aster 5%, Marsh Blue Violet (*Viola cucullata*) 5%, Sedges (*Carex stipata* and *C. pseudocyperus*) 10-15%, Blue-Joint 5%, Lady-Fern 5%, Swamp Aster (*Aster puniceus*) 3%, Fowl Manna-Grass 3%, and Spotted Joe-Pye Weed (*Eupatorium maculatum*) 3%. Small Purple Fringe Orchid (*Platanthera psycodes*) was prominent when in bloom (*e.g.,* pink and white-flowered specimens).

Towards the coast Tall Meadow Rue (*Thalictrum pubescens*) and Virginia Virgin-Bower (*Clematis virginiana*) were observed. Along the western side of the wetland a Shrubby Cinquefoil (*Potentilla fruticosa*, syn. *Dasyphora floribunda*) was noted as a result of the localized availability of calcium from limestone strata elements. At the eroding coastal strand edge of the marine shore, trees and taller shrubs gave way to Sensitive fern mixed with Sweet bayberry (*Myrica gale*) and some Virginia Rose (*Rosa virginiana*), Hedge Bindweed (*Calystegia sepium*), Woodland and Great Angelica (*Angelica sylvestris and A. atropurpurea*).

Wetland 1b consisted of a small open water pond, fringing tall shrub swamp habitat and a mixed wood treed swamp drainage that hooked abruptly to enter Wetland 1a. The small pond was most likely of anthropogenic origin with nearby upland patches of the exotic ornamental Queen-of-the-Meadow (*Filipendula ulmaria*). The open water habitat was dominated by Lesser Duckweed (*Lemna minor*) 80%. Dominant tree class surrounding the tall shrub swamp habitat included: Red Maple 4%, and Paper Birch 1% with some American Larch (*Larix laricina*) and adjacent peripheral Black Spruce (*Picea mariana*) leaning in from the adjacent upland. Dominant shrub class vegetation was comprised of Black Holly (*Ilex verticillatus*) 20%, Speckled Alder 15% and Red Maple 10%. Dominant ground vegetation was comprised of Spotted Jewelweed (*Impatiens capensis*) 20%, Beggar Tick's (*Bidens sps*., predominantly *B. frondosa*) 20%, Sphagnum mosses 15%, other mosses 10%, localized Cinnamon Fern (*Osmunda cinnamomea*) 10%, Swamp Loosestrife (*Lysimachia terrestris*) 10%, localized Sensitive fern (*Onoclea sensiblis*) 10%, Lesser Duckweed 10%, Water Dock (*Rumex orbiculatus*) 5%, Hemlock Water-Parsnip (*Sium suave*) 5%, Cyperus-Like- Sedge (*Carex pseudocyperus*) 5%, other sedges (*Carex brunnescens* and *C. cannescens)* 5% and Marsh Bedstraw

(*Galium palustre*) 5%. Minor amounts of Blue-Joint 2% were also present.

Wetland 1b was influenced by surface water and a small intermittent inflow which entered from a slope at the northern end. The wetland had ill defined semi-channelized flow to the southeast before abruptly hooking to the north-northeast and grading into Wetland 1a and ultimately draining to South Arm.

Below the pond was a mixed wood treed swamp with seeping wet patches dominated by wetland associated ground vegetation and shrubs. This swamp was dominated in the tree class by Red Maple 40%, Balsam Fir 20%, and Paper Birch 1% and some Black Spruce. Dominant shrubs included Balsam Fir 10%, Speckled Alder 3%, and Mountain Holly (*Nemopanthus mucronata*) 3%. Ground vegetation was dominated by Sensitive Fern 30%, Spotted Jewelweed 20%, Cinnamon Fern 15%, and on the higher tree bases Wild Sarsaparilla (*Aralia nudicaulis*) 8%, and Wild-Lily-of-the-Valley (*Maianthemum canadense*) 4% were present.

**Wetland 2**

Wetland 2 is a 0.51 ha wet meadow basin. This open marginal wetland was found northwest of the outflow drainage of Wetland 1 complex. The wetland has no well defined inflows or outflows and appears to be influenced by general surface runoff from the surrounding upland. No open water or dried pools were found and the ground was firm and well retained by dense grass roots. The habitat may be on a drying trend as suggested by the infiltration of more upland type species like Creeping Thistle (*Cirsium arvense*). No tree class vegetation was present. Shrubs were sparse and consisted primarily of Speckled Alder 2-5%, with some Red Raspberry 2%, and a few Narrow-leaved Meadow–Sweets and Virginia Rose each at 1% or less cover. The ground vegetation was largely dominated by dense Blue-Joint Grass 98%, with some Creeping Thistle 3%, Hooded Skullcap (*Scutellaria galericulata)* 2%, Canada goldenrod (*Solidago canadensis*) 2%, Spotted Joe-Pye Weed (*Eupatorium maculatim)* 2%, and Arrow-Leaved Tearthumb (*Polygonium sagittatum)* 1%.

**Wetland 4 Complex**

Wetland 4 complex (4a and 4b) consisted of 2.3 ha. Wetland 4a was situated in the southeastern portion of the Project property. The wetland consisted of open freshwater Barachois Pond surrounded with emergent marsh and shrub swamp vegetation and a relatively narrow coastal strand dune. The wetland was formed by gravelly sand deposition along an indent of South Arm against the upland coast which formed a barachois pond and wetland. The wetland has been generally cut off from saline water and has evolved to be a freshwater system.

The wetland is influenced by surface and subsurface flow from the upland mixed forest to the west and north, and by groundwater. There are no definable inflows; the outflow from the southeastern end of the wetland was more of an overflow outlet via a narrow shrub swamp channel to Barachois Creek.

The barrier beach or low gravelly dune system along the eastern boundary of the wetland was 4-5m wide at its widest and little more than 1m wide at its narrowest. The barrier beach was dominated by Fresh Water Cordgrass (*Spartina pectinata*) 40%, Quackgrass (*Elymus repens*) 40%, Tufted Vetch (*Vicia cracca*) 20%, Field Sowthistle (*Sonchus arvensis*) 5%, and Spotted Jewelweed 3%. The presence of three exotic naturalized species among the dominants was noted.

The open water habitat of the pond was not sampled for aquatic plant species but no water lilies were noted and Lesser Duckweed was little in evidence perhaps due to not infrequent duck presence.

The fringing emergent marsh habitat was dominated by patchy to diffuse Sweet Bayberry (*Myrica gale*) 50% and Broad-Leaf Cattail (*Typha latifolia*) 50%. Freshwater Cordgrass 30%, Marsh Cinquefoil (*Potentilla palustris)* 2%, Large Cranberry (*Vaccinium macrocarpon*) 2%, and Marsh St. John's-Wort (*Triadenum fraseri*) 1%. Low shrub swamp elements have less graminoid dominance and more Sweet Bayberry.

Wetland 4b was a coastal bay fringing salt marsh. The habitat was patchy with widths ranging from 0-15 m wide along the small bay that occurred along the southern end of the property. The wetland was tidally influenced through small brackish stream inflows which have local effects especially on the upper reaches of finger like inflow inlet extensions from the bay. In this area the transition from upland habitat to coastal salt marsh was typically abrupt. A low diversity of vegetation characteristic of many salt marshes was apparent (*e.g.,* species most tolerant of tidal submergence depth and duration) such as: Saltwater Cordgrass (*Spartina alterniflora*) was observed in the lower zone, while species like Black-Grass rush (*Juncus gerardii*) dominated the upper zone. No trees or shrubs were present. The ground vegetation was dominated by black-Grass Rush 50%, Sea-Lavender (*Limonium carolinianum*) 30%, Seaside Plantain (*Plantago maritima*) 35%, Salt-Meadow Cordgrass (*Spartina patens*) 20% and with Saltwater Cordgrass 20% in the lower zone.

Wetland 8 consisted of approximately 0.51 ha of coastal bay fringing salt marsh. The habitat was similar to that described for Wetland 4b and with similar vegetation composition.

**Wetland Function**

The biogeochemical function within the onsite wetlands is likely limited. Fluctuating water tables and emergent vegetation common in swamp and marsh habitats typically result in conditions favorable to theoxidation process (*e.g.,* Biological Oxygen Demand, and water quality improvement). These conditions may be present in Wetlands 4A, which is classified as a Barachois Pond with surrounding emergent marsh and swamp habitat. Conversely, peat accumulation in a wetland suggests that the oxidation process is not dominating the biogeochemical cycling and there is less capacity for water quality improvement. Wetland 1 has peat accumulation and as a result it is interpreted that water quality improvement is not a main function provided by this wetland. Wetland 2 is a wet meadow, and therefore will likely be accumulating peat as well. Peat accumulation in Wetlands 2 and 4A will be sequestering carbon, therefore acting as carbon sinks.

Salt marshes can act as both carbon sources and sinks, which may be the case for Wetlands 4B and 8. Salt marshes have organic carbon production, which may provide nutrients for surrounding marine life. Salt marshes also act as water quality filters for the marine habitat. Depending on the quality of water entering the wetlands, all the wetlands are possibly filtering pollutants from upslope runoff and upstream water sources before discharging into downstream wetlands or directly into the South Arm.

The wetlands have a variety of wetland habitats and collectively provide approximately 6 ha of wetland habitat for flora and fauna. Emergent marsh and swamp vegetation surrounding the Barachois Pond plays an important role in providing habitat for a variety of animals, as well as improving water quality through filtration and reducing wind exposure, which therefore reduces sediment disturbance.

One of the hydrological functions of the wetlands is stormwater retention during high flow events. The observed overflow channels provide evidence that the wetlands have a capacity for water retention. Wetland 4B is an exception, as it is connected and influenced by tidal systems. To a limited extent, Wetlands 1B and 2 will provide augmentation of flow to Wetland 1A during periods of low flow.

There appears to have been some anthropogenic influence at Wetland 1B due to the presence of Queen-of-the-Meadow, an exotic ornamental plant species. There were also nearby rock piles, as well as old building foundations suggesting there were pastures at this location, as well as other anthropogenic activities, which may have influenced the wetlands. More recently, there has been vegetation disturbance near Wetland 1B. There appeared to be no indication that the wetlands are currently used for recreational, agricultural, cultural, or business purposes at the time of the field surveys.

### 4.9.3 Vegetation

A rare plant modeling exercise was performed to determine the likelihood of rare or sensitive plants on the Project property. As part of the modeling exercise, all records of vascular plant species listed by the Nova Scotia Department of Natural Resources (NSDNR) as at risk (Red listed) or sensitive to human activities or natural events (Yellow listed) (NSDNR 2005) within a radius of 100 km were compiled by means of an Atlantic Canada Conservation Data Center (ACCDC) data search. The habitat requirements of these species were compared to the habitat descriptions compiled for the Project property to determine if suitable habitat was present for these species.

A total of 135 Red or Yellow-listed species have been recorded within 100 km of the Project Area. Based on the results of the habitat model, 34 Red or Yellow-listed species could potentially be present on the Project property. None of these species are listed under the federal *Species at Risk Act* (*SARA*) or under the Nova Scotia *Endangered Species Act*. See Table F-2 in Appendix F for a complete list of the species that could potentially be present on site.

Based on the modeling exercise, there are some key habitats in the area of the proposed site that have the greatest potential to harbour uncommon or rare vascular plant species. These include riparian habitats, wetlands, mature rich forest, sandy and gravelly seashores and abandoned pasture. In instances where appropriate habitat was present for a particular species, that species was considered to be potentially present and the suitable habitat in the Project area was identified as a target for future field surveys. The phenology (timing of plant flowering or other biological activities) and ease of identification of each of the species potentially present on the Project property was also incorporated into the model in order to determine the best times to conduct the field surveys. Comprehensive vascular plant surveys for the study area were conducted during June 2006, June, July and August 2007 and September 2008. The timing of these field surveys coincided with the period during which the 34 rare vascular plant species identified as potentially present by the model can be reliably detected.

Four rare or uncommon vascular plant species were observed during the field surveys; Northern Gentian (*Gentianella amarella*), Adder's Tongue Fern (*Ophioglossum pusillum*), Variegated Horsetail (*Equisetum variegatum*), and Loesel's Twayblade (*Liparis loeselii*). Northern Gentian and Adder's Tongue Fern were identified as potentially present by the rare plant model. All rare and uncommon vascular plant species, recorded during the field surveys, are concentrated in a relatively small area near the center of the property (Figure 4.4). All were found in similar habitat which consisted of imperfectly drained abandoned pasture.

Northern gentian is Red listed by the Nova Scotia Department of Natural Resources (NSDNR) indicating that the Nova Scotia population may be at risk. The ACCDC lists this species as S1 indicating that it is very rare, although this species is not legally protected in Nova Scotia. Approximately 250 northern gentian plants were encountered during the field surveys.

Adder's tongue fern is designated as S2S3 by ACCDC indicating that there is some uncertainty regarding the status of the population in Nova Scotia and it ranges from rare (S2) to uncommon (S3). NSDNR designates this species as Yellow indicating that it is sensitive to human activities and natural events. This species was recorded at one location in the study area. This species represents a moderate environmental constraint.

Variegated horsetail and Loesel's twayblade populations in Nova Scotia are considered to be secure in Nova Scotia (Green listed) by NSDNR. Variegated horsetail is listed as S3 (uncommon) by ACCDC and Loesel's twayblade is listed as S3S4 (uncommon to fairly common). Variegated horsetail was found at two locations while Loesel's twayblade was found at 12 locations. Both species are considered to be secure in Nova Scotia so their presence does not represent a serious environmental constraint.

As a result of past and present human disturbance several species of common exotic plant species were observed on site; species such as Common Hops (*Humulis lupulus*), White Poplar (*Populus alba*), Queen-of-the-Meadow (*Filipendula ulmaria*) and False Sneezeweed (*Achillea ptarmica*) are probable remnants of ornamental plantings. Wall Hawkweed (*Hieracium murorum*), a naturalized exotic species more common in this area of Nova Scotia, is particularly invasive in forest off streams in the southwestern portion of the property.

### 4.9.4 Wildlife

A rare wildlife model was prepared using an ACCDC data request for records of red and yellow listed bird, mammal and amphibian species that have been recorded within a 100 km radius of the Project property. A total of 14 Red or Yellow-listed species have been recorded within 100 km. (refer to Table F-3 in Appendix F).

**Birds**

Based on the habitat modeling exercise, the area around the proposed property contains suitable habitat for four rare bird species including Northern Goshawk (*Accipiter gentilis*), Short-eared Owl (*Asio flammeus*), Vesper Sparrow (*Pooecetes gramineus*), and Bobolink (*Dolichonyx oryzivorus*). A breeding bird survey was conducted on the property in June 2007. This survey revealed the presence of four Yellow listed bird species including Common Loon (*Gavia immer*), Common Tern (*Sterna hirundo*), Northern Goshawk and Boreal Chickadee (*Poecile hudsonica*). Commmon Loon and Common Tern are discussed in Section 6.3.

One Boreal Chickadee was observed in mature coniferous forest that would provide suitable nesting habitat. Since Boreal Chickadees nest in tree cavities in mature coniferous and mixedwood forest it is likely that this species nests at the site. The ACCDC considers Boreal Chickadee to be uncommon in Nova Scotia; however, NSDNR considers the Nova Scotia population to be secure. One Northern Goshawk was observed on the Property; ACCDC considers the Northern Goshawk as uncommon (S3) and NSDNR lists the Northern Goshawk as sensitive to human activities or natural events. A Bald Eagle's nest was observed near the proposed terminal site (see Figure 4.4). Bald Eagles are Green listed by NSDNR which means they are not believed to be sensitive or at risk. In the past Bald Eagles have been affected by the historic use of pesticides and past unregulated human disturbance which greatly impacted the population of Bald Eagles in Nova Scotia; as such Bald Eagles are now protected by NSNDR under the Special Management Practices for Eagles (Draft April 2004).

While not surveyed by the Study Team, it is understood that the South Bar peninsula (located within 5 km of the proposed site, on the east side of Sydney Harbour) provides habitat or migratory birds and species of concern. This area is also an important birding area in the province.

**Mammals and Herpetiles**

The rare wildlife model did not identify any rare or sensitive mammal or herpetile species that could potentially be present on the site.  Field surveys conducted during June and August of 2007 did not reveal the presence of any rare or sensitive mammal or herpetile species.

Animals observed during the wetland investigations included: White-Tailed Deer (*Odocoileus virgirianus)*, Green Frog (*Rana clamitans*), Northern Leopard Frog, (*Rana pipiens*), Wood Frog (*R. sylvatica*), and Northern Spring Peeper (*Pseudacris crucifer)*.

## 4.10 Archeological and Heritage Resources

Assessment of archaeological and heritage resource potential in the development area incorporated several documentary sources.  Historic maps and manuscripts, land records, and published literature were consulted at the Public Archives of Nova Scotia (Halifax), Parks Canada (Fortress Louisbourg), Beaton Institute (Sydney), Maritime Museum of the Atlantic (Halifax), and at the Canadian Coast Guard College library (Sydney).  Historians at the Old Sydney Society were consulted regarding knowledge of potential archaeological resources in the area.  Nova Scotia Heritage Division Assistant Curator, Ethnology, Mr. Roger Lewis, was consulted regarding his knowledge of historic First Nations land use and potential archaeological resources in the vicinity of the development area.  Finally, the bathymetric seabed survey report by McGregor GeoScience (2008) was reviewed for evidence of potential shipwrecks and other archaeological resources in the harbour channel and local diver Ken Jardine was consulted regarding his video survey of the harbour, which was prepared for the environmental assessment of this development.  A comprehensive history of the development area is included in Davis Archaeological Consultants Limited's report on the archaeological assessment of the proposed development.

No known archaeological sites have been recorded in the development area, although 18th and 19th century sites do exist at nearby Petersfield Provincial Park which may be of archaeological significance. However, these sites are not expected to be impacted by construction of the marine facility as they are located outside the proposed development area.

An archaeological field reconnaissance of the terminal footprint in October 2008 revealed six archaeological features that could potentially be affected by Project activities. These include two stone and concrete foundations, two earthen depressions, an unidentified feature (possibly a barn), and a historic midden.

Records of potential shipwrecks in the Harbour are incomplete and of varying degrees of precision and accuracy. One hundred potential wrecks have been documented as having gone down in and around the shores of Sydney Harbour. At least one wreck, a wooden tugboat, is known to exist in the assessment area and could be disturbed by dredging activities. No tugboats are listed among the Marine Heritage Database and the significance of this existing wreck is not known. The potential exists for additional wrecks which have not been identified during the bathymetric survey and dive investigation.

The development area is known historically to have been occupied at least as early as the 16th century when early European explorers reported Mi'kmaq people in the area. It is highly probable that the area was occupied much earlier than this by the ancestors of the Mi'kmaq. The potential exists for habitation sites in the near shore area, as the Harbour and Spanish Bay were much higher and drier as recently as 6,000 years B.P. These resources now may be submerged in coastal areas. Archaeological subsurface testing of three areas along the shoreline of Barachois Creek in October 2008 did not provide evidence of past First Nations activity in these areas.

Europeans are known to have settled here at least as early as the 18th century when the French occupied nearby Louisbourg. Basque, Breton, and Norman fishermen may have frequented the area much earlier than this, in the 16th century and Spanish fishing fleets are believed to have been present. The town of Sydney and surrounding areas were settled by United Empire Loyalists in the late 18th century and Point Edward was certainly settled at that time. Point Edward has been continually settled or has been under industrial development since that time.

In the 19th century, the Harbour was heavily fortified and military installations were made at Point Edward and various other places around the shore. These installations were upgraded during the Second World War and later, a naval base was established here.

## 4.11 Vessel Navigation

Sydney Harbour is located at the entrance to the Cabot Strait in Nova Scotia's Cape Breton County. In the past the port was an essential part of the transportation corridor for the Sydney Steel Corporation and the Cape Breton Development Corporation Coal Mines. With the reduction of coal and steel production in Cape Breton and closure of these corporations in 2000-2001, the port's marine traffic was considerably reduced.

**Vessel Traffic Management**

Marine vessels enter Sydney Harbour and North Sydney from Spanish Bay and into Sydney Harbour Channel between Cranberry Point and Low Point (Figure 4.5). From Southeast Bar to the harbour limits, the channel is approximately 5 nautical miles (NM) long with a mid channel maximum water depth of between 18 m and 12 m. The navigable channel (*i.e.,* depth of at least 10 m) has a width of approximately 1000 m (0.54 NM). Inward of Southeast Bar, the channel is divided into the South Arm, which runs towards the proposed Sydport Container Terminal and Sydney Wharves, and the North West Arm, leading to North Sydney. In the South Arm off the proposed Sydport Container Terminal site, the mid channel water depths are between 14 m and 18 m. The navigable channel width in the South Arm is approximately 1150 m (0.62 NM) (Sailing Directions ATL 104, DFO; Canadian Chart 4266, CHS.).

Pursuant to the *Pilotage Act*, Sydney Harbour is a compulsory pilotage area managed by the Atlantic Pilotage Authority (APA). Pilotage is the process of directing and controlling the movement of a vessel through near-shore and inshore waters unfamiliar to the ship's master or providing navigation advice to the master for this purpose (APA web site, Pilotage Profile). In a Compulsory Pilotage Area the vessel must engage the services of a Licensed Pilot or have on board an Officer with a Pilotage Certificate issued by the APA for the class of vessel and the pilotage area. Under the *Pilotage Act*, "Pilot" refers to person who does not belong to a ship and who has the conduct of it.

The Sydney Harbour compulsory pilotage area is shown on Figure 4.5.

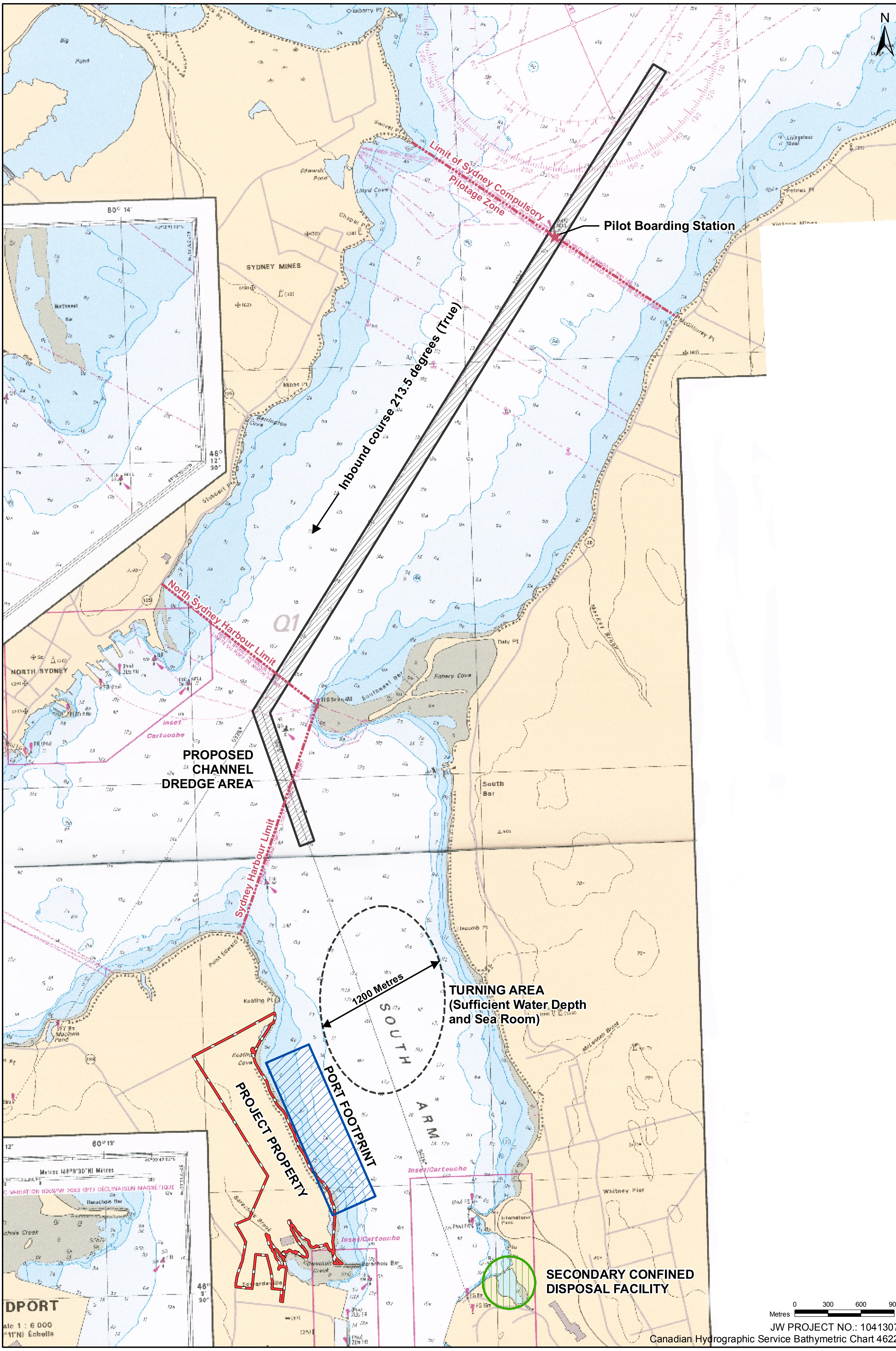
Under the *Atlantic* Pilotage Authority Regulations, the following types of ships are subject to Compulsory Pilotage:

- Canadian registered ships of over 1,500 gross tonnes;
- ships not registered in Canada, including floating cranes;
- oil rigs;
- any combination of tug and tow, if more than one unit is being towed, regardless of gross tonnes;
- pleasure craft over 500 gross tonnes; and
- ferries that are entering or leaving a port that is not one of their regularly scheduled terminals.

There are a number of exceptions that do not require pilotage in compulsory areas, including Canadian government vessels, Canadian registered fishing vessels, and Canadian registered offshore supply vessels of 5,000 gross tonnes or less with a base of operations within a compulsory port.

When pilotage services are required, marine pilots are dispatched to meet and board vessels at the Pilotage Boarding Station as they enter the designated compulsory pilotage areas. A ship arriving in a compulsory pilotage area must give notice of the estimated time of arrival (in G.M.T.) at least 12 hours in advance of arrival, and must also give notice confirming or correcting the estimated time of arrival within a timeframe set out by the Atlantic Pilotage Authority. When departing or moving within a compulsory pilotage area, a ship must notify the Pilotage Authority within a timeframe specified by the Authority.

Pilotage service is provided by the Cape Breton Pilots. There are currently two pilots stationed in Sydney, and if it is necessary, they can be supplemented by pilots from the Cape Breton Pilots that are based elsewhere. (P. Gates, pers. comm., 2008).




| | | |
|---|---|---|
| DATE: 31/10/2008 | Sydney Harbour Access Channel Deepening and the Proposed Sydport Container Terminal | FIGURE NO: **Figure 4.5** |
| PREPARED BY: L. Kendell | | |
| | **Vessel Navigation** | |

Table 4.11 summarizes the recent history of pilotage assignments for vessels within the Compulsory Pilotage area. An assignment is associated with one movement of the vessel. For example, assignments can be from the Pilot boarding station to the berth, or a harbour move from berth to berth, or departing the berth to sea.

**TABLE 4.11 Pilotage assignments for Sydney Harbour**

| Dates | Assignments |
|---|---|
| 1 January to 31 December , 2006 | 318 |
| 1 January to 31 December , 2007 | 277 |
| 1 January to 30 June , 2008 | 121 |

(P Gates, pers. comm. 2008)

Vessels approaching Sydney and North Sydney harbours from seaward must reduce speed and embark a pilot at the Pilot Boarding Station (T. Pittman pers. comm. 2008). The reverse of the courses and distances apply on the outward voyage (Table 4.12).

**TABLE 4.12 Navigation in Sydney Harbour**

| From Position | To Position | Course $^{o}$(T) | Distance (Nautical Miles) | Total Distance (Nautical Miles) | Time on track (Hours) |
|---|---|---|---|---|---|
| Approaches | Fairway Buoy (Pilot Boarding Station) | Various courses | 2.0 | 2.0 | 0.2 |
| Fairway Buoy | South East Bar Lt brg 270 0.3 n miles | 213.5 | 2.8 | 9.4 | 0.3 |
| Southeast Bar Light | Position off berth | 162.5 | 1.4 | 10.8 | 0.2 |
| **Total** | | | | | **0.7** |

(Turner, pers. comm., 2008)

The Canadian Coast Guard supplies the services provided by MCTS (ECAREG VTS Zone,). Their responsibilities include ship to shore communications and the monitoring of traffic entering Canadian waters and local zones. Vessels operating in the area, as in all other Vessel Traffic Services (VTS) Zones, must comply with the requirements of the *Vessel Traffic Services Zones Regulations.* All Traffic utilising the Sydport container terminal will be required to report in to ECAREG as required by the regulation and the normal practices of seafarers. The VTS National Study states “VTS is designed to identify potential conflicts and through an interactive exchange of information with vessels, reduce marine risk” (General VTS Regulatory Principals). Thus, MCTS advises vessels in the zones of the movement of other vessels; receives and relays messages between the Pilots, Harbour Authorities, Government Agencies and ships; monitors and broadcasts information on hazards, weather conditions and Notices to Shipping; advises on the safety of navigation in the area; and reports on non-compliance. The purpose of the MCTS is not to “control” marine traffic in an area, but to monitor passage and advise on safety of navigation. Under most conditions MCTS monitors and reports on the movement of vessels, but has the authority under certain conditions to issue directives. (G. Rose, pers. comm., 2008).

MCTS uses a network of radio, radar and AIS systems to monitor and regulate traffic in its VTS Zones of responsibility. MCTS monitors and advises on the movement of marine traffic through processes such as: traffic clearances, conditional traffic clearances, calling-in-points, traffic and waterway information updates, advising vessels of non-compliance (Pilotage Zone) and other practices and procedures for reporting while vessels operating in the VTS Zone. There is no local VTS Zone for Sydney, and all reports are made to ECAREG.

**Navigation Conditions**

The tides in North Sydney for Large Tides are: High Water 1.4 m above chart datum and Low Water 0.0 m (Canadian Chart 4266, CHS). The tidal regime in Sydney Harbour is not a major safety concern for marine vessel navigation.

Sea ice generally accumulates in the entrance to the Cabot Strait between February and April each year. The ice is seldom thick enough to limit vessel navigation, but onshore winds can cause the development of pressure ridges. Sea ice also forms in Sydney Harbour, but has not traditionally caused delays to ferries or commercial vessels. (T. Pittman, pers. comm. 2008) In March, when the sea ice breaks up in the Gulf of St. Lawrence, broken ice will accumulate in the entrance to the harbour and may result in some pressure ridges when the NE winds pack the ice into that area. This is seldom long lived and causes little delays to vessels. Ice breaking services are available from the CCG if a vessel needs to be assisted.

A review of the ice conditions in Sydney Harbour from 1969 - 2006 by C-Core indicates that in the last 15-year period, February and March 2004 were the only instances where the ice accumulation in the area was sufficient to restrict navigation (a thickness of 30 cm or greater and a concentration of 9/10 or more). During this time, shipping was disrupted for a few days; however, the report suggests that in the future, delays will likely not exceed 1 week total over the course of four years. (C-Core, 2007). Vessels entering Canadian waters pay marine services fees to the government for the navigational aids services provided and for ice breaking services if required. In waters where ice accumulates, the CCG will provide an ice breaking service for vessels destined for those areas.

**Vessel Traffic**

Marine vessel traffic in Sydney Harbour has been generally declining in recent years, with the total number of calls falling to 153 in 2007, down from 192 in 2005 (Table 4.13). Tankers, cargo ships, and the passenger ferry account for the majority of vessel calls in the Harbour. Marine Atlantic operates ferries from North Sydney to Argentia (seasonal) and Port Aux Basques in Newfoundland, with the number of departures ranging from 13 to 22 per week to Port Aux Basques and 1 to 3 per week for Argentia, depending on the time of year. In terms of cargo tonnage handled, Sydney Harbour is the fourth largest port in Nova Scotia, handling a total of just over 2,500,000 tonnes in 2005 (Statistics Canada, 2008). Sydney Harbour is also home to a commercial fishery focused primarily on lobster and rock crab (Section 4.12).

**TABLE 4.13 Vessel Traffic in Sydney Harbour – Annual Vessel Calls by Type**

| Vessel Type | 2005 | 2006 | 2007 |
|---|---|---|---|
| Tanker | 49 | 42 | 43 |
| Chemical Tanker | 1 | 3 | 0 |
| General Cargo | 1 | 13 | 1 |
| Bulk Cargo | 50 | 48 | 43 |

**TABLE 4.13 Vessel Traffic in Sydney Harbour – Annual Vessel Calls by Type**

| Vessel Type | 2005 | 2006 | 2007 |
|---|---|---|---|
| Tug | 19 | 9 | 4 |
| Government | 25 | 23 | 24 |
| Fishing | 3 | 8 | 0 |
| Passenger (cruise ships) | 44 | 34 | 30 |
| Other (vessels > 20m) | 0 | 0 | 8 |
| Total | 192 | 180 | 153 |

(T Pittman & C. MacKay, pers. comm. 2008)

## 4.12 Commercial Fisheries

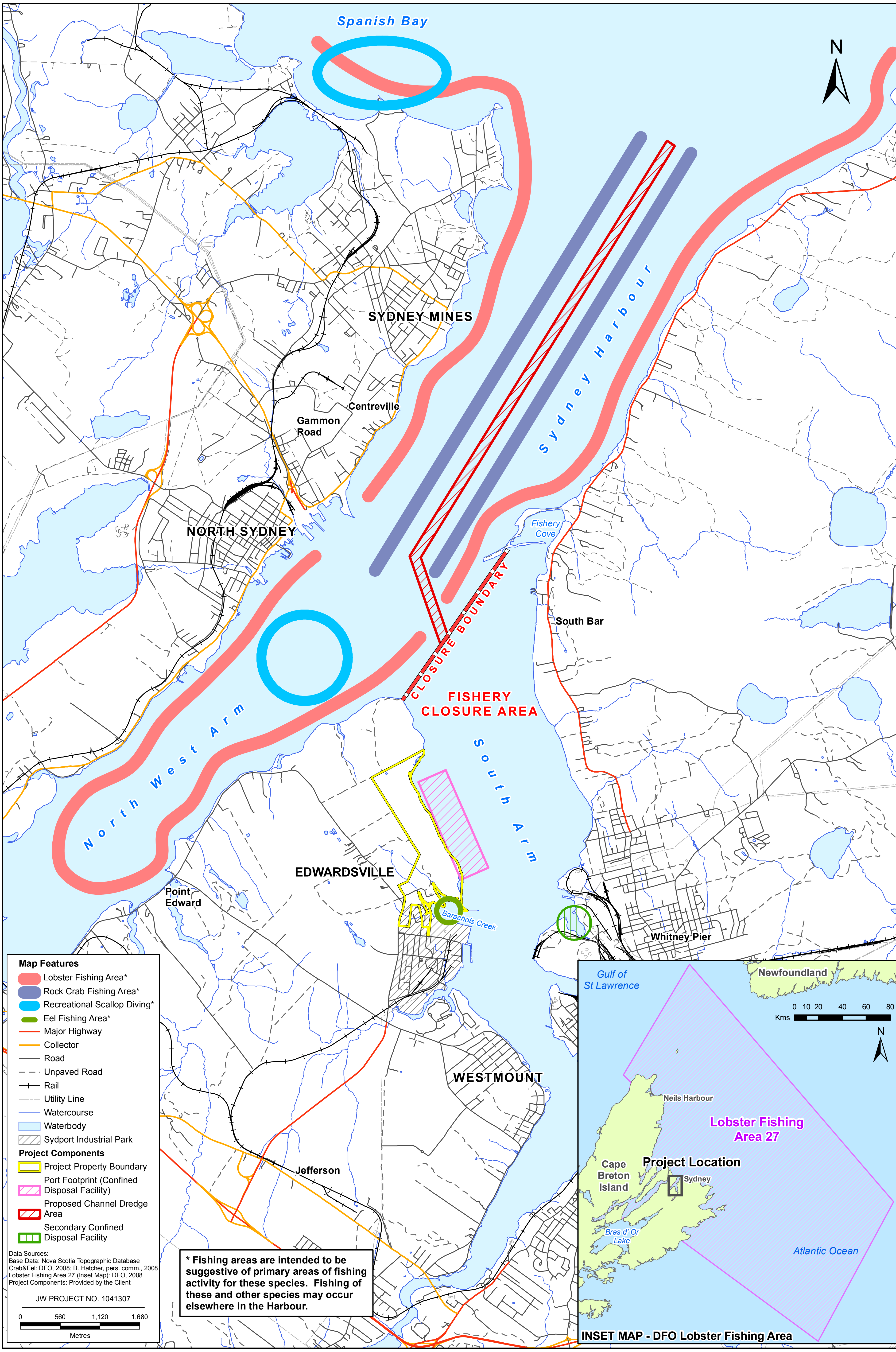
Despite its long history as host to heavy industrial activity, Sydney Harbour continues to support an active commercial fishery. Sydney Harbour is a component of NAFO fishing division 4Vn and LFA 27 (Figure 4.6). Sydney Harbour is also part of the coastal zone known as Sydney Bight (SHACI-Unit 11 - Significant Habitats, Atlantic Coast Initiative), which includes the coastal waters off Eastern Cape Breton Island, and extends from Scatarie Island to Cape North (Figure 4.6). Sydney Bight is an important spawning, nursery, and overwintering area for several finfish and invertebrate stocks. The marine invertebrates found in Sydney Bight include several important commercial species (*e.g.,* lobster, snow crab), as well as many that are little known or little studied. Ecological linkages between Sydney Harbour and the rest of Sydney Bight are described in Section 4.8. Marine invertebrates present in the Assessment Area are described in Section 4.7.

There are currently five species being fished commercially in Sydney Harbour, including lobster, rock crab, herring, mackerel, and eel (Lorne Penny, pers. comm., 2008). Lobsters are by far the most important commercial species, accounting for the largest share of the landings and landed value at ports in Sydney Harbour. Herring and mackerel are fished primarily by gill netters and landings are typically used for lobster bait (Lorne Penny, pers. comm., 2008). Rock crab is the second most important commercial species in Sydney Harbour. Recent landings for lobster and rock crab at ports in and around Sydney Harbour are summarized in Table 4.14.

**TABLE 4.14 Lobster and Rock Crab Landings for Ports in Sydney Harbour**

| Location | Year | Species | Landings (kg) | Landed Value ($CDN) |
|---|---|---|---|---|
| **South Bar** | 2005 | Lobster | 32,330 | 448,033 |
| | | Rock Crab | 7,592 | 5,575 |
| | 2006 | Lobster | 18,708 | 235,841 |
| | 2007 | Lobster | 24,833 | 320,891 |
| **North Sydney** | 2005 | Lobster | 69,521 | 953,366 |
| | | Rock Crab | 26,883 | 19,834 |
| | 2006 | Lobster | 86,448 | 1,099,381 |
| | | Rock Crab | 45,675 | 39,696 |
| | 2007 | Lobster | 82,967 | 1,086,249 |
| | | Rock Crab | 27,141 | 27,466 |
| **Sydney** | 2005 | Lobster | 1,895 | 26,650 |
| | 2007 | Lobster | 231 | 3,357 |

Source: Lorne Penny, pers. comm., 2008




| | | |
|---|---|---|
| DATE: 31/10/2008 | Sydney Harbour Access Channel Deepening and the Proposed Sydport Container Terminal | FIGURE NO: Figure 4.6 |
| PREPARED BY: L. Kendell | | |
| LAURENTIAN ENERGY | **Commercial Fisheries, Sydney Harbour, NS** | Jacques Whitford |

Information on licensing and active seasons for commercial fisheries is provided in Table 4.15

**TABLE 4.15 Commercial Fishing Licenses and Active Fishing Seasons in Sydney Harbour**

| Species | Number of Licensed Vessels | Active Season |
|---|---|---|
| Lobster | 38 | May 15 – July 15 |
| Rock Crab | 4 | Aug 15 – Dec 31 |
| Gaspereau | 6 | May 16 – July 16 |
| Eels | 1 | May – October |
| Bait Fishery | Variable | variable |

Sources: Schaefer *et al*. 2004 (lobster); Tremblay and Reeves 2000 (rock crab); Hatcher *et al*., 2008 (Gaspereau, eels, bait)

In addition to information on species fished and landings, *etc.,* it is essential to understand the spatial patterns of commercial fishers within Sydney Harbour. Fishing generally occurs throughout the harbour, depending on the species being fished and the time of year; however, some particular areas of the harbour are fished more intensively, and these areas of interest are identified in Figure 4.6. The South Arm of Sydney Harbour has been closed to commercial fishing for over 20 years due to the discovery of high levels of contaminants in tissues of commercial and forage species (Lee, 2002); this closure area is indicated on Figure 4.6. Lobster fishing tends to be concentrated along the margins of the harbour where there is primarily hard or broken ground on the seabed. At times lobster fishers will set traps closer to the centre of the Seaward Arm; however, the risk of vessels running over traps keeps many fishers from using this part of the harbour (Hatcher *et al*., 2008). In addition to fishing along the coastlines in Sydney Harbour, rock crab fishing tends to be focused in areas with soft sea bottom, and therefore crab fishers tend to set their traps away from shore and closer to the centre of the channel (Figure 4.6). DFO also notes that rock crab fishermen will place traps as close to the closed fishing area in the South Arm as possible (Lorne Penny, pers. comm., 2008). This was also confirmed through interviews with fishers (Hatcher *et al*., 2008). Gaspereau is fished in areas where freshwater inputs meet the salt water of Sydney Harbour, and eels are fished in brackish water, in particular at Barachois Creek where there is currently one licensed eel fisherman operating (Hatcher *et al*., 2008) (see Figure 4.6). The bait fishery for herring and mackerel is widely dispersed in the harbour.

**Recreational Fishery**

In addition to the commercial fishery, Sydney Harbour is home to a range of recreational fishing activities. Recreational diving for scallops is thought to occur in two particular locations: in the Spanish Bay area and at the mouth of the North West Arm (see Figure 4.6). Other recreational fishing occurs along wharfs, in small fishing boats, and along the coastline throughout the Assessment Area. These recreational fishers are generally fishing for herring, mackerel, and other groundfish (L. Penny, pers. comm., 2008).

**Aboriginal Fishery**

According to DFO, there are currently six Aboriginal fishing licenses in Sydney Harbour, approximately one per Aboriginal community (Lorne Penny, pers. comm., 2008). Commercial aboriginal fishers must follow the same regulations as other licensed fishers including adherence to the designated seasons. Membertou Geomatics Consultants (MGC) have also identified and gathered information on Mi'kmaq traditional knowledge with respect to land and resource use for input to this environmental assessment process. To determine traditional land and resource use in the study area, 20 interviews were conducted,