Table 4.3. Summary of Drilled Well Records

	Drilled Date (yr)	Well Depth (m)	Casing Length (m)	Estimated Yield (Lpm)	Water Level (m)	Overburden Thickness (m)	Water Bearing Fractures (m)
Minimum	1967	20.1	5.2	4.5	3.7	0.9	2.4
Maximum	2001	91.4	7.6	45.4	9.1	7.6	91.5
Average	1982	47.1	4.1	15.9	7.3	4.1	34.6
Number of well records	14	14	12	13	5	13	11

Source: NSE 2015a

Based on short term driller's estimates for the wells in Table 4.3, the average yield is approximately 15.9 Lpm (4.2 gpm) and average well depth is approximately 47.1 m (154.5 ft). These measurements represent very short term yields estimated by the driller at the completion of well construction. Fracture depths ranged from 2.4 m (7.9 ft) to 91.5 m (300.1 ft).

NSE maintains the Nova Scotia Groundwater Observation Well Network (NSE 2015b). The nearest observation well to the Study Area is located approximately 4 km south, near Upper Lawrencetown. This well was drilled to a depth of 53 m through quartzite of the Goldenville Formation. The well had been constructed in 1977 as part of a saltwater intrusion investigation. In 2014, the average water elevation was 2.87 m above sea level and the annual water level fluctuation was 1.1 m.

Groundwater Quality
Groundwater in quartzite and slate are usually calcium bicarbonate waters low in dissolved solids and hardness. Groundwater within the metamorphic bedrock of the Goldenville and Halifax Formations are often slightly acidic and sometimes contain iron, manganese, and occasionally arsenic (Trescott 1969).

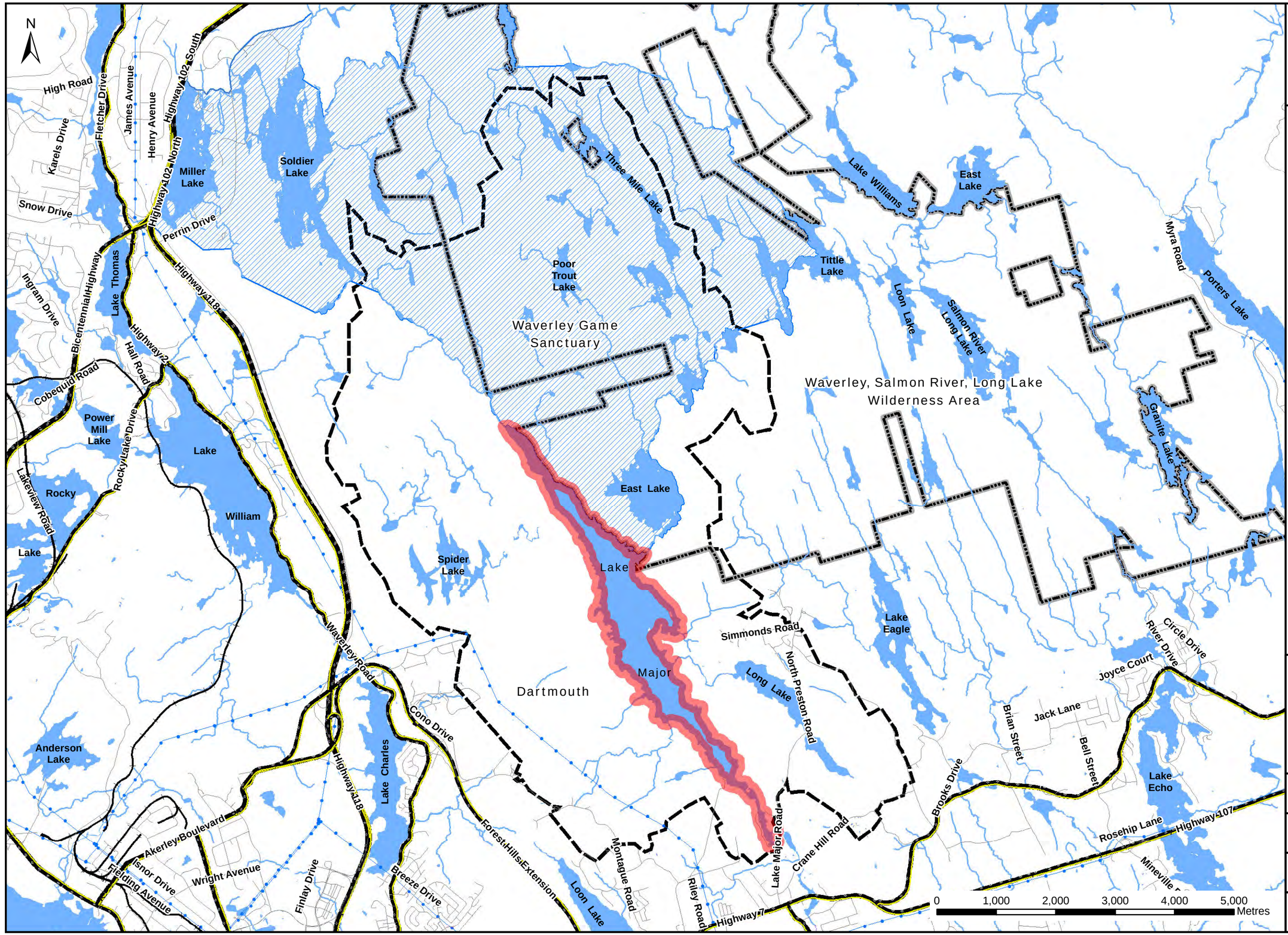
4.3 Freshwater Environment

4.3.1 Watershed

The Lake Major Watershed provides water to Dartmouth, Cole Harbour, Eastern Passage, Westphal, Cherry Brook, North Preston, and Montague Gold Mines (HRM 2015a). The watershed is a protected area with portions of it falling in the Waverly-Salmon River Long Lake Wilderness Area. The Lake Major Watershed Protected Water Area contains 6197 hectares of primarily forested land and 800 hectares of water for a total area of 6997 hectares.

The land within the watershed consists of a combination of Crown land (41.0%), Privately-owned land (17.0%) and land owned by Halifax Water (41.0%). Portions of five communities, Montague, Cherry Brook, Lake Major, East Preston, and North Preston are located within the watershed area (Drawing 4.4).

There are 32 lakes within the designated area (Table 4.4).



Notes:

1. Reference: Digital Topogrpahic Mapping by Nova Scotia Geomatics Centre. Restricted & Limited Land Use Database by Nova Scotia Department of Natural Resources (NS DNR).
2. Projection: NAD83(CSRS), UTM Zone 20 North

Legend:

- Study Area
- Public Roads
- Major Roads and Highways
- Active Railroad
- Existing Transmission Lines
- Mapped Stream
- Water Bodies

Restricted and Limited Use Lands:

- Designated Water Supply Areas
- Provincial Game Sanctuaries
- Wilderness Areas

Lake Major Dam Replacement - Restricted and Limited-Use Lands

Strum 20 YEARS Taking Charge CONSULTING

*Engineering * Surveying * Environmental*
*Bedford * Antigonish * Moncton * Deer Lake*

Date: December 2016	Project #: 16-5799
Scale: 1:60,000	Drawing #: **4.4**
Drawn By: H. Serhan	
Checked By: H. Mosher	

Table 4.4. Lakes within the Lake Major Watershed

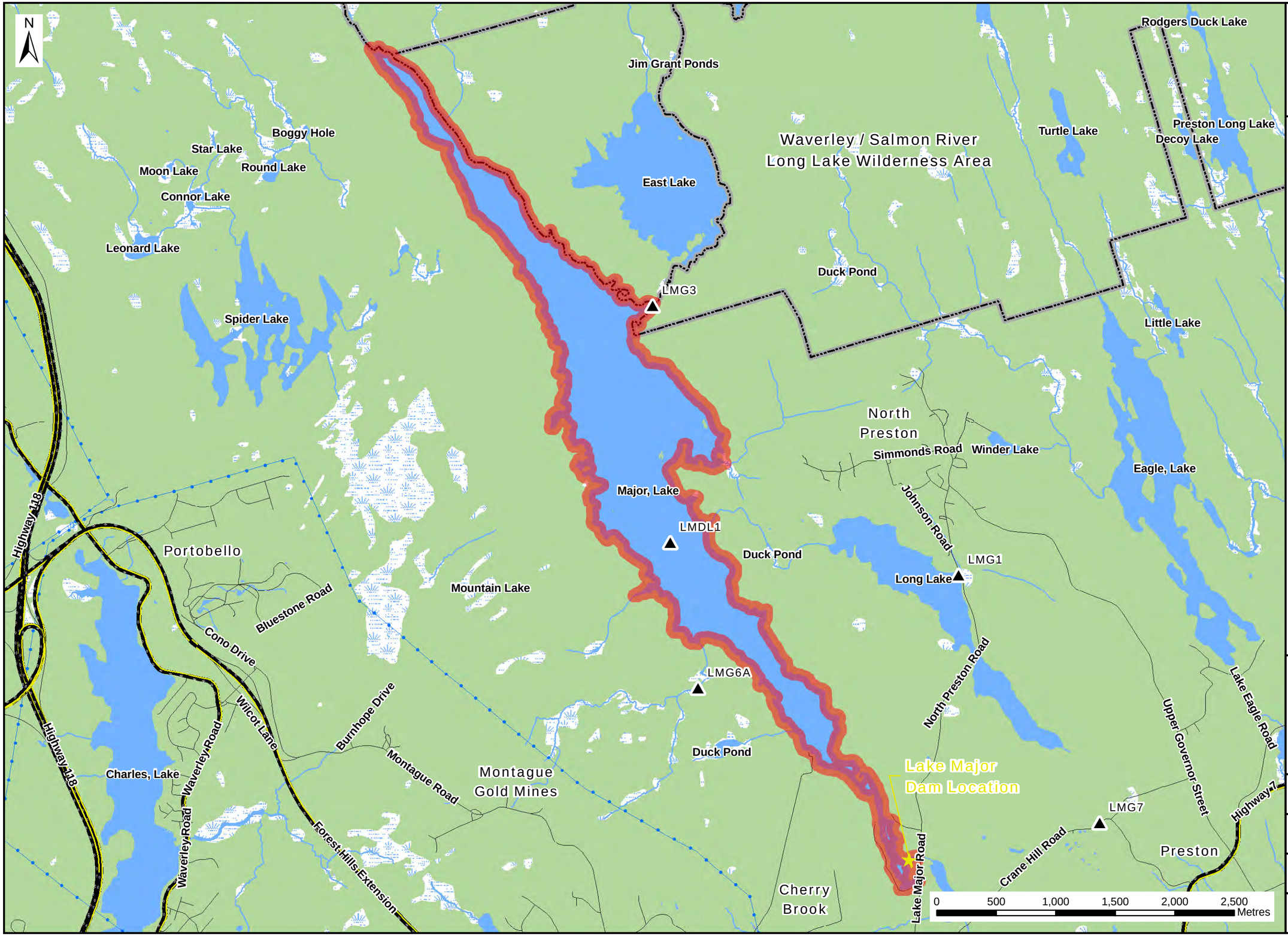
Lake Name	Size (hectares)
Chapman Lake	2.83
North Red Trout Lake	11.32
Fry Pan Hole	0.78
Three Mile Lake	53.24
Birch Lake	4.70
Lookout Lake	5.54
Fox Lake	2.79
Poor Trout Lake	23.37
South Red Trout Lake	25.77
Frying Pan Lake	6.96
Little Frying Pan Lake	0.70
Duck Lake	3.42
Little Duck Lake	1.89
Long Duck Lake	20.65
Dudley Lake	8.48
Soldier Lake Gullies	2.19
East Lake	98.95
Long Lake	64.97
Major Lake	377.22
Spider Lake	63.11
Boggy Hole	0.74
Round Lake	2.40
Star Lake	0.54
Moon Lake	0.80
Conner Lake	1.78
Leonard Lake	4.32
Duck Pond	2.08
Mountain Lake	0.16
Ernst Lake	4.04
Black Lake	2.77
Jim Grant Ponds	0.60
Unnamed	0.75
Total Water Area	**799.86**

Source: Daltech 1999

In the 1960s, the former City of Dartmouth constructed the East Lake Dam, located upstream of Lake Major, as a storage structure to facilitate demand during periods of low water. The catchment areas for Lake Major and East Lake are 47.7 km^2 and 20.9 km^2, respectively (DalTech 1999).

4.3.2 Water Quality

Halifax Water completes annual water quality monitoring as part of the Source Water Quality Monitoring Program (SWQMP) at five locations in Lake Major (Drawing 4.5). The SWQMP



Notes:

1. Reference: Digital Topogrpahic Mapping by Nova Scotia Geomatics Centre.
2. Projection: NAD83(CSRS), UTM Zone 20 North.
3. Sample Locations are Approximate. This Map is for Presentation Purposes Only & Not Intended for Legal Use.

Legend:

- *Water Quality Sample Locations*
- Study Area
- Game Management
- Public Roads
- Major Roads and Highways
- Existing Transmission Lines
- Mapped Stream
- Mapped Wet Areas
- Water Bodies

Lake Major Dam Replacement - Water Quality Sample Locations

Strum 20 YEARS Taking Charge CONSULTING

*Engineering * Surveying * Environmental*
*Bedford * Antigonish * Moncton * Deer Lake*

Date: December 2016	Project #: 16-5799
Scale: 1:30,000	Drawing #: **4.5**
Drawn By: H. Serhan	
Checked By: H. Mosher	

measures the quality of collected raw water against CCME Canadian Water Quality Guidelines for the Protection of Aquatic Life, where applicable. Surface water sampling is completed every second month. Table 4.5 outlines the average surface water quality sampling results from 2015.

Table 4.5. Summary of the 2015 Water Quality Sampling Survey

Site	pH	Turbidity	Conductivity	Colour	Nitrate	Total Phosphorus	Total Organic Carbon	E. Coli	Chloride	Aluminum	Iron	Sodium
Unit	**-**	**NTU**	**µS/cm**	**TCU**	**mg/L**	**mg/L**	**mg/L**	**cfu/100 ml**	**µg/L**	**µg/L**	**µg/L**	**µg/L**
CCME Guideline	**-**	**-**	**-**	**-**	**550**	**-**	**-**	**-**	**-**	**5 (pH<6.5) 100 (pH≥6.5)**	**300**	**-**
LMG1	6.63	1.14	212	20	0.15	0.012	3.0	30	30	35	82	18,500
LMG3	4.66	0.56	22	66	ND	0.009	5.8	4	3.8	270	90	2,150
LMG6A	5.65	0.93	63	70	0.058	0.016	8.3	29	13	215	910	8,000
LMG7	6.11	10.4	487	22	ND	0.004	4.5	ND	4.7	210	124	3,433

Deep lake sampling is completed once annually, field parameters measured every metre of the water column, and detailed analysis on samples taken right below the water surface, in the middle of the water column, and near the bottom. Table 4.6 outlines the deep lake water quality results for 2014 and the depths at which they were collected, from site LMDL1.

Table 4.6. Deep Lake Sampling Water Quality Results for 2014

Parameter	Unit	Surface (0.5 m)	Middle (7 m)	Bottom (34 m)
Temperature	°C	23.17	17.8	3.41
DO	mg/L	8.62	8.8	11.16
DO	%	100.9	92.6	90.6
pH	-	4.76	4.7	4.68
Conductivity	µS/cm	31	30	31
Turbidity	NTU	0.8	0.7	0.72
Colour	TCU	31	34	38
Total Nitrogen	mg/L	0.15	0.14	0.16
Total Phosphorus	mg/L	ND	ND	ND
Total Organic Carbon	mg/L	4.3	4.2	4.4
Total Suspended Solids	mg/L	1.6	1.6	1
E.Coli	cfu/100 mL	ND	ND	ND

Parameter	Unit	Surface (0.5 m)	Middle (7 m)	Bottom (34 m)
Aluminum	µg/L	200	190	220
Iron	µg/L	73	85	130
Sodium	µg/L	3,200	3,300	3,500
TSI	28.2 (Oligotrophic)			

The results of water quality monitoring indicate that Lake Major is an oligotrophic with low phosphate and biological productivity. Additionally, its dark coloration and low pH classify it as a dystrophic lake, typical of Nova Scotian Lakes (Davis and Browne 1996). The water column within Lake Major is defined by low suspended solids and a defined hypolimnion with colder, oxygen rich waters below.

Downstream water quality measurements were measured directly downstream of the existing dam as part of the water withdrawal approval application in 2006. Average values are outlined in Table 4.7.

Table 4.7. Average Water Quality Parameters Downstream of Dam

Parameter	Average value
Flow (m^3/s)	0.030
Flow (cm/s)	22.72
pH	4.81
DO (%)	89.86
Temperature (°C)	20.96

Source: AMEC 2006

4.3.3 Fish and Fish Habitat

A review of the Atlantic Canada Conservation Data Center (ACCDC) database for fish species recorded within a 100 km radius of the Study area was completed. All species, including status rankings, are provided in Table 4.8.

Table 4.8. Fish Species Recorded within a 100 km radius of the Study Area

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status[2]	COSEWIC Status[3]	NSDNR Status[4]	NS S-Rank[5]
Alewife	Alosa pseudoharengus	Not Listed	Not Listed	Not Listed	Sensitive	S3
American Eel	*Anguilla rostrate*	Not Listed	Not Listed	Threatened	Secure	S5
Atlantic Salmon	*Salmo salar*	Not Listed	Not Listed	Endangered	May Be At Risk	S1
Atlantic Salmon	*Salmo salar – Inner Bay of Fundy Population*	Endangered	Not Listed	Endangered	May Be At Risk	S1
Atlantic Sturgeon	*Acipenser Oxyrhynchus*	Not Listed	Not Listed	Threatened	May Be At Risk	S1

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status[2]	COSEWIC Status[3]	NSDNR Status[4]	NS S-Rank[5]
Atlantic Whitefish	*Coregonus huntsman*	Endangered	Endangered	Endangered	Exotic	S1
Brook Trout	*Salvelinus fontinalis*	Not Listed	Not Listed	Not Listed	Sensitive	S3
Lake Trout	*Salvelinus namaycush*	Not Listed	Not Listed	Not Listed	Sensitive	S3
Striped Bass – Bay of Fundy pop.	*Morone sacatilis pop. 2*	Not Listed	Not Listed	Endangered	May Be At Risk	S1B

Source: ACCDC 2016

[1] Government of Canada 2016; [2] NS *ESA* 2015; [3] COSEWIC 2015; [4]NSDNR 2015; [5]ACCDC 2016

A list of fish species within Lake Major (Table 4.9) was compiled from previous studies performed around the lake, including:

- Lake Major Surface Water Withdrawal Approval Application Report (AMEC 2006);
- The Natural History of Nova Scotia (Davis and Browne 1996);
- Provision of Fish Passage at Lake Major Dam – 2015 Report (Levy and Collins 2016);
- Description of selected lake characteristics and occurrence of fish species in 781 Nova Scotia lakes (Alexander et al. 1986); and
- Analysis of Fish Habitat Versus Discharge on Little Salmon River, NS (Collins et al. 2015).

Table 4.9. Fish Species Recorded in Lake Major and Little Salmon River

Species Name	SARA Status[1]	COSEWIC Status[2]	NS ESA Status[3]	NSDNR Status[4]	NS S-Rank[5]	Notes
American Eel *Anguilla rostrata*	No Status	Threatened	Not Listed	4 – Secure	S5	
Atlantic Salmon *Salmo salar*	Not Listed	Endangered	Not Listed	2 – May be at Risk	S2	Individuals have not been identified in Little Salmon River since the 1980's, so their presence is unlikely[6]
Banded Killifish *Fundulus diaphanous*	Not at Risk	Not at Risk	Not Listed	4 – Secure	S5	
Brook Trout *Salvelinus fontinalis*	Not Listed	Not Listed	Not Listed	3 - Senstive	S4	Migratory population recorded passing through the dam[6]
Brown Bullhead *Ameiurus nebulosus*	Not Listed	Not Listed	Not Listed	4 – Secure	S5	
Common Shiner *Lucilus cornutus*	Not Listed	Not Listed	Not Listed	4 – Secure	S5	

Species Name	SARA Status[1]	COSEWIC Status[2]	NS ESA Status[3]	NSDNR Status[4]	NS S-Rank[5]	Notes
Gaspereau *Alosa pseudoharengus*	Not Listed	Not Listed	Not Listed	3 – Sensitive	S4	Large migratory population recorded passing through the dam[6]
Golden Shiner *Notemigonus crysoleucas*	Not Listed	Not Listed	Not Listed	4 – Secure	S5	
Lake Trout *Salvelinus namaycush*	Not Listed	Not Listed	Not Listed	3 - Sensitive	SNA	
Stickleback *Pungitius sp.*	Not Listed	Not Listed	Not Listed	4 – Secure	S5	
White Perch *Morone americana*	Not Listed	Not Listed	Not Listed	4 – Secure	S4	
White Sucker *Catostomus commersonii*	Not Listed	Not Listed	Not Listed	4 – Secure	S5	Small migratory population recorded passing through the dam[6]
Yellow Perch *Perca flavescens*	Not Listed	Not Listed	Not Listed	4 – Secure	S5	

[1] Government of Canada 2016; [2] NS *ESA* 2015; [3] COSEWIC 2015; [4]NSDNR 2015; [5]ACCDC 2016, [6]Levy and Collins, 2016

Fish species that have been recorded within the Lake Major watershed were screened against the criteria outlined in the document "Guide to Addressing Wildlife Species and Habitat in an EA Registration Document" (NSE 2009) to develop a list of priority species (*i.e.*, SOCI), which are assessed further as a VEC.

In the context of this EA, priority species include those that are:

- Listed under *SARA* as "Endangered", "Threatened", or "Special Concern";
- Listed under the NS *ESA* as "Endangered", "Threatened", or "Vulnerable";
- Assessed by COSEWIC as "Endangered", "Threatened", or "Special Concern";
- Assessed by NSDNR as "1 - At Risk", "2 - May be at Risk", or "3 - Sensitive", or "5 – Undetermined"; or
- Ranked by ACCDC as "S1", "S2", or "S3".

Priority fish species include:

- American eel (*Anguilla rostrata*) – "Threatened" (COSEWIC);
- Brook Trout (*Salvelinus fontinalis*) – "3 - Sensitive" (NSDNR);
- Lake Trout (*Salvelinus namaycush*) – "3 – Sensitive" (NSDNR); and
- Gaspereau (*Alosa pseudoharengus*) – "3 – Sensitive" (NSDNR).

American Eel

The distribution of the American eel ranges from South America to Greenland in accessible freshwater systems that are connected to the Atlantic Ocean. This species is a catadromous fish which spawns in the Sargasso Sea, and juveniles drifts in ocean currents, eventually migrating inland through freshwater rivers and their tributaries. In later life stages, American eels persist in a variety of freshwater and estuarine habitats (COSEWIC 2012).

American eels are most active at night, and hide in mud, sand, and graves, and under woody debris and rocks in shallow waters during the day. Eels are extremely mobile and can access seemingly inaccessible habitats through small channels and wet grass; small eels are even capable of climbing vertical barriers. The American eel is commonly found throughout Nova Scotia and has been observed at the Lake Major pumping station. Although listed as 'Threatened' by COSEWIC, the American eel can be considered declining in some locations and be stable elsewhere, such as in Nova Scotia where it is listed by the provincial government as 'Secure'. Potential impacts to American eels are discussed further in Section 10.2.

Brook Trout

Common throughout Nova Scotia and a popular sport fish, the brook trout occurs in river and lake environments as well as marine. The freshwater population prefers clear, cool lakes with good oxygen levels (Scott and Crossman 1985). In the fall (October –November) brook trout will migrate to a spawning locations within riffled streams and fry will emerge in the spring (N.S. Legislature 2016). Migrating individuals (sea-run) remain in freshwater until they are 2-3 years of age and begin migration to salt water in the spring. Non-migrating freshwater species travel a much shorter distance for migration (Macmillan and LeBlanc 2002; Mills 1971).

Brook trout are a poor competitor among other fish species and do well in areas where competition is lower. Competition with bass and perch, habitat loss, and overexploitation threaten this species, however, a management plan and stocking programs are established in Nova Scotia. Approximately two million brook trout are stocked annually. However, catch rate has declined 60% in the past 25 years (NS Department of Agriculture and Fisheries 2005). Potential impacts to Brook Trout are discussed further in Section 10.2.

Lake Trout

Lake trout thrive in large, deep lakes with a cold water and a well-oxygenated hypolimnion. They normally inhabit only lakes with a depth greater than 50 feet due to their requirement for cold, deep waters (OFS 2016). Although active near the water surface during the winter, they begin moving from shallow waters into deep regions of lakes once surface water temperatures begin to warm in the spring (NSDAF 2005). Spawning generally occurs on rocky reefs or shoals when water temperatures are between 6 and 15°C. They are the only *Salvelinus* species that is restricted to freshwater. Due to their lake depth requirements, Lake Trout are uncommon in Nova Scotia and relatively little is known about them (NSDAF 2005). Potential impacts to Lake Trout are discussed further in Section 10.2.

Gaspereau

The Gaspereau, also referred to as the Alewife, is an anadromous schooling fish. They inhabit predominantly marine waters, returning to freshwater to spawn in the spring. Spawning occurs over sandy or gravel substrate where eggs are randomly scattered (CRI 2016). Adults return to sea shortly after spawing, where young-of-the-year will remain in freshwater for the summer, migrating to the sea in late autumn (DFO 2007). Gaspereau will remain in salt water until they mature, at around age 3, when they begin migrating again. Alewife are fished commercially and are a food source for other fish species and birds. There is a well-documented population that migrates through Lake Major annually. Potential impacts to Gaspereau are discussed further in Section 10.2.

4.3.4 Freshwater Mussels

The Nova Scotia Significant Species and Habitat Database (NSDNR 2014) contains 44 unique species and/or habitat records pertaining to freshwater mussels within a 100 km radius of the Study area. These records include:

- One-hundred-and-thirty-six records classified as 'Species at Risk', relating to Triangle Floater (*Alasmidonta undulata*);
- Sixty-six records classified as 'Species at Risk', relating to Brook Floater (*Alasmidonta varicosa*); and
- Two records classified as 'Of Concern', relating to molluscs.

There are no records relating to significant freshwater mussel habitat within 10 km of the Study area.

The ACCDC database (2016) indicates that four species of freshwater mussels have been recorded within a 100 km radius of the Study area (Table 4.10).

Table 4.10. Freshwater Mussel Species Recorded within a 100 km radius of the Study Area

Common Name	Scientific Name	*SARA* Status[1]	COSEWIC Status[3]	NS *ESA* Status[2]	NSDNR Status[4]	NS S-Rank[5]
Brook Floater	*Alasmidonta varicosa*	Special Concern	Special Concern	Threatened	3 – Sensitive	S1S2
Eastern Pearlshell	*Margaritifera margaritifera*	Not Listed	Not Listed	Not Listed	3 – Sensitive	S4
Eastern Lampmussel	*Lampsilis radiata*	Not Listed	Not Listed	Not Listed	3 – Sensitive	S2
Triangle Floater	*Alasmidonta undulata*	Not Listed	Not Listed	Not Listed	4 – Secure	S2S3

Source: ACCDC 2016

[1]Government of Canada 2016; [2]NS ESA 2015; [3]COSEWIC 2015; [4]NSDNR 2015; [5]ACCDC 2016

A freshwater mussel survey was completed at the Study Area September 19, 2016, following a qualitative survey methodology. A stretch of shoreline was surveyed for ≥ 4 person hours within water depths of up to 1 m. In addition, searches for evidence of mussels through individual shells or middens on the shoreline was conducted during the freshwater mussel survey and concurrently during other field surveys at the Study Area.

Freshwater mussel species that have been recorded within the 100 km of the Study Area were screened against the criteria outlined in the document "Guide to Addressing Wildlife Species and Habitat in an EA Registration Document" (NSE 2009) to develop a list of priority species (*i.e.*, SOCI), which are assessed further as a VEC.

Priority freshwater mussel species include those that are:

- Listed under *SARA* as "Endangered", "Threatened", or "Special Concern";
- Listed under the NS *ESA* as "Endangered", "Threatened", or "Vulnerable";
- Assessed by COSEWIC as "Endangered", "Threatened", or "Special Concern";
- Assessed by NSDNR as "1 - At Risk", "2 - May be at Risk", or "3 - Sensitive", or "5 – Undetermined"; or
- Ranked by ACCDC as "S1", "S2", or "S3".

Brook Floater

The Brook Floater (*Alasmidonta varicosa*) is a freshwater mussel native to North American and is found along the US eastern seaboard, and in Nova Scotia and New Brunswick. It is kidney shaped, with one end that is inflated and rounded (DFO 2016). The shell is smooth with growth lines forming ridges and varies in colour from yellow-green to brown-black. They are considered medium-sized and can be up to 70 mm long, 40 mm high, and 30 mm wide (DFO 2016).

Brook Floaters are found in rivers, streams, and lakes. They prefer watercourses with a moderate to high water flow with rocks, cobble, and sand-pocket areas and may also be found in certain lakes in Nova Scotia. Brook floaters rely on certain fish species to complete a portion of its life cycle. This means that the larvae attaches to the gills of a host fish and releases when it has grown to the appropriate size (DFO 2016).

The existing range in Nova Scotia includes parts of Guysborough County, Colchester County, Lunenburg County, and Annapolis County (DFO 2016). ACCDC data indicate that the closest observation of Brook Floater to the Study Area was 33.4 ± 0.0 km away (ACCDC 2016). Potential impacts to Brook Floaters are discussed further in Section 10.2.

Eastern Pearlshell

The Eastern Pearlshell is an elongated shaped mussel, with a light brown to black coloured shell without rays (CDEP 2013). It is found in streams and small rivers that support trout or salmon populations and exist in a variety of substrate (CDEP 2013). Their thick shell allows them the ability to withstand fast flowing, rocking conditions unlike other mussel species. This species is not found in lakes or ponds (CDEP 2013). ACCDC data indicate that the closest observation of Eastern Pearlshell to the Study Area was 25.8 ± 1.0 km away (ACCDC 2016). Due to the lack of proper habitat in the Study Area, it is unlikely that the Project will impact this species. No further consideration of effects and mitigation has been undertaken.

Eastern Lampmussel

The Eastern Lampmussel is an ovate or subovate shaped mussel, with females slightly more rounded (CDEP 2013). S hell colour is yellowish-green to yellowish-brown, greenish-brown, or

brownish-black, with numerous and prominent shell rays (CDEP 2013). It is one of the more common and ecologically dominant unionoid species in eastern Canada, found in Ontario, Nova Scotia, New Brunswick, and Quebec (McAlpine and Smith 2010).

The Eastern Lampmussel is found in streams, rivers, ponds, and lakes (CDEP 2013). It prefers sand and gravel, but is occasionally found in other substrates such as silty or muddy bottoms (CDEP 2013). Potential host species include warm-water fish species such as smallmouth bass, white perch, and yellow perch (McAlpine and Smith 2010). ACCDC data indicate that the closest observation of this species to the Study area was 25.8 ± 0.0 km away (ACCDC 2016). The Study Area provides potential habitat and potential impacts to Brook Floaters are discussed further in Section 10.2.

Triangle Floater
The Triangle Floater is a subovate mussel and a shell coloured yellowish-green to green brown or black with numerous shell rays (CDEP 2013). It is most common in cold-water streams and rivers, but can be found in lakes and ponds, unlike other similar *Alasmidonta* species (CDEP 2013; McAlpine and Smith 2010). It prefers sand and gravel bottoms, living in mostly a mixture of coarse or find gravel with sand and mud, as well as occasionally embedded in mud between larger stones (McAlpine and Smith 2010). It seems to be less sensitive to pollution and habitat disturbance, and uses a broad range of host species for larval distribution, than its close relatives such as the brook floater (CDEP 2013).

Preferred host species include Atlantic Salmon, Brook Trout, and Brown Trout (CDEP 2013). ACCDC data indicate that the closest observation of this species to the Study area was 8.3 ± 0.0 km away (ACCDC 2016). The Study Area provides potential habitat and potential impacts to Brook Floaters which are discussed further in Section 10.2.

4.4 Shoreline Habitat

4.4.1 Shoreline Vegetation

A review of the ACCDC database for recorded observations of vegetative species within a 100 km radius of the Study Area was completed. The ACCDC database review identified 382 vascular and nonvascular plant SOCI within a 100 km radius (ACCDC 2016). Of note is that sightings of many of the most common species are unreported to ACCDC, and are therefore under-represented or absent from the database. Consequently, a review of the ACCDC data reveals predominantly rare or noteworthy species despite the fact that these species certainly represent a small fraction of the existing vegetative community in any area.

A shoreline plant survey was completed August 4, 2016 in the Study area, as well as concurrently with the wetland survey. Vegetation present in the areas of potential impact along the shoreline of Lake Major were surveyed. A complete list of plant species identified during the survey is provided in Table 1, Appendix D.

The shoreline was dominated by a variety of shrubs and rocky outcrops. The shrub area is very narrow along much of the shoreline, particularly along the eastern shore, where steep slopes going

down to the water dominate. In areas of lower slopes, particularly along the western shore, a small shelf exists where areas of greater species diversity exist. Ground cover is predominantly tree needles and dead leaves, with a minimal herb covering. Sphagnum moss cover is present in wetter areas.

Species identified within 100 km of the Study Area were screened against the criteria outlined in the document "Guide to Addressing Wildlife Species and Habitat in an EA Registration Document" (NSE 2009) to develop a shortlist of priority (i.e., SOCI) species.

Priority vegetative species include those that are:

- Listed federally under *SARA* as "Endangered", "Threatened", or "Special Concern";
- Listed provincially under the NS *ESA* as "Endangered", "Threatened", or "Vulnerable";
- Assessed by COSEWIC as "Endangered", "Threatened", or "Special Concern";
- Assessed by NSDNR as "At Risk", "May be at Risk" or "Sensitive";
- Ranked by ACCDC as "S1", "S2", or "S3".

A full list of priority species is available in Table 2 (Appendix D). Potential effects of the Project on terrestrial vegetation and habitat, including priority species, are further addressed in Section 10.3.

4.4.2 Wetlands

4.4.2.1 Desktop Review

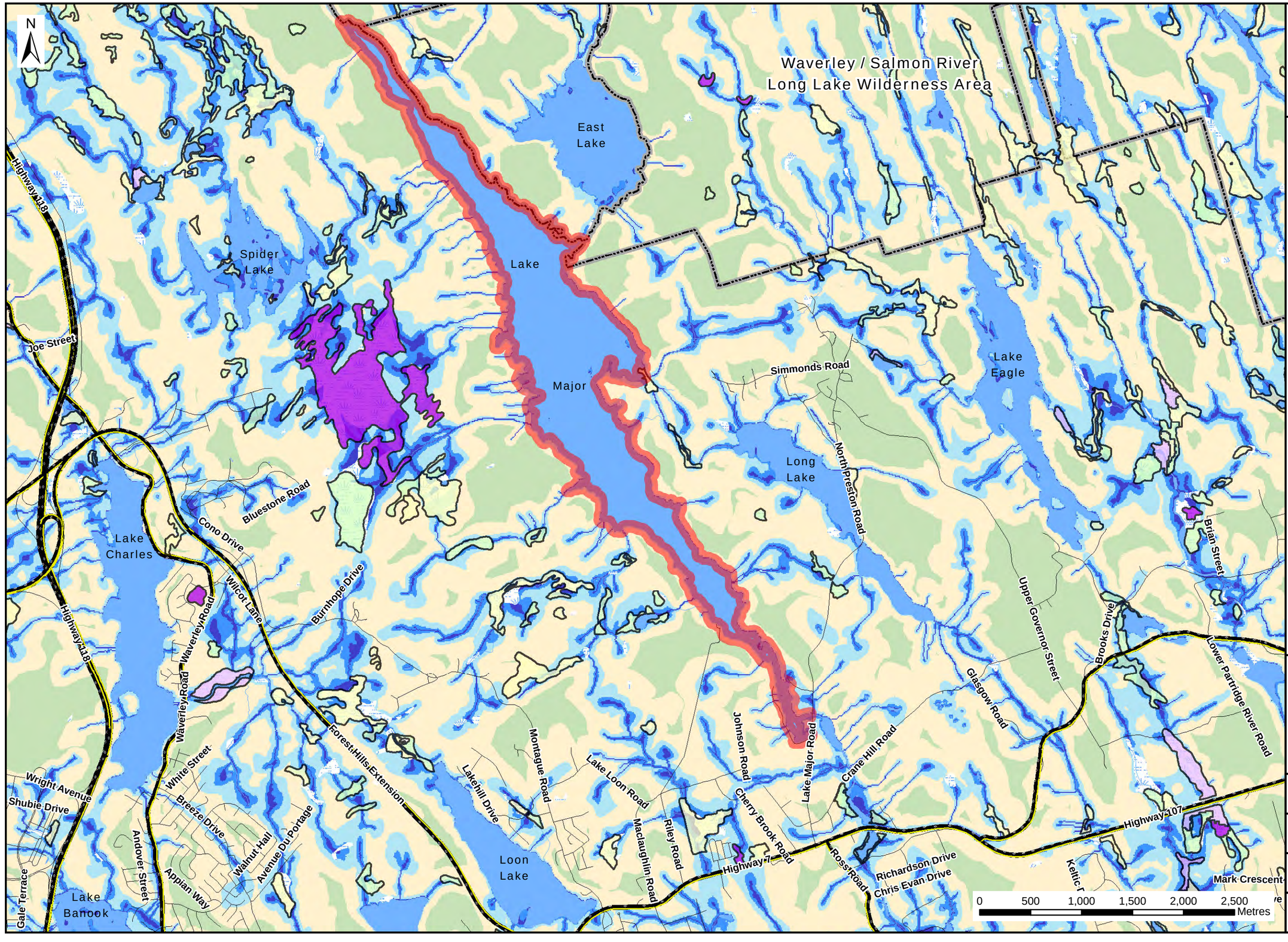
A desktop identification of the location and extent of potential wetlands across the Study Area was completed by reviewing the following information sources:

- Satellite and aerial photography;
- Nova Scotia Wet Areas Mapping database (WAM) (NSDNR 2012a);
- Nova Scotia Geomatics Centre; and
- NS Significant Species and Habitat Database (NSDNR 2014).

The NS Significant Species and Habitat Database identifies one area of wetland habitat within the Study Area boundaries (Drawing 4.6). A 1.594 ha marsh is located along the eastern edge of the lake, 4 km north of the existing dam.

The WAM database indicates the potential for numerous inflow channels into the lake; however, the steep slopes in this area do not suggest that they may have associated wetlands. There are two areas that may support wetland habitat in the middle of the lake along the eastern edge, in the proximity of identified marsh, 4 km north of the existing dam.

The NS Geomatics Centre's topographic data series suggests steep sides to the lake which is not conducive to wetland habitat; particularly along the western edge of the lake and sections at the top and middle of the eastern side of the lake. Numerous watercourses were identified flowing into the Lake. One waterbody is located east of the lake which drains through an area of less steep topography which may have associated wetlands.



Notes:

1. Reference: Bing Satellite Imagery. Digital Topographic Mapping by Nova Scotia Geomatics Centre. Wet Areas Mapping & Wetland Inventory by Nova Scotia Department of Natural Resources (NS DNR).
2. Projection: NAD83(CSRS), UTM Zone 20 North.

Legend:

- Study Area
- Game Management
- Public Roads
- Major Roads and Highways
- Mapped Stream
- Mapped Wet Area
- Water Bodies

NS DNR Wetland Inventory (Habitat)

- Bog or Fen
- Fen
- Marsh
- Salt Marsh
- Swamp

Depth to Water Table (m)

- 0 - 0.10 m
- 0.11 - 0.50 m
- 0.51 - 2 m
- 2.01 - 10 m
- > 10 m

Lake Major Dam Replacement - Desktop Review Results

Strum Consulting — 20 Years Taking Charge

*Engineering * Surveying * Environmental*
*Bedford * Antigonish * Moncton * Deer Lake*

Date: December 2016	Project #: 16-5799
Scale: 1:35,000	Drawing #: **4.6**
Drawn By: H. Serhan	
Checked By: H. Mosher	

4.4.2.2 Field Surveys

Wetland field assessments were completed during 2016 along the perimeter of Lake Major. A total of 2.92 ha of wetland habitat was identified in 13 wetlands along the shoreline of Lake Major (Drawings 4.7A and 4.7B). Most exist as treed swamps or treed swamp/fen complexes with sphagnum dominated organic substrates. Herb layers generally consisted of Canada Mayflower (*Maianthemum canadensis*), Bog Aster (*Oclemena nemoralis*), Swamp Dewberry (*Rubus hispidus*), White Meadowsweet (*Spiraea alba*), Royal Fern (*Osmunda regalis*), Bunchberry (*Cornus canadensis*), Starflower (*Trientalis borealis*), Northern Long Sedge (*Carex folliculata*), Star Sedge (*Carex echinata*), Threeway Sedge (*Dulichium arundinaceum*), Leatherleaf (*Chamaedaphne calyculata*), and Sweet Gale (*Myrica gale*). Common shrubs observed included Speckled Alder (*Alnus incana*), Rhodora (*Rhododendron canadensis*), Wild Raisin (*Viburnum nudum*), Sweet Gale, regenerating Black Spruce (*Picea mariana*), Balsam Fir (*Abies balsamea*), and Red Maple (*Acer rubrum*).

Ten of the wetlands observed, totalling an area of 2.63 ha, are contiguous with the lake. These lakes all consisted of treed swamps or fens and lake water is a main hydrologic source (Table 4.11). The remaining tree wetlands (WL1, WL10, and WL12), totalling an area of 0.29 ha, are hydrologically isolated from the lake, although they are located within 20 m of the shoreline. WL1 is separated from the lake by a large ridge standing approximately 2 m high from the water surface. WL10 and WL12 are both located 1-2 m up from the water surface, although WL10 does have a drainage outflow into the lake.

Table 4.11. Summary of Wetland Assessment

Wetland Type	Wetland IDs	Number Observed	Area (m^2)
Shrub Swamp	WL1, WL10	2	803.7
Treed Swamp	WL2, WL3, WL4, WL5, WL9	5	2,759.2
Treed Swamp/Fen Complex	WL6, WL7, WL8, WL13	4	22,705.9
Fen	WL11	1	842.8
Bog	WL12	1	2,065.6
Total number of wetlands observed		**13**	**29,177.2**
Total number of wetlands contiguous with lake edge		**10**	**26,307.9**

A provincial wetland alteration permit will be sought for the alteration location as required by the Nova Scotia Wetland Alteration Application process. This will be completed during the permitting stage of the Project and will include a characterization of wetland function affected by the development footprint. Detailed mitigation measures and best management practices (BMP) to reduce adverse effects on the altered wetland, as well as the adjacent, non-altered wetlands will be outlined as part of this process. Compensation for direct impacts to the wetland will be provided in accordance with NSE requirements.

The completed wetland delineation report is available in Appendix E.

4.5 Terrestrial Fauna

Information regarding terrestrial fauna for the Study Area, including any SOCI, was obtained through a combination of desktop review and field studies.

N

Waverley / Salmon River
Long Lake Wilderness Area

Spider Lake

Detail E
Figure 3B

Detail F
Figure 3B

Lake

Detail D
Figure 3B

Detail G
Figure 3B

Detail C
Figure 3B

Major

Detail B
Figure 3B

Detail H
Figure 3B

Long Lake

Detail A
Figure 3B

Simmonds Road
Donald Lane
Cain Street
Johnson Road
North Preston Road
Lake Major Road
Burnhope Drive
Montague Road
Gold Lane
Forest Hills Extension

Lake Eagle

0 200 400 600 800 1,000
Metres

Notes:

1. Reference: Bing Satellite Imagery. Digital Topographic Mapping by Nova Scotia Geomatics Centre.
2. Projection: NAD83(CSRS), UTM Zone 20 North.
3. GPS Data Collected is Approximate and Typically to +/-5m Accuracy.

Legend:

- Confirmed Wetland Boundary

Field Identified Wetlands (Habitat)

- Bog
- Fen
- Riparian Treed Swamp
- Shrub Swamp
- Treed Swamp
- Assessment Area
- Game Management
- Public Roads
- Major Roads and Highways
- Mapped Stream
- Water Bodies

Lake Major Dam Replacement - Survey Results

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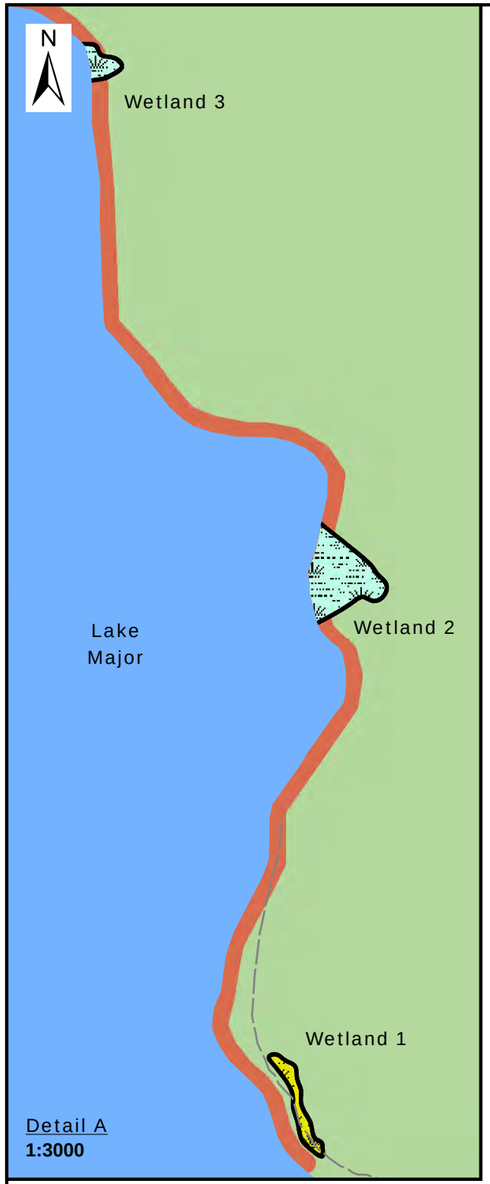
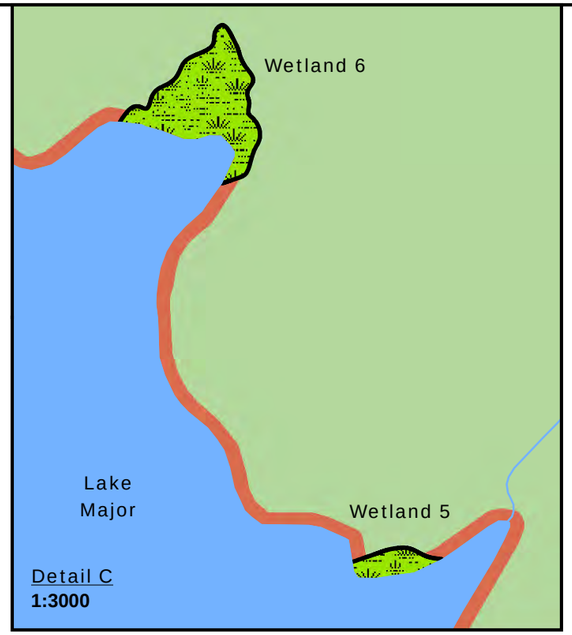
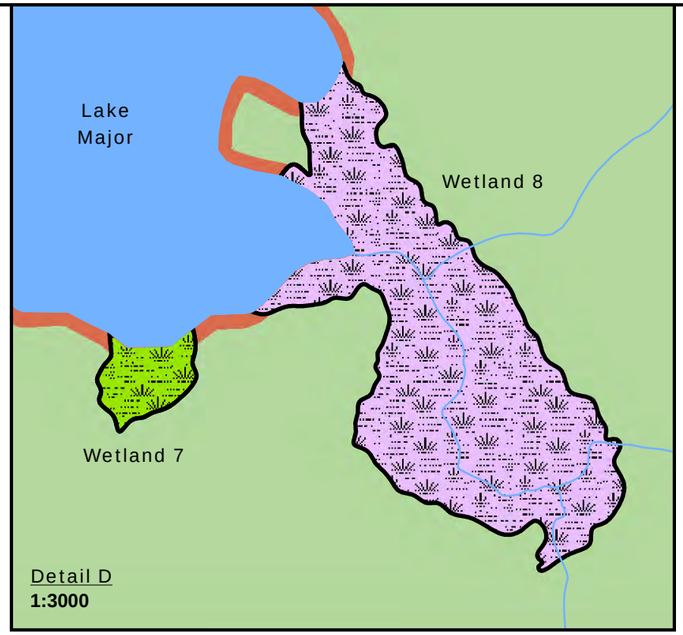
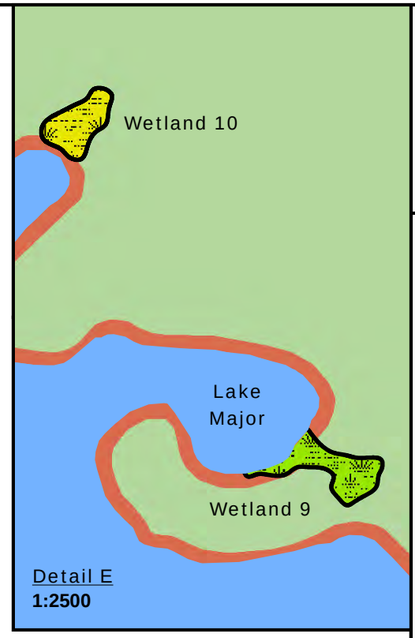
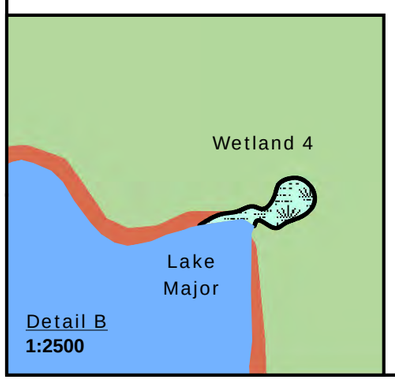
Date: December 2016	Project #: 16-5799
Scale: 1:35,000	Drawing #: **4.7A**
Drawn By: H. Serhan	
Checked By: H. Mosher	

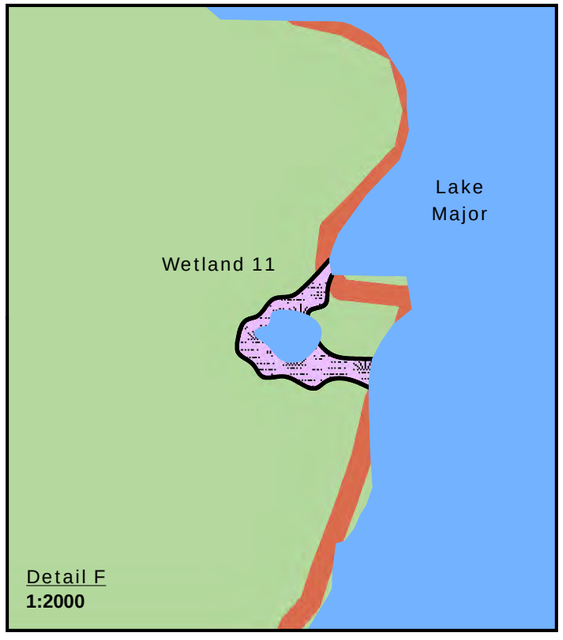


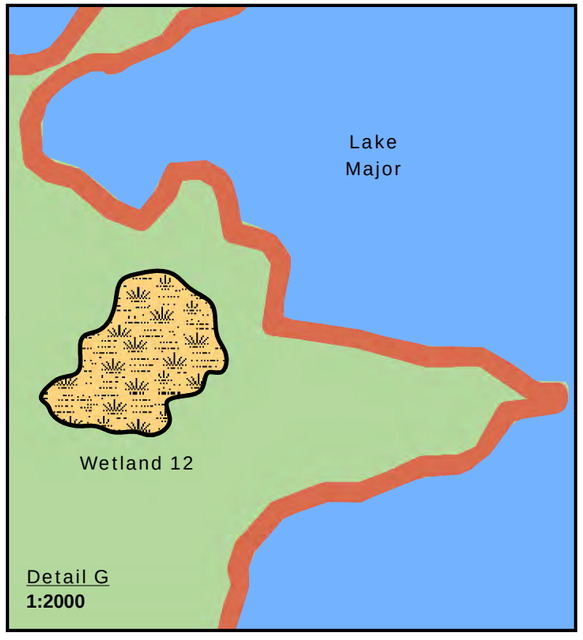


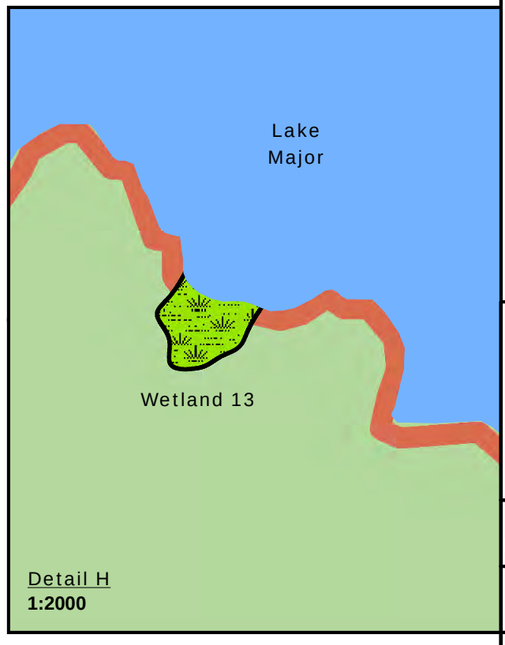












0 20 40 60 80 100 Metres

Notes:

1. Reference: Bing Satellite Imagery. Digital Topographic Mapping by Nova Scotia Geomatics Centre.
2. Projection: NAD83(CSRS), UTM Zone 20 North.
3. GPS Data Collected is Approximate and Typically to +/-5m Accuracy.

Legend:

- Confirmed Wetland Boundary

Field Identified Wetlands (Habitat)

- Bog
- Fen
- Riparian Treed Swamp
- Shrub Swamp
- Treed Swamp
- Assessment Area
- Public Roads
- Access Roads / Trails
- Mapped Stream
- Mapped Indefinite Stream
- Water Bodies

Lake Major Dam Replacement - Survey Results

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Date: December 2016	Project #: 16-5799
Scale: 1:35,000	Drawing #: **4.7B**
Drawn By: H. Serhan	
Checked By: H. Mosher	

Faunal species that have been recorded within 100 km of Lake Major were screened against the criteria outlined in the document "Guide to Addressing Wildlife Species and Habitat in an EA Registration Document" (NSE 2009) to develop a list of priority species (*i.e.*, SOCI), which are assessed further in Section 10.3.

In the context of this EA, priority species include those that are:

- Listed under *SARA* as "Endangered", "Threatened", or "Special Concern";
- Listed under the NS *ESA* as "Endangered", "Threatened", or "Vulnerable";
- Assessed by COSEWIC as "Endangered", "Threatened", or "Special Concern";
- Assessed by NSDNR as "1 - At Risk", "2 - May be at Risk", or "3 - Sensitive", or "5 – Undetermined"; or
- Ranked by ACCDC as "S1", "S2", or "S3".

4.5.1 Mammals

The Nova Scotia Significant Species and Habitat Database (NSDNR 2014) contains eight unique species and/or habitat records pertaining to terrestrial mammals within a 100 km radius of the Study area. These records include:

- Eight records that are classified as "Deer Wintering", which relate to known over-wintering habitat for White-tailed deer (*Odocoileus virginianus*); and
- One record classified as 'Other Habitat', relating to American Black Bear (*Ursus americanus*).

There are no records relating to significant terrestrial mammal habitat within 10 km of the Study area.

The ACCDC database (2016) indicates that six species of terrestrial mammals have been recorded within a 100 km radius of the Study area (Table 4.12).

Table 4.12. Mammal Species Recorded within a 100 km Radius of the Study Area

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status[2]	COSEWIC Status[3]	NSDNR Status[4]	NS S-Rank[5]
Canadian Lynx	*Lynx Canadensis*	No Listed	Endangered	Not At Risk	1 - At Risk	S1
Long-tailed Shrew	*Sorex dispar*	Special Concern	Not Listed	Not At Risk	3 - Sensitive	S2
Southern Flying Squirrel	*Glaucomys Volans*	Special Concern	Not Listed	Not At Risk	3 - Sensitive	S2S3
Mainland Moose	*Alces americanus*	Not Listed	Endangered	Not Listed	1 - At Risk	S1
Southern Bog Lemming	*Synaptomys cooperi*	Not Listed	Not Listed	Not Listed	4 - Secure	S4
Fisher	*Pekania pennant*	Not Listed	Not Listed	Not Listed	3 - Sensitive	S3

Source: ACCDC 2016, [1]Government of Canada 2016; [2]NS ESA 2015; [3]COSEWIC 2015; [4]NSDNR 2015; [5]ACCDC 2016

Of note is that sightings of many of the most common species are unreported to ACCDC, and are therefore under-represented or absent from the database. Consequently, a review of the ACCDC data reveals predominantly rare or noteworthy species despite the fact that these species certainly represent a small fraction of the existing mammalian community in the area.

A targeted mammal survey was not completed in the Study Area, however, observations for mammal sightings/evidence were made concurrently with other surveys. An otter (*Lontra canadensis*; 'Secure' (NSDNR) and 'S5' (ACCDC)) was viewed swimming in the lake near the dam, waiting for fish from the fish syphon. A beaver [Castor canadensis; 'Secure' (NSDNR) and 'S5' (ACCDC)] was observed south of the pump house, near a lodge.

Priority mammal species include:

- Canadian Lynx – "Endangered" (NS *ESA*), "At Risk" (NSDNR), "S1" (ACCDC)
- Long-tailed Shrew – "Sensitive" (NSDNR), "S2" (ACCDC);
- Southern Flying Squirrel – "Special Concern" (*SARA*), "Sensitive" (NSDNR), "S2S3" (ACCDC);
- Mainland Moose – "Endangered" (NS *ESA*), "At Risk" (NSDNR), "S1" (ACCDC); and
- Fisher – "Sensitive" (NSDNR), "S3" (ACCDC).

Canadian Lynx
Although they can occur in a diversity of habitats, Canada Lynx are typically found in coniferous forests with snowshoe hare (their main prey). They require areas with interspersed forest types suitable for different activities, such as those found in previously disturbed forests (insect outbreaks and fire). Deep snow packs are a requirement for Canada Lynx. They are most commonly found in areas of high elevation, which can provide them necessary deep snow, around Cape Breton such as Cape Breton Highlands, North Mountain, Keppoch Mountain, and Boisdale Hills (NSSAR 2016).

Canada Lynx were extirpated from the mainland during the 1950s, but will travel province wide when food is scarce. ACCDC data indicate that the closest observation of Canada Lynx to the Study Area was 87.0 ± 1.0 km away. Due to their restricted range, it is unlikely that the Project will impact this species. No further consideration of effects and mitigation for this species has been undertaken.

Long-tailed Shrew
Long-tailed shrew are closely associated with steep, talus slopes, usually close to running water, and the presence of rocks is considered a principal habitat component (Kirkland 1981). Thought to be found only in the Cobequid Mountains (Scott 1987; Woolaver *et al*. 1998), more recent research has identified an additional population of Long-tailed Shrew near Wolfville at Stewart Mountain, approximately 90 km to the northwest of the Study area (Shafer and Stewart 2006). ACCDC data indicate that the closest observation of Long-tailed shrew to the Study Area was 83.5 ± 5 km away.

Although steep slopes and rocks are found in the Study Area, due to the distance to known population sites it is unlikely that the Project will impact this species. No further consideration of effects and mitigation has been undertaken.

Fisher
Fisher prefer dense, mature to old-growth forests with continuous overhead cover (Allen 1983). Generally considered a forest-interior species (OMNR 2000), Fisher require in large tracts of well-connected habitat (Meyer 2007).

Fisher are distributed throughout mainland Nova Scotia, and trapping data suggests population concentrations in Cumberland, Colchester, and Pictou counties (NSDNR 2016). Approximately 4% of 1,754 Fisher trapped in Nova Scotia between 2000 and 2011 were harvested from Halifax and Hants Counties (NSDNR 2016). ACCDC data indicate that the closest observation of this species to the Study area was 77.1 ± 5 km away.

Suitable habitat in the form of large tracts of mature forest stands surrounds Lake Major. Potential impacts to Fishers and other mammals are further discussed in Section 10.3.

Mainland Moose
Habitat requirements for Mainland moose change throughout the year. Early successional growth, such as that provided by regenerating cutovers, offers quality foraging habitat for moose, and interspersed wetlands provide suitable summer habitat for cows and calves (Parker 2003; Snaith & Beazley 2004). Mature softwood forest is used as escape cover throughout the year, and also provides thermal relief during the summer months (Broders *et al*. 2012) and relief from deep snows in winter (Telfer 1970).

Five significant concentration areas for Mainland moose have been identified in Nova Scotia (NSDNR 2012b). The Study area is located approximately 40 km west of the closest such area, which stretches from the Tangier Grand Lake Wilderness Area to Guysborough. ACCDC records, meanwhile, indicate that the closest observation of this species to the Study area was 25.6 km away.

No evidence of Mainland Moose was observed at the Study area. The Study area does contain key habitat features to support the year-round needs of Mainland moose, namely aquatic sites (wetlands), small areas of softwood forest and extensive foraging habitat (clear cuts). The Study area forms part of a diversified landscape which may support this species, it is therefore possible that Mainland moose occur in the Study area.

Potential effects of the Project on this species, as well as other mammal species, are discussed further in Section 10.3.

Southern Flying Squirrel
Southern flying squirrel requires mast bearing trees for forage and tree cavities for nesting and in the Atlantic Region, southern flying squirrels select older forest stands (COSEWIC 2006). In Nova Scotia, the species demonstrates a particular affinity to red oak (*Quercus rubra*) which is most commonly found in mixed wood stands as opposed to pure hardwood stands (Lavers 2004).

In Nova Scotia, Southern flying squirrel occur primarily in a region bounded by the South Mountain in the north, Kentville in the east, New Ross in Lunenburg County to the south, and extends to Kejiimkujik National Park in the west (COSEWIC 2006). ACCDC data indicate that the closest

observation of this species to the Study area was 74.7 km away. Although the forests surrounding Lake Major provide suitable habitat for the Southern Flying Squirrel, it is unlikely to be impacted by changes to the shoreline and no further consideration of effects and mitigation for this species has been undertaken.

4.5.2 Herptofauna

The Nova Scotia Significant Species and Habitat Database (NSDNR 2014) contains 196 unique species and/or habitat records pertaining to reptiles and amphibians within a 100 km radius of the Study area. These records include:

- 172 that are classified in the database as "Species at Risk", all of which relate to the Wood Turtle (*Glyptemys insculpta*);
- One record classified as "Species of Concern", which relates to the Painted Turtle (*Chrysemys picta*); and
- Twenty-three records classified as "Other Habitat", which also relates to the Wood Turtle.

There are no records pertaining to herptofauna within a 10 km radius of the Study area.

The ACCDC database identifies four terrestrial herpetofauna species within a 100 km radius of the Study area (Table 4.13).

Table 4.13. Reptile and Amphibian Species Recorded within a 100 km Radius of the Study Area

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status[2]	COSEWIC Status[3]	NSDNR Status[4]	NS S-Rank[5]
Eastern Ribbonsnake – Atlantic Pop.	*Thamnophis sauritus – pop. 3*	Threatened	Threatened	Threatened	At Risk	S2S3
Four-toed Salamander	*Hemidactylium scutatum*	Not Listed	Not Listed	Not at Risk	Secure	S3
Snapping Turtle	*Chelydra serpentina*	Special Concern	Vulnerable	Special Concern	Sensitive	S3
Wood Turtle	*Glyptemys insculpta*	Threatened	Threatened	Threatened	Sensitive	S2

Source: ACCDC 2016

[1]Government of Canada 2016; [2]NS ESA 2015; [3]COSEWIC 2015; [4]NSDNR 2015; [5]ACCDC 2016

Of note is that sightings of many of the most common species are unreported to ACCDC, and are therefore under-represented or absent from the database. Consequently, a review of the ACCDC data reveals predominantly rare or noteworthy species despite the fact that these species certainly represent a small fraction of the existing reptilian and amphibian community in the area.

Targeted herptofauna surveys were not completed at the Study Area. However, the following species were observed during other field surveys on site:

- Common Gartersnake (*Thamnophis sirtalis*): "Secure" (NSDNR), "S5" (ACCDC).

Priority herptofauna species include:

- Common Snapping Turtle – "Special Concern" (*SARA*), "Vulnerable" (NS *ESA*), "Special Concern" (COSEWIC); "S3" (ACCDC);
- Four-toed Salamander – "S3" (ACCDC); and
- Wood Turtle – "Threatened" (*SARA*), "Threatened" (NS *ESA*), "Threatened" (COSEWIC), "3 - Sensitive" (NSDNR), "S2" (ACCDC).
- Eastern Ribbonsnake – "Threatened" (*SARA*), "Threatened" (NS *ESA*), "Threatened" (COSEWIC), "At Risk" (NSDNR), "S2S3" (ACCDC)

Common Snapping Turtle
Common snapping turtle, despite its conservation status, is considered relatively common in mainland Nova Scotia (Davis and Browne 1996). Common snapping turtle habitat is usually associated with slow moving water of moderate depth, with a muddy bottom and dense vegetation. Established populations are typically found in ponds, lakes, and river edges (COSEWIC 2008).

The species has a widespread distribution across Nova Scotia, including the central mainland region within which the Study area is located (COSEWIC 2008). ACCDC records indicate that the closest observation of this species to the Study area was 5.8 ± 10 km away.

No indication of Common Snapping Turtle was observed during field studies. However, Lake Major and its tributaries do provide potential habitat. Potential impacts to Snapping Turtles are discussed further in Section 10.3.

Four-toed Salamander
The four-toed salamander has a limited range in Canada (Desroches and Rodrigue 2004), with Nova Scotia situated near the species northern range limit. Although not believed to be sensitive or at risk in Nova Scotia, the four-toed salamander has been found at a relatively small number of widely separated localities (Gilhen 1984). The species is closely associated with sphagnum bogs.

Four-toed salamanders live in bogs, boggy streams, and flood plains in woodland areas. Adults prefer hardwood forests, while larvae live in water pools. The species requires both wetland and woodland habitats, so the protection of both is necessary to ensure their survival (NCC, 2016). During the summer, the species lives in mossy forests and requires sphagnum bogs for reproduction. During the winter they burrow underground, sometimes in groups and occasionally with other amphibians such as eastern red-backed salamanders (NCC 2016).

No indication of four-toed salamander was observed during field studies. One area of bog habitat was found along the perimeter of Lake Major (see Section 5.3.2), however, it was located approximately 2 m above the elevation of the lake and appeared to not share any hydrologic connectivity with the lake. Therefore, it is unlikely that four-toed salamanders will be impacted by Project activities.

Wood Turtle
Wood turtle requires three key habitat components: a watercourse, sandy substrate for nesting, and a forested area for thermal relief during the summer months (MacGregor and Elderkin 2003). Ideal streams have a clear, moderate flow, a hard bottom composed of sand or gravel, and are 7 to 100 feet wide (MacGregor and Elderkin 2003).

The species is found throughout the province but seems to be most abundant in central Nova Scotia, including the Salmon River and Shubenacadie River watersheds (MacGregor and Elderkin 2003). ACCDC data indicate that the closest observation of this species to the Study area was 8.2 ± 1 km away.

No indication of Wood turtle was observed during field studies. Although good habitat is available around tributary streams, ideal habitat is minimal in the Study Area and it is unlikely to be impacted by the proposed Project.

Eastern Ribbonsnake
Eastern Ribbonsnake is a semi-aquatic species typically found in freshwater habitats including wetlands, still water streams, lakeshores, and marshes (COSEWIC 2002). They are rarely found more than 30 m from the water's edge and prefer shallow waters with aquatic vegetation and amphibians (Government of Canada 2016).

In Nova Scotia, concentrations of Eastern Ribbonsnake are thought to be limited to interior portions of the Mersey, Medway, and LaHave River watersheds in the southwestern region of the province, although recent discoveries have expanded the known range of this species to include the Petite Rivière watershed (Gilhen et al. 2012). ACCDC data indicate that the closest observation of this species to the Study area was 99.1 ± 0.0 km away.

Although the Study Area provides suitable habitat for the Eastern Ribbonsnake, the substantial geographic separation from the species known range in Nova Scotia makes it unlikely that it exists in the Study Area.

4.6 Avifauna
The Study area is confined to Lake Major itself, but also encompasses the shoreline, wetlands and forest habitat around the lake. Shoreline habitat is primarily steep exposed rocky shoreline, but areas of lentic-confined marsh wetlands are also prevalent around the Lake, which were also included. As water levels in Lake Major were very low during the time of the surveys as a result of low rainfall levels, much of the shallow areas of the Lake were exposed, which provided unique foraging habitat for birds. These exposed lake bed areas were also included as part of the Study area. Forested areas consist primarily of mature softwood forests, often growing on well-drained talus slopes, but areas of regenerating forest, as well as areas disturbed by residential developments are also included in the southern portion of the Lake dear the existing dam.

Baseline information was utilized to gain insight into protected avifauna habitats, species utilization of the general area, and to identify SOCI potentially occurring at or near the Study area.

The closest Important Bird Area (IBA) (IBA Canada 2012) is the Musquodoboit IBA located 29 km east of the Study Area. The IBA is located at the seaward end of Musquodoboit Harbour, approximately 35 km east of downtown Dartmouth. Musquodoboit is a tidal inlet, largely enclosed by a barrier sand beach and many wooded islands.

The area supports huge congregations of Canada Geese from the breeding population in Newfoundland and Labrador. Throughout most of the year, high numbers of geese have been recorded at this site: during spring migration (8,000 geese representing 7% of the estimated population); during fall migration (2,000 geese about 2%); and during the winter (5,000 geese 4%). Since the 1960s, waterfowl surveys have been generally conducted several times per year. As more open water has appeared in the mid-1970s, geese have become increasingly more common in winter. American Black Ducks are also found in Musquodoboit Harbour in winter and can number as high as 2,000 to 3,000 birds. This represents 1% of the global population of the species. These numbers are peak numbers, while typical numbers are somewhat lower. Piping Plovers (globally vulnerable, nationally endangered) are also found at this site in breeding season (IBA Canada 2012).

The Study area is contained within map square 20MQ65 of the Maritime Breeding Bird Atlas (MBBA 2012). In the most recent edition of the MBBA (covering the years 2006-2010), 77 species were identified as being possible, probable, or confirmed breeders within this area. The following SOCI are considered confirmed breeders in the area:

- Common Nighthawk (*Chordeiles minor*) – "Threatened" (*SARA*), "Threatened" (NS *ESA*), "Threatened" (COSEWIC), "1 – At Risk" (NSDNR), "S3B" (ACCDC);
- Eastern Wood-Pewee (*Contopus virens*) – "Vulnerable" (NS *ESA*), "Special Concern" (COSEWIC), "3 - Sensitive" (NSDNR), "S3S4B" (ACCDC);
- Gray Jay (*Perisoreus canadensis*) – "3 - Sensitive" (NSDNR), "S3S4" (ACCDC);
- Northern Cardinal (*Cardinalis cardinalis*) - "S3S4" (ACCDC); and
- Tree Swallow (*Tachycineta bicolor*) – "3 - Sensitive" (NSDNR), "S4B" (ACCDC);

The NS Significant Species and Habitats database contains 435 unique records pertaining to birds and/or bird habitat within a 100 km radius of the Study area. These records include:

- 101 classified in the database as "Other Habitat", of which the majority relate to Bald Eagle (*Haliaeetus leucocephalus*) (71) and Osprey (*Pandion haliaetus*) (20), but also including records of Great Blue Heron (*Ardea herodias*) (4), Gray Partridge (*Perdix perdix*) (2), unclassified Cormorant species (2), Broad-winged Hawk (*Buteo platypterus*) (1) and Northern Harrier (*Circus cyaneus*) (1);
- 159 records classified as "Species of Concern", of which the majority relate to Common Loon (*Gavia immer*) (110), but also including records of Nelson's Sharp-tailed Sparrow (*Ammodramus nelsoni*) (16), unclassified Tern species (10), and Great Blue Heron (4), among;
- 46 records classified as "Migratory Bird", including feeding area for shorebirds (4), Common Eider (*Somateria mollissima*) (6), Great Blue Heron (9), American Black Duck (*Anas rubripes*) (5), Canada Goose (*Branta canadensis*) (4), Double-crested Cormorant

(*Phalacrocorax auritus*) (8), Black Guillemot (*Cepphys grylle*) (2), Great Cormorant (*Phalacrocorax carbo*) (1), and Herring Gull (*Larus argentatus*) (2); and

- 129 records classified as "Species at Risk", primarily relating to Common Loon (101) and Bald Eagle (100), but also including multiple records relating to Piping Plover (*Charadrius melodus*) (15), Peregrine Falcon (*Falco peregrinus*) (8), and Harlequin Duck (*Histrionicus histrionicus*) (4) among others.

There are 27 significant habitat features related to birds present within a 10 km radius of the Study area (Table 4.14).

Table 4.14. Significant Habitat Features Related to Birds within a 10 km Radius of the Study Area

Species	Location	Distance from Study area (km)	Direction
Common Loon	Waverley-Salmon River Long Lake Wilderness Area	5 - 10	E and S
Bald Eagle Habitat	Lake Major	0	NE
Broad-winged Hawk	Waverley	4.9	W

Source: NSDNR 2014

The ACCDC database contains records of 114 bird species within a 100 km radius of the Study area. Table 4.15 lists these species as well as their respective provincial and national conservation status ranks.

Table 4.15. Bird Species Recorded within a 100 km Radius of the Study Area

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status[2]	COSEWIC Status[3]	NSDNR Status[4]	NS S-Rank[5]
American Coot	*Fulica americana*	Not Listed	Not Listed	Not at Risk	5 Undetermined	S1B
American Golden-Plover	*Pluvialis dominica*	Not Listed	Not Listed	Not Listed	3 Sensitive	S1S2M
American Kestrel	*Falco sparverius*	Not Listed	Not Listed	Not Listed	4 Secure	S3B
Arctic Tern	*Sterna paradisaea*	Not Listed	Not Listed	Not Listed	2 May Be At Risk	S3B
Atlantic Puffin	*Fratercula arctica*	Not Listed	Not Listed	Not Listed	3 Sensitive	S3B,S5N
Baltimore Oriole	*Icterus galbula*	Not Listed	Not Listed	Not Listed	2 May Be At Risk	S2S3B
Bank Swallow	*Riparia riparia*	No Status	Threatened	Threatened	2 May Be At Risk	S2S3B
Barn Swallow	*Hirundo rustica*	No Status	Endangered	Threatened	1 At Risk	S3B
Bay-breasted Warbler	*Dendroica castanea*	Not Listed	Not Listed	Not Listed	3 Sensitive	S3S4B
Black-backed Woodpecker	*Picoides arcticus*	Not Listed	Not Listed	Not Listed	3 Sensitive	S3S4

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status[2]	COSEWIC Status[3]	NSDNR Status[4]	NS S-Rank[5]
Black-bellied Plover	*Pluvialis squatarola*	Not Listed	Not Listed	Not Listed	4 Secure	S3M
Black-billed Cuckoo	*Coccyzus erythropthalmus*	Not Listed	Not Listed	Not Listed	2 May Be At Risk	S3B
Black-headed Gull	*Chroicocephalus ridibundus*	Not Listed	Not Listed	Not Listed	4 Secure	S3N
Black-legged Kittiwake	*Rissa tridactyla*	Not Listed	Not Listed	Not Listed	3 Sensitive	S3B,S5N
Blackpoll Warbler	*Dendroica striata*	Not Listed	Not Listed	Not Listed	3 Sensitive	S3S4B
Blue-winged Teal	*Anas discors*	Not Listed	Not Listed	Not Listed	2 May Be At Risk	S3S4B
Bobolink	*Dolichonyx oryzivorus*	No Status	Vulnerable	Threatened	3 Sensitive	S3S4B
Boreal Chickadee	*Poecile hudsonica*	Not Listed	Not Listed	Not Listed	3 Sensitive	S3
Boreal Owl	*Aegolius funereus*	Not Listed	Not Listed	Not at Risk	5 Undetermined	S2?B
Brant	*Branta bernicla*	Not Listed	Not Listed	Not Listed	3 Sensitive	S2M
Brown Thrasher	*Toxostoma rufum*	Not Listed	Not Listed	Not Listed	5 Undetermined	S1B
Brown-headed Cowbird	*Molothrus ater*	Not Listed	Not Listed	Not Listed	4 Secure	S2B
Buff-breasted Sandpiper	*Tryngites subruficollis*	No Status	Not Listed	Special Concern	8 Accidental	SNA
Bufflehead	*Bucephala albeola*	Not Listed	Not Listed	Not Listed	4 Secure	S3S4N
Canada Warbler	*Wilsonia canadensis*	Threatened	Endangered	Threatened	1 At Risk	S3S4B
Cape May Warbler	*Dendroica tigrina*	Not Listed	Not Listed	Not Listed	3 Sensitive	S2B
Chimney Swift	*Chaetura pelagica*	Threatened	Endangered	Threatened	1 At Risk	S2B,S1M
Cliff Swallow	*Petrochelidon pyrrhonota*	Not Listed	Not Listed	Not Listed	2 May Be At Risk	S2S3B
Common Eider	*Somateria mollissima*	Not Listed	Not Listed	Not Listed	4 Secure	S3S4
Common Goldeneye	*Bucephala clangula*	Not Listed	Not Listed	Not Listed	4 Secure	S2B,S5N
Common Moorhen	*Gallinula chloropus*	Not Listed	Not Listed	Not Listed	5 Undetermined	S1B

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status[2]	COSEWIC Status[3]	NSDNR Status[4]	NS S-Rank[5]
Common Nighthawk	*Chordeiles minor*	Threatened	Threatened	Threatened	1 At Risk	S2S3B
Common Tern	*Sterna hirundo*	Not Listed	Not Listed	Not at Risk	3 Sensitive	S3B
Cooper's Hawk	*Accipiter cooperii*	Not Listed	Not Listed	Not at Risk	5 Undetermined	S1?B
Eastern Bluebird	*Sialia sialis*	Not Listed	Not Listed	Not at Risk	3 Sensitive	S3B
Eastern Kingbird	*Tyrannus tyrannus*	Not Listed	Not Listed	Not Listed	3 Sensitive	S3B
Eastern Meadowlark	*Sturnella magna*	No Status	Not Listed	Threatened	3 Sensitive	SHB
Eastern Wood-Pewee	*Contopus virens*	No Status	Vulnerable	Special Concern	3 Sensitive	S3S4B
Evening Grosbeak	*Coccothraustes vespertinus*	Not Listed	Not Listed	Not Listed	4 Secure	S3S4B,S3N
Fox Sparrow	*Passerella iliaca*	Not Listed	Not Listed	Not Listed	4 Secure	S3S4B
Gadwall	*Anas strepera*	Not Listed	Not Listed	Not Listed	2 May Be At Risk	S2B
Gray Catbird	*Dumetella carolinensis*	Not Listed	Not Listed	Not Listed	2 May Be At Risk	S3B
Gray Jay	*Perisoreus canadensis*	Not Listed	Not Listed	Not Listed	3 Sensitive	S3
Great Cormorant	*Phalacrocorax carbo*	Not Listed	Not Listed	Not Listed	3 Sensitive	S2S3
Great Crested Flycatcher	*Myiarchus crinitus*	Not Listed	Not Listed	Not Listed	2 May Be At Risk	S1B
Greater Yellowlegs	*Tringa melanoleuca*	Not Listed	Not Listed	Not Listed	3 Sensitive	S3B,S3S4M
Harlequin Duck - Eastern pop.	*Histrionicus histrionicus pop. 1*	Special Concern	Endangered	Special Concern	1 At Risk	S2N
Horned Grebe	*Podiceps auritus*	Not Listed	Not Listed	Not Listed	4 Secure	S4N
Horned Lark	*Eremophila alpestris*	Not Listed	Not Listed	Not Listed	4 Secure	SHB,S4S5N
Hudsonian Godwit	*Limosa haemastica*	Not Listed	Not Listed	Not Listed	3 Sensitive	S1S2M
Hudsonian Whimbrel	*Numenius phaeopus hudsonicus*	Not Listed	Not Listed	Not Listed	3 Sensitive	S2S3M
Indigo Bunting	*Passerina cyanea*	Not Listed	Not Listed	Not Listed	5 Undetermined	S1?B

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status[2]	COSEWIC Status[3]	NSDNR Status[4]	NS S-Rank[5]
Killdeer	*Charadrius vociferus*	Not Listed	Not Listed	Not Listed	3 Sensitive	S3B
Lapland Longspur	*Calcarius lapponicus*	Not Listed	Not Listed	Not Listed	4 Secure	S3?N
Laughing Gull	*Leucophaeus atricilla*	Not Listed	Not Listed	Not Listed	4 Secure	SHB
Leach's Storm-Petrel	*Oceanodroma leucorhoa*	Not Listed	Not Listed	Not Listed	4 Secure	S3B,S5M
Least Sandpiper	*Calidris minutilla*	Not Listed	Not Listed	Not Listed	4 Secure	S1B,S3M
Lesser Yellowlegs	*Tringa flavipes*	Not Listed	Not Listed	Not Listed	4 Secure	S3M
Long-eared Owl	*Asio otus*	Not Listed	Not Listed	Not Listed	2 May Be At Risk	S2S3
Marsh Wren	*Cistothorus palustris*	Not Listed	Not Listed	Not Listed	5 Undetermined	S1B
Nelson's Sparrow	*Ammodramus nelsoni*	Not Listed	Not Listed	Not at Risk	4 Secure	S3S4B
Northern Bobwhite	*Colinus virginianus*	Endangered	Not Listed	Endangered		
Northern Gannet	*Morus bassanus*	Not Listed	Not Listed	Not Listed	4 Secure	SHB,S5M
Northern Goshawk	*Accipiter gentilis*	Not Listed	Not Listed	Not Listed	4 Secure	S3S4
Northern Harrier	*Circus cyaneus*	Not Listed	Not Listed	Not at Risk	4 Secure	S3S4B
Northern Mockingbird	*Mimus polyglottos*	Not Listed	Not Listed	Not Listed	4 Secure	S1B
Northern Pintail	*Anas acuta*	Not Listed	Not Listed	Not Listed	2 May Be At Risk	S1B
Northern Shoveler	*Anas clypeata*	Not Listed	Not Listed	Not Listed	2 May Be At Risk	S2B
Olive-sided Flycatcher	*Contopus cooperi*	Threatened	Threatened	Threatened	1 At Risk	S3B
Pectoral Sandpiper	*Calidris melanotos*	Not Listed	Not Listed	Not Listed	4 Secure	S2S3M
Peregrine Falcon - anatum/tundrius	*Falco peregrinus pop. 1*	Special Concern	Vulnerable	Special Concern	3 Sensitive	S1B,SNAM
Philadelphia Vireo	*Vireo philadelphicus*	Not Listed	Not Listed	Not Listed	5 Undetermined	S2?B
Pine Grosbeak	*Pinicola enucleator*	Not Listed	Not Listed	Not Listed	2 May Be At Risk	S2S3B,S5N
Pine Siskin	*Carduelis pinus*	Not Listed	Not Listed	Not Listed	3 Sensitive	S2S3

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status[2]	COSEWIC Status[3]	NSDNR Status[4]	NS S-Rank[5]
Pine Warbler	*Dendroica pinus*	Not Listed	Not Listed	Not Listed	5 Undetermined	S1B
Piping Plover melodus ssp	*Charadrius melodus melodus*	Endangered	Endangered	Endangered	1 At Risk	S1B
Purple Martin	*Progne subis*	Not Listed	Not Listed	Not Listed	2 May Be At Risk	SHB
Purple Sandpiper	*Calidris maritima*	Not Listed	Not Listed	Not Listed	3 Sensitive	S3?N
Razorbill	*Alca torda*	Not Listed	Not Listed	Not Listed	3 Sensitive	S2B,S4N
Red Crossbill	*Loxia curvirostra*	Not Listed	Not Listed	Not Listed	4 Secure	S3S4
Red Knot rufa ssp	*Calidris canutus rufa*	Endangered	Endangered	Endangered	1 At Risk	S2M
Red Phalarope	*Phalaropus fulicarius*	Not Listed	Not Listed	Not Listed	3 Sensitive	S2S3M
Red-breasted Merganser	*Mergus serrator*	Not Listed	Not Listed	Not Listed	4 Secure	S3S4B,S5N
Red-breasted Nuthatch	*Sitta canadensis*	Not Listed	Not Listed	Not Listed	4 Secure	S3
Red-necked Phalarope	*Phalaropus lobatus*	Not Listed	Not Listed	Special Concern	3 Sensitive	S2S3M
Roseate Tern	*Sterna dougallii*	Endangered	Endangered	Endangered	1 At Risk	S1B
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	Not Listed	Not Listed	Not Listed	3 Sensitive	S2S3B
Ruby-crowned Kinglet	*Regulus calendula*	Not Listed	Not Listed	Not Listed	3 Sensitive	S3S4B
Ruddy Turnstone	*Arenaria interpres*	Not Listed	Not Listed	Not Listed	4 Secure	S3M
Rusty Blackbird	*Euphagus carolinus*	Special Concern	Endangered	Special Concern	2 May Be At Risk	S2B
Sanderling	*Calidris alba*	Not Listed	Not Listed	Not Listed	4 Secure	S3M,S2N
Savannah Sparrow (Ipswich)	*Passerculus sandwichensis princeps*	Special Concern	Not Listed	Special Concern	3 Sensitive	S1B
Scarlet Tanager	*Piranga olivacea*	Not Listed	Not Listed	Not Listed	5 Undetermined	S2B
Semipalmated Plover	*Charadrius semipalmatus*	Not Listed	Not Listed	Not Listed	4 Secure	S1B,S3S4M
Semipalmated Sandpiper	*Calidris pusilla*	Not Listed	Not Listed	Not Listed	3 Sensitive	S3M
Short-billed Dowitcher	*Limnodromus griseus*	Not Listed	Not Listed	Not Listed	4 Secure	S3M

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status[2]	COSEWIC Status[3]	NSDNR Status[4]	NS S-Rank[5]
Short-eared Owl	*Asio flammeus*	Special Concern	Not Listed	Special Concern	2 May Be At Risk	S1S2B
Spotted Sandpiper	*Actitis macularius*	Not Listed	Not Listed	Not Listed	3 Sensitive	S3S4B
Swainson's Thrush	*Catharus ustulatus*	Not Listed	Not Listed	Not Listed	4 Secure	S3S4B
Tennessee Warbler	*Vermivora peregrina*	Not Listed	Not Listed	Not Listed	3 Sensitive	S3S4B
Turkey Vulture	*Cathartes aura*	Not Listed	Not Listed	Not Listed	3 Sensitive	S2S3B
Veery	*Catharus fuscescens*	Not Listed	Not Listed	Not Listed	4 Secure	S3S4B
Vesper Sparrow	*Pooecetes gramineus*	Not Listed	Not Listed	Not Listed	2 May Be At Risk	S2B
Virginia Rail	*Rallus limicola*	Not Listed	Not Listed	Not Listed	5 Undetermined	S2S3B
Warbling Vireo	*Vireo gilvus*	Not Listed	Not Listed	Not Listed	5 Undetermined	S1B
Whip-Poor-Will	*Caprimulgus vociferus*	Not Listed	Threatened	Not Listed	1 At Risk	S1?B
White-rumped Sandpiper	*Calidris fuscicollis*	Not Listed	Not Listed	Not Listed	4 Secure	S3M
Willet	*Tringa semipalmata*	Not Listed	Not Listed	Not Listed	2 May Be At Risk	S2S3B
Willow Flycatcher	*Empidonax traillii*	Not Listed	Not Listed	Not Listed	3 Sensitive	S2B
Wilson's Snipe	*Gallinago delicata*	Not Listed	Not Listed	Not Listed	3 Sensitive	S3B
Wilson's Warbler	*Wilsonia pusilla*	Not Listed	Not Listed	Not Listed	3 Sensitive	S3B
Wood Thrush	*Hylocichla mustelina*	No Status	Not Listed	Threatened	5 Undetermined	SUB
Yellow-bellied Flycatcher	*Empidonax flaviventris*	Not Listed	Not Listed	Not Listed	3 Sensitive	S3S4B

Source: ACCDC 2016

[1]Government of Canada 2016; [2]NS ESA 2015; [3]COSEWIC 2015; [4]NSDNR 2015; [5]ACCDC 2016

Field surveys were completed to gather data on the diversity, abundance, breeding status, and habitat utilization of avifauna on and around Lake Major during key times of the year. Surveys were designed to assess bird species diversity, abundance, and habitat utilization on Lake Major and its surrounding areas. Field surveys employed the Standard Area Search methodology (CWS 2007). A summary of each bird survey is provided in the following sections. Detailed results for bird surveys are provided in Appendix F.

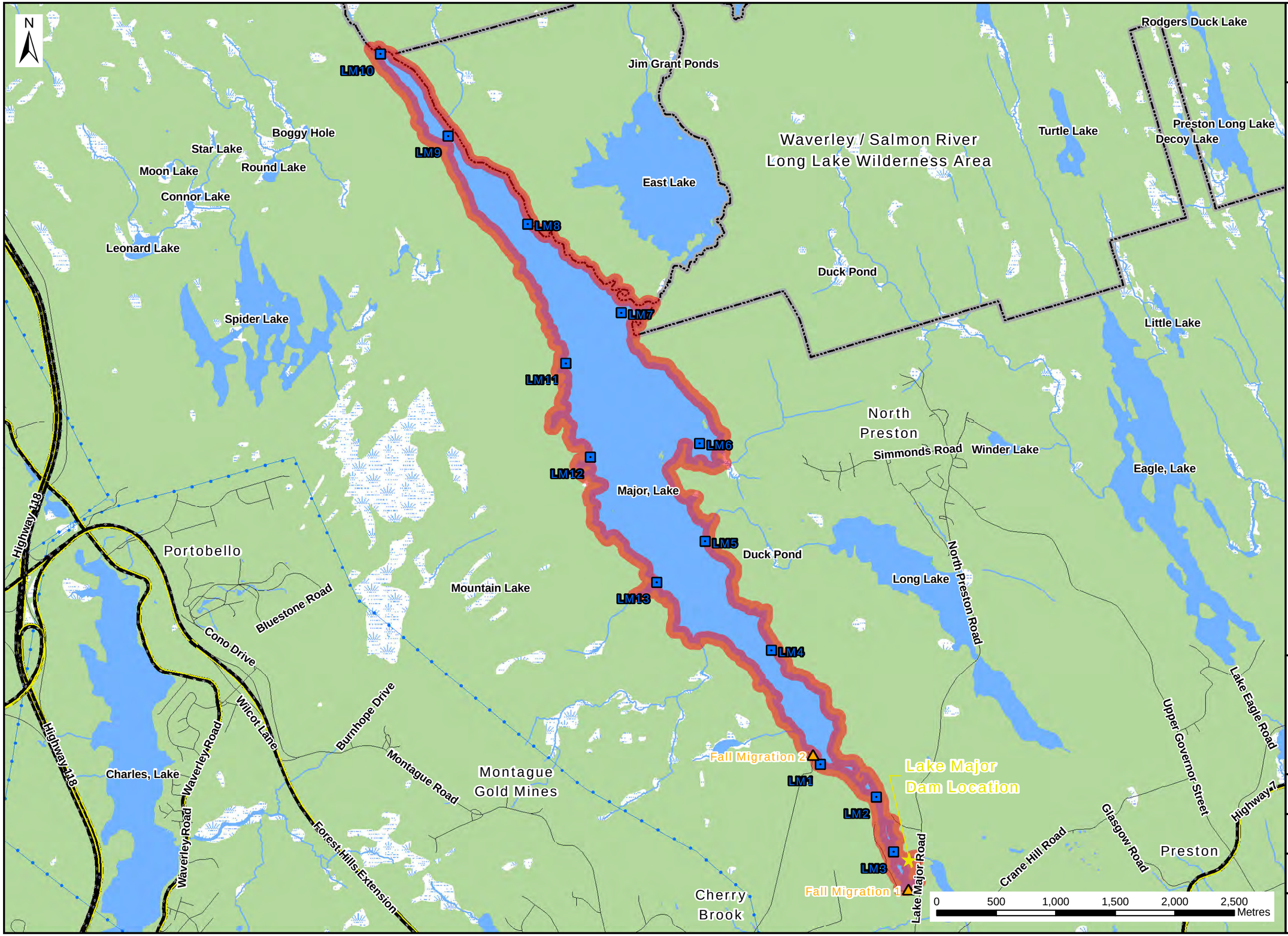
Breeding Bird Surveys

The purpose of the breeding bird surveys was to assess the diversity, abundance, and breeding status of birds in the Study area. Breeding bird surveys were conducted at 13 stopover locations around Lake Major (Drawing 4.8). Surveys were replicated at the same locations twice, once in the morning on August 3, 2016 between sunrise and four hours after sunrise, and once in the evening on August 4, 2016 starting four hours before dusk and ending at sun-set. The purpose of replicating the surveys in the morning and at dusk is to capture diurnal bird movements around the Lake during different times of the day. The detailed results of the surveys are presented in Appendix F.

A total of 239 individual birds encompassing 29 species were observed during the surveys. The vast majority of birds (205 individuals encompassing 33 species) were observed during the morning surveys. Another 34 individual birds encompassing 10 species were observed during the evening surveys. The majority (21) of the species observed were passerines, which were observed in the forest habitat surrounding the lake, or often flying over the lake. Passerines are more detectable in the morning during the morning song chorus, which is likely part of the reason for the higher total bird diversity detected during the morning surveys. Despite this, other species guilds, such as raptors, shorebirds, and waterfowl, were detected in greater abundance in the morning than in the evening as well. The only exception to this is with a few species, namely Double-crested Cormorant and Lesser Black Back Gull, which were observed in low numbers during the evening surveys, but not at all in the morning. The discrepancy between the differences in diversity detected in the morning versus the evening is not clear, but likely relates to passerine detectability, as discussed above, as well as diurnal movement patterns of raptors, shorebirds, and waterfowl.

The types of birds observed during the breeding bird surveys can be put into four categories, or 'guilds'. As discussed above, the majority of birds detected during the breeding season surveys fall into the passerine guild, which were observed utilizing the surrounded forested areas. The majority of these species have no affinity for aquatic environments, and are unlikely to be effected in any way as a result of the Project. A possible exception to this may be the Alder Flycatcher, which is an aerial insectivore, and feeds on insects that may be associated with wetland habitat. The abundance of foraging habitat for this species around Lake Major is likely to change as a result of the Project as the wetland hydrology adjusts to the higher average water levels. However, as Alder Flycatcher was the only aerial insectivore species detected during the surveys, any possible alteration to wetland habitat as a result of Project is not likely to impact a large number of this subset of passerine birds.

Four waterfowl species were detected, including the Mallard duck, Black Duck, Common Loon, and Double-crested Cormorant. The ducks were detected exclusively in the southern portion of the Lake near residential developments. These birds were detected in low numbers, but were 'Confirmed' as breeding on the Lake by the presence of fledged young. A single pair of Common Loons were detected in the approximate middle of the Lake. As these birds were paired, they were assigned the status of 'Probable' breeders, but no young were observed. Despite Lake Major's large size, only one pair of Loons were detected. Lake Major does appear to offer breeding habitat for these waterfowl species, but as they were detected in relatively low abundance, the Lake is apparently not utilized as breeding habitat by large numbers of waterfowl.



Notes:

1. Reference: Digital Topogrpahic Mapping by Nova Scotia Geomatics Centre.
2. Projection: NAD83(CSRS), UTM Zone 20 North

Legend:

- *2016 Fall Migration Survey Locations*
- *2016 Breeding Bird Survey Locations*
- Study Area
- Game Management
- Public Roads
- Major Roads and Highways
- Existing Transmission Lines
- Mapped Stream
- Mapped Wet Areas
- Water Bodies

Lake Major Dam Replacement - Bird Survey Locations

Strum 20 YEARS Taking Charge CONSULTING

*Engineering * Surveying * Environmental*
*Bedford * Antigonish * Moncton * Deer Lake*

Date: December 2016	Project #: 16-5799
Scale: 1:30,000	Drawing #: **4.8**
Drawn By: H. Serhan	
Checked By: H. Mosher	

Shorebirds were detected in low numbers during the breeding season as well. A lone Spotted Sandpiper and a Lone Semipalmated Plover were observed foraging along the lake shore. The low abundance of shorebirds detected on Lake Major during the breeding season serves as evidence that the Lake does not likely host shorebird breeding populations, but may serve as a stopover foraging location, especially when water levels are low and the lakebed is exposed.

Two seabirds were detected during the breeding season, the Lesser Black Back Gull and the Herring Gull. In both cases, lone individuals were observed flying over the Lake, probably on inland foraging trips from the Atlantic coast. These birds are more likely to breed in coastal colonies than on Lake Major, but the Lake may serve as an opportune foraging stopover location during the summer. The abundance of foraging seabirds may well increase as fish passage into the lake is improved.

Four raptor species were observed in the area, including Bald eagle, Broad Winged Hawk, the Great-Horned Owl, and the Osprey. The Owl was observed perched in a large pine tree overlooking the lake. As owls are not known to hunt in aquatic habitats, this species is not likely to utilize the Lake as foraging habitat, but likely nests and forages in the surrounded forested habitat. The other three raptor species may well have an affinity for the lake as foraging habitat, as they are known to take fish from aquatic environments. This guild is likely to benefit from the Project as the improved fish passage into the Lake may turn the lake into a more lucrative hunting ground for raptors.

Fall Migration Surveys

The purpose of the fall migration surveys is to assess the utilization of Lake Major as a stopover location for migrating birds during the fall migration season. Four surveys were conducted from early September to Late October, 2016. Each survey was four hours in duration starting at sunrise. Surveys took place at two locations that offered un-obstructed views of areas of Lake Major that provided important bird habitat (Drawing 4.8). The southern areas of Lake Major were the focus of the surveys, as the breeding bird survey results indicated that bird activity was concentrated in the south, likely resultant of greater habitat diversity. The detailed results of the surveys are presented in Tables 2 and 3 (Appendix F).

In total, 521 individual birds were observed comprised of at-least 28 species, although 8 (all warblers) birds could not be identified to the species level. The vast majority of birds observed (72%) were passerines (Table 3, Appendix F) followed by waterfowl species (26%), with the remaining 2% being comprised of raptor, seabird, and waterfowl species. Observations on how the birds moved through the area were also tracked for each observation. The vast majority (73%) of birds were observed flying over Lake Major (Flyover), with 23% being observed in the terrestrial environments (Terrestrial Stopover) surrounding the Lake, and 4% of birds being observed swimming in the Lake itself of foraging along the lake shores (Lacustrine stopover) (Table 2, Appendix F). The predominant movement direction of birds was from north to south.

The majority of the passerine species observed were European Starlings flying in flocks over the southern portion of the Lake. Flocks of Common Grackles and Blue Jays were also observed, albeit less frequently and in smaller numbers. Crows and Ravens were also observed in abundance throughout the surveys. The majority of the species observed were resident species, including Blue

Jays, Crows, Ravens, and Starlings, but migratory passerines, while in the minority were also represented. Flocks of migratory songbirds were noted to be moving through the trees on the Lake edges, a trend that intensified in the latter surveys as the fall passerine migration season continued. As Lake Major forms a significant landscape feature, extending more than 6 km from north to south, it may form a migratory passage route as migrating birds are funneled along the Lake edges as they migrate through the area. Although Lake Major may concentrate passerine species along its edges during the fall migration season, there is no mechanism by which the Project would affect the migratory behavior of passerines as this guild would be influenced more-so by alterations in terrestrial habitat than in aquatic and riparian habitats.

Only three species of waterfowl were observed, Mallard Ducks, Black Ducks, and Double-Crested Cormorants, but these birds were observed in relative abundance, especially the latter. The duck species were observed exclusively in the southern most-extent of the lake, as they were observed during the breeding surveys. The ducks were typically in small family groups of usually no more than three individuals. These ducks were likely the resident individuals observed during the breeding season surveys. It does not appear that Lake Major hosts large numbers of migrating ducks as a stopover location. Large flocks of Double-Crested Cormorants were observed flying over the lake later in the fall. This provides further evidence that Lake Major, as a substantial feature in the landscape, serves as a migration corridor for birds migrating through the area. Aside from the relatively low abundance of resident ducks, Lake Major does not appear to be an important stopover location for waterfowl migrating through the area in the fall, so the Project is unlikely to impact this guild.

Like in the breeding bird surveys, shorebirds were represented in small numbers in the fall migration survey. A lone Greater Yellowlegs and a lone Semipalmated Plover was observed foraging along the lake shore. As the water levels were extremely low in the fall of 2016 during the surveys, the availability of shorebird foraging habitat along the lake edges was abnormally high. Despite this, only two species were observed in small numbers, indicated that even when foraging opportunities on Lake Major for shorebirds is abnormally high, the Lake is not utilized by this guild to any significant extent during the fall migration period.

Only four seabirds were observed, all of which were seagulls flying over the lake. Two birds, a Common Tern, and a Ring Billed Gull were observed patrolling the Lake, and possibly using it as a stopover foraging location, but this trend was not observed to be a common phenomenon. It is possible that as fish passage into the Lake is improved as a result of the Project, more seabirds will use it as a foraging stopover location during the fall migration.

Four raptor species were observed during the fall migration surveys, the Bald Eagle, the American Kestrel, the Northern Harrier, and the Osprey. It is possible that all of these birds hunt in Lake Major, although this behavior was not directly observed during the surveys. It is likely that this guild would benefit from the Project as improved fish passage would provide more lucrative hunting grounds in the fall, as many fish species may well reside in the lake throughout the fall migration period.

Overall, there were 5 SOCI identified in the breeding bird and fall migration surveys, as summarized in Table 4.16 below.

Table 4.16. Field Identified Bird SOCI

Common Name	Scientific Name	Observed in Breeding Surveys?	Observed in Fall Surveys?	SARA Status[1]	NSESA Status[2]	COSEWIC Status[3]	NSDNR[4]	NS S-Rank[5]
Common Loon	*Gavia immer*	Yes	No	Not Listed	Not Listed	Not at Risk	May Be At Risk	S3B,S4N
Common Tern	*Sterna hirundo*	No	Yes	Not Listed	Not Listed	Not at Risk	Sensitive	S3B
Greater Yellowlegs	*Tringa melanoleuca*	No	Yes	Not Listed	Not Listed	Not Listed	Sensitive	S3B,S5M
Pine Siskin	*Spinus pinus*	No	Yes	Not Listed	Not Listed	Not Listed	Sensitive	S3S4B, S5N
Spotted Sandpiper	*Actitis macularius*	Yes	No	Not Listed	Not Listed	Not Listed	Sensitive	S3S4B

[1]Government of Canada 2016; [2]NS ESA 2015; [3]COSEWIC 2015; [4]NSDNR 2015; [5]ACCDC 2016

Common Loon

The Common Loon is a diving water bird that breeds on quiet, remote freshwater lakes (Evers et al. 2010). In winter and during migration, they are found on lakes, rivers, estuaries, and coastlines. Their diet consists mostly of fish, occasionally catching crustaceans, snails, leeches, and aquatic insect larvae if necessary (Evers et al. 2010). To catch fish they dive quickly under water. Common loons nest on shoreline of freshwater lakes in May or early June (Evers et al. 2010). Males and females build the nest together, making a mound out of dead plant material in hidden spots of lakeshore close to the bank. A nesting pair of loons will often reuse the same site from year to year (Evers et al. 2010).

A pair of Common Loons was identified during the surveys. While no young or nests were detected, it is possible that Loons breed on Lake Major. Potential impacts to Common Loons are discussed further in Section 9.4.

Common Tern

The Common Tern is a waterbird widespread throughout North America (Nisbet 2002). Common Tern nest on islands, marshes, and occasionally the lake and ocean beaches. Nests consist of piles of dead vegetation on the ground (Nisbet 2002). Common Terns hover over the water briefly, before plunging into the water to catch their prey. Their main food source consists of small fish, with the occasional invertebrate (Nisbet 2002).

One lone individual tern was observed during the fall migration surveys, indicating that Lake Major is not important habitat for these birds. The Project would likely improve habitat on Lake Major for these birds by providing better fish passage, and thus better foraging potential. These birds are not expected to be negatively impacted by the Project and will not be discussed further.

Greater Yellowlegs
The Greater Yellowlegs is a medium-sized shorebird commonly found in freshwater ponds and tidal marshes (Elphick and Tibbitts 1998). They feed on small aquatic and terrestrial invertebrates, small fish, frogs, and occasionally seeds and berries (Elphick and Tibbitts 1998). They wade through water and pick up any prey it sees or feels with its beak. Their preferred breeding habitat is bogs and forests with abundant clearings (Elphick and Tibbitts 1998). They build nests on the ground by scraping shallow depressions in moss or peat, lined with vegetation (Elphick and Tibbitts 1998).

One lone individual Greater Yellowlegs was observed during the fall surveys foraging on the lake shore. Water levels in Lake Major were uncharacteristically low in in the fall of 2016, which exposed a fair amount of lake bed that these shorebirds may use as foraging ground. The low abundance of Greater Yellowlegs indicates that even when the foraging potential on Lake Major is atypically good, the Lake is still not used to any great extent by these birds. Therefore these birds are not expected to be negatively impacted by the Project, and they will not be discussed further.

Pine Siskin
Pine siskins are small songbirds that prefer coniferous or mixed coniferous and deciduous forests with open canopies (Dawson 2014). They are opportunistic feeders, foraging in weedy fields, scrubby thickets, backyards, and gardens in search of seeds. They nest in trees, loosely attaching the nest towards the end of a horizontal branch well concealed by foliage (Dawson 2014).

A small flock of these birds were observed during the fall migration surveys. The forested habitats around Lake Major may serve as a migratory flyway for birds migrating through the area in the fall. However, Pine Siskin has no affinity for lacustrine environments, so the Project is not expected to negatively impact these birds, and they will not be discussed further.

Spotted Sandpiper
The spotted sandpiper is a widespread shorebird ubiquitous around water, particularly on rocky shores. Breeding habitat generally occurs along shoreline in semi open areas with nearby patches of dense vegetation (Reed et al. 2013). Nests are placed on the ground within 100 m of the shore. Spotted Sandpipers are active foragers, eating mostly small invertebrates, with occasional small fish and dead fish (Reed et al. 2013).

One lone individual Spotted Sandpiper was observed during the breeding surveys foraging on the lake shore. The low abundance of these birds during the breeding season indicates that Lake Major is not used to any great extent by these birds. Therefore these birds are not expected to be negatively impacted by the Project and they will not be discussed further.

5.0 SOCIO-ECONOMIC ENVIRONMENT

5.1 Local Demographics
The Study Area is located in the community of Lake Major, within the HRM which is home to many long established communities including Halifax, Dartmouth, Bedford, Sackville, and others. The HRM reported a population of 410,000 in 2014 (HRM 2016d). The nearest communities to the Study

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5.0 SOCIO-ECONOMIC ENVIRONMENT

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Area are Cherry Brook (1.2 km), Preston (2.6 km), North Preston (3.2 km), Loon Lake (3.3 km), and Montague Gold Mines (3.7 km) (Drawing 5.1).

5.1.1 Demography

Population statistics for HRM from the 2011 census are summarized in Table 5.1.

Table 5.1. Population in HRM

Population Statistics	**HRM**
Population in 2011	390,096
Population in 2006	372,679
Population change from 2006-2011 (%)	4.7
Total private dwellings in 2011	177,160
Land area (square km)	5,490.28
Population density per square kilometer	71.1

Source: Statistics Canada 2012

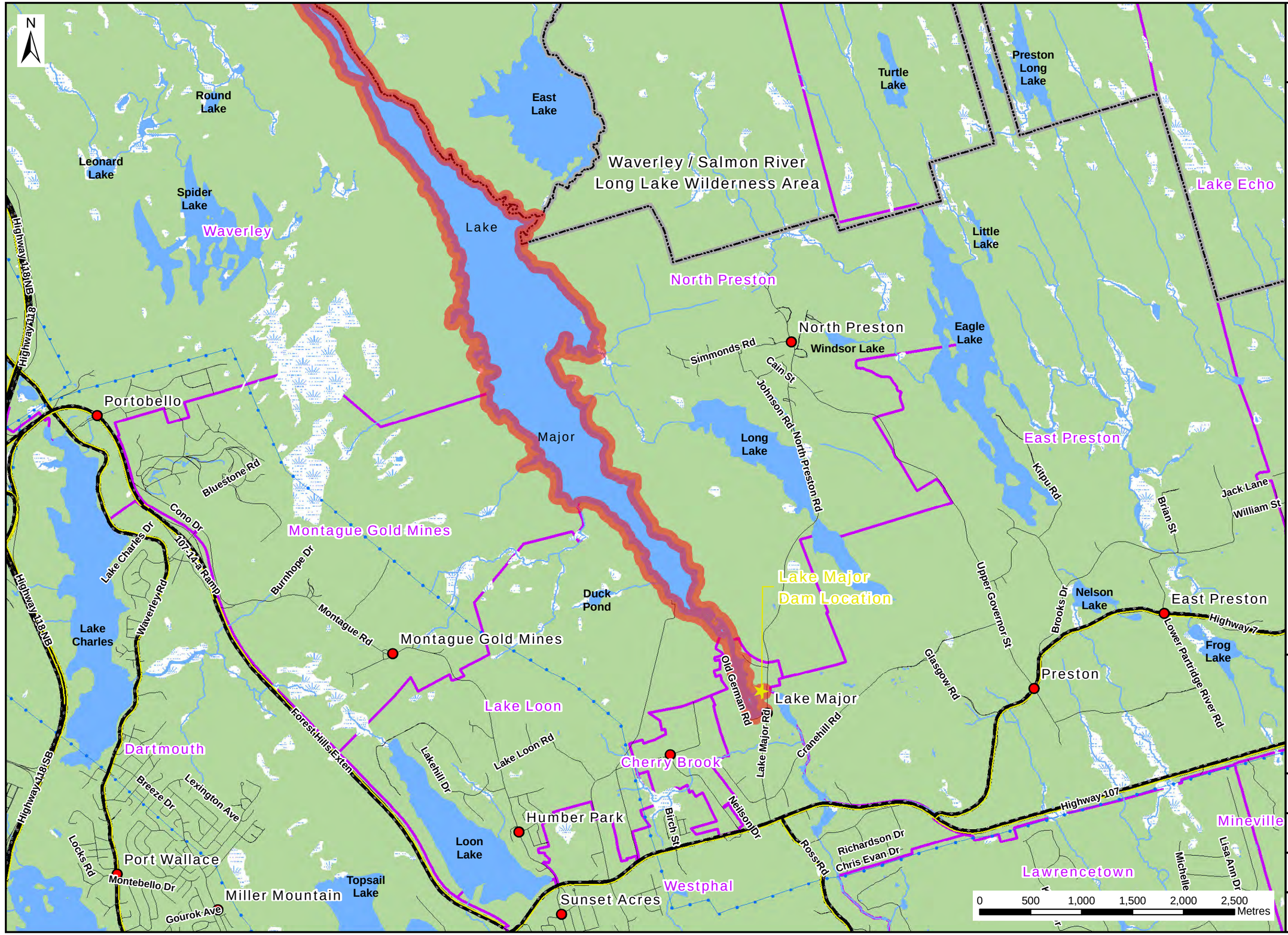
The age distribution in HRM reveals a median age of 39.9 years, which is slightly lower than the provincial median age (43.7) (Statistics Canada 2012). An overview of age distribution for 2011 in HRM is outlined in Table 5.2 below.

Table 5.2. Age Distribution in HRM

Age Statistics	**HRM**
0 - 14 years	59,605 (15.3 %)
15 - 64 years	279, 465 (71.6 %)
65+ years	51,025 (13.1 %)
Total Population	**390,095 (100 %)**

Source: Statistics Canada 2012

In 2010, the average income for individuals in HRM was $40,461 a year, compared with the average of $35,478 for Nova Scotia (Statistics Canada 2013). These averages are slightly lower than the Canadian average individual income of $40,650. The average value of dwellings in HRM increased 26.1% between 2006 and 2010 to $268,612. In comparison, the average value of dwellings in the province increased 27.8% during the same period to $201,991 (Table 5.3).



Notes:

1. Reference: Digital Topogrpahic Mapping by Nova Scotia Geomatics Centre.
2. Projection: NAD83(CSRS), UTM Zone 20 North

Legend:

- Local Communities
- Study Area
- Game Management
- Public Roads
- Major Roads and Highways
- Existing Transmission Lines
- Mapped Stream
- Mapped Wet Areas
- Water Bodies
- Community Boundaries

Lake Major Dam Replacement - Local Communities

Strum 20 YEARS Taking Charge CONSULTING

*Engineering * Surveying * Environmental*
*Bedford * Antigonish * Moncton * Deer Lake*

Date: December 2016	Project #: 16-5799
Scale: 1:35,000	Drawing #: **5.1**
Drawn By: H. Serhan	
Checked By: H. Mosher	

Table 5.3. Household Costs and Average Individual Income

Jurisdictions	Average Housing Value	Average Individual Income
HRM	$268,612	$40,461
Province of Nova Scotia	$201,991	$35,478

Source: Statistics Canada 2013

5.1.2 Health Care and Emergency Services

Halifax Regional Fire and Emergency has 59 fire stations across the region. The nearest stations to the Study Area are located on Highway 7 in Westphal (2.9 km to the southwest) and Cain Street in North Preston (3.1 km to the northeast) (HRM 2016d).

Emergency health services in the region include the Dartmouth General Hospital located in Dartmouth, the QEII Infirmary located in Halifax, and the IWK Health Centre located in Halifax.

5.1.3 Industry and Employment

Statistics for HRM indicate that the unemployment rate in 2011 was 7.2%, which is lower than the provincial average of 10% (Statistics Canada 2013). With regard to employment rates, the HRM employment rate was 64.1%, which is higher than the provincial rate of 56.8% (Statistics Canada 2013).

A breakdown of the labour force within HRM is provided in Table 6.4. The highest proportions of workers in HRM fall into the “public administration” category (12.6%). Other significant industries include health care and social assistance, retail trade and educational services (Statistics Canada 2013).

Table 5.4. Top Industries for the Employed Labour Force, HRM

Industry	Total
Total employed labour force 15 years +	224,515
Public administration	28,390 (12.6%)
Health care and social assistance	26,415 (11.8%)
Retail trade	26,150 (11.6%)
Educational services	18,365 (8.2%)
Professional, scientific and technical services	15,495 (6.9%)
Accommodation and food services	15,165 (6.8%)

Source: Statistics Canada 2013

A review of businesses located within close proximity to the Study Area is provided in Table 5.5.

Table 5.5. Local Businesses and Proximity to Study Area

Business	Distance and direction to Study Area*
Fred M Dunphy Excavating and Construction Ltd	40 m southeast of the Study Area, on Lake Major Road, Dartmouth
Indo Hydroponics Garden Center	270 m south of the Study Area, on Lake Major Road, Dartmouth
Grandview Golf & Country Club	500 m east of the Study Area, on Crane Hill Road, Dartmouth
Sunset Enterprises Plant Nursery	940 m south of the Study Area, on Lake Major Road, Lake Major
Toad's Cycle Works and Tattoo	1.1 km south of the Study Area, on Lake Major Road, Dartmouth
Ruggles Towing Service Ltd	1.2 km south of the Study Area, on Lorne Drive, Dartmouth
First Rate Graphics	1.4 km southwest of the Study Area, on Main Street, Cherry Brook
Watershed Association Development Enterprises Ltd	1.5 km southwest of the Study Area, on Main Street, Cherry Brook
ROCA Music & Art House	1.6 km east of the Study Area, on Glasgow Road, Lake Major

*All distances measured from Lake Major Dam, using the most direct route.

5.2 Land Use and Value

The majority of land surrounding Lake Major is owned by the Halifax Regional Water Commission with restricted access or Crown Land. Land surrounding the top two thirds of the lakes is forested and undeveloped. Halifax Water lands are managed for forestry operations in accordance to the guidelines prescribed by NSE. The crown land along the upper part of the lake is part of the Waverley-Salmon River Long Lake Wilderness Area. The wilderness area is a provincially protected plot of land under the *Wilderness Areas Protection Act*. Halifax Water has a licence from the Nova Scotia Department of Natural Resources (NSDNR) (Appendix G) to carry out activities within the Wilderness Area in support of maintaining a viable water supply for the HRM, including:

- Posting signs at intervals along the boundary of the Protected Water Area, as required to enable the Licensee to meet its obligations under the *Environment Act* with respect to the Protected Water Area;
- Blazing boundaries of the watershed as necessary;
- Temporary flooding of the land abutting the shore of Lake Major beyond the normal high water level as a result of a severe rainfall event. The normal high water level is defined as elevation 20.0 m; and
- Other activities required in an emergency situation in order to fulfill its obligations as waterworks operator, provided that care is taken to have the least environmental impact as possible in the circumstances.

Along the southern edge of the lake, the land is predominantly subdivided into smaller lots and exist as former or existing residential properties. Halifax Water has purchased many of the properties located at the southern side of the lake over the years and these lots are currently vacant, or are leased out. Two houses immediately south of the new dam have leases that expire in March 2017.

The house immediately north of the new dam has a tenant who has chosen to remain in his house during construction of the new dam. Provisions have been made during construction to maintain access to the home. There are five privately owned lots (consisting of four houses), all located at the lower half of the lake off of Lake Major Road and Old German Road.

5.3 Recreation

Recreational use of the environment in the vicinity of the site consists primarily of walking, ATV use, boating, and fishing. The Waverley-Salmon River Long Lake Wilderness Area (WSRLLWA) extends into the northeastern portion of the Study Area. The WSRLLWA is an 8,710 ha area of rugged wilderness. The Crowbar Lakes trail is the only developed trail network within the wilderness area, encompassing West Lake, Granite Lake, and Salmon River, and is located approximately 8 km from the Study Area.

Much of the remaining area surrounding the Study Area is protected Halifax Water land and has restricted access. Land owned by Halifax Water along the western portion of the lake past Old German Road is gated and not accessible to the public. The eastern and northern portion is not gated, but does not have public access roads.

Boating within the lake is permissible to the public but restricted to motors of 9.9 HP or less, and carrying less than 23 L of gasoline. Boat access is available from privately owned properties or Halifax Water properties leased by the public. Fishing is allowed with proper provincial permits except within 100 m of the intake to the treatment plant. Swimming is not allowed anywhere in the PWA except within 800 m from the Lake Major Dam within the vicinity of residential properties and not within 100 m of the intake.

6.0 CULTURAL AND HERITAGE RESOURCES

6.1 Archeological Resource Impact Assessment

Cultural Resource Management Group (CRM Group) was retained by Meco Engineers, on behalf of the Halifax Water, to complete an Archaeological Screening and Reconnaissance for the Project. The purpose of the assessment was to investigate the potential for encountering archaeological resources during the replacement of the Lake Major Dam. The archaeological investigation was conducted according to the terms of Heritage Research Permit A2014NS112 and submitted to Nova Scotia Communities, Culture, and Heritage (NSCCH) June 3, 2015 (Appendix H).

At the time of the assessment, the location of the proposed dam was not yet determined; therefore four potential locations were assessed. The following section discusses the selected location only, identified as locations F-1 and F-2 in the report prepared by CRM Group (2015).

The land within the Study Area was once part of the greater Mi'kmaq territory known as *Sipekne'katik,* meaning 'area of wild potato/turnip'. The surrounding area is dense with lakes and watercourses that would have been important transportation corridors and a resource base for the Mi'kmaq, their ancestors, and predecessors for millennia prior to the arrival of European settlers. Lake Major itself would have been utilized as a transportation route as it is part of a series of connected lakes and rivers providing access into the interior of Nova Scotia. The waterway would

have also served as a significant source of fish. Based on the various components of the background study, including environmental setting, Native land use and property history, the Lake Major Dam Replacement study area is considered to exhibit high potential for encountering Precontact and historic Native archaeological resources and high potential for encountering historic Euro-Canadian archaeological resources (CRM Group 2015).

A field survey completed on December 5, 2014 identified the proposed Study Area as exhibiting high potential for encountering Precontact and/or historic archaeological resources (CRM Group 2015).

The following management recommendations were provided based on the archaeological screening and reconnaissance completed for the Lake Major Dam Replacement:

1. It is recommended that the potential for archaeological impact be reviewed once a development plan has been finalized.
2. It is recommended that any areas of potential archaeological significance be subjected to a program of shovel testing to determine whether or not buried archaeological resources are present and intensified historical research to provide a more comprehensive context for interpreting any archaeological resources.
3. It is recommended that should plans be made to alter or remove the current dam structure, the dam and the area immediately surrounding it be subjected to archaeological assessment.
4. It is recommended that any additional construction related impacts not defined above (including access roads, staging areas, etc.) be subjected to archaeological screening and reconnaissance prior to development.

An in-situ archaeological assessment consisting of shovel testing was conducted in October 2016 according to the terms of Heritage Research Permit (A2016NS058) (Appendix H). Testing unearthed some artifacts of European origin in the form of broken crockery and was labeled not of great significance. A report outlining the results of the survey will be sent to the NSCCH once completed.

Procedures related to potential discovery of archaeological items or sites during construction/ operation will be described in the EPP.

7.0 CONSULTATION AND ENGAGEMENT

7.1 Public/Stakeholder Consultation

Lake Major Watershed Advisory Board
The Lake Major Watershed Advisory Board (the Board) serves as an advisory group to Halifax Water, the HRM, the Province of Nova Scotia, stakeholders, and communities in the Lake Major area on the management of the Lake Major Watershed. The Board serves as the main liaison between stakeholders and the community and Halifax Water and government groups in all things related to the watershed, including activities and policy issues affecting the water quality, flows, levels, stormwater, development, and forest management. The Board is comprised of a community representative from each of the following communities and organizations:

- One voting identifiable group, organization, or individual representative from each of the communities of
    - North Preston;
    - Lake Major;
    - East Preston; and
    - Cherry Brook/Lake Loon.
- One voting technical representative from each of the following organizations:
    - Halifax Water;
    - Halifax Regional Municipality Planning and Development Services;
    - Nova Scotia Environment; and
    - Nova Scotia Department of Natural Resources.

The board meets no less than twice annually, generally once in the fall and once in the spring. A biannual newsletter is prepared and distributed all bodies represented on the Board and any other interested party. The Project has been discussed and/or presented to the Board on the following meeting dates:

- October 2, 2014;
- April 23, 2015;
- September 24, 2015;
- March 10, 2016; and
- October 6, 2016.

Presentations to the board consisted of status updates on the Project as it progressed from concept through to detailed design. Meeting minutes are available in Appendix I, with the exception of the October 6, 2016 meeting (minutes are not yet available). The newsletter distributed in summer 2015 featured an article about the dam replacement (Appendix I).

Public Open House
An open house was held near the Study Area at Graham Creighton Junior High School, in Cherry Brook, NS on November 10, 2016, to inform the public about the Project and to hear local comments and concerns. Letters informing the public of the open house were sent to the Lake Major Watershed Advisory Board newsletter recipients. The open house featured posters that provided information about the Project and associated studies. Copies of the posters and letter delivered to the community from the open house are provided in Appendix I. Attendees had the opportunity to speak one-on-one with the Project team, the Proponent, and the design engineers, and submit written comments and/or questions.

Over 150 local community members attended the open house. The most common concerns raised during the open house included:

- The potential for road closures along Lake Major Road during construction;
- Any potential impacts to water bills;
- Loss of land for properties on Lake Major;
- Whether the Project would aid in preventing downstream flooding; and

- Whether the Project was directly related to the proposed residential developments in the Preston area.

The Project Team will continue to help address any concerns raised by local citizens over the duration of the Project's development.

Other Groups
Due to the limited and restricted access to much of the land surrounding Lake Major, Halifax Water is unaware of any special interest groups/clubs that use the Study Area.

7.2 Aboriginal Engagement

The nearest First Nation Reserve to the Study Area is the Cole Harbour 30 reserve located off Caldwell Road in Dartmouth, approximately 6 km from the Study Area. The Cole Harbour 30 is administratively part of Millbrook First Nation band.

Letters outlining the proposed Project and informing the recipient of the Public Open House were sent to the following aboriginal groups that may be impacted by the Project October 27, 2016:

- Sipekne'katic First Nation (Chief Rufus Copage and Council);
- Kwilmu'kw Maw-klusuagn (Twila Gaudet, Consultation Liason Officer);
- Native Council of Nova Scotia (Chief and President Grace Conrad); and
- Milbrook First Nation (Chief Robert Gloade and Council).

The letters outlined the proposed Project and invited the recipients to contact the Proponent regarding any questions or concerns they may have (copies of the letters are available in Appendix I). As of the registration date, Halifax Water had not received any feedback from the groups contacted.

7.3 Review of Public Concerns

Table 7.1 summarizes the primary concerns raised during the consultation process and the associated responses.

Table 7.1. Community Concerns and Proponent Responses

Concern	Response
Road closures along Lake Major Road during construction	The majority of the construction work will be completed off of Lake Major Road and no road closures will be required during construction. There is the potential for minor traffic delays during mobilization and demobilization of construction equipment and materials.
Will water bills be higher because of this Project	Halifax Water maintains a fund for future Capital Projects, from which this Project is being funded. It is not anticipated that water bills will be impacted by the proposed Project.
Will the Project aid in downstream flooding	The new dam design allows for higher storage potential and greater control of water release during high flow events. Although the Project will not solve downstream flooding issues, as they are a result of numerous influences, it will aid in reducing their severity.

Concern	Response
Loss of land for properties on Lake Major due to higher water levels	Increased water levels are expected to result in minimal inundation of upland. Water levels are not expected to exceed the stated high water level of 20.0 m even during 1:100 year storms.
Is the Project directly related to proposed nearby residential developments	The Project is being completed as the existing dam is in disrepair and requires replacement. It is not a result of any proposed development in the area.

8.0 ENVIRONMENTAL ASSESSMENT METHODOLOGY

The EA focuses on specific components of the biophysical and human environments called Valued Ecosystem Components (VECs) that, if altered by the Project, may be of concern to stakeholders such as regulatory agencies, Aboriginal peoples, resource managers, scientists, and/or the general public. VECs incorporate biological systems as well as human, social, and economic conditions that are affected by changes in the biophysical environment. VECs can therefore relate to ecological, social, and/or economic systems that comprise the environment as a whole. Accidents and malfunctions are considered separately as a VEC.

Interactions between Project and environmental components are evaluated for potential environmental effects on VECs to determine potential effects and their significance. The determination of significance of adverse environmental effects is based on post-mitigation (residual) effects, rather than unmitigated potential effects. Therefore, the effects assessment considers the following:

- A review of potential Project interactions;
- Mitigation and environment protection measures proposed to reduce or eliminate adverse effects;
- The characterization of the residual environmental effects of the Project; and
- Any proposed follow-up monitoring to be completed post-construction.

The ultimate focus of the assessment is on residual environmental effects that remain after planned mitigation has been applied.

8.1 Project Components

Project components are detailed in Section 2.2 and are summarized for the purpose of the effects assessment in Table 9.1.

Table 8.1. Summarized Project Components and Associated Activities

Project Component	Associated Activities
Construction	Site clearing and installation of access roads
	Establishing a construction staging area
	Installation of cofferdams and dewatering
	Prepare foundation and construction of new dam
	Dewatering and restoration of stream bed between new dam and existing dam
	Removing existing dam structure
	Remove temporary access roads and other temporary structures
Operation	Increased full supply level

8.2 Project-Environment Interactions

The identification of interactions between environmental, socio-economic components, and cultural and heritage resources (as outlined in Sections 4.0 - 6.0) and Project activities (as outlined in Section 8.1) is a necessary step in the environmental assessment process, as an environment effect can only exist when there is such an interaction. A preliminary assessment of potential interactions between environmental components and Project activities was undertaken to identify potential VECs (Table 8.2).

Table 8.2. Environmental Component Interaction Table

Project Components	Ecosystem Components													
	Biophysical Environment												Socio-Economic	Cultural and Heritage Resources
	Atmospheric	Geology	Groundwater	Watershed	Water Quality	Fish and Fish Habitat	Freshwater Mussels	Shoreline Vegetation	Wetlands	Mammals	Herpetofauna	Avifauana		
Construction														
Site Clearing/ access roads/ development of staging areas	-	-	0	0	-	-	-	-	0	-	-	-	0	-
Installation of Cofferdams/ de-watering	0	0	0	-	-	-	-	0	0	0	0	0	0	0
Construction of new dam	-	0	0	0	-	-	-	-	0	0	-	0	-	-
Restoration and dewatering of stream bed	0	0	0	0	+	+	+	+	0	+	+	0	+	0

Project Components	Ecosystem Components													
	Biophysical Environment												Socio-Economic	Cultural and Heritage Resources
	Atmospheric	Geology	Groundwater	Watershed	Water Quality	Fish and Fish Habitat	Freshwater Mussels	Shoreline Vegetation	Wetlands	Mammals	Herpetofauna	Avifauana		
Construction														
Removal of existing dam	-	-	0	-	-	-	-	-	0	0	-	0	0	0
Operations														
Rise in full supply level	0	0	0	+	0	-	-	-	-	-	-/+	0	-/+	-
+ denotes a potential positive interaction - denotes a potential negative interaction 0 denotes no perceived interaction														

8.3 VEC Selection

Based on the results from Table 8.2, environmental components requiring further assessment to determine the potential for adverse residual effects by Project activities are outlined in Table 8.3.

Table 8.3. VEC Selection Table

Environmental Component	Project Interactions	Valued Ecosystem Component
Atmosphere	• Site clearing/access roads • Construction of new dam • Removal of existing dam	Geophysical Environment
Geology		
Groundwater		
Watershed	• Site clearing/access roads • Creating cofferdams/de-watering • Construction of new dam • Removal of existing dam • Restoration and dewatering of stream bed • Rise in FSL	Freshwater Environment
Water Quality		
Fish and Fish Habitat		
Freshwater Mussels		
Shoreline Vegetation	• Site clearing/access roads • Construction of new dam • Removal of existing dam • Removal of stream bed	Terrestrial Environment
Wetlands		
Mammals		
Herptofauna		
Avifauna	• Site clearing/access roads • Rise in FSL	Avifauna

Environmental Component	Project Interactions	Valued Ecosystem Component
Socio-Economic Environment	• Construction of new dam • Rise in FSL • Restoration of stream bed	Socio-Economic Environment
Cultural and Heritage Resources	• Site clearing/access roads • Construction of new dam	Cultural and Heritage Resources

8.4 Description of Interactions and Potential Effects

For each VEC, Project interactions and potential effects are described and evaluated. Each potential effects is assessed using the known baseline conditions (as outlined in Sections 4.0 – 6.0), guidance from regulators, and the collective knowledge and expertise of the Project team.

8.5 Specific Mitigative and Protective Measures

Where an adverse environmental effect on a VEC is identified, strategies for mitigation, avoidance or compensation are proposed. Where possible, mitigation measures will be incorporated into Project design to eliminate or reduce potential adverse effects.

8.6 Residual Effects

The determination and characterization of adverse environmental effects for each VEC is based on post-mitigation (residual) effects, rather than unmitigated potential effects in accordance with the criteria outlined in Table 8.4.

Table 8.4. Criteria for Identification and Definition of Environmental Effects

Attribute	Options	Definitions
Scope (Geographic Extent)	Local	Effect restricted to areas within 1 km of the Study Area
	Regional	Effect extends up to several km from the Study Area
	Provincial	Effect extends throughout Nova Scotia
Duration	Short-term	Effects last for less than 1 year
	Medium-term	Effects last for 1 to 10 years
	Long-term	Effects last for greater than 10 years
Frequency	Once	Occurs only once
	Intermittent	Occurs occasionally at irregular intervals
	Continuous	Occurs on a regular basis and regular intervals
Magnitude	Negligible	No measurable change from background in the population or resource; or in the case of air, soil, or water quality. If the parameter remains less than the standard, guideline, or objective.
	Low	Effect causes <1% change in the population or resource (where possible the population or resource base is defined in quantitative terms)
	Moderate	Effect causes 1 to 10% change in the population or resource
	High	Effect causes >10% change in population in resource.

If, based on the criteria in Table 8.4, a residual effect is identified the significance of the residual effect is then evaluated based on the criteria outlined in Table 8.5.

Table 8.5. Definition of Significant Residual Environmental Effect

Significance Level	Definition
High	Potential effect could threaten sustainability of the resource and should be considered a management concern. Research, monitoring, and/or recovery initiatives should be considered.
Medium	Potential effect could result in a decline in resource to lower-than-baseline but stable levels in the study area after Project closure and into the foreseeable future. Regional management actions such as research, monitoring, and/or recovery initiatives may be required.
Low	Potential effect may result in slight decline in resource in study area during life of the Project. Research, monitoring, and/or recovery initiatives would not normally be required.
Minimal/None	Potential effect may result in slight decline in resource in study area during construction phase, but should return to baseline levels.

8.7 Recommended Monitoring and Follow-up

Follow-up and monitoring, in some cases developed in conjunction with regulators, may be recommended to assess effectiveness of measures implemented to mitigate adverse environmental effects.

9.0 EFFECTS ASSESSMENT

9.1 Geophysical Environment

9.1.1 Interactions and Potential Effects

Project activities have the potential to impact the geophysical environment during construction resulting in:

- Disruption of the subsurface soils due to excavation; and
- Release of air-borne particles.

Subsurface soils will be disrupted during construction of the new dam and decommissioning of the existing dam. The new dam will require excavation to bedrock for the placement of the dam base, as well as the removal of the existing dam. Disturbance to soils is expected to be localized in the areas of the dam locations and construction areas and will be temporary, restoration of soils occurring following the respective phases.

Air quality emissions released during construction of the new dam and decommissioning of the existing dam are expected to be minimal and easily mitigated. Emissions may occur as fugitive dust from access roads and construction areas, and as particulate matter and combustion gases from construction equipment (e.g. trucks, dump trucks, excavators). These emissions are expected to be of low quantity and short-term.

9.1.2 Specific Mitigative and Protective Measures

Mitigative measures to minimize the environmental effects of the Project on the geophysical environment include:

- A site specific ESCP will be developed for the Project and included as part of the Environmental Protection Plan;
- Implementation of the EPP, including the spill prevention plan and contingency plan;
- Excavation below the water table will not take place, unless prior approval from NSE is obtained;
- Implement best practices for stored chemical removal to minimize disturbance for the potential for spill releases;
- All soils removed during the excavation phase will be stored according to provincial regulations and best practice guidelines;
- Any soil needed for backfilling, after foundations have been poured, will be stored temporarily adjacent to the excavations until needed. Any remaining excavated material will be used on-site or removed and sent to an approved facility;
- Prior to excavation activities, erosion and sedimentation control measures will be deployed and assessed on a regular basis;
- Once backfilled material has stabilized, temporary erosion and sedimentation controls will be removed. Attention will be paid during site reinstatement to ensure areas will promote wildlife return to the area, to the extent possible;
- Maintain equipment in good working order and properly muffled;
- Keep idling of equipment and vehicles to a minimum; and
- If required, dust will be controlled by using water or a suitable, approved dust suppressant.

9.1.3 Potential Residual Effects

An analysis of the residual effects on the geophysical environment is provided in Table 9.1. It is anticipated that with the implementation of the recommended mitigation measures, Project activities will not have significant residual effects on the geophysical environment.

Table 9.1. Determination of residual effects to the Geophysical Environment

VEC	Potential Effect	Significance Criteria	Residual Effects	Significance of Residual Effects
Geophysical Environment	Disruption in subsurface soils due to excavation (construction)	Scope: Local Duration: Short-term Frequency: Once Magnitude: Low	No	N/A
	Release of air-borne particles (construction)	Scope: Local Duration: Short-term Frequency: Once Magnitude: Low	No	N/A

9.1.4 Recommended Monitoring and Follow-up

An Environmental Protection Plan, with an associated Erosion and Sedimentation Plan, should be developed for the site.

9.2 Freshwater Environment

9.2.1 Interactions and Potential Effects

Project activities have the potential to impact the freshwater environment during construction, operation and decommissioning resulting in:

- Habitat loss/alteration;
- Release of sedimentation and deleterious substances; and
- Direct mortality.

Construction Activities

Construction of the dam will involve the installation and dewatering of the cofferdams within the lake at the site of the new dam, and within the downstream watercourse at the site of the existing dam. The use of cofferdams will result in the temporary loss of freshwater habitat in the areas of the cofferdam. As the construction of the new dam will be completed in phases, fish passage will be maintained above the dam. Fish rescue will be completed within the cofferdam prior to de-watering to ensure that freshwater species are effectively removed and no fish mortality anticipated.

Although the cofferdams are intended to prevent the release of sediment and deleterious substances from the dam construction area, it is possible that sediment may leak out. Additionally, construction activities associated with watercourse restoration, the removal of the existing dam and on land work may potentially release sediment and other deleterious substances into the water. Environmental management measures outlined in Section 3.1 will be implemented to minimize the risk of release of sediment.

Watercourse Restoration

The construction of the new dam will result in the loss of approximate 450 m^2 of existing lentic habitat within the footprint of the new dam. Additional area of lentic habitat between the new and existing dam will be converted into stream habitat prior to the removal of the existing dam. The creation of the reservoir during the construction of the existing dam converted previously flowing-water lotic (stream) habitat in to the Lake Major reservoir. The conversion of the area between the two dams to old streams will restore the habitat to conditions prior to dam construction.

The alteration in flow with the construction of the existing dam resulted in the accumulation of fine sediment over the substrate of the lake, covering up the previous streambed. Over time, it has developed a natural vegetative cover in shallower areas. Although this habitat has value as feeding and rearing habitat for fish species its fine substrate does not provide good spawning habitat for Gaspereau or salmonids, such as Brook Trout and Atlantic Salmon, which require sand or gravel substrates. Additionally, the alterations in water flow associated with damming results in habitat changes that can significantly reduce freshwater mussel population. The accumulation of fine sediments, low flow and deep water makes the freshwater habitat in reservoirs inadequate for most freshwater mussel species (Watters, 1999).

The pre-existing streambed between the new dam and the existing dam will be restored, as best is possible, through the suctioning of the fine sediment that has accumulated and the stabilization of

the new shoreline. The increased vegetative cover, cooler water temperatures, greater aeration, gravel substrate, and flowing water will be of greater value to the freshwater environment than the current lentic habitat. Therefore, although the conversion of previous lentic habitat to lotic habitat will diminish the actual area of freshwater habitat, it will improve its quality.

Restoration work is expected to include limited and directed flow, or no flow through the new dam for a short period of time (approximately 2 weeks) to allow for the restoration of the stream bed downstream of the dam. Maintenance flow will be maintained downstream through directed flow over the new dam or through the culvert by the intersection of Old German Road and Lake Major Road, but fish passage will be restricted during this time. This is planned for the later months of construction and will not interfere with fish migratory periods.

Operation of the New Dam

The rise in FSL with the new dam will result in a minor change in the shoreline. This is expected to be minimal due to the steep topography of the surrounding upland and should not greatly impact existing freshwater species. The new dam will maintain a more consistent water level, particularly during large precipitation events resulting in lower flood level than the existing dam. Irregularities in water levels associated with dams have been shown to be damaging to freshwater mussels (Watters 1999). Although freshwater mussels were not observed within Lake Major and much of the shoreline is not suitable habitat, maintaining a more consistent water level may provide better habitat in shallower areas of the watershed. Combined with better fish passage over the dam, the new dam may work to improve habitat for freshwater mussels in Lake Major.

The fish passage with the existing dam was damaged in 2014 and never repaired. The current syphon system is ineffective and does not encourage natural fish migration. Although it works as a temporary short-term solution, hundreds of fish are trapped downstream of the dam and require physical netting over the dam and was a concern expressed by the community. The new dam includes a fish passage suitable for salmonids and gaspereau, with an incorporated weir design that will ensure functionality even during periods of low water within the reservoir.

Maintenance Flow

Downstream maintenance flow will be set at 0.17 m^3/s annually which was shown to maintain an adequate environment for the river in a wetter perimeter study. This will be supplemented by overspill water that is not withdrawn for drinking purposes. Although higher than what is currently stated in Halifax Water's operation permit, it is lower than the values originally requested by DFO (Leanda Delaney, Pers. Comm.) and an offsetting project will be completed as per the requirements of DFO. Halifax Water has two options under review with DFO which are described below.

<u>Offsetting Option 1: Freshwater Habitat Creation and Enhancement in Settle Run</u>

Settle Run is part of the Cow Bay River Watershed and is located in Cole Harbour, Nova Scotia, approximately 5 km southwest of the Study Area. The stream begins at the outlet of Settle Lake and flows southeast for approximately 3.5 km through the communities of Bel Ayr Park and Colby Village, before emptying into Bissett Lake. Water quality sampling has shown that chemical water quality parameters, such as temperature, pH, dissolved oxygen (DO), total dissolved solids (TDS), and salinity, are within optimum ranges for fish habitat. However, residential development in the

area has degraded physical features of the stream channel making it poor fish habitat.

Settle Run is a viable offsetting option as its physical and chemical water quality indicators are within the optimum range for fish habitat and productivity. Fish presence/absence surveys completed in Settle Lake and Bisset Lake identified a diverse population of fish species within the watershed, including Brook Trout, Yellow Perch, Common Shiner, Golden Shiner, Banded Killifish, American Eel, Smallmouth Bass, Mummichogs, Bridle Shiner, and White Perch. By conducting physical restoration work within the watercourse, fish habitat will be enhanced both in quality and quantity and may encourage a diverse population of fish species.

Restoration of Settle Run will entail:

- Fine sediment removal to improve spawning habitat and restore natural features;
- Culvert remediation to improve fish passage and connectivity during low flow periods;
- Removal of debris jams to improve fish passage and connectivity;
- Installation of low flow barriers to consolidate flow and improve water depth; and
- A 2,953 m^2 habitat gain.

Offsetting Option 2: Freshwater Habitat Creation and Enhancement for Broom Brook

Broom Brook is within a Shore Direct Watershed and is located in Cole Harbour, Nova Scotia, approximately 2.2 km from the Study Area. The stream begins at the outlet of Brook Lake and flows southeast for approximately 3.4 km through mostly undeveloped land before entering an estuary and emptying into the Atlantic Ocean. Broom Brook was heavily impacted by Hurricane Juan, which left large amounts of debris and downed trees in the stream channel. This caused debris jams that washed out the banks and impeding fish passage. Most of these jams were removed in 2016, opening up the stream and making way for further habitat restoration.

Broom Brook is a viable offsetting project as its physical and chemical water quality indicators, such as pH, DO, TDS, and salinity, are within the optimum range for fish habitat and productivity. Temperature was the only water quality parameter that was above optimum, particularly during the summer months. However, it was not high enough to be considered poor and further restoration work in the watercourse may improve it. Fish sampling within the brook identified Brook Trout and American Eels. Preliminary benthic invertebrate surveys identified pollution-sensitive species (such as the caddisfly) which are indicative of good water quality.

Restoration of Broom Brook will entail:

- Improving thalweg and pool depth to keep stream cool and enhance important habitat features;
- Installation of low flow barriers to consolidate the main flow of the watercourse;
- Removal of debris jams to improve connectivity in the watercourse;
- Installation of brush mats to prevent erosion and sedimentation for a section of the watercourse; and
- An estimated 2,915 m^2 habitat gain.

9.2.2 Specific Mitigative and Protective Measures

Mitigative measures to minimize the environmental effects of the Project on the freshwater environment include:

- Implementation of the EPP, including the ESCP, spill prevention plan and contingency plans (as necessary) will be implemented prior to construction;
- ESC structures will be maintained and inspected regularly with particular emphasis before and after forecasted heavy rain events, and with consideration of the timing and types of activities involved;
- Where necessary, ESC measures will remain in place after work is completed until areas have stabilized and natural re-vegetation occurs;
- All overburden removed during the excavation phase will be stored according to provincial regulars and best practice guidelines;
- Exposed soils and stockpiles capable of producing sediment laden-runoff will continue to be stabilized and/or will be covered;
- The length of time stockpiled overburden will be left exposed, and the length without mitigation (e.g., mulching, seeding, rock cover) will be minimized through scheduled work progression;
- The placement of silt booms around the cofferdams as a backup measure for leakage of sediments will be implemented;
- Work vehicles and/or heavy equipment will be cleaned and inspected prior to use to prevent the introduction of invasive species and deleterious substances into the water;
- Temporary storage of waste materials on-site will be located at least 30 m from known watercourses, wetlands, and waterbodies;
- Waste materials will be removed from the site by a qualified waste hauler and disposed/recycled in accordance with provincial waste regulations. All applicable materials will be stored as per WHMIS requirements and transported as per requirements of the Transportation of Dangerous Goods Act (1992);
- Fish passage will be maintained during all construction phases through the continued implementation of the fish syphon;
- Flow levels will be maintained downstream of the bridge during all construction phases;
- In-water work may not occur during October 1 to May 31, or as directed otherwise by government regulators, so as to not interfere with seasonal migration and spawning;
- Appropriate fish-out procedures, as determined by a qualified aquatic biologist, will be carried out prior to draining cofferdam areas and to placing material in water to limit accidental mortalities during construction;
- Water quality monitoring will be completed during construction to ensure erosion, sedimentation, and turbidity measures are effective. Information regarding parameters such as temperature, pH, and dissolved oxygen should be collected as baseline conditions for future monitoring efforts; and
- Vegetation removed from the shoreline during site preparation and construction will be replanted with native species to stabilize soils and provide riparian cover for aquatic species.

9.2.3 Potential Residual Effects

Using criteria based on federal and provincial EA guidance (outlined in Section 10.0) an analysis of residual effects on terrestrial flora from the Project is provided in Table 9.2. No significant residual effects are expected with the implementation of the proposed mitigation measures, including fish rescue procedures.

Table 9.2. Determination of residual effects to the Freshwater Environment

VEC	Potential Effect	Significance Criteria	Residual Effects	Significance of Residual Effects
Freshwater Environment	Habitat loss/alteration (construction, operation)	Scope: Local Duration: Long-term Frequency: Once Magnitude: Low	Yes	Minimal/None
	Release of sedimentation and deleterious substances (construction)	Scope: Local Duration: Short-term Frequency: Once Magnitude: Low	No	N/A
	Direct mortality (construction)	Scope: Local Duration: Short-term Frequency: Once Magnitude: Low	No	N/A

9.2.4 Recommended Monitoring and Follow-up

The following monitoring and follow-up measures are recommended:

- Water levels will be monitored throughout construction to ensure that appropriate levels are maintained downstream of the Study Area;
- An ESCP will be prepared as part of the EPP and will include a water quality monitoring program to ensure that sedimentation and siltation do not exceed guideline values;
- Upon completion of the fish ladder, fish monitoring will be completed during seasonal migrations to ensure functionality; and
- Finalize and implement a habitat offsetting project in consultation with DFO.

9.3 Terrestrial Environment

9.3.1 Potential Interactions and Effects

Project activities have the potential to impact the terrestrial environment during site preparation, construction, operation, and decommissioning resulting in:

- Habitat loss/alteration; and
- Direct mortality.

Habitat Loss/Alteration

Habitat loss and alteration may occur as a result of construction activities as well as through the projected increase in water levels in Lake Major. Project activities associated with construction may impact the terrestrial environment through vegetative loss and disturbance along proposed new access roads and in the onshore footprint of the new dam. The removal of the existing dam however, will convert previously lake habitat downstream of the new dam into terrestrial habitat compensating for the loss habitat in the new dam footprint.

The new FSL during operations of the dam will result in an increase in average water levels of 0.4 m from current conditions. The increase in FSL will result in the inundation of a small portion of the shoreline, resulting in the loss of upland habitat of shoreline habitat around Lake Major. Although expected to be minimal due to the steep topography around much of the shore, loss of upland habitat may impact vegetation, mammals, and herptofauna. The eastern edge of the lake will experience greater impacts as its topography is less steep than the western edge of the lake. It is expected that the shoreline habitat will naturally shift upwards and any vegetation lost will re-establish, resulting in a shoreline very similar to existing conditions. The inundation is not expected to be large enough to have a significant impact on vegetation or SOCI. In addition, as the lake currently experiences high water events above the new FSL, area that will be inundate already experiences intermittent inundation.

Increases in surface water levels may also impact wetland habitat, resulting in wetter hydrologic conditions. Wetland surveys identified ten wetlands contiguous with the lake in which lake water was a main hydrologic source. An increase in the full supply level will ultimately increase surface water and soil saturation levels, potentially resulting in a shift in the vegetative community towards more water-tolerant species (plants with a wetland indicator status of obligate and facultative wet). However, all wetlands also have additional hydrologic sources, generally in the form of surface runoff and inflowing drainage channels and watercourses. They currently experience fluctuations in saturation levels based on the prevalence of these other hydrologic sources as well as existing intermittent flooding from the lake. It is unlikely that the increased in FSL will be detrimentally impact wetland habitat.

The three wetlands that are hydrologically isolated from the lake should remain un-impacted by the changes in FSL, as they are separated by at least a 1 m rise in elevation. It is possible that during extreme high water levels wave action may result in temporary flooding of these wetlands. However, high water levels with the new dam are expected to be lower than what are currently experienced and the risk for intermittent flooding will be less than under current conditions.

Inundation may in fact increase habitat for particular terrestrial species, particularly along the less steep eastern edge of the lake. Shallow and densely vegetated shoreline habitat is important to multiple herptofaunal SOCI species, including turtles and snakes. The inundation of the eastern edge of the lake may increase areas of shallow water with dense vegetation, increasing preferred hertofaunal habitat. Additionally, an increase in areas of shallow water may provide a more complex shoreline and increase vegetative diversity. The lower fluctuations in water levels during high water events (0.2 m with the new dam compared to 1.3 m with the existing dam) will result in a more stable shoreline, and less flooding/drying cycles than the terrestrial habitat currently experiences.

9.3.2 Specific Mitigative and Protective Measures

Mitigative measures to minimize the environmental effects of the Project on the terrestrial environment include:

- General site restoration should be conducted following construction and should include the replanting of any vegetation removed or disturbed at the Study Area;
- Damage and removal of vegetation will be minimized by establishing staging areas and site access routes away from existing trees/naturalized vegetation to the extent possible;
- Stabilize and re-vegetate all exposed soils as soon as possible;
- Implement temporary erosion and sediment control measures to prevent erosion/runoff from impacting adjacent vegetated lands and riparian areas; and
- Waste material will be properly stored and disposed of so as to not attract wildlife to the Study Area.

9.3.3 Potential Residual Effects

An analysis of residual effects on terrestrial flora from the Project is provided in Table 9.3.

Table 9.3. Determination of residual effects to the Terrestrial Environment

VEC	Phase	Significance Criteria	Residual Effects	Significance of Residual Effects
Terrestrial Environment	Habitat loss/alteration (construction, operation)	Scope: Local Duration: Long-term Frequency: Once Magnitude: Low	Yes	Minimal/None
	Direct mortality (construction)	Scope: Local Duration: Short-term Frequency: Once Magnitude: Low	No	N/A

The field surveys did not reveal the presence of any rare or sensitive plants within the Study Area. Furthermore, the habitats present within the expansion area are common throughout the remainder of the Project property and surrounding lands.

9.3.4 Recommended Monitoring and Follow-up

No recommended monitoring and follow-up measures are proposed.

9.4 Avifauna

9.4.1 Interactions and Potential Effects

Project activities have the potential to impact avifauna during construction and operation resulting in:

- Habitat loss/alteration; and
- Direct mortality.

Habitat loss and alteration may occur as a result of vegetation clearing during construction, through the rise in the FSL during operation of the new dam and the alteration of previous lentic habitat downstream of the new dam into lotic habitat. Vegetation clearing for new access roads and laydown areas will result a small amount of habitat loss for passerine birds. Habitat loss in laydown areas will be temporary as this will be revegetated post construction.

The conversion of lentic habitat downstream of the new dam will result in the loss of potential shoreline habitat for shoreline nesting birds, but will contribute additional terrestrial habitat for passerine species. As the shoreline habitat near the dam is not ideal nesting habitat, due to its proximity to residential properties and physical disruptions due to the intake pipe and dam, this small loss of habitat should not negatively impact local shoreline nesting birds.

There is the possibility for direct mortality to nesting birds as a result of vegetation clearing if activities occur during nesting the nesting period (between April and May). Based on the current Project timeline (see Section 2.3), the new dam will be commissioned in November of 2017 and will not impact active loon nests. Additionally, the rise in water levels may result in disruptions to nesting Loons. However, it is unlikely that the higher water levels would disturb active loon nests, so long as water levels are not significantly altered during the active Loon nesting period (Late May to Late August). It is also unlikely that higher average water levels would discourage loons from nesting on the shoreline of Lake Major, as there would still be ample vegetation for nest construction present.

The construction of the fish ladder will likely improve loon habitat within the lake. Fish consist of loon's primary food source and improved fish passage into Lake Major will increase their numbers, benefiting loon and improving breeding habitat.

9.4.2 Specific Mitigative and Protective Measures

Mitigative measures to minimize the environmental effects of the Project on avifauna include:

- Primary mitigation will be through Project planning and scheduling of clearing activities and commissioning of the new dam, on a best-efforts basis, to avoid key nesting periods;
- All requirements as set out in the *Migratory Birds Convention Act* (*MBCA)* will be adhered to for Project activities;
- Vegetation clearing will be kept to a minimum;
- Where possible, clearing of site vegetation will be conducted outside of the breeding and nesting season for birds (April to August);
- Should vegetation clearing be required during nesting periods, searches for migratory bird nests will be undertaken within the area to be disturbed, in consultation with Canadian Wildlife Service (CWS), and all identified nests will be flagged and avoided; and
- Once construction is complete, the resultant water level increase should not be more than 1 m during the loon nesting period (Late April to late August), unless an expert birder has determined the presence or absence of nesting loons on Lake Major.

9.4.3 Potential Residual Effects

An analysis of the residual effects on avifauna is provided in Table 9.4. It is anticipated that with the implementation of the recommended mitigation measures and proper planning, Project activities will not have significant residual effects on avifauna.

Table 9.4. Determination of residual effects to Avifauna

VEC	Proposed Effect	Significance Criteria	Residual Effects	Significance of Residual Effects
Avifauna	Habitat loss/alteration (construction, operation)	Scope: Local Duration: Long-term Frequency: Once Magnitude: Low	Yes	No
	Direct mortality (construction, operation)	Scope: Local Duration: Short-term Frequency: Once Magnitude: Low	No	N/A

9.4.4 Recommended Monitoring and Follow-up

Should water levels on Lake Major be raised more than 1 m as a result of the dam commissioning during the period when the Common Loon may be nesting on the Lake (lake April to late August), surveys for these birds should take place to confirm the presence or absence of nesting loons, and then used to inform a mitigation plan.

9.5 Socio-Economic Environment

9.5.1 Interactions and Potential Effects

Project activities have the potential to impact the socio-economic environment during construction of the new dam, removing the existing dam and operation resulting in:

- Increased noise and traffic;
- Loss of property footage on lake front properties; and
- Risk of inundation in the event of dam failure.

Increased Noise and Traffic

During construction, vehicular traffic and construction activities may result in an increase in noise in the immediate area. This may impact residential properties located off of Lake Major Road and Old German Road in the vicinity of the proposed dam location and the location of the existing dam. Vehicles used during construction will be typical of construction sites and will not exceed noise bylaws. To reduce any potential impacts, vehicles will only be visiting and working on-site during normal daytime hours of operation, where possible, and will be properly muffled and maintained to reduce engine noise.

Vehicular and heavy equipment traffic will be frequently visiting the site and may result in potential temporary traffic delays. However, all construction will be completed off Lake Major Road and disruptions to traffic are expected to be minimal. Disruptions may occur when larger vehicles slow to

turn off Lake Major Road onto the access roads and will consist of minor slowdowns in traffic flow. Travel will avoid high-traffic times of day, when possible, to reduce local traffic congestion and will be conducted using safe work practices for transporting oversized loads and will be in compliance with the "Nova Scotia Temporary Workplace Traffic Control Manual" (NSTIR 2009).

Loss of Property Footage

The increase in FSL associated with the operation of the new dam will result in a small loss of land for properties with lake frontage. However, the new water level will still be below the allowable high level mark for the lake (determined to be 20.0 m by NSDNR) and any potential loss in land will be less than what is currently inundated during high water levels. Additionally, inundation as a result of large storms (i.e. 1:100 year storm events), is expected to be much lower with the new dam than with the existing dam and will minimize the area of land being inundated during high water events.

Risk of Inundation

The replacement structure will not result in greater risk to downstream residents if the dam was to fail. The inundation limits due to dam failure during a flood and dam failure during fair weather are similar. The following areas are to be immediately evacuated when failure of the dam is considered likely:

- Civic #205 - #286 Lake Major Road
- Civic #124 - #172 Crane Hill Road
- Civic #1291 - #1336 Highway 107
- All residents of Lorne Drive
- Civic #90 - #213 Salmon River Drive
- Civic #40 - #68 & #335 - #482 Ross Road
- All residents of Brookside Avenue
- All residents of Greenvale Crescent
- Civic #1813 - #1936 Route 207

The following structures are estimated to be inundated and impassable during a dam failure:

- Timber bridge at Lake Major Road
- Timber bridge at Crane Hill Road
- Concrete bridge at Highway 107
- Timber bridge at Salmon River Drive
- Concrete bridge at Route 207

Limits of flooding are approximation only, based on set procedures and assumptions during modeling, and should be used only as guidance for establishing evacuation zones. Therefore, the following areas outside of the inundation zone should be alerted and ready to evacuate should conditions deteriorate:

- Residents of Old German Road
- Residents of Shannon Drive
- Residents of Ross Road not already evacuated

- Elementary school on Ross Road
- Residents of Westmount Drive
- Residents of Glendale Drive
- Residents of Field Court
- Residents of Ash Tree Court

9.5.2 Specific Mitigative and Protective Measures

Mitigative measures to minimize the effects of the Project on the socio-economic environment include:

- A notice will be placed in public areas along Lake Major Road to inform local residents of signage removal or road infrastructure alterations. Removed signage and guardrails will be immediately replaced and appropriate temporary signage will be provided as necessary to ensure public safety;
- To the extent possible, transportation of materials through Halifax will avoid high traffic times (7-9 am and 3-6 pm; Monday to Friday). All travel will be conducted using safe work practices for transporting oversized loads. Consideration will be given to oversized loads at night to avoid high traffic periods and allow lane closures, as necessary, to navigate turns along the route;
- Equipment transport will utilize a minimum number of vehicles to minimize effects to roadway flow and effects to air quality from exhaust;
- Upgrades will be made to roads and overhead wires, branches, and signs if conflicts arise. Modifications and subsequent reinstatement will be completed to NSTIR specifications;
- Construction equipment will be maintained in good working order and properly muffled;
- Noise-generating construction activities will comply with the requirements of existing by-laws (where applicable);
- Noise control measures (e.g., sound barriers, shrouds, enclosures) will be used where warranted;
- All reasonable efforts will be made to restrict construction-related noise and lighting to between the hours of 9am-6pm, wherever possible;
- The increase in FSL will be kept below the approved high level mark of 20.0 m;
- Minimize the extent and duration of construction activities and associated disruptions;
- Dam infrastructure will be inspected regularly with particular emphasis before and after forecasted heavy rain events, and with consideration of the timing and types of activities involved; and
- Evacuation procedures will be activated immediately should a dam failure occur.

9.5.3 Potential Residual Effects

An analysis of residual effects on the socio-economic environment from the Project is provided in Table 9.5.

Table 9.5. Determination of residual effects to the Socio-Economic Environment

VEC	Phase	Significance Criteria	Residual Effects	Significance of Residual Effects
Socio-economic Environment	Increased noise and traffic (construction)	Scope: Local Duration: Short-term Frequency: Once Magnitude: Low	No	N/A
	Loss of property footage on lake front properties (operations)	Scope: Local Duration: Long-term Frequency: Continuous Magnitude: Low	Yes	Minimal/None
	Risk of inundation in the event of dam failure (operations)	Scope: Local Duration: Short-term Frequency: Once Magnitude: High	No	N/A

Residual adverse impacts of the Project on the Socio-economic environment is limited to the minor loss of property footage on lake front properties due to the increase in water level during the operation of the new dam. This is offset by the fact that the new dam will decrease shoreline flooding during heavy rain and runoff events. The Project is anticipated to have a positive effect on the surrounding community and town of Dartmouth. The new dam will ensure a consistent, clean water supply and will be able to better manage high water-flow conditions, limiting the chance of downstream flooding during storms. It also replaces the existing dam infrastructure that is considered unsafe and is at risk of failure.

9.5.4 Recommended Monitoring and Follow-up

There is no recommended monitoring or follow-up work for the socio-economic VEC.

9.6 Cultural and Heritage Resources

9.6.1 Interactions and Potential Effects

The closest identified First Nation land to the Study Area is the Cole Harbour Mi'kmaq Reserve situated approximately 6 km southwest of the site, which forms part of the Millbrook Reserve.

The Archaeological Screening and Reconnaissance completed for the Project indicated the land within the Study Area was once part of the greater Mi'kmaq territory known as *Sipekne'katik,* meaning 'area of wild potato/turnip'. The surrounding area is dense with lakes and watercourses that would have been important transportation corridors and a resource base for the Mi'kmaq, their ancestors and predecessors for millennia prior to the arrival of European settlers. Lake Major itself would have been utilized as a transportation route as it is part of a series of connected lakes and rivers providing access into the interior of Nova Scotia (CRM Group 2015).

Based on the results of the Archaeological Screening and Reconnaissance for the Project, the study area is considered to exhibit high potential for encountering Precontact and historic Native archaeological resources and high potential for encountering historic Euro-Canadian archaeological

resources (CRM Group 2015). An in-situ archaeological assessment consisting of shovel testing was conducted in October 2016 according to the terms of Heritage Research Permit (A2016NS058). Testing unearthed some artifacts of European origin in the form of broken crockery and was labeled not of great significance. A report outlining the results of the survey will be sent to the Department of Communities, Culture, and Heritage as required by the terms of the Permit.

9.6.2 Specific Mitigative and Protective Measures

Mitigative measures to minimize the environmental effects of the Project on cultural and heritage resources include:

- Any additional construction related impacts not previously assessed will be subjected to archaeological screening and reconnaissance prior to development;
- In the event that archaeological resources or human remains are encountered during development activities associated with the Project all work will be halted and immediate contact will be made with the Coordinator of Special Places, Communities, Culture, and Heritage;
- Response procedures related to the discovery of such items will be outlined in the EPP; and
- Proponent will continue to engage in ongoing consultation with the Sipekne'katic First Nation, Kwilmu'kw Maw-klusuagn, Native Council of Nova Scotia, and Millbrook First Nation.

9.6.3 Potential Residual Effects

An analysis of the residual effects on cultural and heritage resources is provided in Table 9.6. It is anticipated that with the implementation of the recommended mitigation measures, Project activities will not have significant residual effects on cultural and heritage resources.

Table 9.6. Determination of Residual Effects to Cultural and Heritage Resources

VEC	Proposed Effect	Significance Criteria	Residual Effects	Significance of Residual Effects
Cultural and Heritage resources	Disruption of archaeological resources or human remains	Scope: Local Duration: Short-term Frequency: Once Magnitude: Low	No	N/A

9.6.4 Recommended Monitoring and Follow-up

An EPP detailing appropriate response procedures related to the discovery of cultural and heritage resources should be developed for the site.

9.7 Summary of Effects Assessment

Table 9.7 summarizes the results of the effects assessment.

Table 9.7. Summary of Effects Assessments

Project Interaction and Phase	Mitigation Measures	Significant Residual Effect
Geophysical Environment		
Disruption in subsurface soils due to excavation (construction)	• A site specific ESCP will be developed for the Project and included as part of the EPP; • Implementation of the EPP, including the spill prevention plan and contingency plan; • All soils removed during the excavation phase will be stored according to provincial regulations and best practice guidelines; • Any soil needed for backfilling, after foundations have been poured, will be stored temporarily adjacent to the excavations until needed. Any remaining excavated material will be used on-site or removed and sent to an approved facility; • Implement best practices for stored chemical removal to minimize disturbance for the potential for spill releases; and • Once backfilled material has stabilized, temporary erosion and sedimentation controls will be removed. Attention will be paid during site reinstatement to ensure areas will promote wildlife return to the area, to the extent possible.	None
Release of air-borne particles (construction)	• Maintain equipment in good working order and properly muffled; • Keep idling of equipment and vehicles to a minimum; and • If required, dust will be controlled by using water or a suitable, approved dust suppressant.	None
Freshwater Environment		
Habitat loss/alteration (construction, operation)	• Fish passage will be maintained during all construction phases through the continued implementation of the fish syphon; • Flow levels will be maintained downstream of the bridge during all construction phases; • In-water work may not occur during October 1 to May 31, or as directed otherwise by government regulators, so as to not interfere with seasonal migration and spawning; and • Vegetation removed from the shoreline during site preparation and construction will be replanted with native species to stabilize soils and provide riparian cover for aquatic species.	Minimal
Release of sedimentation and deleterious substances (construction)	• Implementation of the EPP, including the ESCP, spill prevention plan and contingency plans (as necessary) will be implemented prior to construction; • ESC structures will be maintained and inspected regularly with particular emphasis before and after forecasted heavy	None

Project Interaction and Phase	Mitigation Measures	Significant Residual Effect
	rain events, and with consideration of the timing and types of activities involved; • Where necessary, ESC measures will remain in place after work is completed until areas have stabilized and natural re-vegetation occurs; • All overburden removed during the excavation phase will be stored according to provincial regulars and best practice guidelines; • Exposed soils and stockpiles capable of producing sediment laden-runoff will continue to be stabilized and/or will be covered; • The length of time stockpiled overburden will be left exposed, and the length without mitigation (e.g., mulching, seeding, rock cover) will be minimized through scheduled work progression; • The placement of silt booms around the cofferdams as a backup measure for leakage of sediments will be implemented; • Work vehicles and/or heavy equipment will be cleaned and inspected prior to use to prevent the introduction of invasive species and deleterious substances into the water; • Temporary storage of waste materials on-site will be located at least 30 m from known watercourses, wetlands, and waterbodies; and • Waste materials will be removed from the site by a qualified waste hauler and disposed/recycled in accordance with provincial waste regulations. All applicable materials will be stored as per WHMIS requirements and transported as per requirements of the Transportation of Dangerous Goods Act (1992).	
Direct mortality (construction)	• Appropriate fish-out procedures, as determined by a qualified aquatic biologist, will be carried out prior to draining cofferdam areas and to placing material in water to limit accidental mortalities during construction; and • Water quality monitoring will be completed during construction to ensure erosion, sedimentation, and turbidity measures are effective. Information regarding parameters such as temperature, pH, and dissolved oxygen should be collected as baseline conditions for future monitoring efforts.	None

Project Interaction and Phase	Mitigation Measures	Significant Residual Effect
Terrestrial Environment		
Habitat loss/alteration (construction, operation)	• General site restoration should be conducted following construction and should include the replanting of any vegetation removed or disturbed at the Study Area; • Damage and removal of vegetation will be minimized by establishing staging areas and site access routes away from existing trees/naturalized vegetation to the extent possible; and • Implement temporary erosion and sediment control measures to prevent erosion/runoff from impacting adjacent vegetated lands and riparian areas.	Minimal
Direct mortality (construction)	• Waste material will be properly stored and disposed of so as to not attract wildlife to the Study Area; and • Stabilize and re-vegetate all exposed soils as soon as possible.	None
Avifauna		
Habitat loss/alteration (construction, operation)	• Where possible, clearing of site vegetation will be conducted outside of the breeding and nesting season for birds (April to August); and • Vegetation clearing will be kept to a minimum.	None
Direct mortality (construction, operation)	• Primary mitigation will be through Project planning and scheduling of clearing activities and commissioning of the new dam, on a best-efforts basis, to avoid key nesting periods; • Should vegetation clearing be required during nesting periods, searches for migratory bird nests will be undertaken within the area to be disturbed, in consultation with CWS, and all identified nests will be flagged and avoided; and • Once construction is complete, commissioning of the dam should not be completed if the resultant water level increase is more than 1 m during the loon nesting period (Late April to late August), unless an expert birder has determined the presence or absence of nesting loons on Lake Major.	None
Socio-Economic Environment		
Increase noise and traffic (construction)	• A notice will be placed in public areas along Lake Major Road to inform local residents of signage removal or road infrastructure alterations. Removed signage and guardrails will be immediately replaced and appropriate temporary signage will be provided as necessary to ensure public safety; • Upgrades will be made to roads and overhead wires, branches, and signs if conflicts arise. Modifications and subsequent reinstatement will be completed to NSTIR specifications;	N/A

Project Interaction and Phase	Mitigation Measures	Significant Residual Effect
	• To the extent possible, transportation of materials through Halifax will avoid high traffic times (7-9 am and 3-6 pm; Monday to Friday). All travel will be conducted using safe work practices for transporting oversized loads. Consideration will be given to oversized loads at night to avoid high traffic periods and allow lane closures, as necessary, to navigate turns along the route; • Equipment transport will utilize a minimum number of vehicles to minimize effects to roadway flow and effects to air quality from exhaust; • Construction equipment will be maintained in good working order and properly muffled; • Noise-generating construction activities will comply with the requirements of existing by-laws (where applicable); • Noise control measures (e.g., sound barriers, shrouds, enclosures) will be used where warranted; • All reasonable efforts will be made to restrict construction-related noise and lighting to between the hours of 9am-6pm, wherever possible; and • Minimize the extent and duration of construction activities and associated disruptions.	
Loss of property footage on lake front properties (operations)	• The increase in FSL will be kept below the approved high level mark of 20.0 m.	None
Risk of inundation in the event of dam failure (operations)	• Dam infrastructure will be inspected regularly with particular emphasis before and after forecasted heavy rain events, and with consideration of the timing and types of activities involved; and • Evacuation procedures will be activated immediately should a dam failure occur.	N/A
Cultural and Heritage Resources		
Disruption of archaeological resources or human remains (construction, operations)	• Any additional construction related impacts not previously assessed will be subjected to archaeological screening and reconnaissance prior to development; • In the event that archaeological resources or human remains are encountered during development activities associated with the Project, immediate contact should be made with the Coordinator of Special Places, Communities Culture, and Heritage; • Response procedures related to the discovery of such items will be outlined in the EPP; and	None

Project Interaction and Phase	Mitigation Measures	Significant Residual Effect
	• Proponent will continue to engage in ongoing consultation with the Sipekne'katic First Nation, Kwilmu'kw Maw-klusuagn, Native Council of Nova Scotia, and Millbrook First Nation.	

10.0 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

Environmental factors that have the potential to have damaging effects on the structural integrity of a dam include:

- Extreme wind (typically associated with hurricanes);
- Precipitation events;
- Droughts;
- Ice formations;
- Lightning strike; and
- Fire.

The primary mitigative measure employed during the construction and operation of the Project will be to educate and train site personnel. Environmental and safety orientations will be conducted prior to the start of construction and all staff will be informed of the potential effects of the environment on the Project. Staff responsible for the operation and maintenance of the Project will be trained on the design and operation of the dam, including applicable operating procedures, safety protocols, and evacuation plans.

The Project design was developed to account for extreme weather and to withstand the force of high water and wave action. The incorporation of sluicegates allows the operator the ability to release water from lake and rapidly lower water levels. Further, best practices and industry standards will be applied to the operation of the Project to manage risks of damage from extreme events.

Table 10.1 outlines potential effects resulting from environmental events and the mitigation associated with each.

Table 10.1. Effects of Environmental Events and Associated Mitigation

Event	Environmental Effect	Mitigation
Extreme wind	High waves resulting in damage to dam	• Dam designed to withstand high water flow; • Dam constructed of concrete which is largely resistant to erosion and can respond to large loads without deformation; and • Appropriate safety protocol.
Precipitation events	Overtopping of dam, damage to dam	• Dam designed to withstand high water flow; • Dam design includes flow controls; and • Appropriate safety protocol.

Event	Environmental Effect	Mitigation
Droughts	Low water, no maintenance flow	• The Dam will employ a pump, similar to the existing dam, to allow for downstream maintenance flow during periods of low water.
Ice formation	Damage to dam	• Dam constructed of concrete which is largely resistant to erosion and can respond to large loads without deformation.
Lightning strike	Potential fire, damage to dam	• Appropriate safety protocol.
Fire	Damage to dam	• Appropriate safety protocol; • Fire prevention plan; • Evacuation plan; and • Local training of first responders.

11.0 CUMULATIVE EFFECTS ASSESSMENT

Concerns are often raised about the long-term changes that may occur not only as a result of a single action but of the combined effects of each successive action on the environment (Hegman et al. 1999).

In addition to the Lake Major Water Supply Plant, Halifax Water operates two additional large water supply plants, the closest being the Bennery Lake Water Supply Plant located approximately 20 km north of the Study Area. All facilities are operated by certified water treatment plant operators, produce water that meets or exceeds the requirements of the Guidelines for Canadian Drinking Water Quality, and have capacity to supply their communities for many years of growth and expansion. As part of the new federal infrastructure fund, Halifax Water has received funding for the following projects that will be starting in 2017:

- Fall River Road Central Water Service Installation;
- Herring Cove Central Water and Sewer Service Installation;
- Lake Major Dam Replacement;
- Sullivan's Pond Storm Sewer Renewal;
- JD Kline Water Supply Plant – Various Upgrades;
- Quinpool Road Watermain Rehabilitation; and
- Northwest Arm Sewer System Rehabilitation.

Given the distance separating these facilities, cumulative impacts as a result of the operation of these facilities is considered insignificant.

Residential/commercial development in the surrounding area could potentially disrupt the natural environment, attributed to an increase in vehicle traffic, noise, dust and increase current water demands within the community. Nearby developments under construction include Lake Loon Estates, situated approximately 3.5 km west of Lake Major. The project consists of townhouses, stacked townhouses, and two condominium buildings. There are a total of 162 units in the community. The first phase of development is currently underway. A development agreement is currently under review to allow the development of a multi-use recreation facility located at 1224

Highway No.7 in Westphal, approximately 1.3 km south of Lake Major. The proposal includes the following:

- approximately 11,148 square metre (120,000 square foot) in size;
- the realignment of the Ross Road and Hwy. No.7 intersection;
- two ice rinks;
- two indoor turf fields;
- interpretive centre;
- fitness facilities;
- viewing stands;
- restaurant; and
- other related amenities.

The majority of the construction work for the Lake Major dam replacement will be completed off of Lake Major Road and no road closures will be required during construction. There is the potential for minor traffic delays during mobilization and demobilization of construction equipment and materials. Steps will be taken to mitigate noise and dust during the construction phase. It is unknown whether the nearby development activities will occur simultaneously, however given the location and size of the activities, it is very unlikely that these might act cumulatively to increase the likelihood of a significant adverse environmental effect on traffic volume, noise, and dust.

Increased water demands resulting from the proposed residential/commercial developments would be addressed during the planning and development phase of each development to ensure the existing water supply facility has the capacity to provide the projected demands.

12.0 OTHER APPROVALS

In addition to the EA Approval, several other permits and/or approvals may be required prior to the start of construction (Table 12.1).

Table 12.1. Future Approvals

Approval/Notification/Permit Required	Government Agency
Provincial	
Water Withdrawal Approval	Nova Scotia Environment
Special Places Protection Act	Nova Scotia Department of Natural Resources
EPP/Sediment and Erosion Control Plan	NSE
Watercourse Alteration Approval	NSE
Wetland Alteration Approval	NSE
Overweight/Special Move Permit	Service Nova Scotia
Access Permit	NSTIR
Federal	
Fisheries Act Authorization	Department of Fisheries and Oceans
Notification of Project	RCMP

13.0 CONCLUSION

In accordance with “A Proponent’s Guide to Environmental Assessment” (NSE 2014), the studies, regulatory assessments, and VEC evaluations described within this document have been considered both singularly and cumulatively.

The results indicate that there are no significant environmental concerns or impacts that may result from the Project that cannot be effectively mitigated or monitored. Best practices and standard mitigation methods will be implemented during all phases of the Project, to ensure methods and practices are comprehensive and are adhered to. Furthermore, an EPP will be developed and communicated to all employees working on the Project.

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