



Henvey Inlet Wind LP

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Henvey Inlet Wind Energy Centre

Water Assessment and Waterbody Report

Final Draft

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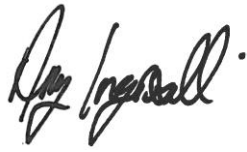
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List of Acronyms and Glossary

BMPs.....	Best Management Practices
CAC.....	Conservation Advisory Committee
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
DFO.....	Fisheries and Oceans Canada
EA	Environmental Assessment
EM.....	Environmental Monitor
ESA	<i>Endangered Species Act</i>
GIS	Geographic Information System
ha	hectare
HIFN.....	Henvey Inlet First Nation
HIW	Henvey Inlet Wind
HIWEC	Henvey Inlet Wind Energy Centre
HONI	Hydro One Network Inc.
HZ	hertz
IESO.....	Independent Electricity System Operator
km	Kilometres
kV	Kilovolt
L/day	Litres per day
m	Metre
m ²	Metres squared
mm	Millimetres
Met tower	Meteorological tower
MNRF	Ontario Ministry of Natural Resources and Forestry
MOECC.....	Ontario Ministry of the Environment and Climate Change
MW.....	Megawatt
NHA.....	Natural Heritage Assessment
NHIC	Natural Heritage Information Centre
O&M	operations and maintenance
OEB.....	Ontario Energy Board
SAR.....	Species at Risk
SARA	<i>Species at Risk Act</i>
TS.....	Transformer Station
WTG.....	Wind Turbine Generator

1. Introduction and Overview

1.1 Henvey Inlet Wind Energy Centre Overview

Nigig Power Corporation (Nigig) received a Feed-in-Tariff (FIT) Contract from the Ontario Power Authority (OPA) in 2011 for a 300 megawatt (MW) wind energy generation centre. Henvey Inlet Wind LP (HIW), a limited partnership between Pattern Renewable Holdings Canada ULC and Nigig Power Corporation, is proposing to develop the Henvey Inlet Wind Energy Centre (HIWEC), a 300 MW facility on Henvey Inlet First Nation Reserve No. 2 (HIFN I.R. #2). AECOM Canada Ltd. (AECOM) was retained by HIW to prepare an Environmental Assessment (EA) for the proposed HIWEC. The EA was conducted in accordance with the Henvey Inlet First Nation Environmental Assessment Guidance Instrument (HIFN EA Guidance) requirements. This Water Assessment and Waterbody Report was prepared in accordance with the HIFN EA Guidance requirements.

1.2 Location and Study Area

The HIWEC study area includes the entirety of HIFN I.R. #2 plus a 550 m buffer extending beyond the HIFN I.R. #2 boundary. HIFN I.R. #2 is bounded on the north by the Key River, Georgian Bay to the west, Highway 69 to the east with some HIFN I.R. #2 property located on the east side of Highway 69. The southern boundary runs from Sandy Bay on the southwest corner in a north easterly direction to Highway 69 south of Bekanon Road. The geographic location is along the eastern shore of Georgian Bay, south of French River Provincial Park and directly north of North Georgian Bay Shoreline and Islands Conservation Reserve (**Figure 1-1**). A site visit of each potential waterbody within a 120 m wide area along these components was conducted. Detailed field assessments were conducted within a 100 m wide area along the alignment of HIWEC access roads, collector and transmission lines and WTGs; where the potential for negative impact is anticipated to be highest. For the purposes of this report, this 120 m wide area of investigation is henceforth referred to as the Waterbodies study area. HIFN I.R. #2 is part of the Georgian Bay Biosphere Reserve which encompasses 347,000 ha of land stretching 300 km from Port Severn to the French River and is designated as a United Nations Educational, Scientific, and Cultural Organization (UNESCO) Biosphere Reserve (Georgian Bay Biosphere, 2015). Highway 69 is a major north-south highway connecting Highway 400 north of Parry Sound with the City of Greater Sudbury at Highway 17.

Generally, the HIWEC study area has shallow soils, with many rocky outcrops forming longitudinal ridges running on a northwest to southeast axis, and is divided roughly in half by the Henvey Inlet waterbody. Numerous wetland pockets are located between the ridges and across the study area, with upland regions supporting forested areas of poplar and jack pine. **Section 4** of the Final Draft EA Report provides a more detailed description of the existing environmental conditions within the study area. The HIWEC study area also includes lands off-Reserve that are within the area that may experience increased noise levels from the HIWEC. All HIWEC components will be located within the HIWEC study area as shown in the site plan provided as **Figure 1-2**.

1.3 Water Assessment and Waterbody Report Requirements

The study area delineated for the purposes of completing the Water Assessment and Waterbody Report includes the aforementioned boundaries of the Waterbodies study area. As defined in the HIFN EA Guidance document, waterbodies located within the Waterbodies study area are to be studied and investigated through a records review and site investigation. If there are waterbodies within the specified distances, then a determination of potential environmental effects is to be completed and mitigation measures proposed to minimize the potential environmental effects which are to be included in the Waterbody Report.

Figure 1-1: Study Area

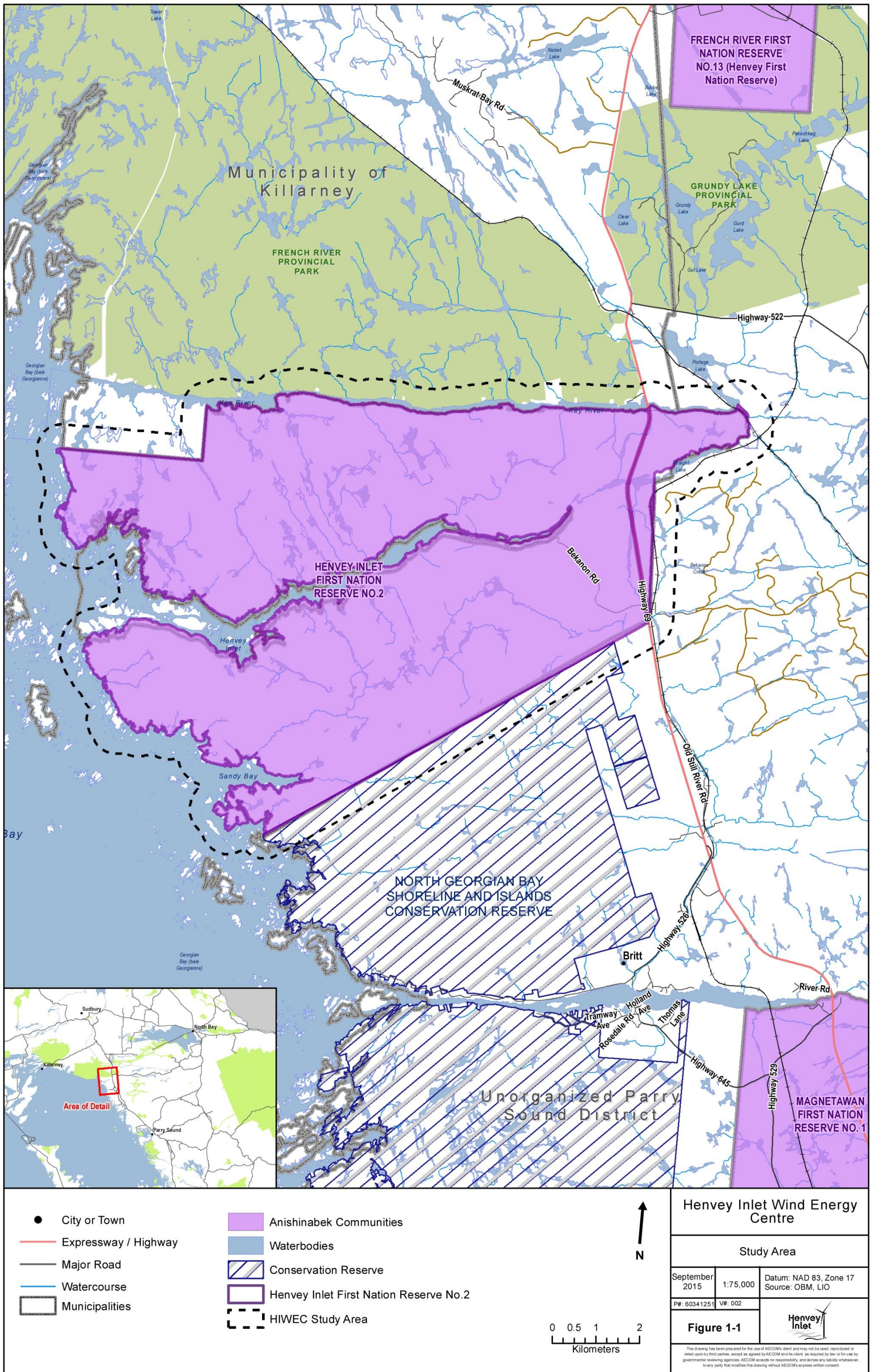
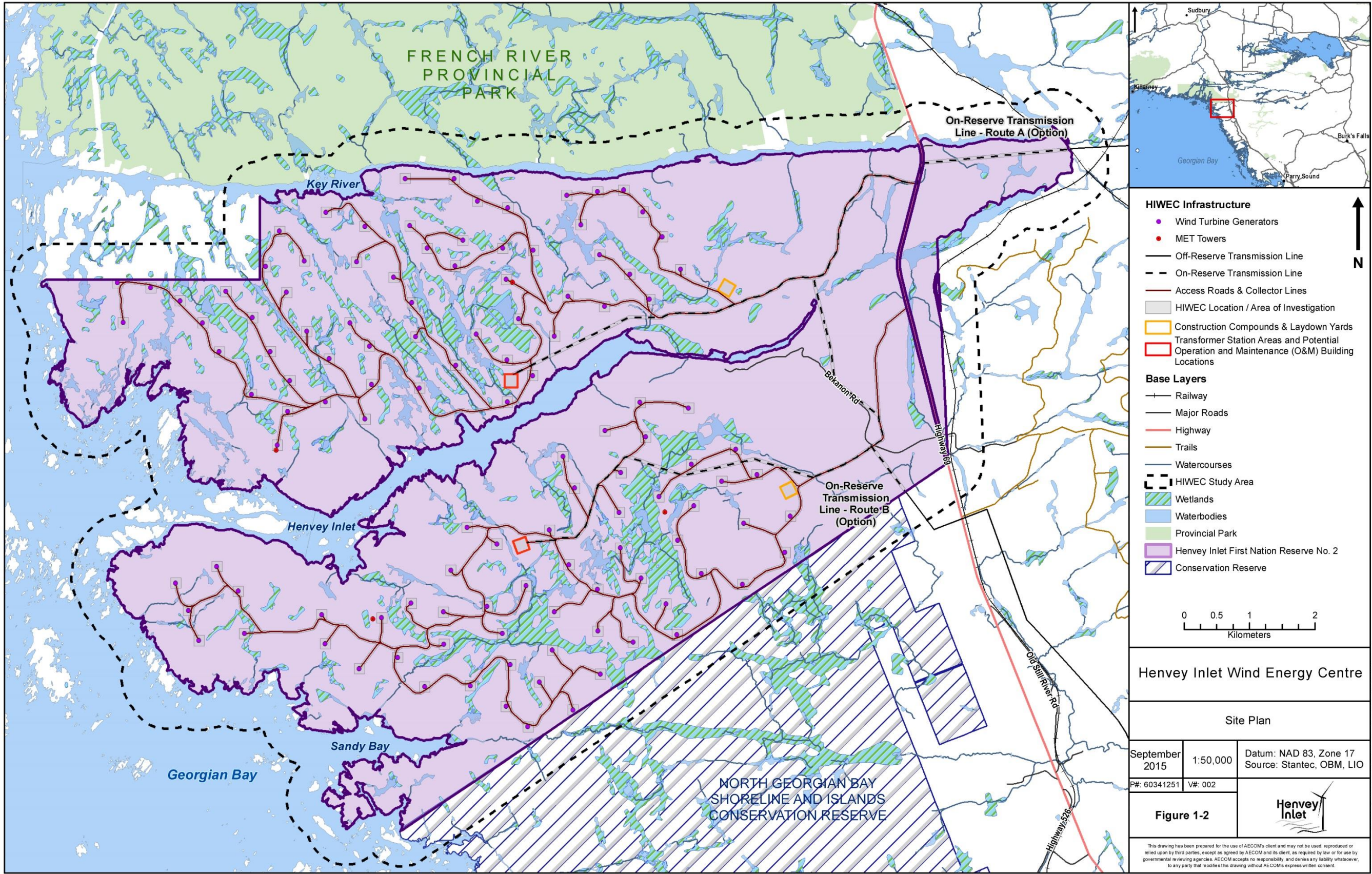


Figure 1-2: Site Plan



In conjunction with the typical provincial process for wind energy projects, the HIWEC EA will conduct a Waterbody Assessment consisting of the following:

- A Records Review
- A Site Investigation

Through this process, AECOM will identify waterbodies within the Waterbodies study area and determine if the standards for avoidance and mitigation are in congruence with the provincial standards applicable to similar wind energy projects located in Ontario.

Ontario Regulation 359/09 under the *Environmental Protection Act* defines a waterbody as a lake, permanent stream, intermittent stream or a seepage area. Definitions of these and other terms used in this report are as follows:

Permanent streama stream that continually flows in an average year;

Intermittent streama natural or artificial channel, other than a dam, that carries water intermittently and does not have established vegetation within the bed of the channel, except vegetation dominated by plant communities that require or prefer the continuous presence of water or continuously saturated soil for their survival;

Lake Trout Lakea lake that has been designated by the Ministry of Natural Resources and Forestry for Lake Trout management, as set out in records maintained by and available from that Ministry, and;

Seepage Areaa site of emergence of groundwater where the water table is present at the ground surface, including a spring.

WetlandLand such as a swamp, marsh, bog or fen, other than land that is being used for agricultural purposes and no longer exhibits wetland characteristics, that:

- Is seasonally or permanently covered by shallow water or has the water table close to or at the surface, and
- Has hydric soils and vegetation dominated by hydrophytic or water-tolerant plants.

Streams, brooks, creeks and rivers are also referred to as lotic, or watercourses; meaning unidirectional flowing water.

Lakes and ponds are also referred to as lentic or waterbodies; meaning body of standing water surrounded by land.

A waterbody does not include:

- (a) Grassed waterways;
- (b) Temporary channels for surface drainage, such as furrows or shallow channels that can be tilled and driven through;
- (c) Rock chutes and spillways;
- (d) Roadside ditches that do not contain a permanent or intermittent stream;
- (e) Temporarily ponded areas that are normally farmed;
- (f) Dugout ponds that have no obvious, visible connection to a another waterbody, and;
- (g) Artificial bodies of water intended for the storage, treatment or recirculation or runoff from farm animal yards, manure storage facilities and sites and outdoor confinement areas.

Waterbodies that were identified within the Waterbodies study area are identified and assessed in this Water Assessment and Waterbody Report.

2. Overall Methodology

As shown on **Figure 2-2**, 120 commercial wind turbine generators (WTGs) are being assessed for the HIWEC with only up to 91 WTGs ultimately being constructed. To date, 20 of the 120 WTG locations have been identified for removal based on technical and environmental studies completed and comments received from HIFN members and the public. The HIWEC includes the following permanent components, as detailed in **Section 2** of the Final Draft EA Report:

- Access roads will be constructed to support construction, operations, and decommissioning activities and to provide access to WTGs and other HIWEC infrastructure.
- Crane pads will be required to be constructed at each WTG.
- Meteorological (Met) towers are required during the operations phase to validate the performance of the WTGs and provide meteorological data to the Independent Electrical System Operator (IESO) to support their wind forecasting activities and operation of the provincial electrical system.
- A pad-mounted transformer will be located at the base of each WTG to step-up the voltage of electricity generated to the collector system voltage (e.g., 690 V to 34.5 kV).
- Two transformer stations (TSs) will be constructed on HIFN I.R. #2 to step up the 34.5 kV voltage of the collector lines to the 230 kV voltage of the Transmission Line that will transport electricity to the provincial transmission grid.
- From the HIWEC TSs, a section of overhead transmission line of 230 kV will be constructed on HIFN I.R. #2. The Transmission Line will consist of Aluminum Conductor Steel Reinforced (ACSR) cable.
- An operations and maintenance (O&M) building will be constructed to monitor the day-to-day operations of the HIWEC and provide an area for storage of spare parts and maintenance equipment.

During HIWEC construction, lands will be temporarily used for: construction compounds and laydown yards; construction areas surrounding infrastructure including parking areas (e.g., WTG staging areas); concrete batch plant(s); crusher(s) and water withdrawal points. These temporary components are further described in **Section 2** of the Final Draft EA Report.

3. Records Review and Summary of Background Information

3.1 Requirements and Methods

In accordance with the HIFN EA Guidance document, available resources and existing data pertaining to the aquatic environment was reviewed. Information obtained from this Records Review provides insight such as where waterbodies occur in the HIWEC study area, their potential to support a fish community, the composition of the existing fish community, critical fish habitat, Species at Risk (SAR) occurrences, and their cultural, recreational and commercial uses.

The Records Review was conducted for the entire HIWEC study area to accommodate any potential changes to the proposed HIWEC layout that may occur during the planning stages. **Figure 3-1** illustrates some of the aquatic environment features identified through the Records Review.

The Records Review was completed to identify the presence of waterbodies, fish and fish habitat, and aquatic Species at Risk located within or in the immediate vicinity of the HIWEC study area using the following secondary resources:

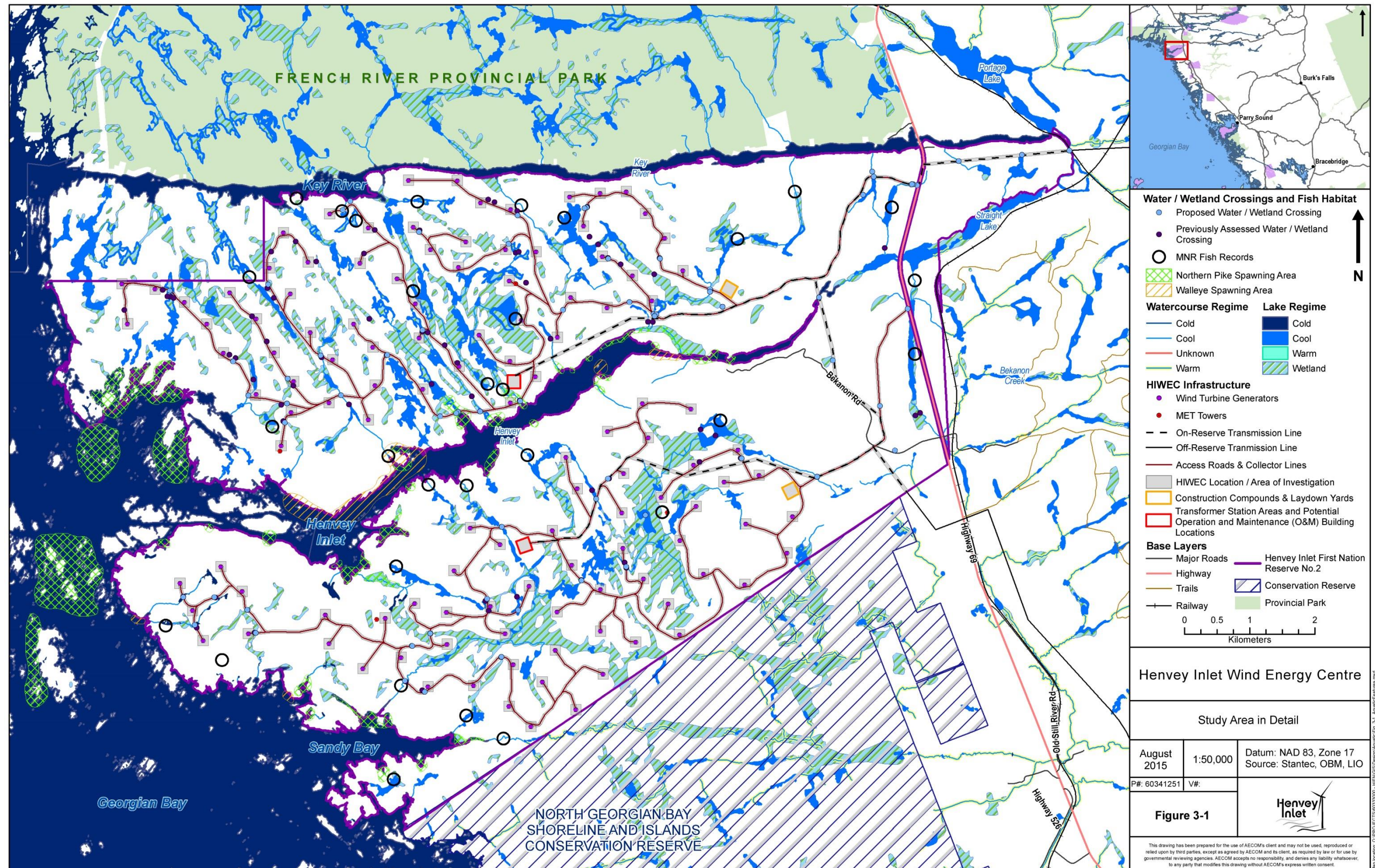
1. Interactive Mapping Sites:
 - ES 1. Ministry of Natural Resources and Forestry (MNR) Make-A-Map: Natural Heritage Areas (2015);
 - ES 2. MNR Natural Heritage Information Centre (NHIC) Rare Species Records (2014b);
 - ES 3. MNR SAR by Area Online Search Tool (2014c); and
 - ES 4. University of Guelph *FishMAP* Online Tool (University of Guelph, 2011)
2. MNR's Natural Resources and Values Information System (NRVIS) mapping from Land Information Ontario (LIO) for:
 - ES 5. Waterbody, watercourse, wetland layers;
 - ES 6. Thermal Regime; and
 - ES 7. Fish Records.

A request for information was submitted to MNR's, Parry Sound District office on January 27 and February 17, 2015 for any data gaps identified during the background information review.

A request for information was submitted to Fisheries and Oceans Canada (DFO) Fisheries Protection Program office in Burlington, Ontario on March 16, 2015 for any additional fishery or SAR data.

Data collected was confirmed, and supplemented during aquatic habitat field assessments completed in 2015. Results of the records review, field studies and analysis have been summarized herein.

Figure 3-1: Aquatic Environment Features



3.2 Summary of Findings from the Record Review

3.2.1 Previous Field Studies

LGL Ltd. completed a records review and site investigation in 2011. This information is documented in the *Nigig Power Corp/Henvey Inlet Wind Project Preliminary Environmental Constraints Analysis* (Neegan Burnside Ltd. Preliminary Report, 2011) is a preliminary review and records search conducted by Neegan Burnside Ltd. The following summarizes the findings of available data and ecological studies, including those completed by LGL in 2011, however the location of records of certain species is not always specified (i.e., whether the record came from the HIWEC study area or one of the alternative Transmission Line routes). Given that these records are from the same geographic area as the current HIWEC study area, all species observed by LGL in 2011 as reported in the Neegan Burnside Ltd. Preliminary Report (2011) were included in the Records Review. Fisheries data obtained from the Neegan Burnside Ltd. Preliminary Report (2011) pertain to the coastal habitats of Georgian Bay and Henley Inlet only. This included a list of game fish species that are known to inhabit these habitats, plus mapping data indicating known game fish spawning grounds within the inlet and eastern shoreline of Georgian Bay in the vicinity of the inlet and HIWEC study area.

In addition, field studies on the aquatic environment were conducted within the HIWEC study area by Tulloch Environmental in 2013. Available information regarding the aquatic component of these field studies are summarized in the following sections. Fish habitat and community assessments at randomly selected sample sites of inland waterbodies were completed by Tulloch Environmental in the summer of 2013. Forty locations were randomly plotted within the HIWEC study area using a transect method. This method was used to account for all potential habitat types and at varying elevations, in order to gain a preliminary assessment of the use of inland waterbodies by fish and the sensitivity of the fish and fish habitat of these waters. At each site, the potential to directly support a fish community based on available habitat, migration barriers and connectivity and water quality was evaluated. Fish community sampling was conducted where this potential was identified and habitat features of the assessment area were documented.

Tulloch Environmental provided fish collection data and Geographic Information System (GIS) data from their 2013 field season to Pattern Energy. These data were assembled into a draft technical memo by AECOM and summarizes the results of Tulloch's field data.

3.2.2 Agency and Online Resource Consultation

Fisheries and Oceans Canada (DFO) provided a list of fish known to occur within the HIWEC study area, including SAR.

The Ontario Ministry of Natural Resources and Forestry (MNRF) provided mapping information for known Northern Pike (*Esox lucius*) spawning areas in Henvey Inlet. As the HIWEC study area is mainly on First Nation's Land, the MNRF acknowledged that the data in their possession may be limited.

Records of documented SAR occurrences within the HIWEC study area were obtained from the MNRF *Make-A-Map: Natural Heritage Areas* (2015) and MNRF NHIC Rare Species Records (2014b).

A list of SAR with the potential to occur within the HIWEC study area where suitable habitat is present (i.e., the HIWEC study area is within the known range of a SAR and/or presence of a SAR is known in the watershed or adjacent areas).

3.2.3 Surface Water

3.2.3.1 Waterbodies

Henvey Inlet is part of the Georgian Bay Biosphere Reserve, the Great Lakes Coastal Reserve and the Lake Huron Drainage Basin (MNRF, 2015). The Georgian Bay Biosphere encompasses ~347,000 ha of land stretching 300 km from the eastern coast of Port Severn to the French River and includes a mixture of open waters, sheltered bays and coastal wetlands (Georgian Bay Biosphere, 2015). The Lake Huron Drainage basin covers a total area of ~134,100 km².

The Henvey Inlet waterbody itself extends the length of HIFN I.R. #2 in an east - west direction. Based on air photo imagery, topographic mapping, Records Review and field observations, most of the aquatic environment of the inlet can be described as rolling and weathered bedrock shorelines and clear water ranging in depth from 1 m to 12 m. Occasional bedrock or boulder / cobble islands and shoals are present throughout the inlet. Many inland tributaries drain to Henvey Inlet and in some areas, the deposition of sediment at these outlets, over time, has created conditions conducive to aquatic and riparian vegetation growth; however, these areas were generally uncommon. The clear water, lack of riparian or aquatic vegetation and bedrock or coarse substrate shorelines noted throughout most of the inlet are likely attributed to the wind and water circulation throughout the inlet from its exposure to Georgian Bay. The eastern limit of the inlet is more protected from the wind and wave action of Georgian Bay by shoals, shoreline and islands. As a result, habitat features such as fine substrates, riparian and aquatic vegetation are significantly more prominent at the eastern point of the inlet.

Based on air photo imagery, topographic mapping, Records Review and field observation; inland waterbodies throughout the HIWEC study area consist mainly of an extensive network of wetlands. Extensive bedrock throughout the landscape plus the abundance of Beaver (*Castor canadensis*) activity facilitated the creation of numerous bogs, fens, open-water ponds and shallow marshes. Flowing streams were present inland, however more-so in closer proximity to the outlets of the main watercourses bordering the HIWEC study area. Inland watercourses and wetlands within the HIWEC study area are tributaries to one of the following: the Key River which runs along the northern boundary of the HIWEC study area, Henvey Inlet, or the eastern shoreline of Georgian Bay.

3.2.3.2 Drainage

Surface drainage of inland waters within the HIWEC study area is generally directed northwest to the Key River and Henvey Inlet and westward towards Georgian Bay. Surface water features where local drainage is conveyed to are common across the site given the complex topography of the site and its rocky nature. Elevation ranges from approximately 230 mASL in the east section of the HIWEC study area to approximately 170 mASL at the most westerly portion of the HIWEC study area near Georgian Bay. Based on correspondence and data provided by Tulloch Environmental, the water quality observed at a significant portion of the inland waterbodies was found to have lower than average dissolved oxygen and pH readings. This is commonly observed in bog and fen-type environments which typically produce acidic drainages.

3.2.4 Aquatic Vegetation

During the summer of 2013, Tulloch Environmental conducted fish habitat assessment surveys at 40 site locations throughout the HIWEC study area, of which 36 sites were sampled for fish. Raw data provided by Tulloch Environmental and personal knowledge from (former) Tulloch biologists, local residents and direct observation has provided general insight on the dominant aquatic vegetation communities observed at these sites (i.e., submergent, emergent or floating), the total percent of aquatic vegetation cover and habitat types within the HIWEC study area. Information from these sources indicates that many of these site locations were considered natural wetland habitats

(e.g., fen) or areas that had converted to wetlands due to beaver activity. The dominant vegetation type observed at the bog and fen habitats was floating mats, with species typical of these low pH habitat such as Sweet Gale (*Myrica gale*), Bog Rosemary (*Andromeda polifolia*), Sheep Laurel (*Kalmia angustifolia*), Bog Laurel (*Kalmia polifolia*), Tamarack (*Larix laricina*), and Pitcher Plant (*Sarracenia purpurea*).

Open-water ponds with bedrock shorelines and bedrock-boulder substrates with a significant component of detritus and muck were frequently observed throughout the HIWEC study area. Those types of ponds were most typical in the mixed wetlands at the Key River. Emergent, submergent and floating aquatic vegetation typical of these habitats such as Yellow Pondlily (*Nuphar variegata*), Fragrant Water Lily (*Nymphaea odorata*), Pondweeds (*Potamogeton* sp.), Bladderwort (*Utricularia* sp.), Cattails (*Typha* sp.) and Milfoil (*Myriophyllum* sp.) were commonly observed. The wetland drains in a northerly direction for ~150 m and descends fairly steeply before draining into the Key River.

The southern edge of Straight Lake consists of emergent and submergent aquatic vegetation. Barren sand substrate dominates the central portion and continues for two-thirds of the lake with depths up to 4.5 m. Submergent vegetation begins to appear at about 130 m from the south shore of the lake. Pockets of submergent and emergent vegetation become more frequent moving northerly along the shore.

3.2.5 Fish and Fish Habitat

Throughout the inland waterbodies (Key River and Henvey Inlet) and coastal shorelines present throughout the HIWEC study area, a variety of aquatic habitats were noted. These variable habitats are able to support warm, cool and coldwater fish communities.

The Henvey Inlet is classified as cold water fish habitat until approximately 5.0 km west of Highway 69 where the thermal regime of the Inlet is unknown (Neegan Burnside Ltd. Preliminary Report (2011)). As an inlet of Georgian Bay, Henvey Inlet has the potential to support numerous fish species. **Table 3-1** is a compilation of fish known to inhabit Henvey Inlet. This information below was collected from data provided in the Neegan Burnside Ltd. Preliminary Report (2011) and from direct observations.

Table 3-1: Fish Likely or Known to Inhabit Henvey Inlet

Common Name	Scientific Name	Common Name	Scientific Name
Alewife	<i>Alosa pseudoharengus</i>	Northern Pike	<i>Esox lucius</i>
Lake Trout	<i>Salvelinus namaycush</i>	Muskellunge	<i>Esox masquinongy</i>
Lake Whitefish	<i>Coregonus clupeaformis</i>	Channel Catfish	<i>Ictalurus punctatus</i>
Cisco	<i>Coregonus artedii</i>	Rock Bass	<i>Ambloplites rupestris</i>
Smallmouth Bass	<i>Micropterus dolomieu</i>	Largemouth Bass	<i>Micropterus salmoides</i>
Black Crappie	<i>Pomoxis nigromaculatus</i>	Yellow Perch	<i>Perca flavescens</i>
Walleye	<i>Sander vitreus</i>	White Bass	<i>Morone chrysops</i>

The Neegan Burnside Ltd. Preliminary Report (2011) also identified known Walleye (*Sander vitreus*) and Northern Pike spawning habitat in Henvey Inlet. Coarse substrates (boulder / cobble) aerated by circulating water preferred by Walleye (Scott and Crossman, 1985) and narrow emergent vegetation in sheltered bays with clear water preferred by Northern Pike (Scott and Crossman, 1985) were noted using air photo imagery and general field observations. Suitable spawning habitat for these fish, especially Northern Pike, was also observed in the Key River using air photo and field observations (Tulloch, 2013).

Fish collection data in the form of MNRF standard fish collection reports were obtained for field work conducted by Tulloch Environmental for the HIWEC study area. This information is based on fish community and habitat field studies conducted by Tulloch Environmental in 2013 preliminary aquatic habitat assessments. The preliminary

aquatic habitat field studies conducted by Tulloch assessed 40 sample sites (both pond and watercourses) chosen at random within the HIWEC study area. The location of the sample sites are shown in **Figure 3-1**. Since field studies conducted by Tulloch Environmental were preliminary and sample sites were chosen at random, the watercourses and online ponds shown in this figure and fish data in **Table 3-2** are not exhaustive lists of all potential permanent or intermittent streams or fish which are or may be present within the HIWEC study area. The following species (**Table 3-2**) were observed during field studies of inland watercourses conducted by Tulloch Environmental in 2013.

Table 3-2: Fish Community of Inland Watercourses and Tributary Outlets To Henvey Inlet, Key River and Georgian Bay

Common Name	Scientific Name	Common Name	Scientific Name
Northern Redbelly Dace	<i>Chrosomus neogaeus</i>	Finescale Dace	<i>Chrosomus eos</i>
Central Mudminnow	<i>Umbra limi</i>	Brown Bullhead	<i>Ameiurus nebulosus</i>
Common Shiner	<i>Luxilus cornutus</i>	Golden Shiner	<i>Notemigonus crysoleucas</i>
Sand Shiner	<i>Notropis stramineus</i>	Fathead Minnow	<i>Pimephales promelas</i>
Brook Stickleback	<i>Culaea inconstans</i>	Rock Bass	<i>Ambloplites rupestris</i>
Pumpkinseed	<i>Lepomis gibbosus</i>	Black Crappie	<i>Pomoxis nigromaculatus</i>
Iowa Darter	<i>Etheostoma exile</i>	Yellow Perch	<i>Perca flavescens</i>
Creek Chub	<i>Semotilus atromaculatus</i>	Emerald Shiner	<i>Notropis atherinoides</i>
Bluntnose Minnow	<i>Pimephales notatus</i>	Mimic Shiner	<i>Notropis volucellus</i>
Bluegill	<i>Lepomis macrochirus</i>	White Sucker	<i>Catostomus commersonii</i>

Data available from the MNRF was limited considering the HIWEC study area is within a First Nation reserve and not within MNRF jurisdiction. The MNRF provided a map indicating confirmed spawning areas for Northern Pike in Henvey Inlet and on the Georgian Bay shoreline within the HIWEC study area.

Identified Northern Pike and Walleye spawning areas are shown in **Figure 3-1**.

Fisheries and Oceans Canada - Fisheries Protection Program biologist Véronique D'Amours Gauthier provided a list of fish known to inhabit the Waterbodies study area on April 2, 2015. These fish include:

Table 3-3: Fish Known to DFO to Occur Within the HIWEC study area

Common Name	Scientific Name	Common Name	Scientific Name
Black Crappie	<i>Pomoxis nigromaculatus</i>	Logperch	<i>Percina caprodes</i>
Blacknose Shiner	<i>Notropis heterolepis</i>	Northern Pike	<i>Esox lucius</i>
Bluntnose Minnow	<i>Pimephales notatus</i>	Northern Redbelly Dace	<i>Chrosomus eos</i>
Bowfin	<i>Amia calva</i>	Pearl Dace	<i>Margariscus margarita</i>
Brook Trout	<i>Salvelinus fontinalis</i>	Pumpkinseed	<i>Lepomis gibbosus</i>
Brown Bullhead	<i>Ameiurus nebulosus</i>	Rock Bass	<i>Ambloplites rupestris</i>
Central Mudminnow	<i>Umbra limi</i>	Sea Lamprey	<i>Petromyzon marinus</i>
Common Shiner	<i>Luxilus cornutus</i>	Smallmouth Bass	<i>Micropterus dolomieu</i>
Creek Chub	<i>Semotilus atromaculatus</i>	Spottail Shiner	<i>Notropis hudsonius</i>
Fathead Minnow	<i>Pimephales promelas</i>	Sucker sp.	<i>Catostomus sp.</i>
Finescale Dace	<i>Chrosomus neogaeus</i>	White Sucker	<i>Catostomus commersonii</i>
Golden Shiner	<i>Notemigonus crysoleucas</i>	Yellow Perch	<i>Perca flavescens</i>
Iowa Darter	<i>Etheostoma exile</i>	Largemouth Bass	<i>Micropterus salmoides</i>
Johnny Darter	<i>Etheostoma nigrum</i>		

Aquatic species at risk data acquired from DFO and online resources are summarized in **Section 3.2.6**.

3.2.5.1 Records Related to Inland Lakes

A review of aerial imagery and online mapping tools show lentic, open waterbodies within the HIWEC study area, two of which are identified as inland lakes.

3.2.5.1.1 Straight Lake

Straight Lake is the easternmost portion of Henvey Inlet and is separated from the main body of the inlet by Highway 69. The average high water mark of the lake lies outside of, but in close proximity to, the HIWEC study area. No results for fish community or habitat data were returned for Straight Lake in the Records Review. Based on aerial imagery, the lake is approximately 2.5 km in length from the divide at Highway 69 to the eastern limit of the lake, and mean width of 230 m. Abundant emergent vegetation creating potential shore-marsh habitats along the shoreline and within the body of the lake are visible based on mapping and aerial imagery. The Highway 69 crossing at Straight Lake does not appear to be creating a passage barrier for fish. Though no fish community data was available specifically for Straight Lake, considering the connectivity to Henvey Inlet, the lake has the potential to support a variety of both predator and forage fish.

As the lake lies outside of the HIWEC study area, no further field studies for Straight Lake are proposed.

3.2.5.1.2 Wolferstan Lake

Wolferstan Lake is a waterbody located in the northwest of the Waterbodies study area, near the coast of Georgian Bay and the mouth of Henvey Inlet. This small lake was not identified on all mapping or online resources referred to in the Records Review, and Wolferstan may be a local name for the waterbody. Consequently no fish community or habitat information was returned in the background information review. Aerial imagery shows the lake may have (or had at one time) connectivity to Georgian Bay, and has the potential to contain both predatory and forage fish. Based on aerial imagery the surrounding topography of the lake and shoreline appears to be dominated by rock barren.

As the lake lies outside of the Waterbodies study area, no further field studies for Wolferstan Lake are proposed.

3.2.5.2 Records Related to Inland Lake Trout Lakes

As described in the MNRF document; *Inland Ontario Lakes Designated for Lake Trout Management* (MNRF, 2006) the HIWEC study area does not contain any inland lakes identified Lake Trout Management Lakes. Additionally, none of the waterbodies within the HIWEC study area are within 300 m of the average annual high water mark of any designated Lake Trout lakes. Georgian Bay, known to contain Lake Trout and is within the HIWEC study area, is not considered to be an inland lake. Therefore no records were reviewed for these waterbodies as none have been identified within the HIWEC study area.

3.2.5.3 Records Related to Seepage Areas

No specific mapping identifying groundwater seepage areas was obtained in the Records Review within the HIWEC study area.

3.2.5.4 Records Related to Permanent or Intermittent Streams and Inland Waterbodies

A number of watercourses are visible using aerial imagery and topographic mapping within the HIWEC study area however a limited amount of data was available from regulatory agencies and previous field studies consulted in the background Records Review.

3.2.6 Species of Conservation Concern and Species at Risk (SAR)

Information and data obtained in the Records Review pertaining to aquatic SAR and species of conservation concern that have the potential to occur within the HIWEC study area are summarized in the subsections below.

The provincial *Endangered Species Act*, 2007 (ESA) offers protection to species designated as Threatened or Endangered, as well as provisions to protect habitat essential to that species' survival. In lands where the MNRF has provincial jurisdiction, additional permitting may be required where impacts to an Endangered Species or its habitat cannot be avoided. Species listed as Endangered or Threatened under the ESA but not listed under Schedule 1 of Federal *Species at Risk Act* (SARA) are treated as provincially protected species for the purpose of this report.

Species listed as Endangered or Threatened under Schedule 1 of the SARA are protected on HIFN I.R. #2 and may require permits and / or authorization administered by Fisheries and Oceans Canada (DFO) if the proposed HIWEC activities are likely to contravene the general or critical habitat prohibition provisions (to be determined in consultation with DFO). Species designated as Special Concern, or species identified as Threatened or Endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and that are under consideration for listing under SARA do not receive protection under the Act.

As defined in the *Significant Wildlife Habitat Technical Guide* (MNR, 2000), species that may be considered species of conservation concern include:

- species identified as nationally Endangered or Threatened by COSEWIC which are not protected in regulation under Ontario's *Endangered Species Act*;
- species identified as Provincially Vulnerable based on lists of Vulnerable, Threatened, Endangered or Extirpated Species of Ontario that are updated periodically by the MNRF;
- species that are listed as rare or historical in Ontario based on records kept by the NHIC in Peterborough (S1 is extremely rare, S2 is very rare, S3 is rare to uncommon);
- species whose populations are known to be experiencing substantial declines in Ontario;
- species that have a high percentage of their global population in Ontario and are rare or uncommon in the planning area;
- species that are rare within the planning area, even though they may not be Provincially rare;
- species that are subjects of recovery programs; and,
- species considered important to the municipality based on recommendations from the Conservation Advisory Committee (CAC).

3.2.6.1 Provincial

Several resources were consulted to identify any aquatic SAR that may occur within the HIWEC study area, such as the MNRF NHIC *Make-a-Map* web application (MNRF 2015) and the MNRF Species at Risk web site (MNRF 2015), which were used to search for SAR records within any of the 1.0 km UTM squares that surrounded the HIWEC study area. The NHIC search resulted in one occurrence of a provincially protected aquatic species, Lake Sturgeon (*Acipenser fulvescens*), which is currently designated as Threatened under the *ESA*. This species is also considered Rare under the SOCC and the Great-Lakes / St. Lawrence population of Lake Sturgeon is under consideration for listing federally with the *SARA*, as summarized in **Table 3-4** below. The University of Guelph *Fish MAP* online tool and MNRF SAR range maps also indicate presence of Lake Sturgeon in the watershed. As Lake Sturgeon are listed as Threatened under the *ESA*, provisions for the protection of this species are determined in consultation with MNRF on lands within provincial jurisdiction.

The search also resulted in two species designated as Special Concern which have been documented within the watershed and have the potential to occur within the HIWEC study area where suitable habitat is present. The University of Guelph *FishMAP* online tool and MNRF SAR range mapping both indicate the presence of Northern Brook Lamprey (*Ichthyomyzon fossor*) and Silver Lamprey (*Ichthyomyzon unicuspis*) in the watershed, particularly in the French River like Henvey Inlet, flows westerly into Georgian Bay on the eastern coastline. Both species are currently designated as Special Concern under the ESA. Species designated as Special Concern under the ESA do not receive additional habitat protection under this Act.

Table 3-4: Provincial Aquatic Species at Risk Potentially Occurring within the HIWEC study area

Taxon	Common Name	Scientific Name	S-Rank ¹	ESA Status ²	COSEWIC Status ³	SARA Schedule ⁴	Year Last Observed
Fish	Lake Sturgeon (Great Lakes - Upper St. Lawrence River population)	<i>Acipenser fulvescens</i>	S2	THR	THR	Under Consideration	1990s
Fish	Northern Brook Lamprey	<i>Ichthyomyzon fossor</i>	S3	SC	SC	SC	unknown
Fish	Silver Lamprey (Great Lakes – Upper St. Lawrence population)	<i>Ichthyomyzon unicuspis</i>	S3	SC	SC	No Schedule	unknown

Notes for Table 3-4

¹**S-rank:** The Natural Heritage provincial ranking system (provincial S-rank) is used by the MNRF NHIC to set protection priorities for rare species and natural communities. Definitions are as follows:

- S1 Extremely rare in Ontario; usually five (5) or fewer occurrences in the province or very few remaining individuals; often especially vulnerable to extirpation.
- S2 Very rare in Ontario; usually between five (5) and 20 occurrences in the province or with many individuals in fewer occurrences; often susceptible to extirpation.
- S3 Rare to uncommon in Ontario; usually between 20 and 100 occurrences in the province; may have fewer occurrences, but with a large number of individuals in some populations; may be susceptible to large-scale disturbances. Most species with an S3 rank are assigned to the watch list, unless they have a relatively high global rank.
- S4 Common and apparently secure in Ontario; usually with more than 100 occurrences in the province.
- S5 Very common and demonstrably secure in Ontario.
- SH Possibly Extirpated (Historical). Species or community occurred historically in the nation or state/province, and there is some possibility that it may be rediscovered. Its presence may not have been verified in the past 20-40 years.
- S#S# A numeric range rank (e.g., S2S3) is used to indicate any range of uncertainty about the status of the species or community.
- S#? Rank uncertain.

²**ESA Status:** The Endangered Species Act 2007 (ESA) protects species listed as Threatened and Endangered on the Species at Risk in Ontario (SARO) List on provincial and private land. The Minister lists species on the SARO list based on recommendations from the Committee on the Status of Species at Risk in Ontario (COSSARO), which evaluates the conservation status of species occurring in Ontario. The following are the categories of at risk:

- END** (Endangered) - A species facing imminent extinction or extirpation in Ontario.
- THR** (Threatened) - Any native species that, on the basis of the best available scientific evidence, is at risk of becoming endangered throughout all or a significant portion of its Ontario range if the limiting factors are not reversed.
- SC** (Special Concern) – A species that may become threatened or endangered due to a combination of biological characteristics and identified threats.
- NAR** (Not at Risk) - A species that has been evaluated and found to be not at risk.

³**COSEWIC Status:** Committee on the Status of Endangered Wildlife in Canada (COSEWIC) evaluates a federal status ranking for all species that it assesses. Rankings include the following:

- END** (Endangered) A species facing imminent extirpation or extinction throughout its range.
- THR** (Threatened) A species likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction
- SC** (Special Concern) A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events, but does not include an extirpated, endangered or threatened species.
- NAR** (Not at Risk) A species that has been evaluated and found to be not at risk.

⁴**SARA Status:** The Species at Risk Act (SARA) protects Species at Risk designated as Endangered, Threatened and Extirpated listed under Schedule 1, including their habitats on federal land. Schedule 1 of SARA is the official list of wildlife species at risk in Canada and includes species listed as Extirpated, Endangered, Threatened and of Special Concern. Once a species is listed on Schedule 1,

they receive protection and recovery measures that are required to be developed and implemented under SARA. Species that were designated at risk by COSEWIC before SARA need to be reassessed based on the new criteria of the Act before they can be listed under Schedule 1. These species that are waiting to be listed under Schedule 1 do not receive official protection under SARA. Once the species on other schedules (2 and 3) have been reassessed, the other schedules are eliminated and the species is either listed under Schedule 1 or is not listed under the Act.

The following are definitions of the SARA status rankings assigned to each species.

END (Schedule 1) – These species are listed as Endangered under Schedule 1 of SARA and receive species and habitat protection under SARA, as well as recovery strategies and action plans.

THR (Schedule 1) – These species are listed as Threatened under Schedule 1 of SARA and receive species and habitat protection under SARA, as well as recovery strategies and action plans.

SC (Schedule 1) – These species are listed as Special Concern under Schedule 1 of SARA and receive management initiatives under SARA to prevent them from becoming endangered and threatened.

No Status (No schedule) – These species are evaluated and designated by COSEWIC but are not listed under Schedule 1 and therefore do not receive protection under SARA.

NAR (Not at Risk) – These species have either been assessed by COSEWIC as Not at Risk or there is not enough sufficient data to assess the status ranking of the species and therefore these are not listed on Schedule 1 nor do they receive protection under SARA.

Not Applicable (N/A) – These species have either been assessed by COSEWIC as Not at Risk or there is not enough sufficient data to assess the status ranking of the species and therefore these are not listed on Schedule 1 nor do they receive protection under SARA.

Source: Government of Canada, 2009: Frequently Asked Questions: What are the SARA schedules? Accessed on February 2015. Available: <http://www.dfo-mpo.gc.ca/species-especes/faq/faq-eng.htm>

3.2.6.2 Federal

No aquatic species protected by Schedule 1 of SARA were identified within the HIWEC study area at the time of assessment.

Results from the Records Review indicate that Lake Sturgeon, Northern Brook Lamprey and Silver Lamprey have the potential to occur within the HIWEC study area where suitable habitat is present. The Great Lakes-Upper St. Lawrence population of Lake Sturgeon has been identified as Threatened by COSEWIC and is under consideration for protection under SARA. The Great Lakes – Upper St. Lawrence population of Northern Brook Lamprey has been identified as a species of Special Concern and is designated as a species of Special Concern under Schedule 1 of SARA. The Silver Lamprey has been identified by COSEWIC as a species of Special Concern and is under consideration for protection under SARA.

Since none of these fish are listed under Schedule 1 of SARA, there are no federal permitting requirements for these species.

In the event that any of these fish become designated as Threatened or Endangered and are granted protection under SARA prior to construction of the HIWEC, authorization from the Federal Minister may be required if these species are detected in the HIWEC study area.

3.3 Summary of Key Findings from the Records Review

Results from the Records Review indicate that Henvey Inlet and the Key River are known to support a rich diversity of warm, cool and coldwater fish communities as well as confirmed spawning areas for Northern Pike and Walleye (Burnside, 2011). Previous field studies (Tulloch, 2013) on inland waters indicate the aquatic habitat types observed inland were dominated by wetlands which were found to support mainly low-diversity communities of baitfish inhabiting warm and coolwater thermal regimes. Streams with connectivity to Henvey Inlet and the Key River unimpeded by fish passage barriers (e.g., beaver dams) demonstrated a richer diversity in fish community including a higher potential to support top-predator game fish pending access from Henvey Inlet or the Key River (Tulloch, 2013). All fish observed in previous field studies are not At Risk or of conservation concern.

No records of aquatic Species at Risk or aquatic Species of Conservation Concern were noted within the HIWEC study area. However, records of Lake Sturgeon, Northern Brook Lamprey and Silver Lamprey were noted within the watershed and their potential to occur within the HIWEC study area where suitable habitat is present should be considered.

A total of 55 locations within the Waterbodies study area were selected for further field studies. These locations are sections of potential waterbodies that HIWEC components (i.e., proposed access roads, collector and transmission lines) in the HIWEC will cross and have a high potential to be impacted by the HIWEC construction and operation. The anticipated area of impact of these waterbodies was assessed in order to: substantiate data obtained in the Records Review, to classify the waterbodies in the areas most susceptible to impacts, to determine the presence or absence of aquatic habitat suitable to support fish, and to document habitat features and areas of significance where habitat is present. Of these 55 locations, 27 were identified as potential wetlands (e.g., swamp, fen, bog, thicket, etc.), five were identified as lentic waterbodies (e.g., pond or lake) and 23 were identified as permanent or intermittent lotic waterbodies (e.g., flowing stream, ephemeral drainage channel, etc.) in the Records Review. **Table 3-5** summarizes these potential waterbodies that were carried forward to field studies.

Table 3-5: Summary of Potential Waterbodies within the Waterbodies study area Identified from Records Review that were Carried Forward to Field Studies

Feature	Number of Waterbodies
Where HIWEC components overlap the average annual high water mark of an identified lake, other than a Lake Trout lake that is at or above development capacity	0
Within 300 m of the average annual high water mark of an identified Inland Lake Trout lake that is at or above development capacity	0
Where HIWEC components overlap the average annual high water mark of a permanent or intermittent lotic watercourses	23
Within 120 m of an identified seepage area	0
Where HIWEC components overlap the average annual high water mark of a wetland or lentic waterbody	32

4. Site Investigation

4.1 Requirements and Methods

Site investigations were completed to confirm the findings of the Records Review for the purpose of determining:

- Whether the results of the Records Review are correct or require correction, and to identify any required corrections,
- Whether any additional waterbodies exist, other than those identified in the Records Review,
- To determine the boundaries of waterbodies within 120 m of the project location and the distance to these boundaries, and
- To document the existing conditions and aquatic habitat features of a waterbody that may be impacted by a component of the HIWEC within the 120 m study area (i.e., access road crossings, etc.).

The names and credentials of the field staff conducting the field studies are provided in Appendix C.

4.2 Site Investigation Methods

Site investigations were conducted for waterbodies within the 120 m Waterbodies study area (see **Section 5.2** for further details on the HIWEC components and infrastructure). Waterbodies identified through the Records Review as well as additional waterbodies identified during field studies were assessed to determine their presence, composition, form and function.

AECOM incorporated a process to ensure all waterbodies within the Waterbodies study area were identified and physically investigated. This three-step process included:

- Records Review - as described in **Section 3.0**;
- Desktop reconnaissance and field study protocol development; and
- Field studies and fish inventory sampling.

To ensure additional accuracy, efforts were co-ordinated with the team of site investigators conducting the Natural Heritage Assessment (NHA) for the same area of investigation. During their site investigations in the Waterbodies study area, any previously unidentified seepage areas or waterbodies were recorded. These were cross-referenced with the mapping to determine if these sites were identified during the Records Review and desktop reconnaissance. If water was noted at these sites, a full waterbodies assessment was conducted (Step 3).

4.2.1 Reconnaissance Survey

Desktop reconnaissance-level investigations were conducted on sites where no waterbody features were identified during the Records Review process to determine if additional waterbodies are present. Geographic Information System (GIS) applications, base and topographic mapping and aerial imagery were used to locate unidentified waterbodies within the 120 m Waterbodies study area to be further investigated in the field studies phase of the assessment. If a potential waterbody was identified during the desktop reconnaissance or records review stage a field study of the physical features and aquatic habitat of the waterbody was conducted. Essential features and measurements to be documented in the field studies were determined and field protocols were developed.

The Waterbodies study area was divided into one north section (north of Henvey Inlet, to the northern boundary of HIFN I.R. #2 at the Key River) and one south section (south of Henvey Inlet, to the southern boundary of HIFN I.R. #2). The areas of development (i.e., road alignment and WTG locations) were sub-divided into 1 km subsequent sections along the proposed road alignment. Each subsection was designated with a unique identifier and hereafter are referred to as Maps. Each potential waterbody location within each Map (referred to as Waterbody Site Feature described below) was designated with a unique identifying number. For example;

WB-N-M12-42

Whereas: WB = Waterbody
N = North section of the HIWEC
M12 = Map 12
42 = Unique number for potential waterbody within Map 12

Each Waterbody Site Feature was plotted on maps using aerial imagery for navigation for field crews. Each Waterbody Site Feature was colour-coded to indicate whether the feature was identified in the Records Review or Desktop Reconnaissance as:

- Pond or Lake – lentic habitat (identified on Maps as “Waterbodies”), including lakes, ponds, beaver ponds created by dammed watercourses;
- Stream or River – lotic habitat (identified on Maps as “Watercourses”) including rivers and streams, with a defined channel and unidirectional flow, or
- A Wetland – Swamps, bogs, fens, marshes and thickets which may or may not have the ability to directly support fish.

Additional features identified during field studies were labelled with an additional identifier. For example, WB-S-M36-53-2 where “2” represents the extra feature identified during the site visit.

4.2.2 Waterbody Field Assessment

Field assessment of waterbodies involved visiting the potential waterbody, detailing the feature, taking photographs and documenting if water and the potential to be fish habitat was present. If water was present and the feature was deemed to be a potential fish-bearing waterbody, a detailed aquatic habitat assessment was completed. If no waterbody was found to be present, this information was documented and mapping was updated and noted. Waterbodies previously identified in the desktop reconnaissance step as either a permanent stream; an intermittent stream; ponds; wetland or a seepage area were confirmed or corrected based on observations made at the time of the field visit.

Watercourse study reaches were typically 100 m in length and were generally delineated starting from the centreline (CL) of any proposed access road and up to 50 m upstream and 50 m downstream of the CL. This approach allowed for a thorough characterization of the waterbody within the area most susceptible to impacts from the HIWEC. As previously discussed, Step 3 would allow for variances or extra considerations should those be observed during field work.

Data collected during field investigations was digitally entered onto tablets. Software programs enabled different electronic field forms to be developed and also facilitated quicker data collection as well as the reducing errors caused in transferring. An electronic field study form was completed for each waterbody investigated or features if no waterbody was found. A Pond/Lake Assessment Form was typically completed for open-water, lentic habitats as well as wetlands including thickets, fens, marshes and features identified as not likely to directly support fish. A

Stream/River Assessment Form was typically completed for waterbody features, permanent or intermittent, with evidence of unidirectional flow. Information recorded on both forms was similar and included the date of assessment, field staff, start and end time of assessment, weather conditions and location of the assessment. An overall assessment of the aquatic habitat was conducted based on a number of criteria, such as whether the watercourse was a natural or modified feature (i.e., channelized, straightened) as well as the type of surrounding natural features and land uses.

Channel dimensions, substrate composition, channel morphology and bank stability were collected in the field. Measurements were taken at more than one location along the watercourse and mean values were calculated in the field and recorded including:

- Mean wetted depth (MWD) (m);
- Mean bankfull depth (MBW) (m); and,
- Mean wetted width (MWW) (m);
- Mean bankfull width (MBW) (m)

For waterways (Henvey Inlet) affected by long term or large scale functions, average annual high water mark data were not available from the HIFN or any other information sources contacted in the Records Review phase. Mean bankfull width and depth were collected by taking a measurement where indicators such as the active scour mark, bank inflection points and location of perennial vegetation/hydrophilic (“*water loving*”) vegetation boundaries were located, to name a few determining features. Bank height measurements and presence of mature riparian vegetation, exposed root structures, and slumping or scouring of banks were used to determine bank stability.

Stream morphology was assessed to describe habitat during the waterbody assessments, these include:

- Runs:** are typically deep, fast moving water with little to no turbulence of water
- Riffles:** are shallow, fast moving water typically running over rocks. Riffles provide areas of high oxygenated waters
- Flats:** low flowing water with a smooth un-agitated surface
- Pools:** are described as deep pockets of slow moving water that provide ideal habitat for fish

Substrate composition (e.g., clay, silt, sand, gravel, cobble, rock, boulder, muck and detritus) were recorded in descending order of dominance. Visual observations of water clarity, water colour, presence and type of macrophytes and algal growth, evidence of runoff, and surrounding land use were recorded as indicators of water quality. Basic water chemistry (pH, conductivity, dissolved oxygen and temperature) were collected using a HORIBA U-22 multi-parameter water quality measurement device, or a Hanna Instruments pH/Conductivity/TDS Handheld tester.

Observations of significant or limiting habitat features which may help determine the sensitivity of the aquatic habitat and other unique habitat features such as suitable substrate or vegetation for sport fish or aquatic SAR spawning habitat, barriers to fish passage, evidence of ongoing erosion, etc. were also recorded.

The quality and quantity of potential fish habitat was recorded based on DFO’s broad definition of fish habitat. Along with the Records Review, including thermal regime and species occurrence records, an assessment of the use of the habitat by fish was documented. These parameters include the availability and quality of habitat features such as in-stream and riparian covers as well as morphological conditions and connectivity of the waterbodies to allow fish passage. As defined by the federal *Fisheries Act*, fish habitat is defined as “*spawning grounds and nursery, rearing, food supply, migration, and any other areas on which fish depend directly or indirectly in order to carry out their life processes*”. The following characteristics were assessed and recorded for each waterbody and used in determination of habitat sensitivity for each waterbody.

In-stream cover was documented based on the percent of cover provided by:

- large woody debris (typically, a base of 1.5 to 2 m long, 30 cm diameter pieces),
- rock: boulders (>256 mm diameter), cobble (256-64 mm diameter),
- aquatic/instream vegetation,
- overhanging vegetation, and
- undercut banks.

In-stream cover was classified as “High” if there was in-stream coverage between the areas of 76-100%; moderate 31-75%; and low 0-30%.

Riparian vegetation canopy cover was provided as a percentage of cover over the site of investigation. Overall canopy cover was classified as: high 61-100%; moderate cover 31-60%; and low cover 0-30%.

Obstructions to fish passage were also noted within the area of site investigation, including:

- beaver dams,
- man-made structures,
- perched/blocked culverts,
- debris jams, and
- possible low-flow barriers.

Adjacent land uses were noted for potential influences or impacts to the waterbodies. This included observations of residential, agriculture uses (crops and livestock), meadows, forests and wetland features. Potential sources of pollution were recorded. These potential sources include: tile drain discharges, other piped discharges, road runoff and any other surface runoff features causing potential nutrient or sediment loading. Topography of the land located within the Waterbodies study area was documented to identify areas of rolling hills or flat areas where water is more likely to accumulate in depressions versus flowing towards the watercourse.

Estimates of the mean riparian zone widths and vegetation composition were documented. Ecological Land Classification (Lee *et al.* 1998) was undertaken as part of the NHA by certified ELC ecologists and describes in further detail landscapes adjacent to waterbodies.

During all site investigations, groundwater seepage areas were identified using the following indicators, as outlined in the Technical Guide to Renewable Energy Approvals (MOE, 2013):

- Occurrence of Watercress (*Nasturtium officinale*), Bittercress (*Cardamine pensylvanica*) and Water Speedwell (*Veronica anagallis-aquatica*);
- Presence of iron staining as indicated through red rust coloured soils along banks and stream beds;
- Bank seepage (as indicated by micro-erosion rills);
- Air bubbles in the stream bed.

Pond features were also assessed during the waterbody assessment. Characteristics documented of any pond features included: type of pond (e.g., dugout, online, agriculture) and their surrounding land use, percentage and type of in situ habitat, estimated size of the pond and observations of wildlife and fish.

A representative photographic log and site sketches were included to detail the general site layout as well as the layout of each waterbody within the Waterbodies study area.

4.2.3 Fish Community Sampling

Ten waterbody features were sampled to gain further insight in addition to the Records Review on the fish community inventory using the aquatic habitat in the HIWEC. Fish community assessment sites and sampling gear were typically selected following the aquatic habitat assessment so that site and habitat conditions observed in the habitat assessment could assist in the selection of the fish inventory sampling sites. Aspects of each site that were considered during site selection for community assessment included:

- Presence of potential fish habitat likely to support fish (i.e., suitable depth, water quality, fish passage etc.),
- Suitable conditions for effective use of sampling gear (i.e., suitable substrate and water depth for electrofishing, suitable water depth for net sets),
- Health and safety considerations (i.e., fast-flowing or water depth unsafe for wading and electrofishing), access (for field study crews with gear), and
- Habitat sensitivity or vulnerability to construction activities (i.e., proximity to Henvey Inlet and higher potential for use by sport fish or SAR, suitable spawning or SAR habitat, steep slopes which would require a large embankment to facilitate road crossing and therefore more significant footprint, etc.).

Table 4-1 summarizes the type of gear used for fish community sampling.

Table 4-1: Fish Community Sampling Equipment Summary

Gear Type	Model and/or description	Suitable habitat types	Number of Sample Sites where Gear Type was Used
Electrofishing	Halltech 2000 battery backpack unit, output settings range: 60 Hz, 550-650 V	Wadeable waterbodies without an over-abundance of soft substrates	7
Netting	Winged hoop net with ~0.5 mm mesh size	Any waterbodies with suitable depth to allow fish capture. Various substrate. Overnight sets. Baited with dog food or lunch meat.	2
Minnow Trap	G-style	Any waterbodies with suitable depth for allow fish capture. Various substrates. Baited with dog food. Overnight sets. Not suitable for large fish.	1
Angling	Rod and reel with artificial lures	Open waterbodies where water depth and access was not suitable for electrofishing or net sets. Targets top predators.	1
Water Quality Parameters	HORIBA U-22	Any site where open water was present.	All sites with open water present
Water Quality Parameters	Hanna 98129 pH, conductivity and temperature meter	Any site where open water was present. Used when Horiba was not available.	All sites with open water present and Horiba was not available

4.3 Sensitivity Classification

To aid in the assessment of each waterbody and to inform the potential environmental effects and mitigation measures, a sensitivity classification was designed and applied to each feature within the Waterbodies study area. The overall objective was to assess the resiliency of the aquatic ecosystem – i.e., the ability of the system to recover from changes in environmental conditions. Each waterbody feature was classified as high, moderate or low sensitivity based on the parameters identified in **Table 4-2** below. This system provided some objectivity to the assessment process and incorporated attributes such as: species sensitivity, habitat resiliency, species

dependence on habitat, and rarity of ‘this’ particular habitat feature. Not all indicators had to be present at one waterbody for an assignment into a particular classification and waterbodies were assigned a sensitivity rating based on where the majority of indicators occurred. For example, a waterbody with a cold water regime could be classified as moderate sensitivity if it was a channelized channel with unstable banks and intermittent flow. Where there were an equal number of indicators, professional opinion and consideration of the overall site was used to assign the waterbody to one classification.

Table 4-2: Sensitivity Classification Indicators

High Sensitivity	Moderate Sensitivity	Low Sensitivity
<ul style="list-style-type: none"> • Cool/cold water thermal regime • Headwater area • Permanent flow • Natural channel • Natural stream process observed (e.g., riffle/run/pool sequence and meanders) • Located in natural area (e.g., woodland, wetland) • Groundwater seepage indicators present • High quality and quantity fish habitat • No fish barriers • Water quality appears good (e.g., clear, no obvious agricultural runoff, no algae) 	<ul style="list-style-type: none"> • Cool/warm water thermal regime • Permanent or intermittent flow • Natural or channelized channel • Natural stream process observed (e.g., riffle/run/pool sequence and meanders) • In natural or impacted areas • Groundwater seepage indicators present • Overall moderate quality and quantity fish habitat • No fish barriers • Some concern for water quality (e.g., suspended solids or algae growth) 	<ul style="list-style-type: none"> • Warm water thermal regime • Permanent or intermittent flow • Channelized channel • Uncontrolled stream processes (e.g., erosion, unstable banks) • Within highly impacted areas • No groundwater indicators present • Low quality and quantity fish habitat • Fish barriers • Concern for water quality (e.g., turbid water, high suspended solids or uncontrolled algae growth)
<p>System is generally considered not to be resilient to environmental perturbations and cannot easily buffer change.</p>	<p>System is somewhat stable and should be resilient to change and perturbation</p>	<p>System is quite stable and resilient to change and perturbation.</p>

Many of the potential waterbodies upon inspection were categorized as wetlands; fens, bogs, thickets or marshes with no open water and unable to directly support fish due to lack of open water and/or connectivity to suitable fish habitat. These wetlands were not categorized as waterbodies. A field form was completed with basic information to maintain a record of the conditions at the time of assessment, and further detail is provided in the Natural Heritage Assessment Report (AECOM 2015). Other online wetland did have permanent or intermittent flow of water and suitable fish habitat; these wetlands are considered to be waterbodies and are described as such in this report.

4.4 Results of Site Investigations

4.4.1 Summary of Site Investigations

A summary of the field studies is presented in **Appendix A**, and includes the date of the study, duration, sites investigated that day, weather conditions, and names and qualifications of AECOM staff conducting the field studies. In some cases, sites were visited more than once if the Waterbodies study area was updated or changed by HIW. **Appendix B** contains detailed field notes for each site visit while **Appendix C** contains the relevant qualifications (i.e., curriculum vitae) for all investigators.

4.4.2 Waterbody Assessment

Based on the waterbody assessment field studies that were conducted (as outlined in **Section 4.2**), the occurrence of waterbodies within the Waterbodies study area are documented below (**Table 4-3**). These results include a description of the surrounding topography and general area, the physical features of the waterbody and the riparian

zone, as well as an assessment of the sensitivity of the feature as described in **Section 4.3**. Representative photos are provided for each site but physical characteristics were often conducted on longer reaches than identified in the photos.

Information from the Records Review is also provided in **Table 4-3** if available for that particular waterbody. Information from both Records Review and field-based site investigations for each feature provides some indication of the overall sensitivity of the site based on the available information. The table is organized according to Feature ID and includes:

- Details of the site investigation, including date of site visit;
- A brief description of the site and surrounding land use;
- Description of the feature summarized from the field notes;
- Channel morphology measurements taken at the time of the investigation;
- Watercourse/drain name (if available);
- Fish records (if available);
- Presence of groundwater indicators; and,
- Feature sensitivity based on criteria outlined in Table 4-1.

4.5 Fish Community Sampling

Table 4-4 summarizes the results of the fish community sampling studies in the Waterbodies study area.

Table 4-3: Site Investigation Summaries

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity						
WB-A-M1-1	May 4 th , 2015	Permanent Pond	Large swamp with snags and aquatic vegetation. Beaver dams upstream and downstream of crossing location	<div>Large ponded study area (swamp) with abundance of snags and aquatic vegetation. Beaver ponds east and west of the swamp. Some flowing water near channel at east end. Fish passage impeded downstream by beaver dams and upstream by perched culvert at of trail. Swamp with snags. Inactive beaver dam. ATV trail downstream of crossing; perched culvert no fish passage. Layer of detritus over silt/clay/sand. Standing water.</div> <table><tr><td>Fish Habitat?</td><td>Direct</td></tr><tr><td>Size (m)</td><td>48.00</td></tr><tr><td>Depth (m)</td><td>0.75</td></tr></table>	Fish Habitat?	Direct	Size (m)	48.00	Depth (m)	0.75	Low
Fish Habitat?	Direct										
Size (m)	48.00										
Depth (m)	0.75										



Photograph 1. Large pond with abundance of old snags looking south from centreline ↑



Photograph 2. Beaver dams approximately 30 m downstream of crossing. Fish passage impeded. Fish observed in pond. ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity
WB-A-M2-2	May 4 th , 2015	Permanent Pond	Ponded water (beaver dams) between bedrock slopes. Landscape slopes below first beaver dam, cluster of boulders below dam may have previously been rapids. Below dams is small (1 m w) channel	<div>Watercourse between bedrock slopes dammed (2 consecutive beaver dam). Bedrock/boulder substrate with layer of detritus. Pond above beaver dam. No fish passage and minimal flow through dams. Assessment area includes pond.</div> <div><div>Fish Habitat?</div><div>Direct</div></div> <div><div>Size (m)</div><div>11.00</div></div> <div><div>Depth (m)</div><div>1.30</div></div>	Low



Photograph 1. Beaver pond between bedrock slopes and at crest of slope. General view of most of study area, looking upstream from approximately 25 m downstream of CL. ↑



Photograph 2. Two beaver dams on slope. Approximately 20-25 m DS of centreline. ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity										
WB-A-M3-3	May 8 th , 2015	Permanent Stream	CP rail line and water crossing, black ash, but oak swamp above right bank. Rail above left bank running along channel, crossing watercourse downstream of transmission line crossing.	<div>Channel of slow-moving flats along rail line. Unstable banks of erodible soils. Cyprinids observed. Erodible banks.</div> <table><tr><td>Fish Habitat?</td><td>Direct</td></tr><tr><td>MWW (m)</td><td>10.0</td></tr><tr><td>MBW (m)</td><td>11.0</td></tr><tr><td>MWD (m)</td><td>1.5</td></tr><tr><td>MBD (m)</td><td>2.5</td></tr></table>	Fish Habitat?	Direct	MWW (m)	10.0	MBW (m)	11.0	MWD (m)	1.5	MBD (m)	2.5	Moderate
Fish Habitat?	Direct														
MWW (m)	10.0														
MBW (m)	11.0														
MWD (m)	1.5														
MBD (m)	2.5														



Photograph 1. Facing downstream (north) looking towards crossing from approximately 30 m upstream
↑



Photograph 2. Facing upstream towards crossing from approximately 35 m downstream ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity						
WB-N-M1-30	May 5 th , 2015	Permanent Pond	Beaver dam pond surrounded by mixed forest. Nice old beaver pond. Fish habitat. Drains into small creek. Max depth 2 m.	<p>Fish sampling was conducted by Tulloch Environmental in 2013 in the watercourse approximately 250 m downstream of WB-N-M1-30; below beaver dam and near outlet to Key River. Fish passage barriers (i.e., slope) from Key River were observed near the outlet. No fish were captured. Sampling of the pond adjacent to WB-N-M1-30, approximately 300 m to the east found Central Mudminnow.</p> <table><tr><td>Fish Habitat?</td><td>Direct</td></tr></table> <table><tr><td>Size (m)</td><td>900.00</td></tr><tr><td>Depth (m)</td><td>2.00</td></tr></table>	Fish Habitat?	Direct	Size (m)	900.00	Depth (m)	2.00	Low
Fish Habitat?	Direct										
Size (m)	900.00										
Depth (m)	2.00										



Photograph 1. Site Overview. ⬆



Photograph 2. Overview of pond looking south (upstream). ⬆

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity										
WB-N-M1-32	May 5 th , 2015	Intermittent Wet Area	Spruce hemlock forest. No watercourse present.	<div>No watercourse. Bogs and pools of standing water observed. No watercourse was observed; therefore no habitat is available to fisheries.</div> <div><table><tr><td>Fish Habitat?</td><td>No</td></tr></table><table><tr><td>MWW (m)</td><td>-</td></tr><tr><td>MBW (m)</td><td>-</td></tr><tr><td>MWD (m)</td><td>-</td></tr><tr><td>MBD (m)</td><td>-</td></tr></table></div>	Fish Habitat?	No	MWW (m)	-	MBW (m)	-	MWD (m)	-	MBD (m)	-	Low
Fish Habitat?	No														
MWW (m)	-														
MBW (m)	-														
MWD (m)	-														
MBD (m)	-														



Photograph 1. Spring is located well outside of the study area. Was observed during period trying to identify watercourse location. ↑



Photograph 2. Site overview. No watercourse present. ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity										
WB-N-M1-33	May 5 th , 2015	Intermittent Drainage Ditch	Hwy 69 runs parallel. Forest to the east.	<p>Stagnant watercourse transporting overland flow under Highway 69. Functions as a stagnant intermittent drainage ditch only. Not fish habitat</p> <table><tr><td>Fish Habitat?</td><td>No</td></tr></table> <table><tr><td>MWW (m)</td><td>0.70</td></tr><tr><td>MBW (m)</td><td>0.00</td></tr><tr><td>MWD (m)</td><td>0.05</td></tr><tr><td>MBD (m)</td><td>0.20</td></tr></table>	Fish Habitat?	No	MWW (m)	0.70	MBW (m)	0.00	MWD (m)	0.05	MBD (m)	0.20	Low
Fish Habitat?	No														
MWW (m)	0.70														
MBW (m)	0.00														
MWD (m)	0.05														
MBD (m)	0.20														



Photograph 1. Looking upstream from culvert. ↑



Photograph 2. Culvert discharging water underneath Highway 69. ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity										
WB-N-M4-59	July 9 th , 2015	Permanent Stream	Mixed coniferous deciduous forest atop bedrock. Easternmost part of Henvey Inlet west of old breached beaver dam and pond.	<div>Information: Eastern reach of Henvey Inlet. Henvey Inlet is known to support a variety of warm, cool and coldwater fish.</div> <table><tr><td>Fish Habitat?</td><td>Direct</td></tr></table> <table><tr><td>MWW (m)</td><td>16.00</td></tr><tr><td>MBW (m)</td><td>17.95</td></tr><tr><td>MWD (m)</td><td>0.66</td></tr><tr><td>MBD (m)</td><td>0.86</td></tr></table>	Fish Habitat?	Direct	MWW (m)	16.00	MBW (m)	17.95	MWD (m)	0.66	MBD (m)	0.86	Moderate
Fish Habitat?	Direct														
MWW (m)	16.00														
MBW (m)	17.95														
MWD (m)	0.66														
MBD (m)	0.86														



Photograph 1. Looking northeast along watercourse from centre line.↑



Photograph 2. Looking southwest from centre line.↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity										
WB-N-M6-3	May 26 th , 2015	Permanent Stream	Mixed deciduous, conifer dominated forest. Dammed stream approximately 4 m wetted width. Slow moving. Bedrock banks.	<p>Crossing area has no connecting area to upstream or downstream waterbodies due to the presence of 3 beaver dams. Tulloch Environmental 2013 sampling in pond approximately 575 m upstream of WB-N-M6-3 found Finescale Dace, Redbelly Dace, Fathead Minnow.</p> <table><tr><td>Fish Habitat?</td><td>Indirect</td></tr></table> <table><tr><td>MWW (m)</td><td>5.00</td></tr><tr><td>MBW (m)</td><td>14.00</td></tr><tr><td>MWD (m)</td><td>0.60</td></tr><tr><td>MBD (m)</td><td>1.50</td></tr></table>	Fish Habitat?	Indirect	MWW (m)	5.00	MBW (m)	14.00	MWD (m)	0.60	MBD (m)	1.50	Low
Fish Habitat?	Indirect														
MWW (m)	5.00														
MBW (m)	14.00														
MWD (m)	0.60														
MBD (m)	1.50														



Photograph 1. At centre line looking downstream 50 m. ↑



Photograph 2. Upstream 50 m. Beaver dam upstream of centre line. ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity										
WB-N-M7-34	May 27 th , 2015	Ephemeral Stream	Mixed deciduous forest and bedrock. Fen downstream. No defined channel. Likely a transitional fen.	<div>Swamp/marshlike area (ELC classified as fen). No flow. Low lying area, no connectivity for fish. No fish habitat. Situated between. Bedrock outcrops.</div> <div><table><tr><td>Fish Habitat?</td><td>No</td></tr></table><table><tr><td>MWW (m)</td><td>3.00</td></tr><tr><td>MBW (m)</td><td>8.00</td></tr><tr><td>MWD (m)</td><td>0.01</td></tr><tr><td>MBD (m)</td><td>0.15</td></tr></table></div>	Fish Habitat?	No	MWW (m)	3.00	MBW (m)	8.00	MWD (m)	0.01	MBD (m)	0.15	Low
Fish Habitat?	No														
MWW (m)	3.00														
MBW (m)	8.00														
MWD (m)	0.01														
MBD (m)	0.15														



Photograph 1. Upstream 35 m from wetland looking toward centre line. ↑



Photograph 2. Downstream 35 m from wetland looking toward centre line. ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity										
WB-N-M9-35	May 28 th , 2015	Ephemeral Stream	Mixed deciduous forest dominated by birch. Key River 800 m downstream. Lowland area between bedrock outcrops.	<p>Roughly 60/100 m. Mostly dry, with some standing water downstream (45 cm). Fen-like. Opens up to large Swamp downstream. Lots of upland vegetation. Dry in most spots, stagnant water downstream. Opens up to larger marsh. No defined channel. Ephemeral. Not fish habitat.</p> <table><tr><td>Fish Habitat?</td><td>No</td></tr><tr><td>MWW (m)</td><td>0.00</td></tr><tr><td>MBW (m)</td><td>80.00</td></tr><tr><td>MWD (m)</td><td>0.40</td></tr><tr><td>MBD (m)</td><td>4.00</td></tr></table>	Fish Habitat?	No	MWW (m)	0.00	MBW (m)	80.00	MWD (m)	0.40	MBD (m)	4.00	Low
Fish Habitat?	No														
MWW (m)	0.00														
MBW (m)	80.00														
MWD (m)	0.40														
MBD (m)	4.00														



Photograph 1. Looking upstream from upstream site limit. ↑



Photograph 2. Looking upstream toward centre line from downstream site limit. ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity										
WB-N-M12-12	May 20 th , 2015	Permanent Stream	Mixed coniferous deciduous forest. Creek with old beaver dams between two large rock outcrops.	<div>Water seeping through dams but at very low flow. Some points channel is dry upstream. Water must be seeping through boulders. Frog sighted and grouse heard.</div> <div><table><tr><td>Fish Habitat?</td><td>Indirect</td></tr></table></div> <div><table><tr><td>MWW (m)</td><td>1.00</td></tr><tr><td>MBW (m)</td><td>2.00</td></tr><tr><td>MWD (m)</td><td>0.40</td></tr><tr><td>MBD (m)</td><td>-</td></tr></table></div>	Fish Habitat?	Indirect	MWW (m)	1.00	MBW (m)	2.00	MWD (m)	0.40	MBD (m)	-	Low
Fish Habitat?	Indirect														
MWW (m)	1.00														
MBW (m)	2.00														
MWD (m)	0.40														
MBD (m)	-														



Photograph 1. At crossing looking upstream ↑



Photograph 2. At crossing looking downstream ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity										
WB-N-M12-12-2	May 20 th , 2015	Permanent Stream	Rolling bedrock and meadow downstream. Site was added, not previously identified by field map. Average to moderate quality habitat with barrier to upstream reach. Cool to coldwater thermal regime.	<p>Channel flowing from beaver pond between bedrock outcrops and through meadow. Fast flowing creek, wetted width 45 cm wide. Water depth average 30 cm. Aquatic macrophytes, grasses. Riparian veg, grasses. Upstream, approximately 15% canopy cover. Substrate: gravel, cobble and sand. Minimal woody debris downstream of falls, approximately 70% upstream. Depth average 20 cm.</p> <table><tr><td>Fish Habitat?</td><td>Direct</td></tr><tr><td>MWW (m)</td><td>1.5</td></tr><tr><td>MBW (m)</td><td>2.30</td></tr><tr><td>MWD (m)</td><td>0.25</td></tr><tr><td>MBD (m)</td><td>-</td></tr></table>	Fish Habitat?	Direct	MWW (m)	1.5	MBW (m)	2.30	MWD (m)	0.25	MBD (m)	-	Moderate
Fish Habitat?	Direct														
MWW (m)	1.5														
MBW (m)	2.30														
MWD (m)	0.25														
MBD (m)	-														



Photograph 1. Facing upstream from crossing ↑



Photograph 2. Waterfall creating barrier to fish moving up. Approximately 3 m in height. Cobble, rock and log at base of waterfall. Pool at base of waterfall. High velocity. ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity						
WB-N-M12-37	May 20 th , 2015	Wetland	Low-lying area with saturated mosses and water-tolerant terrestrial vegetation. Surrounding land use consists of two rock outcrops with mixed deciduous coniferous forest.	<p>No open water or evidence of any flow, even seasonally. Saturated bed of moss occurring in low-lying area with no evidence of any flows. No connectivity to open water. Pond 70 m downstream of CI is an open pond but is not connected to wetland. Wetland is approximately 25 m wide at centre line. Pooling occurs at animal trails.</p> <table><tr><td>Fish Habitat?</td><td>No</td></tr><tr><td>Size (m)</td><td>25.00</td></tr><tr><td>Depth (m)</td><td>0.00</td></tr></table>	Fish Habitat?	No	Size (m)	25.00	Depth (m)	0.00	Low/NA
Fish Habitat?	No										
Size (m)	25.00										
Depth (m)	0.00										



Photograph 1. Centre line looking upstream. ↑



Photograph 2. Centre line looking downstream. ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity						
WB-N-M13-36	May 20 th , 2015	Permanent Wetland	Bog with no open water, no connectivity to open water and no evidence of seasonal or intermittent flows. Bedrock barren forest bordering bog.	<p>Bog vegetation throughout. Bog width at CL is ~50 m wide. Approximately 25 m south of CL bog still ~50 m wide but with ~12 m wide bedrock outcrop in bog. Moving road ~30 m south would reduce footprint in bog. No open water; no aquatic vegetation. Bog vegetation includes Sphagnum moss, leatherleaf, tamarack, black spruce, and speckled alder.</p> <table><tr><td>Fish Habitat?</td><td>No</td></tr></table> <table><tr><td>Size (m)</td><td>50.00</td></tr><tr><td>Depth (m)</td><td>0.00</td></tr></table>	Fish Habitat?	No	Size (m)	50.00	Depth (m)	0.00	Low/NA
Fish Habitat?	No										
Size (m)	50.00										
Depth (m)	0.00										



Photograph 1. Facing north from centre line. ↑



Photograph 2. Looking across bog at centre line from east bank facing west. ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity						
WB-N-M14-38	May 22 nd , 2015	Permanent Wetland	Mixed coniferous deciduous forest atop bedrock outcrops, fen to the northeast and southwest of site.	<p>Saturated low-lying area with no open water. Bedrock from west side projects into saturated area 45 south of the CI so that saturated area is only 5 m wide. Could consider moving CL south to prevent footprint on marsh. Vegetation includes Sphagnum moss, water tolerant grasses and sedges and shrubs, Leather leaf, cranberry, speckled alder, Labrador tea, and low sweet blueberry. Not fish habitat.</p> <table><tr><td>Fish Habitat?</td><td>No</td></tr><tr><td>Size (m)</td><td>9.00</td></tr><tr><td>Depth (m)</td><td>0.00</td></tr></table>	Fish Habitat?	No	Size (m)	9.00	Depth (m)	0.00	Low/NA
Fish Habitat?	No										
Size (m)	9.00										
Depth (m)	0.00										

*** No Photographs Available.

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity						
WB-N-M18-39	May 21 st , 2015	Seasonal Wetland	Bedrock barren borders the low-lying thicket. No aquatic vegetation, no open water.	<p>Saturated low-lying area, alder thicket or grasses/sedges. No open or flowing g water, occasional isolated stagnant pools in thicket. Downstream occasionally a poorly defined channel is observed then dissipated through thicket. Width at CL is 25 m but overall mean width is 30 m. Saturated mosses and grasses/sedges in thicket, occasional stagnant pools. No flow or evidence of channel. Low-lying area collecting overland flow. Does not directly support fish, poor or no connectivity observed in field or on air photos.</p> <table><tr><td>Fish Habitat?</td><td>No</td></tr></table> <table><tr><td>Size (m)</td><td>25.00</td></tr><tr><td>Depth (m)</td><td>0.00</td></tr></table>	Fish Habitat?	No	Size (m)	25.00	Depth (m)	0.00	Low/NA
Fish Habitat?	No										
Size (m)	25.00										
Depth (m)	0.00										



Photograph 1. Facing south at thicket at centre line. ↑



Photograph 2. View of pooling water and thicket understorey approximately 40 m N of centre line. ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity						
WB-N-M18-39-2	May 21 st , 2015	Seasonal Wetland	Mixed coniferous deciduous forest atop bedrock outcrops. Stagnant to low flowing pools of water in low lying areas with limited connectivity. 18 m wide at CL. Depth is max depth of standing pools.	<p>Small intermittent pools with low connectivity and low flow. Added site due to observed water at road crossing. Permanent alder thicket with limited connectivity in a northeast to southwest direction. 30 m downstream area widens into black ash swamp. Water may be present for long enough upstream of CL to support tolerant cyprinids and amphibians, as supported by water tolerant vegetation and emergent. However from field and air photos connectivity appears to be poor or nonexistent.</p> <table><tr><td>Fish Habitat?</td><td>Indirect</td></tr></table> <table><tr><td>Size (m)</td><td>18.00</td></tr><tr><td>Depth (m)</td><td>0.20</td></tr></table>	Fish Habitat?	Indirect	Size (m)	18.00	Depth (m)	0.20	Low
Fish Habitat?	Indirect										
Size (m)	18.00										
Depth (m)	0.20										



Photograph 1. Middle of CL looking upstream. ↑



Photograph 2. Middle of CL looking downstream. ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity						
WB-N-M21-28	May 21 st , 2015	Permanent Wetland	Fen, with open water swamp to the southeast. Bordered by rock barren. Fen connected to open water swamp/fen downstream. No open water within 20 m of CL. Floating mat of bog/fen vegetation.	<p>50 m wide at CL. No open water at CL. From ~20 m downstream of centre line is fen with pockets of open water with depths >1 m but depth unknown. Appears to be flooded, perhaps by a beaver dam downstream. Areas of open water choked with vegetation (Sphagnum). Appears to have historically been dammed. Depth and vegetation notes recorded are of downstream flooded fen only. Notes on in situ cover are of flooded fen 20-50 m DS of CL. Remaining 70 m of study area is fen. Flooded section DS may be accessible too and may support tolerant cyprinids but no open water within 20 m of CL. Consider moving road alignment slightly south.</p> <table><tr><td>Fish Habitat?</td><td>No</td></tr><tr><td>Size (m)</td><td>50.00</td></tr><tr><td>Depth (m)</td><td>0.00</td></tr></table>	Fish Habitat?	No	Size (m)	50.00	Depth (m)	0.00	Low/NA
Fish Habitat?	No										
Size (m)	50.00										
Depth (m)	0.00										



Photograph 1. Looking across fen at CL, facing east. ↑



Photograph 2. Facing south from CL. Bedrock outcrop/point <5 m south of CL. Road alignment could be moved to cross over bedrock and reduce footprint in fen. ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity						
WB-N-M23-40	May 21 st , 2015	Wetland	Low-lying alder thicket with saturated and pooled areas between bedrock with conifer and deciduous forest.	<p>Seasonal over land flow in northeast to southwest direction. Appears from air photo to eventually connect to marsh downstream but no flow or evidence of continuous channel. Water seeping through thicket. Water in low lying areas likely to dry during summer. Vegetation only emergent and terrestrial grasses and herbaceous plants, mosses, ferns and alders.</p> <table><tr><td>Fish Habitat?</td><td>No</td></tr></table> <table><tr><td>Size (m)</td><td>9.00</td></tr><tr><td>Depth (m)</td><td>0.02</td></tr></table>	Fish Habitat?	No	Size (m)	9.00	Depth (m)	0.02	Low/NA
Fish Habitat?	No										
Size (m)	9.00										
Depth (m)	0.02										



Photograph 1. At centre line looking upstream. ↑



Photograph 2. At centre line looking downstream. ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity										
WB-N-M26-21	May 19 th , 2015	Permanent Stream	Steep bedrock sloping towards channel. Watercourse of slow-moving flats between steep bedrock slopes, flowing to Henvey Inlet from marsh upstream.	<p>Previously breached beaver pond approximately 80 m upstream with abundant grasses plus marsh observed on air photo upstream may be spawning habitat for Esocids. Potential spawning habitat not likely to be impacted by proposed road but access to this habitat should be maintained. Water was high and over bankfull. Suitable spawning habitat for Esocids approximately 100 m upstream of centreline of proposed road. Watercourse not wadeable, mean depth is an estimate. Tulloch Environmental 2013 sampling approximately 175 m upstream of WB-N-M26-21 found Central Mudminnow, Redbelly Dace, Brook Stickleback, Finescale Dace, Iowa Darter, Golden Shiner, Fathead Minnow.</p> <table><tr><td>Fish Habitat?</td><td>Direct</td></tr><tr><td>MWW (m)</td><td>8.50</td></tr><tr><td>MBW (m)</td><td>5.00</td></tr><tr><td>MWD (m)</td><td>2.00</td></tr><tr><td>MBD (m)</td><td>-</td></tr></table>	Fish Habitat?	Direct	MWW (m)	8.50	MBW (m)	5.00	MWD (m)	2.00	MBD (m)	-	Moderate
Fish Habitat?	Direct														
MWW (m)	8.50														
MBW (m)	5.00														
MWD (m)	2.00														
MBD (m)	-														



Photograph 1. Facing upstream from centre line ↑



Photograph 2. Facing downstream from centre line ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity										
WB-N-M26-31	May 19 th , 2015	Permanent Stream	Mixed deciduous coniferous forest and rolling bedrock. Connects fen upstream to Henvey Inlet. One main channel flowing through saturated marsh between bedrock.	<p>Creek flowing north to south between two bedrock outcrops could be habitat for tolerant cyprinids (i.e., central mudminnow). Surrounding riparian zone can be inundated and may provide greater habitat for amphibians. Wildlife observed: caterpillar nests, Common Yellowthroat. Poor or no accessibility for fish from Henvey Inlet.</p> <table><tr><td>Fish Habitat?</td><td>Direct</td></tr></table> <table><tr><td>MWW (m)</td><td>0.25</td></tr><tr><td>MBW (m)</td><td>23.00</td></tr><tr><td>MWD (m)</td><td>0.23</td></tr><tr><td>MBD (m)</td><td>-</td></tr></table>	Fish Habitat?	Direct	MWW (m)	0.25	MBW (m)	23.00	MWD (m)	0.23	MBD (m)	-	Low
Fish Habitat?	Direct														
MWW (m)	0.25														
MBW (m)	23.00														
MWD (m)	0.23														
MBD (m)	-														



Photograph 1. Looking upstream from crossing location ↑



Photograph 2. Facing downstream of crossing approximately 25 m where bedrock ledge and strong channelization occurs ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity										
WB-N-M28-16	May 19 th , 2015	Permanent Stream	Open water beaver pond just upstream of crossing CL. Bordered by sloping bedrock. Watercourse between bedrock dammed by beavers. Upstream of CL is open water pond. Downstream and at CL is wet floating mat and hummocks of vegetation, open water is scarce to none.	<p>CL is approximately 15 m downstream of significant beaver pond. Suggest moving crossing further downstream where narrow, marsh/floating mat habitat between bedrock is more suitable to cross than pond. Cyprinids observed in pool between beaver dams. Assessment area focuses on habitat within area of impact below beaver dam. Tulloch 2013 fish sampling in wetland approximately 250 m to the east of WB-N-M28-16 found Brook Stickleback, Fathead Minnow and Finescale Dace.</p> <table><tr><td>Fish Habitat?</td><td>Direct</td></tr><tr><td>MWW (m)</td><td>25.00</td></tr><tr><td>MBW (m)</td><td>26.00</td></tr><tr><td>MWD (m)</td><td>-</td></tr><tr><td>MBD (m)</td><td>-</td></tr></table>	Fish Habitat?	Direct	MWW (m)	25.00	MBW (m)	26.00	MWD (m)	-	MBD (m)	-	Low
Fish Habitat?	Direct														
MWW (m)	25.00														
MBW (m)	26.00														
MWD (m)	-														
MBD (m)	-														



Photograph 1. View of stream with habitat at Centre Line ↑



Photograph 2. Looking upstream from beaver dam ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity										
WB-N-M31-2-2	June 15 th , 2015	Permanent Stream	Black ash swamp bordered by rock barren. Water seeping from beaver dam through black ash swamp. Flows to Key River.	<p>Main small poorly defined channel but entire swamp is saturated with many side pools of standing water throughout. Not likely to directly support fish below beaver dam in black ash swamp. Site was electrofished, no catch. Cyprinids observed upstream of beaver dam in pond. See site features for correct upstream study area limit.</p> <table><tr><td>Fish Habitat?</td><td>Indirect</td></tr><tr><td>MWW (m)</td><td>60.00</td></tr><tr><td>MBW (m)</td><td>60.00</td></tr><tr><td>MWD (m)</td><td>10.00</td></tr><tr><td>MBD (m)</td><td>15.00</td></tr></table>	Fish Habitat?	Indirect	MWW (m)	60.00	MBW (m)	60.00	MWD (m)	10.00	MBD (m)	15.00	Low
Fish Habitat?	Indirect														
MWW (m)	60.00														
MBW (m)	60.00														
MWD (m)	10.00														
MBD (m)	15.00														



Photograph 1. Facing downstream from upstream limit of study area, just above beaver dam. ↑



Photograph 2. Facing upstream from downstream limit of study area. ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity										
WB-N-M32-14	May 27 th , 2015	Permanent Stream	Large waterbody with rock outcrops and mixed deciduous forest.	<p>Upstream consists of small wetland with no defined channel. Leading to waterfall approximately 1 m high creating fish barrier leading to defined channel with fish habitat meandering towards Henvey Inlet. Good electrofishing site. Flows into Henceforth Inlet. Moderate water quality. Downstream portion of reach good fish habitat (particularly during spawning season).</p> <table><tr><th>Fish Habitat?</th><th>Direct</th></tr><tr><td>MWW (m)</td><td>0.85</td></tr><tr><td>MBW (m)</td><td>1.00</td></tr><tr><td>MWD (m)</td><td>0.40</td></tr><tr><td>MBD (m)</td><td>0.40</td></tr></table>	Fish Habitat?	Direct	MWW (m)	0.85	MBW (m)	1.00	MWD (m)	0.40	MBD (m)	0.40	Moderate
Fish Habitat?	Direct														
MWW (m)	0.85														
MBW (m)	1.00														
MWD (m)	0.40														
MBD (m)	0.40														



Photograph 1. Small wetland, cattails present between rock outcrops. Some Upland vegetation. Looking DS toward CL from US 50 m. ↑



Photograph 2. Downstream 50 m. Looking US toward CL from DS site limit. ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity										
WB-N-M32-26	May 27 th , 2015	Ephemeral Stream	Marshland and intermittent coniferous forest. Rock outcrops. Seasonal waterbody. No defined watercourse, no defined channel. Site is a marsh to transitional fen.	<div>Site is a marsh/transitional fen surrounded by bedrock. There is minimal standing water. Not fish habitat as this is an inland wetland.</div> <div><table><tr><td>Fish Habitat?</td><td>No</td></tr><tr><td>MWW (m)</td><td>65.00</td></tr><tr><td>MBW (m)</td><td>-</td></tr><tr><td>MWD (m)</td><td>-</td></tr><tr><td>MBD (m)</td><td>-</td></tr></table></div>	Fish Habitat?	No	MWW (m)	65.00	MBW (m)	-	MWD (m)	-	MBD (m)	-	Low
Fish Habitat?	No														
MWW (m)	65.00														
MBW (m)	-														
MWD (m)	-														
MBD (m)	-														



Photograph 1. Looking downstream from downstream site limit. ↑



Photograph 2. Looking upstream toward centre line from upstream site limit. ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity										
WB-N-M34-42	May 28 th , 2015	Ephemeral Stream	Mixed deciduous forest dominated by conifers, bedrock substrate. Channel feeds nearby swamp	<div>Low flow, undefined channel, between two rock outcrops. Wetland. 20 m wide marsh downstream of large swamp. Some upland vegetation, mostly upstream. No defined channel. No flow. Channel is situated between two bedrock outcrops. Not fish habitat.</div> <div><table><tr><td>Fish Habitat?</td><td>No</td></tr></table><table><tr><td>MWW (m)</td><td>20.00</td></tr><tr><td>MBW (m)</td><td>30.00</td></tr><tr><td>MWD (m)</td><td>0.30</td></tr><tr><td>MBD (m)</td><td>6.00</td></tr></table></div>	Fish Habitat?	No	MWW (m)	20.00	MBW (m)	30.00	MWD (m)	0.30	MBD (m)	6.00	Low
Fish Habitat?	No														
MWW (m)	20.00														
MBW (m)	30.00														
MWD (m)	0.30														
MBD (m)	6.00														



Photograph 1. Looking upstream from upstream site limit ↑



Photograph 2. Looking upstream toward centre line from downstream site limit. ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity										
WB-N-M35-1	May 14 th , 2015	Permanent Stream	Watercourse bordered by bedrock slopes. Fen wetlands downstream and upstream from study area where bedrock widens.	<p>Water from fen US concentrated where bedrock slopes narrow in study area. Another fen downstream where bordering bedrock widens. In study area standing water, vegetated between bedrock with slow flowing small channel in thalweg. Tulloch Environmental sampling in 2013 approximately 200 m downstream of WB-N-M35-1 found no catch. Tulloch 2013 sampling in same watercourse approximately 1.3 km downstream of the site (near the outlet to Henvey Inlet) found Black Crappie, Yellow Perch, Central Mudminnow and Pumpkinseed.</p> <table><tr><td>Fish Habitat?</td><td>Direct</td></tr></table> <table><tr><td>MWW (m)</td><td>15.00</td></tr><tr><td>MBW (m)</td><td>16.00</td></tr><tr><td>MWD (m)</td><td>0.50</td></tr><tr><td>MBD (m)</td><td>1.00</td></tr></table>	Fish Habitat?	Direct	MWW (m)	15.00	MBW (m)	16.00	MWD (m)	0.50	MBD (m)	1.00	Low
Fish Habitat?	Direct														
MWW (m)	15.00														
MBW (m)	16.00														
MWD (m)	0.50														
MBD (m)	1.00														



Photograph 1. Facing downstream from centre line ↑



Photograph 2. Facing upstream from centre line ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity						
WB-N-M37-15	May 14 th , 2015	Permanent Wetland	Large fen surrounded by bedrock and a wetland that is downstream/south of centreline.	<p>Pond characteristics change upstream and downstream of the centreline. Upstream: large fen bordered by bedrock, floating mats of vegetation, no open water and no direct fish habitat. Upstream of CL no fish habitat (fen). DS of CL where bedrock narrows flowing channel to pond DS is direct fish habitat. Fish sampling was conducted by Tulloch Environmental in 2013 of the same system, approximately 700 m downstream (south) of WB-S-M37-15. No fish were captured.</p> <table><tr><td>Fish Habitat?</td><td>Indirect</td></tr></table> <table><tr><td>Size (m)</td><td>50.00</td></tr><tr><td>Depth (m)</td><td>0.05</td></tr></table>	Fish Habitat?	Indirect	Size (m)	50.00	Depth (m)	0.05	Low
Fish Habitat?	Indirect										
Size (m)	50.00										
Depth (m)	0.05										



Photograph 1. Facing south from centre line. ↑



Photograph 2. Downstream from study area south towards pond. ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity						
WB-N-M39-19	May 14 th , 2015	Permanent Wetland	Bog bordered by bedrock and conifer swamp. There is a large body of open water fen marsh to the west that the bog is not connected to; this open water fen is not crossed by the road alignment.	<div>Large bog considered offline; could not locate any connections to surrounding water courses at the time of survey. No open water to support any fish habitat. Large floating mats of vegetation. No aquatic species, floating bog veg - Sphagnum black spruce pitcher plant cranberry. Estimated width is measured at the crossing location, surveyed 50 m east and west of centre line. Not fish habitat.</div> <table><tr><td>Fish Habitat?</td><td>No</td></tr><tr><td>Size (m)</td><td>90.00</td></tr><tr><td>Depth (m)</td><td>0.00</td></tr></table>	Fish Habitat?	No	Size (m)	90.00	Depth (m)	0.00	Low/NA
Fish Habitat?	No										
Size (m)	90.00										
Depth (m)	0.00										



Photograph 1. Facing south at crossing. ↑



Photograph 2. Facing north at crossing. ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity						
WB-N-M41-43	May 12 th , 2015	Permanent Wetland	Thicket fen swamp between bedrock barrens. Fen thicket tamarack swamp between bedrock barrens with pools of standing water over Sphagnum moss, treed/vegetated hummocks.	<p>Poor connectivity to open water habitat, no flowing channel or open water on-site. Standing pools/flooded Sphagnum and vegetated hummocks. Not suspected to directly support fish. Conditions consistent 50 m east and west of centre line. No aquatic species, fen/bog vegetation such as leatherleaf, <i>Sphagnum</i> sp., laurel, grass, and ferns.</p> <table><tr><td>Fish Habitat?</td><td>No</td></tr></table> <table><tr><td>Size (m)</td><td>100.00</td></tr><tr><td>Depth (m)</td><td>0.70</td></tr></table>	Fish Habitat?	No	Size (m)	100.00	Depth (m)	0.70	Low/NA
Fish Habitat?	No										
Size (m)	100.00										
Depth (m)	0.70										



Photograph 1. View of wetland at crossing location facing southeast. ↑



Photograph 2. Facing west from centre line. ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity						
WB-N-M41-44	May 12 th , 2015	Permanent Wetland	Thicket swamp fen surrounded by rock barren. Wetted mean width of wetland is 15 m and mean depth is 0.2 m. Standing water no flowing channel or connection to open water	<p>Fen thicket tamarack swamp between bedrock barrens with pools of standing water over Sphagnum moss, treed/vegetated hummocks. Poor connectivity to open water habitat, no flowing channel or open water on-site. No notable transition in vegetation between swamp and rock barren. Standing pools/flooded Sphagnum and vegetated hummocks. Not suspected to directly support fish. Conditions consistent 50 m east and west of centreline.</p> <table><tr><td>Fish Habitat?</td><td>Indirect</td></tr></table> <table><tr><td>Size (m)</td><td>15.00</td></tr><tr><td>Depth (m)</td><td>0.30</td></tr></table>	Fish Habitat?	Indirect	Size (m)	15.00	Depth (m)	0.30	Low
Fish Habitat?	Indirect										
Size (m)	15.00										
Depth (m)	0.30										



Photograph 1. Looking west in fen from survey point. ↑



Photograph 2. Looking east from survey point. ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity						
WB-N-M43-22	May 13 th , 2015	Permanent Wetland	Fen conifer swamp bordered by bedrock outcrops with pine and occasional poplars. No transition in vegetation between fen and bedrock barren.	<div>Large fen conifer swamp with floating mats throughout with no open water other than occasional flooded pools of stagnant water. Not fish habitat. Large fen conifer swamp with pools of stagnant water not connected to any other watercourse.</div> <div><table><tr><td>Fish Habitat?</td><td>No</td></tr></table><table><tr><td>Size (m)</td><td>165.00</td></tr><tr><td>Depth (m)</td><td>0.00</td></tr></table></div>	Fish Habitat?	No	Size (m)	165.00	Depth (m)	0.00	Low/NA
Fish Habitat?	No										
Size (m)	165.00										
Depth (m)	0.00										



Photograph 1. Southeast of crossing location looking at fen. ↑



Photograph 2. Looking northwest towards crossing. ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity						
WB-N-M46-4	May 12 th , 2015	Permanent Wetland	Slight channel running through fen in-between rock barren landscape.	<p>Poorly defined channel. During time of assessment whole fen area with pools and flooded mean water depth 0.25 m. Floating mats of moss, grasses and water tolerant vegetation. Point location connected to larger body of water upstream as seen on topo map.</p> <table><tr><td>Fish Habitat?</td><td>Direct</td></tr></table> <table><tr><td>Size (m)</td><td>26.00</td></tr><tr><td>Depth (m)</td><td>1.50</td></tr></table>	Fish Habitat?	Direct	Size (m)	26.00	Depth (m)	1.50	Low
Fish Habitat?	Direct										
Size (m)	26.00										
Depth (m)	1.50										



Photograph 1. Facing downstream from point location. ⬆



Photograph 2. Facing upstream from point location. ⬆

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity						
WB-N-M47-45	May 13 th , 2015	Permanent Wetland	Fen surrounded by rock barrens and connected to larger wetland as seen on topo map. No transition in vegetation from wetland to bedrock barren.	<div>Fen bordered by rock barren. No open water, floating mats of vegetation. Mosses, laurel, pitcher plant. Not fish habitat. Not fish habitat. Fen with no open water, covered by floating mats of vegetation.</div> <div><table><tr><td>Fish Habitat?</td><td>No</td></tr></table><table><tr><td>Size (m)</td><td>40.00</td></tr><tr><td>Depth (m)</td><td>0.00</td></tr></table></div>	Fish Habitat?	No	Size (m)	40.00	Depth (m)	0.00	Low/NA
Fish Habitat?	No										
Size (m)	40.00										
Depth (m)	0.00										

*** No Photographs Available.

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity						
WB-N-M49-46	May 13 th , 2015	Permanent Wetland	Extensive wetland bordered by rolling bedrock. 100 m width of fen at crossing. Study area ~50M up and downstream. Mean depth of open flowing water in small channel (useable by fish) at crossing location.	<p>At crossing location extensive fen and marsh wetland with bedrock island. East side of island And upstream is narrow channel flowing through alder thicket and grasses/ sedges over Bo Co from beaver pond approximately 30 m upstream. Downstream is channel. Upstream of crossing is channel flowing over Bo Co through thicket ~0.5 m mean w and ~0.1 d from beaver pond. Downstream channel through wetland flowing to open water pond. Beaver dam upstream impeding fish passage. Likely direct fish habitat.</p> <table><tr><td>Fish Habitat?</td><td>Direct</td></tr></table> <table><tr><td>Size (m)</td><td>100.00</td></tr><tr><td>Depth (m)</td><td>0.30</td></tr></table>	Fish Habitat?	Direct	Size (m)	100.00	Depth (m)	0.30	Low
Fish Habitat?	Direct										
Size (m)	100.00										
Depth (m)	0.30										



Photograph 1. At crossing facing downstream (south) on east side of bedrock island ↑



Photograph 2. Channel upstream of crossing flowing from beaver dam through alder thicket. ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity										
WB-S-M1-58	May 4 th , 2015	Intermittent Drainage Ditch	Forest to the west. Hwy to the east. Stream with open areas surrounded by cattails.	<div>Beaver activity evident. Drainage ditch beside highway 69. Roadside drainage ditch leading to wetland\stream. Heavily overgrown with cattails. Functions for drainage only.</div> <div><table><tr><td>Fish Habitat?</td><td>No</td></tr></table><table><tr><td>MWW (m)</td><td>1.52</td></tr><tr><td>MBW (m)</td><td>2.80</td></tr><tr><td>MWD (m)</td><td>0.75</td></tr><tr><td>MBD (m)</td><td>0.50</td></tr></table></div>	Fish Habitat?	No	MWW (m)	1.52	MBW (m)	2.80	MWD (m)	0.75	MBD (m)	0.50	Low
Fish Habitat?	No														
MWW (m)	1.52														
MBW (m)	2.80														
MWD (m)	0.75														
MBD (m)	0.50														



Photograph 1. Looking upstream at centre line ↑



Photograph 2. Looking downstream at centre line ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity										
WB-S-M13-13	May 6 th , 2015	Intermittent Stream	Two beaver ponds with the assessed watercourse connecting them.	<p>Small intermittent watercourse connecting two beaver dams. Northern painted turtle and Cyprinids observed in upstream pond. Fish sampling conducted by Tulloch Environmental in 2013 in same system, approximately 1.5 km downstream (stream length) of WB-S-M13-13. Sampling found Brown Bullhead, Northern Redbelly Dace, Iowa Darter, Brook Stickleback, Finescale Dace, Golden Shiner, and Central Mudminnow.</p> <table><tr><td>Fish Habitat?</td><td>Direct</td></tr><tr><td>MWW (m)</td><td>0.25</td></tr><tr><td>MBW (m)</td><td>2.00</td></tr><tr><td>MWD (m)</td><td>0.15</td></tr><tr><td>MBD (m)</td><td>0.30</td></tr></table>	Fish Habitat?	Direct	MWW (m)	0.25	MBW (m)	2.00	MWD (m)	0.15	MBD (m)	0.30	Moderate
Fish Habitat?	Direct														
MWW (m)	0.25														
MBW (m)	2.00														
MWD (m)	0.15														
MBD (m)	0.30														

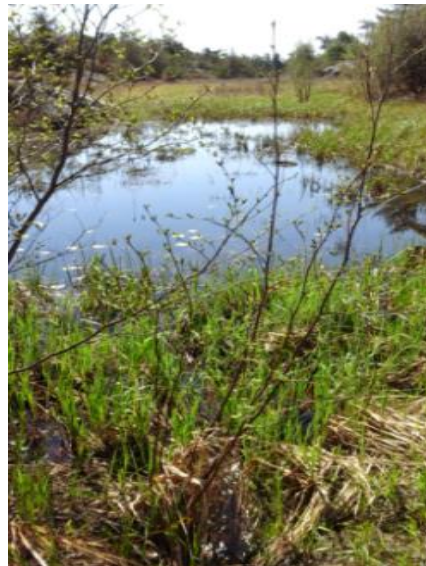


Photograph 1. Looking upstream ↑



Photograph 2. Looking north at downstream end of assessed area towards beaver pond and channel ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity										
WB-S-M30-11	May 13 th , 2015	Permanent Stream	Water flows south to north draining beaver pond into a wetland. Rock outcrop steeply slopes to creek. Small creek with good flow, sandy bottom with good cover.	<p>Small stream with potential to be habitat for cyprinids. Could be stagnant or slow moving during summer. Detritus may contribute to higher biologic oxygen demand. Potential culvert not likely to do much damage. This creek may be susceptible to beaver damming. Fish sampling conducted by Tulloch Environmental in 2013 found Central Mudminnow, approximately 750 m downstream of WB-S-M30-11 in same watercourse.</p> <table><tr><td>Fish Habitat?</td><td>Direct</td></tr><tr><td>MWW (m)</td><td>1.00</td></tr><tr><td>MBW (m)</td><td>2.50</td></tr><tr><td>MWD (m)</td><td>0.20</td></tr><tr><td>MBD (m)</td><td>-</td></tr></table>	Fish Habitat?	Direct	MWW (m)	1.00	MBW (m)	2.50	MWD (m)	0.20	MBD (m)	-	Low
Fish Habitat?	Direct														
MWW (m)	1.00														
MBW (m)	2.50														
MWD (m)	0.20														
MBD (m)	-														



Photograph 1. Upstream 50 m of crossing looking upstream ↑



Photograph 2. Upstream 50 m of crossing at beaver dam looking downstream ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity						
WB-S-M36-50	May 14 th , 2015	Seasonal Wetland	Wetland to east and west; bedrock slopes to edge on south side; forest to east ; mixed deciduous coniferous forest. Wetland edge connects directly to forest. No riparian vegetation.	<p>This area is low-lying between two wetlands but is likely to dry over summer. Currently has the potential to provide spawning habitat for frogs and amphibians. Potential road will be directly over an established animal trail. Considering flooded conditions from recent precipitation there is very low water lying here that will potentially dry during warm season, supported by presence of grasses, mosses, and shrubs.</p> <table><tr><td>Fish Habitat?</td><td>No</td></tr></table> <table><tr><td>Size (m)</td><td>30.00</td></tr><tr><td>Depth (m)</td><td>0.05</td></tr></table>	Fish Habitat?	No	Size (m)	30.00	Depth (m)	0.05	Low/NA
Fish Habitat?	No										
Size (m)	30.00										
Depth (m)	0.05										



Photograph 1. Facing north from centre point. ↑



Photograph 2. Animal trail where road is proposed to cross facing northwest. ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity						
WB-S-M48-17	May 24 th , 2015	Permanent Wetland	Forested bedrock bordering fen wetland. No open water, no aquatic vegetation.	<div>Treed fen. Floating mat of fen vegetation, no open water. Fen vegetation includes sphagnum, ferns, leatherleaf, cottongrass, tamarack, grass, wild calla. Not fish habitat, no open water.</div> <div><table><tr><td>Fish Habitat?</td><td>No</td></tr></table><table><tr><td>Size (m)</td><td>30.00</td></tr><tr><td>Depth (m)</td><td>0.00</td></tr></table></div>	Fish Habitat?	No	Size (m)	30.00	Depth (m)	0.00	Low/NA
Fish Habitat?	No										
Size (m)	30.00										
Depth (m)	0.00										



Photograph 1. Facing northwest, looking across wetland along centreline from southeast bank. ↑



Photograph 2. View of fen facing southwest from Centre point. ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity										
WB-S-M49-9	May 6 th , 2015	Intermittent Stream	Mixed deciduous and coniferous forest. Low lying swamp.	<div>Lowland wetland/swamp. Limited water at time of assessment. Connecting between two swamps? Fish habitat unlikely. Not fish habitat in assessed area.</div> <div><table><tr><td>Fish Habitat?</td><td>No</td></tr></table><table><tr><td>MWW (m)</td><td>22.00</td></tr><tr><td>MBW (m)</td><td>40.00</td></tr><tr><td>MWD (m)</td><td>0.20</td></tr><tr><td>MBD (m)</td><td>0.80</td></tr></table></div>	Fish Habitat?	No	MWW (m)	22.00	MBW (m)	40.00	MWD (m)	0.20	MBD (m)	0.80	Low
Fish Habitat?	No														
MWW (m)	22.00														
MBW (m)	40.00														
MWD (m)	0.20														
MBD (m)	0.80														



Photograph 1. Looking west from centre line ↗



Photograph 2. Looking south from centre line ↗

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity						
WB-S-M49-48	May 24 th , 2015	Permanent Wetland	Conifer forest bordering bog wetland. No distinct riparian zone between fen and conifer forest.	<p>Fen. No open water, floating sphagnum mat with fen vegetation. Fen vegetation includes sphagnum, royal fern, leatherleaf, cottongrass, speckled alder, tamarack, three-way sedge, sheep laurel. Not fish habitat, fen. Centre line of road alignment runs along the south shore of the fen.</p> <table><tr><td>Fish Habitat?</td><td>No</td></tr></table> <table><tr><td>Size (m)</td><td>30.00</td></tr><tr><td>Depth (m)</td><td>0.00</td></tr></table>	Fish Habitat?	No	Size (m)	30.00	Depth (m)	0.00	Low/NA
Fish Habitat?	No										
Size (m)	30.00										
Depth (m)	0.00										



Photograph 1. General view of fen, looking north from centreline. ↑



Photograph 2. View of the fen, looking south from approx. 30 m north of CL. ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity										
WB-S-M50-10	May 6 th , 2015	Intermittent Stream	Low lying area within a mixed forest.	<p>In its natural state may be an intermittent watercourse however it has transitioned into pond/wetland. Flows to Georgian Bay, may be accessible to fish but few beaver dams may impede passage. Fish sampling conducted by Tulloch Environmental in 2013 in the same waterbody, approximately 400 m downstream of WB-S-M50-10. Sampling found Central Mudminnow, Brown Bullhead, Brook Stickleback, Golden Shiner and Finescale Dace.</p> <table><tr><td>Fish Habitat?</td><td>Direct</td></tr><tr><td>MWW (m)</td><td>20.00</td></tr><tr><td>MBW (m)</td><td>25.00</td></tr><tr><td>MWD (m)</td><td>0.60</td></tr><tr><td>MBD (m)</td><td>0.50</td></tr></table>	Fish Habitat?	Direct	MWW (m)	20.00	MBW (m)	25.00	MWD (m)	0.60	MBD (m)	0.50	Moderate
Fish Habitat?	Direct														
MWW (m)	20.00														
MBW (m)	25.00														
MWD (m)	0.60														
MBD (m)	0.50														



Photograph 1. Watercourse transitioning into wetland via beavers looking east (upstream)↑



Photograph 2. Watercourse looking west (downstream)↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity						
WB-S-M52-58	July 9 th , 2015	Permanent Pond	Deciduous dominant forest. Highly disturbed area; Dump west of stagnant pond.	<p>Open pond with small stagnant pond to east separated by gravel fill. This area is highly disturbed with a road northeast off Bekanon road and a dump southeast of east stagnant pond. Large west pond has good water quality and observed presence of fish. Substrate is sand gravel cobble.</p> <table><tr><td>Fish Habitat?</td><td>Direct</td></tr></table> <table><tr><td>Size (m)</td><td>125.00</td></tr><tr><td>Depth (m)</td><td>0.60</td></tr></table>	Fish Habitat?	Direct	Size (m)	125.00	Depth (m)	0.60	Low
Fish Habitat?	Direct										
Size (m)	125.00										
Depth (m)	0.60										



Photograph 1 Looking west at large pond from centre point atop gravel fill to east of large pond separating large pond from small stagnant pond. ↑



Photograph 2. Looking south from the north shore of the large pond. This view includes part of pond within area of disturbance. ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity										
WB-S-M5-7	May 5 th , 2015	Permanent Wetland Connected to Channel	Corridor of open water bog thicket approximately 100 m across.	<div>Bog thicket connected to two permanent watercourses.</div> <div><table><tr><td>Fish Habitat?</td><td>Indirect</td></tr></table><table><tr><td>MWW (m)</td><td>30.00</td></tr><tr><td>MBW (m)</td><td>30.00</td></tr><tr><td>MWD (m)</td><td>0.20</td></tr><tr><td>MBD (m)</td><td>1.00</td></tr></table></div>	Fish Habitat?	Indirect	MWW (m)	30.00	MBW (m)	30.00	MWD (m)	0.20	MBD (m)	1.00	Low
Fish Habitat?	Indirect														
MWW (m)	30.00														
MBW (m)	30.00														
MWD (m)	0.20														
MBD (m)	1.00														



Photograph 1. Bog thicket with open standing water, downstream looking east ↑



Photograph 2. Bog thicket with open water, general overview from centre of assessed area ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity						
WB-S-M8-56	May 12 th , 2015	Vernal Pools	Mixed coniferous and deciduous forest with low lying areas.	<p>Ponds likely due to recent rain and snow melt; not likely to be present during summer. No recognizable water course; no connectivity; wet from recent precipitation; vegetation present not consistent with wetland areas. Not likely to directly support fish.</p> <table><tr><td>Fish Habitat?</td><td>No</td></tr></table> <table><tr><td>Size (m)</td><td>25.00</td></tr><tr><td>Depth (m)</td><td>0.10</td></tr></table>	Fish Habitat?	No	Size (m)	25.00	Depth (m)	0.10	Low/NA
Fish Habitat?	No										
Size (m)	25.00										
Depth (m)	0.10										



Photograph 1. Looking south from crossing location. ↑



Photograph 2. Looking north from crossing location. ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity						
WB-S-M8-57	May 12 th , 2015	Wetland	Low lying area with mixed coniferous and deciduous trees. Beaver pond to the west. Lowland wetland bog.	<p>Potential to be dry during warmer months, potential intermittent fish habitat but full of water at time of assessment. Toads and spring peepers heard calling. Fish sampling was conducted by Tulloch Environmental in 2013 in the adjacent pond approximately 500 m to the west and with potential connectivity to WB-S-M8-57. Sampling of this pond found Central Mudminnow, Northern Redbelly Dace and Finescale Dace.</p> <table><tr><td>Fish Habitat?</td><td>Indirect</td></tr></table> <table><tr><td>Size (m)</td><td>40.00</td></tr><tr><td>Depth (m)</td><td>0.30</td></tr></table>	Fish Habitat?	Indirect	Size (m)	40.00	Depth (m)	0.30	Low
Fish Habitat?	Indirect										
Size (m)	40.00										
Depth (m)	0.30										



Photograph 1. Looking south across proposed road. ↑



Photograph 2. Looking west from crossing location. ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity						
WB-S-M13-55	May 13 th , 2015	Intermittent Wetland	Mixed coniferous deciduous forest. Intermittent pools throughout low-lying area between bedrock.	<div>Low-lying pools likely to dry during warm periods; likely present due to recent precipitation. Wet areas in low-lying land not permanent; not ideal fish habitat.</div> <div><table><tr><td>Fish Habitat?</td><td>No</td></tr></table><table><tr><td>Size (m)</td><td>40.00</td></tr><tr><td>Depth (m)</td><td>0.10</td></tr></table></div>	Fish Habitat?	No	Size (m)	40.00	Depth (m)	0.10	Low/NA
Fish Habitat?	No										
Size (m)	40.00										
Depth (m)	0.10										



Photograph 1. Facing east from centre point. ↑



Photograph 2. Facing west from centre point. ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity										
WB-S-M17-29	May 13 th , 2015	Permanent Stream	Pine forest on rocky outcrops. Fast flowing water flowing from northeast to southwest over beaver dams and rocky ledges from pond into wetland then again into pond.	<div>Beaver pond drainage over bedrock into downstream pond. At time of assessment, high flows from recent precipitation not indicative of base flows. Water is known to slow during warmer months with sediment observed in pool areas. Not recommended for road crossing due to potential flood risk and risk of increased downstream sedimentation.</div> <div><table><tr><td>Fish Habitat?</td><td>Direct</td></tr></table><table><tr><td>MWW (m)</td><td>12.00</td></tr><tr><td>MBW (m)</td><td>30.00</td></tr><tr><td>MWD (m)</td><td>0.80</td></tr><tr><td>MBD (m)</td><td>1.00</td></tr></table></div>	Fish Habitat?	Direct	MWW (m)	12.00	MBW (m)	30.00	MWD (m)	0.80	MBD (m)	1.00	Moderate
Fish Habitat?	Direct														
MWW (m)	12.00														
MBW (m)	30.00														
MWD (m)	0.80														
MBD (m)	1.00														



Photograph 1. Downstream 50 m looking downstream ↑



Photograph 2. At crossing looking upstream ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity										
WB-S-M19-6	May 7 th , 2015	Permanent Stream	Channel flowing between rock barrens and wetlands, flows from fen wetland upstream. Channel flowing through wetlands from the northeast, east and southeast direction.	<p>Riffle-run sequences. Gravel/ sand/ cobble/ boulder substrate. Lots of aeration from riffles and input from a wetland to the northeast direction. Some fallen logs across channel but not posing barriers to fish migration. Mean water depth is 0.20. Prime location to electrofish. Babbling brook with good substrate (gravel sand cobble boulder), riffle-pool sequences, and good cover from tree and shrub canopy, cyprinids observed below bedrock barrier, above barrier habitat is accessible to fish from upstream. Channel flowing between wetlands from northeast, west and southeast areas.</p> <table><tr><td>Fish Habitat?</td><td>Direct</td></tr></table> <table><tr><td>MWW (m)</td><td>2.20</td></tr><tr><td>MBW (m)</td><td>3.50</td></tr><tr><td>MWD (m)</td><td>0.15</td></tr><tr><td>MBD (m)</td><td>0.40</td></tr></table>	Fish Habitat?	Direct	MWW (m)	2.20	MBW (m)	3.50	MWD (m)	0.15	MBD (m)	0.40	Moderate
Fish Habitat?	Direct														
MWW (m)	2.20														
MBW (m)	3.50														
MWD (m)	0.15														
MBD (m)	0.40														

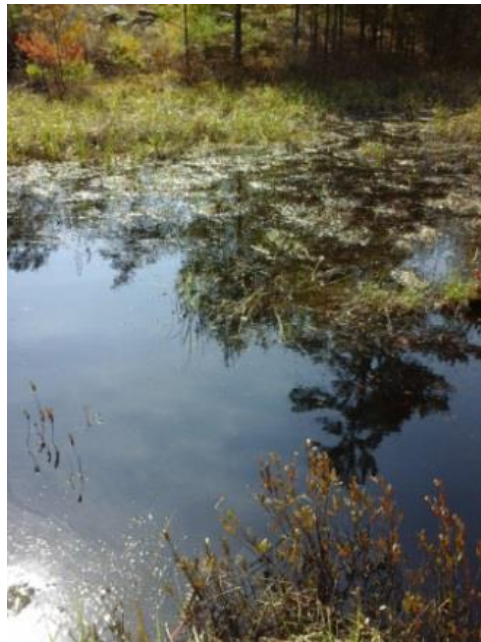


Photograph 1. General view of the watercourse facing downstream (DS) from the centreline (CL)
↑



Photograph 2. General view of the watercourse facing upstream (US) from the centreline (CL) ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity										
WB-S-M34-53	May 7 th , 2015	Permanent Stream	Beaver pond to the west. Wetland to the east. Forest surrounding. Watercourse connecting wetland and beaver pond. Natural and defined channel. Potential historic beaver channel.	<div>Natural watercourse connecting wetland and beaver pond. Frogs observed. Likely fish species present downstream with potential for fish within channel. Fish sampling conducted by Tulloch Environmental in 2013 in same system, approximately 1.5 km downstream (stream length) of WB-S-M34-53. Sampling found Finescale Dace, and Central Mudminnow.</div> <table><tr><td>Fish Habitat?</td><td>Direct</td></tr></table> <table><tr><td>MWW (m)</td><td>1.50</td></tr><tr><td>MBW (m)</td><td>20.00</td></tr><tr><td>MWD (m)</td><td>0.35</td></tr><tr><td>MBD (m)</td><td>1.50</td></tr></table>	Fish Habitat?	Direct	MWW (m)	1.50	MBW (m)	20.00	MWD (m)	0.35	MBD (m)	1.50	Low
Fish Habitat?	Direct														
MWW (m)	1.50														
MBW (m)	20.00														
MWD (m)	0.35														
MBD (m)	1.50														



Photograph 1. Overview from proposed crossing ↑



Photograph 2. Looking west from proposed crossing ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity						
WB-S-M34-54	May 28 th , 2015	Permanent Wetland	Mixed coniferous deciduous forest atop bedrock. Wetland to the north. Saturated Sphagnum with meadow sweet and <i>Carex</i> species with pools between bedrock outcrops.	<p>Estimated size is along cl and includes bedrock outcrops along CL. Channel feature is 18 m wide at CL and ends at tree line 60 m south of CL. Downstream (south) of channel feature is meandering creek that connects to a wetland. Looks like treed end of channel. Rock outcrops jutting into wetland are being used for CL, whole 107 includes 40 m and 4 m bedrock outcrops.</p> <table><tr><td>Fish Habitat?</td><td>No</td></tr></table> <table><tr><td>Size (m)</td><td>107.00</td></tr><tr><td>Depth (m)</td><td>0.02</td></tr></table>	Fish Habitat?	No	Size (m)	107.00	Depth (m)	0.02	Low/NA
Fish Habitat?	No										
Size (m)	107.00										
Depth (m)	0.02										



Photograph 1. Looking southwest at cl from 50 m northeast of centre line. ↑



Photograph 2. Looking north from south end of channel feature towards centre line. ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity						
WB-S-M36-49	May 14 th , 2015	Vernal Pools	Mixed coniferous and deciduous forest between rock outcrops.	<div>Wetland with intermittent pines birches and trembling aspens throughout with woody bushes grasses and mosses. Stagnant pools with limited connectivity. Moose habitat; evidence of feeding and excrement.</div> <div><table><tr><td>Fish Habitat?</td><td>No</td></tr></table><table><tr><td>Size (m)</td><td>40.00</td></tr><tr><td>Depth (m)</td><td>0.15</td></tr></table></div>	Fish Habitat?	No	Size (m)	40.00	Depth (m)	0.15	Low/NA
Fish Habitat?	No										
Size (m)	40.00										
Depth (m)	0.15										



Photograph 1. Facing north from centre point. ↑



Photograph 2. Facing south from centre point. ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity										
WB-S-M39-8	May 8 th , 2015	Permanent Stream	Mixed forest dominated by coniferous trees. Natural, low velocity watercourse. Natural meander. Good cover and riffle run pool sequences.	<p>Natural pool, riffle, run sequence. Woody debris and undercut banks providing good cover. Overall suitable habitat for coolwater fish species. Old beaver dam observed on southern end of study area but was old and the water had broken through leaving a wide channel 1-2 m. Potential for study area to blow out above beaver dam. Creek Chub observed in run just downstream of beaver dam. Suggest alternate route. Suitable nursery habitat for Northern Brook Lamprey, with suitable spawning habitat (riffle/run over gravel) observed upstream (outside of study area). Fish sampling conducted by Tulloch Environmental in the vicinity of WB-S-M39-8 found Creek Chub, Northern Redbelly Dace, Finescale Dace, White Sucker, Central Mudminnow.</p> <table><tr><th>Fish Habitat?</th><th>Direct</th></tr><tr><td>MWW (m)</td><td>4.50</td></tr><tr><td>MBW (m)</td><td>22.00</td></tr><tr><td>MWD (m)</td><td>0.15</td></tr><tr><td>MBD (m)</td><td>0.75</td></tr></table>	Fish Habitat?	Direct	MWW (m)	4.50	MBW (m)	22.00	MWD (m)	0.15	MBD (m)	0.75	High
Fish Habitat?	Direct														
MWW (m)	4.50														
MBW (m)	22.00														
MWD (m)	0.15														
MBD (m)	0.75														



Photograph 1. Looking upstream from crossing ↑



Photograph 2. Looking downstream from crossing ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity						
WB-S-M39-51	May 14 th , 2015	Permanent Wetland	Bedrock outcrops with mixed deciduous coniferous forest. Limited connectivity between pools, water stagnant.	<div>Low-lying wetland with shrubs mosses and grasses and few intermittent trees between two rock outcrops. Water level in ponds likely to lower during summer; good habitat for amphibians.</div> <div><table><tr><td>Fish Habitat?</td><td>No</td></tr></table><table><tr><td>Size (m)</td><td>25.00</td></tr><tr><td>Depth (m)</td><td>0.20</td></tr></table></div>	Fish Habitat?	No	Size (m)	25.00	Depth (m)	0.20	Low/NA
Fish Habitat?	No										
Size (m)	25.00										
Depth (m)	0.20										



Photograph 1. Facing north from centre point. ↑



Photograph 2. Facing south from centre point. ↑

Feature ID	Investigation Date	Type of Waterbody	Description of Site	Feature Description	Feature Sensitivity						
WB-S-M41-52	May 14 th , 2015	Permanent Wetland	Mixed deciduous and coniferous forest sparsely located among bedrock. Connects two large wetlands.	<p>Slow moving water to stagnant pools in wetland. May be habitat for small cyprinids and amphibians, connected to wetland downstream. Fish sampling was conducted by Tulloch Environmental in 2013 of the same system, approximately 1 km downstream (south) of WB-S-M41-52 found Central Mudminnow, Brown Bullhead, Brook Stickleback, Golden Shiner and Finescale Dace.</p> <table><tr><td>Fish Habitat?</td><td>Direct</td></tr></table> <table><tr><td>Size (m)</td><td>15.00</td></tr><tr><td>Depth (m)</td><td>0.20</td></tr></table>	Fish Habitat?	Direct	Size (m)	15.00	Depth (m)	0.20	Low
Fish Habitat?	Direct										
Size (m)	15.00										
Depth (m)	0.20										



Photograph 1. Facing north from centre line. ↑



Photograph 2. Facing east from centre line. ↑

Table 4-4: Results of Fish Community Sampling of Waterbodies in the Waterbodies study area

Feature ID	Date	Gear Type	Settings and Effort	Fish Capture		Count
WB-N-M6-3	June 16, 2015	Winged hoop net	Overnight set	Brook Stickleback	<i>Culaea inconstans</i>	1
				Brown Bullhead	<i>Ameiurus nebulosus</i>	1
				Central Mudminnow	<i>Umbra limi</i>	12
WB-N-M-31-2-2	June 15, 2015	Backpack electrofisher	253 seconds, 650 V, 60 Hz	***No catch		
WB-S-26-1	June 11, 2015	Angling	3 lines in water for 2 hours	***No catch		
WB-N-N12-12	June 10, 2015	Backpack electrofisher	410 seconds, 650 V, 60 Hz	Finescale Dace	<i>Chrosomus neogaeus</i>	2
				Northern Redbelly Dace	<i>Chrosomus eos</i>	7
				Central Mudminnow	<i>Umbra limi</i>	17
				Brook Stickleback	<i>Culaea inconstans</i>	2
WB-N-M26-21	June 10, 2015	Winged hoop net and minnow traps	Overnight set	Golden Shiner	<i>Notemigonus crysoleucas</i>	18
				Brown Bullhead	<i>Ameiurus nebulosus</i>	2
				Pumpkinseed	<i>Lepomis gibbosus</i>	3
				Yellow Perch	<i>Perca flavescens</i>	4
WB-S-17-29	June 9, 2015	Backpack electrofisher	835 seconds, 650 V, 60 Hz	Northern Redbelly Dace	<i>Chrosomus eos</i>	24
				Creek Chub	<i>Semotilus atromaculatus</i>	12
				Iowa Darter	<i>Etheostoma exile</i>	4
				Pumpkinseed	<i>Lepomis gibbosus</i>	4
				Unknown – suspected Emerald Shiner	<i>Notropis atherinoides</i>	1
				Blacknose Shiner	<i>Notropis heterolepis</i>	32
				Brook Stickleback	<i>Culaea inconstans</i>	6
				Bluntnose Minnow	<i>Pimephales notatus</i>	3
				Central Mudminnow	<i>Umbra limi</i>	3
				Johnny Darter	<i>Etheostoma nigrum</i>	4
				Rock Bass	<i>Ambloplites rupestris</i>	8
				Creek Chub	<i>Semotilus atromaculatus</i>	2
WB-S-19-6	June 9, 2015	Backpack electrofisher	1177 seconds, 650 V, 60 Hz	Northern Redbelly Dace	<i>Chrosomus eos</i>	5
				Central Mudminnow	<i>Umbra limi</i>	3
				Brook Stickleback	<i>Culaea inconstans</i>	1
WB-S-13-13	June 8, 2015	Backpack electrofisher	336 seconds, 650 V, 60 Hz	Finescale Dace	<i>Chrosomus neogaeus</i>	1
				Northern Redbelly Dace	<i>Chrosomus eos</i>	2
				Central Mudminnow	<i>Umbra limi</i>	1
WB-N-32-14	June 5, 2015	Backpack electrofisher	959 seconds, 650 V, 60 Hz	Fathead Minnow	<i>Pimephales promelas</i>	2
				Iowa Darter	<i>Etheostoma exile</i>	2
				Central Mudminnow	<i>Umbra limi</i>	13
				Brook Stickleback	<i>Culaea inconstans</i>	2
				Yellow Perch	<i>Perca flavescens</i>	2

Table 4-4: Results of Fish Community Sampling of Waterbodies in the Waterbodies study area

Feature ID	Date	Gear Type	Settings and Effort	Fish Capture		Count
S-39-8	June 4, 2015	Backpack electrofisher	3160 seconds, 550 V, 60 Hz	Fathead Minnow	<i>Pimephales promelas</i>	4
				Iowa Darter	<i>Etheostoma exile</i>	9
				Central Mudminnow	<i>Umbra limi</i>	29
				Brook Stickleback	<i>Culaea inconstans</i>	27
				Finescale Dace	<i>Chrosomus neogaeus</i>	10
				Creek Chub	<i>Semotilus atromaculatus</i>	9
				Northern Redbelly Dace	<i>Chrosomus eos</i>	30
				White Sucker	<i>Catostomus commersonii</i>	6
				Common Shiner	<i>Luxilus cornutus</i>	27
				Fathead Minnow	<i>Pimephales promelas</i>	4
				Brassy Minnow	<i>Hybognathus hankinsonii</i>	3
				Blacknose Shiner	<i>Notropis heterolepis</i>	5
				Johnny Darter	<i>Etheostoma nigrum</i>	1

4.6 Seepage Areas

The seepages identified in the Waterbodies study area are described as localized and isolated seeps of groundwater (**Figure 4-1**). Twelve seepage areas were identified by both terrestrial natural heritage and aquatic assessment crews during field studies.

Of all waterbodies studied, **5** locations contained seepage or groundwater indicators including the presence of Watercress, Water Speedwell, Bittercress, Skunk Cabbage, iron staining and bank seepage. Another **7** locations were identified during field investigations completed while assessing terrestrial features. **Table 4-5** below is a summary of the seepage locations.

Table 4-5: Seepage Areas Observed in the Waterbodies study area

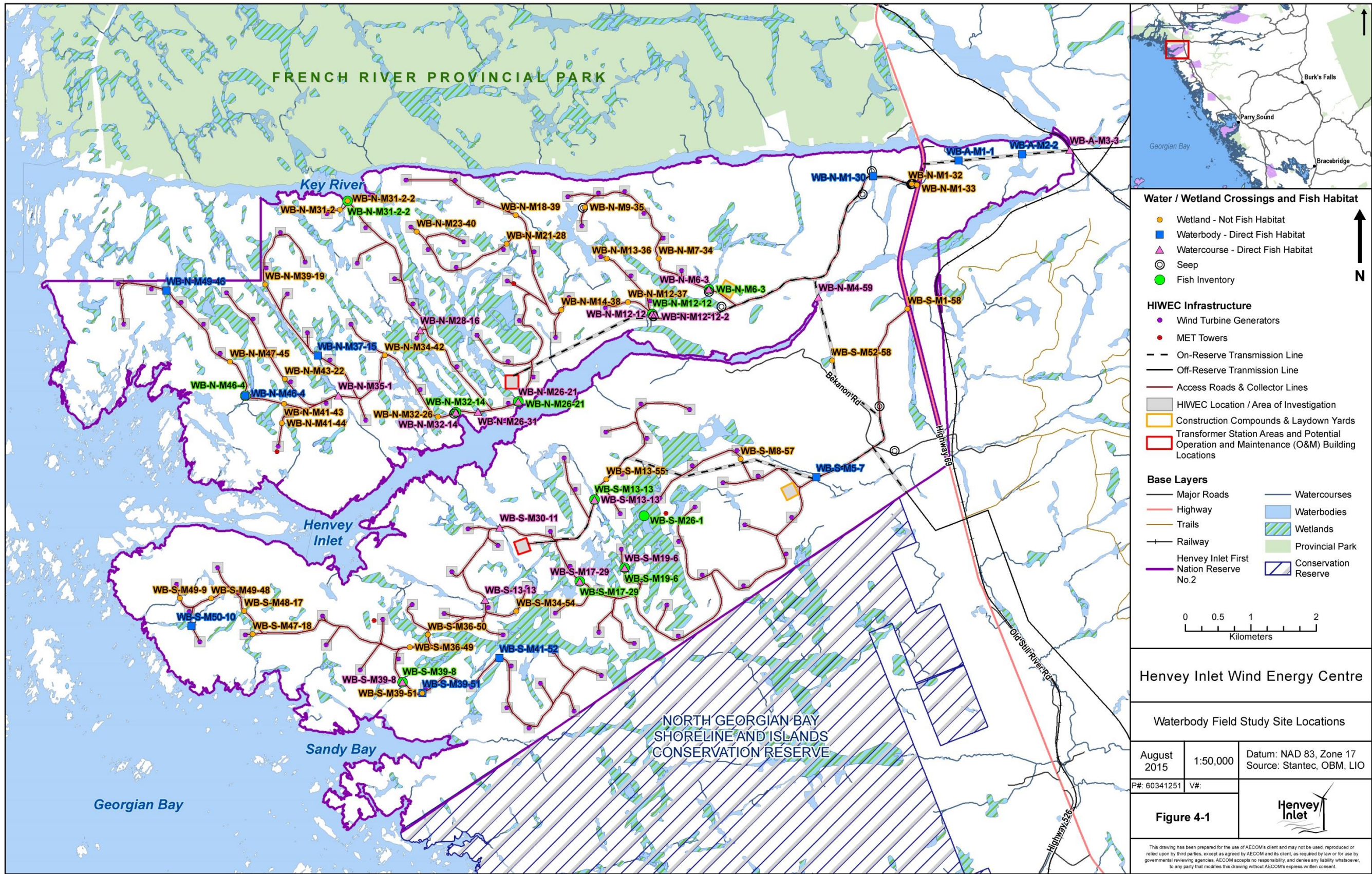
Co-ordinates (Latitude, Longitude)	Site Feature Identifier	Indicator
45.886783, -80.567218	WB-N-M1-33	Sheen and iron staining
45.86882, -80.618108	WB-N-M6-3	Iron staining
45.872143, -80.607126	WB-N-M6-3-2	Iron Staining
45.855551, -80.657424	WB-N-M32-14	Iron staining
45.883756, -80.631877	WB-N-M9-35	Watercress growing sporadically throughout wetland
45.885427, -80.576764	Not associated with an aquatic feature identifier	Rust colour in small stream running into wetland
45.886825, -80.566851	Not associated with an aquatic feature identifier	Pool, 1 m by 2 m, silt at the bottom. Very deep, at least 60 cm; the soil auger keeps sinking in. Depth of water is 30 cm, clear water. No groundwater indicators; no amphibians observed.
45.888621, -80.574919	Not associated with an aquatic feature identifier	Iron staining
45.886854, -80.567093	Not associated with an aquatic feature identifier	40 cm deep, clear water, small vernal pool 3 m long by 2 m wide, in a coniferous forest, substrate is mineral soil. Very likely to be a seep or spring. Water clear and not frozen, substrate at bottom seems to be disturbed from rising groundwater.
45.870068, -80.604674	Not associated with an aquatic feature identifier	Iron staining observed on substrate of small creek. Creek flowing from forest to what was a beaver pond. It appears that a beaver dam downstream has breached. Iron staining in the flowing water at inlet of old beaver pond.
45.850115, -80.570772	Not associated with an aquatic feature identifier	Groundwater recharge, flows underground to stream along Bekanon Road.
45.856276, -80.573642	Not associated with an aquatic feature identifier	Possible mineral lick, very muddy with orange staining

Where a seep was discovered at a waterbody site investigation site, details of the site assessment are provided in Table 4-3 and in Appendices A and BA. Where seeps were discovered elsewhere, further details of the site and mitigations are provided in Hydrogeological Assessment and Effects Assessment report (AECOM 2015). The seep locations are shown in **Figure 4-1**.

4.7 Corrections to Records Review

Any inconsistencies or corrections that were made to the Records Review based on the findings from the field studies are noted in **Table 4-3**. As there was very little data available in the Records Review for inland waterbodies, there were no corrections to be made other than: the addition of assessment sites at previously un-mapped features that were identified during field studies, and the classification of some site features as wetlands rather than waterbodies.

Figure 4-1: Waterbody Field Study Site Locations



A total of **three** new features were identified after site investigations, of these **one** was a pond feature, one was a watercourse and one was a wetland (not fish habitat). These sites are labelled in Table 4-3 with an additional digit in the site identifying number (as described in Section 4.2. Thirty-one (31) features were identified as wetlands (e.g., bog, fen, surface-water collection) during the field studies. While these features are not categorized as waterbodies and not fish habitat (within the assessment area), they are further described in **Table 4-3** and in the Natural Heritage Assessment (AECOM, 2015). No seeps were identified in the Records Review.

4.8 Number of Confirmed Waterbodies in Waterbodies study area

A total of 55 locations (32 ponds, 23 watercourses) were identified in the Waterbodies study area during the Records Review and carried forward to field studies. During field studies, 3 additional features were found, identified, and assessed for a total of 58 features. The locations of these waterbodies, the approximate distances to access roads and WTG locations, and of the assessment sites are shown in **Figure 4-1**.

Of the 58 features investigated:

- 31 of the assessment sites were identified as wetlands only, and not a waterbody or fish habitat (within the area of investigation) because they either did not fit the definition of a waterbody as outlined in **Section 1.4** of this report, or had no permanent or intermittent flow of water or ability to directly support a fish community. Wetlands are further discussed in the Natural Heritage Assessment (AECOM, 2015).
- A total of 27 waterbodies were identified in the study area. All of these waterbodies are proposed to be crossed by an access road, collection and/or transmission line. Since they are being crossed it can be said that these waterbodies are 0 m from project infrastructure. These were carried forward to the Effects Assessment and are summarized below in **Table 4-6**.

Table 4-6: Summary of Waterbodies in the Waterbodies study area Confirmed through Site Investigations and Carried Forward to Effects Assessment

Process stage	Number of Waterbodies
Features identified through Records Review	55
Additional features identified through site investigations	3
Total sites visited for field investigations	58
Features identified as wetlands (not waterbodies)	31
Features identified as waterbodies and potential fish habitat, carried forward to Effects Assessment	27

Effects and mitigation measures associated with each component of the HIWEC are discussed further in **Section 5**.

5. Description of Environmental Effects, Proposed Mitigation Measures and Net Effects

5.1 Methodology

This section presents a description of the potential negative effects of the HIWEC on the identified waterbodies and the area within 30 m of the waterbody. Activities associated with construction and their potential negative effects on the aquatic environment were identified using DFO's Pathways of Effects. A summary of the potential negative residual effects is provided below. The mitigation measures used to negate or minimize these impacts and a summary of residual effects associated with the HIWEC components and the environment are outlined for the construction/decommissioning and operation phases in Sections 5.3 and 5.4.

The assessment of the potential negative environmental effects characterizes and evaluates the nature of any anticipated negative effects and is briefly described below in **Section 5.2**. The evaluation of the potential negative residual effects following implementation of all mitigation and protection measures outlined in **Section 5.4** includes the spatial extent, magnitude, frequency and duration of the likely adverse effects.

5.2 Potential Negative Effects

5.2.1 Effects Associated with Wind Turbine Generators (including WTG staging area)

Table 5-2 describes the waterbody location and sensitivity, potential effects, mitigation measures, residual effect evaluation and residual effects associated with WTG as they relate to waterbodies and the land within 30 m of the waterbody.

Effects during the construction and decommissioning phase are primarily related to uncontrolled sediment release and blasting. Activities such as excavation and grading may result in exposed and unstable soils, which may be released to nearby waterbodies. The potential negative effects are changes in sediment concentrations, habitat, baseflows and/or water temperatures.

Blasting near waterbodies may cause the release of blast residues, particles at high velocity, instant and significant pressure changes and exposed soils. This may result in changes in sediment and contaminant concentrations, or direct fish mortality. Oil, fuel or other deleterious substance leaks from industrial equipment may change contaminant concentrations or result in direct mortality. If dewatering is required, the release of sediment-laden water to a waterbody may change sediment concentrations.

The negative effects associated with the operation of the WTG consist of those associated with alterations to drainage patterns, potential spills from maintenance equipment and ongoing erosion. Alterations to land drainage due to loss of vegetation and changes in topography could lead to erosion and cause changes in sediment concentrations. Spills from equipment may change contaminant concentrations or result in direct mortality. Activities and associated effects resulting from decommissioning are similar to those resulting from construction.

5.2.2 Effects Associated with Access Roads

Table 5-3 describes the waterbody location and sensitivity, potential effects, mitigation measures, residual effect evaluation and residual effects associated with access roads as they relate to waterbodies and the land within 30 m of the waterbody.

Potential impacts resulting from road construction are primarily related to sediment and erosion control, water crossing construction and blasting.

Activities relating to the construction of access roads such as excavation, clearing, grubbing, grading and stockpiling materials may result in exposed and unstable soils, which may be released to nearby waterbodies. The potential negative effects are changes in sediment concentrations, habitat, baseflows and/or water temperatures.

Oil, fuel or other deleterious substance leaks from industrial equipment may change contaminant concentrations or result in direct mortality.

The placement of structures in water during road crossing installation may result in temporary disturbances to fish, such as release in sediment and reduction in passage (e.g., during dewatering, etc.). The placement of structures or materials in water may also result in longer-term effects. The placement of structures on the banks and below the bankfull level of a waterbody such as culverts, crossing embankments and/or footings, abutments, rock protection or reduction in riparian vegetation may result in longer-term effects such as changes in habitat, cover, nutrient or sediment concentrations. Depending on structure design, there is the potential for more intensive impacts. Water crossings other than a clear-span type have a high potential to result in an alteration or loss of habitat within the permanent footprint of the structure and embankment.

Blasting may be required for road construction. Blasting near waterbodies may cause the release of blast residues, particles at high velocity, instant and significant pressure changes and exposed soils. This may result in changes in sediment and contaminant concentrations, or direct fish mortality.

Oil, fuel or other deleterious substance leaks from industrial equipment may change contaminant concentrations or result in direct mortality.

Dewatering of an in-water work area may result in the release of sediment-laden water, temporary reduction in fish passage and the stranding or entrainment of fish. The residual effects are changes in sediment concentration, habitat and cover or fish mortality.

Routine and/or unplanned WTG maintenance may be required and could include the use of maintenance vehicles using the watercourse crossing. Sediment may enter the watercourse from vehicles using the crossing and ongoing erosion from trails, access roads and embankments. Contaminant spills may occur during maintenance activities.

5.2.3 Effects Associated with Transmission and Collector Lines

The associated report; *Henvey Inlet Wind Water Assessment and Waterbody Report – Transmission Line Routes A and B* (AECOM, 2015) describes the location of off-Reserve transmission line crossings of waterbodies and their sensitivity assessment. This section of the report reviews the potential effects, mitigation measures, and residual effects associated with proposed on-Reserve portions of the Route A Transmission Line and Route B Transmission Line, as they relate to waterbodies and the 30 m area surrounding the waterbody.

Table 5-4 and 5-5 describes the waterbody location and sensitivity, potential effects, mitigation measures, residual effect evaluation and residual effects associated with transmission and collector lines as they relate to waterbodies and the land within 30 m of the waterbody.

The residual effects associated with installation of transmission and collector lines are primarily those resulting from blasting, grubbing and clearing work to facilitate installation of poles. Potential negative effects include changes in sediment concentrations caused by loss of riparian vegetation, exposed soils, loss of plant root systems and clearing/grubbing.

Blasting may be required for pole installation and has a high potential result in blast materials, residues and particulate matter entering a waterbody, high velocity debris and sudden, extreme changes in pressure from the blasts. The negative residual effects are changes in contaminant and sediment concentrations or fish mortality.

Negative effects associated with operation and maintenance of transmission and collector lines include those associated with vegetation removal and release of deleterious substances included dust, grease, oil, fuel etc. from incidental spills from maintenance equipment.

5.2.4 Effects Associated with Transformer Stations, Construction Compounds and Laydown Yards

Table 5-6 describes the waterbody location and sensitivity, potential effects, mitigation measures, residual effect evaluation and residual effects associated with the TSs, construction compounds and laydown yards as they relate to waterbodies and the 30 m land surrounding the waterbody.

Effects during the construction and decommissioning phase are primarily related to uncontrolled sediment release and blasting. Activities such as excavation, clearing, grubbing and grading may result in exposed and unstable soils, which may be released to nearby waterbodies. The potential negative effects are changes in sediment concentrations, habitat, baseflows and/or water temperatures.

Blasting near waterbodies may cause the release of blast residues, particles at high velocity, instant and significant pressure changes and exposed soils. This may result in changes in sediment and contaminant concentrations, or direct fish mortality.

Oil, fuel or other deleterious substance leaks from industrial equipment may change contaminant concentrations or result in direct mortality.

Negative effects associated with operation and maintenance activities include those associated with vegetation removal and release of deleterious substances included dust, grease, oil, fuel etc. from incidental spills from maintenance equipment.

5.2.5 Effects Associated with the Operations and Maintenance Building

Table 5-6 describes the waterbody location and sensitivity, potential effects, mitigation measures, residual effect evaluation and residual effects associated with the construction and use of the proposed O&M building as it relates to waterbodies and the 30 m land surrounding the waterbody.

Effects during the construction and decommissioning phase are primarily related to uncontrolled sediment release and blasting. Activities such as excavation, clearing, grubbing and grading may result in exposed and unstable

soils, which may be released to nearby waterbodies. The potential negative effects are changes in sediment concentrations, habitat, baseflows and/or water temperatures.

Blasting near waterbodies may cause the release of blast residues, particles at high velocity, instant and significant pressure changes and exposed soils. This may result in changes in sediment and contaminant concentrations, or direct fish mortality.

Oil, fuel or other deleterious substance leaks from industrial equipment may change contaminant concentrations or result in direct mortality.

Negative effects associated with operation and maintenance activities include those associated with vegetation removal and release of deleterious substances included dust, grease, oil, fuel etc. from incidental spills from maintenance equipment.

5.2.6 Effects Associated with Meteorological Towers

Table 5-7 describes the waterbody location and sensitivity, potential effects, mitigation measures, residual effect evaluation and residual effects associated with the permanent meteorological (Met) towers as they relate to waterbodies and the 30 m land surrounding the waterbody.

Effects during the construction and decommissioning phase are primarily related to uncontrolled sediment release and blasting. Activities such as excavation, clearing, grubbing and grading may result in exposed and unstable soils, which may be released to nearby waterbodies. The potential negative effects are changes in sediment concentrations, habitat, baseflows and/or water temperatures.

Blasting near waterbodies may cause the release of blast residues, particles at high velocity, instant and significant pressure changes and exposed soils. This may result in changes in sediment and contaminant concentrations, or direct fish mortality.

Oil, fuel or other deleterious substance leaks from industrial equipment may change contaminant concentrations or result in direct mortality.

Negative effects associated with operation and maintenance activities include those associated with vegetation removal and release of deleterious substances included dust, grease, oil, fuel etc. from incidental spills from maintenance equipment.

5.3 Mitigation Measures

Mitigation techniques are proposed to offset possible effects of the construction, decommissioning and operation activities of the HIWEC. Mitigation measures recommended to minimize potential impacts to the waterbodies include the implementation of standard Best Management Practices (BMPs) and guidance provided by DFO, as described below.

BMPs are work practices that outline acceptable practices to follow when carrying out certain activities. DFO has developed guidelines and measures to protect fish habitat which, when implemented properly, will avoid conditions that may harmfully alter aquatic habitat. These DFO guidelines are being used in conjunction with standard mitigation measures that should be implemented to protect surface water quality and the aquatic ecosystem.

Tables 5-2 to 5-7 itemizes the anticipated potential negative effects which may result from construction, operation and decommissioning activities. Proposed mitigation measures and BMPs are provided in this table for each potential negative effect to be implemented during the appropriate phase (i.e., construction, operation and decommissioning) in order to minimize or avoid these potential negative effects. The recommended mitigation measures are not limited to those waterbodies listed in the table and appropriate measures should be implemented when there is risk to any body of water.

The following BMPs and proposed mitigation measures are applicable to the HIWEC.

Blasting

- Undertake blasting operations in accordance with relevant federal and provincial guidelines and standards.
- Develop and implement a Blasting Plan that includes standard BMPs to minimize extent of adverse noise, vibration and slope instability from blasting, including:
- Follow proper drilling, explosive handling and loading procedures;
- Implement safe handling and storage procedures for all material, including soluble substances used for blasting;
- Use blasting mats over top of holes to minimize scattering of blast debris around the area;
- Reduce blasting footprint to the extent possible;
- Ensure the order of firing is correct to minimize the frequency of blasts;
- Do not use ammonium nitrate based explosives near water due to the production of toxic by-products; and
- Remove all blasting debris and other associated equipment / products from the blast area.

Work Area

- Delineate work areas.
- Maintain undisturbed buffer strips greater than 30 m in width around waterbodies and wetlands, where possible, except where access roads approach waterbody and wetland crossings.
- Restrict vehicle traffic to posted speed limits.
- Investigate complaints related to dust and emissions and address to the extent possible.

Equipment Use

- In order to avoid compacting or hardening of natural ground surface, and to avoid movement of machinery on sensitive slopes, restrict construction equipment to designated controlled vehicle access routes and to within identified work areas.
- Whenever possible, operate machinery from outside the waterbody and on land above the high water mark or on ice in a manner that minimizes disturbance to the banks and bed of the waterbody.
- Limit machinery fording (if required) to only the amount necessary and only outside of sensitive time periods and upon consultation with a qualified environmental monitor. If repeated fording of the waterbody is required, construct a temporary crossing structure (e.g., jersey bridge, swamp mats).
- Ensure machinery is maintained free of fluid leaks.
- Site maintenance, vehicle maintenance, vehicle washing and refuelling to be done in specified areas at least 30 m away from wetlands and waterbodies.
- Wash water used for the cleaning of cement construction materials not to come in contact with the ground. Deposit waste water in a concrete washout container that allows evaporation and hardening for easier disposal or recover and recycle wash water back into cement truck.

- Use and maintain emission control devices on motorized equipment (as provided by the manufacturer of the equipment) to minimize the emissions so that they remain within industry standards. Heavy equipment and machinery to be used within operating specifications.
- Run vehicles and equipment only when necessary (i.e., limit idling).

Erosion and Sediment Control

- A Sediment and Erosion Control Plan will be prepared prior to construction start.
- Implement sediment and erosion control measures prior to construction near wetlands or waterbodies and maintain such measures until re-vegetation of disturbed areas is complete.
- Monitoring to ensure erosion and sedimentation control measures are in good repair and properly functioning prior to conducting daily work and re-install or repair as required prior to commencing daily construction activities.
- In areas where bedrock is exposed at surface or trenching and securing of erosion control fencing is not possible, sediment logs (compost filter sock) may be utilized.
- Ensure an additional supply of erosion and sediment control materials are readily available on the site.
- Minimize removal of riparian vegetation to the greatest extent possible (maintaining riparian shrubs) in order to limit the area of exposed soil.
- In the Erosion and Sedimentation Control Plan include measures (e.g., monitoring and response) should a flood or higher water levels occur due to adverse weather events.
- Discharge water through energy dissipation and filtration systems (filter bag, sediment basin), as required. Ensure the volume of water is controlled and ensure that any water discharged to the natural environment does not result in scouring, erosion or physical alteration of the streams channel or banks.
- Use temporary crossing structures or other practices to cross waterbodies with steep and highly erodible (e.g., dominated by organic materials and silts) banks and beds.
- Remove non-biodegradable erosion and sediment control materials once site is stabilized.

Maintenance

- Conduct access road maintenance (e.g., grading, addition of coarse surficial material) as required to maintain adequate road conditions. This will assist in minimizing dust generation.
- Spray water as a dust suppressant to be used as necessary.
- Inspect culverts during routine maintenance activities for buildup of debris and remove debris as necessary to maintain flows and allow fish passage.

Material Stockpiling and Handling

- Stabilize and store stockpiled materials (topsoil, grubbed materials) above the high water mark and 30 m away from wetlands and waterbodies. Transmission and collector poles or other structures will be placed above the normal high water mark.
- Soil stockpiles to be graded by mechanical means to compact the soil and limit the erosion. Tracks of machinery should be perpendicular to the slope of the pile to reduce the flow velocity of rainfall over the stockpile.
- Place only clean materials free of fine particulate matter in the water for temporary construction measures (e.g., coffer dams to be constructed of 'pea gravel' bags / meter bags, geotextile fabric, sheet pile or other clean material).
- Waste management to be completed in accordance with relevant federal and provincial guidelines and standards.

- Dispose of any contaminated waste material generated from construction activities off-site by authorized and approved haulers and receivers.

Grading and Excavation

- Grade disturbed / remediated slopes or stockpiles to a stable angle to avoid slope instability and reduce erosion.
- Where construction activities occur within 30 m of a waterbody, ensure BMPs are used to maintain current existing drainage patterns, including:
 - Limit changes in land contours to the maximum extent possible.
 - Ensure roadway culverts are designed and installed to maintain existing drainage patterns.
 - Where the installation of a flow equalizing culvert is proposed, appropriate erosion control measures (i.e., rip rap, seeding) will be installed at the ends of each culvert to prevent erosion.

Construction Timing Windows

- Time in-water work to avoid sensitive life stages of fish species (i.e., spawning) for waterbodies, as follows:
 - No in-water work from October 1st to July 15th
 - WB-N-M4-59
 - No in-water work from March 15th to July 15th
 - WEC North (WB-N-M32-14, WB-N-M6-3, WB-N-M12-12-2, WB-N-M12-12, WB-N-M26-21, WB-N-M26-31, WB-N-M28-16, WB-N-M35-1, WB-A-M3-3);
 - WEC South (WB-S-M17-29, WB-S-M30-11, WB-S-M39-8, WB-S-M19-6, WB-S-M34-53, WB-S-M13-13)

Isolated Crossing

- If streams are flowing during waterbody crossing structure installation, use appropriate work site isolation techniques (e.g., dam and pump, bypass channel, partial coffer damming) to minimize impacts on aquatic environment. If work sites are isolated during construction, fish are to be salvaged from isolated area and transferred to undisturbed habitat downstream of the work site.
- Phase crossing structure removal so no fording of watercourses is required following structure removal (i.e., the last activity as the road is being decommissioned).

Culvert Design

- Design water crossings installed at waterbodies supporting direct fish habitat to facilitate fish passage.
- Design water crossings to accommodate high and low flows of the waterbody.
- High sensitivity water bodies will be avoided by using clear span structures (WB-S-M39-8 and WB-N-M26-21)

Water Quality

- Develop and implement a Spill Prevention and Response Plan outlining steps to prevent and contain any chemicals or to avoid contamination of adjacent waterbodies and train staff on associated procedures.
- Turbid water shall not be discharged to a watercourse or wetland.
- Vegetation management will be done using mechanical techniques rather than herbicides.

Dewatering Activities (if necessary)

- Limit duration of dewatering to as short a time frame as possible.
- Develop and implement a construction dewatering discharge plan describing appropriate areas and methods for discharge.
- Leave a layer of vegetation intact between the outfall and receiving waterbody to provide additional water dispersion and entrapment of suspended solids, if discharge is to a waterbody and/or wetland, where feasible.
- Discharge water shall not be directed to a waterbody that has potential to flood as a result of the added input of water caused by direct dewatering discharge.
- Screen all hoses drawing water from a waterbody to prevent potential entrainment of fish and other species.
- If dewatering of excavations is required, mitigation could include the use of splash pads, discharge diffusers, filter bags, sediment basins or similar measures (if required and as appropriate) at discharge locations to ensure that any water discharged to the natural environment does not result in scouring, erosion or physical alteration of the streams channel or banks.
- If dewatering of excavations is required and expected to exceed 50,000 L/day, discharge water shall be sampled daily during the days the water is discharged and tested for suspended sediments. If the increase in suspended sediments is greater than 25 mg/L, appropriate measures (e.g., geosock or similar device) to mitigate these impacts will be implemented.
- Limit water taking quantities by implementing targeted groundwater cut-offs (i.e., slurry trench walls) where possible.
- No direct discharge to Georgian Bay, Key River, Henvey Inlet or any surface water feature outside the HIWEC will occur without acquiring applicable approvals.

Water Management

- Should groundwater dewatering activities be expected to exceed 50,000 L/day, the following measures will be implemented:
 - Inlet pump head shall be surrounded with clear stone and filter fabric.
- The discharge shall be regulated at such a rate that there is no flooding in the receiving water body and that no soil erosion is caused that impacts the receiving water body.
- Conduct a Detailed Water Taking Assessment and determine the water supply well location at the O&M building based on geotechnical investigation results to determine anticipated groundwater taking quantities, groundwater quality and predicted zone of influence (ZOI) prior to construction. Based on this assessment site-specific mitigation measures and a monitoring program for groundwater dependent natural features and private wells within the anticipated ZOI will be provided.
- Where feasible, leave a layer of low cover vegetation intact between the outfall and receiving waterbody to provide additional water dispersion and entrapment of suspended solids.
- No direct discharge to Georgian Bay, Key River, Henvey Inlet or any surface water feature outside the HIWEC will occur without acquiring applicable regulatory approvals
- Divert access road runoff through drainage ditches directed into vegetated areas or through environmental protection measures (such as sediment traps, rock flow check dams, sediment barriers etc.) to ensure that exposed soils or road materials are not transported into watercourses or wetlands. Ditches >5% in slope may require lining with appropriate sized rip rap to protect against erosion and also slow the flow velocity.

- Apply measures for managing water flowing onto the construction site as well as water being pumped / diverted from the construction site such that sediment is filtered out prior to the water entering a waterbody or wetland.
- Minimize paved surfaces and design roads to promote groundwater infiltration.
- Implement groundwater infiltration techniques to the maximum extent possible. Examples include:
 - releasing water to vegetated areas;
 - ditches should not be lined with an impermeable material (i.e., clay); and,
 - groundwater should remain on site and not disposed of off-site (unless contaminated).
 - Where possible, groundwater discharge water shall be directed to areas of groundwater recharge to allow for natural infiltration to the groundwater system.

Rehabilitation

- Re-vegetate or stabilize exposed sites as soon as possible following disturbance using species native to the area to limit the duration of soil exposure.

5.4 Description of Residual Effects

Residual effects are those effects that remain following the application of mitigation measures. These effects are summarized using the descriptors outlined in **Table 5-1**. The residual effects were assessed based on professional judgment and related project experience.

Table 5-1: Residual Effects Criteria

Variable	Definition
Spatial Extent	The direct footprint of the development as well as the areas indirectly affected.
Frequency	The likelihood that the negative effects will occur on more than one occasion
Duration	The expected length of construction and the amount of time a residual effect will persist.
Magnitude	The degree and extent of change from the baseline condition. This usually varies according to the project phase.

The potential residual negative effects are presented in **Tables 5-2 to 5-7** and are arranged in relation to the sensitivity of the waterbody determined in the field studies table (**Section 4.4**) and the significance of the residual effects of impact from proposed HIWEC component. Proposed mitigation measures are the same for all waterbodies regardless of the feature sensitivities.

Table 5-2 describes the waterbody location and sensitivity, potential effects, mitigation measures, residual effects evaluation associated with the construction, operation and decommissioning of WTGs as they relate to waterbodies and the 30 m area surrounding the waterbody.

Table 5-2: Potential Residual Effects Associated with Wind Turbine Generators (WTG) (including WTG staging area)

Activity	Project Component	Potential Effects	Mitigation Measures (see Section 5.3 for further details)	Residual Effect Evaluation	Significance of Residual Effect	Monitoring Plan and Contingency Measures
Construction and Decommissioning	WTG	• Adverse Impacts to Surface Water Quality and Quantity Due to Dewatering Discharge	• Dewatering Activities • Timing Windows • Water Management • Water Quality	• Spatial Extent – isolated to area of disturbance (localized extent) • Frequency – During dewatering activities (if required) • Duration – short term (days) • Magnitude – small scale dewatering (if required) and no long-term change to the baseline flow	Not significant – effects can be mitigated.	<ul style="list-style-type: none">Monitor on-site conditions (i.e., erosion and sediment control, spills, flooding, etc.) where construction occurs within 30 m of a water course on the following basis:<ul style="list-style-type: none">Weekly during active construction periods.Prior to, during and post forecasted large rainfall events (>20 mm in 24 hours) or significant snowmelt events (i.e., spring freshet).Daily during extended rain or snowmelt periods.Monthly during inactive construction periods, where the site is left alone for 30 days or longer.In the event that a spill / discharge of sediment occur, report the details of the event to EC and/or DFO depending on the nature of the discharge. Include in the description, the type of discharge and any assessment and remediation undertaken. Contingency Measures: Suspend work if excessive flows of sediment discharges occur until mitigation measures are in place.
		• Disturbance to Fish and Fish Habitat or Mortality of Fish Due to Construction Blasting and/or Vibration (includes disturbance to or mortality of fish eggs or larvae)	• Blasting • Timing Windows	• Spatial Extent – isolated area (localized extent) • Frequency –low- one time installation • Duration – short term (days) • Magnitude – small	Not significant - Most effects can be mitigated with effective blasting plan. Incidental release of blast rock and dust, vibrations.	<ul style="list-style-type: none">Monitor use and effectiveness of mitigation and protection measures for blasting. Blasting in and near waterbodies avoided as much as possible. Contingency Measures: <ul style="list-style-type: none">In the event of fish mortality, immediately stop all work and correct the cause of the mortality.Report the fish kill immediately to DFO, MNRF and HIFN If release of significant blast rock, dust or residues is detected, suspend blast work until additional mitigations as required are in place.
		• Alterations to Local Drainage Patterns Due to Loss of Vegetation, Changes in Surficial Topography and Changes in Surficial Soils in Disturbed Construction Areas Including Along Access Roads	• Erosion and sediment control • Water Management • Grading and Excavation Rehabilitation	• Spatial Extent – isolated to area of disturbance • Frequency – low • Duration – high. WTG pads and drainage ditching will be permanent • Magnitude – low	Not significant – effects can be mitigated	<ul style="list-style-type: none">Monitor on-site conditions (i.e., erosion and sediment control, spills, flooding, etc.) where construction occurs within 30 m of a watercourse on the following basis:<ul style="list-style-type: none">Weekly during active construction periods.Prior to, during and post forecasted large rainfall events (>20 mm in 24 hours) or significant snowmelt events (i.e., spring freshet).Daily during extended rain or snowmelt periods.Monthly during inactive construction periods, where the site is left alone for 30 days or longer. Contingency Measures: Suspend work if excessive flows of sediment discharges occur until mitigation measures are in place.
		• Adverse Impacts to Surface Water Quality from Erosion and Sedimentation resulting from Construction Activities (including blasting)	• Erosion and sediment control • Grading and Excavation • Equipment use • Blasting • Timing Windows • Water Quality • Material Stockpiling and Handling • Rehabilitation • Work Area	• Spatial Extent – localized area if mitigation is provided • Frequency – ongoing through construction period • Duration – short term (days to weeks) • Magnitude – small	Not significant – With effective sediment and erosion control, effects are mitigated. Incidental minor releases of sediment may occur.	<ul style="list-style-type: none">Monitor on-site conditions (i.e., erosion and sediment control, spills, flooding, etc.) where construction occurs within 30 m of a water course on the following basis:<ul style="list-style-type: none">Weekly during active construction periods.Prior to, during and post forecasted large rainfall events (>20 mm in 24 hours) or significant snowmelt events (i.e., spring freshet).Daily during extended rain or snowmelt periods.Monthly during inactive construction periods, where the site is left alone for 30 days or longer.In the event that a spill / flooding occurs, report the details of the event to MOE, including a description of any assessment and remediation undertaken. Contingency Measures: Suspend work if excessive flows of sediment discharges occur until mitigation measures are in place (e.g., installation of extra erosion and sediment control materials kept on site, such as silt fencing, straw bales etc.)

Table 5-2: Potential Residual Effects Associated with Wind Turbine Generators (WTG) (including WTG staging area)

Activity	Project Component	Potential Effects	Mitigation Measures (see Section 5.3 for further details)	Residual Effect Evaluation	Significance of Residual Effect	Monitoring Plan and Contingency Measures
		• Adverse Impacts on Surface Water Quality Aquatic Biota (Fish, Invertebrates) and Aquatic Habitat Due to Accidents and/or Spills including Fuels, Lubricants and Concrete Washing	• Equipment Use • Water Quality	• Spatial Extent – isolated to area of disturbance although some potential for downstream effects • Frequency – low • Duration – short term (days to weeks) • Magnitude – no change to baseline conditions	Not Significant – effects can be mitigated. Incidental minor leaks and spills may occur.	▪ Contractor to conduct routine inspections of construction equipment for leaks / spills ▪ Develop an emergency spills plan. Contingency Measures : ▪ Immediately stop all work until the spill is cleaned up. ▪ Notify MOECC's Spills Action Centre of any leaks or spills. ▪ If a spill enters a waterbody, collect and analyze water samples for appropriate parameters. Monitor daily until cleanup is completed
		• Reduction in Groundwater Recharge Quantities Due to Increases in Impervious Surfaces	• Water Management • Grading and Excavation	• Spatial Extent – localized effect • Frequency – during operation of WTG • Duration – during operation of WTG • Magnitude – no change expected to baseline conditions	Not significant – effects can be mitigated	
		• Adverse Impacts on Surface Water Quality, Aquatic Biota and Habitat Due to Contaminant Spills, Dust and Emissions from Maintenance Vehicles and Equipment.	• Equipment Use • Material Stockpiling and Handling • Water Quality	• Spatial Extent – isolated to area of disturbance although some potential for downstream effects • Frequency – low • Duration – short term (days to weeks) • Magnitude – no change to baseline conditions	Not significant – effects can be mitigated. Incidental minor leaks and spills may occur.	▪ Contractor to conduct routine inspections of construction equipment for leaks / spills ▪ Develop an emergency spills plan. Contingency Measures : ▪ Immediately stop all work until the spill is cleaned up. ▪ Notify MOECC's Spills Action Centre of any leaks or spills. ▪ If a spill enters a waterbody, collect and analyze water samples for appropriate parameters. Monitor daily until cleanup is completed
Operations	WTG	• Adverse Impacts on Surface Water Quality, Aquatic Biota and Habitat Due to Contaminant Spills, Dust and Emissions from Maintenance Vehicles and Equipment.	• Equipment Use • Material Stockpiling and Handling • Water Quality	• Spatial Extent – isolated to area of disturbance although some potential for downstream effects • Frequency – low • Duration – short term (days to weeks) • Magnitude – no change to baseline conditions	Not significant – effects can be mitigated. Incidental minor leaks and spills may occur.	▪ Contractor to conduct routine inspections of construction equipment for leaks / spills ▪ Develop an emergency spills plan. Contingency Measures : ▪ Immediately stop all work until the spill is cleaned up. ▪ Notify MOECC's Spills Action Centre of any leaks or spills. ▪ If a spill enters a waterbody, collect and analyze water samples for appropriate parameters. Monitor daily until cleanup is completed

Table 5-3: Potential Residual Effects Associated with Access Roads

Activity	HIWEC Component	Waterbody Location and Sensitivity	Potential Effects	Mitigation Measures (see Section 5.3 for further details)	Residual Effect Evaluation	Residual Effect	Monitoring Plan and Contingency Measures
Construction and Decommissioning	Road Crossing	<ul style="list-style-type: none"> • High Sensitivity – WB-S-M39-8 • Moderate Sensitivity – WB-A-M3-2, WB-N-M4-59, WB-N-M12-12-2, MB-N-M26-21, WB-N-M32-14, WB-S-M13-13, WB-S-M50-10, WB-S-M17-29, WB-S-M19-6 • Low Sensitivity – WB-A-M1-1, WB-A-M2-2, WB-N-M1-30, WB-N-M1-32, WB-N-M1-33, WB-N-M6-3, WB-N-M7-34, WB-N-M9-35, WB-N-M12-12, WB-N-M12-37, WB-N-M13-36, WB-N-M14-38, WB-N-M18-39, WB-N-M18-39-2, WB-N-M21-28, WB-N-M23-40, WB-N-M26-31, WB-N-M28-16, WB-N-M31-2-2, WB-N-M32-26, WB-N-M34-42, WB-N-M35-1, WB-N-M37-15, WB-N-M39-19, WB-N-M41-43, WB-N-M41-44, WB-N-M43-22, WB-N-M46-4; WB-N-M47-45, WB-N-M49-46, WB-S-M1-58, WB-S-M30-11, WB-S-M36-50, WB-S-M48-17, WB-S-M49-9, WB-S-M49-48, WB-S-M52-58 WB-S-M5-7, WB-S-M8-56, WB-S-M8-57, WB-S-M13-55, WB-S-M34-53, WB-S-M34-54, WB-S-M36-49, WB-S-M39-51, WB-S-M41-52 	<ul style="list-style-type: none"> • Disturbance of Aquatic Biota (Fish, Invertebrates) and Aquatic Habitat During Water Crossing Installation and Removal (Due to in Water Work, Alteration of Channel Bed, Banks and Riparian Area, due to Erosion and Sedimentation) 	<ul style="list-style-type: none"> • Culvert Design • Isolated crossing • Blasting • Work Area • Equipment Use • Erosion and Sediment Control • Material Stockpiling and Handling • Grading and Excavation • Timing Windows • Dewatering Activities • Rehabilitation 	<ul style="list-style-type: none"> • Spatial Extent – limited to localized crossing of watercourse. • Frequency – one-time installation • Duration – effects associated with installation are short term (days or weeks). Pending culvert design, footprint of structure and embankment may be permanent • Magnitude – temporary reduction in habitat suitability during installation. Where permanent fill is placed below high water mark there is a loss of habitat within this footprint, however limited to a localized area. Though the magnitude is high within that footprint, the magnitude of the negative residual effect on the fishery is not significant. 	<p>Low to high (but localized) pending culvert design. Not significant to significant (but localized), pending crossing design</p> <p>May result in loss of in-stream and riparian habitat.</p>	<ul style="list-style-type: none"> ▪ Monitor fish habitat throughout duration of in-water construction to identify any minor or major disturbances caused by construction activities. ▪ Document changes to aquatic habitat as a result of construction activities and obtain photographic documentation. <p>Contingency Measures: Mitigate or create off-setting habitat for any harmful disturbance or destruction to/of fish habitat according to DFO guidance</p>
			<ul style="list-style-type: none"> • Adverse Impacts to Surface Water Quality and Quantity Due to Dewatering Discharge 	<ul style="list-style-type: none"> • Dewatering Activities • Timing Windows • Water Management • Water Quality 	<ul style="list-style-type: none"> • Spatial Extent – isolated to area of disturbance (localized extent) • Frequency – During dewatering activities (if required) • Duration – short term (days) • Magnitude – small scale dewatering (if required) and no long-term change to the baseline flow 	<p>Not significant – effects can be mitigated</p>	<p>See above</p>
			<ul style="list-style-type: none"> • Disturbance to Fish and Fish Habitat or Mortality of Fish Due to Construction Blasting and/or Vibration (includes disturbance to or mortality of fish eggs or larvae) 	<ul style="list-style-type: none"> • Blasting • Timing Windows 	<ul style="list-style-type: none"> • Spatial Extent – limited to localized area of disturbance. • Frequency – one-time installation • Duration – short term (days) • Magnitude – Moderate – potential changes to baseline conditions 	<p>Not significant -</p> <p>An effective blasting plan can mitigate most effects, however considering the high potential for significant impacts when blasting near waterbodies, the risk of residual impacts including mortality is elevated.</p> <p>Incidental release of blast rock and dust vibrations. Potential changes to in-stream and riparian habitat. .</p>	<p>See above</p>
			<ul style="list-style-type: none"> • Adverse Impacts on Surface Water Quality Aquatic Biota (Fish, Invertebrates) and Aquatic Habitat Due to Accidents and/or Spills including Fuels, Lubricants and Concrete Washing 	<ul style="list-style-type: none"> • Equipment Use • Material Stockpiling and Handling • Water Quality 	<ul style="list-style-type: none"> • Spatial Extent – isolated to area of disturbance although some potential for downstream effects • Frequency – low • Duration – short term (days to weeks) • Magnitude – no change to baseline conditions 	<p>Not significant – With effective sediment and erosion control, effects are mitigated. Level of risk is increased in closer proximity to waterbodies.</p> <p>Incidental minor releases of sediment may occur.</p> <p>Incidental release of blast rock and dust, vibrations.</p>	<p>See above</p>

Table 5-3: Potential Residual Effects Associated with Access Roads

Activity	HIWEC Component	Waterbody Location and Sensitivity	Potential Effects	Mitigation Measures (see Section 5.3 for further details)	Residual Effect Evaluation	Residual Effect	Monitoring Plan and Contingency Measures
	Access Road and Associated Buffer	<ul style="list-style-type: none"> • High Sensitivity – WB-S-M39-8 • Moderate Sensitivity – WB-A-M3-2, WB-N-M4-59, WB-N-M12-12-2, MB-N-M26-21, WB-N-M32-14, WB-S-M13-13, WB-S-M50-10, WB-S-M17-29, WB-S-M19-6 • Low Sensitivity – WB-A-M1-1, WB-A-M2-2, WB-N-M1-30, WB-N-M1-32, WB-N-M1-33, WB-N-M6-3, WB-N-M7-34, WB-N-M9-35, WB-N-M12-12, WB-N-M12-37, WB-N-M13-36, WB-N-M14-38, WB-N-M18-39, WB-N-M18-39-2, WB-N-M21-28, WB-N-M23-40, WB-N-M26-31, WB-N-M28-16, WB-N-M31-2-2, WB-N-M32-26, WB-N-M34-42, WB-N-M35-1, WB-N-M37-15, WB-N-M39-19, WB-N-M41-43, WB-N-M41-44, WB-N-M43-22, WB-N-M46-4, WB-N-M47-45, WB-N-M49-46, WB-S-M1-58, WB-S-M30-11, WB-S-M36-50, WB-S-M48-17, WB-S-M49-9, WB-S-M49-48, WB-S-M52-58 WB-S-M5-7, WB-S-M8-56, WB-S-M8-57, WB-S-M13-55, WB-S-M34-53, WB-S-M34-54, WB-S-M36-49, WB-S-M39-51, WB-S-M41-52 	<ul style="list-style-type: none"> • Adverse Impacts to Surface Water Quality from Erosion and Sedimentation resulting from Construction Activities (including blasting) 	<ul style="list-style-type: none"> • Erosion and sediment control • Grading and Excavation • Equipment Use • Blasting • Work Area • Material Stockpiling and Handling • Water Management • Rehabilitation 	<ul style="list-style-type: none"> • Spatial Extent – localized area • Frequency – ongoing through construction period • Duration – short term (days to weeks) • Magnitude – small 	<p>Not significant – With effective sediment and erosion control, effects are mitigated.</p> <p>Incidental minor releases of sediment may occur.</p> <p>Incidental release of blast rock and dust vibrations.</p>	See above
			<ul style="list-style-type: none"> • Adverse Impacts on Surface Water Quality Aquatic Biota (Fish, Invertebrates) and Aquatic Habitat Due to Accidents and/or Spills including Fuels, Lubricants and Concrete Washing 	<ul style="list-style-type: none"> • Equipment Use • Material Stockpiling and Handling • Water Quality • 	<ul style="list-style-type: none"> • Spatial Extent – isolated to area of disturbance although some potential for downstream effects • Frequency – one-time installation • Duration – short term (days to weeks) • Magnitude – no change to baseline conditions 	<p>Not significant – effects can be mitigated.</p> <p>Incidental minor leaks and spills may occur.</p>	See above
			<ul style="list-style-type: none"> • Adverse Impacts to Surface Water Quality and Quantity Due to Dewatering Discharge 	<ul style="list-style-type: none"> • Water Quality • Erosion and sediment control • Water Management • Dewatering Activities • Timing Windows 	<ul style="list-style-type: none"> • Spatial Extent – isolated to area of disturbance (localized extent) • Frequency – During dewatering activities (if required) • Duration – short term (days) • Magnitude – small scale dewatering (if required) and no long-term change to the baseline flow 	<p>Not significant– effects can be mitigated</p>	See above
			<ul style="list-style-type: none"> • Alterations to Local Drainage Patterns Due to Loss of Vegetation, Changes in Surficial Topography and Changes in Surficial Soils in Disturbed Construction Areas Including Along Access Roads 	<ul style="list-style-type: none"> • Erosion and sediment control • Water Management • Grading and Excavation • Rehabilitation 	<ul style="list-style-type: none"> • Spatial Extent – isolated to area of disturbance • Frequency – low • Duration – high. Roads and drainage ditching will be permanent • Magnitude – low 	<p>Not significant– effects can be mitigated</p>	See above
			<ul style="list-style-type: none"> • Reduction in Groundwater Recharge Quantities Due to Increases in Impervious Surfaces 	<ul style="list-style-type: none"> • Water Management • Grading and Excavation • 	<ul style="list-style-type: none"> • Spatial Extent – localized effect • Frequency – during operation of WTG • Duration – high, WTG and pads are permanent structures • Magnitude – low, no change expected to baseline conditions 	<p>Not significant– effects can be mitigated</p>	
Operations	Road Crossing	<ul style="list-style-type: none"> • High Sensitivity – WB-S-M39-8 • Moderate Sensitivity – WB-A-M3-2, WB-N-M4-59, WB-N-M12-12-2, MB-N-M26-21, WB-N-M32-14, WB-S-M13-13, WB-S-M50-10, WB-S-M17-29, WB-S-M19-6 • Low Sensitivity – WB-A-M1-1, WB-A-M2-2, WB-N-M1-30, WB-N-M1-32, WB-N-M1-33, WB-N-M6-3, WB-N-M7-34, WB-N-M9-35, WB-N-M12-12, WB-N-M12-37, WB-N-M13-36, WB-N-M14-38, WB-N-M18-39, WB-N-M18-39-2, WB-N-M21-28, WB-N-M23-40, WB-N-M26-31, WB-N-M28-16, WB-N-M31-2-2, WB-N-M32-26, WB-N-M34-42, WB-N-M35-1, WB-N-M37-15, WB-N-M39-19, WB-N-M41-43, WB-N-M41-44, WB-N-M43-22, WB-N-M46-4, WB-N-M47-45, WB-N-M49-46, WB-S-M1-58, WB-S-M30-11, WB-S-M36-50, WB-S-M48-17, WB-S-M49-9, WB-S-M49-48, WB-S-M52-58 WB-S-M5-7, WB-S-M8-56, WB-S-M8-57, WB-S-M13-55, WB-S-M34-53, WB-S-M34-54, WB-S-M36-49, WB-S-M39-51, WB-S-M41-52 	<ul style="list-style-type: none"> • Adverse Impacts on Surface Water Quality, Aquatic Biota and Habitat Due to Contaminant Spills, Dust and Emissions from Maintenance Vehicles and Equipment 	<ul style="list-style-type: none"> • Equipment Use • Material Stockpiling and Handling • Water Quality 	<ul style="list-style-type: none"> • Spatial Extent – isolated to area of disturbance although some potential for downstream effects • Frequency – low • Duration – short term (days to weeks) • Magnitude – no change to baseline conditions 	<p>Not significant– effects can be mitigated.</p> <p>Incidental minor leaks and spills may occur.</p>	See above
			<ul style="list-style-type: none"> • Obstruction of Lateral Flows and Fish Passage in Waterbodies Due to Design of Culverts and Debris Build-Up at Water Crossings 	<ul style="list-style-type: none"> • Culvert Design • Timing Windows • Isolated Crossing 	<ul style="list-style-type: none"> • Spatial Extent – isolated to area of disturbance • Frequency – low • Duration – low • Magnitude – low 	<p>Not significant– effects can be mitigated by proper culvert sizing</p>	<ul style="list-style-type: none"> ▪ Monitor on-site conditions at all waterbody crossings (i.e., culverts are installed properly and embedded below the streambed.): ▪ prior to, during and after the installation of the culvert to ensure lateral flows have been maintained. <p>Contingency Measures: In the event the culvert creates issues relating to lateral flow and fish barriers, steps will be required to fix issues which may involve re-installing the culvert and ensuring it is properly installed and embedded within the streambed.</p>

Table 5-4: Potential Residual Effects Associated with Collector Lines

Activity	HIWEC Component	Waterbody Location and Sensitivity	Potential Effects	Mitigation Measures (see Section 5.3 for further details)	Residual Effect Evaluation	Residual Effect	Monitoring Plan and Contingency Measures
Construction	Collector Line Crossing	<ul style="list-style-type: none"> • High Sensitivity – WB-S-M39-8 • Moderate Sensitivity – WB-A-M3-2, WB-N-M4-59, WB-N-M12-12-2, MB-N-M26-21, WB-N-M32-14, WB-S-M13-13, WB-S-M50-10, WB-S-M17-29, WB-S-M19-6 • Low Sensitivity – WB-A-M1-1, WB-A-M2-2, WB-N-M1-30, WB-N-M1-32, WB-N-M1-33, WB-N-M6-3, WB-N-M7-34, WB-N-M9-35, WB-N-M12-12, WB-N-M12-37, WB-N-M13-36, WB-N-M14-38, WB-N-M18-39, WB-N-M18-39-2, WB-N-M21-28, WB-N-M23-40, WB-N-M26-31, WB-N-M28-16, WB-N-M31-2-2, WB-N-M32-26, WB-N-M34-42, WB-N-M35-1, WB-N-M37-15, WB-N-M39-19, WB-N-M41-43, WB-N-M41-44, WB-N-M43-22, WB-N-M46-4; WB-N-M47-45, WB-N-M49-46, WB-S-M1-58, WB-S-M30-11, WB-S-M36-50, WB-S-M48-17, WB-S-M49-9, WB-S-M49-48, WB-S-M52-58 WB-S-M5-7, WB-S-M8-56, WB-S-M8-57, WB-S-M13-55, WB-S-M34-53, WB-S-M34-54, WB-S-M36-49, WB-S-M39-51, WB-S-M41-52 	<ul style="list-style-type: none"> • Disturbance to Fish and Fish Habitat or Mortality of Fish Due to Construction Blasting and/or Vibration (includes disturbance to or mortality of fish eggs or larvae) 	<ul style="list-style-type: none"> • Directional Drilling • Water Quality • Blasting 	<ul style="list-style-type: none"> • Spatial Extent – isolated area (localized extent) • Frequency –low- one time installation • Duration – short term (days) • Magnitude – small 	<p>Not significant -</p> <p>Most effects can be mitigated with effective blasting plan. Incidental release of blast rock and dust Potential vibrations</p>	<ul style="list-style-type: none"> ▪ Monitor fish habitat once per week or throughout duration of in-water construction to identify any minor or major disturbances caused by construction activities by undertaking the following: <ul style="list-style-type: none"> ▪ Turbidity monitoring for sediment loading; ▪ Monitoring bank stability; ▪ Monitoring substrate composition; ▪ Monitoring stream flow and ensure fish passage is maintained at all times. ▪ Document changes to aquatic habitat as a result of construction activities and obtain photographic documentation. <p>Contingency Measures: Mitigate or create off-setting habitat for any harmful disturbance or destruction to/of fish habitat according to DFO authorization (if applicable) and HIFN.</p>
			<ul style="list-style-type: none"> • Disturbance of Aquatic Biota (Fish Invertebrates) and Aquatic Habitat During Collector / Transmission line Installation and Removal (Due to in Water Work, Alteration of Channel Bed, Banks and Riparian Area, due to Erosion and Sedimentation) 	<ul style="list-style-type: none"> • Water Quality • Erosion and sediment control • Timing Windows • Dewatering Activities • Blasting • Rehabilitation • Grading and Excavation • Rehabilitation 	<ul style="list-style-type: none"> • Spatial Extent – localized area • Frequency – one time construction • Duration – installation is short term (days). Collector line poles are permanent structures • Magnitude – low, no changes to baseline conditions 	<p>Not significant – effects can be mitigated provided placement below high water mark is avoided</p>	
			<ul style="list-style-type: none"> • Adverse Impacts to Surface Water Quality and Quantity Due to Dewatering Discharge 	<ul style="list-style-type: none"> • Water management • Water Quality • Dewatering Activities • Timing Windows 	<ul style="list-style-type: none"> • Spatial Extent – isolated to area of disturbance (localized extent) • Frequency – During dewatering activities (if required) • Duration – short term (days) • Magnitude – small scale dewatering (if required) and no long-term change to the baseline flow 	<p>Not significant – effects can be mitigated</p>	
	Collector Line Crossing and Associated Buffer	<ul style="list-style-type: none"> • High Sensitivity – WB-S-M39-8 • Moderate Sensitivity – WB-A-M3-2, WB-N-M4-59, WB-N-M12-12-2, MB-N-M26-21, WB-N-M32-14, WB-S-M13-13, WB-S-M50-10, WB-S-M17-29, WB-S-M19-6 • Low Sensitivity – WB-A-M1-1, WB-A-M2-2, WB-N-M1-30, WB-N-M1-32, WB-N-M1-33, WB-N-M6-3, WB-N-M7-34, WB-N-M9-35, WB-N-M12-12, WB-N-M12-37, WB-N-M13-36, WB-N-M14-38, WB-N-M18-39, WB-N-M18-39-2, WB-N-M21-28, WB-N-M23-40, WB-N-M26-31, WB-N-M28-16, WB-N-M31-2-2, WB-N-M32-26, WB-N-M34-42, WB-N-M35-1, WB-N-M37-15, WB-N-M39-19, WB-N-M41-43, WB-N-M41-44, WB-N-M43-22, WB-N-M46-4; WB-N-M47-45, WB-N-M49-46, WB-S-M1-58, WB-S-M30-11, WB-S-M36-50, WB-S-M48-17, WB-S-M49-9, WB-S-M49-48, WB-S-M52-58 WB-S-M5-7, WB-S-M8-56, WB-S-M8-57, WB-S-M13-55, WB-S-M34-53, WB-S-M34-54, WB-S-M36-49, WB-S-M39-51, WB-S-M41-52 	<ul style="list-style-type: none"> • Adverse Impacts to Surface Water Quality from Erosion and Sedimentation resulting from Construction Activities (including blasting) 	<ul style="list-style-type: none"> • Erosion and sediment control • Water management • Blasting • Material Stockpiling and Handling • Grading and Excavation 	<ul style="list-style-type: none"> • Spatial Extent – localized area if mitigation is provided • Frequency – ongoing through construction period • Duration – short term (days to weeks) • Magnitude – small 	<p>Not significant – With effective sediment and erosion control, effects are mitigated.</p> <p>Incidental minor releases of sediment may occur</p>	See above
Operation / Decommissioning	N/A	• N/A	<ul style="list-style-type: none"> • Adverse Impacts on Surface Water Quality Aquatic Biota (Fish, Invertebrates) and Aquatic Habitat Due to Accidents and/or Spills including Fuels, Lubricants and Concrete Washing 	<ul style="list-style-type: none"> • Equipment Use • Water Quality • Material Stockpiling and Handling 	<ul style="list-style-type: none"> • Spatial Extent – isolated to area of disturbance although some potential for downstream effects • Frequency – low • Duration – short term (days to weeks) • Magnitude – no change to baseline conditions 	<p>Not significant – effects can be mitigated.</p> <p>Incidental minor leaks and spills may occur.</p>	See above
			<ul style="list-style-type: none"> • Disturbance of Aquatic Biota (Fish Invertebrates) and Aquatic Habitat During Collector / Transmission line Installation and Removal (Due to in Water Work, Alteration of Channel Bed, Banks and Riparian Area, due to Erosion and Sedimentation) 	<ul style="list-style-type: none"> • Water Quality • Erosion and sediment control • Timing Windows • Dewatering Activities • Blasting • Rehabilitation • Grading and Excavation • Rehabilitation 	<ul style="list-style-type: none"> • Spatial Extent – localized area • Frequency – one time construction • Duration – installation is short term (days). Collector line poles are permanent structures • Magnitude – low, no changes to baseline conditions 	<p>Not significant – effects can be mitigated provided placement below high water mark is avoided</p>	See above
Operation / Decommissioning	N/A	• N/A	• N/A	• N/A	• N/A	N/A	

Table 5-5: Potential Residual Effects Associated with Overhead Transmission and Collector Lines

Activity	HIWEC Component	Waterbody Location and Sensitivity	Potential Effects	Mitigation Measures (see Section 5.3 for further details)	Residual Effect Evaluation	Residual Effect	Monitoring Plan and Contingency Measures
Construction and Decommissioning	Overhead Transmission Line	<ul style="list-style-type: none">• Moderate Sensitivity – WB-A-M3-2• Low Sensitivity – WB-A-M1-1, WB-A-M2-2	• Disturbance of Aquatic Biota (Fish Invertebrates) and Aquatic Habitat During Collector / Transmission line Installation and Removal (Due to in Water Work, Alteration of Channel Bed, Banks and Riparian Area, due to Erosion and Sedimentation)	<ul style="list-style-type: none">• Water Quality• Erosion and sediment control• Timing Windows• Dewatering Activities• Blasting• Rehabilitation• Grading and Excavation• Rehabilitation	<ul style="list-style-type: none">• Spatial Extent – localized area• Frequency – one time construction• Duration – installation is short term (days). Collector line poles are permanent structures• Magnitude – low, no changes to baseline conditions	Not significant – effects can be mitigated provided placement below high water mark is avoided	See above
			• Adverse Impacts to Surface Water Quality from Erosion and Sedimentation resulting from Construction Activities (including blasting)	<ul style="list-style-type: none">• Erosion and sediment control• Water management• Blasting• Material Stockpiling and Handling• Grading and Excavation	<ul style="list-style-type: none">• Spatial Extent – localized area if mitigation is provided• Frequency – ongoing through construction period• Duration – short term (days to weeks)• Magnitude – low	Not significant – With effective sediment and erosion control, effects are mitigated. Incidental minor releases of sediment may occur	See above
			• Adverse Impacts to Surface Water Quality and Quantity Due to Dewatering Discharge	<ul style="list-style-type: none">• Water management• Water Quality• Dewatering Activities• Timing Windows	<ul style="list-style-type: none">• Spatial Extent – isolated to area of disturbance (localized extent)• Frequency – During dewatering activities (if required)• Duration – short term (days)• Magnitude – small scale dewatering (if required) and no long-term change to the baseline flow	Not significant – effects can be mitigated	See above
			• Disturbance to Fish and Fish Habitat or Mortality of Fish Due to Construction Blasting and/or Vibration (includes disturbance to or mortality of fish eggs or larvae)	<ul style="list-style-type: none">• Water Quality• Blasting	<ul style="list-style-type: none">• Spatial Extent – isolated area (localized extent)• Frequency –low- one time installation• Duration – short term (days)• Magnitude – small	Not significant - Most effects can be mitigated with effective blasting plan. Incidental release of blast rock and dust	See above
			• Adverse Impacts on Surface Water Quality Aquatic Biota (Fish, Invertebrates) and Aquatic Habitat Due to Accidents and/or Spills including Fuels, Lubricants and Concrete Washing	<ul style="list-style-type: none">• Equipment Use• Water Quality• Material Stockpiling and Handling	<ul style="list-style-type: none">• Spatial Extent – isolated to area of disturbance although some potential for downstream effects• Frequency – low• Duration – short term (days to weeks)• Magnitude – no change to baseline conditions	Not significant – effects can be mitigated. Incidental minor leaks and spills may occur.	See above
Operations	Overhead Transmission Line	<ul style="list-style-type: none">• Moderate Sensitivity – WB-A-M3-2• Low Sensitivity – WB-A-M1-1, WB-A-M2-2	• Adverse Impacts on Surface Water Quality, Aquatic Biota and Habitat Due to Contaminant Spills, Dust and Emissions from Maintenance Vehicles and Equipment	<ul style="list-style-type: none">• Equipment Use• Material Stockpiling and Handling• Water Quality	<ul style="list-style-type: none">• Spatial Extent – isolated to area of disturbance although some potential for downstream effects• Frequency – low• Duration – short term (days to weeks)• Magnitude – no change to baseline conditions	Not significant – effects can be mitigated. Incidental minor leaks and spills may occur.	See above

Table 5-6: Potential Residual Effects Associated with Transformer Stations, Construction Compounds, Laydown Yards and Operations and Maintenance Building

Activity	HIWEC Component	Potential Effects	Mitigation Measures (see Section 5.3 for further details)	Residual Effect Evaluation	Residual Effect	Monitoring Plan and Contingency Measures
Construction and Decommissioning	TSS, Construction Compounds, Laydown Yards and O&M Building	• Adverse Impacts to Surface Water Quality from Erosion and Sedimentation resulting from Construction Activities (including blasting)	• Erosion and sediment control • Water management • Blasting • Material Stockpiling and Handling • Grading and Excavation	• Spatial Extent – localized area if mitigation is provided • Frequency – ongoing through construction period • Duration – short term (days to weeks) • Magnitude – small	Not significant – With effective sediment and erosion control, effects are mitigated. Incidental minor releases of sediment may occur	See above
		• Adverse Impacts on Surface Water Quality Aquatic Biota (Fish, Invertebrates) and Aquatic Habitat Due to Accidents and/or Spills including Fuels, Lubricants and Concrete Washing	• Equipment Use • Water Quality	• Spatial Extent – isolated to area of disturbance although some potential for downstream effects • Frequency – low • Duration – short term (days to weeks) • Magnitude – no change to baseline conditions	Not significant – effects can be mitigated. Incidental minor leaks and spills may occur.	See above
		• Alterations to Local Drainage Patterns Due to Loss of Vegetation, Changes in Surficial Topography and Changes in Surficial Soils in Disturbed Construction Areas Including Along Access Roads.	• Water Quality • Erosion and sediment control	• Spatial Extent – isolated to area of disturbance • Frequency – low • Duration – high. Structures and drainage ditching will be permanent • Magnitude – low	Not significant – effects can be mitigated	See above
Operations	TSS, Construction Compounds, Laydown Yards and O&M Building	• Adverse Impacts on Surface Water Quality Aquatic Biota (Fish, Invertebrates) and Aquatic Habitat Due to Accidents and/or Spills including Fuels, Lubricants and Concrete Washing	• Equipment Use • Water Quality • Material Stockpiling and Handling	• Spatial Extent – isolated to area of disturbance although some potential for downstream effects • Frequency – low • Duration – short term (days to weeks) • Magnitude – no change to baseline conditions	Not significant – effects can be mitigated. Incidental minor leaks and spills may occur.	See above

Table 5-7: Effects Associated with Meteorological Towers

Activity	HIWEC Component	Potential Effects	Mitigation Measures (see Section 5.3 for further details)	Residual Effect Evaluation	Residual Effect	Monitoring Plan and Contingency Measures
Construction and Decommissioning	Met Tower	• Adverse Impacts to Surface Water Quality from Erosion and Sedimentation resulting from Construction Activities (including blasting)	• Erosion and sediment control • Water management • Blasting • Material Stockpiling and Handling • Grading and Excavation	• Spatial Extent – localized area if mitigation is provided • Frequency – ongoing through construction period • Duration – short term (days to weeks) • Magnitude – small	Not significant – With effective sediment and erosion control, effects are mitigated. Incidental minor releases of sediment may occur	See above
		• Adverse Impacts on Surface Water Quality Aquatic Biota (Fish, Invertebrates) and Aquatic Habitat Due to Accidents and/or Spills including Fuels, Lubricants and Concrete Washing	• Equipment Use • Water Quality	• Spatial Extent – isolated to area of disturbance although some potential for downstream effects • Frequency – low • Duration – short term (days to weeks) • Magnitude – no change to baseline conditions	Not significant – effects can be mitigated. Incidental minor leaks and spills may occur.	See above
		• Alterations to Local Drainage Patterns Due to Loss of Vegetation, Changes in Surficial Topography and Changes in Surficial Soils in Disturbed Construction Areas Including Along Access Roads.	• Water Quality • Erosion and sediment control • Grading and Excavation	• Spatial Extent – isolated to area of disturbance • Frequency – low • Duration – high. MET towers drainage ditching will be permanent • Magnitude – low	Not significant – effects can be mitigated	See above
Operations	Met Tower	• Adverse Impacts on Surface Water Quality Aquatic Biota (Fish, Invertebrates) and Aquatic Habitat Due to Accidents and/or Spills including Fuels, Lubricants and Concrete Washing	• Equipment Use • Water Quality • Material Stockpiling and Handling	• Spatial Extent – isolated to area of disturbance although some potential for downstream effects • Frequency – low • Duration – short term (days to weeks) • Magnitude – no change to baseline conditions	Not significant – effects can be mitigated. Incidental minor leaks and spills may occur.	See above

5.5 Summary of Environmental Effects

Provided all the outlined mitigation and protection measures are effectively implemented and maintained throughout the construction phase, it is anticipated that the residual effects to waterbodies from the construction, decommissioning and operation phases of the WTGs, collector lines, Met towers, transmission line, TSs, construction compounds, laydown yards, and construction of the O&M building as part of the HIWEC, are not significant.

Adherence to timing windows will minimize the potential impact to spawning behaviours during construction of road crossings and should avoid impacts to the fish community in the long-term and at a population level.

Considering the amount of bedrock present in the Waterbodies study area, it is expected that blasting will be required for access road and WTG foundation construction. Blasting has the potential to cause serious harm to aquatic biota. In order to minimize the risk of these impacts, a blasting plan should be prepared and adhered to that includes standard BMPs in accordance with federal and provincial guidelines and standards.

Effective sediment and erosion control measures and BMPs related to construction and equipment usage are also particularly important for all HIWEC components. Adherence to these mitigation measures will ensure the risk of negative impacts to surrounding waterbodies will remain low.

Certain features have been classified as wetlands, and are not considered waterbodies as outlined in **Section 1.4** of this report. These features are typically low lying surface drainage collection areas or wetlands without the ability to directly support a fish community. Basic mitigation measures should be implemented to prevent the transport of sediments from work areas to these features as some of these features may act as surface water conveyance to downstream waterbodies during the spring freshet and high rain events. These areas will be determined on a site specific basis.

Cumulative effects are described as residual effects on the environment (i.e., negative effects that persist after mitigation measures have been put in place) combined with the environmental effects of past, present and future projects or activities. Cumulative effects can also “...result from the combination of different individual environmental effects of the project acting on the same environmental component” (CEAA, 2010).

Each waterbody and watercourse (see **Section 4.2.2** and **Figure 4-1** for further details) was assessed within the Waterbodies study area for potential cumulative effects from the construction; operation and decommissioning of HIWEC components. Professional judgement was used to define cumulative effects based on the size of drainage feature; the number of waterbodies; the number of HIWEC components; the type and variety of HIWEC components; proximity of HIWEC components and the significance of residual negative effects after implementation of the mitigation measures as outlined in **Section 5.3**.

None of the waterbodies assessed in the Records Review or field studies are crossed more than once by an access road crossing; no more than once by a collector line; and, are not in close proximity to more than one WTG site. It is anticipated that of the significance of residual cumulative effects to inland waterbodies will remain low.

5.6 Environmental Effects Monitoring Plan

An adaptive management approach to waterbody protection should be implemented to complement the objectives of the EA. This requires regular site inspections and monitoring by a designated on-site Environmental Monitor(s) (EM) during construction/decommissioning. Understanding the condition of the natural ecosystem throughout all phases of the HIWEC will form the basis upon which to consider altering construction methods, environmental

protection measures and monitoring programs. Ultimately, any determination related to the application of mitigation and contingency measures not addressed through the EA will be informed by ongoing analyses of monitoring data and rely on the experience and judgment of the on-site EM.

Active construction monitoring is essential to ensure mitigation measures remain effective and is recommended at all locations where waterbodies are present. Construction monitoring is recommended to ensure all BMPs are properly installed and located appropriately. Monitoring is recommended to ensure that proper restoration, stabilization and overall quality of the site. The following are the general proposed monitoring activities related to construction in or near surface water features:

- On-site conditions such as erosion and sediment control, spills, flooding etc.;
- Monitor weather conditions;
- Ensure all timing windows are adhered to;
- Water quality; and,
- Fish habitat.

Monitoring activities specific to construction related groundwater dewatering include the following:

- Water quality (groundwater and surface water); and,
- Stream erosion and sedimentation.

The potential effects associated with water takings during construction and decommissioning phases of the HIWEC are described in **Section 5.2**. In order to monitor these effects, discharge water will be sampled and analyzed for total suspended solids (TSS) each day that water is discharged. In the event that sampling results show that Total Dissolved Solids (TDS) readings in the discharge water exceeds 25 mg/L, the construction contractor will implement appropriate contingency measures such as utilizing a settling tank, geosock or similar device, to mitigate these impacts.

5.6.1 Mitigation Measures, Residual Effects and Monitoring Plan

Table 5-2 to **Table 5-7** provides mitigation measures, residual effects and the monitoring plan for each potential effect identified above.

6. Summary and Conclusions

This water assessment of the Waterbodies study area includes both Records Review and field studies with the purpose of identifying and characterizing waterbodies in the Waterbodies study area. Segments of these waterbodies were assessed in detail where a component (access road, transmission or collector line crossing) overlaps or crosses the waterbody below the high water mark. Through a combination of Records Review, aerial photography interpretation, reconnaissance site visits and field studies, a total of 55 segments categorized as waterbodies with the potential to directly support fish were identified.

To aid in the assessment of waterbodies and to focus mitigation measures, water quality, flow observations, aquatic habitat and riparian features information was collected during field studies. This information was also used to provide an understanding of the system's resiliency. The majority of the waterbodies were found to be fairly resilient to environmental perturbations. This is supported by background data collated from previous studies and regulatory agencies. Generally, coldwater habitats are more sensitive to environmental change than warmwater habitats. HIFN inland waterbodies, while they primarily consist of coolwater baitfish communities, they are generally common and demonstrably secure on a global, national and local level. No federally or provincially rare or at risk aquatic species are known to occur in the inland waters and zone of impact in the Waterbodies study area.

In general, water quality throughout the Waterbodies study area appears to have not been impacted from human activities. Provided all the recommended mitigation and protection measures are implemented properly and monitored for efficiency, it is expected that the negative residual effects to inland and adjacent waterbodies from HIWEC activities will likewise remain low. It is expected that alterations to the function or productivity of inland waterbodies, or serious harm to a commercial, recreational or Aboriginal fishery can be avoided pending water crossing structure design and proper application of mitigation measures.

The potential cumulative impacts from the HIWEC were also taken into consideration during the assessment of effects. At the time of assessment, site plans and designs indicate that waterbodies in the Waterbodies study area will be crossed by an access road no more than once, or will be in close proximity to a WTG site. Therefore the risk of cumulative effects to waterbodies was determined also to be low.

This waterbody assessment provides details on segments of individual waterbodies within the Waterbodies study area where a HIWEC component is anticipated to cross or overlap the waterbody below the high water mark. This assessment is completed in order to determine the potential negative effects and to identify mitigation and protection measures required for each site to negate these effects. The mitigation measures and Environmental Effects Monitoring Plan outline requirements for construction, operation and decommissioning of the HIWEC to ensure that the degree of risk to the waterbodies is lowered as much as feasible.

It is expected that the risk of negative residual impacts to waterbodies and the fishery as a result of HIWEC activities will generally remain low. Small-scale, incidental occurrences such as equipment oil, gas, etc. leaks, minor releases of sediment and/or minor release of blast materials are likely to occur prior to detection or remedy by the Contractor or Environmental Monitor. While contingency plans will be developed for these incidental occurrences, these events are not expected to have a notable impact to the aquatic environment.

High impact activities including water crossing construction and blasting pose a higher risk to waterbodies and the fishery. Implementation of the recommended mitigation measures will significantly decrease the level of risk in many instances; however there may be scenarios where the effects of these activities may not be avoided. Further review of a blasting plan and water crossing design details will identify the potential risk and/or degree of impact as a result of these activities when these plans are available.

It should be emphasized that the low risk assessment for most activities associated with the HIWEC, as outlined in **Section 5.0**, was determined considering all of the recommended mitigation and protection measures provided in this report. It is critical that in order to avoid negative impacts to waterbodies and the fishery, all of the recommended mitigation measures must be implemented, maintained and monitored for effectiveness through all phases of the HIWEC.

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Appendix A

Field Study Summary

Summary of Site Investigations

Study Area	Site ID	Study Type	Survey Date	Weather	Start Time	End Time	Field Crew
WEC	WB-N-M12-12	FISH INVENTORY	6/10/2015	Air Temp.: 20.00°C; Cloud Cover: 100.00%; Precipitation: 0; Wind: 4	12:23	13:20	Jay Cashubec Kalynn Parrott
		STREAM/RIVER ASSESSMENT	5/20/2015	Air Temp.: 13.00°C; Cloud Cover: 0.00%; Precipitation: 0; Wind: 4	11:49	12:41	Amy Ingriselli Jessica Mendoza
	WB-N-M12-12-2	STREAM/RIVER ASSESSMENT	5/20/2015	Air Temp.: 14.00°C; Cloud Cover: 0.00%; Precipitation: 0; Wind: 4	13:03	14:30	Amy Ingriselli Jessica Mendoza
		STREAM/RIVER ASSESSMENT	5/26/2015	Air Temp.: 17.00°C; Cloud Cover: 70.00%; Precipitation: 0; Wind: 2	08:40	09:45	Ashley Minion Kalynn Parrott
	WB-N-M12-37	POND/LAKE ASSESSMENT	5/20/2015	Air Temp.: 7.00°C; Cloud Cover: 0.00%; Precipitation: 0; Wind: 3	09:16	09:43	Amy Ingriselli Jessica Mendoza
	WB-N-M1-30	POND/LAKE ASSESSMENT	5/5/2015	Air Temp.: 15.00°C; Cloud Cover: 30.00%; Precipitation: 0; Wind: 1	12:31	12:59	Mike Godard Devon Fowler
	WB-N-M1-32	STREAM/RIVER ASSESSMENT	5/5/2015	Air Temp.: 16.00°C; Cloud Cover: 50.00%; Precipitation: 0; Wind: 0	11:45	11:53	Mike Godard Devon Fowler
	WB-N-M1-33	STREAM/RIVER ASSESSMENT	5/5/2015	Air Temp.: 15.00°C; Cloud Cover: 60.00%; Precipitation: 0; Wind: 2	10:50	11:28	Mike Godard Devon Fowler
	WB-N-M13-36	POND/LAKE ASSESSMENT	5/20/2015	Air Temp.: 10.00°C; Cloud Cover: 0.00%; Precipitation: 0; Wind: 3	10:16	10:41	Amy Ingriselli Jessica Mendoza
	WB-N-M14-38	POND/LAKE ASSESSMENT	5/22/2015	Air Temp.: 4.00°C; Cloud Cover: 50.00%; Precipitation: 0; Wind: 4	09:03	09:26	Amy Ingriselli Jessica Mendoza
	WB-N-M18-39	POND/LAKE ASSESSMENT	5/21/2015	Air Temp.: 10.00°C; Cloud Cover: 80.00%; Precipitation: 0; Wind: 5	14:37	15:03	Amy Ingriselli Jessica Mendoza
	WB-N-M18-39-2	POND/LAKE ASSESSMENT	5/21/2015	Air Temp.: 10.00°C; Cloud Cover: 100.00%; Precipitation: 0; Wind: 4	15:24	16:09	Amy Ingriselli Jessica Mendoza
	WB-N-M21-28	POND/LAKE ASSESSMENT	5/21/2015	Air Temp.: 10.00°C; Cloud Cover: 80.00%; Precipitation: 0; Wind: 5	13:15	14:05	Amy Ingriselli Jessica Mendoza
	WB-N-M23-40	POND/LAKE ASSESSMENT	5/21/2015	Air Temp.: 10.00°C; Cloud Cover: 0.00%; Precipitation: 0; Wind: 4	09:28	10:04	Amy Ingriselli Jessica Mendoza
	WB-N-M26-21	FISH INVENTORY	6/10/2015	Air Temp.: 16.00°C; Cloud Cover: 100.00%; Precipitation: 1; Wind: 3	10:59	11:20	Jay Cashubec Kalynn Parrott
		STREAM/RIVER ASSESSMENT	5/19/2015	Air Temp.: 14.00°C; Cloud Cover: 100.00%; Precipitation: 0; Wind: 5	14:02	15:04	Amy Ingriselli Jessica Mendoza
	WB-N-M26-31	STREAM/RIVER ASSESSMENT	5/19/2015	Air Temp.: 13.00°C; Cloud Cover: 100.00%; Precipitation: 0; Wind: 5	12:20	13:35	Amy Ingriselli Jessica Mendoza
	WB-N-M28-16	STREAM/RIVER ASSESSMENT	5/19/2015	Air Temp.: 12.00°C; Cloud Cover: 100.00%; Precipitation: 0; Wind: 5	09:59	11:08	Amy Ingriselli Jessica Mendoza
	WB-N-M31-2-2	FISH INVENTORY	6/15/2015	Air Temp.: 16.00°C; Cloud Cover: 100.00%; Precipitation: 0; Wind: 0	09:55	11:41	Ami Arsenault Amy Ingriselli
		STREAM/RIVER	6/15/2015	Air Temp.: 16.00°C; Cloud Cover:	11:42	12:20	Amy Ingriselli Ami Arsenault

Summary of Site Investigations

	ASSESSMENT		100.00%; Precipitation: 0; Wind: 0			
WB-N-M32-14	FISH INVENTORY	6/5/2015	Air Temp.: 18.00°C; Cloud Cover: 100.00%; Precipitation: 1; Wind: 1	09:05	10:21	Amy Ingriselli Jessica Mendoza Kalynn Parrott
	STREAM/RIVER ASSESSMENT	5/27/2015	Air Temp.: 22.00°C; Cloud Cover: 0.00%; Precipitation: 0; Wind: 4	13:32	14:24	Ashley Minion Kalynn Parrott
WB-N-M32-26	STREAM/RIVER ASSESSMENT	5/27/2015	Air Temp.: 22.00°C; Cloud Cover: 20.00%; Precipitation: 0; Wind: 4	14:38	15:20	Ashley Minion Kalynn Parrott
WB-N-M34-42	STREAM/RIVER ASSESSMENT	5/28/2015	Air Temp.: 18.00°C; Cloud Cover: 90.00%; Precipitation: 0; Wind: 1	09:57	10:36	Ashley Minion Kalynn Parrott
WB-N-M35-1	STREAM/RIVER ASSESSMENT	5/14/2015	Air Temp.: 15.00°C; Cloud Cover: 0.00%; Precipitation: 0; Wind: 4	15:22	16:22	Amy Ingriselli Ami Arsenault
WB-N-M37-15	POND/LAKE ASSESSMENT	5/14/2015	Air Temp.: 13.00°C; Cloud Cover: 10.00%; Precipitation: 0; Wind: 4	12:52	14:20	Amy Ingriselli Ami Arsenault
WB-N-M39-19	POND/LAKE ASSESSMENT	5/14/2015	Air Temp.: 12.00°C; Cloud Cover: 20.00%; Precipitation: 0; Wind: 5	11:36	11:59	Amy Ingriselli Ami Arsenault
WB-N-M41-43	POND/LAKE ASSESSMENT	5/12/2015	Air Temp.: 11.00°C; Cloud Cover: 100.00%; Precipitation: 0; Wind: 5	13:31	14:00	Amy Ingriselli Ami Arsenault
WB-N-M41-44	POND/LAKE ASSESSMENT	5/12/2015	Air Temp.: 11.00°C; Cloud Cover: 100.00%; Precipitation: 0; Wind: 5	14:28	14:46	Amy Ingriselli Ami Arsenault
WB-N-M43-22	POND/LAKE ASSESSMENT	5/13/2015	Air Temp.: 14.00°C; Cloud Cover: 10.00%; Precipitation: 0; Wind: 5	15:27	15:44	Amy Ingriselli Ami Arsenault
WB-N-M4-59	STREAM/RIVER ASSESSMENT	7/9/2015	Air Temp.: 25.00°C; Cloud Cover: 0.00%; Precipitation: 0; Wind: 2	15:07	16:00	Amy Ingriselli Jessica Mendoza
WB-N-M46-4	POND/LAKE ASSESSMENT	5/12/2015	Air Temp.: 11.00°C; Cloud Cover: 100.00%; Precipitation: 0; Wind: 5	12:36	13:01	Amy Ingriselli Ami Arsenault
WB-N-M47-45	POND/LAKE ASSESSMENT	5/13/2015	Air Temp.: 14.00°C; Cloud Cover: 20.00%; Precipitation: 0; Wind: 5	13:38	13:50	Amy Ingriselli Ami Arsenault
WB-N-M49-46	POND/LAKE ASSESSMENT	5/13/2015	Air Temp.: 13.00°C; Cloud Cover: 5.00%; Precipitation: 0; Wind: 2	11:35	12:39	Amy Ingriselli Ami Arsenault
WB-N-M6-3	FISH INVENTORY	6/16/2015	Air Temp.: 20.00°C; Cloud Cover: 10.00%; Precipitation: 0; Wind: 1	10:35	11:48	Amy Ingriselli Ami Arsenault
	STREAM/RIVER ASSESSMENT	5/26/2015	Air Temp.: 20.00°C; Cloud Cover: 10.00%; Precipitation: 0; Wind: 2	11:37	13:15	Ashley Minion Kalynn Parrott
WB-N-M7-34	STREAM/RIVER ASSESSMENT	5/27/2015	Air Temp.: 16.00°C; Cloud Cover: 75.00%; Precipitation: 0; Wind: 5	10:01	10:53	Ashley Minion Kalynn Parrott
WB-N-M9-35	STREAM/RIVER ASSESSMENT	5/28/2015	Air Temp.: 22.00°C; Cloud Cover: 90.00%; Precipitation: 0; Wind: 1	13:53	14:28	Ashley Minion Kalynn Parrott
WB-S-M13-13	FISH INVENTORY	6/8/2015	Air Temp.: 14.00°C; Cloud Cover: 100.00%; Precipitation: 0; Wind: 4	13:32	14:30	Jay Cashubec Kalynn Parrott

Summary of Site Investigations

	STREAM/RIVER ASSESSMENT	5/6/2015	Air Temp.: 17.00°C; Cloud Cover: 0.00%; Precipitation: 0; Wind: 3	14:10	14:43	Mike Godard Devon Fowler
WB-S-M13-55	POND/LAKE ASSESSMENT	5/13/2015	Air Temp.: 8.00°C; Cloud Cover: 10.00%; Precipitation: 0; Wind: 4	13:38	14:02	Mike Godard Jessica Mendoza
WB-S-M1-58	STREAM/RIVER ASSESSMENT	5/4/2015	Air Temp.: 12.00°C; Cloud Cover: 100.00%; Precipitation: 1; Wind: 2	13:44	14:43	Mike Godard Devon Fowler
WB-S-M17-29	FISH INVENTORY	6/9/2015	Air Temp.: 18.00°C; Cloud Cover: 35.00%; Precipitation: 0; Wind: 4	13:09	14:52	Jay Cashubec Kalynn Parrott
	STREAM/RIVER ASSESSMENT	5/13/2015	Air Temp.: 9.00°C; Cloud Cover: 30.00%; Precipitation: 0; Wind: 4	11:55	12:45	Mike Godard Jessica Mendoza
WB-S-M19-6	FISH INVENTORY	6/9/2015	Air Temp.: 22.00°C; Cloud Cover: 60.00%; Precipitation: 0; Wind: 1	10:40	11:43	Jay Cashubec Kalynn Parrott
	STREAM/RIVER ASSESSMENT	5/7/2015	Air Temp.: 18.00°C; Cloud Cover: 10.00%; Precipitation: 0; Wind: 2	11:32	13:06	Amy Ingriselli Ami Arsenault
WB-S-M26-1	FISH INVENTORY	6/11/2015	Air Temp.: 20.00°C; Cloud Cover: 50.00%; Precipitation: 0; Wind: 3	10:31	12:36	Jay Cashubec Kalynn Parrott
WB-S-M30-11	STREAM/RIVER ASSESSMENT	5/13/2015	Air Temp.: 4.00°C; Cloud Cover: 10.00%; Precipitation: 0; Wind: 4	10:02	11:05	Mike Godard Jessica Mendoza
WB-S-M34-53	STREAM/RIVER ASSESSMENT	5/7/2015	Air Temp.: 18.00°C; Cloud Cover: 15.00%; Precipitation: 0; Wind: 3	10:57	11:33	Mike Godard Devon Fowler
WB-S-M34-54	POND/LAKE ASSESSMENT	5/28/2015	Air Temp.: 15.00°C; Cloud Cover: 100.00%; Precipitation: 0; Wind: 1	10:42	11:31	Amy Ingriselli Jessica Mendoza
WB-S-M36-49	POND/LAKE ASSESSMENT	5/14/2015	Air Temp.: 10.00°C; Cloud Cover: 0.00%; Precipitation: 0; Wind: 4	12:18	12:41	Mike Godard Jessica Mendoza
WB-S-M36-50	POND/LAKE ASSESSMENT	5/14/2015	Air Temp.: 10.00°C; Cloud Cover: 20.00%; Precipitation: 0; Wind: 4	11:18	11:51	Mike Godard Jessica Mendoza
WB-S-M39-51	POND/LAKE ASSESSMENT	5/14/2015	Air Temp.: 10.00°C; Cloud Cover: 0.00%; Precipitation: 0; Wind: 4	13:28	13:58	Mike Godard Jessica Mendoza
WB-S-M39-8	FISH INVENTORY	6/4/2015	Air Temp.: 17.00°C; Cloud Cover: 100.00%; Precipitation: 0; Wind: 2	09:53	13:43	Amy Ingriselli Jessica Mendoza Kalynn Parrott
	STREAM/RIVER ASSESSMENT	5/8/2015	Air Temp.: 17.00°C; Cloud Cover: 10.00%; Precipitation: 0; Wind: 5	10:31	11:17	Casey O'Driscoll Mike Godard
WB-S-M41-52	POND/LAKE ASSESSMENT	5/14/2015	Air Temp.: 15.00°C; Cloud Cover: 30.00%; Precipitation: 0; Wind: 4	14:41	15:01	Mike Godard Jessica Mendoza
WB-S-M48-17	POND/LAKE ASSESSMENT	7/24/2015	Air Temp.: 19.00°C; Cloud Cover: 0.00%; Precipitation: 0; Wind: 3	10:53	11:21	Amy Ingriselli
WB-S-M49-48	POND/LAKE ASSESSMENT	7/24/2015	Air Temp.: 18.00°C; Cloud Cover: 0.00%; Precipitation: 0; Wind: 1	11:59	12:34	Amy Ingriselli
WB-S-M49-9	STREAM/RIVER ASSESSMENT	5/6/2015	Air Temp.: 13.00°C; Cloud Cover: 0.00%; Precipitation: 0; Wind: 4	10:12	10:42	Mike Godard Devon Fowler

Summary of Site Investigations

WB-S-M50-10	STREAM/RIVER ASSESSMENT	5/6/2015	Air Temp.: 15.00°C; Cloud Cover: 0.00%; Precipitation: 0; Wind: 4	11:12	12:12	Mike Godard Devon Fowler
WB-S-M52-58	POND/LAKE ASSESSMENT	7/9/2015	Air Temp.: 22.00°C; Cloud Cover: 15.00%; Precipitation: 0; Wind: 4	13:33	15:04	Amy Ingriselli Jessica Mendoza
WB-A-M3-3	STREAM/RIVER ASSESSMENT	5/8/2015	Air Temp.: 16.00°C; Cloud Cover: 5.00%; Precipitation: None; Wind: 3	09:33	10:49	Amy Ingriselli Ami Arsenault
WB-S-M8-56	POND/LAKE ASSESSMENT	5/12/2015	Air Temp.: 3.00°C; Cloud Cover: 100.00%; Precipitation: None; Wind: 4	09:17	10:09	Mike Godard Jessica Mendoza
WB-N-M31-2						
WB-A-M1-1	POND/LAKE ASSESSMENT	5/4/2015	Air Temp.: 12.00°C; Cloud Cover: 100.00%; Precipitation: Light Rain; Wind: 1	14:22	14:56	Amy Ingriselli Ami Arsenault
WB-A-M2-2	POND/LAKE ASSESSMENT	5/4/2015	Air Temp.: 14.00°C; Cloud Cover: 90.00%; Precipitation: None; Wind: 4	12:51	13:25	Amy Ingriselli Ami Arsenault
WB-S-M5-7	STREAM/RIVER ASSESSMENT	5/5/2015	Air Temp.: 8.00°C; Cloud Cover: 60.00%; Precipitation: 0; Wind: 0	08:20	09:20	Devon Fowler Mike Godard
WB-S-M8-57	POND/LAKE ASSESSMENT	5/12/2015	Air Temp.: 3.00°C; Cloud Cover: 100.00%; Precipitation: 0; Wind: 4	09:17	10:09	Mike Godard Jessica Mendoza
	POND/LAKE ASSESSMENT	5/12/2015	Air Temp.: 3.00°C; Cloud Cover: 30.00%; Precipitation: 0; Wind: 1	12:45	13:45	Mike Godard Jessica Mendoza

Appendix B

Field Notes

Stream/River Assessment

Site ID	WB-S-M1-58	Field Crew	Mike Godard Devon Fowler		3
Study Area	WEC				
Location	Drainage ditch running west side of Hwy 69. Connects to culvert connecting watercourses under Hwy 69 to wetland east of Hwy 69. Wetland area 80m from drainage ditch.				
Project Number	60341251	Air Temp. (degC)	12.0	Weather Notes	
Tablet	AECOM5	Wind Speed (beaufort)	2		
Start Date	5/4/2015 1:44:20 PM	Precipitation	1		
End Date	5/4/2015 2:43:23 PM	Cloud Cover	100.00		
Upstream Endpoint	Latitude:45.870836, Longitude:-80.568487, Altitude:188				
Downstream Endpoint	Latitude:45.868569, Longitude:-80.56762, Altitude:187				

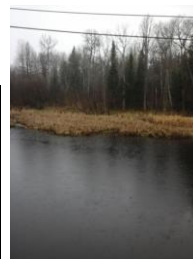
Stream/River Assessment

Site Features

Feature 3 Feature Location
Description

Looking
west over
open water
cattail marsh
in waterbody
south of site.

Latitude:45.868273,Longitude:-
80.56737,Altitude:190.4,Speed:1.1729333,Accuracy:1.5,Provider:gps,Time:05/04/2015
01:49:24 EDT



Feature 6 Feature Location
Description

Looking
upstream

Latitude:45.867941,Longitude:-
80.567306,Altitude:189.6,Speed:0.015433333,Accuracy:1.25,Provider:gps,Time:05/04/2015
01:52:28 EDT



Feature 9 Feature Location
Description

Road runoff at
downstream end
of reach

Latitude:,Longitude:,Altitude:,Speed:,Accuracy:,Provider:,Time:



Feature 12 Feature Location
Description

Downstream of
drainage ditch

Latitude:,Longitude:,Altitude:,Speed:,Accuracy:,Provider:,Time:



Feature 15 Feature Location
Description

Centre of
assessed area

Latitude:,Longitude:,Altitude:,Speed:,Accuracy:,Provider:,Time:



Feature 18 Feature Location
Description

Looking
downstream of
centre

Latitude:,Longitude:,Altitude:,Speed:,Accuracy:,Provider:,Time:






Execution Time 8/19/2015 12:09:29 PM

Filter Start Date 4/1/2015

Filter End Date 8/21/2015

Stream/River Assessment

Feature Description		21 Feature Location	
Looking upstream of centre	Latitude:,Longitude:,Altitude:,Speed:,Accuracy:,Provider:,Time:		
Feature Description		24 Feature Location	
End of site looking downstream	Latitude:,Longitude:,Altitude:,Speed:,Accuracy:,Provider:,Time:		
Feature Description		27 Feature Location	
End of site looking upstream	Latitude:,Longitude:,Altitude:,Speed:,Accuracy:,Provider:,Time:		

Stream/River Assessment

Surrounding Land Use	Forest,Wetland,Other			
	Forest to the west. Hwy to the east			
Type of Watercourse	Permanent,Natural Channel			
	Stream with open areas surrounded by cattails. Beaver activity evident. Drainage ditch beside hwy 69			
Input Description	Overland flow. Drainage ditches			
Water Body Underground / Not As Mapped?	No			
Surrounding Land Topography	Slight slope with rock outcroppings			
In-Situ Water Quality				
WT (deg. C)	10.2	AT (degC)	12.0	Water Quality Notes 92us conductivity
pH	7.0	Cond. (s/cm)	0.09	
D.O. (mg/L)	7.5	Water Colour	Yellow/Brown	
Water Clarity	Clear			
Seepage Indicators	None			
Stream Morphology				
Site Length (m)	150.00	Bank Stability		
Channel Dimensions		Left Bank	1.52	
		Right Bank	2.80	
Mean Wetted Width (m)	1.52	Mean Wetted Depth (m)	0.75	Notes Vegetated and stable. Road runoff evident
Mean Bankfull Width (m)	2.80	Mean Bankfull Depth (m)	0.50	
Mean Top of Bank Width (m)	5.75	Mean Top of Bank Depth (m)	2.50	
Flow Description	Stagnant			
Habitat				
Substrate Description	Mk dt sa			

Stream/River Assessment

Morphological Structure (%)

Pool

Riffle

Run

Flat

Notes

Instream Cover

Woody Debris

Boulders

Cobble

Aquatic Vegetation

Structures

Total Instream Cover

Undercut Banks

Average Depth(m)

Percent Cover (%)

Aquatic Vegetation
Species Present

Emergent cattails

Canopy Cover

Percent Closed Cover (%)

Trees

Shrubs

Grasses

Herbaceous

Man Made

Other

Cover Description

Limited canopy cover. Grasses potentiaklly during summer

Left Bank Riparian Vegetation

2m grasses

Right Bank Riparian Vegetation

5+m grasses sedges trees leading to forest

Overhanging
Vegetation (%)

0.00

Cattails in channel. Grasses and sedges potentially during warmer months

Obstruction to Fish
Passage

None Observed

Barrier Height (M)

Stream/River Assessment

Study Area Comments




Roadside drainage ditch leading to wetland\stream. Heavily overgrown with cattails.drainage function only



Horizontal View of Channel



Stream/River Assessment

Site ID	WB-S-M5-7	Field Crew	Devon Fowler Mike Godard	6
Study Area	WEC			
Location	WEC South. Hiked south from Bekanon Road			
Project Number	60341251	Air Temp. (degC)	8.0	Weather Notes Heavey fog this morning cleared by the time we got to site
Tablet	AECOM5	Wind Speed (beaufort)	0	
Start Date	5/5/2015 8:20:35 AM	Precipitation	0	
End Date	5/5/2015 9:20:00 AM	Cloud Cover	60.00	
Upstream Endpoint	Latitude:45.846711,Longitude:-80.585728,Altitude:201.6,Speed:0.010288889,Accuracy:1.75,Provider:gps,Time:05/05/2015 08:27:31 EDT			
Downstream Endpoint	Latitude:45.846715,Longitude:-80.585805,Altitude:199.5,Speed:0.041155554,Accuracy:1.75,Provider:gps,Time:05/05/2015 08:24:34 EDT			
Site Features				
Feature Description	45	Feature Location		
Bog thicket with open standing water, upstream looking west	Latitude:45.846715,Longitude:-80.585805,Altitude:199.5,Speed:0.041155554,Accuracy:1.75,Provider:gps,Time:05/05/2015 08:24:34 EDT			
Feature Description	48	Feature Location		
Bog thicket with open standing water, downstream looking east	Latitude:45.846711,Longitude:-80.585728,Altitude:201.6,Speed:0.010288889,Accuracy:1.75,Provider:gps,Time:05/05/2015 08:27:31 EDT			
Feature Description	51	Feature Location		
Bog thicket with open water, general overview from centre of assessed area	Latitude:45.846709,Longitude:-80.585775,Altitude:198.8,Speed:0.041155554,Accuracy:2.0,Provider:gps,Time:05/05/2015 08:32:14 EDT			
Surrounding Land Use	Forest,Wetland			
	Corridor of open water bog thicket approx 100 m across			

Stream/River Assessment

Type of Watercourse	Permanent,Natural Channel			
	Bog thicket connected to two permanent watercourses			
Input Description	Overland flow from waterbody to the west connected to water body to the east, possible groundwater re-charge			
Water Body Underground / Not As Mapped?	On map it is represented as a watercourse however it more of a wetland with connectivity to two water bodies			
Surrounding Land Topography	Large bedrock outcroppings with a gradual decline to the watercourse.			
In-Situ Water Quality				
WT (deg. C)	9.1	AT (degC)	8.0	Water Quality Notes Stagnent water
pH	6.6	Cond. (s/cm)		
D.O. (mg/L)	1.6	Water Colour	Yellow/Brown	
Water Clarity	Clear			
Seepage Indicators	None			
Stream Morphology				
Site Length (m)	100.00	Bank Stability		
Channel Dimensions		Left Bank	30.00	
		Right Bank	30.00	
Mean Wetted Width (m)	30.00	Mean Wetted Depth (m)	0.20	Notes Low lying wetland
Mean Bankfull Width (m)	30.00	Mean Bankfull Depth (m)	1.00	
Mean Top of Bank Width (m)	110.00	Mean Top of Bank Depth (m)	2.00	
Flow Description	Stagnant			
Habitat				
Substrate Description	Muck, detritus			
Morphological Structure (%)				
Pool	Riffle	Run	Flat	
0.00			100.00	
Notes				

Stream/River Assessment

Instream Cover

Woody Debris

Boulders

Cobble

Aquatic Vegetation

Structures

Total Instream Cover

Undercut Banks

Average Depth(m)

Percent Cover (%)

Aquatic Vegetation
Species Present

Algae, emergent

Canopy Cover

Percent Closed Cover (%)

60-
30%

Trees

Shrubs

Grasses

Herbaceous

Man Made

Other

Cover Description

Spagnum spp. (No "stream" to note. Cover would be supplied by the following list)

Left Bank Riparian Vegetation

3 m riparian shrub and moss

Right Bank Riparian Vegetation

3 m riparian shrub

Overhanging
Vegetation (%)

5.00

Trees and shrub

Obstruction to Fish
Passage

None Observed

Barrier Height (M)

Study Area Comments

Wetland



Stream/River Assessment

Horizontal View of Channel



Stream/River Assessment

Site ID	WB-N-M1-33	Field Crew	Mike Godard Devon Fowler	9
Study Area	WEC			
Location	West side of hwy 69 south of key river			
Project Number	60341251	Air Temp. (degC)	15.0	Weather Notes
Tablet	AECOM5	Wind Speed (beaufort)	2	Mostly sunny and warm
Start Date	5/5/2015 10:50:22 AM	Precipitation	0	
End Date	5/5/2015 11:28:39 AM	Cloud Cover	60.00	
Upstream Endpoint	Latitude:45.887048,Longitude:-80.565941,Altitude:197.4,Speed:0.0463,Accuracy:2.1,Provider:gps,Time:05/05/2015 11:09:07 EDT			
Downstream Endpoint	Latitude:45.886756,Longitude:-80.566139,Altitude:194.9,Speed:0.07202222,Accuracy:1.8,Provider:gps,Time:05/05/2015 11:21:36 EDT			

Stream/River Assessment

Site Features

Feature 54 Feature Location
Description

Culvert
outletting
water under
hwy 69
Latitude:45.887048,Longitude:-
80.565941,Altitude:197.4,Speed:0.0463,Accuracy:2.1,Provider:gps,Time:05/05/2015
11:09:07 EDT



Feature 57 Feature Location
Description

Looking
upstream
from culvert
Latitude:45.887113,Longitude:-
80.565905,Altitude:197.8,Speed:0.03601111,Accuracy:1.8,Provider:gps,Time:05/05/2015
11:13:44 EDT



Feature 60 Feature Location
Description

Looking
upstream
from midpoint
of assessed
watercourse
Latitude:45.887031,Longitude:-
80.56605,Altitude:197.6,Speed:0.0051444443,Accuracy:1.8,Provider:gps,Time:05/05/2015
11:18:04 EDT



Feature 63 Feature Location
Description

Bank
seepage
observed
seeping
between
bedrock
along the
steep slope
running
parallel to
Hwy 69.
Latitude:45.886919,Longitude:-
80.566047,Altitude:197.8,Speed:0.010288889,Accuracy:1.8,Provider:gps,Time:05/05/2015
11:19:07 EDT



Feature 66 Feature Location
Description

Looking
downstream
from end of
assessed
area.
Latitude:45.886756,Longitude:-
80.566139,Altitude:194.9,Speed:0.07202222,Accuracy:1.8,Provider:gps,Time:05/05/2015
11:21:36 EDT



Surrounding Land
Use

Forest,Other

Hwy 69 runs parallel. Forest to the east

Execution Time 8/19/2015 12:09:29 PM

Filter Start Date 4/1/2015

Filter End Date 8/21/2015

Stream/River Assessment

Type of Watercourse	<div>Intermittent,Natural Channel</div> <div>Stagnant watercourse transporting overland flow under hwy 69</div>		
Input Description	<div>Overland flow</div>		
Water Body Underground / Not As Mapped?	<div>No</div>		
Surrounding Land Topography	<div>Steep slope along hwy 69. Natural slightly sloping</div>		
In-Situ Water Quality			
WT (deg. C)	<div>6.2</div>	AT (degC)	<div>15.0</div>
pH	<div>6.6</div>	Cond. (s/cm)	<div></div>
D.O. (mg/L)	<div>5.7</div>	Water Colour	<div>Other</div>
Water Clarity	<div>Clear</div>	<div>Water Quality Notes</div> <div>Stagnant. Oil and rusty colour</div>	
Seepage Indicators	<div>None</div> <div>Water was observed seeping between bedrock along the steep slope running parallel to Hwy 69 and causing staining.</div>		
Stream Morphology			
Site Length (m)	<div>50.00</div>	Bank Stability	
Channel Dimensions		Left Bank	<div>0.70</div>
		Right Bank	<div>0.00</div>
Mean Wetted Width (m)	<div>0.70</div>	Mean Wetted Depth (m)	<div>0.05</div>
Mean Bankfull Width (m)	<div>0.00</div>	Mean Bankfull Depth (m)	<div>0.20</div>
Mean Top of Bank Width (m)	<div>0.00</div>	Mean Top of Bank Depth (m)	<div>0.20</div>
		Notes	<div>Heavily vegetated with grass and cattails</div>
Flow Description	<div>Stagnant</div>		
Habitat			
Substrate Description	<div>Mk dt si</div>		

Stream/River Assessment

Morphological Structure (%)

Pool

Riffle

Run

Flat

Notes

Instream Cover

Woody Debris

Boulders

Cobble

Aquatic Vegetation

Structures

Total Instream Cover

Undercut Banks

Average Depth(m)

Percent Cover (%)

Aquatic Vegetation
Species Present

Emergent cattails. Horse tail

Canopy Cover

Percent Closed Cover (%)

30-1%

Trees

Shrubs

Grasses

Herbaceous

Man Made

Other

Cover Description

Cattail choked watercourse. Sedges and grasses. Culvert under hwy 69 adds to cover

Left Bank Riparian Vegetation

<5m Spruce tree forest

Right Bank Riparian Vegetation

>5m Grasses and a few smaller spruce

Overhanging
Vegetation (%)

60.00

Occasional spruce. Cattails within channel.

Obstruction to Fish
Passage

Low Flow Barrier

Low flow

Barrier Height (M)

0.1

Stream/River Assessment

Study Area Comments



Stagnant intermittent drainage function only. No fish habitat



Horizontal View of Channel



Stream/River Assessment

Site ID	WB-N-M1-32	Field Crew	Mike Godard Devon Fowler	12
Study Area	WEC			
Location	Wec North. Access site west of Hwy 69, south of Key River			
Project Number	60341251	Air Temp. (degC)	16.0	Weather Notes
Tablet	AECOM5	Wind Speed (beaufort)	0	Sunny and warm
Start Date	5/5/2015 11:45:46 AM	Precipitation	0	
End Date	5/5/2015 11:53:37 AM	Cloud Cover	50.00	
Upstream Endpoint				
Downstream Endpoint				
Site Features				
Feature Description	69 Feature Location			
Spring is located well outside of the study area. Was observed during period trying to identify watercourse location.	Latitude:45.886783,Longitude:-80.567218,Altitude:193.5,Speed:0.087455556,Accuracy:1.8,Provider:gps,Time:05/05/2015 11:47:59 EDT			
Feature Description	72 Feature Location			
Site overview. No watercourse present	Latitude:45.886765,Longitude:-80.567212,Altitude:195.0,Speed:0.05658889,Accuracy:2.1,Provider:gps,Time:05/05/2015 11:49:41 EDT			
Surrounding Land Use	Forest			
	Spruce hemlock forest			
Type of Watercourse	Intermittent			
	No watercourse present			

Stream/River Assessment

Input Description	Spring. Overland flow		
Water Body Underground / Not As Mapped?	No		
Surrounding Land Topography	Slope from Hwy 69 is fairly steep towards the watercourse. Area in general vicinity of this watercourse gently slopes towards the north.		

In-Situ Water Quality				
WT (deg. C)	<input type="text"/>	AT (degC)	<input type="text" value="16.0"/>	Water Quality Notes <input type="text"/>
pH	<input type="text"/>	Cond. (s/cm)	<input type="text"/>	
D.O. (mg/L)	<input type="text"/>	Water Colour	<input type="text"/>	
Water Clarity	<input type="text"/>			

Seepage Indicators	None
	<input type="text"/>

Stream Morphology		Bank Stability		
Site Length (m)	<input type="text"/>	Left Bank	<input type="text"/>	
Channel Dimensions		Right Bank	<input type="text"/>	
Mean Wetted Width (m)	<input type="text"/>	Mean Wetted Depth (m)	<input type="text"/>	Notes <input type="text"/>
Mean Bankfull Width (m)	<input type="text"/>	Mean Bankfull Depth (m)	<input type="text"/>	
Mean Top of Bank Width (m)	<input type="text"/>	Mean Top of Bank Depth (m)	<input type="text"/>	

Flow Description	No watercourse
------------------	----------------

Habitat	
Substrate Description	<input type="text"/>

Morphological Structure (%)			
Pool	Riffle	Run	Flat
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Notes	<input type="text"/>		

Stream/River Assessment

Instream Cover

Woody Debris

Boulders

Cobble

Aquatic Vegetation

Structures

Total Instream Cover

Undercut Banks

Average Depth(m)

Percent Cover (%)

Aquatic Vegetation
Species Present

Canopy Cover

Percent Closed Cover (%)

Trees

Shrubs

Grasses

Herbaceous

Man Made

Other

Cover Description

Left Bank Riparian Vegetation

Right Bank Riparian Vegetation

Overhanging
Vegetation (%)

Obstruction to Fish
Passage

None Observed

Barrier Height (M)




Study Area Comments

No watercourse. Bogs and pools of standing water observed. No watercourse was observed, therefore no habitat is available to fisheries.

Stream/River Assessment

Horizontal View of Channel

Stream/River Assessment

Site ID	WB-S-M49-9	Field Crew	Mike Godard Devon Fowler	30
Study Area	WEC			
Location	Swamp wetland southeast of turbine 77 (boated to the north end of the site and hiked south to the site).			
Project Number	60341251	Air Temp. (degC)	13.0	Weather Notes
Tablet	AECOM5	Wind Speed (beaufort)	4	Sunny and clear.
Start Date	5/6/2015 10:12:59 AM	Precipitation	0	
End Date	5/6/2015 10:42:42 AM	Cloud Cover	0.00	
Upstream Endpoint	Latitude:45.830650,Longitude:-80.710836			
Downstream Endpoint	Latitude:45.830086,Longitude:-80.712102			
Site Features				
Feature Description	162 Feature Location			
Looking west from centre of assessed area	Latitude:45.830558,Longitude:-80.71168,Altitude:176.4,Speed:0.051444445,Accuracy:2.0,Provider:gps,Time:05/06/2015 10:15:44 EDT			
Feature Description	165 Feature Location			
Looking south from centre of assessed area	Latitude:45.830552,Longitude:-80.711655,Altitude:176.7,Speed:0.21606667,Accuracy:2.4,Provider:gps,Time:05/06/2015 10:18:21 EDT			
Feature Description	168 Feature Location			
Looking east from centre of assessed area	Latitude:45.830565,Longitude:-80.711565,Altitude:177.2,Speed:0.10803334,Accuracy:2.1,Provider:gps,Time:05/06/2015 10:19:09 EDT			
Surrounding Land Use	Forest			
	Mixed deciduos and coniferous forest			
Type of Watercourse	Intermittent,Ephemeral,Natural Channel			
	Lowland wetland/swamp. Limited water at time of assessment. Connecting between two swamps? Fish habitat unlikely.			

Stream/River Assessment

Input Description	Overland flow.		
Water Body Underground / Not As Mapped?	No		
Surrounding Land Topography	Rolling towards waterbody. Waterbody within low lying area		

In-Situ Water Quality				
WT (deg. C)	<input type="text" value="10.6"/>	AT (degC)	<input type="text" value="13.0"/>	Water Quality Notes Slight oily sheen to pools of water
pH	<input type="text"/>	Cond. (s/cm)	<input type="text"/>	
D.O. (mg/L)	<input type="text" value="3.3"/>	Water Colour	<input type="text" value="Yellow/Brown"/>	
Water Clarity	<input type="text" value="Clear"/>			

Seepage Indicators	<input type="text" value="None"/>
<input type="text"/>	

Stream Morphology		Bank Stability		
Site Length (m)	<input type="text" value="75.00"/>	Left Bank	<input type="text" value="22.00"/>	
Channel Dimensions		Right Bank	<input type="text" value="40.00"/>	
Mean Wetted Width (m)	<input type="text" value="22.00"/>	Mean Wetted Depth (m)	<input type="text" value="0.20"/>	Notes Grasses and mosses on bedrock and boulder
Mean Bankfull Width (m)	<input type="text" value="40.00"/>	Mean Bankfull Depth (m)	<input type="text" value="0.80"/>	
Mean Top of Bank Width (m)	<input type="text" value="50.00"/>	Mean Top of Bank Depth (m)	<input type="text" value="0.80"/>	

Flow Description	Stagnant. Limited water mostly standing puddles
------------------	---

Habitat	
Substrate Description	Mk si

Morphological Structure (%)			
Pool	Riffle	Run	Flat
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text" value="100.00"/>
Notes	<input type="text"/>		

Stream/River Assessment

Instream Cover

Woody Debris

Boulders

Cobble

Aquatic Vegetation

Structures

Total Instream Cover

Undercut Banks

Average Depth(m)

Percent Cover (%)

Aquatic Vegetation
Species Present

Reed canary grass grasses and sedges

Canopy Cover

Percent Closed Cover (%)

30-1%

Trees

Shrubs

Grasses

Herbaceous

Man Made

Other

Cover Description

Grasses and coniferous trees. Low lying wetland.

Left Bank Riparian Vegetation

<5m mixed forest

Right Bank Riparian Vegetation

<5m mixed forest

Overhanging
Vegetation (%)

30.00

Grasses trees shrubs

Obstruction to Fish
Passage

Low Flow Barrier

No watercourse identified. Standing water in low lying area only

Barrier Height (M)

Study Area Comments

Low lying swamp. Intermittent and ephemeral. Not fish habitat in assessed area






Stream/River Assessment

Horizontal View of Channel



Stream/River Assessment

Site ID	WB-S-M50-10	Field Crew	Mike Godard Devon Fowler	33
Study Area	WEC			
Location	Watercourse transitioned into beaver pond, sections of the watercourse still have connectivity to the pond to the west			
Project Number	60341251	Air Temp. (degC)	15.0	Weather Notes
Tablet	AECOM5	Wind Speed (beaufort)	4	
Start Date	5/6/2015 11:12:34 AM	Precipitation	0	
End Date	5/6/2015 12:12:00 PM	Cloud Cover	0.00	
Upstream Endpoint	Latitude:45.826297,Longitude:-80.708567			
Downstream Endpoint	Latitude:45.826515,Longitude:-80.710035			
Site Features				
Feature Description	171 Feature Location			
Watercourse transitioning into wetland via beavers looking east (upstream)	Latitude:45.82661,Longitude:-80.709262,Altitude:179.6,Speed:0.041155554,Accuracy:1.75,Provider:gps,Time:05/06/2015 11:15:41 EDT			
Feature Description	174 Feature Location			
Watercourse looking west (downstream)	Latitude:45.826723,Longitude:-80.709324,Altitude:183.2,Speed:0.10803334,Accuracy:2.1,Provider:gps,Time:05/06/2015 11:21:14 EDT			
Feature Description	177 Feature Location			
Beaver dam	Latitude:45.826723,Longitude:-80.709326,Altitude:183.1,Speed:0.06173333,Accuracy:2.4,Provider:gps,Time:05/06/2015 11:22:32 EDT			
Surrounding Land Use	Forest,Wetland			
	Low lying area within a mixed forest.			
Type of Watercourse	Permanent,Natural Channel			
	Only permanent because of beaver dams			

Execution Time 8/19/2015 12:09:29 PM

Filter Start Date 4/1/2015

Filter End Date 8/21/2015

Stream/River Assessment

Input Description	Overland flow
Water Body Underground / Not As Mapped?	No
Surrounding Land Topography	Rock outcroppings with thicket patches and mixed forest

In-Situ Water Quality				
WT (deg. C)	10.0	AT (degC)	15.0	Water Quality Notes Areas of stagnant water
pH		Cond. (s/cm)		
D.O. (mg/L)	4.0	Water Colour	Yellow/Brown	
Water Clarity	Clear			

Seepage Indicators	None

Stream Morphology				Bank Stability	
Site Length (m)	100.00			Left Bank	20.00
Channel Dimensions				Right Bank	25.00
Mean Wetted Width (m)	20.00	Mean Wetted Depth (m)	0.60	Notes Vegetation has been heavily cleared on left bank	
Mean Bankfull Width (m)	25.00	Mean Bankfull Depth (m)	0.50		
Mean Top of Bank Width (m)	25.00	Mean Top of Bank Depth (m)	0.80		

Flow Description	Stagnant to low flow depending on dam location
------------------	--

Habitat	
Substrate Description	

Morphological Structure (%)			
Pool	Riffle	Run	Flat
Notes			

Stream/River Assessment

Instream Cover

Woody Debris

Boulders

Cobble

Aquatic Vegetation

Structures

Total Instream Cover

Undercut Banks

Average Depth(m)

Percent Cover (%)

Aquatic Vegetation
Species Present

Canopy Cover

Percent Closed Cover (%)

Trees

Shrubs

Grasses

Herbaceous

Man Made

Other

Cover Description

Left Bank Riparian Vegetation

Right Bank Riparian Vegetation

Overhanging
Vegetation (%)

Obstruction to Fish
Passage

Natural

Three dams within the 100m site length

Barrier Height (M)

0.5

Study Area Comments

In its natural state it would be a intermittant watercourse however it has transitioned into pond/wetland and has been cut off from the waterbody that is fish habitat.



Stream/River Assessment

Horizontal View of Channel



Stream/River Assessment

Site ID	WB-S-M13-13	Field Crew	Mike Godard Devon Fowler	72
Study Area	WEC			
Location	Wec south. HNV South 13. Walk south from "Joe's Cabin" along new argo trail.			
Project Number	60341251	Air Temp. (degC)	17.0	Weather Notes Sunny and warm. Slight breeze
Tablet	AECOM5	Wind Speed (beaufort)	3	
Start Date	5/6/2015 2:10:56 PM	Precipitation	0	
End Date	5/6/2015 2:43:35 PM	Cloud Cover	0.00	
Upstream Endpoint	Latitude:45.843404,Longitude:-80.629743,Altitude:190.2,Speed:0.015433333,Accuracy:1.8,Provider:gps,Time:05/06/2015 02:23:25 EDT			
Downstream Endpoint	Latitude:45.843983, Longitude:-80.629944, Altitude:194			

Stream/River Assessment

Site Features

Feature 180 Feature Location
Description

Looking west
at watercourse
proposed
crossing

Latitude:45.843361,Longitude:-
80.629729,Altitude:189.5,Speed:0.010288889,Accuracy:1.8,Provider:gps,Time:05/06/2015
02:14:24 EDT



Feature 183 Feature Location
Description

Looking
upstream

Latitude:45.843366,Longitude:-
80.629714,Altitude:189.5,Speed:0.10288889,Accuracy:1.8,Provider:gps,Time:05/06/2015
02:15:19 EDT



Feature 186 Feature Location
Description

Looking
downstream

Latitude:45.843369,Longitude:-
80.629714,Altitude:189.3,Speed:0.10803334,Accuracy:1.8,Provider:gps,Time:05/06/2015
02:15:52 EDT



Feature 189 Feature Location
Description

Dam at
upstream pond

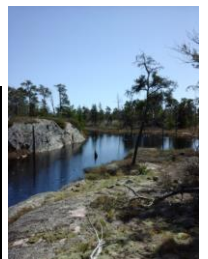
Latitude:45.843404,Longitude:-
80.629743,Altitude:190.2,Speed:0.015433333,Accuracy:1.8,Provider:gps,Time:05/06/2015
02:23:25 EDT



Feature 192 Feature Location
Description

Looking south
at upstream
pond

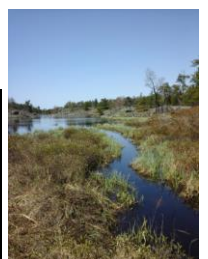
Latitude:45.842798,Longitude:-
80.629723,Altitude:184.4,Speed:0.015433333,Accuracy:1.8,Provider:gps,Time:05/06/2015
02:30:09 EDT



Feature 195 Feature Location
Description

Looking north
at downstream
end of
assessed
towards
beaver pond

Latitude:45.843723,Longitude:-
80.629875,Altitude:185.4,Speed:0.07202222,Accuracy:1.8,Provider:gps,Time:05/06/2015
02:34:50 EDT



Execution Time 8/19/2015 12:09:29 PM

Filter Start Date 4/1/2015

Filter End Date 8/21/2015

Stream/River Assessment

and channel

Surrounding Land Use

Forest

2 beaver ponds with the assessed watercourse connecting them

Stream/River Assessment

Type of Watercourse	Intermittent,Natural Channel
	Small drainage feature between two beaver ponds.

Input Description	Overland flow. Beaver pond
Water Body Underground / Not As Mapped?	No
Surrounding Land Topography	Rolling towards. Steep slope off of bedrock

In-Situ Water Quality				
WT (deg. C)	19.5	AT (degC)	17.0	Water Quality Notes Stagnant.
pH		Cond. (s/cm)		
D.O. (mg/L)	3.5	Water Colour	Yellow/Brown	
Water Clarity	Clear			

Seepage Indicators	None

Stream Morphology				Bank Stability	
Site Length (m)	100.00			Left Bank	0.25
Channel Dimensions				Right Bank	2.00
Mean Wetted Width (m)	0.25	Mean Wetted Depth (m)	0.15	Notes	Slightly soft
Mean Bankfull Width (m)	2.00	Mean Bankfull Depth (m)	0.30		
Mean Top of Bank Width (m)	2.50	Mean Top of Bank Depth (m)	0.35		

Flow Description	Stagnant
------------------	----------

Habitat	
Substrate Description	Dt mk si

Morphological Structure (%)				
Pool	Riffle	Run	Flat	
			100.00	
Notes				

Stream/River Assessment

Instream Cover

Woody Debris

Boulders

Cobble

Aquatic Vegetation

Structures

Total Instream Cover

Undercut Banks

Average Depth(m)

0.10

Percent Cover (%)

30.00

Aquatic Vegetation
Species Present

None

Canopy Cover

Percent Closed Cover (%)

60-
30%

Trees

60.00

Shrubs

20.00

Grasses

30.00

Herbaceous

Man Made

Other

Cover Description

Long grasses along margins

Left Bank Riparian Vegetation

5m. Meadow species trees and shrubs

Right Bank Riparian Vegetation

<5m mixed forest

Overhanging
Vegetation (%)

55.00

Grasses trees and shrubs

Obstruction to Fish
Passage

Natural

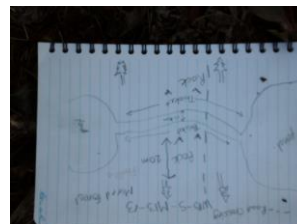
Beaver dam

Barrier Height (M)

5.0

Study Area Comments

Small intermittent watercourse connecting two beaver dams.
Northern painted turtle and Cyprinids observed in upstream pond






Stream/River Assessment

Horizontal View of Channel



Stream/River Assessment

Site ID	WB-S-M34-53	Field Crew	Mike Godard Devon Fowler	45
Study Area	WEC			
Location	Wec south. North of T107			
Project Number	60341251	Air Temp. (degC)	18.0	Weather Notes
Tablet	AECOM5	Wind Speed (beaufort)	3	Sunny. Warm. Slight breeze
Start Date	5/7/2015 10:57:25 AM	Precipitation	0	
End Date	5/7/2015 11:33:38 AM	Cloud Cover	15.00	
Upstream Endpoint	Latitude:45.830138,Longitude:-80.650875			
Downstream Endpoint	Latitude:45.829532,Longitude:-80.651905			
Site Features				
Feature Description	231 Feature Location			
Overview from proposed crossing	Latitude:45.829954,Longitude:-80.651496,Altitude:186.1,Speed:0.0463,Accuracy:2.1,Provider:gps,Time:05/07/2015 11:01:19 EDT			
Feature Description	234 Feature Location			
Looking west from proposed crossing	Latitude:45.829938,Longitude:-80.651474,Altitude:186.8,Speed:0.06173333,Accuracy:2.1,Provider:gps,Time:05/07/2015 11:02:19 EDT			
Feature Description	237 Feature Location			
Looking east from proposed crossing	Latitude:45.829937,Longitude:-80.651475,Altitude:186.8,Speed:0.09774444,Accuracy:2.1,Provider:gps,Time:05/07/2015 11:02:53 EDT			
Surrounding Land Use	Forest			
	Beaver pond to the west. Wetland to the east. Forest surrounding			
Type of Watercourse	Permanent,Natural Channel			
	Watercourse connecting wetland and beaver pond. Natural and defined channel. Potential historic beaver channel			

Stream/River Assessment

Input Description	Overland flow. Wetland		
Water Body Underground / Not As Mapped?	No		
Surrounding Land Topography	Rolling in sections. Sloping from bedrock		

In-Situ Water Quality				
WT (deg. C)	14.7	AT (degC)	18.0	Water Quality Notes No pH\conductivity meter.
pH		Cond. (s/cm)		
D.O. (mg/L)	19.2	Water Colour	Yellow/Brown	
Water Clarity	Clear			

Seepage Indicators	None

Stream Morphology		Bank Stability		
Site Length (m)	75.00	Left Bank	1.50	
Channel Dimensions		Right Bank	20.00	
Mean Wetted Width (m)	1.50	Mean Wetted Depth (m)	0.35	Notes Mostly bedrock
Mean Bankfull Width (m)	20.00	Mean Bankfull Depth (m)	1.50	
Mean Top of Bank Width (m)	22.00	Mean Top of Bank Depth (m)	2.00	

Flow Description	Stagnant to minimal flow
------------------	--------------------------

Habitat	
Substrate Description	Mk dt

Morphological Structure (%)			
Pool	Riffle	Run	Flat
			100.00
Notes			

Stream/River Assessment

Instream Cover

Woody Debris

Boulders

Cobble

Aquatic Vegetation

Structures

Total Instream Cover

Undercut Banks

Average Depth(m)

Percent Cover (%)

Aquatic Vegetation
Species Present

Reed canary grass. Sedges. Bog laural.

Canopy Cover

Percent Closed Cover (%)

30-1%

Trees

Shrubs

Grasses

Herbaceous

Man Made

Other

Cover Description

Grasses, sedges, shrubs and coniferous trees.

Left Bank Riparian Vegetation

Wetland species. White pine. Tamarac. <5m mixed forest

Right Bank Riparian Vegetation

Wetland species. White pine. Tamarac. <5m mixed forest

Overhanging
Vegetation (%)

35.00

Reed canary grass

Obstruction to Fish
Passage

None Observed

Barrier Height (M)

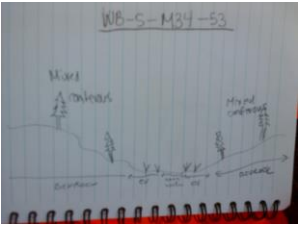
Study Area Comments

Nice and natural watercourse connecting wetland and beaver pond. Frogs observed. Likely fish species present downstream with potential for fish within channel



Stream/River Assessment

Horizontal View of Channel



Stream/River Assessment

Site ID	WB-S-M19-6	Field Crew	Amy Ingriselli Ami Arsenault		48
Study Area	WEC				
Location	Argo trail from behind Joe's cabin south, then west along flag line. Then southeast along flag line around wetland to site.				
Project Number	60341251	Air Temp. (degC)	18.0	Weather Notes	
Tablet	AECOM6	Wind Speed (beaufort)	2		
Start Date	5/7/2015 11:32:13 AM	Precipitation	0		
End Date	5/7/2015 1:06:07 PM	Cloud Cover	10.00		
Upstream Endpoint	Latitude:45.833812, Longitude:-80.623393, Altitude:190				
Downstream Endpoint	Latitude:45.834513, Longitude:-80.624426, Altitude:191				

Stream/River Assessment

Site Features

Feature 240 Feature Location
Description

General view
of the
watercourse
facing
downstream
(DS) from the
centreline (CL)

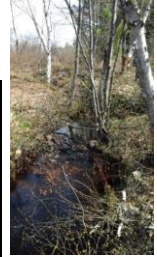
Latitude:45.834189,Longitude:-
80.624068,Altitude:195.6,Speed:0.010288889,Accuracy:1.8,Provider:gps,Time:05/07/2015
11:35:45 EDT



Feature 243 Feature Location
Description

General view
of the
watercourse
facing
upstream (US)
from the
centreline (CL)

Latitude:45.834198,Longitude:-
80.624051,Altitude:194.7,Speed:0.03601111,Accuracy:1.8,Provider:gps,Time:05/07/2015
11:41:27 EDT



Feature 246 Feature Location
Description

Small input
channel
coming from
wetland
northeast of
site. Left bank,
steep over
bedrock
(barrier)

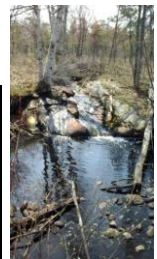
Latitude:45.834252,Longitude:-
80.623927,Altitude:196.4,Speed:0.030866666,Accuracy:1.8,Provider:gps,Time:05/07/2015
11:46:55 EDT



Feature 249 Feature Location
Description

Large pool
downstream
from middle of
site below
steep bedrock
slope. Barrier
to fish
passage. Fish
observed
below barrier

Latitude:45.834351,Longitude:-
80.62415,Altitude:193.8,Speed:0.041155554,Accuracy:2.1,Provider:gps,Time:05/07/2015
12:03:00 EDT



Feature 252 Feature Location
Description

Two beaver
dams
downstream
from site

Latitude:45.834381,Longitude:-
80.624284,Altitude:195.0,Speed:0.0463,Accuracy:1.8,Provider:gps,Time:05/07/2015
12:05:12 EDT



Stream/River Assessment

Feature Description 25 Feature Location 5



View of the stream at the crossing from left bank (meaning where the flagline, or centreline of the proposed road crosses the watercourse

Latitude:45.834183,Longitude:-80.624103,Altitude:192.1,Speed:0.10803334,Accuracy:1.8,Provider:gps,Time:05/07/2015 01:20:44 EDT

Surrounding Land Use

Forest,Wetland
Channel flowing between rock barrens and wetlands, flows from fen wetland upstream

Stream/River Assessment

Type of Watercourse	Permanent,Natural Channel			
	Channel flowing through wetlands from the northeast, east and south east direction. Riffle-run sequences. Gravel/sand/cobble/boulder substrate. Lots of aeration from riffles and input from a wetland to the northeast direction. Some fallen logs accross channel but not posing barriers to fish migration. Mean water depth is 0.20.			
Input Description	Water flowing into the channel from wetland northeast of survey area.			
Water Body Underground / Not As Mapped?	No			
Surrounding Land Topography	Surrounding topography sloping towards watercourse. Wetlands and rock barren surrounding site.			
In-Situ Water Quality				
WT (deg. C)	16.9	AT (degC)	16.2	Water Quality Notes Ph pen not measuring conductivity properly, even though calibrated this morning. Slightest yellow water tint.
pH	6.8	Cond. (s/cm)	4.00	
D.O. (mg/L)	7.3	Water Colour	Colourless	
Water Clarity	Clear			
Seepage Indicators	None			
Stream Morphology			Bank Stability	
Site Length (m)	100.00		Left Bank	2.20
Channel Dimensions			Right Bank	3.50
Mean Wetted Width (m)	2.20	Mean Wetted Depth (m)	0.15	Notes Banks well vegetated but some areas slumping has occurred from high flows.
Mean Bankfull Width (m)	3.50	Mean Bankfull Depth (m)	0.40	
Mean Top of Bank Width (m)	3.76	Mean Top of Bank Depth (m)	0.50	
Flow Description	Moderate flow through riffles and pools			
Habitat				
Substrate Description	Gravel dominate, sand, cobble, boulder			
Morphological Structure (%)				
Pool	Riffle	Run	Flat	
12.00	36.00	28.00	24.00	
Notes				

Execution Time

8/19/2015 12:09:29 PM

Filter Start Date 4/1/2015

Filter End Date 8/21/2015

Stream/River Assessment

Instream Cover

Woody Debris

Boulders

Cobble

Aquatic Vegetation

Structures

Total Instream Cover

Undercut Banks

Average Depth(m)

0.10

Percent Cover (%)

5.00

Aquatic Vegetation
Species Present

No aquatic species present

Canopy Cover

Percent Closed Cover (%)

90-
60%

Trees

50.00

Shrubs

40.00

Grasses

10.00

Herbaceous

Man Made

Other

Cover Description

large trees dominating most of stream cover, shrubs and some grasses

Left Bank Riparian Vegetation

no real riparian zone - forest and vegetation come right to the edge of the channel.

Right Bank Riparian Vegetation

no real riparian zone - forest and vegetation come right to the edge of the channel.

Overhanging
Vegetation (%)

None

Obstruction to Fish
Passage

Natural

Beaver dam downstream of 100m reach

Barrier Height (M)

1.5

Study Area Comments

Prime location to electrofish. Babbling brook with good substrate (gravel sand cobble boulder), riffle-pool sequences, good cover from tree and shrub canopy, cyprinids observed below bedrock barrier, above barrier habitat is accessible to fish from upstream. Channel flowing between wetlands from northeast, west and southeast areas.



Stream/River Assessment

Horizontal View of Channel



Stream/River Assessment

Site ID	WB-S-M39-8	Field Crew	Casey O'Driscoll Mike Godard	51
Study Area	WEC			
Location	WEC South			
Project Number	60341251	Air Temp. (degC)	17.0	Weather Notes
Tablet	AECOM5	Wind Speed (beaufort)	5	
Start Date	5/8/2015 10:31:02 AM	Precipitation	0	
End Date	5/8/2015 11:17:02 AM	Cloud Cover	10.00	
Upstream Endpoint	Latitude:45.818558,Longitude:-80.667289			
Downstream Endpoint	Latitude:45.818344,Longitude:-80.668055			

Stream/River Assessment

Site Features

Feature 258 Feature Location
Description

Beaver dam extending from south bank but 1-2m channel by north bank downstream of crossing	Latitude:45.818583,Longitude:-80.667874,Altitude:180.0,Speed:0.74594444,Accuracy:1.75,Provider:gps,Time:05/08/2015 10:33:35 EDT
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Feature 261 Feature Location
Description

Overview from south bank at crossing	Latitude:45.818635,Longitude:-80.667794,Altitude:183.8,Speed:0.015433333,Accuracy:1.75,Provider:gps,Time:05/08/2015 10:38:25 EDT
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Feature 264 Feature Location
Description

Looking upstream from crossing	Latitude:45.818644,Longitude:-80.667776,Altitude:184.2,Speed:0.030866666,Accuracy:1.75,Provider:gps,Time:05/08/2015 10:39:11 EDT
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Feature 267 Feature Location
Description

Looking downstream from crossing	Latitude:45.818678,Longitude:-80.667775,Altitude:184.0,Speed:0.051444445,Accuracy:1.75,Provider:gps,Time:05/08/2015 10:40:00 EDT
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Feature 270 Feature Location
Description

Riffle downstream of beaver dam	Latitude:45.818639,Longitude:-80.667926,Altitude:181.6,Speed:0.010288889,Accuracy:1.5,Provider:gps,Time:05/08/2015 11:03:53 EDT
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Surrounding Land Use

Forest

Mixed forest dominated by coniferous

Stream/River Assessment

Type of Watercourse	Permanent,Natural Channel
	Natural, low velocity watercourse. Natural meander. Good cover and riffle run pool sequences

Input Description	Overland flow
Water Body Underground / Not As Mapped?	No
Surrounding Land Topography	Rolling to the west. Steep heavily eroded banks to the east

In-Situ Water Quality				
WT (deg. C)	16.2	AT (degC)	17.0	Water Quality Notes
pH	6.6	Cond. (s/cm)	0.04	
D.O. (mg/L)	6.0	Water Colour	Yellow/Brown	
Water Clarity	Clear			

Seepage Indicators	None

Stream Morphology				Bank Stability	
Site Length (m)	100.00			Left Bank	4.50
Channel Dimensions				Right Bank	22.00
Mean Wetted Width (m)	4.50	Mean Wetted Depth (m)	0.15	Notes	Heavy erosion on right bank. Left bank more stabkle. Dominated by sandy soil
Mean Bankfull Width (m)	22.00	Mean Bankfull Depth (m)	0.75		
Mean Top of Bank Width (m)	26.00	Mean Top of Bank Depth (m)	2.20		

Flow Description	Low flow conditions
------------------	---------------------

Habitat	
Substrate Description	Sa cl cb

Morphological Structure (%)			
Pool	Riffle	Run	Flat
20.00	10.00	10.00	60.00
Notes			

Stream/River Assessment

Instream Cover

Woody Debris

Boulders

Cobble

Aquatic Vegetation

Structures

Total Instream Cover

Undercut Banks

Average Depth(m)

0.15

Percent Cover (%)

20.00

Aquatic Vegetation
Species Present

None present

Canopy Cover

Percent Closed Cover (%)

30-1%

Trees

Shrubs

Grasses

Herbaceous

Man Made

Other

Cover Description

Canopy cover was limited and consisted mainly of coniferous trees.

Left Bank Riparian Vegetation

1m Heavy beaver activity. Small shrubs observed.

Right Bank Riparian Vegetation

First 2m void of veg. After 2m mixed forest begins

Overhanging
Vegetation (%)

0.00

None observed

Obstruction to Fish
Passage

None Observed

Barrier Height (M)

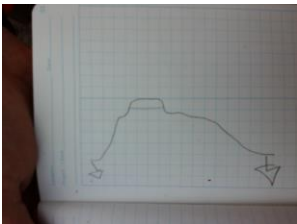
Study Area Comments

Natural pool, riffle, run sequence. Woody debris and undercut banks providing good cover. Overall suitable habitat for coolwater fish species. Old beaver dam observed on southern end of study area but was old and the water had broken through leaving a wide channel 1-2 m. Potential for study area to blow out above beaver dam. Creek Chub observed in run just downstream of beaver dam. Suggest alternate route.



Stream/River Assessment

Horizontal View of Channel



Stream/River Assessment

Site ID	WB-S-M30-11	Field Crew	Mike Godard Jessica Mendoza	57
Study Area	WEC			
Location	Small creek at bottom of large rock outcrop connecting a beaver dam and wetland			
Project Number	60341251	Air Temp. (degC)	4.0	Weather Notes
Tablet	AECOM1	Wind Speed (beaufort)	4	Rained the day before 20-30mm in the last 48 hours
Start Date	5/13/2015 10:02:09 AM	Precipitation	0	
End Date	5/13/2015 11:05:44 AM	Cloud Cover	10.00	
Upstream Endpoint	Latitude:45.839789,Longitude:-80.648154,Altitude:189.8,Speed:0.43213335,Accuracy:1.5,Provider:gps,Time:05/13/2015 10:58:14 EDT			
Downstream Endpoint	Latitude:45.840089,Longitude:-80.64905			

Stream/River Assessment

Site Features

Feature 345 Feature Location
Description

Facing north at crossing
Latitude:,Longitude:,Altitude:,Speed:,Accuracy:,Provider:,Time:



Feature 348 Feature Location
Description

Facing south at crossing
Latitude:,Longitude:,Altitude:,Speed:,Accuracy:,Provider:,Time:



Feature 351 Feature Location
Description

Facing east at crossing
Latitude:,Longitude:,Altitude:,Speed:,Accuracy:,Provider:,Time:



Feature 354 Feature Location
Description

Facing west at crossing
Latitude:,Longitude:,Altitude:,Speed:,Accuracy:,Provider:,Time:



Feature 357 Feature Location
Description

Downstream 50m of crossing looking downstream
Latitude:,Longitude:,Altitude:,Speed:,Accuracy:,Provider:,Time:



Feature 360 Feature Location
Description

Downstream 50m of crossing looking upstream
Latitude:,Longitude:,Altitude:,Speed:,Accuracy:,Provider:,Time:



Stream/River Assessment

Feature 363 Feature Location
Description

Upstream 50m of crossing looking upstream	Latitude:45.839881,Longitude:-80.648052,Altitude:189.6,Speed:0.30866668,Accuracy:1.5,Provider:gps,Time:05/13/2015 10:55:46 EDT
---	--



Feature 366 Feature Location
Description

Upstream 50 m of crossing at beaver dam looking downstream	Latitude:45.839789,Longitude:-80.648154,Altitude:189.8,Speed:0.43213335,Accuracy:1.5,Provider:gps,Time:05/13/2015 10:58:14 EDT
--	--



Feature 369 Feature Location
Description

Overview of beaver dam and creek from east rock outcrop	Latitude:45.839749,Longitude:-80.648186,Altitude:189.1,Speed:0.087455556,Accuracy:1.5,Provider:gps,Time:05/13/2015 11:00:42 EDT
---	---



Stream/River Assessment

Surrounding Land Use	Forest,Wetland			
	Water flows south to north draining beaver pond into a wetland. Rock outcrop steeply slopes to creek			
Type of Watercourse	Permanent,Natural Channel			
	Small creek with good flow, sandy bottom with good cover			
Input Description	Overland flow			
Water Body Underground / Not As Mapped?	No			
Surrounding Land Topography	Steep rock outcrop to the east, low lying land to the north and south, forest to the west			
In-Situ Water Quality				
WT (deg. C)	<input type="text" value="9.5"/>	AT (degC)	<input type="text" value="4.0"/>	Water Quality Notes No ysi data available for dissolved oxygen
pH	<input type="text" value="5.4"/>	Cond. (s/cm)	<input type="text" value="0.01"/>	
D.O. (mg/L)	<input type="text"/>	Water Colour	<input type="text" value="Colourless"/>	
Water Clarity	<input type="text" value="Clear"/>			
Seepage Indicators	<input type="text" value="None"/>			
<input type="text"/>				
Stream Morphology				
Site Length (m)	<input type="text" value="100.00"/>	Bank Stability		
Channel Dimensions	Left Bank		<input type="text" value="1.00"/>	
	Right Bank		<input type="text" value="2.50"/>	
Mean Wetted Width (m)	<input type="text" value="1.00"/>	Mean Wetted Depth (m)	<input type="text" value="0.20"/>	Notes Ferns and shrubs established but signs of erosion from overland flow
Mean Bankfull Width (m)	<input type="text" value="2.50"/>	Mean Bankfull Depth (m)	<input type="text"/>	
Mean Top of Bank Width (m)	<input type="text" value="40.00"/>	Mean Top of Bank Depth (m)	<input type="text"/>	
Flow Description	<input type="text" value="Average depth 0.2m. Stream slows down and more vegetated downstream"/>			
Habitat				
Substrate Description	<input type="text" value="Sa>dt>mk"/>			

Stream/River Assessment

Morphological Structure (%)

Pool	Riffle	Run	Flat
<input type="text"/>	<input type="text"/>	30.00	70.00

Notes	<input type="text"/>
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Instream Cover

Woody Debris	Boulders	Cobble	Aquatic Vegetation	Structures	Total Instream Cover
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Undercut Banks

Average Depth(m)	<input type="text" value="0.10"/>	Percent Cover (%)	<input type="text" value="5.00"/>
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Aquatic Vegetation Species Present	<input type="text" value="Wetland species present (grasses)"/>
------------------------------------	--

Canopy Cover

Percent Closed Cover (%)	<input type="text" value="90-60%"/>				
Trees	Shrubs	Grasses	Herbaceous	Man Made	Other
<input type="text" value="30.00"/>	<input type="text" value="70.00"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Cover Description	<input type="text" value="Pines and shrubs"/>
-------------------	---

Left Bank Riparian Vegetation

5m trees shrubs herbaceous plants (ferns) grasses
<input type="text"/>

Right Bank Riparian Vegetation

5m pines shrubs grasses herbaceous species
<input type="text"/>

Overhanging Vegetation (%)	<input type="text" value="10.00"/>
	<input type="text" value="Grasses"/>

Obstruction to Fish Passage	<input type="text" value="Natural"/>
	<input type="text" value="Beaver dam"/>

Barrier Height (M)	<input type="text" value="1.0"/>
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Stream/River Assessment

Study Area Comments

Small stream with potential to be habitat for cyprinids. Could be stagnant or slow moving during summer. Detritus may contribute to higher biologic oxygen demand. Potential culvert not likely to do much damage. This creek may be susceptible to beaver damming.



Horizontal View of Channel



Stream/River Assessment

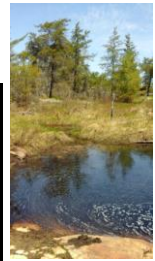
Site ID	WB-S-M17-29	Field Crew	Mike Godard Jessica Mendoza		60
Study Area	WEC				
Location	Large river flowing north east to south west				
Project Number	60341251	Air Temp. (degC)	9.0	Weather Notes	
Tablet	AECOM1	Wind Speed (beaufort)	4	20-30 mm rain in past 48 hours	
Start Date	5/13/2015 11:55:28 AM	Precipitation	0		
End Date	5/13/2015 12:45:17 PM	Cloud Cover	30.00		
Upstream Endpoint	Latitude:45.832743,Lngitude:-80.632377				
Downstream Endpoint	Latitude:45.832047,Longitude:-80.633193				

Stream/River Assessment

Site Features

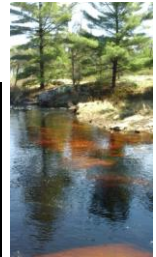
Feature 372 Feature Location
Description

Facing north at
centreline Latitude:45.832542,Longitude:-
80.632692,Altitude:186.8,Speed:0.010288889,Accuracy:2.1,Provider:gps,Time:05/13/2015
11:57:55 EDT



Feature 375 Feature Location
Description

Facing east at
centreline Latitude:45.832528,Longitude:-
80.632696,Altitude:186.8,Speed:0.03601111,Accuracy:1.8,Provider:gps,Time:05/13/2015
12:02:25 EDT



Feature 378 Feature Location
Description

Facing south
at centreline Latitude:45.832531,Longitude:-
80.632696,Altitude:186.8,Speed:0.020577777,Accuracy:1.8,Provider:gps,Time:05/13/2015
12:03:05 EDT



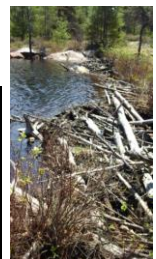
Feature 381 Feature Location
Description

Facing west at
centreline Latitude:45.832529,Longitude:-
80.632696,Altitude:187.3,Speed:0.020577777,Accuracy:2.1,Provider:gps,Time:05/13/2015
12:03:42 EDT



Feature 384 Feature Location
Description

Beaver dam
barrier
upstream Latitude:45.832826,Longitude:-
80.632509,Altitude:185.7,Speed:0.08231111,Accuracy:1.8,Provider:gps,Time:05/13/2015
12:05:16 EDT



Feature 387 Feature Location
Description

Bedrock
barrier Latitude:45.832335,Longitude:-
80.6329,Altitude:180.3,Speed:0.030866666,Accuracy:1.8,Provider:gps,Time:05/13/2015
12:07:25 EDT



Execution Time 8/19/2015 12:09:29 PM

Filter Start Date 4/1/2015

Filter End Date 8/21/2015

Stream/River Assessment

Feature 390 Feature Location
Description

Downstream 50 m looking downstream
Latitude:45.832326,Longitude:-80.632944,Altitude:180.7,Speed:0.14404444,Accuracy:1.8,Provider:gps,Time:05/13/2015 12:08:14 EDT



Feature 393 Feature Location
Description

Downstream 50 m looking upstream
Latitude:45.832042,Longitude:-80.63327,Altitude:183.1,Speed:0.0926,Accuracy:2.1,Provider:gps,Time:05/13/2015 12:09:42 EDT



Feature 396 Feature Location
Description

At crossing looking upstream
Latitude:45.832519,Longitude:-80.632769,Altitude:185.0,Speed:0.59675556,Accuracy:1.8,Provider:gps,Time:05/13/2015 12:11:45 EDT



Stream/River Assessment

Surrounding Land Use	Forest			
	Pine forest on rocky outcrops			
Type of Watercourse	Permanent,Natural Channel			
	Fast flowing water flowing from north-east to south-west over beaver dams and rocky ledges from pond into wetland then again into pond			
Input Description	Overland flow			
Water Body Underground / Not As Mapped?	No			
Surrounding Land Topography	Rolling bedrock irregular			
In-Situ Water Quality				
WT (deg. C)	11.4	AT (degC)	9.0	Water Quality Notes No ysi data available for dissolved oxygen
pH	6.1	Cond. (s/cm)	0.01	
D.O. (mg/L)		Water Colour	Yellow/Brown	
Water Clarity	Clear			
Seepage Indicators	None			
Stream Morphology				
Site Length (m)	100.00	Bank Stability		
Channel Dimensions		Left Bank	12.00	
		Right Bank	30.00	
Mean Wetted Width (m)	12.00	Mean Wetted Depth (m)	0.80	Notes Bedrock banks
Mean Bankfull Width (m)	30.00	Mean Bankfull Depth (m)	1.00	
Mean Top of Bank Width (m)	30.00	Mean Top of Bank Depth (m)	1.20	
Flow Description	High flow over ledges / dams into deep ponds with strong current			
Habitat				
Substrate Description	Bedrock>bo>si>gr			

Stream/River Assessment

Morphological Structure (%)

Pool

Riffle

Run

Flat

10.00

10.00

80.00

Notes

Instream Cover

Woody Debris

Boulders

Cobble

Aquatic Vegetation

Structures

Total Instream Cover

Undercut Banks

Average Depth(m)

0.05

Percent Cover (%)

5.00

Aquatic Vegetation
Species Present

None present

Canopy Cover

Percent Closed Cover (%)

30-1%

Trees

Shrubs

Grasses

Herbaceous

Man Made

Other

Cover Description

Pine trees

Left Bank Riparian Vegetation

>5 m grasses shrubs pines

Right Bank Riparian Vegetation

>5m grasses shrubs pines

Overhanging
Vegetation (%)

5.00

Grasses

Obstruction to Fish
Passage

Natural

Beaver damming upstream and bedrock ledge downstream

Barrier Height (M)

1.0

Stream/River Assessment

Study Area Comments

Beaver pond drainage over bedrock into downstream pond. At time of assessment, high flows from recent precipitation not indicative of base flows. Water is known to slow during warmer months with sediment observed in pool areas. Not recommended for road crossing due to potential flood risk and risk of increased downstream sedimentation.



Horizontal View of Channel



Stream/River Assessment

Site ID	WB-N-M35-1	Field Crew	Amy Ingriselli Ami Arsenault		63
Study Area	WEC				
Location	Wind centre map 35				
Project Number	60341251	Air Temp. (degC)	15.0	Weather Notes	
Tablet	AECOM16	Wind Speed (beaufort)	4		
Start Date	5/14/2015 3:22:24 PM	Precipitation	0		
End Date	5/14/2015 4:22:34 PM	Cloud Cover	0.00		
Upstream Endpoint	Latitude:45.858495,Longitude:-80.680394				
Downstream Endpoint	Latitude:45.857734,Longitude:-80.679775				

Stream/River Assessment

Site Features

Feature 51 Feature Location
Description 0

Facing
downstream
south from
approximately
30 m
downstream
of CL to
downstream
marsh
meadow

Latitude:45.857963,Longitude:-
80.679552,Altitude:181.3,Speed:0.010288889,Accuracy:1.25,Provider:gps,Time:05/14/2015 04:00:29 EDT



Feature 51 Feature Location
Description 3

Facing
downstream
from CL

Latitude:45.858093,Longitude:-
80.679918,Altitude:188.3,Speed:0.020577777,Accuracy:1.5,Provider:gps,Time:05/14/2015 04:12:29 EDT



Feature 516 Feature Location
Description

Facing US
from CL

Latitude:45.858093,Longitude:-
80.679922,Altitude:188.2,Speed:0.0463,Accuracy:1.5,Provider:gps,Time:05/14/2015 04:13:09 EDT



Feature 51 Feature Location
Description 9

Facing US
from 10m US
of CL

Latitude:45.858124,Longitude:-
80.679996,Altitude:186.7,Speed:0.010288889,Accuracy:1.5,Provider:gps,Time:05/14/2015 04:16:30 EDT



Feature 522 Feature Location
Description

Across
watercourse at
centreline

Latitude:45.858143,Longitude:-
80.680021,Altitude:188.3,Speed:0.0463,Accuracy:1.5,Provider:gps,Time:05/14/2015 04:17:39 EDT



Stream/River Assessment

Surrounding Land Use	Forest,Wetland			
	Watercourse bordered by bedrock slopes. Fen wetlands downstream and upstream from study area where bedrock widens			
Type of Watercourse	Permanent			
	Water from fen US concentrated where bedrock slopes narrow in study area. Another fen downstream where bordering bedrock widens. In study area standing water, vegetated between bedrock with slow flowing small channel in thalweg.			
Input Description	Flow/input from upstream wetland			
Water Body Underground / Not As Mapped?	No			
Surrounding Land Topography	Bedrock sloping towards watercourse			
In-Situ Water Quality				
WT (deg. C)	16.7	AT (degC)	15.0	Water Quality Notes Questionable readings from conductivity meter. pH from ysi and pH pen are consistent
pH	3.7	Cond. (s/cm)	0.01	
D.O. (mg/L)	7.9	Water Colour	Colourless	
Water Clarity	Clear			
Seepage Indicators	None			
Stream Morphology				
Site Length (m)	100.00	Bank Stability		
Channel Dimensions		Left Bank	15.00	
		Right Bank	16.00	
Mean Wetted Width (m)	15.00	Mean Wetted Depth (m)	0.50	Notes Bedrock
Mean Bankfull Width (m)	16.00	Mean Bankfull Depth (m)	1.00	
Mean Top of Bank Width (m)		Mean Top of Bank Depth (m)		
Flow Description	Wetted area standing water between bedrock with active channel: slow flow as flats, I thalweg. No top of bank; no defined channel, water fom wetland concentrated between bedrock. Mean depth in active channel 1m, mean overall 0.5.			
Habitat				
Substrate Description	Detritus, bedrock			

Stream/River Assessment

Morphological Structure (%)

Pool

Riffle

Run

Flat

20.00

80.00

Notes

Instream Cover

Woody Debris

Boulders

Cobble

Aquatic Vegetation

Structures

Total Instream Cover

Undercut Banks

Average Depth(m)

Percent Cover (%)

Aquatic Vegetation
Species Present

Submergent grass, algae. Emergent grasses, sedges. Significant cover provided by water-tolerant terrestrial fen vegetation such as ferns, grasses and leatherleaf.

Canopy Cover

Percent Closed Cover (%)

60-
30%

Trees

Shrubs

Grasses

Herbaceous

Man Made

Other

35.00

55.00

10.00

Cover Description

Not significant now, but when fen shrubs leaf out, will provide shade.

Left Bank Riparian Vegetation

Riparian is bedrock with conifers on both banks. Wetland shrubs in wetted width include sweet gale, leatherleaf, grasses, ferns. Mean ~2 m in vicinity of CL. 30-50 m US of CL and 20-30 m DS of CL channel bordered by approximately mean 10 m of shore fen

Right Bank Riparian Vegetation

Same as left bank

Overhanging
Vegetation (%)

80.00

Sweet gale, leatherleaf, ferns

Obstruction to Fish
Passage

None Observed

Barrier Height (M)

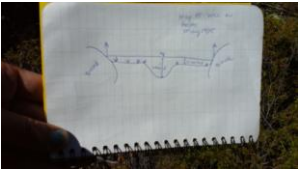
Stream/River Assessment

Study Area Comments

N/A



Horizontal View of Channel



Stream/River Assessment

Site ID	WB-N-M28-16	Field Crew	Amy Ingriselli Jessica Mendoza	138
Study Area	WEC			
Location	North map 28 near turbine 101. Crossing CL just downstream of open water beaver pond and dam			
Project Number	60341251	Air Temp. (degC)	12.0	Weather Notes
Tablet	AECOM4	Wind Speed (beaufort)	5	
Start Date	5/19/2015 9:59:23 AM	Precipitation	0	
End Date	5/19/2015 11:08:57 AM	Cloud Cover	100.00	
Upstream Endpoint	Latitude:45.867458,Longitude:-80.664366			
Downstream Endpoint	Latitude:45.866672,Longitude:-80.663685			

Stream/River Assessment

Site Features

Feature 540 Feature Location
Description

Facing downstream from CL
Latitude:45.866865,Longitude:-80.664,Altitude:180.0,Speed:0.11317778,Accuracy:1.8,Provider:gps,Time:05/19/2015 10:32:37 EDT



Feature 54 Feature Location
Description 3

Looking across watercourse at CL
Latitude:45.866995,Longitude:-80.664211,Altitude:178.8,Speed:0.010288889,Accuracy:1.8,Provider:gps,Time:05/19/2015 10:33:49 EDT



Feature 54 Feature Location
Description 6

View of stream with habitat at CL
Latitude:45.867026,Longitude:-80.664159,Altitude:178.3,Speed:0.030866666,Accuracy:1.8,Provider:gps,Time:05/19/2015 10:34:47 EDT



Feature 54 Feature Location
Description 9

Beaver dam ~15m US of CL
Latitude:45.867248,Longitude:-80.664281,Altitude:177.5,Speed:0.37554446,Accuracy:1.8,Provider:gps,Time:05/19/2015 10:37:11 EDT



Feature 55 Feature Location
Description 2

Looking US from beaver dam
Latitude:45.86728,Longitude:-80.663962,Altitude:180.4,Speed:0.025722222,Accuracy:1.8,Provider:gps,Time:05/19/2015 10:38:33 EDT



Surrounding Land Use

Forest,Wetland

Open water beaver pond just upstream of crossing CL. Bordered by sloping bedrock

Execution Time 8/19/2015 12:09:29 PM

Filter Start Date 4/1/2015

Filter End Date 8/21/2015

Stream/River Assessment

Type of Watercourse	Permanent			
	Watercourse between bedrock dammed by beavers. Upstream of CL is open water pond. Downstream and at CL is wet floating mat and hummocks of vegetation, open water is scarce to none			
Input Description	Online and overland			
Water Body Underground / Not As Mapped?	No			
Surrounding Land Topography	Bedrock sloping on both banks to watercourse			
In-Situ Water Quality				
WT (deg. C)	16.7	AT (degC)	12.0	Water Quality Notes
pH	5.0	Cond. (s/cm)	0.01	
D.O. (mg/L)	7.1	Water Colour	Yellow/Brown	
Water Clarity	Clear			
Seepage Indicators	None			
Stream Morphology				
Site Length (m)	55.00	Bank Stability		
Channel Dimensions		Left Bank	25.00	
		Right Bank	26.00	
Mean Wetted Width (m)	25.00	Mean Wetted Depth (m)		Notes Bedrock
Mean Bankfull Width (m)	26.00	Mean Bankfull Depth (m)		
Mean Top of Bank Width (m)	26.00	Mean Top of Bank Depth (m)		
Flow Description	From ~5m upstream of CL downstream for 50m: Stagnant, saturated floating mat of vegetation with occasional small pool and water seeping through beaver dams.			
Habitat				
Substrate Description	Detritus, bedrock			
Morphological Structure (%)				
Pool	Riffle	Run	Flat	
			100.00	
Notes				

Stream/River Assessment

Instream Cover

Woody Debris

Boulders

Cobble

Aquatic Vegetation

Structures

Total Instream Cover

Undercut Banks

Average Depth(m)

Percent Cover (%)

Aquatic Vegetation
Species Present

At crossing only emergent sedges for aquatic vegetation. Most of vegetation is water-tolerant terrestrial/wetland species such as grasses, speckled alder, large cranberry, Sphagnum moss. In pond upstream: watershield, grasses.

Canopy Cover

Percent Closed Cover (%)

60-30%

Trees

Shrubs

Grasses

Herbaceous

Man Made

Other

Cover Description

At crossing mostly floating mats and hummocks of aquatic vegetation

Left Bank Riparian Vegetation

0.5m grasses, ferns, trees on bedrock

Right Bank Riparian Vegetation

Same as LB

Overhanging
Vegetation (%)

40.00

Grasses and shrubs on floating mat

Obstruction to Fish
Passage

Natural

Beaver dams and low flow barrier downstream of dams impeding fish passage, but cyprinids observed in pool between 2 dams. Therefore, fish may access downstream habitat during high flow periods

Barrier Height (M)

1.0

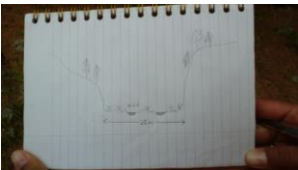
Study Area Comments

CL is approximately 15m downstream of significant beaver pond. Suggest moving crossing further downstream where narrow, marsh/floating mat habitat between bedrock is more suitable to cross than pond. Cyprinids observed in pool between beaver dams. Assessment area focuses on habitat within area of impact below beaver dam.



Stream/River Assessment

Horizontal View of Channel



Stream/River Assessment

Site ID	WB-N-M26-31	Field Crew	Amy Ingriselli Jessica Mendoza		144
Study Area	WEC				
Location	Small channel between bedrock outcrops connecting fen channel upstream to henvey inlet downstream. Downstream water channel becomes more defined				
Project Number	60341251	Air Temp. (degC)	13.0	Weather Notes	
Tablet	AECOM4	Wind Speed (beaufort)	5	Overcast day	
Start Date	5/19/2015 12:20:50 PM	Precipitation	0		
End Date	5/19/2015 1:35:08 PM	Cloud Cover	100.00		
Upstream Endpoint	Latitude:45.856181,Longitude:-80.653020				
Downstream Endpoint	Latitude:45.855507,Longitude:-80.652110				

Stream/River Assessment

Site Features

Feature 555 Feature Location
Description

Looking
upstream from
crossing location

Latitude:,Longitude:,Altitude:,Speed:,Accuracy:,Provider:,Time:



Feature 558 Feature Location
Description

Looking
downstream
from crossing
location

Latitude:,Longitude:,Altitude:,Speed:,Accuracy:,Provider:,Time:



Feature 561 Feature Location
Description

Looking at the
left bank at the
centre line from
the right bank

Latitude:,Longitude:,Altitude:,Speed:,Accuracy:,Provider:,Time:



Feature 564 Feature Location
Description

Looking at the
right bank at the
centre line from
the left bank

Latitude:,Longitude:,Altitude:,Speed:,Accuracy:,Provider:,Time:



Feature 567 Feature Location
Description

Overview of
channel
downstream of
crossing on left
bank looking
upstream

Latitude:,Longitude:,Altitude:,Speed:,Accuracy:,Provider:,Time:



Feature 570 Feature Location
Description

Facing
downstream of
crossing
approximately
25m where
bedrock ledge

Latitude:,Longitude:,Altitude:,Speed:,Accuracy:,Provider:,Time:



Execution Time 8/19/2015 12:09:29 PM

Filter Start Date 4/1/2015

Filter End Date 8/21/2015

Stream/River Assessment

and strong
channelization
occurs

Surrounding Land
Use

Forest,Wetland

Mixed deciduous coniferous forest and rolling bedrock

Stream/River Assessment

Type of Watercourse	Permanent,Channelized,Natural Channel			
	Connects fen upstream to Henvey Inlet. One main channel flowing through saturated marsh between bedrock.			
Input Description	Overland flow, fen upstream			
Water Body Underground / Not As Mapped?	No			
Surrounding Land Topography	Bedrock outcrops slope toward water course from east and west			
In-Situ Water Quality				
WT (deg. C)	13.7	AT (degC)	13.0	Water Quality Notes
pH	4.0	Cond. (s/cm)	0.01	
D.O. (mg/L)	5.7	Water Colour	Yellow/Brown	
Water Clarity	Clear			
Seepage Indicators	None			
Stream Morphology				
Site Length (m)	70.00	Bank Stability		
Channel Dimensions		Left Bank	0.25	
		Right Bank	23.00	
Mean Wetted Width (m)	0.25	Mean Wetted Depth (m)	0.23	Notes Stabilized by grasses
Mean Bankfull Width (m)	23.00	Mean Bankfull Depth (m)		
Mean Top of Bank Width (m)	23.00	Mean Top of Bank Depth (m)		
Flow Description	Moderate flow no stagnant poolsDepth of channel 0.17m			
Habitat				
Substrate Description	Detritus, muck, silt dominant upstream and at centre lineDownstream bedrock gravel and sand dominant			
Morphological Structure (%)				
Pool	Riffle	Run	Flat	
	2.00	98.00		
Notes				

Stream/River Assessment

Instream Cover

Woody Debris

Boulders

Cobble

Aquatic Vegetation

Structures

Total Instream Cover

Undercut Banks

Average Depth(m)

0.25

Percent Cover (%)

5.00

Aquatic Vegetation
Species Present

Narrow emergents and grasses, water-tolerant terrestrial grasses

Canopy Cover

Percent Closed Cover (%)

100-
90%

Trees

Shrubs

10.00

Grasses

90.00

Herbaceous

Man Made

Other

Cover Description

Grasses (mainly) and shrubs will completely cover water course

Left Bank Riparian Vegetation

11m grasses shrubs and sedges

Right Bank Riparian Vegetation

11m grasses shrubs and sedges

Overhanging
Vegetation (%)

100.00

Grasses

Obstruction to Fish
Passage

Natural

Natural bedrock ledge downstreamLow flow during warm periods, velocity barrier over bedrock slope in high flows

Barrier Height (M)

0.3

Study Area Comments

Creek flowing north to south between two bedrock outcrops could be habitat for tolerant cyprinids (i.e. central mudminnow). Surrounding riparian zone can be inundated and may provide more habitat for amphibians. Wildlife observed: caterpillar nests, Common Yellowthroat. Poor or no accessibility for fish from Henvey Inlet



Stream/River Assessment

Horizontal View of Channel



Stream/River Assessment

Site ID	WB-N-M26-21	Field Crew	Amy Ingriselli Jessica Mendoza		75
Study Area	WEC				
Location	WEC north near turbine 91 approximately 100m upstream from outlet to Henvey Inlet				
Project Number	60341251	Air Temp. (degC)	14.0	Weather Notes	
Tablet	AECOM4	Wind Speed (beaufort)	5		
Start Date	5/19/2015 2:02:43 PM	Precipitation	0		
End Date	5/19/2015 3:04:48 PM	Cloud Cover	100.00		
Upstream Endpoint	Latitude:45.857530,Longitude:-80.645220				
Downstream Endpoint	Latitude:45.856809,Longitude:-80.644437				

Stream/River Assessment

Site Features

Feature 57 Feature Location
Description 3

Looking
across
watercourse
at CL facing
east

Latitude:45.857233,Longitude:-
80.644918,Altitude:171.4,Speed:0.025722222,Accuracy:1.5,Provider:gps,Time:05/19/20
15 02:15:35 EDT



Feature 57 Feature Location
Description 6

Looking
upstream from
CL

Latitude:45.857245,Longitude:-
80.644839,Altitude:174.6,Speed:0.066877775,Accuracy:2.0,Provider:gps,Time:05/19/20
15 02:21:19 EDT



Feature 57 Feature Location
Description 9

Facing
downstream
from CL

Latitude:45.857246,Longitude:-
80.644846,Altitude:174.4,Speed:0.015433333,Accuracy:2.0,Provider:gps,Time:05/19/20
15 02:22:22 EDT



Feature 58 Feature Location
Description 2

Breached
beaver dam
approximately
75 m
upstream of
CL. Not a
barrier at this
time but fresh
beaver activity
was observed
(freshly
gnawed
shrubs) facing
upstream from
60m US of CL

Latitude:45.857793,Longitude:-
80.64559,Altitude:170.5,Speed:0.066877775,Accuracy:1.8,Provider:gps,Time:05/19/20
15 02:47:46 EDT



Stream/River Assessment

Feature Description 58 Feature Location 5



Facing downstream from approximately 60m upstream of CL	Latitude:45.857647,Longitude:-80.645403,Altitude:177.0,Speed:0.07202222,Accuracy:1.5,Provider:gps,Time:05/19/2015 02:58:58 EDT
---	--

Surrounding Land Use	Forest
	Steep bedrock sloping towards channel
Type of Watercourse	Permanent,Channelized
	Watercourse of slow-moving flats between steep bedrock slopes, flowing to Henvey Inlet from marsh upstream

Stream/River Assessment

Input Description	Online from upstream marsh		
Water Body Underground / Not As Mapped?	Na		
Surrounding Land Topography	Steep sloping bedrock to waterbody with mainly coniferous forest		

In-Situ Water Quality				
WT (deg. C)	<input type="text" value="14.7"/>	AT (degC)	<input type="text" value="14.0"/>	Water Quality Notes <div></div>
pH	<input type="text" value="5.0"/>	Cond. (s/cm)	<input type="text" value="0.02"/>	
D.O. (mg/L)	<input type="text" value="6.8"/>	Water Colour	<input type="text" value="Yellow/Brown"/>	
Water Clarity	<input type="text" value="Clear"/>			

Seepage Indicators	<input type="text" value="None"/>
	<div></div>

Stream Morphology		Bank Stability		
Site Length (m)	<input type="text" value="100.00"/>	Left Bank	<input type="text" value="8.50"/>	
Channel Dimensions		Right Bank	<input type="text" value="5.00"/>	
Mean Wetted Width (m)	<input type="text" value="8.50"/>	Mean Wetted Depth (m)	<input type="text" value="2.00"/>	Notes Bedrock on right bank, bedrock and riparian shrubs on left
Mean Bankfull Width (m)	<input type="text" value="5.00"/>	Mean Bankfull Depth (m)	<input type="text"/>	
Mean Top of Bank Width (m)	<input type="text" value="5.00"/>	Mean Top of Bank Depth (m)	<input type="text"/>	

Flow Description	Flow conditions higher than typical. Wetted width over bankfull, flooded riparian shrubs and obvious inflection point under ~0.5m of water
------------------	--

Habitat	
Substrate Description	Silt, bedrock, detritus, clay, sand

Morphological Structure (%)			
Pool	Riffle	Run	Flat
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text" value="100.00"/>
Notes	<div></div>		

Stream/River Assessment

Instream Cover

Woody Debris

Boulders

Cobble

Aquatic Vegetation

Structures

Total Instream Cover

Undercut Banks

Average Depth(m)

Percent Cover (%)

Aquatic Vegetation
Species Present

Narrow emergent present but sparse

Canopy Cover

Percent Closed Cover (%)

90-
60%

Trees

Shrubs

Grasses

Herbaceous

Man Made

Other

Cover Description

Overhanging riparian speckled alder and conifers

Left Bank Riparian Vegetation

Grasses and speckled alder, 2m

Right Bank Riparian Vegetation

Bedrock. Riparian vegetation scarce (speckled alder) 0.5m

Overhanging
Vegetation (%)

40.00

Mainly riparian speckled alder and some conifers

Obstruction to Fish
Passage

None Observed

No barrier at this time but breached beaver dam was observed with evidence of recent beaver activity. Recorded barrier height is of breached dam.

Barrier Height (M)

1.0

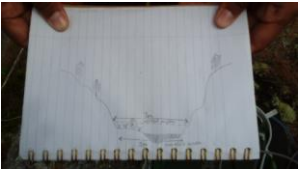
Study Area Comments

Previously breached beaver pond approximately 80m upstream with abundant grasses plus marsh observed on air photo upstream may be spawning habitat for Esocids. Potential spawning habitat not likely to be impacted by proposed road but access to this habitat should be maintained. Water was high and over bankfull. Suitable spawning habitat for Esocids approximately 100 m upstream of centreline of proposed road. Watercourse not wadeable, mean depth is an estimate.






Stream/River Assessment

Horizontal View of Channel



Stream/River Assessment

Site ID	WB-N-M12-12	Field Crew	Amy Ingriselli Jessica Mendoza	78
Study Area	WEC			
Location	WEC north map 12. Near turbine 31			
Project Number	60341251	Air Temp. (degC)	13.0	Weather Notes
Tablet	AECOM4	Wind Speed (beaufort)	4	
Start Date	5/20/2015 11:49:58 AM	Precipitation	0	
End Date	5/20/2015 12:41:41 PM	Cloud Cover	0.00	
Upstream Endpoint	Latitude:45.869473,Longitude:-80.617932			
Downstream Endpoint	Latitude:45.868799,Longitude:-80.618423			
Site Features				
Feature 615 Feature Location Description				
At crossing looking upstream	Latitude:45.869216,Longitude:-80.618411,Altitude:186.6,Speed:0.24693333,Accuracy:2.1,Provider:gps,Time:05/20/2015 11:55:04 EDT			
Feature 618 Feature Location Description				
At crossing looking downstream	Latitude:45.869216,Longitude:-80.618409,Altitude:186.5,Speed:0.030866666,Accuracy:2.1,Provider:gps,Time:05/20/2015 11:55:53 EDT			
Feature 621 Feature Location Description				
Looking upstream from 50 m downstream of crossing	Latitude:45.868955,Longitude:-80.618663,Altitude:184.1,Speed:0.0051444443,Accuracy:2.1,Provider:gps,Time:05/20/2015 12:26:59 EDT			
Surrounding Land Use	Forest			
	Mixed coniferous deciduous forest			
Type of Watercourse	Permanent,Natural Channel			
	Creek with old beaver dams between two large rock outcrops			

Stream/River Assessment

Input Description	Overland flow		
Water Body Underground / Not As Mapped?	No		
Surrounding Land Topography	Rolling bedrock towards water course		

In-Situ Water Quality				
WT (deg. C)	10.0	AT (degC)	13.0	Water Quality Notes Lots of detritus and lack of flow will probably contribute to low bod
pH	4.4	Cond. (s/cm)	0.01	
D.O. (mg/L)	4.0	Water Colour	Yellow/Brown	
Water Clarity	Clear			

Seepage Indicators	None

Stream Morphology		Bank Stability		
Site Length (m)	100.00	Left Bank	1.00	
Channel Dimensions		Right Bank	2.00	
Mean Wetted Width (m)	1.00	Mean Wetted Depth (m)	0.40	Notes Vegetated banks with no exposed soils
Mean Bankfull Width (m)	2.00	Mean Bankfull Depth (m)		
Mean Top of Bank Width (m)	2.00	Mean Top of Bank Depth (m)		

Flow Description	Low Flow. Max pool depth 0.57m
------------------	--------------------------------

Habitat	
Substrate Description	Detritus muck silt

Morphological Structure (%)			
Pool	Riffle	Run	Flat
50.00			50.00
Notes			

Stream/River Assessment

Instream Cover

Woody Debris

Boulders

Cobble

Aquatic Vegetation

Structures

Total Instream Cover

Undercut Banks

Average Depth(m)

Percent Cover (%)

Aquatic Vegetation
Species Present

None, vegetation is grasses (emergent and terrestrial)

Canopy Cover

Percent Closed Cover (%)

90-
60%

Trees

Shrubs

Grasses

Herbaceous

Man Made

Other

Cover Description

Shade provided mostly be trees in overstory

Left Bank Riparian Vegetation

5m trees shrubs grasses herbaceous plants

Right Bank Riparian Vegetation

Same as lb

Overhanging
Vegetation (%)

30.00

Trees deciduous and coniferous

Obstruction to Fish
Passage

Natural

Five beaver dams well established (old) and low flow barrier upstream; limiting water flow and obstructing fish passage

Barrier Height (M)

2.0

Study Area Comments

Water seeping through dams but at very low flow. Some points channel is dry upstream. Water must be seeping through boulders. Frog sighted and grouse heard.



Stream/River Assessment

Horizontal View of Channel



Stream/River Assessment

Site ID	WB-N-M12-12-2	Field Crew	Amy Ingriselli Jessica Mendoza	243
Study Area	WEC			
Location	WEC north map 12 near turbine 31			
Project Number	60341251	Air Temp. (degC)	14.0	Weather Notes
Tablet	AECOM4	Wind Speed (beaufort)	4	
Start Date	5/20/2015 1:03:27 PM	Precipitation	0	
End Date	5/20/2015 2:30:21 PM	Cloud Cover	0.00	
Upstream Endpoint	Latitude:45.869379,Longitude:-80.617243			
Downstream Endpoint	Latitude:45.868704,Longitude:-80.618145			

Stream/River Assessment

Site Features

Feature 62 Feature Location
Description 4

Stream at crossing facing southeast
Latitude:45.869137,Longitude:-80.617623,Altitude:183.7,Speed:0.051444445,Accuracy:2.4,Provider:gps,Time:05/20/2015 01:20:18 EDT



Feature 62 Feature Location
Description 7

Facing US from crossing
Latitude:45.869088,Longitude:-80.617759,Altitude:181.7,Speed:0.39612222,Accuracy:2.1,Provider:gps,Time:05/20/2015 01:21:38 EDT



Feature 63 Feature Location
Description 0

Facing DS from crossing
Latitude:45.869037,Longitude:-80.617823,Altitude:180.6,Speed:0.31895554,Accuracy:2.1,Provider:gps,Time:05/20/2015 01:22:14 EDT



Feature 633 Feature Location
Description

Bedrock drop/falls slope barrier to fish passage. Photo taken from DS of crossing.
Latitude:45.86888,Longitude:-80.617921,Altitude:182.2,Speed:0.1389,Accuracy:1.8,Provider:gps,Time:05/20/2015 01:33:14 EDT



Feature 63 Feature Location
Description 6

Looking US from 50m DS of crossing
Latitude:45.868835,Longitude:-80.617966,Altitude:182.1,Speed:0.10803334,Accuracy:2.1,Provider:gps,Time:05/20/2015 01:46:21 EDT



Stream/River Assessment

Feature 63 Feature Location
Description 9



Input from watercourse at WB-N-M12-12	Latitude:45.868832,Longitude:-80.617957,Altitude:181.9,Speed:0.066877775,Accuracy:1.8,Provider:gps,Time:05/20/2015 01:47:28 EDT
---------------------------------------	---

Feature 64 Feature Location
Description 2



Looking upstream from ~20 US of crossing	Latitude:45.869007,Longitude:-80.617886,Altitude:182.0,Speed:0.45785555,Accuracy:2.1,Provider:gps,Time:05/20/2015 02:29:20 EDT
--	--

Stream/River Assessment

Surrounding Land Use	Forest,Meadow			
	Rolling bedrock and meadow downstream			
Type of Watercourse	Permanent,Natural Channel			
	Channel flowing from beaver pond between bedrock outcrops and through meadow			
Input Description	Online, overland			
Water Body Underground / Not As Mapped?	Crossing was not identified as a site to be assessed. It was observed in the field and added as a site.			
Surrounding Land Topography	At crossing sloping bedrock to channel. Downstream the is channel flows through meadow which appears to have formerly been beaver pond (has dried since a dam breach).			
In-Situ Water Quality				
WT (deg. C)	12.2	AT (degC)	15.0	Water Quality Notes
pH	5.0	Cond. (s/cm)	0.01	
D.O. (mg/L)	8.9	Water Colour	Colourless	
Water Clarity	Clear			
Seepage Indicators	None			
Stream Morphology				
Site Length (m)	30.00	Bank Stability		
Channel Dimensions	Left Bank		1.50	
	Right Bank		2.30	
Mean Wetted Width (m)	1.50	Mean Wetted Depth (m)	0.25	Notes Vegetated, boulder and bedrock
Mean Bankfull Width (m)	2.30	Mean Bankfull Depth (m)		
Mean Top of Bank Width (m)	2.80	Mean Top of Bank Depth (m)		
Flow Description	Section is from 10m US from CL to 15m dS of CL. Moderate flow below bankfull from breached beaver dam			
Habitat				
Substrate Description	Sand gravel bedrock detritus			

Stream/River Assessment

Morphological Structure (%)

Pool	Riffle	Run	Flat
20.00	30.00	30.00	20.00

Notes

Instream Cover

Woody Debris	Boulders	Cobble	Aquatic Vegetation	Structures	Total Instream Cover

Undercut Banks

Average Depth(m) 0.15 Percent Cover (%) 20.00

Aquatic Vegetation
Species Present

Horsetail, algae, grasses

Canopy Cover

Percent Closed Cover (%) 90-60%

Trees	Shrubs	Grasses	Herbaceous	Man Made	Other
40.00	20.00	30.00	10.00		

Cover Description

Overhanging trees and riparian shrubs around CL, overhanging. Grasses in meadow

Left Bank Riparian Vegetation

2 m at crossing. Raspberry speckled alder present

Right Bank Riparian Vegetation

1.5m at crossing. Honeysuckle speckled alder hard maple

Overhanging
Vegetation (%)

50.00

At CL and 15m Us and DS riparian vegetation is shrubs and trees as described in left and right banks fields. 30-50m DS is of crossing is meadow with dense overhanging grasses. 20-50m US is pond

Obstruction to Fish
Passage

Natural

Vertical bedrock drop just DS of CL. 3 beaver dams all breached or in poor. Condition, not restricting passage.

Barrier Height (M)

2.0

Stream/River Assessment

Study Area Comments




Site was added, not previously identified by field map



Horizontal View of Channel



Stream/River Assessment

Site ID	WB-N-M12-12-2	Field Crew	Ashley Minion Kalynn Parrott	84
Study Area	WEC			
Location	WEC North			
Project Number	60341251	Air Temp. (degC)	17.0	Weather Notes
Tablet	AECOM17	Wind Speed (beaufort)	2	Partly cloudy with sun, slight breeze
Start Date	5/26/2015 8:40:24 AM	Precipitation	0	
End Date	5/26/2015 9:45:11 AM	Cloud Cover	70.00	
Upstream Endpoint	Latitude:45.869426,Longitude:-80.617160			
Downstream Endpoint	Latitude:45.868777,Longitude:-80.618063			
Site Features				
Feature Description	696 Feature Location			
Waterfall creating barrier to fish moving us. Approximately 3m in height. Cobble, rock and log at base of waterfall. Pool at base of waterfall. High velocity.	Latitude:45.868829,Longitude:-80.618039,Altitude:186.8,Speed:0.025722222,Accuracy:1.75,Provider:gps,Time:05/26/2015 08:48:00 EDT			
Feature Description	699 Feature Location			
Pool upstream of waterfall. Large rock outcrops on both sides of stream bank. Substrate woody debris, detritus and some rock.	Latitude:45.868977,Longitude:-80.617774,Altitude:187.3,Speed:0.6945,Accuracy:1.75,Provider:gps,Time:05/26/2015 09:07:24 EDT			
Feature Description	702 Feature Location			
Looking US from US site limit.	Latitude:45.868804,Longitude:-80.618005,Altitude:171.4,Speed:0.14918889,Accuracy:1.75,Provider:gps,Time:05/26/2015 09:47:55 EDT			

Stream/River Assessment

Feature 705 Feature Location
Description

Looking DS
from DS site
limit.

Latitude:45.86882,Longitude:-
80.618108,Altitude:178.7,Speed:1.1112,Accuracy:1.5,Provider:gps,Time:05/26/2015
09:53:40 EDT



Surrounding Land
Use

Forest

Mixed deciduous forest, beaver dam and wet meadow

Type of Watercourse

Permanent

Fast flowing creek, wetted width 45 cm wide. Water depth avg 30 cm. Aquatic macrophytes, grasses. Riparian veg, grasses. Upstream, approximately 15% canopy cover. Substrate: gravel, cobble and sand. Minimal woody debris downstream of falls, approximately 70% upstream. Depth avg 20 cm

Input Description

Tributary to Henvy Inlet (Georgian Bay). Some overland flow.

Water Body
Underground / Not As
Mapped?

No

Surrounding Land
Topography

Rock outcrop valley, upstream fen.

Execution Time

8/19/2015 12:09:29 PM

Filter Start Date 4/1/2015

Filter End Date 8/21/2015

Stream/River Assessment

In-Situ Water Quality

WT (deg. C)	<input type="text" value="6.0"/>	AT (degC)	<input type="text" value="17.0"/>	Water Quality Notes <div></div>
pH	<input type="text" value="6.8"/>	Cond. (s/cm)	<input type="text"/>	
D.O. (mg/L)	<input type="text" value="6.0"/>	Water Colour	<input type="text" value="Yellow/Brown"/>	
Water Clarity	<input type="text" value="Clear"/>			

Seepage Indicators	<input type="text" value="Iron Staining,None"/>
	<input type="text" value="Slight red tinge to downstream water"/>

Stream Morphology				Bank Stability	
Site Length (m)	<input type="text" value="100.00"/>			Left Bank	<input type="text" value="0.35"/>
Channel Dimensions				Right Bank	<input type="text" value="1.14"/>
Mean Wetted Width (m)	<input type="text" value="0.35"/>	Mean Wetted Depth (m)	<input type="text" value="0.30"/>	Notes	<input type="text" value="Stable vegetated"/>
Mean Bankfull Width (m)	<input type="text" value="1.14"/>	Mean Bankfull Depth (m)	<input type="text" value="1.00"/>		
Mean Top of Bank Width (m)	<input type="text" value="1.70"/>	Mean Top of Bank Depth (m)	<input type="text" value="1.00"/>		

Flow Description	<input type="text" value="High to moderate flow"/>
------------------	--

Habitat	
Substrate Description	<input type="text" value="Gr Co Sa"/>

Morphological Structure (%)			
Pool	Riffle	Run	Flat
<input type="text" value="40.00"/>	<input type="text" value="30.00"/>	<input type="text" value="10.00"/>	<input type="text" value="20.00"/>
Notes	<input type="text"/>		

Instream Cover					
Woody Debris	Boulders	Cobble	Aquatic Vegetation	Structures	Total Instream Cover
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Undercut Banks					
Average Depth(m)	<input type="text" value="0.00"/>	Percent Cover (%)	<input type="text" value="65.00"/>		
Aquatic Vegetation Species Present	<input type="text" value="Submerged grasses. Emergent grasses."/>				

Stream/River Assessment

Canopy Cover

Percent Closed Cover (%)

30-1%

Trees

10.00

Shrubs

5.00

Grasses

70.00

Herbaceous

15.00

Man Made

Other

Cover Description

Mostly grasses along the downstream reach, some coniferous trees in the upstream reach.

Left Bank Riparian Vegetation

~2.5m, only at downstream reach. Grasses dominant with some Juniper. Minimal Spruce and Cedar.

Right Bank Riparian Vegetation

~2.5m, only at downstream reach. Grasses dominant with some Juniper. Minimal Spruce and Cedar.

Overhanging
Vegetation (%)

10.00

Mostly grasses, minimal coniferous tree cover when sun is in the East.

Obstruction to Fish
Passage

Natural

3m waterfall

Barrier Height (M)

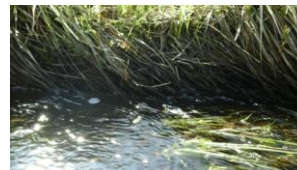
3.0

Study Area Comments

Average to moderate quality habitat with barrier to upstream. Cool to cold water



Horizontal View of Channel



Stream/River Assessment

Site ID	WB-N-M6-3	Field Crew	Ashley Minion Kalynn Parrott		87
Study Area	WEC				
Location	WEC North				
Project Number	60341251	Air Temp. (degC)	20.0	Weather Notes	
Tablet	AECOM17	Wind Speed (beaufort)	2	Mostly sunny with a few cloudy areas. Slight breeze	
Start Date	5/26/2015 11:37:33 AM	Precipitation	0		
End Date	5/26/2015 1:15:30 PM	Cloud Cover	10.00		
Upstream Endpoint	Latitude:45.872683,Longitude:-80.606981				
Downstream Endpoint	Latitude:45.871855,Longitude:-80.607519				

Stream/River Assessment

Site Features

Feature 70 Feature Location
Description 8

Beaver dam approximately 4m long, 2m tall creating an upstream pool approximately 0.75 deep. Downstream view is rock outcrops on stream banks. Beaver dam upstream of CL.

Latitude:45.872154,Longitude:-80.607139,Altitude:196.3,Speed:0.066877775,Accuracy:1.75,Provider:gps,Time:05/26/2015 11:45:28 EDT



Feature 711 Feature Location
Description

Downstream 50 m

Latitude:45.872143,Longitude:-80.607126,Altitude:196.9,Speed:0.1852,Accuracy:2.1,Provider:gps,Time:05/26/2015 11:46:02 EDT



Feature 71 Feature Location
Description 4

Beaver dam, approximately 3m long and 1m high. Upstream pool depth approximately 0.5 m deep. Looking toward CL.

Latitude:45.872616,Longitude:-80.607028,Altitude:193.2,Speed:0.12861112,Accuracy:2.1,Provider:gps,Time:05/26/2015 11:50:16 EDT



Feature 717 Feature Location
Description

Beaver dam, approximately 1.5m tall and 5m long. Upstream pool depth approximately 0.5 m deep. Beaver dam downstream of CL.

Latitude:45.872764,Longitude:-80.607008,Altitude:188.6,Speed:0.11317778,Accuracy:2.1,Provider:gps,Time:



Stream/River Assessment

Feature 720 Feature Location
Description

Upstream 50m.
Beaver dam
downstream of
CL.

Latitude:,Longitude:,Altitude:,Speed:,Accuracy:,Provider:,Time:



Surrounding Land
Use

Forest

Mixed deciduous, conifer dominated

Type of Watercourse

Permanent

Dammed stream approximately 4 m wetted width. Slow moving. Bedrock banks.

Stream/River Assessment

Input Description	Wetland downstream, some overland, maybe some groundwater.
Water Body Underground / Not As Mapped?	No
Surrounding Land Topography	Bedrock outcrops, gradual slope toward wetland downstream.

In-Situ Water Quality				
WT (deg. C)	9.0	AT (degC)	20.0	Water Quality Notes Water has reddish tinge, but likely due to rock substrate.
pH	6.8	Cond. (s/cm)		
D.O. (mg/L)	3.0	Water Colour	Yellow/Brown	
Water Clarity	Clear			

Seepage Indicators	Iron Staining
	Water has a reddish hue.

Stream Morphology				Bank Stability	
Site Length (m)	100.00			Left Bank	5.00
Channel Dimensions				Right Bank	14.00
Mean Wetted Width (m)	5.00	Mean Wetted Depth (m)	0.60	Notes	Bedrock.
Mean Bankfull Width (m)	14.00	Mean Bankfull Depth (m)	1.50		
Mean Top of Bank Width (m)	14.00	Mean Top of Bank Depth (m)	1.50		

Flow Description	Low, 3 beaver dams within site range
------------------	--------------------------------------

Habitat	
Substrate Description	Rock, boulder, detritus, silt.

Morphological Structure (%)			
Pool	Riffle	Run	Flat
90.00		5.00	5.00
Notes			

Stream/River Assessment

Instream Cover

Woody Debris

Boulders

Cobble

Aquatic Vegetation

Structures

Total Instream Cover

Undercut Banks

Average Depth(m)

0.00

Percent Cover (%)

40.00

Aquatic Vegetation
Species Present

Minimal, grasses, sedges and a few shrubs

Canopy Cover

Percent Closed Cover (%)

30-1%

Trees

80.00

Shrubs

10.00

Grasses

10.00

Herbaceous

Man Made

Other

Cover Description

Pine and poplar

Left Bank Riparian Vegetation

0.5 m of grasses and sedges, mostly bedrock

Right Bank Riparian Vegetation

0.25 mm grades and herbaceous shrubs, mature trees and bedrock dominant

Overhanging
Vegetation (%)

5.00

Minimal small grasses and large trees

Obstruction to Fish
Passage

Natural

3 beaver dams

Barrier Height (M)

1.5

Study Area Comments

Crossing area has no connecting area to upstream or downstream waterbodies due to the presence of 3 beaver dams.





Stream/River Assessment

Horizontal View of Channel



Stream/River Assessment

Site ID	WB-N-M7-34	Field Crew	Ashley Minion Kalynn Parrott	90
Study Area	WEC			
Location	WEC North			
Project Number	60341251	Air Temp. (degC)	16.0	Weather Notes
Tablet	AECOM17	Wind Speed (beaufort)	5	
Start Date	5/27/2015 10:01:59 AM	Precipitation	0	
End Date	5/27/2015 10:53:41 AM	Cloud Cover	75.00	
Upstream Endpoint	Latitude:45.876949,Longitude:-80.616639			
Downstream Endpoint	Latitude:45.876443,Longitude:-80.617094			
Site Features				
Feature Description	72	Feature Location		
Upstream 35m from wetland looking toward CL.		Latitude:45.876706,Longitude:-80.616867,Altitude:192.7,Speed:0.13375555,Accuracy:1.75,Provider:gps,Time:05/27/2015 10:11:16 EDT		
				
Feature Description	72	Feature Location		
Downstream 35m from wetland looking toward CL.		Latitude:45.876556,Longitude:-80.617169,Altitude:195.3,Speed:0.19548889,Accuracy:1.75,Provider:gps,Time:05/27/2015 10:14:31 EDT		
				
Surrounding Land Use	Forest			
	Mixed deciduous forest and bedrock. Fen downstream.			
Type of Watercourse	Ephemeral			
	Swamp/marshlike area (ELC classified as fen). No flow. Low lying area, no connectivity for fish. No fish habitat. Situated between. Bedrock outcrops.			
Input Description	Overland flow and nearby fen.			
Water Body Underground / Not As Mapped?	No			

Stream/River Assessment

Surrounding Land Topography	Bedrock outcrops, gradual slope to low lying area.		
In-Situ Water Quality			
WT (deg. C)	14.0	AT (degC)	16.0
pH	6.2	Cond. (s/cm)	
D.O. (mg/L)	2.0	Water Colour	Yellow/Brown
Water Clarity	Clear	Water Quality Notes Low DO likely as there is no flow- stagnant.	
Seepage Indicators	None		
Stream Morphology			
Site Length (m)	70.00	Bank Stability	
Channel Dimensions		Left Bank	3.00
		Right Bank	8.00
Mean Wetted Width (m)	3.00	Mean Wetted Depth (m)	0.01
Mean Bankfull Width (m)	8.00	Mean Bankfull Depth (m)	0.15
Mean Top of Bank Width (m)	8.00	Mean Top of Bank Depth (m)	0.15
Flow Description		Stagnant.	
Habitat			
Substrate Description		Detritus, muck, Sphagnum moss.	
Morphological Structure (%)			
Pool	Riffle	Run	Flat
15.00			85.00
Notes			

Stream/River Assessment

Instream Cover

Woody Debris

Boulders

Cobble

Aquatic Vegetation

Structures

Total Instream Cover

Undercut Banks

Average Depth(m)

0.00

Percent Cover (%)

100.00

Aquatic Vegetation
Species Present

Mostly emergent (Sphagnum, sweet gale, elder) and some submergent (lichen)

Canopy Cover

Percent Closed Cover (%)

100-
90%

Trees

Shrubs

Grasses

Herbaceous

Man Made

Other

15.00

70.00

15.00

Cover Description

Heavy cover, trees birch and hemlock. Plants/shrubs already listed.

Left Bank Riparian Vegetation

3m, no bank, low area, standing water with few Riparian trees (already listed) and dense shrubs (already listed)

Right Bank Riparian Vegetation

3 m no bank. Standing water in low area with a few riparian trees (already listed) and dense shrubs (already listed)

Overhanging
Vegetation (%)

15.00

Some riparian trees.

Obstruction to Fish
Passage

Natural

Low connectivity, minimal water, no flow, dry areas. Not fish habitat.

Barrier Height (M)

Study Area Comments

No defined channel. Likely a transitional fen.






Stream/River Assessment

Horizontal View of Channel



Stream/River Assessment

Site ID	WB-N-M32-14	Field Crew	Ashley Minion Kalynn Parrott		93
Study Area	WEC				
Location	WEC North				
Project Number	60341251	Air Temp. (degC)	22.0	Weather Notes	
Tablet	AECOM17	Wind Speed (beaufort)	4	Full sun, windy.	
Start Date	5/27/2015 1:32:15 PM	Precipitation	0		
End Date	5/27/2015 2:24:04 PM	Cloud Cover	0.00		
Upstream Endpoint	Latitude:45.855529,Longitude:-80.656595				
Downstream Endpoint	Latitude:45.855342,Longitude:-80.656957				
Site Features					
Feature Description	729 Feature Location				
Small waterfall. Fish barrier. Approximately 10-20m US of CL.	Latitude:45.855551,Longitude:-80.657424,Altitude:180.1,Speed:0.030866666,Accuracy:2.1,Provider:gps,Time:05/27/2015 01:37:03 EDT				
					
Feature Description	73 Feature Location				
Upstream 50m. Looking US at wetland from US site limit.	Latitude:45.855627,Longitude:-80.657699,Altitude:182.4,Speed:0.07716667,Accuracy:2.1,Provider:gps,Time:05/27/2015 01:39:58 EDT				
					
Feature Description	73 Feature Location				
Small wetland, cattails present between rock outcrops. Some Upland vegetation. Looking DS toward CL from US 50 m.	Latitude:45.85564,Longitude:-80.657821,Altitude:180.9,Speed:0.020577777,Accuracy:2.4,Provider:gps,Time:05/27/2015 01:41:29 EDT				
					

Stream/River Assessment

Feature Description 73 Feature Location 8



Downstream 50m. Looking US toward CL from DS site limit. Latitude:45.855344,Longitude:-80.65728,Altitude:176.4,Speed:0.05658889,Accuracy:2.1,Provider:gps,Time:05/27/2015 01:45:55 EDT

Surrounding Land Use Forest
Large waterbody with rock outcrops and mixd deciduous forest.

Type of Watercourse Permanent
Upstream consists of small wetland with no defined channel. Leading to waterfall approximately 1 m high creating fish barrier leading to defined channel with fish habitat meandering towards Henvey Inlet.

Input Description Wetland, overland flow, potential groundwater.
Water Body Underground / Not As Mapped? No
Surrounding Land Topography Large waterbody with rock outcrops and mixed deciduous forest.

Stream/River Assessment

In-Situ Water Quality

WT (deg. C)	<input type="text" value="7.0"/>	AT (degC)	<input type="text" value="22.0"/>	Water Quality Notes Water clear but with strong reddish tinge.
pH	<input type="text" value="7.0"/>	Cond. (s/cm)	<input type="text"/>	
D.O. (mg/L)	<input type="text" value="4.0"/>	Water Colour	<input type="text" value="Yellow/Brown"/>	
Water Clarity	<input type="text" value="Clear"/>			

Seepage Indicators	<input type="text" value="Iron Staining"/>
	<input type="text" value="Red hue to water."/>

Stream Morphology				Bank Stability	
Site Length (m)	<input type="text" value="100.00"/>			Left Bank	<input type="text" value="0.85"/>
Channel Dimensions				Right Bank	<input type="text" value="1.00"/>
Mean Wetted Width (m)	<input type="text" value="0.85"/>	Mean Wetted Depth (m)	<input type="text" value="0.40"/>	Notes	<input type="text" value="Dense riparian veg and intermittent grasses. Silty surficial material."/>
Mean Bankfull Width (m)	<input type="text" value="1.00"/>	Mean Bankfull Depth (m)	<input type="text" value="0.40"/>		
Mean Top of Bank Width (m)	<input type="text" value="6.00"/>	Mean Top of Bank Depth (m)	<input type="text" value="0.45"/>		

Flow Description	<input type="text" value="Slow to moderate flow downstream of waterfall. High flow at waterfall. Slow to moderate flow upstream."/>
------------------	---

Habitat	
Substrate Description	<input type="text" value="Medium sand."/>

Morphological Structure (%)			
Pool	Riffle	Run	Flat
<input type="text"/>	<input type="text" value="10.00"/>	<input type="text"/>	<input type="text" value="90.00"/>
Notes	<input type="text"/>		

Instream Cover					
Woody Debris	Boulders	Cobble	Aquatic Vegetation	Structures	Total Instream Cover
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Undercut Banks					
Average Depth(m)	<input type="text" value="20.00"/>	Percent Cover (%)	<input type="text" value="10.00"/>		
Aquatic Vegetation Species Present	<input type="text" value="Emergent (trees, ferns, few grasses, lichen), submerged (lichen)"/>				

Stream/River Assessment

Canopy Cover

Percent Closed Cover (%)

100-90%

Trees

80.00

Shrubs

Grasses

10.00

Herbaceous

10.00

Man Made

Other

Cover Description

Mostly elder trees, some intermittent grasses.

Left Bank Riparian Vegetation

2m mostly trees and shrubs, some grasses and some herbaceous.

Right Bank Riparian Vegetation

10m, mostly trees and shrubs, some grasses and some herbaceous

Overhanging Vegetation (%)

90.00

Dense trees cover, with some overhanging shrubs and grasses

Obstruction to Fish Passage

Natural

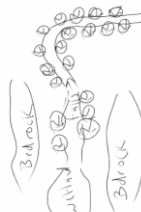
Small waterfall dividing upstream wetland from downstream channel. Not good fish habitat upstream.

Barrier Height (M)

1.0

Study Area Comments

Good electrofishing site. Flows into Henceforth Inlet. Moderate water quality. Downstream portion of reach good fish habitat (particularly during spawning season).



Horizontal View of Channel





Execution Time

8/19/2015 12:09:29 PM

Filter Start Date 4/1/2015

Filter End Date 8/21/2015

Stream/River Assessment

Site ID	WB-N-M32-26	Field Crew	Ashley Minion Kalynn Parrott	96
Study Area	WEC			
Location	WEC North			
Project Number	60341251	Air Temp. (degC)	22.0	Weather Notes
Tablet	AECOM17	Wind Speed (beaufort)	4	Sun, windy, few clouds
Start Date	5/27/2015 2:38:32 PM	Precipitation	0	
End Date	5/27/2015 3:20:13 PM	Cloud Cover	20.00	
Upstream Endpoint	Latitude:45.855091,Longitude:-80.660446			
Downstream Endpoint	Latitude:45.855024,Longitude:-80.659853			
Site Features				
Feature Description	74	Feature Location		
Looking DS from DS site limit.		Latitude:45.855024,Longitude:-80.659853,Altitude:184.9,Speed:0.020577777,Accuracy:1.8,Provider:gps,Time:05/27/2015 02:40:44 EDT		
Feature Description	74	Feature Location		
Looking DS toward CL from US site limit.		Latitude:45.855091,Longitude:-80.660446,Altitude:184.3,Speed:0.051444445,Accuracy:1.8,Provider:gps,Time:05/27/2015 02:46:47 EDT		
Surrounding Land Use	Forest			
	Marshland and intermittent coniferous forest. Rock outcrops.			
Type of Watercourse	Ephemeral			
	Seasonal waterbody. No defined watercourse, no defined channel. Site is a marsh to transitional fen. No flow. Not fish habitat.			
Input Description	Overland flow, potential groundwater.			
Water Body Underground / Not As Mapped?	No			

Stream/River Assessment

Surrounding Land Topography	Rolling rock outcrops, gradual slope toward wetland.			
In-Situ Water Quality				
WT (deg. C)	<input type="text" value="15.0"/>	AT (degC)	<input type="text" value="22.0"/>	Water Quality Notes Very little water present.
pH	<input type="text" value="5.8"/>	Cond. (s/cm)	<input type="text"/>	
D.O. (mg/L)	<input type="text" value="2.0"/>	Water Colour	<input type="text" value="Colourless"/>	
Water Clarity	<input type="text" value="Clear"/>			
Seepage Indicators	<input type="text" value="None"/>			
<input type="text"/>				
Stream Morphology		Bank Stability		
Site Length (m)	<input type="text" value="100.00"/>	Left Bank	<input type="text" value="65.00"/>	
Channel Dimensions		Right Bank	<input type="text"/>	
Mean Wetted Width (m)	<input type="text" value="65.00"/>	Mean Wetted Depth (m)	<input type="text"/>	Notes No defined banks. Site is a marsh/fen. Bedrock on perimeter.
Mean Bankfull Width (m)	<input type="text"/>	Mean Bankfull Depth (m)	<input type="text"/>	
Mean Top of Bank Width (m)	<input type="text"/>	Mean Top of Bank Depth (m)	<input type="text"/>	
Flow Description	<input type="text" value="Stagnant."/>			
Habitat				
Substrate Description	<input type="text" value="Moss/bog mat. Grasses. Peat."/>			
Morphological Structure (%)				
Pool	Riffle	Run	Flat	
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	
Notes	<input type="text"/>			

Stream/River Assessment

Instream Cover

Woody Debris

Boulders

Cobble

Aquatic Vegetation

Structures

Total Instream Cover

Undercut Banks

Average Depth(m)

Percent Cover (%)

Aquatic Vegetation
Species Present

Emergent (grasses, few shrubs, Sphagnum moss) submergent (moss)

Canopy Cover

Percent Closed Cover (%)

100-
90%

Trees

Shrubs

Grasses

Herbaceous

Man Made

Other

Cover Description

Mostly grasses and Sphagnum moss, some dead trees and few black spruce.

Left Bank Riparian Vegetation

NA

Right Bank Riparian Vegetation

NA

Overhanging
Vegetation (%)

90.00

Grass.

Obstruction to Fish
Passage

Natural

No flow, no connectivity no channel. Site is a wetland surrounded by rock outcrops.

Barrier Height (M)

1.2

Study Area Comments

Site is a marsh/transitional fen surrounded by bedrock. There is minimal standing water. Not fish habitat as this is an inland wetland.





Stream/River Assessment

Horizontal View of Channel



Stream/River Assessment

Site ID	WB-N-M34-42	Field Crew	Ashley Minion Kalynn Parrott	99
Study Area	WEC			
Location	Access from Flower Pot, followed flagging around water to site			
Project Number	60341251	Air Temp. (degC)	18.0	Weather Notes
Tablet	AECOM17	Wind Speed (beaufort)	1	Cloudy with sunny breaks.
Start Date	5/28/2015 9:57:03 AM	Precipitation	0	
End Date	5/28/2015 10:36:22 AM	Cloud Cover	90.00	
Upstream Endpoint	Latitude:45.863408,Longitude:-80.670603			
Downstream Endpoint	Latitude:45.863621,Longitude:-80.670994			
Site Features				
Feature Description	76	Feature Location		
Looking US from US site limit.	Latitude:45.863408,Longitude:-80.670603,Altitude:187.9,Speed:0.020577777,Accuracy:1.8,Provider:gps,Time:05/28/2015 10:02:48 EDT			
Feature Description	77	Feature Location		
Looking US toward CL from DS site limit.	Latitude:45.863621,Longitude:-80.670994,Altitude:190.0,Speed:0.020577777,Accuracy:1.8,Provider:gps,Time:05/28/2015 10:06:27 EDT			
Surrounding Land Use	Forest			
	Mixed deciduous forest dominated by conifers, bedrock substrate. Channel feeds nearby swamp.			
Type of Watercourse	Ephemeral			
	20 m wide marsh downstream of large swamp. Some upland vegetation, mostly upstream. No defined channel. No flow. Channel is situated between two bedrock outcrops.			
Input Description	Upstream swamp (Henvey Inlet at furthest reach), some overland.			
Water Body Underground / Not As Mapped?	No			

Stream/River Assessment

Surrounding Land Topography		Rock outcrops sloping downward toward wetland.			
In-Situ Water Quality					
WT (deg. C)	<input type="text" value="12.0"/>	AT (degC)	<input type="text" value="18.0"/>	Water Quality Notes	
pH	<input type="text" value="7.0"/>	Cond. (s/cm)	<input type="text"/>		
D.O. (mg/L)	<input type="text" value="4.0"/>	Water Colour	<input type="text" value="Colourless"/>		
Water Clarity	<input type="text" value="Clear"/>				
Seepage Indicators		<input type="text" value="None"/>			
		<input type="text"/>			
Stream Morphology					
Site Length (m)		<input type="text" value="100.00"/>		Bank Stability	
Channel Dimensions				Left Bank	<input type="text" value="20.00"/>
				Right Bank	<input type="text" value="30.00"/>
Mean Wetted Width (m)	<input type="text" value="20.00"/>	Mean Wetted Depth (m)	<input type="text" value="0.30"/>	Notes	<input type="text" value="Bedrock banks"/>
Mean Bankfull Width (m)	<input type="text" value="30.00"/>	Mean Bankfull Depth (m)	<input type="text" value="6.00"/>		
Mean Top of Bank Width (m)	<input type="text" value="30.00"/>	Mean Top of Bank Depth (m)	<input type="text" value="6.00"/>		
Flow Description		<input type="text" value="No observed flow."/>			
Habitat					
Substrate Description		<input type="text" value="Sphagnum moss, muck, detritus, peat"/>			
Morphological Structure (%)					
Pool	Riffle	Run	Flat		
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>		
Notes		<input type="text"/>			

Stream/River Assessment

Instream Cover

Woody Debris

Boulders

Cobble

Aquatic Vegetation

Structures

Total Instream Cover

Undercut Banks

Average Depth(m)

Percent Cover (%)

Aquatic Vegetation
Species Present

Emergent, minimal submergent

Canopy Cover

Percent Closed Cover (%)

100-
90%

Trees

Shrubs

Grasses

Herbaceous

Man Made

Other

Cover Description

Predominantly grasses, with submergent Sphagnum moss and some upland vegetation (pine, hemlock, sweet gale) in waterbody

Left Bank Riparian Vegetation

6m bedrock outcrop, some moss, lichen, sweet gale, and tamarack

Right Bank Riparian Vegetation

6m rock outcrop, some moss, lichen, sweet gale, tamarack and juniper

Overhanging
Vegetation (%)

20.00

Some trees (Pine, tamarack, hemlock)

Obstruction to Fish
Passage

Natural

Low flow leading to low connectivity.

Barrier Height (M)

0.0

Study Area Comments

Low flow, undefined channel, between two rock outcrops. Wetland.
Not fish habitat.





Stream/River Assessment

Horizontal View of Channel



Stream/River Assessment

Site ID	WB-N-M9-35	Field Crew	Ashley Minion Kalynn Parrott	102
Study Area	WEC			
Location	Key river north approximately 3k. Exit west. Follow flags.			
Project Number	60341251	Air Temp. (degC)	22.0	Weather Notes
Tablet	AECOM17	Wind Speed (beaufort)	1	Cloudy, with sunny breaks
Start Date	5/28/2015 1:53:06 PM	Precipitation	0	
End Date	5/28/2015 2:28:05 PM	Cloud Cover	90.00	
Upstream Endpoint	Latitude:45.883893,Longitude:-80.63149			
Downstream Endpoint	Latitude:45.883756,Longitude:-80.631877			
Site Features				
Feature Description	77	Feature Location		
Looking US from US site limit.	Latitude:45.883893,Longitude:-80.63149,Altitude:200.0,Speed:0.025722222,Accuracy:2.25,Provider:gps,Time:05/28/2015 01:57:11 EDT			
Feature Description	777	Feature Location		
Looking US toward CL from DS site limit.	Latitude:45.883756,Longitude:-80.631877,Altitude:169.1,Speed:0.1852,Accuracy:1.8,Provider:gps,Time:05/28/2015 02:00:29 EDT			
Surrounding Land Use	Forest			
	Mixed deciduous forest dominated by birch. Key river 800m downstream.			
Type of Watercourse	Ephemeral			
	Roughly 60/100m. Mostly dry, with some standing water downstream (45cm). Fenlike. Opens up to large Swamp downstream.			
Input Description	Overland flow and groundwater discharge.			
Water Body Underground / Not As Mapped?	No			
Surrounding Land Topography	Rock outcrops sloping downward toward wetland.			

Execution Time 8/19/2015 12:09:29 PM

Filter Start Date 4/1/2015

Filter End Date 8/21/2015

Stream/River Assessment

In-Situ Water Quality

WT (deg. C)	<input type="text" value="13.0"/>	AT (degC)	<input type="text" value="22.0"/>	Water Quality Notes Very little water present.
pH	<input type="text" value="7.0"/>	Cond. (s/cm)	<input type="text"/>	
D.O. (mg/L)	<input type="text" value="2.0"/>	Water Colour	<input type="text" value="Turbid"/>	
Water Clarity	<input type="text" value="Turbid"/>			

Seepage Indicators

<input type="text" value="Watercress"/>
<input type="text" value="Sporadically dispersed throughout wetland."/>

Stream Morphology

Site Length (m)

Channel Dimensions

Mean Wetted Width (m)	<input type="text" value="0.00"/>	Mean Wetted Depth (m)	<input type="text" value="0.40"/>
Mean Bankfull Width (m)	<input type="text" value="80.00"/>	Mean Bankfull Depth (m)	<input type="text" value="4.00"/>
Mean Top of Bank Width (m)	<input type="text" value="80.00"/>	Mean Top of Bank Depth (m)	<input type="text" value="6.00"/>

Bank Stability

Left Bank	<input type="text" value="0.00"/>
Right Bank	<input type="text" value="80.00"/>
Notes	<input type="text" value="Bedrock"/>

Flow Description

<input type="text" value="No flow. Very little water present"/>

Habitat

Substrate Description	<input type="text" value="Moss, detritus, topsoil"/>
-----------------------	--

Morphological Structure (%)

Pool	Riffle	Run	Flat
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Notes	<input type="text"/>
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Instream Cover

Woody Debris	Boulders	Cobble	Aquatic Vegetation	Structures	Total Instream Cover
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Undercut Banks

Average Depth(m)	<input type="text"/>	Percent Cover (%)	<input type="text"/>
------------------	----------------------	-------------------	----------------------

Aquatic Vegetation Species Present	<input type="text" value="Emergent - Sphagnum moss, watercress, sedges, Grasses"/>
------------------------------------	--

Stream/River Assessment

Canopy Cover

Percent Closed Cover (%)

100-90%

Trees

10.00

Shrubs

10.00

Grasses

80.00

Herbaceous

Man Made

Other

Cover Description

Some trees (birch) shrubs (elder) grasses, sedges and moss

Left Bank Riparian Vegetation

10m Upland vegetation (maple, poplar, pine)

Right Bank Riparian Vegetation

10m upland vegetation (maple, poplar, pine)

Overhanging
Vegetation (%)

100.00

Mostly grasses, sedges.

Obstruction to Fish
Passage

Natural

Dry, low flow channel through large swamp and low lying areas. Not fish habitat.

Barrier Height (M)

0.0

Study Area Comments

Lowland area between bedrock outcrops. Lots of upland vegetation. Dry in most spots, stagnant water downstream. Opens up to larger marsh. No defined channel. Ephemeral. Not fish habitat.



Horizontal View of Channel






Execution Time

8/19/2015 12:09:29 PM

Filter Start Date 4/1/2015

Filter End Date 8/21/2015

Stream/River Assessment

Site ID	WB-N-M31-2-2	Field Crew	Amy Ingriselli Ami Arsenault	189
Study Area	WEC			
Location	South of Key River			
Project Number	60341251	Air Temp. (degC)	16.0	Weather Notes
Tablet	AECOM12	Wind Speed (beaufort)	0	
Start Date	6/15/2015 11:42:59 AM	Precipitation	0	
End Date	6/15/2015 12:20:45 PM	Cloud Cover	100.00	
Upstream Endpoint	Latitude:45.884278,Longitude:-80.677818,Altitude:151.8,Speed:0.03601111,Accuracy:1.8,Provider:gps,Time:06/15/2015 12:11:58 EDT			
Downstream Endpoint	Latitude:45.884741,Longitude:-80.678254,Altitude:166.7,Speed:0.31381112,Accuracy:1.75,Provider:gps,Time:06/15/2015 12:30:27 EDT			
Site Features				
Feature Description	155	Feature Location		
View of swamp at centrwline, looking across swamp from rock barren facing north	Latitude:45.884368,Longitude:-80.678253,Altitude:188.9,Speed:0.015433333,Accuracy:2.1,Provider:gps,Time:06/15/2015 11:57:36 EDT			
Feature Description	156	Feature Location		
Facing downstream from upstream limit of study area, just above beaver dam	Latitude:45.884278,Longitude:-80.677818,Altitude:151.8,Speed:0.03601111,Accuracy:1.8,Provider:gps,Time:06/15/2015 12:11:58 EDT			
Feature Description	156	Feature Location		
Facing upstream from downstream limit of study area	Latitude:45.884691,Longitude:-80.678337,Altitude:171.3,Speed:0.05658889,Accuracy:1.75,Provider:gps,Time:06/15/2015 12:28:20 EDT			

Stream/River Assessment

Feature Description 156 Feature Location 6



View of main flow through study area facing upstream (south)

Latitude:45.884742,Longitude:-80.678287,Altitude:168.2,Speed:0.066877775,Accuracy:1.75,Provider:gps,Time:06/15/2015 12:29:18 EDT

Surrounding Land Use

Forest,Wetland

Black ash swamp bordered by rock barren

Type of Watercourse

Permanent

Water seeping from beaver dam through black ash swamp. Flows to Key River. Main small poorly defined channel but entire swamp is saturated with many side pools of standing water throughout

Input Description

Seeping through beaver dam

Water Body Underground / Not As Mapped?

Yes, site was not identified on map, observed en route to other site

Surrounding Land Topography

Rock barren sloping to swamp

Stream/River Assessment

In-Situ Water Quality

WT (deg. C)	<input type="text" value="16.5"/>	AT (degC)	<input type="text" value="16.3"/>	Water Quality Notes <div></div>
pH	<input type="text" value="5.0"/>	Cond. (s/cm)	<input type="text" value="0.02"/>	
D.O. (mg/L)	<input type="text" value="7.1"/>	Water Colour	<input type="text" value="Colourless"/>	
Water Clarity	<input type="text" value="Clear"/>			

Seepage Indicators	<input type="text" value="None"/>
<div></div>	

Stream Morphology

Site Length (m)	<input type="text" value="100.00"/>
-----------------	-------------------------------------

Channel Dimensions

Mean Wetted Width (m)	<input type="text" value="60.00"/>	Mean Wetted Depth (m)	<input type="text" value="10.00"/>
Mean Bankfull Width (m)	<input type="text" value="60.00"/>	Mean Bankfull Depth (m)	<input type="text" value="15.00"/>
Mean Top of Bank Width (m)	<input type="text" value="60.00"/>	Mean Top of Bank Depth (m)	<input type="text" value="15.00"/>

Bank Stability

Left Bank	<input type="text" value="60.00"/>
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Right Bank	<input type="text" value="60.00"/>
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Notes	<div>Bedrock</div>
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Flow Description	<div>Low flow. Max depth above beaver dams 0.6m</div>
------------------	---

Habitat

Substrate Description	<div>Detritus muck silt</div>
-----------------------	-------------------------------

Morphological Structure (%)

Pool	Riffle	Run	Flat
<input type="text" value="35.00"/>	<input type="text" value="25.00"/>	<input type="text" value="40.00"/>	<input type="text"/>

Notes	<div></div>
-------	-------------

Instream Cover

Woody Debris	Boulders	Cobble	Aquatic Vegetation	Structures	Total Instream Cover
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Undercut Banks

Average Depth(m)	<input type="text"/>	Percent Cover (%)	<input type="text"/>
------------------	----------------------	-------------------	----------------------

Aquatic Vegetation Species Present	<div>None</div>
------------------------------------	-----------------

Stream/River Assessment

Canopy Cover

Percent Closed Cover (%)

100-90%

Trees

65.00

Shrubs

25.00

Grasses

Herbaceous

10.00

Man Made

Other

Cover Description

Black ash swamp also with dense shrub layer

Left Bank Riparian Vegetation

30 black ash swamp, sensitive fern, round - leaf dogwood speckled alder

Right Bank Riparian Vegetation

Same as LB

Overhanging Vegetation (%)

30.00

Ferns

Obstruction to Fish Passage

Low Flow Barrier

Low depth, slope, beaver dam

Barrier Height (M)

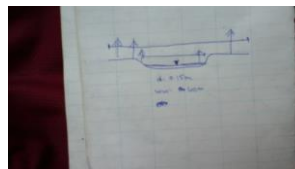
1.0

Study Area Comments

Not likely to directly support fish below beaver dam in black ash swamp. Site was electrofished, no catch. Cyprian id's observed upstream of beaver dam in pond. See site features for correct upstream study area limit.



Horizontal View of Channel



Execution Time

8/19/2015 12:09:29 PM

Filter Start Date 4/1/2015

Filter End Date 8/21/2015

Stream/River Assessment

Site ID	WB-N-M4-59	Field Crew	Amy Ingriselli Jessica Mendoza	288
Study Area	WEC			
Location	Eastern portion of henvey inlet, west of hwy 69			
Project Number	60341251	Air Temp. (degC)	25.0	Weather Notes
Tablet	AECOM10	Wind Speed (beaufort)	2	
Start Date	7/9/2015 3:07:28 PM	Precipitation	0	
End Date	7/9/2015 4:00:33 PM	Cloud Cover	0.00	
Upstream Endpoint	Latitude:45.871675,Longitude:-80.585377,Altitude:167.2,Speed:1.1935111,Accuracy:3.3,Provider:gps,Time:07/09/2015 03:35:14 EDT			
Downstream Endpoint	Latitude:45.870852,Longitude:-80.58579,Altitude:162.4,Speed:0.16462222,Accuracy:2.5,Provider:gps,Time:07/09/2015 03:53:06 EDT			

Stream/River Assessment

Site Features

Feature 241 Feature Location
Description 5

Looking
northeast along
watercourse
from cL

Latitude:45.871275,Longitude:-
80.585639,Altitude:177.9,Speed:0.03601111,Accuracy:3.3,Provider:gps,Time:07/09/20
15 03:24:22 EDT



Feature 241 Feature Location
Description 8

Looking
southwest from
CL

Latitude:45.87125,Longitude:-
80.585666,Altitude:176.2,Speed:0.025722222,Accuracy:2.7,Provider:gps,Time:07/09/20
15 03:25:02 EDT



Feature 242 Feature Location
Description 1

Looking across
channel at CL
facing
northwest

Latitude:45.871225,Longitude:-
80.585625,Altitude:174.5,Speed:0.14404444,Accuracy:3.0,Provider:gps,Time:07/09/20
15 03:25:50 EDT



Feature 242 Feature Location
Description 4

Looking
downstream
from 50m
upstream

Latitude:45.871738,Longitude:-
80.585381,Altitude:165.7,Speed:0.06173333,Accuracy:2.75,Provider:gps,Time:07/09/20
15 03:36:01 EDT



Feature 242 Feature Location
Description 7

Looking
upstream
standing from
downstream
limit

Latitude:45.870837,Longitude:-
80.585781,Altitude:161.8,Speed:0.066877775,Accuracy:2.5,Provider:gps,Time:07/09/20
15 03:53:17 EDT



Stream/River Assessment

Surrounding Land Use	Forest			
	Mixed coniferous deciduous forest atop bedrock			
Type of Watercourse	Permanent,Natural Channel			
	Easternmost part of henvey inlet west of old breached beaver dam and pond			
Input Description	Overland flow			
Water Body Underground / Not As Mapped?	No			
Surrounding Land Topography	Rolling bedrock sloping towards watercourse			
In-Situ Water Quality				
WT (deg. C)	21.8	AT (degC)	25.0	Water Quality Notes
pH	6.6	Cond. (s/cm)	0.08	
D.O. (mg/L)	8.9	Water Colour	Colourless	
Water Clarity	Clear			
Seepage Indicators	None			
Stream Morphology				
Site Length (m)	100.00	Bank Stability		
Channel Dimensions		Left Bank	16.00	
		Right Bank	17.95	
Mean Wetted Width (m)	16.00	Mean Wetted Depth (m)	0.66	Notes Vegetated bedrock
Mean Bankfull Width (m)	17.95	Mean Bankfull Depth (m)	0.86	
Mean Top of Bank Width (m)	17.95	Mean Top of Bank Depth (m)	0.86	
Flow Description	Low			
Habitat				
Substrate Description	Cobble sand gravel boulder			

Stream/River Assessment

Morphological Structure (%)

Pool

Riffle

Run

Flat

Notes

Instream Cover

Woody Debris

Boulders

Cobble

Aquatic Vegetation

Structures

Total Instream Cover

Undercut Banks

Average Depth(m)

Percent Cover (%)

Aquatic Vegetation
Species Present

Fragrant water lily, emergent grasses, cattails, submergent grasses and weeds, bladderwort

Canopy Cover

Percent Closed Cover (%)

60-
30%

Trees

Shrubs

Grasses

Herbaceous

Man Made

Other

Cover Description

Alder, pine and cedar

Left Bank Riparian Vegetation

5m grasses herbaceous plants alder

Right Bank Riparian Vegetation

2m grasses herbaceous plants alder

Overhanging
Vegetation (%)

5.00

Grasses

Obstruction to Fish
Passage

None Observed

Barrier Height (M)

Stream/River Assessment

Study Area Comments




Eastern portion of Henvey inlet



Horizontal View of Channel



Pond/Lake Assessment

Site ID	WB-N-M1-30	Field Crew	Mike Godard Devon Fowler	15
Study Area	WEC			
Location	Walk west from HWY 69. Snowmobile trails runs perpendicular to the Beaver pond			
Project Number	60341251	Air Temp. (degC)	15.0	Weather Notes
Tablet	AECOM5	Wind Speed (beaufort)	1	Sunny and warm
Start Date	5/5/2015 12:31:30 PM	Precipitation	0	
End Date	2015-05-05 12:59:49	Cloud Cover	30.00	
Site Features				
Feature Description	75 Feature Location			
Overview	Latitude:;Longitude:;Altitude:;Speed:;Accuracy:;Provider:;Time:			
Feature Description	78 Feature Location			
Overview of pond looking south or upstream	Latitude:45.88742,Longitude:-80.574624,Altitude:206.2,Speed:0.06173333,Accuracy:2.4,Provider:gps,Time:05/05/2015 12:35:43 EDT			
Feature Description	81 Feature Location			
Old beaver dam is located at north of the assessed area.	Latitude:45.887421,Longitude:-80.574664,Altitude:205.9,Speed:0.28294444,Accuracy:2.7,Provider:gps,Time:05/05/2015 12:36:43 EDT			
Surrounding Land Use	Forest			
	Beaver dam pond surrounded by mixed forest			
Type of Pond	Natural,Permanent,Online			
	Old beaver pond. Max depth 2m			

Pond/Lake Assessment

In-Situ Water Quality

WT (deg. C)	<input type="text" value="6.2"/>	AT (degC)	<input type="text" value="15.0"/>	Water Quality Notes <div></div>
pH	<input type="text" value="6.6"/>	Cond. (s/cm)	<input type="text" value="0.03"/>	
D.O. (mg/L)	<input type="text" value="5.7"/>	Water Colour	<input type="text" value="Yellow/Brown"/>	
Water Clarity	<input type="text" value="Clear"/>			

Seepage Indicators

Fish & Wildlife
Observations

Potential Bullfrog obvserved by guide. Green frog and canada geese observed

In-Situ Habitat

Physical Characteristics

Estimated Size Estimated Depth

Notes

In-Situ Cover

Woody Debris	Boulders	Cobble	Aquatic Vegetation	Structures	Total Instream Cover
<input type="text" value="35.00"/>	<input type="text"/>	<input type="text"/>	<input type="text" value="65.00"/>	<input type="text"/>	<input type="text" value="40.00"/>





Aquatic Vegetation
Species Present

Description & Width
of Riparian
Vegetation

Study Area Comments



Pond/Lake Assessment

Site ID	WB-S-M8-57	Field Crew	Mike Godard Jessica Mendoza	18
Study Area	WEC			
Location	Wec South			
Project Number	60341251	Air Temp. (degC)	3.0	Weather Notes
Tablet	AECOM1	Wind Speed (beaufort)	1	
Start Date	5/12/2015 12:45:39 PM	Precipitation	0	
End Date	2015-05-12 13:45:00	Cloud Cover	30.00	
Site Features				
Feature 297 Feature Location Description				
Looking south across proposed road	Latitude:45.849439,Longitude:-80.60138,Altitude:189.7,Speed:0.015433333,Accuracy:1.75,Provider:gps,Time:05/12/2015 11:42:26 EDT			
Feature 300 Feature Location Description				
Looking west from crossing location	Latitude:45.849436,Longitude:-80.601376,Altitude:189.5,Speed:0.025722222,Accuracy:1.75,Provider:gps,Time:05/12/2015 11:43:22 EDT			
Feature 303 Feature Location Description				
Looking east from crossing location	Latitude:45.849434,Longitude:-80.60137,Altitude:189.5,Speed:0.010288889,Accuracy:1.75,Provider:gps,Time:05/12/2015 11:43:56 EDT			
Feature 306 Feature Location Description				
Beaver pond to the west of proposed road crossing	Latitude:45.84987,Longitude:-80.601163,Altitude:188.0,Speed:0.066877775,Accuracy:2.4,Provider:gps,Time:05/12/2015 11:52:18 EDT			
Surrounding Land Use	Forest,Wetland			
	Low lying area with mixed coniferous and deciduos trees			

Execution Time 8/19/2015 12:09:29 PM

Filter Start Date 4/1/2015

Filter End Date 8/21/2015

Pond/Lake Assessment

Type of Pond	Natural,Offline				
	Low lying wetland with beaver pond to the west				

In-Situ Water Quality					
WT (deg. C)	9.3	AT (degC)	3.0	Water Quality Notes	
pH	6.6	Cond. (s/cm)	0.04	No YSI meter for dissolved oxygen readings	
D.O. (mg/L)		Water Colour	Yellow/Brown		
Water Clarity	Clear				


Seepage Indicators	None

Fish & Wildlife Observations	None
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In-Situ Habitat	Overhanging grasses and sedges as well as trees.
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Physical Characteristics			
Estimated Size	40.00	Estimated Depth	0.30
Notes	Not a pond. Wetland bog with standing stagnant water. Water likely from precipitation and overland flow		

In-Situ Cover					
Woody Debris	Boulders	Cobble	Aquatic Vegetation	Structures	Total Instream Cover
					0.00
Aquatic Vegetation Species Present	None observed				
Description & Width of Riparian Vegetation	<5m mixed coniferous and deciduos forest				

Study Area Comments	
Lowland wetland bog. Unlikely to be fish habitat. Potential to be dry during warmer months but full of water at time of assessment. Toads and spring peepers heard calling.	

Pond/Lake Assessment


Site ID	WB-S-M8-57	Field Crew	Mike Godard Jessica Mendoza	21
Study Area	WEC			
Location	Wec south			
Project Number	60341251	Air Temp. (degC)	3.0	Weather Notes
Tablet	AECOM1	Wind Speed (beaufort)	4	
Start Date	5/12/2015 9:17:11 AM	Precipitation	0	
End Date	2015-05-12 10:09:30	Cloud Cover	100.00	
Site Features				
Feature 309 Feature Location Description				
Looking south from crossing location	Latitude:45.848631,Longitude:-80.608951,Altitude:189.6,Speed:0.010288889,Accuracy:1.75,Provider:gps,Time:05/12/2015 10:58:07 EDT			
Feature 312 Feature Location Description				
Looking east from crossing location	Latitude:45.848629,Longitude:-80.608958,Altitude:189.9,Speed:0.06173333,Accuracy:2.1,Provider:gps,Time:05/12/2015 10:59:37 EDT			
Feature 315 Feature Location Description				
Looking north from crossing location	Latitude:45.848628,Longitude:-80.608959,Altitude:189.9,Speed:0.0463,Accuracy:2.1,Provider:gps,Time:05/12/2015 11:00:28 EDT			
Feature 318 Feature Location Description				
Looking south from crossing location	Latitude:45.848626,Longitude:-80.608959,Altitude:189.8,Speed:0.03601111,Accuracy:2.1,Provider:gps,Time:05/12/2015 11:01:20 EDT			
Surrounding Land Use	Forest			
	Mixed coniferous and deciduous forest with low lying areas			

Execution Time 8/19/2015 12:09:29 PM




Filter Start Date 4/1/2015

Filter End Date 8/21/2015

Pond/Lake Assessment

Type of Pond	Natural,Vernal Pools				
	Ponds likely due to recent rain and snow melt; not likely to be present during summer				
In-Situ Water Quality					
WT (deg. C)		AT (degC)	3.0	Water Quality Notes	
pH		Cond. (s/cm)		No measurement due to unlikelihood of ponds during drier periods/ only present due to recent precipitation	
D.O. (mg/L)		Water Colour	Colourless		
Water Clarity	Clear				
Seepage Indicators	None				
Fish & Wildlife Observations	Ruffed grouse and downy woodpecker heard				
In-Situ Habitat	None				
Physical Characteristics					
Estimated Size	25.00	Estimated Depth	0.10		
Notes	Ponded water likely due to recent precipitation				
In-Situ Cover					
Woody Debris	Boulders	Cobble	Aquatic Vegetation	Structures	Total Instream Cover
100.00					50.00
Aquatic Vegetation Species Present	None				
Description & Width of Riparian Vegetation	Greater than 5m; mixed deciduous forest				
Study Area Comments					
No recognizable water course; no connectivity; wet from recent precip; vegetation present not consistent with wetland areas					

Pond/Lake Assessment

Site ID	WB-N-M46-4	Field Crew	Amy Ingriselli Ami Arsenault	24
Study Area	WEC			
Location	By turbine 7 in WEC North			
Project Number	60341251	Air Temp. (degC)	11.0	Weather Notes
Tablet	AECOM3	Wind Speed (beaufort)	5	
Start Date	5/12/2015 12:36:23 PM	Precipitation	0	
End Date	2015-05-12 13:01:03	Cloud Cover	100.00	
Site Features				
Feature Description	32 1	Feature Location		
Facing downstream from point location	Latitude:45.858124,Longitude:-80.698575,Altitude:177.4,Speed:0.051444445,Accuracy:1.5,Provider:gps,Time:05/12/2015 12:37:33 EDT			
Feature Description	32 4	Feature Location		
Facing upstream from point location	Latitude:45.858138,Longitude:-80.698597,Altitude:183.4,Speed:0.05658889,Accuracy:1.5,Provider:gps,Time:05/12/2015 12:59:29 EDT			
Feature Description	32 7	Feature Location		
Facing south across fen from point location	Latitude:45.858139,Longitude:-80.698593,Altitude:182.9,Speed:0.0051444443,Accuracy:1.5,Provider:gps,Time:05/12/2015 01:00:06 EDT			
Surrounding Land Use	Forest,Wetland			
	Slight channel running through fen in-between rock barren landscape.			
Type of Pond	Natural,Permanent,Online			
	Poorly defined channel. During time of assessment whole fen area with pools and flooded mean water depth 0.25m. Floating mats of moss, grasses and water tolerant vegetation. Point location connected to larger body of water upstream as seen on topo map.			

Pond/Lake Assessment

In-Situ Water Quality

WT (deg. C)	<input type="text" value="10.6"/>	AT (degC)	<input type="text" value="11.0"/>	Water Quality Notes Slight tea colored tint to water. No DO meter (was not shipped from equipment store) and pH conductivity not measuring properly again.
pH	<input type="text"/>	Cond. (s/cm)	<input type="text"/>	
D.O. (mg/L)	<input type="text"/>	Water Colour	<input type="text" value="Yellow/Brown"/>	
Water Clarity	<input type="text" value="Clear"/>			

Seepage Indicators	<input type="text" value="None"/>
	<input type="text"/>

Fish & Wildlife Observations	<input type="text" value="Potential fish habitat as the main channel is online to a larger body of water upstream as seen on topo map."/>
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In-Situ Habitat	<input type="text" value="Heavily vegetated bog, all plants terrestrial"/>
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Physical Characteristics

Estimated Size	<input type="text" value="100.00"/>	Estimated Depth	<input type="text" value="1.50"/>
Notes	<input type="text" value="Total fen wetted width is 26m, however channel flowing through fen is ~0.3m wide and ~0.5m deep."/>		



In-Situ Cover

Woody Debris	Boulders	Cobble	Aquatic Vegetation	Structures	Total Instream Cover
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text" value="100.00"/>	<input type="text"/>	<input type="text" value="100.00"/>
Aquatic Vegetation Species Present	<input type="text" value="Aquatic vegetation is water tolerant (i.e. fen species like moss, leatherleaf, lorrel, grasses, tamarac)"/>				
Description & Width of Riparian Vegetation	<input type="text" value="0 m. No riparian transition from fen to overland bedrock barren and jack pine forest."/>				

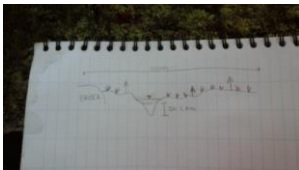
Study Area Comments






Pond/Lake Assessment

Site ID	WB-N-M41-43	Field Crew	Amy Ingriselli Ami Arsenault	27
Study Area	WEC			
Location	Wind centre north near turbine 9			
Project Number	60341251	Air Temp. (degC)	11.0	Weather Notes
Tablet	AECOM3	Wind Speed (beaufort)	5	
Start Date	5/12/2015 1:31:49 PM	Precipitation	0	
End Date	2015-05-12 14:00:24	Cloud Cover	100.00	
Site Features				
Feature Description	330	Feature Location		
View of wetland at crossing location facing southeast	Latitude:45.857081,Longitude:-80.6916,Altitude:178.4,Speed:0.015433333,Accuracy:1.5,Provider:gps,Time:05/12/2015 01:57:30 EDT			
Feature Description	333	Feature Location		
Facing west from CL	Latitude:45.857087,Longitude:-80.691642,Altitude:178.5,Speed:0.0463,Accuracy:1.5,Provider:gps,Time:05/12/2015 01:59:03 EDT			
Surrounding Land Use	Forest,Wetland			
	Thicket fen swamp between bedrock barrens			
Type of Pond	Natural,Permanent,Offline			
	Fen thicket tamarack swamp between bedrock barrens with pools of standing water over Sphagnum moss, treed/vegetated hummocks			
In-Situ Water Quality				
WT (deg. C)	9.1	AT (degC)	11.0	Water Quality Notes
pH	4.1	Cond. (s/cm)		
D.O. (mg/L)		Water Colour	Colourless	
Water Clarity	Clear			

Pond/Lake Assessment

Seepage Indicators	<div>None</div> <div></div>				
Fish & Wildlife Observations	<div>None</div>				
In-Situ Habitat	<div>Pools of standing water, flooded Sphagnum fen thicket</div>				
Physical Characteristics					
Estimated Size	<div>100.00</div>	Estimated Depth	<div>0.70</div>		
Notes	<div>No open or flowing channel of water. Flooded thicket Sphagnum fen swamp with treed/vegetated hummocks. Poor or no connectivity to open water (from air photo)</div>				
In-Situ Cover					
Woody Debris	Boulders	Cobble	Aquatic Vegetation	Structures	Total Instream Cover
<div>60.00</div>	<div></div>	<div></div>	<div>40.00</div>	<div></div>	<div>100.00</div>
Aquatic Vegetation Species Present	<div>No aquatic species, fen/bog veg such as leatherleaf, Sphagnum, laurel, grass, ferns,</div>				
Description & Width of Riparian Vegetation	<div>Tamarack/black spruce swamp/fen bordered by bedrock barren. 0 m. No vegetation transition between fen and forested rock barren</div>				
Study Area Comments					
<div>Poor connectivity to open water habitat, no flowing channel or open water on-site. Standing pools/flooded Sphagnum and vegetated hummocks. Not suspected to directly support fish. Conditions consistent 50m east and west of centreline</div>					

Pond/Lake Assessment

Site ID	WB-N-M41-44	Field Crew	Amy Ingriselli Ami Arsenault	30
Study Area	WEC			
Location	South of turbine 9			
Project Number	60341251	Air Temp. (degC)	11.0	Weather Notes
Tablet	AECOM3	Wind Speed (beaufort)	5	
Start Date	5/12/2015 2:28:02 PM	Precipitation	0	
End Date	2015-05-12 14:46:05	Cloud Cover	100.00	
Site Features				
Feature Description	336	Feature Location		
Looking west in fen from survey point	Latitude:45.854384,Longitude:-80.691231,Altitude:181.0,Speed:0.010288889,Accuracy:1.5,Provider:gps,Time:05/12/2015 02:43:31 EDT			
Feature Description	339	Feature Location		
Looking east from survey point	Latitude:45.854385,Longitude:-80.691226,Altitude:180.8,Speed:0.015433333,Accuracy:1.5,Provider:gps,Time:05/12/2015 02:44:08 EDT			
Feature Description	342	Feature Location		
Facing south towards fen from survey point	Latitude:45.854384,Longitude:-80.691223,Altitude:180.6,Speed:0.015433333,Accuracy:1.5,Provider:gps,Time:05/12/2015 02:44:47 EDT			
Surrounding Land Use	Forest,Wetland			
	Thicket swamp fen surrounded by rock barren			
Type of Pond	Natural,Permanent,Offline			
	Fen thicket tamarack swamp between bedrock barrens with pools of standing water over Sphagnum moss, treed/vegetated hummocks			

Pond/Lake Assessment

In-Situ Water Quality

WT (deg. C)	<input type="text" value="10.0"/>	AT (degC)	<input type="text" value="11.0"/>	Water Quality Notes No DO meter, conductivity meter not working
pH	<input type="text" value="4.5"/>	Cond. (s/cm)	<input type="text"/>	
D.O. (mg/L)	<input type="text"/>	Water Colour	<input type="text" value="Colourless"/>	
Water Clarity	<input type="text" value="Clear"/>			

Seepage Indicators	<input type="text" value="None"/>
	<input type="text"/>

Fish & Wildlife Observations	<input type="text" value="None observed."/>
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In-Situ Habitat	<input type="text" value="Pools of standing water, hummocks"/>
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Physical Characteristics

Estimated Size	<input type="text" value="15.00"/>	Estimated Depth	<input type="text" value="0.30"/>
Notes	<input type="text" value="Wetted mean width of wetland is 15m and mean depth was 0.2m. standing water no flowing channel or connection to open water."/>		

In-Situ Cover





Woody Debris	Boulders	Cobble	Aquatic Vegetation	Structures	Total Instream Cover
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text" value="100.00"/>	<input type="text"/>	<input type="text" value="100.00"/>
Aquatic Vegetation Species Present	<input type="text" value="Water tolerant terrestrial species; mosses, grass, ferns, laurel"/>				
Description & Width of Riparian Vegetation	<input type="text" value="Thicket fen swamp bordered by bedrock. 0m thicket fen swamp bordered by bedrock, no notable transition in vegetation between swamp and rock barren."/>				

Study Area Comments


Poor connectivity to open water habitat, no flowing channel or open water on-site. Standing pools/flooded Sphagnum and vegetated hummocks. Not suspected to directly support fish. Conditions consistent 50m east and west of centreline



Pond/Lake Assessment

Site ID	WB-S-M13-55	Field Crew	Mike Godard Jessica Mendoza	33
Study Area	WEC			
Location	Lowland bog with no connectivity. Pines and canary grass present			
Project Number	60341251	Air Temp. (degC)	8.0	Weather Notes
Tablet	AECOM1	Wind Speed (beaufort)	4	Recent precipitation 20-30mm over last 48 hrs
Start Date	5/13/2015 1:38:06 PM	Precipitation	0	
End Date	2015-05-13 14:02:46	Cloud Cover	10.00	
Site Features				
Feature Description	399 Feature Location			
Facing north from centre point	Latitude:45.846368,Longitude:-80.62774,Altitude:187.6,Speed:0.030866666,Accuracy:2.1,Provider:gps,Time:05/13/2015 01:40:12 EDT			
Feature Description	402 Feature Location			
Facing east from centre point	Latitude:45.846368,Longitude:-80.62774,Altitude:188.0,Speed:0.015433333,Accuracy:2.1,Provider:gps,Time:05/13/2015 01:42:35 EDT			
Feature Description	405 Feature Location			
Facing south from centre point	Latitude:45.84637,Longitude:-80.627752,Altitude:187.9,Speed:0.025722222,Accuracy:2.1,Provider:gps,Time:05/13/2015 01:43:07 EDT			
Feature Description	408 Feature Location			
Facing west from centre point	Latitude:45.846436,Longitude:-80.627701,Altitude:187.4,Speed:0.16462222,Accuracy:2.1,Provider:gps,Time:05/13/2015 01:43:59 EDT			
Surrounding Land Use	Forest			
	Mixed coniferous deciduous forest			

Pond/Lake Assessment

Type of Pond	Natural, Seasonal, Offline				
	Intermittent pools throughout lowlying area between bedrock				
In-Situ Water Quality					
WT (deg. C)	18.9	AT (degC)	9.0	Water Quality Notes	
pH	4.3	Cond. (s/cm)	3.30	Standing water with high temps and low ph	
D.O. (mg/L)	0.0	Water Colour	Colourless		
Water Clarity	Clear				
Seepage Indicators	None				
Fish & Wildlife Observations	Crane heard				
In-Situ Habitat	None				
Physical Characteristics					
Estimated Size	40.00	Estimated Depth	0.10		
Notes	Lowlying pools likely to dry during warm periods; likely present due to recent precipitation				
In-Situ Cover					
Woody Debris	Boulders	Cobble	Aquatic Vegetation	Structures	Total Instream Cover
100.00					100.00
Aquatic Vegetation Species Present	None				
Description & Width of Riparian Vegetation	0.3m shrubs, grasses, trees				
Study Area Comments					
Wet areas in lowlying land not permanent; not ideal fish habitat					

Pond/Lake Assessment

Site ID	WB-N-M49-46	Field Crew	Amy Ingriselli Ami Arsenault		36
Study Area	WEC				
Location	Wind centre north, west side				
Project Number	60341251	Air Temp. (degC)	13.0	Weather Notes	
Tablet	AECOM3	Wind Speed (beaufort)	2		
Start Date	5/13/2015 11:35:41 AM	Precipitation	0		
End Date	2015-05-13 12:39:43	Cloud Cover	5.00		

Pond/Lake Assessment

Site Features

Feature 41 Feature Location
Description 1

Facing north across wetland at crossing location
Latitude:45.872101,Longitude:-80.713246,Altitude:173.8,Speed:0.30352223,Accuracy:1.5,Provider:gps,Time:05/13/2015 11:39:05 EDT



Feature 41 Feature Location
Description 4

At crossing facing upstream (northeast), on east side of bedrock island
Latitude:45.87217,Longitude:-80.713331,Altitude:171.8,Speed:0.8694111,Accuracy:1.5,Provider:gps,Time:05/13/2015 11:40:47 EDT



Feature 41 Feature Location
Description 7

At crossing facing downstream (south) on east side of bedrock island
Latitude:45.872355,Longitude:-80.71321,Altitude:173.4,Speed:0.010288889,Accuracy:1.5,Provider:gps,Time:05/13/2015 11:43:22 EDT



Feature 42 Feature Location
Description 0

View of the fen on the west side of bedrock island facing upstream
Latitude:45.872254,Longitude:-80.713645,Altitude:173.6,Speed:0.087455556,Accuracy:1.5,Provider:gps,Time:05/13/2015 11:54:11 EDT



Feature 423 Feature Location
Description

Looking downstream from bedrock island
Latitude:45.872252,Longitude:-80.713656,Altitude:173.7,Speed:0.0463,Accuracy:1.5,Provider:gps,Time:05/13/2015 11:56:51 EDT



Pond/Lake Assessment

Feature 426 Feature Location
Description

Beaver dam
and pond
upstream
~30M FROM
CROSSING

Latitude:45.87255,Longitude:-
80.712813,Altitude:171.7,Speed:0.1389,Accuracy:1.5,Provider:gps,Time:05/13/2015
12:19:51 EDT



Feature 429 Feature Location
Description

Channel
upstream of
crossing
flowing from
beaver dam
through alder
thicket

Latitude:45.87246,Longitude:-
80.712609,Altitude:178.7,Speed:0.1389,Accuracy:1.5,Provider:gps,Time:05/13/2015
12:45:45 EDT



Pond/Lake Assessment

Surrounding Land Use	Forest,Wetland				
	Extensive wetland bordered by rolling bedrock				
Type of Pond	Natural,Permanent,Dammed,Online				
	At crossing location extensive fen and marsh wetland with bedrock island. East side of island And upstream isnarrow channel flowing through alder thicket and grasses/ sedges over Bo Co from beaver pond approximately 30m upstream. Downstream is channel t				
In-Situ Water Quality					
WT (deg. C)	12.2	AT (degC)	12.0	Water Quality Notes	
pH	5.3	Cond. (s/cm)		Conductivity not working, no do meter	
D.O. (mg/L)		Water Colour	Yellow/Brown		
Water Clarity	Clear				
Seepage Indicators	None				
Fish & Wildlife Observations	White-throated sparrow. Snapping turtle basking in beaver pond upstream of crossing				
In-Situ Habitat	Fen/marsh downstream thicket/ pond upstream				
Physical Characteristics					
Estimated Size	100.00	Estimated Depth	0.30		
Notes	100m width of fen at crossing. Study area ~50M up and downstream. Mean depth is of open flowing water in small channel (useable by fish) at crossing location. Upstream of crossing is channel flowing over Bo Co through thicket ~0.5m mean w and ~0.1 d from beaver pond. Downstream channel through wetland flowing to open water pond				
In-Situ Cover					
Woody Debris	Boulders	Cobble	Aquatic Vegetation	Structures	Total Instream Cover
30.00	5.00	5.00	60.00		100.00
Aquatic Vegetation Species Present	Cattail, grasses, sedges, leatherleaf, laurel, speckled alder, reeds, sphagnum				
Description & Width of Riparian Vegetation	Channel at crossing and downstream bordered by floating mat of fen/marsh and bedrock, thicket upstream of crossing (sedges, grasses, speckled alder) riparian approximately 7m mean width				

Pond/Lake Assessment

Study Area Comments

Beaver dam upstream impeding fish passage. Likely direct fish habitat.



Pond/Lake Assessment

Site ID	WB-N-M47-45	Field Crew	Amy Ingriselli Ami Arsenault	39
Study Area	WEC			
Location	WEC North			
Project Number	60341251	Air Temp. (degC)	14.0	Weather Notes
Tablet	AECOM3	Wind Speed (beaufort)	5	
Start Date	5/13/2015 1:38:35 PM	Precipitation	0	
End Date	2015-05-13 13:50:57	Cloud Cover	20.00	
Surrounding Land Use	Forest,Wetland			
	Fen surrounded by rock barrens and connected to larger wetland as seen on topo map			
Type of Pond	Natural,Permanent,Online			
	Fen bordered by rock barren. No open water, floating mats of vegetation. Mosses, laurel, pitcher plant. Not fish habitat.			
In-Situ Water Quality				
WT (deg. C)		AT (degC)	14.0	Water Quality Notes
pH		Cond. (s/cm)		
D.O. (mg/L)		Water Colour		
Water Clarity				
Seepage Indicators	None			
Fish & Wildlife Observations	No fish observed.			
In-Situ Habitat	None. Floating mats of vegetation.			
Physical Characteristics				
Estimated Size	40.00	Estimated Depth	0.00	
Notes	No open water to estimate mean depth of fen. Floating mats of vegetation surrounded by bedrock.			

Pond/Lake Assessment

In-Situ Cover

Woody Debris	Boulders	Cobble	Aquatic Vegetation	Structures	Total Instream Cover
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	0.00



Aquatic Vegetation Species Present	None
Description & Width of Riparian Vegetation	0 m. No transition in vegetation from wetland to bedrock barren

Study Area Comments

Not fish habitat. Fen with no open water, covered by floating mats of vegetation



Pond/Lake Assessment

Site ID	WB-N-M43-22	Field Crew	Amy Ingriselli Ami Arsenault	42
Study Area	WEC			
Location	WEC North			
Project Number	60341251	Air Temp. (degC)	14.0	Weather Notes
Tablet	AECOM3	Wind Speed (beaufort)	5	
Start Date	5/13/2015 3:27:19 PM	Precipitation	0	
End Date	2015-05-13 15:44:20	Cloud Cover	10.00	
Site Features				
Feature Description	43	Feature Location		
	2			
Southeast of crossing location looking at fen	Latitude:45.860319,Longitude:-80.69073,Altitude:178.4,Speed:0.015433333,Accuracy:1.5,Provider:gps,Time:05/13/2015 03:39:35 EDT			
Feature Description	43	Feature Location		
	5			
Looking northwest towards crossing	Latitude:45.860369,Longitude:-80.690744,Altitude:177.4,Speed:0.12346666,Accuracy:1.5,Provider:gps,Time:05/13/2015 03:41:30 EDT			
Surrounding Land Use	Forest,Wetland			
	Fen conifer swamp bordered by bedrock outcrops with pine and occasional poplars.			
Type of Pond	Natural,Permanent			
	Large fen conifer swamp with floating mats throughout with no open water other then occasional flooded pools of stagnant water.			
In-Situ Water Quality				
WT (deg. C)		AT (degC)	14.0	Water Quality Notes
pH		Cond. (s/cm)		
D.O. (mg/L)		Water Colour	Colourless	
Water Clarity	Clear			
No water chemistry taken as area does not support fish habitat				

Pond/Lake Assessment

Seepage Indicators	None

Fish & Wildlife Observations	None
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In-Situ Habitat	None
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Physical Characteristics	
Estimated Size	165.00
Estimated Depth	0.00
Notes	Large fen bordered by bedrock.





In-Situ Cover					
Woody Debris	Boulders	Cobble	Aquatic Vegetation	Structures	Total Instream Cover
					0.00

Aquatic Vegetation Species Present	None. Water tolerant terrestrial species present (Sphagnum moss, Labrador tea, grasses)
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Description & Width of Riparian Vegetation	0 m. No transition in vegetation between fen and bedrock barren
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Study Area Comments	
Not fish habitat. Large fen conifer swamp with pools of stagnant water not connected to any other watercourse.	

Pond/Lake Assessment

Site ID	WB-S-M36-50	Field Crew	Mike Godard Jessica Mendoza	45
Study Area	WEC			
Location	Lowlying ground between two wetlands near rock outcrop			
Project Number	60341251	Air Temp. (degC)	10.0	Weather Notes
Tablet	AECOM1	Wind Speed (beaufort)	4	Heavy rains 3 days ago caused flooding
Start Date	5/14/2015 11:18:03 AM	Precipitation	0	
End Date	2015-05-14 11:51:57	Cloud Cover	20.00	
Site Features				
Feature 438 Feature Location Description				
Facing north from centre point	Latitude:45.82495,Longitude:-80.662789,Altitude:182.0,Speed:0.010288889,Accuracy:1.75,Provider:gps,Time:05/14/2015 11:21:13 EDT			
Feature 441 Feature Location Description				
Facing east from centre point	Latitude:45.824949,Longitude:-80.662791,Altitude:182.2,Speed:0.07716667,Accuracy:2.1,Provider:gps,Time:05/14/2015 11:24:08 EDT			
Feature 444 Feature Location Description				
Facing south from centre point	Latitude:45.82495,Longitude:-80.662786,Altitude:182.1,Speed:0.051444445,Accuracy:2.1,Provider:gps,Time:05/14/2015 11:24:50 EDT			
Feature 447 Feature Location Description				
Facing west from centre point	Latitude:45.824953,Longitude:-80.662794,Altitude:182.3,Speed:0.051444445,Accuracy:2.1,Provider:gps,Time:05/14/2015 11:25:29 EDT			

Pond/Lake Assessment

Feature 450 Feature Location
Description

Animal trail
where road is
proposed to
cross facing
northwest

Latitude:45.824954,Longitude:-
80.662797,Altitude:182.4,Speed:0.030866666,Accuracy:2.1,Provider:gps,Time:05/14/2015
11:26:10 EDT



Surrounding Land
Use

Forest,Wetland

Wetland to east and west; bedrock slopes to edge on south side; forest to east ; mixed deciduous
coniferous forest

Type of Pond

Natural,Seasonal,Offline

30 m across with grasses, shrubs, reeds

Pond/Lake Assessment

In-Situ Water Quality

WT (deg. C)	<input type="text" value="12.9"/>	AT (degC)	<input type="text" value="10.0"/>	Water Quality Notes <input type="text"/>
pH	<input type="text" value="3.7"/>	Cond. (s/cm)	<input type="text" value="0.09"/>	
D.O. (mg/L)	<input type="text" value="0.0"/>	Water Colour	<input type="text" value="Yellow/Brown"/>	
Water Clarity	<input type="text" value="Clear"/>			

Seepage Indicators

Fish & Wildlife
Observations

In-Situ Habitat

Physical Characteristics

Estimated Size

Estimated Depth

Notes

In-Situ Cover

Woody Debris

Boulders

Cobble

Aquatic Vegetation

Structures

Total Instream Cover





Aquatic Vegetation
Species Present

Description & Width
of Riparian
Vegetation

Study Area Comments



Pond/Lake Assessment


Site ID	WB-S-M36-49	Field Crew	Mike Godard Jessica Mendoza	48
Study Area	WEC			
Location	Lowlying wetland between upland mixed forest			
Project Number	60341251	Air Temp. (degC)	10.0	Weather Notes
Tablet	AECOM1	Wind Speed (beaufort)	4	Clear sunny dayHeavy precipitation 3 days ago has flooded lowlying land
Start Date	5/14/2015 12:18:15 PM	Precipitation	0	
End Date	2015-05-14 12:41:28	Cloud Cover	0.00	
Site Features				
Feature 453 Feature Location				
Description				
Facing north from centre point	Latitude:45.823414,Longitude:-80.66666,Altitude:171.6,Speed:0.15433334,Accuracy:1.8,Provider:gps,Time:05/14/2015 12:20:08 EDT			
Feature 456 Feature Location				
Description				
Facing east from centre point	Latitude:45.823409,Longitude:-80.666658,Altitude:171.4,Speed:0.06173333,Accuracy:1.8,Provider:gps,Time:05/14/2015 12:22:21 EDT			
Feature 459 Feature Location				
Description				
Facing south from centre point	Latitude:45.823406,Longitude:-80.666659,Altitude:171.3,Speed:0.0463,Accuracy:1.8,Provider:gps,Time:05/14/2015 12:22:57 EDT			
Feature 462 Feature Location				
Description				
Facing west from centre point	Latitude:45.823394,Longitude:-80.666669,Altitude:171.2,Speed:0.0463,Accuracy:1.8,Provider:gps,Time:05/14/2015 12:23:36 EDT			
Surrounding Land Use	Forest			
	Mixed coniferous and deciduous forest between rock outcroppings			

Execution Time 8/19/2015 12:09:29 PM





Filter Start Date 4/1/2015

Filter End Date 8/21/2015

Pond/Lake Assessment

Type of Pond	Natural,Vernal Pools,Offline				
	Wetland with intermittent pines birches and trembling aspens throughout with woody bushes grasses and mosses				
In-Situ Water Quality					
WT (deg. C)	9.6	AT (degC)	10.0	Water Quality Notes	
pH	3.9	Cond. (s/cm)	0.00	Cond in microsiemens	
D.O. (mg/L)	0.0	Water Colour	Yellow/Brown		
Water Clarity	Clear				
Seepage Indicators	None				
Fish & Wildlife Observations	Ruffed Grouse heard. Evidence of moose feeding and a well established moose trail.				
In-Situ Habitat	Habitat only for frogs or other amphibians				
Physical Characteristics					
Estimated Size	40.00	Estimated Depth	0.15		
Notes	Stagnant pools with limited connectivity.				
In-Situ Cover					
Woody Debris	Boulders	Cobble	Aquatic Vegetation	Structures	Total Instream Cover
100.00					5.00
Aquatic Vegetation Species Present	None				
Description & Width of Riparian Vegetation	>40m deciduous and coniferous mosses grasses herbaceous plants				
Study Area Comments					
Moose habitat; evidence of feeding and excrement					

Pond/Lake Assessment


Site ID	WB-S-M39-51	Field Crew	Mike Godard Jessica Mendoza	51
Study Area	WEC			
Location	Lowlying pools between bedrock outcrops			
Project Number	60341251	Air Temp. (degC)	10.0	Weather Notes
Tablet	AECOM1	Wind Speed (beaufort)	4	Heavy precipitation 3 days ago flooding lowland area
Start Date	5/14/2015 1:28:59 PM	Precipitation	0	
End Date	2015-05-14 13:58:23	Cloud Cover	0.00	
Site Features				
Feature Description	465 Feature Location			
Facing north from centre point	Latitude:45.817147,Longitude:-80.663979,Altitude:168.6,Speed:0.34982222,Accuracy:1.5,Provider:gps,Time:05/14/2015 01:33:09 EDT			
Feature Description	468 Feature Location			
Facing east from centre point	Latitude:45.817169,Longitude:-80.663723,Altitude:173.4,Speed:0.025722222,Accuracy:1.5,Provider:gps,Time:05/14/2015 01:43:26 EDT			
Feature Description	471 Feature Location			
Facing south from centre point	Latitude:45.81717,Longitude:-80.663726,Altitude:173.7,Speed:0.05658889,Accuracy:1.5,Provider:gps,Time:05/14/2015 01:44:17 EDT			
Feature Description	474 Feature Location			
Facing west from centre point	Latitude:45.81717,Longitude:-80.663756,Altitude:175.2,Speed:0.15947777,Accuracy:1.5,Provider:gps,Time:05/14/2015 01:44:56 EDT			
Surrounding Land Use	Forest			
	Bedrock outcrops with mixed deciduous coniferous forest			

Execution Time 8/19/2015 12:09:29 PM





Filter Start Date 4/1/2015

Filter End Date 8/21/2015

Pond/Lake Assessment

Type of Pond	Natural,Permanent,Offline				
	Lowlying wetland with shrubs mosses and grasses and few intermittent trees between two rock outcrops				
In-Situ Water Quality					
WT (deg. C)	11.8	AT (degC)	14.0	Water Quality Notes	
pH	4.2	Cond. (s/cm)	0.01		
D.O. (mg/L)	0.0	Water Colour	Yellow/Brown		
Water Clarity	Clear				
Seepage Indicators	None				
Fish & Wildlife Observations	Chipmunk red squirrel dragonfly				
In-Situ Habitat	None				
Physical Characteristics					
Estimated Size	25.00	Estimated Depth	0.20		
Notes	Limited connectivity between pools, water stagnant				
In-Situ Cover					
Woody Debris	Boulders	Cobble	Aquatic Vegetation	Structures	Total Instream Cover
100.00					5.00
Aquatic Vegetation Species Present	Aquatic grasses and hydrophilic mosses				
Description & Width of Riparian Vegetation	No riparian vegetation; wetland lies between two outcrops to the east and west				
Study Area Comments					
Water level in ponds likely to lower during summer; good habitat for amphibians					

Pond/Lake Assessment

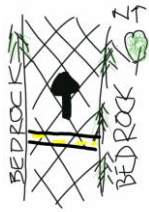
Site ID	WB-S-M41-52	Field Crew	Mike Godard Jessica Mendoza	54
Study Area	WEC			
Location	Wetland between bedrock outcrops			
Project Number	60341251	Air Temp. (degC)	15.0	Weather Notes Heavy precipitation in last 3 days
Tablet	AECOM1	Wind Speed (beaufort)	4	
Start Date	5/14/2015 2:41:38 PM	Precipitation	0	
End Date	2015-05-14 15:01:20	Cloud Cover	30.00	
Site Features				
Feature 477 Feature Location Description				
Facing north from centre point	Latitude:45.821873,Longitude:-80.64894,Altitude:181.3,Speed:0.06173333,Accuracy:1.5,Provider:gps,Time:05/14/2015 02:43:43 EDT			
Feature 480 Feature Location Description				
Facing east from centre point	Latitude:45.821868,Longitude:-80.648923,Altitude:181.8,Speed:0.015433333,Accuracy:1.5,Provider:gps,Time:05/14/2015 02:45:22 EDT			
Feature 483 Feature Location Description				
Facing south from centre point	Latitude:45.821869,Longitude:-80.648913,Altitude:182.0,Speed:0.0051444443,Accuracy:1.5,Provider:gps,Time:05/14/2015 02:45:56 EDT			
Feature 486 Feature Location Description				
Facing west from centre point	Latitude:45.821874,Longitude:-80.648901,Altitude:182.8,Speed:0.015433333,Accuracy:1.5,Provider:gps,Time:05/14/2015 02:46:31 EDT			
Surrounding Land Use	Forest			
	Mixed deciduous and coniferous forest sparsely located among bedrock			

Execution Time 8/19/2015 12:09:29 PM



Filter Start Date 4/1/2015

Filter End Date 8/21/2015

Pond/Lake Assessment

Type of Pond	Natural,Permanent,Online				
	Slow moving water to stagnant pools in wetland				
In-Situ Water Quality					
WT (deg. C)	13.7	AT (degC)	15.0	Water Quality Notes	
pH	4.4	Cond. (s/cm)	0.00		
D.O. (mg/L)	4.4	Water Colour	Yellow/Brown		
Water Clarity	Clear				
Seepage Indicators	None				
Fish & Wildlife Observations	Chicadees moths ruffed grouse				
In-Situ Habitat	Small shaded channels and pools				
Physical Characteristics					
Estimated Size	15.00	Estimated Depth	0.20		
Notes	Connects two large wetlands				
In-Situ Cover					
Woody Debris	Boulders	Cobble	Aquatic Vegetation	Structures	Total Instream Cover
100.00					5.00
Aquatic Vegetation Species Present	Wetland grasses and sedges				
Description & Width of Riparian Vegetation	0m no riparian zone due to bedrock outcrops				
Study Area Comments					
May be habitat for small cyprinids and amphibians, connected to wetland downstream					

Pond/Lake Assessment

Site ID	WB-N-M39-19	Field Crew	Amy Ingriselli Ami Arsenault	57
Study Area	WEC			
Location	Located along centerline on map 39			
Project Number	60341251	Air Temp. (degC)	12.0	Weather Notes
Tablet	AECOM16	Wind Speed (beaufort)	5	
Start Date	5/14/2015 11:36:01 AM	Precipitation	0	
End Date	2015-05-14 11:59:30	Cloud Cover	20.00	
Site Features				
Feature Description	48	Feature Location		
Facing south at crossing	Latitude:45.873391,Longitude:-80.694416,Altitude:180.2,Speed:0.041155554,Accuracy:1.5,Provider:gps,Time:05/14/2015 11:42:32 EDT			
Feature Description	49	Feature Location		
Facing north at crossing	Latitude:45.873387,Longitude:-80.694407,Altitude:180.1,Speed:0.015433333,Accuracy:1.5,Provider:gps,Time:05/14/2015 11:44:07 EDT			
Surrounding Land Use	Forest,Wetland			
	Bog bordered by bedrock and conifer swamp. There is a large body of open water fen marsh to the west that the bog is not connected to; this open water fen is not crossed by the road alignment.			
Type of Pond	Natural,Permanent,Offline			
	Large bog considered offline; could not locate any connections to surrounding water courses at the time of survey. No open water to support any fish habitat. Large floating mats of vegetation.			
In-Situ Water Quality				
WT (deg. C)		AT (degC)	12.0	Water Quality Notes
pH		Cond. (s/cm)		
D.O. (mg/L)		Water Colour		
Water Clarity				
No water chemistry taken as there is no open water				

Pond/Lake Assessment

Seepage Indicators	None

Fish & Wildlife Observations	None
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In-Situ Habitat	None
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Physical Characteristics			
Estimated Size	<div>90.00</div>	Estimated Depth	<div>0.00</div>
Notes	Estimated width is measured at the crossing location, surveyed 50m east and west of centreline.		

In-Situ Cover					
Woody Debris	Boulders	Cobble	Aquatic Vegetation	Structures	Total Instream Cover
<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div>0.00</div>





Aquatic Vegetation Species Present	No aquatic species, floating bog veg - Sphagnum black spruce pitcher plant cranberry...
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Description & Width of Riparian Vegetation	0 m no transition in vegetation between conifer swamp and bedrock
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Study Area Comments
Not fish habitat



Pond/Lake Assessment

Site ID	WB-N-M37-15	Field Crew	Amy Ingriselli Ami Arsenault		60
Study Area	WEC				
Location	Located in fen along centerline on map 37				
Project Number	60341251	Air Temp. (degC)	13.0	Weather Notes	
Tablet	AECOM16	Wind Speed (beaufort)	4		
Start Date	5/14/2015 12:52:46 PM	Precipitation	0		
End Date	2015-05-14 14:20:04	Cloud Cover	10.00		
Site Features					
Feature Description	49	Feature Location			
Facing north from centerline	Latitude:45.863522,Longitude:-80.684139,Altitude:178.7,Speed:0.041155554,Accuracy:1.5,Provider:gps,Time:05/14/2015 12:56:38 EDT				
					
Feature Description	49	Feature Location			
Facing south from centerline	Latitude:45.863521,Longitude:-80.68414,Altitude:178.6,Speed:0.07716667,Accuracy:1.5,Provider:gps,Time:05/14/2015 12:57:14 EDT				
					
Feature Description	501	Feature Location			
Small channel upstream of center line (north facing photo)	Latitude:45.863677,Longitude:-80.683956,Altitude:181.7,Speed:0.025722222,Accuracy:1.5,Provider:gps,Time:05/14/2015 01:35:42 EDT				
					
Feature Description	50	Feature Location			
Facing upstream (north) from 50m DS of CL	Latitude:45.863189,Longitude:-80.683697,Altitude:184.9,Speed:0.041155554,Accuracy:2.1,Provider:gps,Time:05/14/2015 02:20:52 EDT				
					

Pond/Lake Assessment

Feature 507 Feature Location
Description

Downstream
from study
area south
towards pond

Latitude:45.863174,Longitude:-
80.68374,Altitude:183.4,Speed:0.03601111,Accuracy:1.75,Provider:gps,Time:05/14/2015
02:23:16 EDT



Surrounding Land
Use

Forest,Wetland

Fen surrounded by bedrock

Type of Pond

Natural,Permanent,Online

Large fen surrounded by bedrock and a wetland that is downstream/south of centerline. Pond characteristics change upstream and downstream of the centerline. Upstream: large fen bordered by bedrock, floating mats of vegetation, no open water and no direct

Pond/Lake Assessment

In-Situ Water Quality

WT (deg. C)	<input type="text" value="11.5"/>	AT (degC)	<input type="text" value="13.0"/>	Water Quality Notes <div></div>
pH	<input type="text" value="3.9"/>	Cond. (s/cm)	<input type="text" value="0.02"/>	
D.O. (mg/L)	<input type="text" value="4.1"/>	Water Colour	<input type="text" value="Colourless"/>	
Water Clarity	<input type="text" value="Clear"/>			

Seepage Indicators

Fish & Wildlife
Observations

In-Situ Habitat

Physical Characteristics

Estimated Size

Estimated Depth

Notes

In-Situ Cover

Woody Debris

Boulders

Cobble

Aquatic Vegetation

Structures

Total Instream Cover





Aquatic Vegetation
Species Present

Description & Width
of Riparian
Vegetation

Study Area Comments



Pond/Lake Assessment


Site ID	WB-N-M12-37	Field Crew	Amy Ingriselli Jessica Mendoza	63
Study Area	WEC			
Location	Wetland between two rock outcrops. Wind centre north map 12			
Project Number	60341251	Air Temp. (degC)	7.0	Weather Notes
Tablet	AECOM4	Wind Speed (beaufort)	3	
Start Date	5/20/2015 9:16:00 AM	Precipitation	0	
End Date	2015-05-20 09:43:42	Cloud Cover	0.00	
Site Features				
Feature Description	588 Feature Location			
Centre line from east to west	Latitude:45.870787,Longitude:-80.622936,Altitude:193.5,Speed:0.025722222,Accuracy:1.75,Provider:gps,Time:			
Feature Description	591 Feature Location			
Centre line looking upstream	Latitude:45.870799,Longitude:-80.623086,Altitude:194.1,Speed:0.030866666,Accuracy:1.5,Provider:gps,Time:05/20/2015 09:21:58 EDT			
Feature Description	594 Feature Location			
Centre line looking downstream	Latitude:45.870799,Longitude:-80.623086,Altitude:194.1,Speed:0.010288889,Accuracy:1.5,Provider:gps,Time:05/20/2015 09:22:11 EDT			
Feature Description	597 Feature Location			
Understory at Cl	Latitude:45.8708,Longitude:-80.623108,Altitude:194.5,Speed:0.025722222,Accuracy:1.5,Provider:gps,Time:05/20/2015 09:28:34 EDT			
Surrounding Land Use	Forest			
	Two rock outcrops with mixed deciduous coniferous forest			

Execution Time 8/19/2015 12:09:29 PM





Filter Start Date 4/1/2015

Filter End Date 8/21/2015

Pond/Lake Assessment

Type of Pond	Natural,Seasonal,Offline				
Lowlying area with saturated mosses and water-tolerant terrestrial vegetation. No open water or evidence of any flow, even seasonally					
In-Situ Water Quality					
WT (deg. C)		AT (degC)	7.0	Water Quality Notes	
pH		Cond. (s/cm)		Not enough water for measurement	
D.O. (mg/L)		Water Colour	Colourless		
Water Clarity	Clear				
Seepage Indicators	None				
Fish & Wildlife Observations	Sand hill cranes heard				
In-Situ Habitat	None				
Physical Characteristics					
Estimated Size	25.00	Estimated Depth	0.00		
Notes	25 m estimated width is at centre line. Pooling occurs at animal trails.				
In-Situ Cover					
Woody Debris	Boulders	Cobble	Aquatic Vegetation	Structures	Total Instream Cover
10.00			90.00		100.00
Aquatic Vegetation Species Present	None, only water tolerant mosses, grasses, raspberry				
Description & Width of Riparian Vegetation	1m mosses juniper shrubs and trees				
Study Area Comments					
Saturated bed of moss occurring in lowlying area with no evidence of any flows. No connectivity to open water. Pond 70m downstream of CI is an open pond but is not connected to wetland					

Pond/Lake Assessment

Site ID	WB-N-M13-36	Field Crew	Amy Ingriselli Jessica Mendoza		66
Study Area	WEC				
Location	WEC north map 13 near turbine 30				
Project Number	60341251	Air Temp. (degC)	10.0	Weather Notes	
Tablet	AECOM4	Wind Speed (beaufort)	3		
Start Date	5/20/2015 10:16:11 AM	Precipitation	0		
End Date	2015-05-20 10:41:06	Cloud Cover	0.00		
Site Features					
Feature Description	60	Feature Location			
Facing north from CL	Latitude:45.876788,Longitude:-80.627125,Altitude:189.5,Speed:0.2675111,Accuracy:1.5,Provider:gps,Time:05/20/2015 10:19:18 EDT				
					
Feature Description	60	Feature Location			
Facing south from CL	Latitude:45.876786,Longitude:-80.627136,Altitude:189.8,Speed:0.025722222,Accuracy:1.5,Provider:gps,Time:05/20/2015 10:19:49 EDT				
					
Feature Description	60	Feature Location			
Looking across bog at CL from east bank facing west	Latitude:45.876728,Longitude:-80.626998,Altitude:188.9,Speed:0.041155554,Accuracy:2.1,Provider:gps,Time:05/20/2015 10:35:28 EDT				
					
Feature Description	609	Feature Location			
View of bog floor/understory	Latitude:45.876749,Longitude:-80.627036,Altitude:189.1,Speed:0.59675556,Accuracy:2.1,Provider:gps,Time:05/20/2015 10:36:34 EDT				
					

Pond/Lake Assessment

Feature Description 61 Feature Location 2

View from top of bedrock facing southwest, looking across CL and bedrock outcrop to the south

Latitude:45.876911,Longitude:-80.626783,Altitude:195.3,Speed:0.28294444,Accuracy:1.8,Provider:gps,Time:05/20/2015 10:39:07 EDT



Surrounding Land Use

Forest,Wetland
Bedrock barren forest bordering bog

Type of Pond

Natural,Permanent,Offline
Bog with no open water, no connectivity to open water and no evidence of seasonal or intermittent flows. Bog vegetation throughout

Pond/Lake Assessment

In-Situ Water Quality

WT (deg. C)	<input type="text"/>	AT (degC)	<input type="text" value="10.0"/>	Water Quality Notes No open water, moist bog moss
pH	<input type="text"/>	Cond. (s/cm)	<input type="text"/>	
D.O. (mg/L)	<input type="text"/>	Water Colour	<input type="text"/>	
Water Clarity	<input type="text"/>			

Seepage Indicators

None

Fish & Wildlife Observations

White-throated sparrow, swamp sparrow

In-Situ Habitat

None

Physical Characteristics

Estimated Size	<input type="text" value="50.00"/>	Estimated Depth	<input type="text" value="0.00"/>
Notes	<input type="text" value="Bog 50m wide at CL"/>		

In-Situ Cover

Woody Debris	Boulders	Cobble	Aquatic Vegetation	Structures	Total Instream Cover
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text" value="0.00"/>

Aquatic Vegetation Species Present

No open water; no aquatic vegetation. Bog vegetation includes Sphagnum moss, leatherleaf, tamarack, black spruce, speckled alder

Description & Width of Riparian Vegetation





0 riparian. Rock barren conifers to edge of rock barren and bog

Study Area Comments

Bog width at CL is ~50m wide. Approximately 25m south of CL bog still ~50m wide but with ~12m wide bedrock outcrop in bog. Moving road ~30m south would reduce footprint in bog.



Pond/Lake Assessment


Site ID	WB-N-M23-40	Field Crew	Amy Ingriselli Jessica Mendoza	69
Study Area	WEC			
Location	WEC north, south of Key River near turbine 20			
Project Number	60341251	Air Temp. (degC)	10.0	Weather Notes
Tablet	AECOM4	Wind Speed (beaufort)	4	
Start Date	5/21/2015 9:28:44 AM	Precipitation	0	
End Date	2015-05-21 10:04:23	Cloud Cover	0.00	
Site Features				
Feature Description	645 Feature Location			
Along centre line from east looking west	Latitude:45.880471,Longitude:-80.664364,Altitude:179.0,Speed:0.015433333,Accuracy:1.75,Provider:gps,Time:05/21/2015 09:32:00 EDT			
Feature Description	648 Feature Location			
At CI looking upstream	Latitude:45.880457,Longitude:-80.664398,Altitude:179.1,Speed:0.041155554,Accuracy:1.5,Provider:gps,Time:05/21/2015 09:33:22 EDT			
Feature Description	651 Feature Location			
At CI looking downstream	Latitude:45.880459,Longitude:-80.664409,Altitude:179.1,Speed:0.06173333,Accuracy:1.5,Provider:gps,Time:05/21/2015 09:34:06 EDT			
Feature Description	654 Feature Location			
Upstream stagnant pooling in low lying area	Latitude:45.880457,Longitude:-80.664189,Altitude:184.1,Speed:0.025722222,Accuracy:1.5,Provider:gps,Time:05/21/2015 09:51:08 EDT			
Surrounding Land Use	Forest,Wetland			
	Lowlying alder thicket with saturated and pooled areas between bedrock with conifer and deciduous forest			

Execution Time 8/19/2015 12:09:29 PM





Filter Start Date 4/1/2015

Filter End Date 8/21/2015

Pond/Lake Assessment

Type of Pond	Natural,Seasonal,Offline				
Seasonal over land flow in north east to south west direction. Appears from air photo to eventually connect to marsh downstream but no flow or evidence of continuous channel. Seeping through thicket.					
In-Situ Water Quality					
WT (deg. C)		AT (degC)	10.0	Water Quality Notes	
pH		Cond. (s/cm)		No open water mostly saturated moss and detritus	
D.O. (mg/L)		Water Colour			
Water Clarity					
Seepage Indicators	None				
Fish & Wildlife Observations	Grouse, sand hill crane, and Woodpecker heard				
In-Situ Habitat	None				
Physical Characteristics					
Estimated Size	9.00	Estimated Depth	0.02		
Notes	Overland flow and saturated ground is likely to be seasonal and may dry during summer, presence of water is due to lowlying area				
In-Situ Cover					
Woody Debris	Boulders	Cobble	Aquatic Vegetation	Structures	Total Instream Cover
20.00			80.00		75.00
Aquatic Vegetation Species Present	None, only emergent and terrestrial grasses and herbaceous plants, mosses, ferns and alders				
Description & Width of Riparian Vegetation	4m. Mixed deciduous and coniferous trees, shrubs, herbaceous plants, mosses, grass				
Study Area Comments					
Water in low lying areas likely to dry during summer					

Pond/Lake Assessment

Site ID	WB-N-M21-28	Field Crew	Amy Ingriselli Jessica Mendoza	72
Study Area	WEC			
Location	Wind centre north, south of Key River, map 21			
Project Number	60341251	Air Temp. (degC)	10.0	Weather Notes
Tablet	AECOM4	Wind Speed (beaufort)	5	
Start Date	5/21/2015 1:15:46 PM	Precipitation	0	
End Date	2015-05-21 14:05:07	Cloud Cover	80.00	
Site Features				
Feature Description	65	Feature Location		
Looking across fen at CL, facing east	Latitude:45.878739,Longitude:-80.64723,Altitude:181.6,Speed:0.14918889,Accuracy:2.1,Provider:gps,Time:05/21/2015 01:25:06 EDT			
Feature Description	66	Feature Location		
Facing north from CL	Latitude:45.878857,Longitude:-80.646982,Altitude:183.3,Speed:0.11832222,Accuracy:1.8,Provider:gps,Time:05/21/2015 01:26:38 EDT			
Feature Description	66	Feature Location		
Facing south from CL	Latitude:45.878888,Longitude:-80.646902,Altitude:183.9,Speed:0.010288889,Accuracy:1.8,Provider:gps,Time:05/21/2015 01:27:43 EDT			
Feature Description	66	Feature Location		
Facing south from CL. Bedrock outcrop/point <5m south of CL. Road alignment could be moved to	Latitude:45.878876,Longitude:-80.646977,Altitude:183.3,Speed:0.07202222,Accuracy:1.8,Provider:gps,Time:05/21/2015 01:28:24 EDT			

Execution Time 8/19/2015 12:09:29 PM

Filter Start Date 4/1/2015

Filter End Date 8/21/2015

Pond/Lake Assessment

cross over
bedrock and
reduce
footprint in
fen.

Feature 66
Description 9
Feature Location

Fen
approximately
20m DS of CL
with pockets
of open water
but still
dominated by
floating mat

Latitude:45.878733,Longitude:-
80.646694,Altitude:182.0,Speed:0.08231111,Accuracy:1.8,Provider:gps,Time:05/21/20
15 01:31:32 EDT



Surrounding Land
Use

Forest,Wetland

Fen, with open water swamp to the southeast. Bordered by rock barren

Type of Pond

Natural,Permanent,Online

Fen connected to open water swamp/fen downstream. No open water within 20m of CL. Floating mat of bog/fen vegetation.

Pond/Lake Assessment

In-Situ Water Quality

WT (deg. C)	<input type="text" value="13.0"/>	AT (degC)	<input type="text" value="10.0"/>	Water Quality Notes Measured at open fen downstream of cl. Dissolved oxygen seems oddly high for fen
pH	<input type="text" value="3.7"/>	Cond. (s/cm)	<input type="text" value="0.02"/>	
D.O. (mg/L)	<input type="text" value="9.2"/>	Water Colour	<input type="text" value="Colourless"/>	
Water Clarity	<input type="text" value="Clear"/>			

Seepage Indicators	<input type="text" value="None"/>
	<input type="text"/>

Fish & Wildlife Observations	<input type="text" value="White throated sparrow, moose browsing evidence"/>
------------------------------	--

In-Situ Habitat	<input type="text" value="Pockets of open water in flooded fen downstream"/>
-----------------	--

Physical Characteristics

Estimated Size	<input type="text" value="50.00"/>	Estimated Depth	<input type="text" value="0.00"/>
Notes	<input type="text" value="50m wide at CL. No open water at CL. From ~20m downstream of centre line is fen with pockets of open water with depths >1m but depth unknown. Appears to be flooded, perhaps by a beaver dam downstream. Areas of open water choked with vegetation (Sphagnum). Appears to have historically been dammed. Depth and vegetation notes recorded are of downstream flooded fen only."/>		

In-Situ Cover





Woody Debris	Boulders	Cobble	Aquatic Vegetation	Structures	Total Instream Cover
<input type="text" value="5.00"/>	<input type="text"/>	<input type="text"/>	<input type="text" value="95.00"/>	<input type="text"/>	<input type="text" value="100.00"/>
Aquatic Vegetation Species Present	<input type="text" value="Submerged/flooded Sphagnum and other fen vegetation. Fragrant water lily present but sparse."/>				
Description & Width of Riparian Vegetation	<input type="text" value="No riparian zone. Floating mat of fen veg to bedrock barren."/>				

Study Area Comments


Notes on in-situ cover are of flooded fen 20-50m DS of CL. Remaining 70m of study area is fen. Flooded section DS may be accessible too and may support tolerant cyprinids but no open water within 20m of CL. Consider moving road alignment slightly south o







Pond/Lake Assessment

Site ID	WB-N-M18-39	Field Crew	Amy Ingriselli Jessica Mendoza	75
Study Area	WEC			
Location	Wind centre north south from Key River near turbine 74			
Project Number	60341251	Air Temp. (degC)	10.0	Weather Notes
Tablet	AECOM4	Wind Speed (beaufort)	5	
Start Date	5/21/2015 2:37:53 PM	Precipitation	0	
End Date	2015-05-21 15:03:58	Cloud Cover	80.00	
Site Features				
Feature Description	67	Feature Location		
Facing south at thicket at CL	Latitude:45.882888,Longitude:-80.645294,Altitude:177.4,Speed:0.010288889,Accuracy:2.1,Provider:gps,Time:05/21/2015 02:50:13 EDT			
Feature Description	675	Feature Location		
Facing west from 5m west of CL	Latitude:45.882831,Longitude:-80.645266,Altitude:179.5,Speed:0.0463,Accuracy:2.1,Provider:gps,Time:05/21/2015 02:52:07 EDT			
Feature Description	678	Feature Location		
View of pooling water and thicket understory approximately 40m N of CL	Latitude:45.883343,Longitude:-80.64508,Altitude:178.5,Speed:0.025722222,Accuracy:2.7,Provider:gps,Time:05/21/2015 02:57:10 EDT			
Feature Description	681	Feature Location		
Facing northeast from CL	Latitude:45.882899,Longitude:-80.645369,Altitude:180.1,Speed:0.14918889,Accuracy:2.1,Provider:gps,Time:05/21/2015 03:07:42 EDT			


Pond/Lake Assessment

Surrounding Land Use	Forest,Wetland				
	Bedrock barren borders the low-lying thicket				
Type of Pond	Natural,Seasonal				
	Saturated low-lying area, alder thicket or grasses/sedges. No open or flowing g water, occasional isolated stagnant pools in thicket. Downstream occasionally a poorly defined channel is observed then dissipated through thicket				
In-Situ Water Quality					
WT (deg. C)		AT (degC)	10.0	Water Quality Notes No flow	
pH		Cond. (s/cm)			
D.O. (mg/L)		Water Colour	Colourless		
Water Clarity	Clear				
Seepage Indicators	None				
Fish & Wildlife Observations	None				
In-Situ Habitat	Not fish habitat				
Physical Characteristics					
Estimated Size	25.00	Estimated Depth	0.00		
Notes	Width at CL is 25m but overall mean width is 30m. Saturated mosses and grasses/sedges in thicket, occasional stagnant pools. No flow or evidence of channel. Low-lying area collecting overland flow				
In-Situ Cover					
Woody Debris	Boulders	Cobble	Aquatic Vegetation	Structures	Total Instream Cover
					0.00
Aquatic Vegetation Species Present	No aquatic vegetation, no open water. Saturated Sphagnum and water-tolerant terrestrial species such as speckled alder, grasses, sedges				
Description & Width of Riparian Vegetation	~2 m of low sweet blueberry, Labrador tea between thicket and rock barren				
Study Area Comments					
Does not directly support fish, poor or no connectivity observed in field or on air photos					

Pond/Lake Assessment

Site ID	WB-N-M18-39-2	Field Crew	Amy Ingriselli Jessica Mendoza	78
Study Area	WEC			
Location	Added site due to observed water at road crossing. Road runs north west to south east perpendicular to thicket. Near turbine 73			
Project Number	60341251	Air Temp. (degC)	10.0	Weather Notes
Tablet	AECOM4	Wind Speed (beaufort)	4	
Start Date	5/21/2015 3:24:32 PM	Precipitation	0	
End Date	2015-05-21 16:09:59	Cloud Cover	100.00	
Site Features				
Feature Description	684 Feature Location			
Along the CI from the right bank	Latitude:45.884409,Longitude:-80.650519,Altitude:179.6,Speed:0.015433333,Accuracy:2.1,Provider:gps,Time:05/21/2015 03:42:07 EDT			
Feature Description	687 Feature Location			
Middle of CI looking upstream	Latitude:45.884397,Longitude:-80.650458,Altitude:179.4,Speed:0.16976666,Accuracy:2.1,Provider:gps,Time:05/21/2015 03:47:33 EDT			
Feature Description	690 Feature Location			
Middle of CI looking downstream	Latitude:45.88439,Longitude:-80.650443,Altitude:179.6,Speed:0.020577777,Accuracy:2.1,Provider:gps,Time:05/21/2015 03:48:16 EDT			
Feature Description	693 Feature Location			
Water crossing snowmobile trail	Latitude:45.884325,Longitude:-80.650459,Altitude:178.6,Speed:0.26236665,Accuracy:2.1,Provider:gps,Time:05/21/2015 03:49:39 EDT			

Pond/Lake Assessment

Surrounding Land Use	Forest,Meadow				
	Mixed coniferous deciduous forest atop bedrock outcrops				
Type of Pond	Natural,Permanent,Seasonal,Offline				
	Small intermittent pools with low connectivity and low flow. Added site due to observed water at road crossing. Permanent alder thicket with limited connectivity in a north east to south west direction. 30m downstream area widens into black ash swamp w				
In-Situ Water Quality					
WT (deg. C)	12.0	AT (degC)	15.0	Water Quality Notes	
pH	4.0	Cond. (s/cm)	0.02		
D.O. (mg/L)	6.2	Water Colour	Yellow/Brown		
Water Clarity	Clear				
Seepage Indicators	None				
Fish & Wildlife Observations	None				
In-Situ Habitat	Pools around grasses and shrubs				
Physical Characteristics					
Estimated Size	18.00	Estimated Depth	0.20		
Notes	Stagnant to low flowing pools of water in lowlying areas with limited connectivity. 18m wide at CL. Depth is max depth of standing pools				
In-Situ Cover					
Woody Debris	Boulders	Cobble	Aquatic Vegetation	Structures	Total Instream Cover
70.00			30.00		70.00
Aquatic Vegetation Species Present	Marsh marigold, woodland horsetail, alder, some filamentous algae upstream				
Description & Width of Riparian Vegetation	Currant, raspberry, marsh marigold 2m				
Study Area Comments					
Water may be present for long enough upstream of CL to support tolerant cyprinids and amphibians, as supported by water tolerant vegetation and emergents. However from field and air photos connectivity appears to be poor or nil. Snowmobile trail crosses					

Execution Time 8/19/2015 12:09:29 PM

Filter Start Date 4/1/2015

Filter End Date 8/21/2015

Pond/Lake Assessment

Site ID	WB-N-M14-38	Field Crew	Amy Ingriselli Jessica Mendoza	81
Study Area	WEC			
Location	WEC north map 14 near turbine t24			
Project Number	60341251	Air Temp. (degC)	4.0	Weather Notes
Tablet	AECOM4	Wind Speed (beaufort)	4	
Start Date	5/22/2015 9:03:26 AM	Precipitation	0	
End Date	2015-05-22 09:26:57	Cloud Cover	50.00	
Surrounding Land Use	Forest,Wetland			
	Mixed coniferous deciduous forest atop bedrock outcrops, fen to the northeast and southwest of site			
Type of Pond	Natural,Permanent,Online			
	Saturated Sphagnum moss with water tolerant grasses and sedges			
In-Situ Water Quality				
WT (deg. C)		AT (degC)	4.0	Water Quality Notes
pH		Cond. (s/cm)		
D.O. (mg/L)		Water Colour		
Water Clarity				
Seepage Indicators	None			
Fish & Wildlife Observations	None			
In-Situ Habitat	None			
Physical Characteristics				
Estimated Size	9.00	Estimated Depth	0.00	
Notes				

Pond/Lake Assessment

In-Situ Cover

Woody Debris	Boulders	Cobble	Aquatic Vegetation	Structures	Total Instream Cover
10.00			90.00		100.00

Aquatic Vegetation Species Present	Sphagnum moss, water tolerant grasses and sedges and shrubs, Leather leaf, cranberry, speckled alder, Labrador tea, low sweet blueberry
Description & Width of Riparian Vegetation	1m. Mosses shrubs

Study Area Comments

Saturated lowlying area with no open water. Bedrock from west side projects into saturated area 45 south of the CI so that saturated area is only 5m wide. Could consider moving CI south to prevent footprint on marsh.



Pond/Lake Assessment

Site ID	WB-S-M34-54	Field Crew	Amy Ingriselli Jessica Mendoza		84
Study Area	WEC				
Location	Wetland on north west side of CI adjacent to bedrock				
Project Number	60341251	Air Temp. (degC)	15.0	Weather Notes Rained 20-30mm in past 48 hours	
Tablet	AECOM16	Wind Speed (beaufort)	1		
Start Date	5/28/2015 10:42:35 AM	Precipitation	0		
End Date	2015-05-28 11:31:09	Cloud Cover	100.00		

Pond/Lake Assessment

Site Features

Feature 747 Feature Location
Description

Looking south west along cl
Latitude:45.828543,Longitude:-80.645114,Altitude:181.2,Speed:0.15433334,Accuracy:2.1,Provider:gps,Time:05/28/2015 10:50:36 EDT



Feature 750 Feature Location
Description

Looking south west along Cl
107m south west from centre point
Latitude:45.828088,Longitude:-80.645898,Altitude:191.3,Speed:0.010288889,Accuracy:1.75,Provider:gps,Time:05/28/2015 11:09:04 EDT



Feature 753 Feature Location
Description

Looking north east along Cl
107m from centrepont
Latitude:45.82804,Longitude:-80.645956,Altitude:191.7,Speed:0.030866666,Accuracy:1.75,Provider:gps,Time:05/28/2015 11:19:03 EDT



Feature 756 Feature Location
Description

Looking south from Cl at channel feature
Latitude:45.8282,Longitude:-80.645741,Altitude:190.8,Speed:0.7973889,Accuracy:2.1,Provider:gps,Time:05/28/2015 11:20:37 EDT



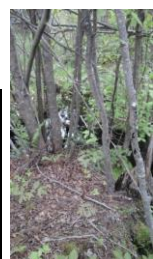
Feature 759 Feature Location
Description

Looking north from south end of channel feature towards cl
Latitude:45.827659,Longitude:-80.64549,Altitude:180.1,Speed:0.015433333,Accuracy:1.5,Provider:gps,Time:05/28/2015 11:43:24 EDT



Feature 762 Feature Location
Description

Looking south from treed end of south channel
Latitude:45.827658,Longitude:-80.645482,Altitude:179.2,Speed:0.06173333,Accuracy:1.5,Provider:gps,Time:05/28/2015 11:44:55 EDT



Execution Time 8/19/2015 12:09:29 PM

Filter Start Date 4/1/2015

Filter End Date 8/21/2015

Pond/Lake Assessment


Feature 765 Feature Location
Description

Looking
southwest at cl
from 50m
northeast of cl




Latitude:45.828473,Longitude:-
80.6452,Altitude:181.6,Speed:0.65334445,Accuracy:1.8,Provider:gps,Time:05/28/2015
11:53:44 EDT





Pond/Lake Assessment

Surrounding Land Use	Forest,Wetland				
	Mixed coniferous deciduous forest atop bedrock. Wetland to north				
Type of Pond	Natural,Permanent,Offline				
	Saturated Sphagnum with meadow sweet and Carex species with pools between bedrock outcrops				
In-Situ Water Quality					
WT (deg. C)		AT (degC)	15.0	Water Quality Notes No open water to sample	
pH		Cond. (s/cm)			
D.O. (mg/L)		Water Colour			
Water Clarity					
Seepage Indicators	None				
Fish & Wildlife Observations	Wilson's snipe heard, white throated sparrow, Red-breasted nuthatch, oven bird, black throated green warbler, chipping sparrow, woodpecker				
In-Situ Habitat	None				
Physical Characteristics					
Estimated Size	107.00	Estimated Depth	0.20		
Notes	Rock outcrops jutting into wetland are being used for cl, whole 107 includes 40m and 4m bedrock outcrops.				
In-Situ Cover					
Woody Debris	Boulders	Cobble	Aquatic Vegetation	Structures	Total Instream Cover
5.00			95.00		100.00
Aquatic Vegetation Species Present	Sphagnum sp., Carex sp., Alnus, larex, pinus, sheep laurel				
Description & Width of Riparian Vegetation	1m shrubs and mosses near bedrock				
Study Area Comments					
Estimated size is along cl and includes bedrock outcrops along cl.Channel feature is 18m wide at CL and ends at treeline 60m south of CL. Downstream (south) of channel feature is meandering creek that connects to a wetland. Looks like treed end of channe					

Pond/Lake Assessment

Site ID	WB-S-M52-58	Field Crew	Amy Ingriselli Jessica Mendoza	258
Study Area	WEC			
Location	East of Bekanon Road			
Project Number	60341251	Air Temp. (degC)	22.0	Weather Notes
Tablet	AECOM10	Wind Speed (beaufort)	4	
Start Date	7/9/2015 1:33:44 PM	Precipitation	0	
End Date	2015-07-09 15:04:28	Cloud Cover	15.00	
Site Features				
Feature Description	240	Feature Location		
Looking west at large pond from centre point atop gravel fill to east of large pond separating large pond from small stagnant pond	Latitude:45.862586,Longitude:-80.582949,Altitude:206.4,Speed:0.066877775,Accuracy:2.5,Provider:gps,Time:07/09/2015 02:02:44 EDT			
Feature Description	240	Feature Location		
Looking north along centre line from atop gravel fill to east of large pond separating large pond from small stagnant pond	Latitude:45.86261,Longitude:-80.582937,Altitude:205.8,Speed:0.03601111,Accuracy:2.75,Provider:gps,Time:07/09/2015 02:08:45 EDT			
Feature Description	240	Feature Location		
Looking south along cl from atop gravel fill to east of large pond separating large pond from small stagnant pond	Latitude:45.862612,Longitude:-80.582942,Altitude:205.9,Speed:0.066877775,Accuracy:2.25,Provider:gps,Time:07/09/2015 02:09:31 EDT			

Pond/Lake Assessment

Feature Description	240	Feature Location	
Looking east at stagnant, isolated pocket of water from west bank	Latitude:45.862601,Longitude:-80.582935,Altitude:205.5,Speed:0.10803334,Accuracy:2.25,Provider:gps,Time:07/09/2015 02:10:46 EDT		
Feature Description	241	Feature Location	
Looking south from the north shore of the large pond. This view includes part of pond within area of disturbance.	Latitude:45.862585,Longitude:-80.582931,Altitude:205.8,Speed:0.17491111,Accuracy:2.25,Provider:gps,Time:07/09/2015 02:14:47 EDT		
Surrounding Land Use	<div>Forest,Other</div> <div>Deciduous dominant forest. Highly disturbed area; Dump west of stagnant pond</div>		
Type of Pond	<div>Natural,Permanent,Offline</div> <div>Open pond with small stagnant pond to east separated by gravel fill</div>		

Pond/Lake Assessment

In-Situ Water Quality

WT (deg. C)	<input type="text" value="20.0"/>	AT (degC)	<input type="text" value="22.5"/>	Water Quality Notes <div></div>
pH	<input type="text" value="5.6"/>	Cond. (s/cm)	<input type="text" value="0.03"/>	
D.O. (mg/L)	<input type="text" value="9.4"/>	Water Colour	<input type="text" value="Colourless"/>	
Water Clarity	<input type="text" value="Clear"/>			

Seepage Indicators	<input type="text" value="None"/>
	<div></div>

Fish & Wildlife Observations	<input type="text" value="Tadpoles, kingfisher, minnows, darters"/>
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In-Situ Habitat	<input type="text" value="Standing pond with fish observed"/>
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Physical Characteristics

Estimated Size	<input type="text" value="125.00"/>	Estimated Depth	<input type="text" value="0.60"/>
Notes	<input type="text" value="125m along east west axis 55m disturbed along north south axisStagnant pool is 11 by 8m"/>		




In-Situ Cover

Woody Debris	Boulders	Cobble	Aquatic Vegetation	Structures	Total Instream Cover
<input type="text"/>	<input type="text"/>	<input type="text" value="30.00"/>	<input type="text" value="70.00"/>	<input type="text"/>	<input type="text" value="90.00"/>
Aquatic Vegetation Species Present	<input type="text" value="Algae, tape grass, submergent weed, emergent grass"/>				
Description & Width of Riparian Vegetation	<input type="text" value="1m sweet gale meadow sweet, raspberry, alder"/>				

Study Area Comments



Pond/Lake Assessment

Site ID	WB-S-M48-17	Field Crew	Amy Ingriselli	267
Study Area	WEC			
Location	Wind Centre south, map 48 near turbine 79			
Project Number	60341251	Air Temp. (degC)	19.0	Weather Notes
Tablet	AECOM16	Wind Speed (beaufort)	3	
Start Date	7/24/2015 10:53:22 AM	Precipitation	0	
End Date	2015-07-24 11:21:47	Cloud Cover	0.00	
Site Features				
Feature Description	246 Feature Location			
Facing northwest, looking across wetland along centreline from southeast bank	Latitude:45.82841,Longitude:-80.698612,Altitude:180.0,Speed:0.051444445,Accuracy:1.8,Provider:gps,Time:07/24/2015 11:09:23 EDT			
Feature Description	2472 Feature Location			
View of fen facing southwest from Centre point	Latitude:45.8285,Longitude:-80.698769,Altitude:179.7,Speed:0.0463,Accuracy:1.8,Provider:gps,Time:07/24/2015 11:12:37 EDT			
Feature Description	247 Feature Location			
View of fen facing northeast from Centre point	Latitude:45.828512,Longitude:-80.698777,Altitude:180.4,Speed:0.12861112,Accuracy:1.8,Provider:gps,Time:07/24/2015 11:13:25 EDT			
Surrounding Land Use	Forest,Wetland Forested bedrock bordering fen wetland			
Type of Pond	Natural,Permanent,Online Treed fen. Floating mat of fen vegetation, no open water			

Pond/Lake Assessment

In-Situ Water Quality

WT (deg. C)

AT (degC)

19.8

Water Quality Notes

pH

Cond. (s/cm)

D.O. (mg/L)

Water Colour

Water Clarity

Water quality not taken, no open water

Seepage Indicators

None

Fish & Wildlife Observations

Song sparrow, white throated sparrow

In-Situ Habitat

Not fish habitat, no open water

Physical Characteristics

Estimated Size

30.00

Estimated Depth

0.00

Notes

Mean 30 m across at CL. No open water. Saturated floating sphagnum mat in fen

In-Situ Cover

Woody Debris

Boulders

Cobble

Aquatic Vegetation

Structures

Total Instream Cover

100.00

100.00

Aquatic Vegetation Species Present

No open water, no aquatic vegetation. Fen vegetation includes sphagnum, ferns, leatherleaf, cottongrass, tamarack, grass, wild calla

Description & Width of Riparian Vegetation





Fen bordered by mean 1 m of speckled alder

Study Area Comments


Not fish habitat, no open water



Pond/Lake Assessment



Site ID	WB-S-M49-48	Field Crew	Amy Ingriselli	270
Study Area	WEC			
Location	Wind Centre south map 49 near turbine 80			
Project Number	60341251	Air Temp. (degC)	18.0	Weather Notes
Tablet	AECOM16	Wind Speed (beaufort)	1	
Start Date	7/24/2015 11:59:31 AM	Precipitation	0	
End Date	2015-07-24 12:34:36	Cloud Cover	0.00	
Site Features				
Feature Description	247	Feature Location		
General view of fen, looking north from centreline	Latitude:45.83022,Longitude:-80.70568,Altitude:181.3,Speed:0.025722222,Accuracy:2.1,Provider:gps,Time:07/24/2015 12:20:28 EDT			
Feature Description	248	Feature Location		
Looking southwest from centreline	Latitude:45.830225,Longitude:-80.705642,Altitude:180.4,Speed:0.066877775,Accuracy:2.1,Provider:gps,Time:07/24/2015 12:22:40 EDT			
Feature Description	248	Feature Location		
Looking southwest along centreline from edge of fen	Latitude:45.830243,Longitude:-80.705473,Altitude:181.9,Speed:0.010288889,Accuracy:2.4,Provider:gps,Time:07/24/2015 12:26:24 EDT			
Feature Description	248	Feature Location		
View of the fen, looking south from approx 30 m north of CL	Latitude:45.830499,Longitude:-80.705689,Altitude:179.2,Speed:0.07202222,Accuracy:2.4,Provider:gps,Time:07/24/2015 12:31:01 EDT			

Pond/Lake Assessment

Surrounding Land Use	Forest,Wetland				
	Conifer forest bordering bog wetland				
Type of Pond	Natural,Permanent,Offline				
	Fen. No open water, floating sphagnum mat with fen vegetation				
In-Situ Water Quality					
WT (deg. C)		AT (degC)	18.8	Water Quality Notes No open water, no water quality taken	
pH		Cond. (s/cm)			
D.O. (mg/L)		Water Colour			
Water Clarity					
Seepage Indicators	None				
Fish & Wildlife Observations	Winter wren				
In-Situ Habitat	Not fish habitat				
Physical Characteristics					
Estimated Size	30.00	Estimated Depth	0.00		
Notes	Floating mat of sphagnum, fen vegetation. No open water. Fen approx 30 m wide along CL.				
In-Situ Cover					
Woody Debris	Boulders	Cobble	Aquatic Vegetation	Structures	Total Instream Cover
			100.00		100.00
Aquatic Vegetation Species Present	No open water, no aquatic vegetation. Fen vegetation includes sphagnum, royal fern, leatherleaf, cottongrass, speckled alder, tamarack, three way sedge, sheep laurel				
Description & Width of Riparian Vegetation	0m. No distinct riparian zone between fen and Conifer forest				
Study Area Comments					
Not fish habitat, fen. Centreline of road alignment runs along the south shore of the fen					

Pond/Lake Assessment

Fish Inventory

Site ID	WB-S-M39-8		Field Crew	Amy Ingriselli Jessica Mendoza Kalynn Parrott		3
Study Area	WEC					
Waterbody	Unnamed tributary to Sandy Bay (Georgian Bay)					
MNR District	Parry Sound					
Location	Unnamed Tributary to Sandy Bay/Georgian Bay					
Project Number	60341251	Air Temp. (degC)	17.0	Weather Notes		
Tablet	AECOM17	Wind Speed (beaufort)	2	Lightly cloudy, with sun		
Start Date	6/4/2015 9:53:46 AM	Precipitation	0			
End Date	6/4/2015 1:43:06 PM	Cloud Cover	100.00			
Surface Conditions	Calm					
Site Features						
Feature Description	840	Feature Location				
US 50 m of study area, photo taken from CL		Latitude:45.818348,Longitude:-80.667046,Altitude:186.3,Speed:0.0926,Accuracy:297.0,Provider:gps,Time:06/04/2015 01:18:50 EDT				
Feature Description	843	Feature Location				
DS 50 m of study area, photo taken from CL		Latitude:45.818414,Longitude:-80.667733,Altitude:176.5,Speed:0.21606667,Accuracy:1.75,Provider:gps,Time:06/04/2015 01:42:47 EDT				
Upstream Water Quality	Upstream Length	50.0				
WT (deg. C)	15.4	AT (degC)	17.0	Water Quality Notes		
pH	5.8	Cond. (s/cm)	0.03			
D.O. (mg/L)	7.3	Water Colour	Yellow/Brown			
Water Clarity	Clear					
Upstream Water Quality	Downstream Length	50.0				
WT (deg. C)	15.4	AT (degC)	17.0	Water Quality Notes		
pH	5.8	Cond. (s/cm)	0.03			
D.O. (mg/L)	7.3	Water Colour	Yellow/Brown			
Water Clarity	Clear					

$$\left[\begin{array}{c} \\ \vdots \\ \end{array} \right]$$
[illegible]

Fish Inventory

Gear

Electrofisher	<input type="checkbox"/> Y	Length (m)	<input type="text" value="100.0"/>	Settings	<input type="text" value="550 V, 60Hz"/>	Seconds	<input type="text" value="3160.0"/>
Minnow Trap	<input type="checkbox"/> N	Number	<input type="text"/>				
Seine	<input type="checkbox"/> N	Hauls	<input type="text"/>	Length (m)	<input type="text"/>		
Dip Net	<input type="checkbox"/> N	Trap Net	<input type="checkbox"/> N	Gill Net	<input type="checkbox"/> N	Other	<input type="checkbox"/> N <input type="text"/>
Smallest Mesh Size (cm)	<input type="text"/>		Mimimum Depth of Capture (m)	<input type="text"/>			
Largest Mesh Size (cm)	<input type="text"/>		Maximum Depth of Capture (m)	<input type="text"/>			

Fish Kept	<input type="checkbox"/> N	Number of Bags	<input type="text"/>	Amy Ingriselli Jessica Mendoza Kalynn Parrott	<input type="text"/>
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Fish Capture

Count	<input type="text" value="9.00"/>	Fish With Blackspot	<input type="text" value="3"/>
Sample Kept	<input type="checkbox"/> N	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>
Fish Species	<input type="text" value="Creek Chub"/>		
Length (mm)	<input type="text"/>		
Age Class	<input type="text" value="Adult"/>		

Count	<input type="text" value="10.00"/>	Fish With Blackspot	<input type="text" value="1"/>
Sample Kept	<input type="checkbox"/> N	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>
Fish Species	<input type="text" value="Finescale Dace"/>		
Length (mm)	<input type="text"/>		
Age Class	<input type="text" value="Adult"/>		

Count	<input type="text" value="29.00"/>	Fish With Blackspot	<input type="text"/>
Sample Kept	<input type="checkbox"/> N	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>
Fish Species	<input type="text" value="Central Mudminnow"/>		
Length (mm)	<input type="text"/>		
Age Class	<input type="text" value="Adult"/>		

Count	<input type="text" value="27.00"/>	Fish With Blackspot	<input type="text"/>
Sample Kept	<input type="checkbox"/> N	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>
Fish Species	<input type="text" value="Brook Stickleback"/>		
Length (mm)	<input type="text"/>		
Age Class	<input type="text" value="Adult"/>		

Fish Inventory



3

6

9

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Fish Inventory

Count	<input type="text" value="30.00"/>	Fish With Blackspot	<input type="text"/>
Sample Kept	<input type="text" value="N"/>	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>
Fish Species	<input type="text" value="Northern Redbelly Dace"/>		
Length (mm)	<input type="text"/>		
Age Class	<input type="text" value="Adult"/>		

Count	<input type="text" value="6.00"/>	Fish With Blackspot	<input type="text" value="4"/>
Sample Kept	<input type="text" value="N"/>	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>
Fish Species	<input type="text" value="White Sucker"/>		
Length (mm)	<input type="text"/>		
Age Class	<input type="text" value="YOY"/>		

Count	<input type="text" value="9.00"/>	Fish With Blackspot	<input type="text"/>
Sample Kept	<input type="text" value="N"/>	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>
Fish Species	<input type="text" value="Iowa Darter"/>		
Length (mm)	<input type="text"/>		
Age Class	<input type="text" value="Adult"/>		

Count	<input type="text" value="27.00"/>	Fish With Blackspot	<input type="text" value="1"/>
Sample Kept	<input type="text" value="N"/>	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>
Fish Species	<input type="text" value="Common Shiner"/>		
Length (mm)	<input type="text"/>		
Age Class	<input type="text" value="Adult"/>		

Count	<input type="text" value="4.00"/>	Fish With Blackspot	<input type="text"/>
Sample Kept	<input type="text" value="N"/>	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>
Fish Species	<input type="text" value="Fathead Minnow"/>		
Length (mm)	<input type="text"/>		
Age Class	<input type="text" value="Adult"/>		

Count	<input type="text" value="3.00"/>	Fish With Blackspot	<input type="text"/>
Sample Kept	<input type="text" value="N"/>	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>
Fish Species	<input type="text" value="Brassy Minnow"/>		
Length (mm)	<input type="text"/>		
Age Class	<input type="text" value="Adult"/>		

Fish Inventory

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Fish Inventory

Count	<input type="text" value="5.00"/>	Fish With Blackspot	<input type="text"/>
Sample Kept	<input type="text" value="N"/>	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>
Fish Species	<input type="text" value="Blacknose Shiner"/>		
Length (mm)	<input type="text"/>		
Age Class	<input type="text" value="Adult"/>		

Count	<input type="text" value="1.00"/>	Fish With Blackspot	<input type="text"/>
Sample Kept	<input type="text" value="N"/>	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>
Fish Species	<input type="text" value="Johnny Darter"/>		
Length (mm)	<input type="text"/>		
Age Class	<input type="text" value="Adult"/>		

Inventory Comments	Some male Common Shiner and Iowa Darter with spawning colours. Some areas of the site had sand/silt substrate suitable for Lamprey ammocoete nursery habitat. Following fish sampling of the entire site, approximately 15m US and DS of CL, settings were changed to 40hz 250v and charge was pulsed to target ammocoetes. None observed. Silt content may have been higher than optimal for use by Lamprey ammocoetes, but they may be present in the watercourse.
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Fish Inventory

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Fish Inventory

Site ID	WB-N-M32-14		Field Crew	Amy Ingriselli Jessica Mendoza Kalynn Parrott		6	
Study Area	WEC						
Waterbody	Unnamed tributary to Henvey Inlet						
MNR District	Parry Sound						
Location	Just upstream (North) of the Henvey Inlet, Flower Pot Bay						
Project Number	60341251	Air Temp. (degC)	18.0	Weather Notes			
Tablet	AECOM17	Wind Speed (beaufort)	1				
Start Date	6/5/2015 9:05:24 AM	Precipitation	1				
End Date	6/5/2015 10:21:34 AM	Cloud Cover	100.00				
Surface Conditions	Calm						
Site Features							
Feature Description	846	Feature Location					
DS 50 m of study area, photo taken from CL	Latitude:45.855259,Longitude:-80.657167,Altitude:178.5,Speed:0.051444445,Accuracy:2.4,Provider:gps,Time:06/05/2015 09:10:49 EDT						
Feature Description	849	Feature Location					
US 50 m of study area, photo taken from CL	Latitude:45.855903,Longitude:-80.657402,Altitude:176.3,Speed:0.10803334,Accuracy:2.4,Provider:gps,Time:06/05/2015 10:26:00 EDT						
Upstream Water Quality	Upstream Length	50.0	Water Quality Notes				
WT (deg. C)	14.3	AT (degC)					18.6
pH	5.4	Cond. (s/cm)					0.02
D.O. (mg/L)	8.5	Water Colour					Yellow/Brown
Water Clarity	Clear						
Upstream Water Quality	Downstream Length	50.0	Water Quality Notes				
WT (deg. C)	14.3	AT (degC)					18.6
pH	5.4	Cond. (s/cm)					0.02
D.O. (mg/L)	8.5	Water Colour					Yellow/Brown
Water Clarity	Clear						

Fish Inventory

[Empty table structure]

[Empty table structure]

Fish Inventory

Gear

Electrofisher	<input type="text" value="N"/>	Length (m)	<input type="text" value="100.0"/>	Settings	<input type="text" value="650 V, 60 Hz"/>	Seconds	<input type="text" value="959.0"/>
Minnow Trap	<input type="text" value="N"/>	Number	<input type="text"/>				
Seine	<input type="text" value="N"/>	Hauls	<input type="text"/>	Length (m)	<input type="text"/>		
Dip Net	<input type="text" value="N"/>	Trap Net	<input type="text" value="N"/>	Gill Net	<input type="text" value="N"/>	Other	<input type="text" value="N"/>
Smallest Mesh Size (cm)	<input type="text"/>	Mimimum Depth of Capture (m)	<input type="text"/>				
Largest Mesh Size (cm)	<input type="text"/>	Maximum Depth of Capture (m)	<input type="text"/>				

Fish Kept	<input type="text" value="N"/>	Number of Bags	Amy Ingrisel li Jessica Mendo za Kalynn Parrott	
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Fish Inventory



Fish Inventory

Fish Capture			
Count	<input type="text" value="13.00"/>	Fish With Blackspot	<input type="text"/>
Sample Kept	<input type="text" value="N"/>	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>
Fish Species	<input type="text" value="Central Mudminnow"/>		
Length (mm)	<input type="text"/>		
Age Class	<input type="text" value="Adult"/>		
Count	<input type="text" value="2.00"/>	Fish With Blackspot	<input type="text"/>
Sample Kept	<input type="text" value="N"/>	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>
Fish Species	<input type="text" value="Fathead Minnow"/>		
Length (mm)	<input type="text"/>		
Age Class	<input type="text" value="Adult"/>		
Count	<input type="text" value="2.00"/>	Fish With Blackspot	<input type="text"/>
Sample Kept	<input type="text" value="N"/>	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>
Fish Species	<input type="text" value="Iowa Darter"/>		
Length (mm)	<input type="text"/>		
Age Class	<input type="text" value="Adult"/>		
Count	<input type="text" value="2.00"/>	Fish With Blackspot	<input type="text"/>
Sample Kept	<input type="text" value="N"/>	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>
Fish Species	<input type="text" value="Brook Stickleback"/>		
Length (mm)	<input type="text"/>		
Age Class	<input type="text" value="Adult"/>		
Count	<input type="text" value="2.00"/>	Fish With Blackspot	<input type="text"/>
Sample Kept	<input type="text" value="N"/>	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>
Fish Species	<input type="text" value="Yellow Perch"/>		
Length (mm)	<input type="text" value="60.00"/>		
Age Class	<input type="text" value="YOY"/>		
Inventory Comments	<input type="text" value="Pulsed the charge in some areas of sand/silt substrate to target Lamprey ammocoetes. None observed"/>		

Fish Inventory

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Fish Inventory


Site ID	WB-N-M46-4	Field Crew	Jay Cashubec Kalynn Parrott	9
Study Area	WEC			
Waterbody	Unnamed tributary to Henvey Inlet			
MNR District	Parry Sound			
Location	Downstream of inland lake. Wetland area.			
Project Number	60341251	Air Temp. (degC)	14.0	Weather Notes
Tablet	AECOM17	Wind Speed (beaufort)	3	
Start Date	6/8/2015 10:28:38 AM	Precipitation	0	
End Date	6/8/2015 10:51:57 AM	Cloud Cover	95.00	
Surface Conditions	Calm			

Site Features

Feature Description	852	Feature Location	
Looking downstream from pond outlet		Latitude:45.858686,Longitude:-80.697391,Altitude:181.6,Speed:0.10803334,Accuracy:2.1,Provider:gps,Time:06/08/2015 10:16:03 EDT	

Feature Description	855	Feature Location	
Upstream inland pond.		Latitude:45.858695,Longitude:-80.697383,Altitude:184.3,Speed:0.087455556,Accuracy:2.1,Provider:gps,Time:06/08/2015 10:16:21 EDT	

Feature Description	858	Feature Location	
Looking upstream. Wetland area. Watercourse spreads out.		Latitude:45.858055,Longitude:-80.698504,Altitude:175.1,Speed:0.030866666,Accuracy:2.1,Provider:gps,Time:06/08/2015 10:26:08 EDT	

Feature Description	861	Feature Location	
Looking downstream. Wetland area. Not a suitable channel for electrofishing.		Latitude:45.858061,Longitude:-80.698517,Altitude:174.6,Speed:0.03601111,Accuracy:2.1,Provider:gps,Time:06/08/2015 10:27:05 EDT	

$$\left[\begin{array}{c} \vdots \\ \vdots \\ \vdots \end{array} \right]$$

Fish Inventory

Upstream Water Quality	Upstream Length	50.0	Water Quality Notes DO not taken. High algae concentration.	
WT (deg. C)	14.9	AT (degC)		14.0
pH	4.1	Cond. (s/cm)		0.03
D.O. (mg/L)		Water Colour		Yellow/Brown
Water Clarity	Clear			

Upstream Water Quality	Downstream Length	50.0	Water Quality Notes DO not taken. High algae concentration.	
WT (deg. C)	14.9	AT (degC)		14.0
pH	4.1	Cond. (s/cm)		0.03
D.O. (mg/L)		Water Colour		Yellow/Brown
Water Clarity	Clear			

Gear

Electrofisher	<input type="checkbox"/> Y	Length (m)	100.0	Settings		Seconds	0.0
Minnow Trap	<input type="checkbox"/> N	Number					
Seine	<input type="checkbox"/> N	Hauls		Length (m)			
Dip Net	<input type="checkbox"/> N	Trap Net	<input type="checkbox"/> N	Gill Net	<input type="checkbox"/> N	Other	<input type="checkbox"/> N
Smallest Mesh Size (cm)		Mimimum Depth of Capture (m)					
Largest Mesh Size (cm)		Maximum Depth of Capture (m)					

Fish Kept	<input type="checkbox"/> N	Number of Bags	Jay Cashu bec Kalynn Parrott	
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Inventory Comments	Not fishable. No fish community information obtained. See site features for details.
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Fish Inventory

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Fish Inventory

Site ID	WB-S-M13-13		Field Crew	Jay Cashubec Kalynn Parrott		12
Study Area	WEC					
Waterbody	Unnamed tributary to Henvey Inlet					
MNR District	Parry Sound					
Location	Small creek flowing toward inland pond. Slightly meandering. Grassy riparian zone surrounded by bedrock outcrops.					
Project Number	60341251	Air Temp. (degC)	14.0	Weather Notes		
Tablet	AECOM17	Wind Speed (beaufort)	4	Cloudy, good chance of rain.		
Start Date	6/8/2015 1:32:29 PM	Precipitation	0			
End Date	6/8/2015 2:30:43 PM	Cloud Cover	100.00			
Surface Conditions	Calm					
Site Features						
Feature Description	864	Feature Location				
Upstream 50 m, photo taken from CL. Water flowing toward pond.	Latitude:45.843398,Longitude:-80.629241,Altitude:191.2,Speed:0.11317778,Accuracy:1.5,Provider:gps,Time:06/08/2015 02:20:29 EDT					
Feature Description	867	Feature Location				
Downstream 50 m, photo taken from CL. Channel narrows.	Latitude:45.843581,Longitude:-80.629601,Altitude:0.0,Speed:0.041155554,Accuracy:100.0,Provider:gps,Time:06/08/2015 02:23:43 EDT					
Upstream Water Quality	Upstream Length	50.0				
WT (deg. C)	13.8	AT (degC)	15.0	Water Quality Notes		
pH	5.8	Cond. (s/cm)	0.02	DO not taken.		
D.O. (mg/L)		Water Colour	Yellow/Brown			
Water Clarity	Clear					
Upstream Water Quality	Downstream Length	50.0				
WT (deg. C)	13.8	AT (degC)	15.0	Water Quality Notes		
pH	5.8	Cond. (s/cm)	0.02	DO not taken.		
D.O. (mg/L)		Water Colour	Yellow/Brown			
Water Clarity	Clear					

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Fish Inventory

Gear

Electrofisher	<input type="checkbox"/> Y	Length (m)	<input type="text" value="100.0"/>	Settings	<input type="text" value="650 V, 60 Hz"/>	Seconds	<input type="text" value="336.0"/>
Minnow Trap	<input type="checkbox"/> N	Number	<input type="text"/>				
Seine	<input type="checkbox"/> N	Hauls	<input type="text"/>	Length (m)	<input type="text"/>		
Dip Net	<input type="checkbox"/> N	Trap Net	<input type="checkbox"/> N	Gill Net	<input type="checkbox"/> N	Other	<input type="checkbox"/> N <input type="text"/>
Smallest Mesh Size (cm)	<input type="text"/>	Mimimum Depth of Capture (m)	<input type="text"/>				
Largest Mesh Size (cm)	<input type="text"/>	Maximum Depth of Capture (m)	<input type="text"/>				

Fish Kept	<input type="checkbox"/> N	Number of Bags	<input type="text"/>	Jay Cashu bec Kalynn Parrott	<input type="text"/>
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Fish Capture

Count	<input type="text" value="2.00"/>	Fish With Blackspot	<input type="text"/>	<input type="button" value="✖"/>
Sample Kept	<input type="checkbox"/> N	Fish With Lesions, Tumors, Maturity, etc	<input type="text" value="1"/>	
Fish Species	<input type="text" value="Northern Redbelly Dace"/>			
Length (mm)	<input type="text" value="38.00"/>			
Age Class	<input type="text" value="Adult"/>			

Count	<input type="text" value="1.00"/>	Fish With Blackspot	<input type="text"/>
Sample Kept	<input type="checkbox"/> N	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>
Fish Species	<input type="text" value="Finescale Dace"/>		
Length (mm)	<input type="text"/>		
Age Class	<input type="text" value="Adult"/>		

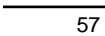
Count	<input type="text" value="1.00"/>	Fish With Blackspot	<input type="text"/>
Sample Kept	<input type="checkbox"/> N	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>
Fish Species	<input type="text" value="Central Mudminnow"/>		
Length (mm)	<input type="text"/>		
Age Class	<input type="text" value="Adult"/>		

Inventory Comments	<input type="text" value="Four additional fish observed, not caught. Species unknown."/>
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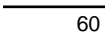
Fish Inventory



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Fish Inventory

Site ID	WB-S-M19-6	Field Crew	Jay Cashubec Kalynn Parrott	15
Study Area	WEC			
Waterbody	Unnamed Tributary to Henvey Inlet			
MNR District	Parry Sound			
Location	South side of Henvey Inlet, riffle/pool run.			
Project Number	60341251	Air Temp. (degC)	22.0	Weather Notes Direct sunlight, light breeze
Tablet	AECOM17	Wind Speed (beaufort)	1	
Start Date	6/9/2015 10:40:24 AM	Precipitation	0	
End Date	6/9/2015 11:43:26 AM	Cloud Cover	60.00	
Surface Conditions	Calm			

Site Features

Feature Description	1149	Feature Location	
Downstream 50m - riffle pool run. Multiple cascades (fish barriers) downstream, as well as at the inlet from the adjoining tributary at the downstream reach of site.		Latitude:45.834306,Longitude:-80.623959,Altitude:200.6,Speed:0.041155554,Accuracy:1.8,Provider:gps,Time:06/09/2015 10:45:12 EDT	

Feature Description	1152	Feature Location	
Upstream 50m, photo taken at CL.		Latitude:45.833724,Longitude:-80.623394,Altitude:191.3,Speed:0.015433333,Accuracy:1.8,Provider:gps,Time:06/09/2015 11:58:39 EDT	

Upstream Water Quality	Upstream Length	50.0	Water Quality Notes YSI not present on site.
WT (deg. C)	AT (degC)		
pH	Cond. (s/cm)		
D.O. (mg/L)	Water Colour	Yellow/Brown	
Water Clarity	Clear		

Upstream Water Quality	Downstream Length	50.0	Water Quality Notes YSI not present on site.
WT (deg. C)	AT (degC)		
pH	Cond. (s/cm)		
D.O. (mg/L)	Water Colour	Yellow/Brown	
Water Clarity	Clear		

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Fish Inventory

Gear

Electrofisher	<input type="checkbox"/> Y	Length (m)	<input type="text" value="100.0"/>	Settings	<input type="text" value="650 V, 60 Hz"/>	Seconds	<input type="text" value="1177.0"/>
Minnow Trap	<input type="checkbox"/> N	Number	<input type="text"/>				
Seine	<input type="checkbox"/> N	Hauls	<input type="text"/>	Length (m)	<input type="text"/>		
Dip Net	<input type="checkbox"/> N	Trap Net	<input type="checkbox"/> N	Gill Net	<input type="checkbox"/> N	Other	<input type="checkbox"/> N <input type="text"/>
Smallest Mesh Size (cm)	<input type="text"/>	Minimum Depth of Capture (m)	<input type="text"/>				
Largest Mesh Size (cm)	<input type="text"/>	Maximum Depth of Capture (m)	<input type="text"/>				

Fish Kept	<input type="checkbox"/> N	Number of Bags	<input type="text"/>	Jay Cashu bec Kalynn Parrott	<input type="text"/>
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Fish Capture

Count	<input type="text" value="2.00"/>	Fish With Blackspot	<input type="text"/>	<input type="checkbox"/>
Sample Kept	<input type="checkbox"/> N	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>	
Fish Species	<input type="text" value="Creek Chub"/>			
Length (mm)	<input type="text" value="115.00"/>			
Age Class	<input type="text" value="Adult"/>			

Count	<input type="text" value="5.00"/>	Fish With Blackspot	<input type="text"/>
Sample Kept	<input type="checkbox"/> N	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>
Fish Species	<input type="text" value="Northern Redbelly Dace"/>		
Length (mm)	<input type="text"/>		
Age Class	<input type="text" value="Adult"/>		

Count	<input type="text" value="3.00"/>	Fish With Blackspot	<input type="text"/>
Sample Kept	<input type="checkbox"/> N	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>
Fish Species	<input type="text" value="Central Mudminnow"/>		
Length (mm)	<input type="text"/>		
Age Class	<input type="text" value="Adult"/>		

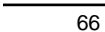
Count	<input type="text" value="1.00"/>	Fish With Blackspot	<input type="text"/>
Sample Kept	<input type="checkbox"/> N	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>
Fish Species	<input type="text" value="Brook Stickleback"/>		
Length (mm)	<input type="text"/>		
Age Class	<input type="text" value="Adult"/>		

Inventory Comments	<input type="text" value="Riffle pool run, multiple cascades (fish barriers) downstream. Cascades also observed at the inlet, caused by confluence with adjoining tributary at the downstream reach of the site. Woody debris and small cascades may act as seasonal barriers. One Northern Redbelly Dace caught in full spawning colours."/>
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Fish Inventory



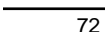
63



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Fish Inventory

Site ID	WB-S-M17-29		Field Crew	Jay Cashubec Kalynn Parrott		18
Study Area	WEC					
Waterbody	Unnamed Tributary to Henvey Inlet					
MNR District	Parry Sound					
Location	South side of inland pond, DS of beaver dam/ waterfall.					
Project Number	60341251	Air Temp. (degC)	18.0	Weather Notes		
Tablet	AECOM17	Wind Speed (beaufort)	4	Breezy now, sunny		
Start Date	6/9/2015 1:09:44 PM	Precipitation	0			
End Date	6/9/2015 2:52:22 PM	Cloud Cover	35.00			
Surface Conditions	Rippled					
Site Features						
Feature Description	1155	Feature Location				
DS of beaverdam/waterfall. Plunge pool into riffle/pool sequence. Flow then continues downstream into pond/wetland.		Latitude:45.832377,Longitude:-80.632596,Altitude:186.1,Speed:0.03601111,Accuracy:1.8,Provider:gps,Time:06/09/2015 01:14:17 EDT				
Feature Description	1158	Feature Location				
Upstream 40m, photo taken from CL. Waterfall serves as a barrier to fish passage. End of reach.		Latitude:45.832301,Longitude:-80.632974,Altitude:191.3,Speed:0.12861112,Accuracy:2.7,Provider:gps,Time:06/09/2015 03:01:09 EDT				
Upstream Water Quality	Upstream Length	40.0				
WT (deg. C)		AT (degC)		Water Quality Notes		
pH		Cond. (s/cm)		YSI not present on site.		
D.O. (mg/L)		Water Colour	Yellow/Brown			
Water Clarity	Clear					
Upstream Water Quality	Downstream Length	40.0				
WT (deg. C)		AT (degC)		Water Quality Notes		
pH		Cond. (s/cm)		YSI not present on site.		
D.O. (mg/L)		Water Colour	Yellow/Brown			
Water Clarity	Clear					

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Fish Inventory

Gear

Electrofisher	<input type="checkbox"/> Y	Length (m)	<input type="text" value="80.0"/>	Settings	<input type="text" value="650 V, 60 Hz"/>	Seconds	<input type="text" value="835.0"/>
Minnow Trap	<input type="checkbox"/> N	Number	<input type="text"/>				
Seine	<input type="checkbox"/> N	Hauls	<input type="text"/>	Length (m)	<input type="text"/>		
Dip Net	<input type="checkbox"/> N	Trap Net	<input type="checkbox"/> N	Gill Net	<input type="checkbox"/> N	Other	<input type="checkbox"/> N <input type="text"/>
Smallest Mesh Size (cm)	<input type="text"/>	Minimum Depth of Capture (m)	<input type="text"/>				
Largest Mesh Size (cm)	<input type="text"/>	Maximum Depth of Capture (m)	<input type="text"/>				

Fish Kept	<input type="checkbox"/> N	Number of Bags	<input type="text"/>	Jay Cashu bec Kalynn Parrott	<input type="text"/>
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Fish Capture

Count	<input type="text" value="24.00"/>	Fish With Blackspot	<input type="text"/>
Sample Kept	<input type="checkbox"/> N	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>
Fish Species	<input type="text" value="Northern Redbelly Dace"/>		
Length (mm)	<input type="text"/>		
Age Class	<input type="text" value="Adult"/>		

Count	<input type="text" value="12.00"/>	Fish With Blackspot	<input type="text"/>
Sample Kept	<input type="checkbox"/> N	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>
Fish Species	<input type="text" value="Creek Chub"/>		
Length (mm)	<input type="text"/>		
Age Class	<input type="text" value="Adult"/>		

Count	<input type="text" value="4.00"/>	Fish With Blackspot	<input type="text"/>
Sample Kept	<input type="checkbox"/> N	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>
Fish Species	<input type="text" value="Iowa Darter"/>		
Length (mm)	<input type="text"/>		
Age Class	<input type="text" value="Adult"/>		

Count	<input type="text" value="1.00"/>	Fish With Blackspot	<input type="text"/>	<input type="button" value="✖"/>
Sample Kept	<input type="checkbox"/> N	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>	
Fish Species	<input type="text" value="Blackchin Shiner"/>			
Length (mm)	<input type="text"/>			
Age Class	<input type="text" value="Adult"/>			

Fish Inventory



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Fish Inventory

Count	<input type="text" value="4.00"/>	Fish With Blackspot	<input type="text"/>
Sample Kept	<input type="text" value="N"/>	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>
Fish Species	<input type="text" value="Pumpkinseed"/>		
Length (mm)	<input type="text"/>		
Age Class	<input type="text" value="YOY"/>		

Count	<input type="text" value="32.00"/>	Fish With Blackspot	<input type="text"/>
Sample Kept	<input type="text" value="N"/>	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>
Fish Species	<input type="text" value="Blacknose Shiner"/>		
Length (mm)	<input type="text"/>		
Age Class	<input type="text" value="Adult"/>		

Count	<input type="text" value="6.00"/>	Fish With Blackspot	<input type="text"/>
Sample Kept	<input type="text" value="N"/>	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>
Fish Species	<input type="text" value="Brook Stickleback"/>		
Length (mm)	<input type="text"/>		
Age Class	<input type="text" value="Adult"/>		

Count	<input type="text" value="3.00"/>	Fish With Blackspot	<input type="text"/>
Sample Kept	<input type="text" value="N"/>	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>
Fish Species	<input type="text" value="Bluntnose Minnow"/>		
Length (mm)	<input type="text"/>		
Age Class	<input type="text" value="Adult"/>		

Count	<input type="text" value="3.00"/>	Fish With Blackspot	<input type="text"/>
Sample Kept	<input type="text" value="N"/>	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>
Fish Species	<input type="text" value="Central Mudminnow"/>		
Length (mm)	<input type="text"/>		
Age Class	<input type="text" value="Adult"/>		

Count	<input type="text" value="4.00"/>	Fish With Blackspot	<input type="text"/>
Sample Kept	<input type="text" value="N"/>	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>
Fish Species	<input type="text" value="Johnny Darter"/>		
Length (mm)	<input type="text"/>		
Age Class	<input type="text" value="Adult"/>		

Fish Inventory

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Fish Inventory

Count	<input type="text" value="8.00"/>	Fish With Blackspot	<input type="text"/>
Sample Kept	<input type="text" value="N"/>	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>
Fish Species	<input type="text" value="Rock Bass"/>		
Length (mm)	<input type="text" value="17.00"/>		
Age Class	<input type="text" value="YOY"/>		




Inventory Comments	<input type="text" value="Fished from downstream pond/wetland to upstream waterfall. Site was therefore less than 100 m due to upstream barrier to fish passage."/>
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Fish Inventory

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Fish Inventory

Site ID	WB-N-M26-21		Field Crew	Jay Cashubec Kalynn Parrott		21
Study Area	WEC					
Waterbody	Unnamed tributary to Henvey Inlet (North)					
MNR District	Parry Sound					
Location	North of Joe's Cabin, creek between bedrock outcrops flowing directly into Henvey Inlet. Wind blowing from South (downstream)					
Project Number	60341251	Air Temp. (degC)	16.0	Weather Notes		
Tablet	AECOM17	Wind Speed (beaufort)	3	Rainy, earlier thunderstorms, overcast		
Start Date	6/10/2015 10:59:50 AM	Precipitation	1			
End Date	6/10/2015 11:20:56 AM	Cloud Cover	100.00			
Surface Conditions	Rippled					
Site Features						
Feature Description	1203	Feature Location				
Upstream 50m. Hoop net set to capture fish migrating downstream toward Henvey Inlet.		Latitude:45.857094,Longitude:-80.644765,Altitude:173.6,Speed:0.03601111,Accuracy:2.1,Provider:gps,Time:06/10/2015 11:08:40 EDT				
Feature Description	1206	Feature Location				
Downstream 50m. Creek flows into Henvey Inlet North.		Latitude:45.8571,Longitude:-80.644746,Altitude:171.7,Speed:0.05144445,Accuracy:1.8,Provider:gps,Time:06/10/2015 11:12:38 EDT				
Feature Description	1209	Feature Location				
Minnow trap location. At the mouth where creek discharges into the Henvey inlet. Left side of bank looking downstream.		Latitude:45.856736,Longitude:-80.644325,Altitude:167.7,Speed:0.5247333,Accuracy:2.1,Provider:gps,Time:06/10/2015 11:26:22 EDT				
Upstream Water Quality	Upstream Length		50.0	Water Quality Notes		
WT (deg. C)	17.8	AT (degC)	17.0	DO not taken.		
pH	7.8	Cond. (s/cm)	0.08			
D.O. (mg/L)		Water Colour	Yellow/Brown			
Water Clarity	Clear					

Fish Inventory

Upstream Water Quality		Downstream Length	50.0	Water Quality Notes DO not taken.
WT (deg. C)	17.8	AT (degC)	17.0	
pH	7.8	Cond. (s/cm)	0.08	
D.O. (mg/L)		Water Colour	Yellow/Brown	
Water Clarity	Clear			

Gear

Electrofisher	<input type="checkbox"/> N	Length (m)		Settings		Seconds	
Minnow Trap	<input type="checkbox"/> Y	Number	1				
Seine	<input type="checkbox"/> N	Hauls		Length (m)			
Dip Net	<input type="checkbox"/> N	Trap Net	<input type="checkbox"/> N	Gill Net	<input type="checkbox"/> N	Other	<input type="checkbox"/> Y
						Winged Hoop Net	
Smallest Mesh Size (cm)		0.5		Mimimum Depth of Capture (m)		0.50	
Largest Mesh Size (cm)		0.5		Maximum Depth of Capture (m)		1.25	

Fish Kept	<input type="checkbox"/> N	Number of Bags		Jay Cashu bec Kalynn Parrott	
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Fish Inventory



Fish Inventory

Fish Capture

Count	<input type="text" value="18.00"/>	Fish With Blackspot	<input type="text"/>
Sample Kept	<input type="text" value="N"/>	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>
Fish Species	<input type="text" value="Golden Shiner"/>		
Length (mm)	<input type="text"/>		
Age Class	<input type="text" value="Adult"/>		

Count	<input type="text" value="2.00"/>	Fish With Blackspot	<input type="text"/>
Sample Kept	<input type="text" value="N"/>	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>
Fish Species	<input type="text" value="Brown Bullhead"/>		
Length (mm)	<input type="text"/>		
Age Class	<input type="text" value="Adult"/>		

Count	<input type="text" value="3.00"/>	Fish With Blackspot	<input type="text"/>
Sample Kept	<input type="text" value="N"/>	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>
Fish Species	<input type="text" value="Pumpkinseed"/>		
Length (mm)	<input type="text"/>		
Age Class	<input type="text" value="YOY"/>		

Count	<input type="text" value="4.00"/>	Fish With Blackspot	<input type="text"/>
Sample Kept	<input type="text" value="N"/>	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>
Fish Species	<input type="text" value="Yellow Perch"/>		
Length (mm)	<input type="text" value="180.00"/>		
Age Class	<input type="text" value="YOY"/>		

Inventory Comments	<div>Hoop net set across the length of a channel flowing directly into Henvey Inlet. Hole approx. 10 cm wide in caught end of net observed during catch processing. May have been some capture loss. Photos of fish taken only when species identification was not positive. Lengths of fish taken on game fish/top predators only.</div>
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Fish Inventory

129



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135

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Fish Inventory

Site ID	WB-N-M12-12		Field Crew	Jay Cashubec Kalynn Parrott		24
Study Area	WEC					
Waterbody	Unnamed tributary to Henvey Inlet N					
MNR District	Parry Sound					
Location	North side of Henvey Inlet. Stream slightly meandering downstream toward inlet. Upstream waterfall fish barrier. Reach broken at waterfall.					
Project Number	60341251	Air Temp. (degC)	20.0	Weather Notes		
Tablet	AECOM17	Wind Speed (beaufort)	4	Overcast, chance of rain and thunderstorm		
Start Date	6/10/2015 12:23:38 PM	Precipitation	0			
End Date	6/10/2015 1:20:13 PM	Cloud Cover	100.00			
Surface Conditions	Calm					
Site Features						
Feature Description	1212	Feature Location				
50 m upstream, photo taken at CL. Waterfall serves as end of reach and a barrier to fish passage.		Latitude:45.8688,Longitude:-80.618127,Altitude:181.9,Speed:0.0926,Accuracy:2.7,Provider:gps,Time:06/10/2015 01:05:22 EDT				
Feature Description	1215	Feature Location				
50 m downstream, photo taken at CL.		Latitude:45.868662,Longitude:-80.61826,Altitude:184.7,Speed:0.041155554,Accuracy:1.8,Provider:gps,Time:06/10/2015 12:31:30 EDT				
Upstream Water Quality	Upstream Length	50.0				
WT (deg. C)	16.0	AT (degC)	20.0	Water Quality Notes		
pH	6.6	Cond. (s/cm)	0.02	DO not taken.		
D.O. (mg/L)		Water Colour	Yellow/Brown			
Water Clarity	Clear					
Upstream Water Quality	Downstream Length	50.0				
WT (deg. C)	16.0	AT (degC)	20.0	Water Quality Notes		
pH	6.6	Cond. (s/cm)	0.02	DO not taken.		
D.O. (mg/L)		Water Colour	Yellow/Brown			
Water Clarity	Clear					

$$\left[\begin{array}{c} \\ \\ \\ \\ \end{array} \right]$$
[illegible]

Fish Inventory

Gear

Electrofisher	<input type="checkbox"/> Y	Length (m)	<input type="text" value="100.0"/>	Settings	<input type="text" value="650 V, 60 Hz"/>	Seconds	<input type="text" value="410.0"/>
Minnow Trap	<input type="checkbox"/> N	Number	<input type="text"/>				
Seine	<input type="checkbox"/> N	Hauls	<input type="text"/>	Length (m)	<input type="text"/>		
Dip Net	<input type="checkbox"/> N	Trap Net	<input type="checkbox"/> N	Gill Net	<input type="checkbox"/> N	Other	<input type="checkbox"/> N <input type="text"/>
Smallest Mesh Size (cm)	<input type="text"/>	Mimimum Depth of Capture (m)	<input type="text"/>				
Largest Mesh Size (cm)	<input type="text"/>	Maximum Depth of Capture (m)	<input type="text"/>				

Fish Kept	<input type="checkbox"/> N	Number of Bags	<input type="text"/>	Jay Cashu bec Kalynn Parrott	<input type="text"/>
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Fish Capture

Count	<input type="text" value="17.00"/>	Fish With Blackspot	<input type="text"/>
Sample Kept	<input type="checkbox"/> N	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>
Fish Species	<input type="text" value="Central Mudminnow"/>		
Length (mm)	<input type="text" value="9.00"/>		
Age Class	<input type="text" value="Adult"/>		

Count	<input type="text" value="7.00"/>	Fish With Blackspot	<input type="text"/>
Sample Kept	<input type="checkbox"/> N	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>
Fish Species	<input type="text" value="Northern Redbelly Dace"/>		
Length (mm)	<input type="text"/>		
Age Class	<input type="text" value="Adult"/>		

Count	<input type="text" value="2.00"/>	Fish With Blackspot	<input type="text"/>
Sample Kept	<input type="checkbox"/> N	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>
Fish Species	<input type="text" value="Finescale Dace"/>		
Length (mm)	<input type="text"/>		
Age Class	<input type="text" value="Adult"/>		

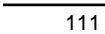
Count	<input type="text" value="2.00"/>	Fish With Blackspot	<input type="text"/>
Sample Kept	<input type="checkbox"/> N	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>
Fish Species	<input type="text" value="Brook Stickleback"/>		
Length (mm)	<input type="text"/>		
Age Class	<input type="text" value="Adult"/>		

Inventory Comments	<input type="text" value="Northern Water Snake captured while shocking."/>
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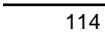
Fish Inventory



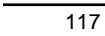
108



111





114



117



Fish Inventory

Site ID	WB-S-M26-1		Field Crew	Jay Cashubec Kalynn Parrott		27	
Study Area	WEC						
Waterbody	Unnamed inland pond, a Henvey Inlet waterbody.						
MNR District	Parry Sound						
Location	Henvey Inlet South. Large transitional fen with open waterbody in the centre. Site was 390m in length by 190m at N end and 125m at S end.						
Project Number	60341251	Air Temp. (degC)	20.0	Weather Notes			
Tablet	AECOM17	Wind Speed (beaufort)	3	Sunny with partial clouds. Light wind.			
Start Date	6/11/2015 10:31:20 AM	Precipitation	0				
End Date	6/11/2015 12:36:46 PM	Cloud Cover	50.00				
Surface Conditions	Rippled						
Site Features							
Feature Description	1413	Feature Location					
Upstream 50 m, photo taken near CL.	Latitude:45.841737,Longitude:-80.620689,Altitude:192.9,Speed:0.07202222,Accuracy:2.4,Provider:gps,Time:06/11/2015 11:22:31 EDT						
Feature Description	1416	Feature Location					
Downstream 50 m, photo taken near CL.	Latitude:45.841608,Longitude:-80.620504,Altitude:195.7,Speed:0.2880889,Accuracy:2.4,Provider:gps,Time:06/11/2015 11:23:35 EDT						
Upstream Water Quality	Upstream Length	125.0	Water Quality Notes				
WT (deg. C)		AT (degC)					20.0
pH		Cond. (s/cm)					
D.O. (mg/L)		Water Colour					Yellow/Brown
Water Clarity	Clear						
Upstream Water Quality	Downstream Length	190.0	Water Quality Notes				
WT (deg. C)		AT (degC)					20.0
pH		Cond. (s/cm)					
D.O. (mg/L)		Water Colour					Yellow/Brown
Water Clarity	Clear						

[illegible]

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Fish Inventory

Gear

Electrofisher	<input type="checkbox"/> N	Length (m)	<input type="text"/>	Settings	<input type="text"/>	Seconds	<input type="text"/>
Minnow Trap	<input type="checkbox"/> N	Number	<input type="text"/>				
Seine	<input type="checkbox"/> N	Hauls	<input type="text"/>	Length (m)	<input type="text"/>		
Dip Net	<input type="checkbox"/> N	Trap Net	<input type="checkbox"/> N	Gill Net	<input type="checkbox"/> N	Other	<input type="checkbox"/> Y Angling <input type="text"/>
Smallest Mesh Size (cm)	<input type="text"/>	Mimimum Depth of Capture (m)	<input type="text"/>	0.00			
Largest Mesh Size (cm)	<input type="text"/>	Maximum Depth of Capture (m)	<input type="text"/>	1.50			

Fish Kept	<input type="checkbox"/> N	Number of Bags	<input type="text"/>	Jay Cashu bec Kalynn Parrott	<input type="text"/>
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Inventory Comments	Angling survey was conducted to examine whether Northern Pike are present in inland waterbody. No Pike were captured nor was there any observed evidence of Pike presence. Note: A Spruce Grouse with nestlings was observed on the Argo trail approaching the wetland. Four confirmed Sandhill Cranes were heard calling in wetland and were observed flying over site. Caspian Tern observed feeding in wetland. Unidentified cyprinids observed in shallow waters near shoreline.
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Fish Inventory

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Fish Inventory

Site ID	WB-N-M31-2-2		Field Crew	Ami Arsenault Amy Ingriselli		30	
Study Area	WEC						
Waterbody	Unnamed tributary to Key River						
MNR District	Parry Sound						
Location	South of Key River in map n-31. Site not previously identified in maps, was observed en route to other site. Habitat assessment also performed at this location.						
Project Number	60341251	Air Temp. (degC)	16.0	Weather Notes			
Tablet	AECOM12	Wind Speed (beaufort)	0				
Start Date	6/15/2015 9:55:56 AM	Precipitation	0				
End Date	6/15/2015 11:41:08 AM	Cloud Cover	100.00				
Surface Conditions	Calm						
Site Features							
Feature Description	1551	Feature Location					
Facing upstream from downstream limit of study area		Latitude:45.884872,Longitude:-80.678191,Altitude:180.5,Speed:0.03601111,Accuracy:2.7,Provider:gps,Time:06/15/2015 10:48:36 EDT					
Feature Description	1554	Feature Location					
Facing downstream from upstream limit of study area		Latitude:45.884861,Longitude:-80.678178,Altitude:178.5,Speed:0.14404444,Accuracy:2.4,Provider:gps,Time:06/15/2015 11:01:52 EDT					
Upstream Water Quality	Upstream Length	50.0	Water Quality Notes				
WT (deg. C)	16.5	AT (degC)					16.3
pH	5.0	Cond. (s/cm)					0.02
D.O. (mg/L)	7.1	Water Colour					Colourless
Water Clarity	Clear						
Upstream Water Quality	Downstream Length	50.0	Water Quality Notes				
WT (deg. C)	16.5	AT (degC)					16.3
pH	5.0	Cond. (s/cm)					0.02
D.O. (mg/L)	7.1	Water Colour					Colourless
Water Clarity	Clear						

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[illegible]

Fish Inventory

Gear

Electrofisher	<input type="checkbox"/> Y	Length (m)	<input type="text" value="60.0"/>	Settings	<input type="text" value="650 V, 60 Hz"/>	Seconds	<input type="text" value="253.0"/>
Minnow Trap	<input type="checkbox"/> N	Number	<input type="text"/>				
Seine	<input type="checkbox"/> N	Hauls	<input type="text"/>	Length (m)	<input type="text"/>		
Dip Net	<input type="checkbox"/> N	Trap Net	<input type="checkbox"/> N	Gill Net	<input type="checkbox"/> N	Other	<input type="checkbox"/> N <input type="text"/>
Smallest Mesh Size (cm)	<input type="text"/>	Mimimum Depth of Capture (m)	<input type="text"/>				
Largest Mesh Size (cm)	<input type="text"/>	Maximum Depth of Capture (m)	<input type="text"/>				

Fish Kept	<input type="checkbox"/> N	Number of Bags	<input type="text"/>	Ami Arsena ult Amy Ingrisel li	<input type="text"/>
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Inventory Comments	No catch, electrofisher stopped working but most of the site within the road alignment was sampled. Within alignment, watercourse downstream of beaver dam was a shallow Black Ash dominated swamp with several seasonal low flow barriers. Not likely direct fish habitat.
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Fish Inventory

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Fish Inventory

Site ID	WB-N-M6-3	Field Crew	Amy Ingriselli Ami Arsenault	33
Study Area	WEC			

Waterbody	Unnamed tributary to Henvey Inlet			
MNR District	Parry Sound			
Location	North of Henvey Inlet, east end			
Project Number	60341251	Air Temp. (degC)	20.0	Weather Notes
Tablet	AECOM12	Wind Speed (beaufort)	1	
Start Date	6/16/2015 10:35:09 AM	Precipitation	0	
End Date	6/16/2015 11:48:38 AM	Cloud Cover	10.00	
Surface Conditions	Calm			

Site Features

Feature Description	1629	Feature Location	
Net set at CL		Latitude:45.872434,Longitude:-80.60704,Altitude:191.2,Speed:0.015433333,Accuracy:2.1,Provider:gps,Time:06/16/2015 11:27:01 EDT	

Upstream Water Quality	Upstream Length	50.0	Water Quality Notes	
WT (deg. C)	17.2	AT (degC)		20.0
pH	4.3	Cond. (s/cm)		0.01
D.O. (mg/L)	8.5	Water Colour		Yellow/Brown
Water Clarity	Clear			

Upstream Water Quality	Downstream Length	50.0	Water Quality Notes	
WT (deg. C)	17.2	AT (degC)		20.0
pH	4.3	Cond. (s/cm)		0.01
D.O. (mg/L)	8.5	Water Colour		Yellow/Brown
Water Clarity	Clear			

Gear

Electrofisher	<input type="checkbox"/> N	Length (m)	<input type="text"/>	Settings	<input type="text"/>	Seconds	<input type="text"/>
Minnow Trap	<input type="checkbox"/> N	Number	<input type="text"/>				
Seine	<input type="checkbox"/> N	Hauls	<input type="text"/>	Length (m)	<input type="text"/>		
Dip Net	<input type="checkbox"/> N	Trap Net	<input type="checkbox"/> N	Gill Net	<input type="checkbox"/> N	Other	<input type="checkbox"/> Y <input type="text" value="Winged Hoop Net"/>
Smallest Mesh Size (cm)	<input type="text" value="1.0"/>	Minimum Depth of Capture (m)	<input type="text" value="0.20"/>				
Largest Mesh Size (cm)	<input type="text" value="1.0"/>	Maximum Depth of Capture (m)	<input type="text" value="0.50"/>				

Execution Time 9/9/2015 11:35:34 AM

Filter Start Date 5/1/2015

Filter End Date 9/1/2015

Fish Inventory

Fish Kept	<input type="text" value="N"/>	Number of Bags	Amy Ingriselli Arsenal	<input type="text"/>
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Fish Capture

Count	<input type="text" value="1.00"/>	Fish With Blackspot	<input type="text"/>
Sample Kept	<input type="text" value="N"/>	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>
Fish Species	<input type="text" value="Brook Stickleback"/>		
Length (mm)	<input type="text"/>		
Age Class	<input type="text" value="Adult"/>		

Count	<input type="text" value="1.00"/>	Fish With Blackspot	<input type="text"/>	<input type="button" value="✖"/>
Sample Kept	<input type="text" value="N"/>	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>	
Fish Species	<input type="text" value="Brown Bullhead"/>			
Length (mm)	<input type="text" value="65.00"/>			
Age Class	<input type="text" value="Adult"/>			

Count	<input type="text" value="12.00"/>	Fish With Blackspot	<input type="text"/>
Sample Kept	<input type="text" value="N"/>	Fish With Lesions, Tumors, Maturity, etc	<input type="text"/>
Fish Species	<input type="text" value="Central Mudminnow"/>		
Length (mm)	<input type="text"/>		
Age Class	<input type="text" value="Adult"/>		

Inventory Comments	Net set at centreline. Watercourse dammed upstream and down. Snapping turtle observed upstream. Net set with opening facing upstream. Large hole at back of net above waterline occurred after setting. Nine (9) large unidentified tadpoles captured in net.
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Fish Inventory



120

123

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Appendix C

Field Staff Qualifications



Ami Arsenault

Environmental Technician

Education

Diploma, Ecosystem Management
Technology, Sir Sandford Fleming
College, 2011

Years of Experience

With AECOM: 2.5
With Other Firms: 1

Training and Certifications

Class 1 Electrofishing Certificate, 2011
Class II Electrofishing Certificate 2014
Ontario Benthos Biomonitoring Network
Certification, 2011
Certification in Standard First Aid and
CPR 2014
Valid Class G License

Ms. Arsenault is an environmental technician and part of the Natural Sciences team in the Markham office. She has a Diploma in Ecosystem Management from Sir Sanford Fleming College. She has had the opportunity to work and volunteer for many environmental organizations which furthered her ability to produce quality work for clients. As an environmental technician, Ms. Arsenault will be responsible for ground water and surface water sampling, conducting stream flow measurements, and wetland monitoring. Ms. Arsenault has extensive experience with electrofishing, identifying fish species and conducting habitat assessments. Ms. Arsenault will also be responsible for data entry and report preparation.

PROJECT EXPERIENCE

Southeast Collector Trunk Sewer Project, York Region, Ontario. Field Technician involved in conducting stream assessments, monthly ground water-surface monitoring, and wetland monitoring as well as, data entry of results. During the summer, is responsible for fish habitat assessments, fish spawning surveys and geomorphological assessments of watercourses. Technician is currently undergoing training to become a secondary sediment and erosion control inspector at the 13 construction shafts throughout the Trunk Sewer Project. (01/12 – present)

Mount St Louis Moonstone Ski Resort, Coldwater, Ontario. Field Technician Involves installing surface water monitoring stations, conducting stream flow measurements, monitoring surface water levels via in-stream installed loggers and monitoring effects of water taking on watercourse. (01/12-11/12)

Highway 62 – Permit To Take Water Construction Monitoring, Belleville, Ontario. Field Technician involved the collection of base-line data from well owners within a buffer zone of the Hwy 62 expansion via general well water surveys. Weekly and monthly groundwater levels will be taken from accessible wells, and water quality will be tested from approved homes. Stream flow measurements will be conducted from a tributary running through the expansion area to monitor effects construction may have on watercourse. (02/12-09/12)

Halton Waste Management Site, Halton Region, Milton, Ontario. Field Technician involved in the monthly collection of groundwater levels, leachate samples from wells within the landfill. Stream flow measurements will be taken from surrounding watercourses to assess the effect of water taking from the landfill. Quarterly and bi-annual surface water and groundwater sampling also conducted throughout the year.(01/12-present)

County of Simcoe Landfill Monitoring, Simcoe County, Ontario. Field technician responsible for monitoring the following landfills in Simcoe County: Essa landfill, Tosorontino landfill, Medonte landfill, Vespra landfill, Alliston landfill, Adjala landfill and the Mara landfill. During site visits, water levels and gas measurements are taken, and groundwater and surface water samples are collected as required. Responsible for shipping samples and updating field data once field event is completed. Report tables, figures and appendices are created for the annual monitoring reports. (05/12-present)

Duncan Creek – German Mills Model and Monitoring, Toronto, Ontario. Field technician responsible for monitoring Duncan Creek and German Mills waterways during 'wet weather' events. Tasks included calculating flow measurements, collecting surface water samples and photographs at each designated site (2012).

Blueland McCormick Quarry, Town of Caledon, Peel Region. Field technician responsible for collecting quarterly water levels at monitoring wells, monitoring Warnock Lake and small tributary. Also required to update field data upon return (02/ 12-present).

Olympia Sand and Gravel Ltd, Town of Caledon, Peel Region. Field technician responsible for collecting quarterly water levels at monitoring stations and conducting well water surveys and groundwater samples at residential homes in the



boundaries of the proposed Olympia Sand and Gravel operation (02/ 12-present).

Ogden Point Quarry (Holcim), Colbourne, Ontario. Technician responsible for conducting monthly water levels at mini-piezometer locations, monthly surface water sampling, quarterly borehole water levels and downloading monthly flowmatrix data (07/12 – 03/13).

Major Mackenzie Tree Assessment, Vaughn, Ontario. Assisted AECOM arborist with identifying, sizing and marking trees for removal. Used GPS to mark all locations for further mapping.

Nextera Energy Canada, Bluewater Wind Energy Centre, Municipality of Bluewater, Ontario. Field technician assisted aquatic biologist with stream assessments in the Bluewater municipality; taking chemistry readings, measuring geomorphic stream dimensions, identifying water bodies on maps. Completed amphibian surveys, recording frog species heard and their locations.

NextEra Energy Canada, Jericho Wind Energy Centre, Lambton and Middlesex County, Ontario. Field technician assisted aquatic biologist with stream assessments in the Bluewater municipality; taking chemistry readings, measuring geomorphic stream dimensions, identifying water bodies on maps. Completed amphibian surveys, recording frog species heard and their locations.

NextEra Energy Canada, Goshen Wind Energy Centre, Huron County, Ontario. Field technician assisted aquatic biologist with stream assessments in the Bluewater municipality; taking chemistry readings, measuring geomorphic stream dimensions, identifying water bodies on maps. Completed amphibian surveys, recording any heard frog species and their locations. Carried out Water Well Surveys to residents within a 500m buffer zone of turbine construction, speaking to residents about the general use of their wells, gaining permission to take water levels or water quality samples if the project later requested.

St. Mary's Cement, CBM Aggregates, various locations. Field technician responsible for conducting quarterly environmental monitoring events at various CMB aggregate pits, including the Sunderland, Aberfoyle, Dabrowski, Brown, Mast Snyder, Cannington and Woodville locations. These monitoring programs include collecting surface water, groundwater and residential water quality samples, taking water levels, downloading and interpreting temperature logger information, and reporting on any changes on site (environmental or other; ie: vandalism on closed sites). Data entry is required upon completion of monitoring event

Metrolinx, Lakeshore East Expansion GTA, Ontario. Assisted team lead with Ecological Land Classification surveys in the field, as well as data entry when field work completed. (June 2014).

Metrolinx, Stouffville Corridor Rail Service Expansion, Scarborough, Ontario. Assisted with amphibian breeding surveys throughout the study area (May 2014).



Jay Cashubec

Environmental Technologist (E.P.)

Education

Diploma, Environmental Sciences/Environmental Technician, Sir Sandford Fleming College, 2008

Environmental Site Assessment Course, Sheridan College, Brampton, Ontario, Canada, 2010

Years of Experience

With AECOM: 1

With Other Firms: 5

Professional Associations

Canadian Environmental Certification Approvals Board

Training and Certifications

EPT Environmental Professional Certification

First Aid/CPR Training, Level C

Small Non-pleasure Vessel Basic Safety MED A3

Class II Electrofishing Training – Backpack Crew Leader

Drinking Water Operator Level 1

Outdoor Wilderness Survival Certification

Pleasure Craft Operator Card

Quality Assurance Program for Environmental Investigations in Ontario

2 Day Environmental Site Assessment Field Camp

40-hour HAZWOPER Training, 8-hour Re-certification

WHMIS Training

Technical Writing

3 Day Bioscience Field Camp (Aquatic)

Certificate in Ichthyology (ROM)

Natural Biological Hazards Training

ATV Safety Training

Hazardous Material and

Jay is an Environmental Technologist with over 6 years of experience. His work has involved fish and benthic invertebrate identification and associated methods of capture, including electrofishing, gill netting, seine netting, etc. He is also regularly responsible for Terrestrial work, including bird nesting and amphibian surveys. He is responsible for drafting in and near water works proposals, as well as endangered species identification and mitigation plans.

Jay is also proficient in a multitude of ground and surface water measuring and sampling techniques, and is practiced in the writing of factual reports and drafting of associated methods for presenting data. He is well versed in working in remote environments, including the use of all-terrain vehicles, helicopters, and various boats.

In addition, Jay has conducted construction monitoring in relation to terrestrial and aquatic species, with regards to soil and erosion controls, spills, drilling frac-outs, species at risk identification, and the drafting of corresponding reports.

Mr. Cashubec is familiar with creel surveys, water body and stream characterization, stream flow measurements, electrofishing, and bathymetry. Jay holds many job related certifications and safety trainings, and currently sits on the Executive Board of Directors for the Middle Grand River Chapter of Trout Unlimited.

Project Experience

Ecology/Bioscience

Metrolinx, GO Transit – Aquatic Monitoring, Whitby, Ontario. Fish salvage - Conduct electrofishing and transplant efforts. Identify and classify fish within Redside Dace habitat. Recommend pump-around techniques and erosion controls for in-water works.

Mining Client, Proposed Iron Ore Mine, Iqaluit, Quebec. Crew lead on multiple occasions in extremely remote environment in northern Quebec. Baseline fishery study that involved gill netting, electro-fishing, stream and water body mapping and characterization (both from the ground and the air), bathymetry, and stream flow measurements. Helicopters were used for the transportation of equipment and people, and meticulous care was needed for planning the work and the safe return of staff for the duration of the stay.

Mining Client, Proposed Lithium Mine, Chibougamou, Quebec. Baseline fishery study including: gill netting, minnow traps, and electro-fishing, as well as water body and stream characterization. Responsible for organizing water sampling gear and protocols, as well as sample bottle requirements for a large scale surface water sampling program, including depth controlled water sampling, and sediment and benthic sampling. Work



Transportation of Dangerous
Goods Shipping Awareness (CAN)

Module 1 & 2 Behavior Based
Safety Awareness (AECOM)

Cold and Heat Stress Prevention
Training

Electrical Hazards Awareness
(CCOHS)

Heavy Equipment Hazard
Awareness

Incident Investigation Awareness

Canadian Due Diligence – OH&S
Training

Railroad General Worker
Protection Awareness

Traffic Safety and Control
Awareness

Trench and Excavation Safety
Awareness

Working Around Water Safety
Awareness

was conducted in a remote environment using helicopters, all-terrain vehicles, and 4-wheel drive trucks.

Ontario Power Generation, Baseline Fishery Studies, Darlington, Ontario. Setting and removal of gill nets for baseline study in Lake Ontario. This included the measuring, counting, and identification of different species within the great lakes system.

Lafarge, Proposed Quarry - Electrofishing, Mansfield, Ontario. Electrofished cold water stream, including fish identification and measurement for baseline study, as well as habitat mapping.

OPG, Hydro-Electric Operating Facility - Fish Salvage, Niagara, Ontario. Large scale fish salvage effort during the dewatering of the power facility. Salvaged and transported fish through various means of gill netting, trap netting, and electrofishing. This included the identification, measurement, and transportation of a variety of species. Also managed sediment sampling program concerning environmental impacts.

Bruce Power, Power Facility – Entrainment Sampling, Kincardine, Ontario. Sampled for larval fish and eggs using a plankton net in conjunction with a swift water rescue system for lowering and raising the net into high velocity intake channel, as well as trolling plankton nets on Lake Huron.

NextEra Energy, Wind Energy Construction – Construction Monitoring, Bluewater, Ontario. Monitored for soil and erosion controls, spills, directional drilling frac- outs, impacts to terrestrial and aquatic species, alterations to natural features, species at risk identification, during the construction of wind turbines. Drafting of Weekly Construction Monitoring Reports.

NextEra Energy, Wind Energy Construction – Bird Nesting Surveys, Bluewater/Jericho, Ontario. Monitored proposed construction sites for nests and breeding bird activities. Responsibilities included classifying active and non-active nests, removal of non-active nests, bird and species at risk identification.

Bruce Power, Power Facility - Creel Survey, Kincardine, Ontario. Conducted creel surveys at various boat launches. Work included fish identification, measurement, and scale samples.

Surface Water/Hydro Geology

Lafarge, Aggregate Quarry Monitoring, Bath, Ontario; and Brantford, Ontario. Conducted stream flow measurements at various creeks and rivers surrounding quarry to assess water usage. Retrieved data loggers and downloaded information at multiple monitoring locations to assess groundwater levels.

Contaminated Sites

Acting Site Supervisor, Kitchener/Waterloo Wastewater Treatment Plant

Stand in supervisor for all construction related activities pertaining to the decommissioning and redevelopment of the Attenuation ponds at the KW



Wastewater Treatment Plant. Duties included overseeing the treatment and removal of biosolids, contractor oversight including ensuring they meet contractual agreements, sampling of imported and exported materials.

Confidential Client, Phase II and III Assessment and Remedial Efforts, Oakville, Ontario. Managed drillers with the sampling and installation of monitoring wells. Sampled wells using low flow procedures. Observed appropriate quality control measures in accordance with Reg.153/04 and possible site specific risk assessment.

AKZO/ICI, Phase II and III Testing and Remedial Efforts, Parry Sound, Ontario. Environmental technician involved with hand augering, soil delineation, sediment sampling, and surface and groundwater sampling to assess nitro-aromatic impact. Work also involved sediment sampling through lake ice and accompanying safety measures.

Shawcor, Phase II and III Soil Delineation, Hamilton, Ontario. Managed the excavation of test pits to assess delineation of coal tar impact.

FSM Management, Oil Water Separator and Groundwater Investigation, Mississauga, Ontario. Monitored oil water separators in accordance with TSSA regulations, and sampled effluent for petroleum hydrocarbon exceedances. Monitored and sampled groundwater wells within fuel storage tank farm area for petroleum hydrocarbon impact. Drafted multiple factual reports for client based on analytical data and information gathered on site.

TransCanada Pipeline, Soil and Ground and Surface Water Investigation, Hearst, Ontario. Hand augured boreholes in and surrounding run-off ditch to assess hydrocarbon and metals impact in sediment. Sampled groundwater wells stretching from Ramore to 90 kilometres west of Hearst.

IBM, Soil Vapour and Ambient Air Sampling, Toronto, Ontario. Conducted a soil vapour sampling program in an industrial building. Duties included installing sub-slab soil vapour probes; vacuum leak testing with helium; screening for various gases, including O₂, CO₂, CH₄, He, and Isobutylene; and sampling via summa canisters and flow controllers. Ambient and background air samples were taken using summa canister's and flow controllers for quality assurance.

John Deere, Contaminate Mitigation between Adjacent Properties, Woodstock, Ontario. Responsible for retrieving defensible soil vapour samples, including vacuum leak tests using helium, collecting samples via flow controllers and summa canisters. Also responsible for low-flow groundwater sampling using peristaltic pump and flow- through cell to document geochemical parameters to ensure that stabilization had occurred and water was being sampled from the representative formation. All in accordance with Ministry of Environment/Environmental Protection Agency protocols.

Hydro One, Phase II Proposed Hydro-Generating Station, Holland Landing, Ontario. Managed the installation of boreholes and monitoring wells. Conducted surface and groundwater sampling to assess the condition of the site and potential impacts. As well, collected soil samples to assess geotechnical soil integrity and composition for building purposes. Conducted GPS and shot elevation survey to ensure well location and flow of groundwater.



Public Works and Government Services Canada, Phase I and II Site Investigation, Parry Sound, Ontario. Assisted with Phase I site visit for federal client. Managed drillers in conducting Phase II soil sampling and well installation regarding impact from former gas station.

Public Works and Government Services Canada, Phase II Investigation, Multiple Sites, Toronto, Ontario. Working for a federal client, managed drillers in conducting soil sampling and well installations to assess subsurface impacts from armoury buildings on multiple sites across Toronto. Sampled water and shot elevation surveys to help determine groundwater flow direction.

Federal Government Client, Phase II Investigation of Subsurface Impact, Thunder Bay, Ontario. Responsible for overseeing drillers while conducting soil sampling and well installation surrounding fire fighter training facility inside airport in-field. Organized and shipped soil and groundwater samples.



Devon Fowler

Honours B.Sc., EPt,
Restoration Ecologist

Education

Honours Bachelor of
Science
Trent University
2011 – 2013

Ecosystem Restoration
Diploma
Fleming College
2009 – 2011

Years of Experience

With AECOM: 2 years
With Other Firms: 0

Training and Certifications

Erosion and Sediment Control Design
Certificate Course - TRCA
Electrofishing - Class 1
ECO Canada-Environmental Professional
in Training
Member Society For Ecological
Restoration
Standard First Aid and CPR- C
Standard Wilderness First Aid

Devon graduated with an Honours Bachelor of Science degree from Trent University and is a graduate of Fleming College with a diploma in Ecological Restoration. Through a combination of education and work experience Devon has become proficient in ecological restoration, erosion and sediment control design and implementation, regulatory approvals for Species at Risk, aquatic habitat assessments and environmental monitoring.

Project Experience

Ecological Restoration and Regulatory Permitting

Ministry of Transportation, Highway 401 Widening from Highway 403/401 Interchange to the Credit River - Aquatic Species at Risk Permitting and Channel Rehabilitation and Riparian Restoration Plan (2014-2016) – Worked as part of an interdisciplinary team to design comprehensive channel rehabilitation plan drawings and design brief specific to Redside Dace preferred conditions. Lead the design process for the shoreline and riparian restoration plan drawings. Finalized the necessary environmental drawings and mitigation measures required for the approval process under the Permit 17 (2)(c) application under the *Endangered Species Act*, 2007.

Township of Centre Wellington, Stormwater Management Pond and Discharge Structure at the Northeast Industrial Park Expansion – Stormwater Pond Planting Plan (2015) – designed and coordinated a planting plan specific to the GRCA guidelines in order to obtain approval under the Ontario Regulation 150/06 Application for Development, Interference With Wetlands and Alterations to Shorelines and Watercourses Permit.

City of Ottawa, Wetland Compensation and Restoration Plan at the West Carleton Environmental Centre – Conceptual Wetland Restoration Plan (2015) – Assisted Senior Terrestrial Ecologist in the creation of a conceptual wetland restoration plan for four hectares of compensation wetland habitat suitable for amphibian breeding near the proposed landfill footprint

Region of Peel, Queen Street West Widening- Aquatic Species at Risk Permitting and Shoreline Restoration Plan – (2013-2015) – Assisted Senior Fisheries Biologist in obtaining an Overall Benefit permit for a road widening that crossed four watercourses designated as critical habitat for Redside Dace, a species with habitat protection under the *Endangered Species Act*, 2007. This included the design and coordination of a shoreline restoration plan for submission to the MNR and submission of a Notice of Activity with a detailed mitigation plan for an additional watercourse that went through the streamlined self-registry process.

Metrolinx-Georgetown South Project-M9.60 Weston Sub-Humber River Bridge Shoreline Restoration (2013-2014) - Assisted Senior Ecologist in the creation of a landscape restoration plan for the riparian habitat on the slope of the Humber River in post construction phase of the Georgetown South Service Expansion and Union-Pearson Rail Link.

NextEra Wind Energy Centre, Jericho and Goshen Wind Energy Centre, Regulatory permitting under the ESA (2013) – Assisted Wildlife Biologist in preparing mitigation plans and habitat compensation plans for such species as Bobolink, Eastern Meadowlark and two SAR bat species (Northern Long eared bat and Little Brown bat). Assisted in the completion of long term monitoring plans as part of the application process for species protected under the *Endangered Species Act*, 2007.

York Region, YDSS Sanitary Sewer Rehabilitation for North Don and Maple Collectors- Aquatic Species at Risk Permitting and Shoreline Restoration Plan – (2014)

Assisted Infrastructure Engineers to obtain an Overall Benefit permit for an YDSS Sanitary Sewer Rehabilitation project within the Don River watershed which contains areas designated as critical habitat for Redside Dace, a species with habitat protection under the Endangered Species Act, 2007. This included the design and coordination of a shoreline restoration plan for submission to the MNR.

Environmental Monitoring

NextEra Wind Energy Centre, Bluewater Energy Centre- Environmental Monitoring during Construction (2014- ongoing) – Environmental Monitors are responsible for assisting Contractors and Project Owners in exercising environmental due diligence. This includes overseeing and co-ordinating adherence to permit conditions. Daily physical site evaluations were conducted to determine if refinements to the Sediment and Erosion Control Plan are required.

Township of Halton Hills, Side Road 27 Bridge Construction- Aquatic Species at Risk Environmental Monitoring (2013) - Environmental Monitoring services for the 27th Sideroad Structure Rehabilitation construction works. Since “in water” works on the structure began after the MNR’s Redside Dace Timing window (July 1st to Sept 15th), the Ministry of Natural Resources (MNR) requested that daily monitoring be undertaken during in-water construction works, and after any significant/ extended rainfall event or during the spring freshet. Weekly monitoring was also a requirement once in-water works had commenced.

GO Transit-East Rail Maintenance Facility -Wetland Design and Post Construction Monitoring (2013-ongoing) - Assisted in the creation and implementation of a long term environmental monitoring program for the East Rail Maintenance Facility’s Fish Habitat and Wetland Compensation Design created to avoid formal HADD authorization from DFO. This monitoring plan was created to document, review and provide mechanisms that will identify the need for action to be taken in response to any changes in species, fish habitat, vegetation community and hydrologic function that exceed the established thresholds or that may indicate negative effect on the ecological features from the construction of the Hemi Marsh wetland.

Class Environmental Assessments

Ministry of Transportation Ontario, Highway 11 Culvert Rehabilitation, Town of Gravenhurst (2014) - Characterized fish community composition and fish habitat to support the assessment of highway expansion activities at four culverts. Conducted aquatic habitat mapping and backpack electrofishing to document resident fish communities which included the Special Concern species Grass Pickerel.

City of Ottawa, Improvements to Ottawa Road 174 from the Highway 417/ Ottawa Road 174- Class Environmental Assessment (EA) Schedule ‘C’ (2013) – Supported the Fisheries Biologist in characterizing fish community composition and fish habitat conditions to document existing conditions in the assessment of highway expansion activities at one hundred crossings.



Michael Godard, B. Sc. Hon.

Fisheries Biologist

Professional History

2013 - present, AECOM, Fisheries Biologist

2011 – 2012 OHL/FCC JV, Fisheries Biologist

2006-2011, Centre for Environment, Fisheries and Aquaculture Science, Fisheries Biologist

2001 – 2004 Heritage Aquaculture, Fish Health Technician

Education

Aquaculture Technology Diploma (Letter of Academic Achievement) Sir Sandford Fleming College Lindsay, ON 1999-2001

Environmental Science (Honours) Open University, England 2008 – 2011

Years of Experience

With AECOM: 1

With Other Firms: 10

Training

Canadian Pleasure Craft Operator

WHMIS Training

Fall Arrest Training

Electrofishing Certification Level 2 Backpack Crew Leader

Standard First Aid with CPR Level A

Mr. Godard is an intermediate fisheries biologist with over 11 years of experience in the fisheries field in both the private and public sector. Michael is part of the Environmental Division and is based out of the Kitchener Office. He has worked on a diverse range of projects including environmental assessments, environmental baseline studies, environmental monitoring projects, Renewable Energy projects, transportation projects, environmental impact studies, construction monitoring projects, and Species at Risk screenings and surveys. Michael has co-ordinated and implemented a variety of ecological and water resource monitoring activities for various projects and also has experience collecting benthic invertebrates, fish sampling and conducting detailed fish habitat information. He has experience in the collection and analysis of water quality data, stream assessments, various lake sampling techniques, installation of a variety of surface water field equipment, and report writing. Michael has published research papers on a multitude of factors affecting fisheries such as hybridization with non-natives, predicting changes to fish populations based on climate change scenarios, density dependant growth and diel patterns of diet and habitat usage.

Michael has much practical experience in fisheries management and in the techniques used to assess and monitor habitat and fish populations, including studies using acoustic telemetry to determine habitat utilization of the European Eel (*Anguilla anguilla*) as well as PIT (Passive Integrated Transponder) studies on eels to determine microhabitat preferences for this species. He is also experienced in the micro-tagging of Atlantic Salmon (*Salmo salar*) and Sea Trout (*Salmo trutta*) for long term studies on the migratory behaviour of these species.

Fisheries Act Approvals

Waterloo LRT, Waterloo, ON

Prepared and submitted *Fisheries Act* “requests for reviews for Cedar and Laurel Creek crossings in Waterloo.

NextEra Wind Energy. Jericho and Goshen.

Prepared and submitted *Fisheries Act* “requests for reviews” for 50+ culvert installations throughout the study areas.

Middle Abutment Stabilization Works at Bridge CP#8304, French River, ON

Completed fish habitat assessments on areas surrounding a bridge abutment within the French River to assess risk to fish and fish habitat to submit “Request for Review” for the proposed works to the DFO.

Fisheries Act Self-Assessments

Bisch St Culvert Replacement

Aquatic investigations were undertaken to aid in the assessment of potential effects of bridge replacement. . Detailed background review and



fish habitat mapping was conducted using a standardized AECOM assessment protocol

Floradale Bridge Replacement

Aquatic investigations were undertaken to aid in the assessment of potential effects of bridge replacement. Detailed background review and fish habitat mapping was conducted using a standardized AECOM assessment protocol

Fisheries and Fish Habitat Assessments

Ottawa LRT EIS, Ottawa, ON

Aquatic investigations were undertaken to aid in the assessment of potential effects of bridge replacements and road widening for the LRT project in Ottawa. Detailed background review and fish habitat mapping was conducted using a standardized AECOM assessment protocol. This also included the screening of SAR habitat within the study area.

Waterloo LRT EIS, Waterloo, ON

Aquatic investigations were undertaken to aid in the assessment of potential effects of bridge replacements and road widening for the LRT project in Kitchener and Waterloo. Detailed background review and fish habitat mapping was conducted using a standardized AECOM assessment protocol. This also included the screening of SAR habitat within the study area.

Williams Parkway Road Widening, Brampton, ON

Aquatic investigations were undertaken to aid in the assessment of potential effects of bridge replacements and road widening along Williams Parkway between McLaughlin Road to North Park Drive. Detailed background review and fish habitat mapping was conducted using a standardized AECOM assessment protocol.

Ottawa Road 174-CR 17 Class EA Study from Highway 417 to Landry Road, City of Ottawa, ON

Completed aquatic habitat investigations and assessment of alternatives for the proposed alternate Highway 417 routes along the entire study area for existing aquatic habitat conditions. This also included the screening of SAR habitat within the study area.

Parkway Corridor Class EA, City of Peterborough, ON

Completed aquatic habitat investigations and assessment of alternatives for Parkway Corridor including aquatic habitat mapping and fish community surveys.

Middle Abutment Stabilization Works at Bridge CP#8304, French River, ON

Completed fish habitat assessments on areas surrounding a bridge abutment within the French River to assess risk to fish and fish habitat.

MTO - Highway 17 Widening, North Bay, ON

Completed aquatic habitat investigations and assessment of alternative routes for widening of Highway 17. Detailed background review and fish habitat mapping was conducted.

MTO - Leamington Breakwater, Leamington, ON Environmental Assessment,

Field data collection and reporting for fisheries assessment of the Leamington Breakwater to assess options for reconstruction or removal.

Fisheries assessment consisted of diver-assisted video documentation and sediment sampling with dredge-type sampler.

Indian Creek, Milton, ON

Completed aquatic habitat investigations including aquatic habitat mapping and fish community surveys

Victoria Street Widening, Whitby, ON

Aquatic investigations were undertaken to aid in the assessment of potential effects of bridge and culvert replacements and road widening along Victoria Street between Halls Road and Seaboard Gate in Whitby, ON. Detailed background review, fish habitat mapping and Species at Risk investigations were conducted.

GO Transit East Rail Maintenance Facility, Whitby ON

Completed aquatic habitat investigations including aquatic habitat mapping and fish community surveys.

Mineola Gardens, Mississauga, ON

Completed aquatic habitat investigations including aquatic habitat mapping relating to alleviating existing erosion issues in a reach of Cooksville Creek.

Environmental and Construction Monitoring

Sideroad 27, Halton Hills, ON

Coordinating and implementing the long-term monitoring program which monitored the impacts from a bridge widening over a coldwater Brook Trout stream. Daily, and then weekly construction monitoring and water quality sampling. Also responsible for data collection and organization and preparing reports for the client.

Mining and Minerals

Probe Mines Limited., Borden Lake, ON

Environmental baseline studies (hydrology, hydrogeology, ecology, water quality). Completed an adult fish survey and detailed habitat mapping (shoreline and transects) in support of a proposed open pit gold mine in northern Ontario.

Recent Publications

E. M. A. Rees, J. R. Britton, M. J. Godard, N. Crooks, J. I. Miller, K. J. Wesley and G. H. Copp. 2014. Efficacy of tagging European catfish *Silurus glanis* (L., 1758) released into ponds. *Journal of Applied Ichthyology*. 30, 127–129.

G. Zięba, S. Stakėnas, M. Ives, **M. J. Godard**, J. Seymour, M. G. Carter and G. H. Copp. 2014. Long-term decline of barbel *Barbus barbus* in the original course of the Lower River Lee (England), with particular reference to the survival of tagged fish during a water pollution incident. *Fundamentals of Applied Limnology*.

G. H. Copp, **M. J. Godard**, I. C. Russell, E. J. Peeler, F. Gherardi, E. Tricarico, L. Miossec, P. Gouletquer, D. Almeida, J. R. Britton, L. Vilizzi, J. Mumford, C. Williams, A. Reading, E. M. A. Rees, and R. Merino-Aguirre. 2014. A preliminary evaluation of the European Non-native Species in Aquaculture Risk Assessment Scheme applied to species listed on Annex IV of the EU Alien Species Regulation. *Fisheries Management and Ecology*

Fobert, E., Zięba, G., Vilizzi, L., **Godard, M.J.**, Fox, M.G., Stakėnas, S. & Copp, G.H. 2012. Non-native fish dispersal under conditions of climate change: case study in England of the pumpkinseed *Lepomis gibbosus* in a newly-invaded floodplain pond. *Ecology of Freshwater Fish*

Godard, M.J., Davison, P.I., Copp, G.H. & Stebbing, P.D. 2012. Review of invasion pathways and provisional pathway management plan for non-native ponto-caspian species of potential invasion risk to Great Britain. Cefas contract report for Defra.

Zięba, G., Stakėnas, S., **Godard, M.J.**, Ives, M., Semour, J. Carter, M.G. & Copp, G.H. Long-term decline of barbel *Barbus barbus* in the original course of the Lower River Lee (England), with particular reference to the survival of tagged fish during a water pollution incident. (submitted)

Godard, M.J., Almeida, D., Zięba, G. & Copp, G.H. 2012. Diet patterns of diet and habitat use of non-native fathead minnow *Pimephales promelas* in England. *Hydrobiologia*. DOI: 10.1007/s10750-012-1269-8.

Sayer, C.D., Copp, G.H., Emson, D., **Godard, M.J.**, Zięba, G., & Wesley, K.J. 2011. Towards the conservation of crucian carp *Carassius carassius*: understanding the extent and causes of decline within parts of its native English range. *Journal of Fish Biology* **79**, 1608–1624.

Masson, L., Almeida, D., **Godard, M.J.** & Copp, G.H. 2011. Biometric relationships between body size and bone size of the threatened native crucian carp and its hybrids with goldfish for dietary studies of Eurasian otter. *Journal of Applied Ichthyology* **27**, 1286–1290.

Tarkan, A.S., Gaygusuz, O., **Godard, M.J.** & Copp, G.H. 2011. Density-dependent basis of long-term growth patterns in a pond-dwelling population of crucian carp *Carassius carassius*. *Fisheries Management & Ecology* **18**, 375–383.

Britton, J.R., Cucherousset, J., Davies, G.D., **Godard, M.J.** & Copp, G.H. 2010. Non-native fishes and climate change: predicting species responses to warming temperatures in a temperate region. *Freshwater Biology* **55**, 1130–1141.

Tarkan, A.S., Cucherousset, J., Zięba, G., **Godard, M.J.** & Copp, G.H. 2010. Growth and reproduction of introduced goldfish *Carassius auratus* in small ponds of southeast England with and without native crucian carp *Carassius carassius*. *Journal of Applied Ichthyology* **26**, 102–108.

Copp, G.H., Tarkan, A.S., **Godard, M.J.**, Edmonds, N.J. & Wesley, K.J. 2010. A preliminary assessment of feral goldfish impacts on ponds, with particular reference to native crucian carp. *Aquatic Invasions* **5**, 413–422.

Tarkan, A.S., Copp, G.H., Zięba, G., **Godard, M.J.** & Cucherousset, J. 2009. Growth and reproduction of threatened native crucian carp *Carassius carassius* in small ponds of Epping Forest, southeast England. *Aquatic Conservation: Marine & Freshwater Ecosystems* **19**, 797–805.

Copp, G.H., Vilizzi, L., Mumford, J., Fenwick, G.V., **Godard, M.J.** & Gozlan, R.E. 2009. Calibration of FISK, an invasive-ness screening tool for non-native freshwater fishes. *Risk Analysis* **29**, 457–467.



Amy Ingriselli

Fish and Wildlife Technologist

Professional Qualifications

Professional History

Tulloch Environmental
Credit Valley Conservation Authority
Rideau River Conservation Authority
Fisheries and Oceans Canada
Anishnaabe Environmental Services
(on contract for Ontario Ministry of
Natural Resources and Forestry)
Orkin Canada

Education

Diploma, Fish and Wildlife Technician,
Sir Sandford Fleming College, 2001

Diploma, Fish and Wildlife
Technologist, Sir Sandford Fleming
College, 2002

Training and Certifications

Ontario Stream Assessment Protocol.
Ontario Benthos Biomonitoring
Network.
Class I Electrofishing Certification
CPR, Standard First Aid
WHMIS
Structural and Mosquito/Biting Fly
Aquatic Exterminator licences.
Radio Telemetry Tracking Certified
Pleasure Craft Operator's licence,
Canada Safety Council ATV Safety
Training
Ontario Ministry of Transportation
Registry, Appraisal and Qualification
System (RAQS) Fisheries
Assessment Specialist
Erosion and Sediment Control
Wildlife Trapping, Handling, Control
and Exclusion Techniques Training
Class G Driver's License

Amy is a Fish and Wildlife Biologist in AECOM's Water and Natural Resources Group. Amy has experience and expertise in fisheries biology and fish habitat assessments. She has been conducted and led fisheries assessment projects with various objectives in both the private and public sectors, including work with aquatic Species at Risk. Though her focus is aquatic science, through volunteer work, education, work experience and personal interest she also offers a variety of experience and knowledge in terrestrial natural heritage features such as wildlife, plants, birds, invertebrates (aquatic and terrestrial) and species at risk.

Experience

MTO FISHERIES ASSESSMENTS

Conducted field investigations and impact assessment of several highway repair and maintenance projects to gather fisheries and terrestrial data. Documentation and reports were prepared to describe existing conditions in the study areas, as well as an impact assessment of the features identified and in accordance with the MTO Environmental Guide to Fish and Fish Habitat and the MTO/DFO/MNRF Fisheries Protocol.

- Highway 17 Twinning Red Rock to Nipigon
- Highway 17 Roadway Improvements, Nipigon
- Highway 17 Roadway Improvements, Terrace Bay
- Highway 17 Twinning at Pass Lake
- Highway 17 Detour Bridge at Pic River
- Replacement of 29 Water Crossing Structures in NW Ontario

Fish, Bird and Wildlife Habitat Assessments

LAKE ONTARIO ATLANTIC SALMON RESTORATION PROGRAM – SMOLT MIGRATION MONITORING IN THE CREDIT RIVER, MISSISSAUGA

Responsible for the operation of a rotating screw trap in the Credit River, including; collection and identification of fish, collection of biological data and tissue samples of salmonid species, operation and maintenance of the trap, and applying Visible Implant Elastomer (VIE) tags to Atlantic Salmon smolts as part of the Lake Ontario Atlantic Salmon Restoration program. Also participated in stream electrofishing using a punt unit, collecting biological data and working with volunteers as part of the fish community monitoring program.

American Eel Abundance and Distribution Assessment in the Rideau River Watershed, Ottawa

Lead technician on this population assessment project. This involved leading a field crew and conducting fish assessments using several tools and techniques, but typically boat electrofishing in the Rideau and Ottawa River systems. Duties also included coordinating logistics and scheduling assessments, sampling fish and obtaining biological information, conducting background fish community and habitat research, analyzing data and compiling the report.



Kemptville Creek Species at Risk Habitat Mapping, Kemptville

Performed fish habitat mapping and stream assessments, water quality and fish community assessments of Kemptville Creek in Eastern Ontario. In addition to general stream assessments (RVCA protocol based on Ontario Stream Assessment Protocol principles) specific habitat River Redhorse, Pugnose Shiner and Bridle Shiner (species at risk) was targeted.

Espanola Light Industrial Park Expansion, Espanola

Fish habitat assessment, mapping and fish community assessment of undeveloped wetland. In support of requests for regulatory approvals for proposed development.

Grimesthorpe Creek Bridge Replacement, Manitoulin Island

Fish habitat and species community assessment of Grimesthorpe Creek and general assessment of surrounding terrestrial habitat features. Habitat conditions and impact assessment reports were prepared to describe the existing habitat, assess the impacts of the proposed work and recommend mitigation measures in support of a Municipal Class Environmental Assessment and project review by Fisheries and Oceans Canada.

Nichols Creek Via Rail Culvert Replacement, Smiths Falls

Fish habitat and species community assessment of Nichols Creek, and general assessment of surrounding terrestrial habitat features. Documentation and reports were prepared to describe the existing habitat, assess the impacts of the proposed work and in support of project review by Fisheries and Oceans Canada.

Elliot Lake Golf Course Permit to Take Water

Fish habitat and species community assessment of Lakes 26 and 27, and Ryan Lake. Identified fish habitat features and species data used to assess impacts of water level fluctuations.

Dokis First Nation Culvert Replacement Project, Nipissing

Five fish habitat assessments at 5 water crossings for culvert replacements along Dokis Road. Fish habitat features were assessed in the vicinity and surrounding areas to determine mitigation and potential impacts of the proposed work.

Elliot Lake Retirement Living Natural Heritage Assessments of 14 Lakes

Assessment of fish habitat, identification and mapping of critical habitat features and suitable spawning habitat was conducted on lakes proposed for development. Spawning habitat identified specifically for Lake Trout, Walleye, Smallmouth Bass, Northern Pike, Brook Trout and Rainbow Trout. Aquatic habitat assessment, mapping and species community assessments of tributaries were conducted where water crossings for access roads are proposed. Also participated in terrestrial general reconnaissance surveys which, once complete, identified areas requiring additional specific species at risk surveys. Surveys for Eastern Whip-poor-will, Blanding's Turtle and bat maternity roosting habitat according to MNRF protocols were conducted the following season.

Brewer's Creek Post-Construction Monitoring of Culvert Replacement and Rehabilitation, Algonquin Park

Assessment of fish habitat and fish passage through a culvert following restoration work to alleviate barriers to fish passage. Fish sampling using electrofishing and netting and velocity measurements were conducted to evaluate effectiveness of mitigation measures and fish passage through the culvert.

North Channel Post-Construction Monitoring of Compensation Measures, Little Current

Assessment of fish habitat compensation measures as per *Fisheries Act* authorization. Evaluation of the installation and effectiveness of the compensation measures and fish sampling using netting and traps to determine the amount of use of the compensation measures by fish.

Colston Creek Post-Construction Monitoring of Compensation Measures, Bracebridge

Assessment of fish habitat compensation measures as per *Fisheries Act* authorization. Evaluation of the installation and effectiveness of the compensation measures and fish sampling using electrofishing to determine the amount of use of the compensation measures by fish.

Lake Ontario Angler and Creel Survey, Mississauga and Scarborough

Lead technician for two seasons on a recurring creel survey conducted at Lake Ontario boat launches. This involved angler activity counts, angler interviews and collection of biological data and tissue collection (otolith and scale) for analysis.



Petro Canada and St. Lawrence Cement Mosquito Monitoring and Treatment Program, Mississauga

Regular monitoring of waterbodies on two large commercial properties. Aquatic invertebrate sampling at any standing waterbodies and identification of invertebrates (to family for mosquito species, to order for all other families). Treatment of standing water with larvicide upon identification of mosquito larvae.

Nigig Power Corporation – Wind Farm Project at Henvey Inlet First Nation, Georgian Bay

Preliminary fish and fish habitat assessment of inland watercourses and tributaries to Georgian Bay. Data collected included watercourse permanency, connectivity, morphology, water quality, quality of available habitat and identification of significant features and fish sampling using various methods (i.e. electrofishing, fyke nets, dip nets, minnow traps).

Pattern Energy and Nigig Power Corporation – Henvey Inlet Wind Energy Project, Henvey Inlet First Nation, Georgian Bay

Environmental and Natural Heritage assessment of proposed wind energy center and transmission line. Lead field biologist and field coordinator for aquatic environment assessments. This involved a detailed habitat assessment at all proposed water crossings, access roads and transmission lines, and fish community assessments using electrofishing and netting at representative habitats. Habitat assessments involved documentation of flow conditions, suitability to directly or indirectly support fish, habitat features such as morphology, substrate and vegetation, suitable spawning habitat, fish passage barriers, water quality parameters, evidence of erosion and bank stability, etc. The data was assessed and summarized in report form. Assessment was used to identify potential negative impacts to the fishery and mitigation measures which may negate these impacts.

In addition, considerable involvement in terrestrial natural heritage and species at risk field studies, including bat maternity roosting habitat surveys, identification of Significant Wildlife Habitat features and herptile surveys.

Blue Earth Renewables – Bow Lake Wind Farm

Environmental monitoring for construction work. Surveyed construction works, roads and access trails, evaluated existing sediment controls, and indicated where repair or further measures were required. Documented areas of occurrences and concern, and location, mean, extent, etc. of installation of additional controls (e.g. sediment fence).

SP Power – Goulais River Wind Farm

Conducted pre-construction assessment of fish habitat at road crossings. Documented watercourse conditions, habitat features and areas of concern.

Ontario Northland Rail Water Crossing Replacements, Temagami and Kirkland Lake, ON

Fish and aquatic environment habitat assessments of 6 rail crossing structures in the Temagami area and 8 near Kirkland Lake, ON. Documentation of habitat features and watercourse morphological characteristics were used to prepare reports to describe the existing habitat, assess the potential impacts and recommend mitigation measures in support of any potential requirements for regulatory approvals.

VIA Rail Canada Aquatic Habitat Assessments for Water Crossing Maintenance Project; Smiths Falls, Alexandria and Chatham, ON

Assessment of 72 culverts along the Chatham, Smiths Falls and Alexandria Rail Subdivisions in order to; determine whether or not fish habitat was present, describe the aquatic environment and identify significant habitat features, assess the sensitivity of the habitat and the potential for any aquatic species at risk to occur. This data was used to prepare reports to describe the existing habitat, assess the potential impacts and to recommend mitigation and protection measures for the proposed maintenance work. The project and specific mitigations to protect American Eel, Northern Madtom and Grass Pickerel was reviewed and a Letter of Advice was provided by Fisheries and Oceans Canada (DFO) Habitat Management Program.

The City of Sault Ste. Marie Bridge Replacement Project

Assessment of the aquatic environment at four bridges on the Big Carp and Little Carp Rivers, including description of habitat features, identification of critical habitat of salmonids and species at risk (Northern Brook Lamprey and Silver Lamprey) and stream flow and channel measurements. Data was used to prepare habitat description, impact assessment and mitigation reports in support of Municipal Class Environmental Assessments. Fish removal prior to construction work following specific techniques to target Northern Brook Lamprey and Silver Lamprey ammocoetes was required to remove species at risk from the work area.

Natural Environment Level 1 and 2 Assessments for proposed development in Northern Ontario;

- **Darian Aggregates proposed trap rock extraction pit, Blind River**
- **Onaping, Worthington and Seal Lake quarries for William Day Construction**
- **Leroy Construction proposed quarry in Blind River, ON**

Extensive field surveys including botanical, breeding bird point count surveys, raptor stick nest, vernal pool monitoring, marsh monitoring surveys and Ecological Land Classification protocol for Northern Ontario was used to describe the natural area and identify



Ecosites of the study area. Potential habitat for species at risk was identified and specific surveys targeting Eastern Whip-poor-will, Blanding's Turtle and bat maternity roosting habitat were carried out following MNRF protocols. Fish habitat identified in the area was assessed and habitat features including suitable spawning habitat, stream morphology, general habitat characteristics and mapping, and fish community sampling were carried out.

The Kensington Conservancy Stobie Creek Rehabilitation Project, Desbarats, ON

Assessment Stobie Creek from the outlet to Lake Huron upstream for 2 km. The Kensington Conservancy intends to rehabilitate this stretch of Stobie Creek which has been significantly impacted by human activity (such as agriculture). The creek in the study was surveyed and mapped to identify and prioritize areas of concern, such as heavy erosion, slumping banks, heavy sedimentation, sources of pollution, etc., as well as areas of significant habitat (such as suitable salmonid spawning habitat).



Shelley J. Lohnes Ecologist

Education

B.Sc. with Honours, Wildlife Biology, University of Guelph, 2004

Diploma, Arctic and Boreal Entomology, University of the Arctic, 2004

Years of Experience

With AECOM: 3
With other firms: 9

Professional Associations

Certified Inspector of Sediment and Erosion Control, CISEC CAN-145
Environmental Professional, EPT
Society for Ecological Restoration
Bird Studies Canada
Ontario Field Ornithologists
American Fisheries Society

Languages

English and French (bilingual)

Training

MTO/MNR Endangered Species Act Training
Fisheries Assessment and Fisheries Contracts Specialist for the MTO/DFO/OMNR Protocol (listed on RAQS)
Royal Ontario Museum Fish Identification Workshop
OMNR Stream Habitat Assessment Protocol
Pleasure Craft and Zodiac Operator's Certification
Electrofishing Crew Leader Backpack
St. John's Ambulance Advanced First Aid and C.P.R.
Automated External Defibrillator
CN Rail Safety
WHMIS/Transportation of Dangerous Goods

Additional Relevant Experience

Environmental Advisory Committee, City of Guelph, 2nd term ending November 2014.

As a part of the committee, provides peer review and expert opinion on development applications submitted to the City of Guelph. Understanding of how all relevant policies and legislation apply on a case by case basis is critical to providing City Council with commentary on the proposed development. Currently assigned to draft guidelines to preparing an EIS for use by the City of Guelph during development application review.

Shelley Lohnes is an Ecologist with over ten years of ecological experience in Ontario in areas of specialty including environmental assessments, regulatory approvals and permits, species at risk permitting, wildlife ecology, terrestrial and aquatic habitat assessments, ecological restoration and construction monitoring. Ms. Lohnes has conducted baseline ecological inventories focussing on potential impacts to wildlife populations, corridors and linkages, and rare species. Ms. Lohnes has experience designing, permitting, and constructing wildlife habitat and erosion control projects. She is well versed in requirements for compliance and amendments for activities under many pieces of legislation pertaining to wildlife and fisheries including the federal Fisheries Act and Species at Risk Act (SARA), the provincial Endangered Species Act and Conservation Authorities Regulation and has experience with amendments to previous authorizations. In addition to work at the design stage, Ms. Lohnes has worked closely with proponents in the transportation, energy, and public sectors during construction projects providing environmental monitoring including erosion and sediment control inspection, Species at Risk identification and relocation, aquatic species relocations for in-water works, and pre-clearing bird nesting surveys for a number of projects in Ontario under permits with the Endangered Species Act. She has also successfully prepared and negotiated Overall Benefit permit applications as well as Mitigation Plans supporting Notices of Activity under the amended Endangered Species Act (2007). She is listed under RAQS for *Fisheries Assessment* and *Fisheries Contracts Specialist* and has completed numerous Fisheries Act screenings all over Ontario. Ms. Lohnes was voted Chair of the Environmental Advisory Committee for the City of Guelph, where she provided peer-review of environmental impact studies for development applications within the city limits.

Relevant Project Experience

Blewater, Goshen, Jericho Wind Farms. 2012-2013. NextEra Energy Canada ULC.

Ms. Lohnes led Species at Risk evaluations under the *Endangered Species Act, 2007* for three wind facilities. A screening for over 50 at risk species and their habitats for three study areas was carried out. Ms. Lohnes prepared work plans, developed and implemented a rigorous field program, and prepared relevant reports and applications including mapping of significant wildlife habitat for submission to the Ministry of Natural Resources.

Environmental Impact Assessment for the Dingman Creek Erosion Control Wetland. 2009-2012. Delcan for the City of London. [prior to AECOM]

Completed comprehensive inventories of species throughout the study area, including fish, mussels, birds, butterflies, dragonflies, amphibians and mammals in order to complete an impact analysis for the creation of an online erosion control wetland. Prepared the natural environment components of the impact assessment, and consulted with agencies. Ms. Lohnes also completed the design of wildlife habitat features for the wetland.

Highway 401 and Wonderland Road Interchange, London. 2011-2012. Ministry of Transportation Ontario – West Region. [prior to AECOM]

Ecologist responsible for ecological fieldwork design, implementation and reporting, including wildlife and vegetation surveys as a part of the Terrestrial Assessment, including agency consultation. Also completed Fish and Fish Habitat Screening.



Environmental Impact Study for the Stoney Creek Erosion Control Wetland. 2009-2010. Delcan for the City of London. [prior to AECOM]

Completed a comprehensive inventory of aquatic and terrestrial species within the study area, including fish, mussels, birds, butterflies, dragonflies, amphibians and mammals in order to complete an impact analysis related to the creation of an online erosion control wetland. Assisted in preparing the natural environment components of the impact assessment, and consulted with agencies. Ms. Lohnes completed the design of wildlife habitat structures for the wetland design.

Environmental Impact Study for the Stoney Creek Trunk Sanitary Sewer and Watermain Crossing. 2009-2010. Delcan for the City of London. [prior to AECOM]

Ms. Lohnes completed a wildlife inventory that included avian, amphibian, mammal, butterfly and dragonfly surveys. An analysis of significance of species identified was also carried out in order to assess the sensitivity of the natural areas within the study zone.

Highway 11 New Interchange at South Entrance to Powassan From 5.7 km South of Highway 534, northerly 5.0 km Detail Design Study (G.W.P. 323-00-00). 2012. Ontario Ministry of Transportation.

Completed aquatic species at risk screening, fisheries assessment fieldwork, and preparation of the risk management framework for HADD authorization and approvals from Department of Fisheries and Oceans on behalf of MTO.

Environmental Monitor for Conestogo Wind Energy Centre, Arthur, Ontario. July 2012 – ongoing. NextEra Energy Canada ULC.

Ms. Lohnes acted as lead environmental monitor to conduct the daily inspection activities, which included using an adaptive approach to environmental protection based on site-specific conditions. Coordination of permitting conditions during construction activities as well as input on construction methods was an integral part of successfully constructing the project infrastructure in compliance with all requirements under the REA approval. Shelley assisted with navigating Ontario regulations in coordination with federal legislation and notification requirements during construction. Specific conditions outlined in compliance matrix documentation, as well as the less obvious environmental protection requirements in the province of Ontario, were communicated to the contractor as well as the client to ensure clarity in carrying out construction activities in accordance with relevant legislation.

Highway 404 Extension from Green Lane to Queensville Sideroad. 2010-2012. HCI. Environmental Monitor [prior to AECOM]

Working for the Contract Administrator, provided guidance on environmental issues and oversight of compliance with contract documents as well as federal and provincial permits and environmental assessment commitments. The site required removal of Butternut, a tree species at risk, and pre-clearing surveys for birds were also undertaken. Dewatering and stream diversion were problematic, and acted as a critical part of the team to devise a solution that was suitable to fisheries protection, contractor efficiency and cost-sensitive for the client.

Highway 8 Bridge Widening. 2009-2012. Bot Construction. Fisheries Contracts Specialist [prior to AECOM]

Oversaw construction activities within the Grand River and assisted contractor with compliance to the federal Fisheries Act authorization. Works involved the twinning of a 4-lane bridge over sensitive fish and mussel habitat. Mitigative activities included mussel and fish relocation, protection of fish habitat during in-water works through isolation of work and dewatering, construction of fish spawning habitat and monitoring of restoration activities. Site conditions required amendments to the compensation design, and a new design was created and submitted for approval to the Department of Fisheries and Oceans. An amendment to the Fisheries Act approval was granted.

Species at Risk Surveys for Rehabilitation of Highway 7 from Maberly to Wemyss, WP 4512-02-00. 2010. Delcan for the Ontario Ministry of Transportation. [prior to AECOM]

Developed the work plan and survey methodology in consultation with the MNR to carry out species-specific surveys for 20 species at risk along 13.5km of right-of-way. Recommended an avoidance and mitigation plan to protect species at risk and to prevent contravention of the *Endangered Species Act* by the proponent. [prior to AECOM]

Avian and Wildlife Assessment for the Realignment of Italia Lane, Kingston, GWP 4330-04-01. 2008-2009. Ainley Group for the Ontario Ministry of Transportation. [prior to AECOM]

As an Ecologist on this assignment negotiated acquisition of a permit under the *Endangered Species Act (2007)* for the removal and retention of Butternut tree specimens on the property. As a part of this application, a compensation strategy was developed for the replacement of retainable Butternut at a location off-site.

Terrestrial Assessment for Highway 401 and Highway 6 South, Morriston – Speed Change Lane Extension. 2011. Ontario Ministry of Transportation. [prior to AECOM]

Carried out a Species at Risk screening in accordance with the *Endangered Species Act*. Led species-specific surveys and habitat inventories within appropriate timing windows in order to identify site constraints related to proposed highway widening design.

Avian and Wildlife Assessment for the Rehabilitation of Highway 37 from the North Limits of Tweed Northerly to Highway 7, GWP 213-00-00. 2008-2009. Ontario Ministry of Transportation. [prior to AECOM]



Carried out species-specific surveys and habitat inventories in accordance with the *Endangered Species Act* along 13.5 km of rural highway within appropriate timing windows in order to identify site constraints related to proposed highway widening design.

Avian and Wildlife Assessment for the Old Gull River Bridge Removal – Highway 35, Rehabilitation of Sharpe’s Creek Culverts – Highway 11, Replacement of Portage Creek Culvert – Highway 124, and Rehabilitation of Hurricane Creek Culvert – Highway 118. 2008-2010. D.M. Wills Associates for the Ontario Ministry of Transportation.

[prior to AECOM]

Acted as Lead Ecologist for four structural assignments that involved complete assessments for Fish and Fish Habitat Existing Conditions & Impact Assessment; one HADD Authorization & Fisheries Compensation Design, extensive DFO and MNR agency consultation, and complete vegetation and wildlife inventories as a part of the Terrestrial Ecosystems Assessment. Also provided development of environmental components of contract documents and review of environmental commitments. Carried out species and habitat inventories in accordance with the *Endangered Species Act* at all study area locations within appropriate timing windows in order to identify site constraints related to structural replacement or rehabilitation.

Avian Assessment for the Glen Miller Bridge, Trenton. 2010. USL Concreate. *[prior to AECOM]*

Identified locations of and species of birds nesting within the construction zone in the bridge platform over the Trent River. Provided guidance on permitting and avoidance of the nesting birds to provide compliance with the *Migratory Birds Convention Act*, *Fish and Wildlife Conservation Act* and the *Endangered Species Act*.

Total Project Management/Detailed Design Services for Bridge and Hydrology Engineering for Local Road Board Structures; Replacement of Culverts along Nepewassi Lake Road at Highway 69 and Onaping Lake Road at Highway 144, Sudbury Area, G.W.P. 5022-10-00 & 5023-10-00. 2011-2012. Ontario Ministry of Transportation.

[prior to AECOM]

As Lead Ecologist on the project, completed Species at Risk screenings for each location, developed terrestrial and aquatic field programs, and prepared fisheries impact assessments for each proposed structure replacement on behalf of the Ministry of Transportation (Ontario).

Fisheries assessment and impact assessment for rehabilitation of culverts crossing Highway 4 from Kippen to Clinton, W.P. 75-85-00. 2010-2011. Ontario Ministry of Transportation. *[prior to AECOM]*

Completed fish and fish habitat assessments for all watercourses crossing Highway 4, including impact assessment and risk management framework in preparation of fisheries file for DFO submission. As a part of this assignment a Species at Risk screening was completed under both the *Endangered Species Act* (ESA) and the *Species at Risk Act* (SARA).

Detailed Design Services for the New Interchange and Extension of existing 4-laning, Highway 17 at the west junction of Sudbury Municipal Road 55, from 20.5 km west of Highway 144, easterly for 6.5km, Sudbury. 2011-2012. Ministry of Transportation Ontario – Northeastern Region *[prior to AECOM]*

Ecologist responsible for species at risk screening, wildlife survey study design and existing conditions reporting. Acted on behalf of MTO to consult with regulatory agencies.

Highway 8 from Seaforth East Limits Easterly to Mitchell West Limits Excluding 0.94km in Dublin. 2008. Ministry of Transportation Ontario – West Region. *[prior to AECOM]*

Ecologist responsible for assessing aquatic and terrestrial ecosystems for the rehabilitation of Highway 8, which included structural rehabilitation of culverts crossing this alignment. Reporting included Fish and Fish Habitat Existing Conditions and Impact Assessment; Terrestrial Ecosystems Assessment, and input to and review of contract documents.

Avian and Wildlife Assessment for the Realignment of Italia Lane, Kingston, GWP 4330-04-01. 2008-2009. Ainley Group for the Ontario Ministry of Transportation. *[prior to AECOM]*

As an Ecologist on this assignment negotiated acquisition of a permit under the *Endangered Species Act (2007)* for the removal and retention of Butternut tree specimens on the property. As a part of this application, a compensation strategy was developed for the replacement of retainable Butternut at a location off-site.

Additional Project Experience

Environmental Monitoring and Construction Administration

- Environmental Monitor for Summerhaven Wind Energy Centre, Nanticoke, Ontario. July 2012 – ongoing. NextEra Energy Canada ULC.
- Highway 3 from 1.6 km West of Essex County Road 11 Easterly to 0.2 km East of Essex County Road 34, Cont 2009–3005 , Ministry of Transportation (2009-2010)
- Windsor Bridges Cont 2009-3017 , LEA Consulting (2009-2010)
- Highway 6 from Arthur to Mount Forest, Cont 2007-3052, Construction Environmental Inspection and Administration (2010)



- Highway 6 from Mount Forest to Durham, Cont 2008-3008, Construction Environmental Inspection and Administration (2010)
- Highway 401 - Homer Watson Interchange, Post-Construction Monitoring, Ministry of Transportation (2009-2010)
- Highway 6 Post-Construction Monitoring, Ministry of Transportation (2009)
- Highway 11 - Emsdale Cont. 2008-5114, Construction Environmental Inspection and Administration (2009)
- Burk's Falls Environmental Inspection, LBC (2009)
- Highway 7 Peterborough, Cont 2007 - 4005, Fisheries Contracts Specialist, LBC, (2008)
- Ceramics Post-Construction Monitoring (2007-2008)
- Highway 40 at Moore Line, Cont 2007-3044, Construction Environmental Inspection and Administration (2008)
- Mercury Experiment To Assess Atmospheric Loading (METAALICUS), Department of Fisheries and Oceans, (2004)
- Ottawa River Seasonal Biological Monitoring Program at Britannia Beach, Mooney's Bay, Westboro Beach, Petrie Island, City of Ottawa, (2003)
- Surface Water Pesticide Monitoring Program, City of Ottawa, (2003).

Wildlife Surveys

- Avian Assessment for the Fort York Pedestrian Bridge, City of Toronto, AECOM (2010)
- Avian Assessment for the Ken Whillans Drive Extension, City of Brampton, AECOM (2007/2010)
- Avian and Wildlife Survey for 220 Greyabbey Trail Lake Ontario Shoreline Environmental Impact Assessment, IBI Group (2009-2010)
- Avian Inventory and Assessment for Hope Side Road Extension Class Environmental Assessment, City of Ottawa (2008-2009).

Fish and Fish Habitat Assessments

- Fisheries assessment and impact assessment for Highway 6, Durham to Dornoch, Grey County Fisheries Assessment, MTO Assignment # 3008-E-0023 (5), DFO Authorization # BU-08-3450 (2010-2011)
- Fisheries assessment and impact assessment for structural culvert rehabilitation at Walden Drain, Walker Drain and Kading Drain on Highway 21, Grand Bend; Woodlawn Drain, Highway 403, Brantford; and McKenzie Creek, Highway 6, Caledonia. MTO Assignment # 3008-E-0023 (6) (2010-2011)
- Total Project Management/Detailed Design Services for the Rehabilitation of Highway 37 from the North Limits of Tweed Northerly to Highway 7, GWP 213-00-00 (2008-2009)
- Natural Resources Inventory and Assessment for the Hope Side Road Extension Class Environmental Assessment, City of Ottawa (2008-2009)
- Detail Design for Highway 522 from 32.2 km west of Highway 524 easterly 6 km, Ministry of Transportation (2008)
- Mud Creek Stream Habitat Survey, City of Ottawa (2003)
- Rideau River Fisheries Assessment, City of Ottawa, (2003)
- Freshwater Aquaculture Research Program, Department of Fisheries and Oceans (2003)

Individual Environmental Assessments

- Scoped Environmental Impact Assessment for the Temporary Works Yard at Oxford Road 29, Township of Blandford-Blenheim (2009)
- Greyabbey Trail Environmental Impact Assessment, City of Toronto (2009)
- Natural Resource Assessment for the Intersection Improvements at Winchester and Ritson Road North, Region of Durham (2009)
- Neyagawa Boulevard Natural Resource Assessment, Town of Oakville (2009)
- GO Transit Layover Natural Environment Assessment, Town of Markham (2009).

Vegetation Surveys

- Total Project Management/Detailed Design Services for Consolidated Central Region Traffic Signals Design Assignment, Agreement # 2004-E-0067, (2005-2009)
- Total Project Management/Detailed Design Services for the Re-alignment of Italia Lane, Kingston, GWP 4330-04-01 (2008)
- Neyagawa Boulevard Natural Environment Inventory Avian and Vegetation Assessment (2009),
- GO Transit Layover Natural Environment Assessment (2009).
- Hope Side Road Extension Environmental Assessment (2008).
- Highway 8 from Seaforth East Limits Easterly to Mitchell West Limits Excluding 0.94km in Dublin, Ministry of Transportation (2008)
- Stoney Creek and Powell Drain for the City of London (2008)
- Highway 522 from 0.6 km west of Highway 522B in Trout Creek, westerly 19.7 km (2008).
- Dundas Street West Bridge over Humber River Vegetation Removals and Restoration Plan (2008).



Ashley Minion, B.Sc, (Hons) EPT., RBIT Aquatic Biologist, Environment

Professional History

05/2014 - present, AECOM, Aquatic Biologist, Environment

01/2011 - 05/2014, Cambium Inc.- Senior Environmental Technologist

09/2010 - 01/2011, Department of Fisheries and Oceans Canada- Fish Habitat Biologist

05/2008 - 09/2010, Ministry of Natural Resources-Fish and Wildlife Technician/Crew Leader

04/2007 - 08/2007, Alberta Sustainable Resource Development- Helitack Forest Firefighter

Education

B.Sc., Biology and Environmental Science (Honours), Trent University

Advanced Diploma, Ecosystem Management Technology; Sir Sandford Fleming College

Years of Experience

With AECOM: 1
With Other Firms: 7

Professional Affiliations

Alberta Society of Professional Biologists- Registered Biologist in Training

Canadian Society of Environmental Biologists- Environmental Professional in Training

National Council for Science and the Environment

Ashley Minion is an Aquatic Biologist with over seven years of experience in Ontario in areas of specialty including environmental assessments, regulatory approvals and permits, species at risk, aquatic biology, terrestrial and aquatic habitat assessments, and ecological restoration. Ashley has experience permitting, and overseeing construction of fisheries habitat compensation measures, and erosion control projects. As a biologist with the Department of Fisheries and Oceans, Ashley was involved in developing water management protocols for the Trent Severn Waterway and compensation for various projects under the federal *Fisheries Act*. Ashley is well versed in requirements for compliance and amendments for activities under many pieces of legislation pertaining to fisheries including the federal *Fisheries Act* and *Species at Risk Act* (SARA), the provincial *Endangered Species Act* and *Conservation Authorities Regulation*. She has also successfully prepared and negotiated Overall Benefit permit applications including compensation strategies under the *Endangered Species Act* (2007). Ms. Minion has conducted extensive baseline ecological studies focusing on potential impacts to fish and wildlife populations and their presence/absence. In addition to work at the design stage, Ashley has worked closely with proponents in the transportation, energy, and public sectors during construction projects to complete aquatic species relocations for in-water works, and Species at Risk identification and relocation for a number of projects in Ontario under permits with the *Endangered Species Act*. Ms. Minion has extensive experience conducting construction and post construction inspection/compliance monitoring. Ashley is a certified MTO/MNR/DFO *Fisheries Assessment* and *Fisheries Contracts Specialist* and registered as a Biologist in Training with the *Alberta Society of Professional Biologists*.

Project Experience

Water and Waste Water

Regional Municipality of Durham, Engineering and Design Services for the Jeffrey Street Sanitary Sewer Pumping Station, Durham Region, Ontario. As the Aquatic Biologist, responsible the field studies including baseline aquatic ecology, wetland, and surface water monitoring, obtaining environmental permit requirements, and obtaining permits and approvals under the *Conservation Authorities Act*, *Fisheries Act*, and federal *Species At Risk Act*, as required. [2014-present]

City of Toronto, Construction Inspection/Environmental Compliance Monitoring for the Highland Creek Wastewater Treatment Plant, Toronto, Ontario.

As the environmental compliance lead monitor on site, provides technical oversight to the contractor and ensures compliance with all permits and drawings. Completion of a Fisheries Act Self-Assessment was completed. [2014-present]

City of Kitchener, Kitchener Wastewater Treatment Plant Upgrades, Kitchener, Ontario. As aquatic biologist, obtained appropriate permits and completion of a Request for Review to Fisheries and Oceans Canada. [2014-present]

Transportation

Training and Certifications

MTO/MNR Endangered Species Act Training
Fisheries Assessment and Fisheries Contracts Specialist
Society for Freshwater Science Benthics Taxonomy course
Inspector of Sediment and Erosion Control course
Trenching and Excavation Safety OSAP certified Level 1 Fish Identification
Class 1 Electrofishing Certification-Crew Leader
Standard First Aid and CPR WHMIS
Pleasure Craft Operator License Possession and Acquisition (PAL) Licence
Ontario Hunter Education/License
Radio Telemetry Certification
Ontario Benthos Biomonitoring Network Certification
Atlantic Salmon Restoration
National Coaching Certification Level 1

City of Markham, Birchmount Bridge Crossing of the Rouge River, Markham, Ontario. As aquatic ecology field lead, provides technical oversight in the field, crew leader for aquatic field studies and completion of deliverables for the Effectiveness Monitoring Program, including aquatic habitat, benthic macroinvertebrate and fish community surveys, completed in accordance with the conditions of a permit issued under the *Endangered Species Act* for works within Redside Dace habitat. [2014-present].

City of Markham, Verclaire Gate Bridge Crossing of the Rouge River, Markham, Ontario. As aquatic ecology field lead, provides technical oversight in the field, crew leader for aquatic field studies and completion of deliverables for the Effectiveness Monitoring Program, acquisition of all associated permits. [2014-present].

Town of Whitby, Brawley Road Culvert, Whitby, Ontario. As aquatic biologist, provides permit submission to agencies (MNRF, DFO), obtaining environmental permit requirements, and obtaining permits and approvals under the *Conservation Authorities Act*, *Fisheries Act*, and *Endangered Species Act*, as required. [2014-present].

Municipality of Clarington, Lake Road Extension, Bowmanville, Ontario. As Aquatic Biologist, obtained permits and approvals from government agencies, including License to Collect Fish (MNRF). Completion of fish salvage and relocation, environmental compliance monitoring, and post-construction monitoring. [2014-present].

Toronto Port Authority, Environmental Assessment of Proposed Extension of Runway 08-26, Billy Bishop Toronto City Airport, Toronto, Ontario. As Aquatic Biologist, carried out the natural environment work plan, including fish habitat mapping in Lake Ontario, and a Natural Environment Impact Assessment and Mitigation Report. [2014].

Renewable Energy

NextEra Energy Canada, Bluewater, Goshen, Jericho and East Durham Wind Energy Centres, Numerous Municipalities, Ontario. As Aquatic Biologist for environmental monitoring services during construction, responsible for onsite environmental monitoring to ensure compliance with permit conditions and effective implementation of mitigation measures, writing of weekly compliance monitoring reports, client consultation, adherence to health and safety, quality assurance and quality control requirements. [2014-present]

Other AECOM Projects

City of Hamilton, Upper Hannon Creek Master Drainage and Servicing Study, Hamilton, Ontario. Completed aquatic habitat field assessments with a focus on confirming existing conditions and characterizing flow characteristics; morphology; riparian cover; in-stream cover; substrate; groundwater indicators, and any barriers to fish passage. [2014-present]

Niagara Parks Commission, Assessment of Geomorphic and Ecological Effects of Shoreline Docks on the Niagara River, Niagara Falls, Ontario. Collected detailed fisheries characterization information including potential fish barriers. Collected dock installation details and bank conditions to determine existing best practice guidance and potential measures for improvement.



Kalynn Parrott

Honours B.Sc.

Ecologist

Professional Qualifications

Education

Honours Bachelor of Science
Trent University
2011-2013

Diploma, Ecosystem Restoration
Fleming College
2009-2011

Years of Experience

With AECOM: 0 years
With Other Firms: 1 Year

Training and Certifications

Class II Electrofishing Certification
CPR, Standard First Aid
WHMIS
Pleasure Craft Operator's licence,
Class G Driver's License

Kalynn is a Junior Ecologist in AECOM's Water and Natural Resources Group. Owing to a long standing interest in natural resources and the environment, Kalynn graduated with honours from the Trent-Fleming Ecological Restoration B.Sc. program. Through a combination of education, work experience, volunteer work and personal interest, Kalynn offers a variety of experience and knowledge in ecological restoration, habitat assessment, fish community sampling and environmental monitoring.

PROJECT EXPERIENCE

ENVIRONMENTAL MONITORING

NextEra Wind Energy Centre, East Durham Wind Energy Centre – Environmental Monitoring during Construction (2015) –

Environmental Monitors are responsible for assisting Contractors and Project Owners in exercising environmental due diligence. This includes overseeing and co-ordinating adherence to permit conditions. Daily physical site evaluations were conducted to determine if refinements to the Sediment and Erosion Control Plan were required. Daily monitoring was also a requirement for the protection of amphibians during breeding season and also once in-water works had commenced.

NextEra Wind Energy Centre, Summerhaven Wind Energy Centre – Environmental Monitoring during Construction (2015-ongoing) –

Assisted in the long-term environmental monitoring of three nesting platforms that were implemented to provide habitat for Bald Eagles following the development of a large scale wind project.

CLASS ENVIRONMENTAL ASSESSMENTS

Henvey Inlet Wind LP, Henvey Inlet Wind Energy Centre and Transmissions Lines – Class Environmental Assessment (2015-ongoing) –

Characterized fish community composition and fish habitat to support the implementation of a wind energy centre and associated transmission lines. Conducted aquatic habitat mapping and backpack electrofishing to document resident fish communities. Assisted in the development of the Waterbodies Report for the Wind Energy Centre and the Transmission Lines.

Ministry of Transportation, Highway 427 Expansion – Class Environmental Assessment (EA) Schedule 'C' (2015-ongoing) –

Conducted assessments of fish habitat conditions to document existing conditions in the assessment of highway expansion activities at multiple crossings.

ECOLOGICAL RESTORATION AND REGULATORY PERMITTING

Region of Durham, Bloor St. East Watermain Replacement – DFO Self-Assessment and Conceptual Restoration Markups (2015-ongoing)

Assisted the Senior Ecologist in the creation of a landscape restoration plan for the riparian and in-stream habitat of the Oshawa Creek in the post construction phase of the Bloor St. East Feedermain installation.



**Municipality of Clarington, Lake Road Extension – Technical Memo
Preparation (2015-ongoing)**

Prepared a Technical Memo summarizing the extent of the aquatic works to date performed by AECOM as it related to the larger study area surrounding Bennett Creek. Compiled a comprehensive photo log, and prepared a detailed Species at Risk screening.

Professional History**AECOM**

(formerly Earth Tech)
(formerly Proctor & Redfern)

Senior Environmental Technician
Hamilton
1997 – Present

MDA Consulting
1995 - 1996

Academic Training

Diploma, Environmental
Engineering Technology
Fleming College
1994

Summary

Mr. Munro is a Senior Environmental Technician with more than 18 years of experience working on a variety of projects involving environmental site investigation and remediation, and solid waste management design, construction and monitoring. He has a broad range of experience with Phase II ESAs and site remediation, focusing on groundwater, surface water, soil and sediment assessment & remediation. Mr. Munro is practised at sampling and monitoring techniques for varied environmental contaminants. His experience also extends to DPE & SVE treatment systems operation and maintenance.

Mr. Munro has carried out field review, coordination, and contract administration for a number of environmental remediation, waste management site development, and civil engineering projects. Typical projects have included construction of landfill cells, liner, capping, and related infrastructure, and impacted soils excavation and groundwater remediation. He is accustomed to working on larger projects with several contributors; including contractors, clients, and other AECOM team members to achieve project goals.

Mr. Munro experience also includes detailed engineering design and construction for solid waste management site development and operations. He uses his technical expertise in CADD design to contribute to various projects, including landfill site design components, construction and operations, groundwater and contaminant assessment, and environmental remediation design. Mr. Munro uses his CADD experience in conjunction with his knowledge of surveying to conduct structural assessments, provide construction layout, quantity and density calculations, and topographic information for a variety of environmental, civil, and land development projects.

Selected Experience**FCA – Windsor Assembly Plant, Windsor, Ontario.**

Soil characterization and environmental review of planned excavation areas throughout the approximately 50 hectare facility, prior to 14 week shutdown for \$2 billion construction and re-tooling project. Conducted pre-construction soil assessments throughout the plant, and provided on-site environmental assessment of active excavations during construction to ensure appropriate handling and disposal of impacted soils. Prepared field summaries and final report detailing findings, soils quantities and management.

Provided oversight and coordination of soil and sediment characterization at wastewater treatment facility. Carried out borehole drilling, monitoring well installation, and sediment sampling for assessment of retention pond liner and waste sediments. Groundwater sampling was completed to assess for potential migration of sediment wastes from the retention pond.

Newalta, Stoney Creek Landfill Site, Hamilton, Ontario.

Lead inspector responsible for overseeing several phases of landfill site development. Completed cell construction, including recompacted clay and geomembrane liner, leachate collection system, and related components, final capping and storm water management system construction. Responsible for contract administration and review of all construction design and components, including testing and sampling of construction materials, review of completed



items and grades, and tracking of materials and quantities, as per specifications. Conducted in-situ hydraulic conductivity testing, collected material and soil samples for off-site laboratory testing, and verified quantities and grades through surveys. Conduct annual topographic and grade surveys for site development and air space calculations.

FCA – Brampton Assembly Plant, Brampton, Ontario.

Assessment, delineation and remediation of diesel fuel release related to 45,000 litre above ground storage tank. Conducted soil borings and groundwater sampling to assess subsurface conditions and determine remedial actions. Provided oversight of remedial excavation of impacted soils, directed contractor activities, and prepared final report to meet TSSA requirements.

Waterloo Light Rail Transit, Kitchener-Waterloo, Ontario.

Environmental assessment of soil conditions along proposed route of the transit system connecting cities of Cambridge, Kitchener, and Waterloo. Worked with geotechnical consultants to obtain and review soil samples at numerous locations within the project area. Samples were evaluated and tested on site, for physical, environmental and corrosivity parameters, and were submitted routinely for laboratory analysis. Maintained summary of field testing and observations, and reviewed analytical data.

Disco Road Transfer Station SSO, City of Toronto.

Responsible for on-site environmental management and field review of waste soils excavation and transportation, for construction for City of Toronto Source Separated Organic Material Processing Facility. Waste soils were excavated and transferred to a landfill site prior to installing tube piles and foundations for the new facility. Conducted environmental monitoring (air, noise and odour) and inspections of daily site operations during the excavation of approximately 96,600 tonnes of waste materials, in effort to minimize potential environmental impacts. Inspected and confirmed that all environmental mitigation controls were in place and being maintained throughout the project. A waste soils investigation and characterization was conducted prior to construction/excavation phase to determine appropriate handling and disposal measures.

Confidential Client, Former Tire Manufacturing Facility, Kitchener, Ontario.

Provided field direction and supervision of contractor activities related to soil remediation works, and technical assistance during on-site groundwater monitoring and remedial activities at a large former tire manufacturing facility. The groundwater monitoring program involved the collection of groundwater samples, using low flow sampling techniques, from observation wells that were installed across the property. The cleanup involved excavating and stockpiling soils that were impacted with carbon black. Stockpiles were screened to separate the impacted soil fines from the larger non-impacted coarser materials. Responsible for the collection and submission of the verification and confirmation soil samples from the areas of excavation and screened materials. Conducted several site surveys to confirm excavation quantities and depths.

Magnetic Metals Ltd., Site Remediation, Brantford, Ontario.

Conducted Phase II environmental investigation and directed remediation activities for industrial property with petroleum hydrocarbon and VOC impacted soils. Phase II work involved monitoring well installation, soil and groundwater sampling, and contaminant delineation and assessment. Following completion of Phase II, prepared tender package and contract documents, and evaluated remediation contractors prior to award of contract. Helical piers were installed to support the building during the remediation phase to allow for excavation of impacted soils around the footings. Water management was required throughout, due to shallow groundwater conditions. Once excavation was completed, collected verification samples, reviewed analytical data and prepared final report.

Loblaws, College Square Site Remediation and DPE Plants, Ottawa, Ontario.

On-site management and maintenance of 2 dual phase extraction systems used for groundwater remediation of chlorinated solvents and hydrocarbon impacts at former dry-cleaning and gas station locations. Conducted system maintenance, troubleshooting, and seasonal/quarterly groundwater sampling and system monitoring in support of remediation. Reviewed analytical data and prepared detailed drawings of contaminant plumes and groundwater surfaces.

Confidential Client, Phase II Environmental Investigation, London, Ontario.

Coordinated field investigation of former paint manufacturing facility, including borehole & monitoring well installation, soil sampling and logging, and groundwater sampling and assessment. Directed contractor activities related to removal of oil/water separator, and conducted verification sampling of excavation. Prepared drawings, reviewed analytical data, and report preparation.



Hamilton Port Authority, Sherman Inlet, Pier 15, Hamilton, Ontario.

Conducted phase II ESA of an industrial property and adjacent storm water channel discharging to Hamilton harbour. Monitoring program entailed collection of air, soil, sediment, surface water and groundwater samples to evaluate site conditions. A site survey was conducted, based on IGLD 1985 datum, and detailed site plans were created as part of the final report, based on the survey, analytical results, and inferred groundwater conditions

Hamilton Port Authority, Hamilton Harbour Mapping and Dredging, Hamilton, Ontario.

Conducted soundings and bathymetric survey of shipping areas of the harbour for dredging and maintenance. Prepared design drawings and excavation quantities for contract preparation.

Sydney Tar Ponds Agency, Tar Ponds Remedial Pre-design, Sydney, Nova Scotia.

Contributed to pre-design and drawings for large scale remedial plan for a PAH, petroleum hydrocarbon and metal contaminated site formerly operated as a steel manufacturing facility. Calculated quantities, and reviewed surveyed data.

Confidential Client, Sheet Pile Construction, Toronto, Ontario.

Provided design and CADD support for planning of sheet pile barrier construction. Calculated quantities and layout based on site and groundwater conditions.

Glanbrook Landfill Site, City of Hamilton.

Provided operations support including density and consumed air space calculations, final contour layout, and miscellaneous surveying. Provided engineering services including CADD design and surveying related to final contour layout, site plan revision, and available capacity calculations and stormwater pond construction.

City of Hamilton, John Street, Hamilton, Ontario.

Provided on-site direction and coordination of remedial excavation of hydrocarbon impacted soils at a former industrial property. Responsible for soil and verification sampling, analytical review, site survey and quantity verification, and final report preparation.

Region of Waterloo, South Cambridge Pumping Station, Cambridge, Ontario.

Supervised contractor activities and conducted verification sampling related to removal and disposal of underground diesel fuel storage tank. Prepared site plans and excavation and sampling details.

City of Greater Sudbury, Environmental Remediation of Junction Creek, Sudbury, Ontario.

Provided environmental technical support, including drawing preparation and quantity calculation for the environmental monitoring plan for the Junction Creek environmental cleanup. This project involved the removal of aromatic hydrocarbons (PAH) impacted sediments and soils from a stormwater drainage channel and the bed of Junction Creek.

Confidential Client, Phase II ESA and Data Gap Investigation, Welland, Ontario.

Conducted a Phase II ESA and data gap investigation of a former industrial property located along the Welland Canal to support the redevelopment of the brownfield site into a residential/commercial mixed use property. Investigation involved low-flow groundwater sampling, site survey and layout, and review of analytical data. Prepared drawings including site plans, and groundwater and contaminant modeling.

Ontario Realty Corporation, 3 Sites, Sudbury Region, Ontario.

Organized and conducted a multi-site Phase II ESA project of 3 ORC sites, including monitoring well installation, soil sampling and logging, groundwater sampling, site surveys, and CADD drawing and report preparation.

Confidential Client, Hamilton, Ontario.

Coordinated and implemented field investigation component for a detailed Phase II ESA of two metal scrap yard properties for a proposed sale and potential redevelopment. Field program included borehole & monitoring well installation, soil and groundwater sampling, and test pitting. Reviewed analytical data, prepared drawings of groundwater flow and impact assessment.

Confidential Client, Caledonia, Ontario.

Conducted Phase II investigation, delineation and soil remediation of PHC impacted site, for sale and redevelopment of commercial property.

Region of Peel, Lakeview and Clarkson WWTPs, Mississauga, Ontario.

Conducted hazardous materials and designated substances survey at Lakeview water treatment plant and Clarkson wastewater treatment plant prior to construction and demolition activities related to plant expansions.



Georgia-Pacific Canada Inc., Gypsum Mine, Caledonia, Ontario.

Coordinated and conducted long term assessment of groundwater influence related to mine dewatering activities. Carried out ground water and surface water monitoring programs, and reporting in accordance with client's Permit to Take Water, Certificate of Approval, and MISA requirements.

StelPipe Manufacturing Facility, Welland, Ontario.

Conducted groundwater monitoring and cone of depression assessment program at an industrial site, in support of in-situ PCB groundwater remediation system.

Amcan Castings Ltd., Hamilton, Ontario.

Contributed to Phase II environmental site assessment of a Brownfield site, including supervision of drilling contractor, soil sampling, site survey, and site plan and impact drawing preparation.

Air Liquide Canada Inc., Hamilton, Ontario.

Successfully prepared report in support of clients' application for delisting from city's wastewater abatement program. Reviewed and compiled water usage data provided. Coordinated and carried out sewer sampling and analysis program in support of the application.

City of Hamilton, Storm Sewer Investigation, Hamilton, Ontario.

Conducted a large scale storm sewer sampling program to determine and delineate the extent of storm sewer and sanitary sewer cross connections throughout the city.

CBS-Viacom, Hamilton, Ontario.

Conducted PCB contaminated flooring material investigation, delineation, and provided support for the remediation phase.

O.P.G./Hydro One, Nanticoke, Ontario.

Organized and implemented effluent monitoring program to determine effectiveness of current system, and compliance with provincial and federal regulations.

Mark IV Industries Inc., Mississauga, Ontario.

Conducted groundwater investigation and remediation of an auto parts manufacturing plant.

Surveying

Mr. Munro has managed and conducted numerous engineering surveys for waste management, environmental investigation and remediation, and municipal/civil projects including topographic surveys, structural monitoring, pre-design detail surveys, volumetric surveys, and construction layout, using total station and GPS surveying technology.

Port Dalhousie Pier Structural Analysis, Public Works & Government Services Canada, Port Dalhousie, Ontario.

Completed detailed structural survey of piers, totaling approximately 1.5 kilometers in length, in conjunction with engineering inspection and assessment of marine works. Prepared plan and profile drawings and cross sections based on the surveyed information and assessment results.

Garden Ave Bridge Monitoring, Brantford, Ontario .

Conducted structural monitoring of bridge structure for potential movement/settlement through repeated surveys of established surface and control points.

Clarkson Wastewater Treatment Plant, Clarkson, Ontario.

Coordinated and conducted detailed topographic survey of 36 Ha. WWTP site. Completed multiple site surveys for design, construction layout and as-constructed purposes related to several expansions of the plant.

Duffin Creek Wastewater Treatment Plant, Pickering, Ontario.

Conducted field verification of contractor layout and grades related to expansion of the plant.

Woodward Wastewater Treatment Plant, Hamilton, Ontario.

Conducted numerous topographic site surveys for design, construction, and as-built purposes.

City of Hamilton, Dundas closed landfill gas venting system, Dundas, Ontario.

Conducted detailed pre-design survey, field review, and effectiveness testing for the construction and start up of a landfill gas venting system.



CSX Transportation, New York State.

Conducted pre-design survey, prepared design drawings, and provided construction inspection services for stormwater/wastewater collection and treatment system improvements.

Niagara Road 12 Landfill Site, Region of Niagara.

Conducted pre-design survey, prepared design drawings, and provided construction inspection services for new cell construction.

Newalta Stoney Creek Landfill, Hamilton, Ontario.

Confirmed contractor control and layout during construction. Coordinate and conduct annual topographic surveys for reporting and waste filling operations. Calculate consumed airspace, prepare grading plans, and provide grading layout. Carried out pre-design survey, prepared design drawings, and provided field inspection services for a leachate force main construction project.

Jessica Mendoza

Honours B.E.S., M.Sc. Candidate

Junior Ecologist

Education

Master of Science Candidate
University of Waterloo
2012-Present

Honours Bachelor of
Environmental Studies (CO-OP)
Diploma in Ecological Restoration and
Rehabilitation
University of Waterloo
2007 – 2012

Years of Experience

With AECOM: <1 year
With Other Firms: 0

Training and Certifications

Canadian Aquatic Biomonitoring Network
(CABIN) Project Manager
Ontario Benthic Biomonitoring Network
(OBBN)
Ontario Stream Assessment Protocol
(OSAP)
Electrofishing Certification Level 2
Backpack Crew Leader and Boat-
Electrofishing Certification
Small Vessel Operator Proficiency
(SVOP) and Small Non-Pleasure
Vessel Basic Safety (MED A3)
Canadian Pleasure Craft Operator
Ontario Freshwater Fish Identification and
Minnow Identification by the Royal
Ontario Museum
Standard First Aid and CPR- C
Advanced Wilderness Remote First Aid
Swiftwater / Flood Rescue Technician
Level 2
Member Society For Environmental

Jessica is a Junior Aquatic Ecologist on AECOM's Water & Natural Resources Team of the Midwest Environment Business Line and is based in the Guelph, Ontario office. She graduated with an Honours Bachelor of Environmental Studies degree from the University of Waterloo and is completing her Masters of Science in Biology. Her Masters work entailed monitoring population effects of white sucker and has also contributed to her knowledge of benthic invertebrates and their identification to the order and family levels. Her previous work has been characterized by quantifying anthropogenic impacts on the natural environment by means of a variety of techniques. Through a combination of education, training, and work experience, Jessica has developed a speciality in aquatic biology and toxicology to become a qualified candidate to be used in aquatic habitat assessments and environmental effects monitoring, environmental assessments, baseline studies, and ecological restoration.

Project Experience

Aquatic Habitat Assessments

Henvey Inlet Wind Energy Centre and Transmission Lines (2015)

Completed aquatic investigations to characterize fish community composition and fish habitat to assess potential effects of road and transmission line crossings. Backpack electrofishing and hoop netting was conducted to document resident fish communities.

Highway 427 Extension (2015)

Completed aquatic investigations along Highway 427 to characterize fish habitat and assessment of highway expansion activities.

Previous Experience

Laboratory and Field Technician (2012)

University of Waterloo, Waterloo, Ontario

Conducted monthly fish sampling using a variety of techniques to determine estrogenic effects of waste water treatment effluent on native fish species.

Teaching Assistant (2011-2014)

University of Waterloo, Waterloo, Ontario

Taught 3rd year level undergraduate laboratories in animal dissection for physiology and ecology classes.

Research Assistant/Field and Lab Technician (2009, 2010)

Environment Canada, Centre for Inland Waters, Burlington, Ontario

Regularly conducted water quality monitoring in Lake Ontario, Hamilton Harbour,



Toxicology and Chemistry, Trout
Unlimited Canada

Lake Simcoe and Georgian Bay to determine anthropogenic causes of algal blooms.

Research Assistant (2009)

Alberta Research Council/University of Victoria, Victoria, British Columbia

Provided research support to hydrogeologists using stable isotopes to trace groundwater movement impacted by oil mining in northern Alberta.

Joseph M. de Laronde

Senior Ecologist and Aboriginal Specialist

Professional Qualifications

Education

Bachelor of Science in Fisheries
Biology, University of Northern British
Columbia, 1997

Bachelor of Science in Wildlife Biology
University of Northern British
Columbia, 1997

Associate of Arts Degree, Northern
Lights College, 1989

Training and Certifications

Numerous courses, training and
conferences regarding Aboriginal
Law, Relationships,
Engagement, Consultation,
Negotiation and Accommodation

Basic and Advanced Negotiation
Skills Development

Advanced Leadership and Mentoring

Conflict Management and Resolution

Various Ontario provincial policy
development

Various DFO training including habitat
components, CEAA and SARA

Health and Safety

Mr. de Laronde has an Associate of Arts degree and holds two Bachelor of Science degrees; one in Fisheries Biology, the other in Wildlife Biology with majors in aquatic and terrestrial ecology from the University of Northern British Columbia. Joseph has extensive natural resource-based experience in a wide variety of fish, wildlife and habitat protection oriented positions including resource inventories and restorations.

Joseph has extensive experience as a fish and wildlife biologist and has exceptional experience in engagement, relationship-forming, consultation, negotiation and accommodation with First Nations and Metis communities as well.

Experience

Since joining the AECOM team in January 2015, Joseph has been involved in numerous projects of various scales including aquatics, ecological and aboriginal consultation. Most notable, Joseph is the aquatics lead on the Billy Bishop Toronto City Airport Expansion project and the Port of Algoma project in Sault Ste. Marie.

Ontario Ministry of Environment and Climate Change – Aboriginal Affairs Branch

Senior Advisor – Outreach and Program Support; Regional Advisor – West Central, Central and Eastern Regions; Aboriginal Technical (Dams/Mining Support) – North September 2013 to January 2015

Ontario Ministry of Transportation – Aboriginal Relations Branch

Aboriginal Liaison Officer – West, Central and Eastern Regions, MTO Negotiation Team September 2012 – September 2013

Ontario MOECC/Environmental Assessment, Access and Service Integration Branch

Aboriginal Specialist/Aboriginal Relations Coordinator July 2009-August 2012

Ontario Ministry of Environment/Aboriginal Affairs Branch

Senior Advisor July 2009 – August 2012

Department of Fisheries and Oceans Canada

Acting District Manager/Acting Senior Biologist/Fish Habitat Biologist
2002-July 2009



Upper Thames River Conservation Authority

Stream Health Monitoring Technician/ Fish and Wildlife Biologist

2001-2002

de Laronde Environmental Consulting (dEC) Services

Owner/Contractor

Fish and Wildlife Biologist/Ecologist

1995-2001

Various projects including:

- Fish Habitat Impact Assessment Biologist; Sombot Consulting, May 2001
- Cat fall (machinery) impact assessment on Prophet River
- Modeling Ecologist; Lynx Consulting/CANFOR Products, January 2001 – June 2001
- Develop Access Management Framework Model
- Wildlife Biologist; BC MOE-Wildlife Dept., January 1999 - February 1999
- Wood bison transplant project
- Fisheries Biologist; BC MOE-Fisheries Dept./BC Conservation Foundation, 1997-1999
- Tabor Lake fisheries assessment including construction of fish passage
- Fish Inventory Biologist/QA Biologist; BC MOE/Forest Renewal BC, 1997-1999
- Fish/Fish habitat inventories; Quality Assurance of all FRBC inventories in BC
- Wetland Ecologist; BC MOE-Fisheries Dept./BC Conservation Foundation, 1997-1999
- Fish/wildlife wetland inventories, wetland design, led wetland restoration project
- Fisheries Biologist; BC MOE-Fisheries Dept./BC Conservation Foundation, 1996-1998
- Fisheries assessment of northern rivers; bull trout/grayling telemetry studies
- Wildlife Biologist; BC MOE-Fisheries Dept./BC Forestry, August 1998
- Forestry blocks post-timber harvest wildlife assessments
- Fisheries Biologist; BC MOE-Fisheries Department, 1998
- bull trout studies/sub-population analysis/genetic tissue collection
- Wildlife Biologist; BC MOE-Wildlife Dept./BCCF, Dec 1997 - April 1998
- Moose, elk, mule deer population estimates; select blocks in NE BC
- Fisheries Biologist; University of Northern BC, 1996-1997
- Riparian studies/Nechako River; "Jumbo" Pygmy Whitefish genetic studies
- Wildlife Technician; BC Ministry of Environment-Wildlife Dept., 1996-1997
- Conducting necropsies on moose, deer, elk, grizzlies, cougars for life history analysis
- Wildlife Technician; BC MOE-Wildlife Dept., Spring 1996 and Spring 1997
- Mule deer life history analysis via net trapping
- Fisheries Technician; BC MOE-Fisheries Dept./BC Conservation Foundation, 1996
- Bull trout habitat analysis, morphometric data collection for LDFs
- Fisheries Technician; BC MOE-Fisheries Dept./BC Conservation Foundation, 1996
- Brook trout escapement assessment; brook-bull trout hybridization assessments
- Fisheries Technician; BC MOE-Fisheries Dept./BC Conservation Foundation, 1995-1996
- Design and construct artificial spawning channel for rainbow and brook trout
- Fisheries Technician; Peace-Williston Lake Compensation Project, 1995
- Fish and fish habitat assessments, Carbon Creek watersheds
- Fisheries Technician; Peace-Williston Lake Compensation Project, 1995
- Fish and fish habitat assessments, various Peace River watersheds
- Fisheries Technician; BC MOE-Fisheries Dept., UNBC, Tabor Lake Commission, 1995
- Impact assessment/habitat utilization of rainbow trout on Tabor Lake/Skaret Cr.



Nick Hodges Senior Ecologist

Professional History

AECOM
Senior Ecologist
2008 – Present

Gartner Lee Limited
Ecologist
2005-2008

EcoTec Environmental Consultants Inc
Resource Technician & Environmental
Inspector
2001 – 2005

EcoTec Construction Limited
Ecological Restoration Technician
2001 – 2005

U.S. Fish & Wildlife Service
Research Assistant, Mojave Desert
1999

Education

Fish & Wildlife Technician Diploma
(Letter of Academic Achievement)
Sir Sandford Fleming College
Lindsay, ON
2000

Terrain & Water Technician Diploma
(Letter of Academic Achievement)
Sir Sandford Fleming College
Lindsay, ON
1999

Years of Experience

With AECOM: 6
With Other Firms: 7

Professional Affiliations

Field Botanists of Ontario
Society for Ecological Restoration

Training & Certifications

Class 1 Electrofishing Certification, 2010
Temperate Wetland Restoration, 2008

Nick Hodges is a Senior Ecologist with over thirteen years of consulting experience with expertise in fisheries and aquatic habitat assessment, environmental impact studies, ecological restoration and regulatory approvals. Applying his expertise in fisheries and aquatic habitat assessments for municipal and provincial clients, Nick has obtained Fisheries Act authorizations by developing fish habitat compensation plans and has overseen implementation of fish habitat improvement projects throughout his career. He is trained in the application of DFO's Risk Management Framework for assessing impacts to fish habitat. He has helped facilitate regulatory approvals under the Fisheries Act, Conservation Authorities Act, Endangered Species Act, Planning Act, Ontario Environmental Assessment Act and the Canadian Environmental Assessment Act. Nick has obtained MTO/DFO/OMNR Fisheries Protocol training (2006) and is RAQS-certified as a Fisheries Assessment Specialist (2003) and Fisheries Contracts Specialist (2003). He has completed Royal Ontario Museum Fish Identification (SAR) workshops and holds a Class 1 Electrofishing certification (2010). Nick works closely with hydraulic engineers and fluvial geomorphologists to prepare integrated environmental designs for culverts, fish passage, natural channel design and fish habitat enhancement. Nick has participated in over 100 Class EA /Detail Design / Construction Monitoring projects.

Select Experience

Fisheries Act Approvals

Lake Erie (Leamington) Breakwater Assessment, MTO (2013-2014)
Coordinated field data collection and reporting for fisheries assessment of the Leamington Breakwater to assess options for reconstruction or removal. Fisheries assessment consisted of diver-assisted video documentation and sediment sampling with dredge-type sampler.

Humber River Rail Bridge Widening, GO Transit (2012-2014)
Prepared *Fisheries Act* amendment and liaised with TRCA to facilitate in-water construction in Humber River. Represented GO Transit at agency meetings.

Port Granby Long-Term Waste Management Facility (Elliott Road Widening & Culvert Extensions), Public Works and Government Services Canada (2012-2013)
Conducted detailed aquatic habitat assessment and prepared fish habitat compensation plan. Obtained *Fisheries Act* HADD authorization and *Conservation Authorities Act* permit.

Hays Pond Modifications, Oakville (2011)
Prepared aquatic habitat enhancement plan and regulatory submission for approval of fish habitat modifications under *Fisheries Act* (Letter of Advice) and *Conservation Authorities Act*.

Lakeshore Water Treatment Plant Expansion, Town of Innisfil (2010)
Conducted nearshore/lakebed fisheries assessments and stream assessment for water intake pipe and facility construction in Cooks Bay, Lake Simcoe. Conducted seine netting, electrofishing, and diver-



Fish Species-at-Risk Identification
Workshop - Royal Ontario Museum, 2007

Introduction to Project Management
Effectivation 2007

MTO/DFO/OMNR Fisheries Protocol,
2006

Canadian Pleasure Craft Operator, 2006

Ecological Land Classification for
Southern Ontario, 2005

Electrofishing Crew Leader (2nd Class
backpack certification), 2007, 2001

RAQS certification: Fisheries Assessment
Specialist, 2003

RAQS certification: Fisheries Contracts
Specialist, 2003

Fish Identification Workshop - Royal
Ontario Museum, 2001

WHMIS Training

First Aid and CPR Training

Fall Protection Training

assisted video documentation of lakebed fish habitat.

Fisheries Existing Conditions and Impact Assessment for Whitman Dam
Road Embankment Repairs, MTO (2010)
Conducted an impact assessment to sensitive fish habitat in the
Goulais River and recommended fish and fish habitat mitigation
measures. Applied DFO Risk Management Framework, Pathways of
Effect and prepared HADD/no HADD forms.

Marina Conceptual Development and Fisheries Act Review, Port Severn
(2005-2007)
Conducted multi-season fisheries inventory using trap nets and fyke
nets. Conducted muskellunge spawning habitat assessment. Assessed
significance and sensitivity of fish habitat, impact assessment and
developed mitigation measures. Reviewed Fisheries Act regulations
and provided assessment of opportunities for marina development
adjacent to Provincially Significant Wetland.

Sunnybrook Sub-trunk Sewer Construction, City of Toronto (2005-2007)
Conducted fisheries and aquatic habitat assessment and subsequently
developed an open-cut stream crossing mitigation plan and
streambank restoration plan. Developed a frac-out contingency plan
for directional drilling operations. Assisted in obtaining regulatory
approvals for above noted works.

Blueshores Marina Development, Collingwood (2005-2006)
Obtained an amendment to a Fisheries Act HADD authorization for in-
water works in a Georgian Bay marina. Provided client and contractor
with advice on Fisheries Act regulations.

DFO Compliance Monitoring, City of Guelph (2005 – 2009)
Project manager for a multi-year pond monitoring study resulting in
management recommendations for improvements to water quality,
mitigation of nuisance wildlife and suitability of fish stocking.
Conducted fish community and habitat assessments and related water
quality results to inform management recommendations.

Detail Design for Highway 11/502, GWP 407-00-00, MTO, Fort Frances
(2004)
Conducted fisheries and aquatic habitat assessments for multiple
watercourse crossings, developed a fish habitat compensation and
post-construction monitoring plan, and obtained Fisheries Act HADD
authorization for works to proceed in accordance with DFO policies on
fish habitat.

Transportation Class EA

Detailed Design for Highway 11 Four Structures, Gravenhurst, MTO (2014)

Preliminary Design for Highway 17 Bonfield, MTO (2013-2014)

Emergency Culvert Shoring Works (DFO submissions), Northeast Region, MTO (2013-2014)

Detailed Design for Highway 401 Widening, Hurontario Street, MTO (2011-2013)

Conducted fisheries assessment and prepared associated EA documentation as per MTO/DFO/MNR protocol.

Detailed Design for Highway 401 Culvert Rehabilitation, Cobourg, MTO (2011-2013)

Detailed Design for Highway 11 New Interchange, Powassan, MTO (2012-2013)

Highway 60 Culvert 43-146C Fisheries Assessment, Whitney, MTO (2012)

Conducted fisheries and natural science (terrestrial) assessment to support No-HADD determination for culvert shoring works.

- **Preliminary Design for Highway 8, Stratford, MTO (2007)**

Participated in collection of aquatic ecosystem and amphibian data to support EA.



- **Planning Study and Preliminary Design for Highway 401 from Brock Road to Courtice Road, WP 242-86-00, MTO (2004-2005)**

Assisted with preparation of Class EA documentation for highway improvements.

- **Preliminary & Detail Design for Highway 11/502, GWP 407-00-00, Fort Frances, MTO (2001-2004)**

Conducted all phases of Class EA process, including agency consultation, for preliminary and detail design.

- **Detailed Design for Highway 11/17, GWP 524-00-00, Thunder Bay, MTO (2004)**

Conducted all phases of Class EA process, including agency consultation, for preliminary and detail design.

Preliminary Design for Reconstruction of Ravenshoe Road from Prout Road to Lakeridge Road, Region of York (2001-2002)

Conducted natural science field inventories to support preliminary design for highway improvements. Conducted literature search for highway wildlife collision mitigation options.

Renewable Energy

- **NextEra Energy Canada, Bluewater, Goshen and Jericho Wind Energy Centres, Numerous Municipalities, Ontario (2011-2014)**

Senior reviewer for Waterbodies Assessment on multiple project sites in accordance with the requirements of the Renewable Energy Approval (REA) process under the Environmental Protection Act.

Fisheries and Aquatic Habitat Inventory, Assessment and Monitoring

Fish Habitat Assessment of the Grand River, Town of Elora (2006)

Characterized fish habitat in Elora Gorge reach of Grand River to support an Assimilative Capacity Study.

Brook Trout Spawning Survey, Fisheries and Aquatic Habitat Assessment for Blue Springs Creek, City of Guelph (2006)

Conducted fall spawning surveys to identify brook trout redds, and conducted fish community sampling and aquatic habitat mapping to support a Class EA for municipal groundwater taking.

Marine Water Intake Pipeline, City of Barrie (2005)

Assisted in development of mitigation measures for 700 m length open-cut marine trench to accommodate raw water intake pipeline in Kempenfelt Bay, Lake Simcoe.

Lake Assessment Study, City of Brampton (2005)

Conducted trap netting and seine netting of multiple lakes in City of Brampton to support Lake Management Study.

Brook Trout Monitoring Survey, Town of Caledon (2005)

Conducted electrofishing of brook trout habitat using three-pass removal method to facilitate population estimation in support of OWRA permit monitoring.

Fisheries and Aquatic Habitat Assessment for Corbyville Creek, MTO (2002-2004)

Characterized fish community composition and aquatic habitat to support highway reconstruction activities.

Fisheries Assessment and Compensation Planning, Ravenshoe Road, Town of Georgina (2003)

Assisted in development of fish habitat compensation planning for road widening in PSW.

Fisheries and Aquatic Habitat Assessment for Highway 6, MTO (2003)

Characterized fish community composition and aquatic habitat to support highway reconstruction activities.

Fisheries and Aquatic Habitat Assessment for Highway 118, MTO (2003)

Characterized fish community composition and aquatic habitat to support highway reconstruction activities.

Lake Sturgeon Spawning Assessment for Petrie Island, Ottawa River, City of Ottawa (2003)

Implemented larval sampling program for Lake Sturgeon in Ottawa River.

Long Term Monitoring of Highway 417 Mississippi River Fish Habitat Compensation, MTO (2002-2003)

Conducted trap netting and electrofishing to monitor effectiveness of fish habitat compensation measures on Mississippi River.

Fish Residency and Shoreline Aquatic Habitat Assessment for Morton Bay, Whitefish Lake, Parks Canada, Rideau Canal Office (2002)

Assisted with snorkelling surveys and centrarchid nest mapping for Whitefish Lake on behalf of Parks Canada.



Ecological Restoration

- **Whitby East Rail Maintenance Facility, GO Transit (2013)**
Designed a hemi-marsh wetland in Pringle Creek watershed as part of a Fish Habitat Compensation plan authorized under the *Fisheries Act*.
- **Credit River Bridge Re-construction, CN Rail, Georgetown (2012)**
Developed ecological restoration plan for Credit River erosion protection plan including fish habitat restoration and riparian landscape plan for *Conservation Authorities Act* permitting with Credit Valley Conservation.
- **Windermere Basin Fish Habitat Restoration, City of Hamilton (2008)**
Identified a suite of sentinel fish species to form the basis of a fish habitat compensation plan to provide enhanced aquatic habitat as part of Hamilton Harbour remediation activities.
- **Walpole Island First Nation (2008)**
Conducted Phase 1 of a feasibility study, including sediment and water sampling, in order to commence a strategy to restore 14 linear kilometers of fish habitat.

Fish Habitat Compensation Works – Rootwad Installation, Iron Bridge, Ministry of Transportation (2003)

Installed rootwads on Mississauga River and aquatic vegetation renewal in back bay habitat.

Carruthers Creek Channel Realignment and Landscaping, Ajax, Ministry of Transportation (2003)

Supervised construction of natural channel design for Carruthers Creek realignment.

Trout Creek Fisheries Compensation Implementation, MTO (2001)

Constructed and installed LUNKERS and rootwads for creation of fish refuge habitat and shoreline stabilization on Trout Creek as part of fish habitat compensation.

Environmental Impact Studies, Feasibility Studies

Environmental Baseline Survey, Henvey Inlet First Nation (2012)

Conducted baseline ecological surveys and Species At Risk screening for proposed rock quarry.

Feasibility Study for Gas Main Crossing of Grand River, Ohsweken (2011-2013)

Provided advice on various crossing techniques for gas main pipeline and their resultant level of regulatory approvals and permitting with DFO and GRCA.

Impact Assessment to Grand River Fish Habitat from the Proposed Elora WWTP Expansion, Elora (2010)

Assessed potential impacts of revised effluent criteria to Grand River fish habitat. Reviewed potential impacts of proposed changes in water quality as they relate to brown trout spawning habitat.

Hayes Bridge Replacement EIS, Municipality of Trent Hills (2008)

Conducted fish habitat assessment of Hoards Creek tributary to document existing conditions and identify potential impacts to an adjacent Provincially Significant Wetland as a result of a proposed bridge replacement.

EIS to support Replacement of Bridge Structure on Speed River Tributary (2006)

Conducted assessment of terrestrial ecosystems and developed mitigation measures for proposed bridge replacement.



Dan McParland, M.Sc., G.I.T. Fluvial Geomorphologist

Education

M.Sc. (Fluvial Geomorphology),
University of British Columbia,
Canada (2013)

B.Sc. (Honours Specialist,
Physical Geography), Queen's
University, Canada (2011)

Years of Experience

With AECOM: 2

With Other Firms: 0

Professional and other Affiliations

Association of Professional
Geoscientists of Ontario

Canadian Geophysical Union

Canadian Geomorphology
Research Group

Registrations

Geoscientist-in-Training, Ontario

Training

Natural Channel Design,
Canadian Rivers Institute

WHMIS

First-Aid

Working Around Water Safety

Dan McParland is a fluvial geomorphologist with experience in applying the science to watercourses throughout Canada. He has completed analyses at a range of spatial scales from watershed to reach level and is skilled in both field work and desktop analyses. Mr. McParland was mentored by three of Canada's most prominent fluvial geomorphologists, Drs. Brett Eaton, Mike Church, and Marwan Hassan, at the University of British Columbia. His masters' thesis examined the linkages between the physical sciences (hydrology and geomorphology) and aquatic ecology. Mr. McParland has experience in meander belt and 100 year erosion analyses, erosion assessments and inventories, aquatic habitat assessments, hydrodynamic and morphodynamic modelling, natural channel design, and designing erosion structures and water crossings from a geomorphic perspective.

Project Experience

The Gore Road Widening EA, Region of Peel: Brampton, Ontario.

Geomorphologist responsible for documenting existing morphological conditions along Wylie's Creek with particular emphasis on channel form and function at three road crossings. As well, I conducted a meander belt and 100 year erosion assessment.

Queensway/Hurontario Sanitary Sewer EA, Region of Peel: Mississauga, Ontario.

Geomorphologist responsible for field investigation and desktop analyses of channel migration near a proposed 1350 mm sanitary sewer. Geomorphic investigation of existing and historic channel processes was conducted to predict possible channel lateral and vertical movement.

Queen Street Widening, Region of Peel: Brampton, Ontario.

Worked alongside the senior geomorphologist on the natural channel design of five new crossings. The design included specifying bed morphology, bank protection, and stone sizing as well as determining fish passage through the crossings.

Erosion Assessment and Implementation Plan, The Corporation of the Town of Markham: Markham, Ontario.

Geomorphologist responsible for conducting a city-wide assessment of channel conditions and background investigation to define context (e.g., profile, geology, land use history, etc.). Walked all the channels within the study area to identify erosion sites, fish barriers, and bank protection failure. Helped to develop a priority ranking scheme to identify a Top 30 list of restoration sites.

SW Georgetown Subwatershed Study, Halton Region: Halton, Ontario.

Worked alongside the other members of the geomorphology team to characterize drainage features, determine drainage density objectives, and conduct erosion threshold analyses for sensitive reaches.



Credit River Erosion Protection, CN Rail: Georgetown, Ontario.

Conducted post-construction monitoring of erosion structures placed near a CN rail crossing following bridge expansion construction. Field investigations included observing the condition of erosion structures and documenting on-going or recent morphological changes in the reach. Furthermore, the stability of the valley slopes, the health of planted riparian vegetation, and the quantity and quality of aquatic habitat was also observed.

HWY 404 Wildlife Crossing, Ministry of Transportation: Richmond Hill, Ontario.

Worked alongside a team of engineers to design a bed structure that allowed wildlife to cross through an enlarged culvert as well as accommodate spring freshets and large storm flows. Determined the appropriate stone sizing and designed upstream and downstream erosion protection structures.

Pottery Road Pedestrian Bridge, City of Toronto: Toronto, Ontario.

Conducted a geomorphological assessment within the vicinity of a proposed pedestrian bridge to determine appropriate bridge sizing and orientation. The assessment included historical aerial review, meander amplitude calculations, and site reconnaissance.

Rehabilitation of the York Durham Sanitary System, Town of Aurora, Town of Markham, and City of Vaughan: Richmond Hill, Ontario.

Conducted a desktop analysis of lateral channel movement processes near a proposed sanitary sewer. The analysis included meander belt and 100 year erosion assessments. Furthermore, Mr. McParland specified stone sizing and dimensions of a rock protection structure that will be placed along an active meander bend.

401 Culvert Replacement, Ministry of Transportation: Halton Region, Ontario.

Geomorphologist responsible for documenting current morphological conditions and risks at three culvert crossings between Trafalgar Road and the Guelph Line. The assessment included a field investigation, meander belt delineation, as well as providing recommendations for the culvert design.

Port Granby Creek, Municipality of Clarington: Port Hope, Ontario.

Conducted geomorphic post-construction monitoring on Port Granby Creek following the removal of a small dam. Monitoring included substrate quantification, cross-sectional profiles, measuring erosion pins, and documenting any areas of geomorphic change.

West Don River Crossing, GO Transit: Vaughan, Ontario.

Conducted field investigation and desktop analyses for the West Don River in the vicinity of crossing that was being replaced. Desktop analyses included meander belt and erosion assessments. The field assessment included reach walks to identify channel form and function, a crossings assessment to determine local geomorphic and hydraulic conditions, and pebble counts to characterize the substrate.

Upper York Sanitary Solutions, York Region: Newmarket, Ontario.

Geomorphologist responsible for sampling bed sediment in a backwatered river to determine erosion thresholds downstream of a proposed outfall structure. Results were summarized in a technical memo to the client.

Fish Passage Analysis – Lynde Creek, City of Whitby: Whitby, Ontario.

Examined the ability of small, medium and large sized forage fish to successfully pass through a culvert for current and post-construction conditions. The analysis examined velocities and minimum depths for flows ranging from summer low flow to a 25 year storm event.

Bank Protection and Channel Realignment Feasibility Study, CN Rail: Richmond Hill, Ontario.

Conducted field investigation and desktop analyses for a reach of German Mills Creek that ran parallel with a CN Rail bed. Worked alongside water resource engineers to determine appropriate channel realignment and bank protection.

Colborne St. Outfall Channel Design, City of London: London, Ontario.

Applied the principles of natural channel design to an unstable storm sewer outfall channel along the Thames River. The design included bioengineered banks, an energy dissipation apron, and pool-riffle sequences.

Niagara River Private Dock Assessment, Niagara Parks Commission: Niagara Falls, Ontario.

Documented the impacts of private docks on channel hydraulics and morphology along the Niagara River. As well, I assessed bank/slope erosion issues within the vicinity of private footpaths that accessed the docks.



Riverside Drive Retaining Wall – Watercourse Assessment, City of Toronto: Toronto, Ontario.

Geomorphologist responsible for documenting existing morphological conditions along the Humber River in the vicinity of retaining wall being rehabilitated. The assessment also included review of historic aerial photographs to quantify changes in channel planform through time as well as a review of an existing hydraulic model.

Axford Brothers Farm Subwatershed Study, Doug Tarry Limited: St. Thomas, Ontario.

Geomorphologist responsible for documenting existing morphological conditions along three drainage features including topographic survey and pebble counts. The collected data were used to set erosion threshold targets for the channels.

Publications and Conference Presentations

McParland, D.J., Eaton, B.C., Rosenfeld, J.S. 2014. At-a-station hydraulic geometry simulator. *River Research and Applications* DOI: 10.1002/rra.2851

McParland, D.J., 2013. Empirical aquatic habitat assessment tools for British Columbian channels. Presented at: Canadian Geomorphologic Research Group Annual Meeting, Edmonton, AB, August 22, 2013.

McParland, D.J., 2012. Statistical habitat methods for British Columbian channels. Presented at: University of Washington Hydrology Symposium, Seattle, WA, September 22, 2012.