Environmental Impact Assessment

McCrae Bay Pier Improvement

ECOLOGICAL SERVICES

October 15, 2020

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RE: Environmental Impact Assessment for Kehoe Marine Construction

Dear Mr. Kehoe,

Please find attached the results of our fish habitat assessment and EIA work for the proposed shoreline upgrade work at your facility in McCrae Bay.

The two main conflicts we anticipate are the Provincially Significant Wetland (PSW) boundary and SAR fish habitat. In our opinion, it should be possible to undertake your project and not impact the PSW and SAR fish habitat because the work will not be taking place in wetland. Due to existing uses on the Kehoe Marine Construction property, the current unstable shoreline can result in impacts to adjacent river habitat and the proposed stabilization of this shoreline should result in a net benefit.

Discussions with the Department of Fisheries and Oceans (DFO) are ongoing, which may result in a need for habitat compensation. There are opportunities for compensation in McCrae Bay itself, and St. Lawrence Islands National Park also has suggestions for habitat compensation in Thompson Bay, a known habitat area of the Pugnose Shiner, a species at risk.

Respectfully submitted,

Rob Snetsinger

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1. Summary

This environmental impact assessment was completed at the request of Kehoe Marine Construction who are proposing to upgrade their shoreline at their existing use facility in McCrae Bay. Due to the unstable nature of this shoreline from many years of marina use, this upgrade can provide a net benefit to the adjacent aquatic habitat.

The two main proposed upgrade areas are shown as a shaded A site (to the west) and a shaded B site (to the east) in the image velow. It will also involve upgrading the existing boat launch.

The water off the A site is mostly over 2m deep because of long term historical dredging, and this depth puts it outside of wetland mapping as per provincial mapping guidelines. Continued dredging is supported via Local Planning Appeal Tribunal case PL160282 (issued on Nov. 14, 2019). The existing sheet piling wall is failing and not up to the tasks required by Kehoe Marine Construction. This has resulted in rubble and debris inadvertently entering the river, and the proposed work should greatly help in reducing this impact. The water off the B site averages about 1 meter deep and contains insufficient vegetation to be considered wetland as per provincial mapping guideline. The B site is also used to support existing use activity, such as barge loading, and like the A site, shoreline rubble and debris can inadvertently enter the river. Upgrade work should reduce this potential impact.

Due to the existing uses of the A and B uplands, that includes use by heavy equipment and storage of marine construction infrastructure, they have little ecological value. The waters of the A and B sites also have limited ecological value, presumably due to the heavy shoreline use from Kehoe Marine Construction activity. It does not contain significant natural heritage features, and in our opinion this project can be in compliance with the 2018 Township of Leeds and the Thousand Islands Official Plan (OP) and the 2020 Provincial Policy Statement (PPS).

Although parts of the A and B sites are included with Provincial Significant Wetland (PSW) mapping, it is our opinion that this is inaccurate as per instructions in the wetland evaluation manual (MNR 2013) to not include areas that are deeper than 2 m, are unvegetated, or have been converted to another use. As a case in point, we note the correct Cataraqui River Wetland mapping that excluded the Rideau Marina.

The adjacent habitat includes the provincially significant Ivy Lea Wetland Complex, fish habitat, and St. Lawrence River from Mallorytown Landing to west of Howe Island has been designated by the Department of Fisheries and Oceans (DFO) as Pugnose Shiner (THR) habitat. No Species at Risk (SAR) were observed, and the potential for them to be associated with the A and B sites is low.

Impact recommendations are supplied in this EIA, but impacts to fish habitat and potential compensation for the A and B site shoreline upgrade are part of ongoing discussions with DFO. If the need arises, there are opportunities for compensation in McCrae Bay, as well as a site proposed by Josh Van Wieren (Park Ecologist, Saint Lawrence Islands National Park) in Thompson Bay.

2. McCrae Bay History

Aerial imagery from 1954 of McCrae Bay shows the current site of the Kehoe Marine facility to be farmland, next to open water with no shoreline buffering.

Dave and Howard Williams bought property in 1956 with the intention of servicing boats and providing some docking. To facilitate this, Art Simpson was contracted to undertake the first major dredge in 1957. By 1961, the marina business was well underway, as shown in this 1961 aerial photo. Since 1957, the use of the property expanded to include businesses by River Rat marina and Kehoe Construction. The adjoining property to the west was bought by Mot Peck in the late 1970's to establish Peck's Marina.

The Bond Marine company did a second major dredge in 1972, which was funded through Public Works and Small Craft Harbors as part of a shoreline improvement program. Numerous subsequent maintenance dredges were undertaken by the Williams family from 1972 to 2008. Kehoe Marine has continued dredging operations, with the most recent being in 2016.

The marina expanded with more docks and services into the late 80's to match the current dock footprint. Kehoe Marine Construction bought into the property in 2007 and have been expanding operations continuously since that time. This has resulted in a much larger existing use footprint on the land side, including the construction of various service buildings and the storage of construction material.

In summary, the site where the upgrade work is to take place has been in a constant state of disturbance for over 60 years, which has resulted in a site with a low ecological value.

3. Policy and Methodology

POLICY: Provincial Policy Statement (PPS)

Issued under the *Planning Act*, the 2020 version of the PPS requires that municipalities consider natural heritage features in assessing proposed work proposals. Guidance on the extent of adjacent lands is provided in a Natural Heritage Reference Manual (MNR 2010). The adjacent land width for significant natural heritage features is 120 m. From the PPS:

2.1.4 Proposed work and site alteration shall not be permitted in:
a) significant wetlands in Ecoregions 5E, 6E and 7E1; and

2.1.5 Proposed work and site alteration shall not be permitted in:
b) significant woodlands in Ecoregions 6E;
c) significant valleylands in Ecoregions 6E;
d) significant wildlife habitat;
e) significant areas of natural and scientific interest;
… unless it has been demonstrated that there will be no negative impacts on the natural features or their ecological functions.
unless it has been demonstrated that there will be no *negative impacts* on the natural features or their *ecological functions*.

2.1.6 Proposed work and site alteration shall not be permitted in fish habitat except in accordance with provincial and federal requirements.

2.1.7 Proposed work and site alteration shall not be permitted in habitat of endangered species and threatened species, except in accordance with provincial and federal requirements.

2.1.8 Proposed work and site alteration shall not be permitted on adjacent lands to the natural heritage features and areas identified in policies 2.1.4, 2.1.5, and 2.1.6 unless the ecological function of the adjacent lands has been evaluated and it has been demonstrated that there will be no negative impacts on the natural features or on their ecological functions.

POLICY: Township of Leeds and the Thousand Islands Official Plan (2018)

Impact assessments determine whether an activity is going to have a negative impact on a significant natural heritage feature. Field work for this project was completed under the guidance of the PPS and the Township of Leeds and the Thousand Islands Official Plan.

5.5.1 General: Natural Heritage System Strategy

The Natural Heritage System Strategy consists of several components which, together, comprise a coordinated approach to the long-term management of the ecological health of the natural environment within the Township and the community. The components are illustrated on Schedules 'A2' and 'A3' of this Plan and include:

- *Provincially Significant Wetlands and significant coastal wetlands;*
- *Coastal wetlands;*
- *Areas of Natural and Scientific Interest (Life Science and Earth Science);*
- *Significant valleylands;*

• Woodlands;
• Habitat of endangered and threatened species, including nesting sites;
• Wildlife Habitat; and
• Fish habitat, including spawning areas.

5.52 Adjacent Lands

The 2014 Provincial Policy Statement defines adjacent lands as those lands contiguous to a specific natural heritage feature or area where it is likely that proposed work or site alteration would have a negative impact on the feature or area. The extent of adjacent lands may be recommended by the Province or based on municipal approaches which achieve the same objectives. For the purposes of this Plan, adjacent lands are determined to include all lands within the specific distance of the boundary of natural heritage features and areas as set out in Table 5-1:

Provincially Significant Wetlands and Significant Coastal Wetlands	*120 m*
Wetlands 120 m Areas of Natural and Scientific Interest – Life Science	*120 m*
Provincially Significant Areas of Natural and Scientific Interest – Earth Science	*50 m*
Significant Valleylands	*120 m*
Significant Woodlands	*120 m*
Significant Habitat of Endangered and Threatened Species	*120 m*
Significant Wildlife Habitat	*120 m*

1. No proposed work or site alteration shall be permitted on adjacent lands unless the ecological function of the adjacent lands has been evaluated and it has been demonstrated, through an Environmental Impact Study (EIS) prepared in accordance with the Environmental Impact Study Section of this Plan, that there will be no negative impact on the natural features or their ecological functions.

Section 9.8.1 Full Environmental Impact Study (EIS)

Where a full EIS is required, such a study will be prepared by a qualified professional with expertise in environmental science, which, at a minimum, shall:

a) define the nature and the boundaries of any significant features, ecological functions and values on, or adjacent to, the site;

Note: Maps are provided in this EIS.

b) describe and map the proposed proposed work activities, including building location, excavation, site grading, landscaping, drainage works, roadway construction, paving, sewer and water servicing, in relation to various environmental considerations;

Note: Maps are provided in this EIS.

c) predict the effects of the proposed proposed work on the various components of the environment on and adjacent to the site, such as wildlife, fish, vegetation, soil, surface water, groundwater, air and any other relevant factors, taking into consideration effects during and after site alteration;

Note: Provided in this EIS.

d) evaluate the significance of all predicted and negative and positive impacts on the various environmental considerations.

Note: Provided in this EIS.

e) itemize and recommend all measures that can be taken to avoid, or mitigate the predicted negative impacts;

Note: Provided in this EIS.

f) evaluate the cumulative impacts that the project (and any other known projects or activities) may have following implementation of any mitigation measures on the natural features, areas, and adjacent lands and the ecological functions identified for protection;

Note: All impacts are cumulative, but for these to be significant, they must surpass prescribed thresholds, such as those set out in MNR (2015).

g) conclude with a professional opinion on whether negative impacts on the natural features, areas, and adjacent lands, and the ecological functions will occur, the significance of such impacts, and whether ongoing monitoring is required; and

Note: Provided in this EIS.

h) describe and map any water access and staging areas.

Note: Provided in this EIS.

METHODOLOGY

Site screening was undertaken using the MNRF (2018) and MECP (2019) screening protocols.

Habitat communities are described following the methodology outlined in the Ecological Land Classification (ELC) manual for Southern Ontario (Lee *et al*., 1998). Plant species were used to characterize ELC community types.

The Natural Heritage Reference Manual (MNR 2010), Significant Wildlife Habitat Ecoregion Criteria Schedules (MNRF 2015) and Significant Wildlife Habitat Technical Guide (MNR 2000) were used to define significant natural features.

Breeding bird surveys were based on the Ontario Breeding Bird Atlas Guide for Participants (Cadman and Kopysh, 2001) and the Canadian Wildlife Service Forest Bird Monitoring Program. Birding survey results were posted to eBird.

Marsh Monitoring followed protocols provided by TRCA (2011). Snake surveys were based on SAR snake protocols provided by MNRF (2016). Protocols for targeted SAR surveys were applied where necessary, such as for Least Bittern (Jobin et al. 2010) and Blanding's Turtles (MNRF 2015).

The work personnel and timing and nature of the site visits is presented in Table 1 and Table 2.

Table 1. Personnel who worked on this project.

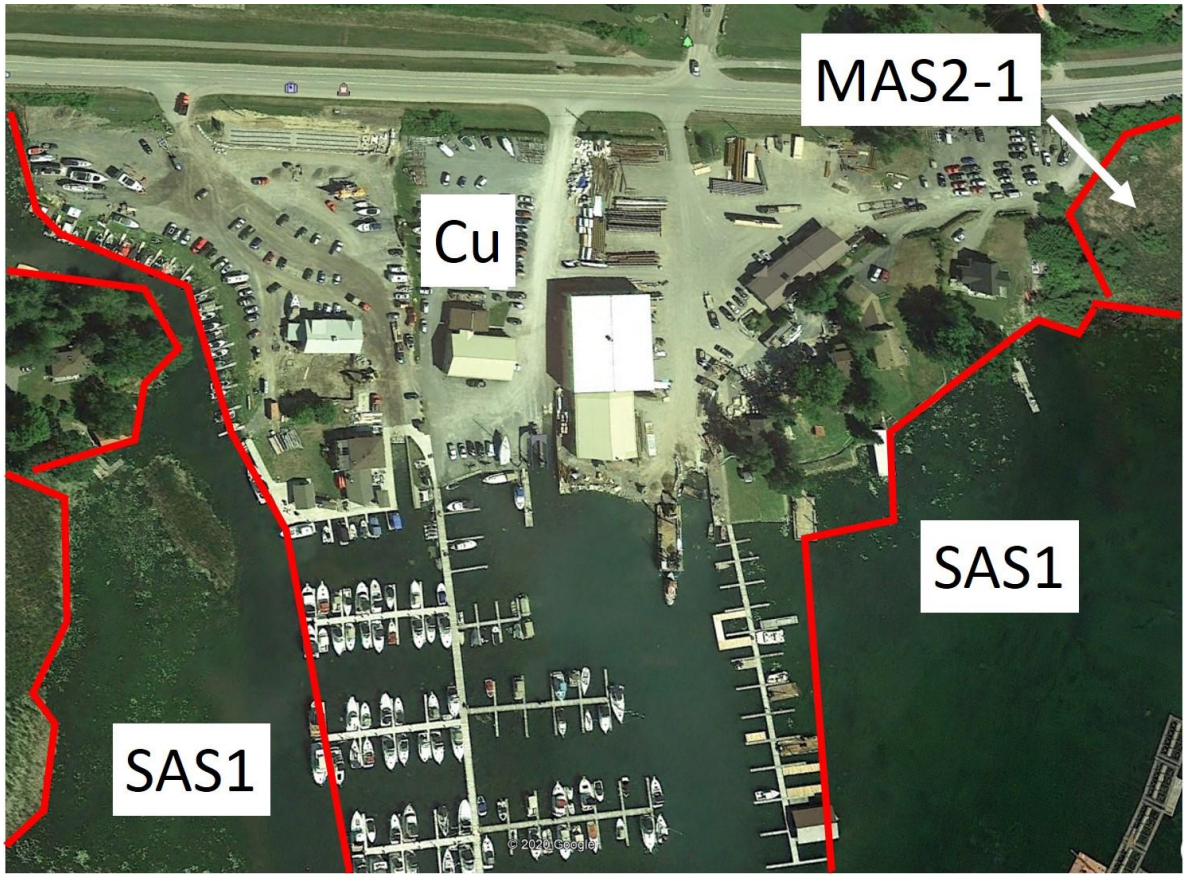
Name	Primary Task	Secondary Task
Rob Snetsinger M.Sc.	Project Supervisor	All ecological aspects.
Kurt Hennige	Birds Marsh Monitoring	General Ecology
Megan Snetsinger M.Sc.	Herps	General Ecology

Table 2. Site Visit Summary

Survey Date 2020	Starting Time	Surveyors	Main Focus of Visit
May 12	900	Rob Snetsinger Megan Snetsinger	General Ecology and Herps
May 14	2200	Rob Snetsinger	Marsh Monitoring
May 20	1200	Megan Snetsinger Rob Snetsinger	Birding, Herps, General Ecology
May 24	430	Kurt Hennige	Birding
May 24	2200	Kurt Hennige	Marsh Monitoring
May 27	850	Megan Snetsinger	Herps
May 27	1050	Megan Snetsinger	Herps
June 9	850	Megan Snetsinger	Herps
June 9	2240	Kurt Hennige	Birding Marsh Monitoring
July 4	500	Kurt Hennige	Birding Marsh Monitoring
July 13	600	Kurt Hennige	Birding Marsh Monitoring
July 24	1000	Rob Snetsinger Megan Snetsinger	ELC, Herps, Fish Habitat
Sept 5	1300	Rob Snetsinger Megan Snetsinger	Herps

4. Ecological Land Classification (ELC)

Ecological land classification determination was based on Lee et al. (1998), where habitat fragments of less than 0.5 ha. are lumped in with the larger overall ELC type. There are three ELC types within 120 m of the proposed A and B sites. ELC mapping is provided below, followed by a description of the ELC types.



Cultural (Cu): A cultural site (Cu) is one that is influenced more by cultural activities than those that define the eco-types listed in the ELC manual. The upland portion of this Cu site includes parking, offices, fabrication buildings, marina buildings, houses, and marine fabrication storage. It has an overall low ecological value. The water portion of this Cu site includes marina docking as well as the operational portion of Kehoe Marine where barge associated work is often ongoing. This portion of the Cultural site does contain fish habitat, and diffuse submergent aquatic vegetation that is representative of the types found in the adjacent SAS1 eco-type.

Submerged Shallow Ecosite (SAS1): The non-marina portion of McCrae Bay is dominated by submergent vegetation with no clear dominant species. Common species present include milfoil, eelgrass, *Elodea, Chara,* and *Potamogeton* species. It contains good fish habitat features and was classified as suW1 by Atkinson and Huizer (1991) as part of their wetland evaluation and noted to contain "*pondweeds, milfoil, filamentous algae*"

Cattail Mineral Shallow Marsh Type (MAS2-1): Starting about 117 m to the east of the B site and existing largely as a monoculture of Narrow Leaved Cattail (*Typha angustifolia*). It was classified as reM1 by Atkinson and Huizer (1991) as part of their wetland evaluation and noted to contain "*cattails*".

5. Assessment of Natural Features

5.0 Threatened or Endangered Species

The following Species at Risk (SAR) were considered during the field work because of their potential to be associated with the proposed work site, as based on background screening.

Barn Swallow (THR): All open structures in the vicinity of the marina were checked for Barn Swallows. None of the marina structures were used, but a residential boathouse more than 120 m west of the A site was used for Barn Swallow nesting. These birds would not be at risk from the A and B work because of the separation distance and because of their well-known tolerance to nearby human activity.

Blanding's Turtles (THR). The probability for these turtles to be found in association with the A and B sites is low due to the many disturbance features and a lack of favorable habitat. The wetland areas further east and west do have favorable habitat features, but the lack of basking sites limits their value. Furthermore, in our experience this species is less tolerant of nearby human activity compared to the other turtle species commonly found in this region (e.g., Map, Painted and Snapping Turtles), and the constant activity in the bay would likely be an inhibition.

There are no nearby postings for Blanding's Turtles in iNaturalist and no Blanding's Turtles were observed during the field work.

Cutlip Minnow (THR): The following tables show habitat preferences for the Cutlip Minnow as per COSEWIC (2013) in relation to the habitat at the A and B sites where it can be seen that the A and B sites are mainly lacking in appropriate habitat features. As a result, we rate the Cutlip Minnow habitat potential for the A and B sites as low.

A Site as it relates to Cutlip Minnow habitat preferences	
Habitat preference	**A Site**
Small to Moderate sized stream with some water flow	No
St. Lawrence River, fast flowing runs	No, sheltered site
Water up to 1.2 m deep	No, dredged marina, with shoreline walls
Rock/Gravel Bottom for nest building	No, mucky silty clay
In Stream Cover (large rocks, logs, vegetation, overhanging banks)	Partial. Large boulders/concrete pieces forming shoreline wall. Actively used shoreline to facilitate Kehoe Marine Construction.

B Site as it relates to Cutlip Minnow habitat preferences	
Habitat preference	**B Site**
Small to Moderate sized stream	No
St. Lawrence River, fast flowing runs	No, sheltered site
Water up to 1.2 m deep	Yes
Rock/Gravel Bottom for nest building	No, mucky silty clay
In Stream Cover (large rocks, logs, vegetation, overhanging banks)	Partial, largely lacking in-water vegetation, but some non-natural debris such as a sunken dock. Actively used shoreline to facilitate Kehoe Marine Construction.

The following tables show habitat preferences for the Cutlip Minnow in relation to the adjacent habitat to the A and B sites where it can be seen that the habitat is mostly lacking next to the A site, but portions within 120 m of the B site have some habitat favorable features. However, we rate the chances of the Cutlip Minnow being here as low. The only sightings for this region are for Ivy Lea bay in 1936, 1937, 1967, and 1994. COSEWIC (2013) note that these sightings were at the extreme western edge of its

range and they suggest it is no longer in these waters. Regardless, the adjacent habitat that could support the Cutlip Minnow is dominated by robust submerged aquatics that are largely immune to adjacent impacts. They have been able to thrive here in their location that is adjacent to marina activity for 60 years, and the proposed work will not change the status quo in this regard.

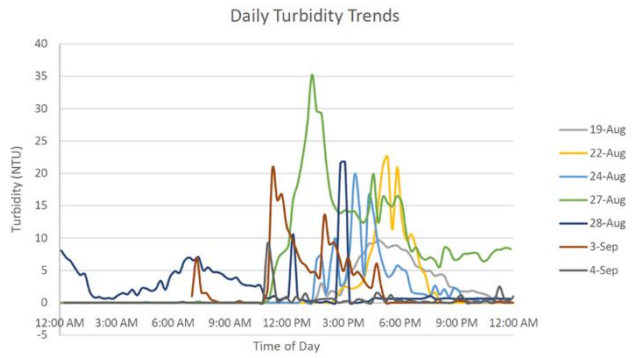
Adjacent to the A Site as it relates to Cutlip Minnow habitat preferences	
Habitat preference	**Adjacent A Site Features**
Small to Moderate sized stream	No
St. Lawrence River, fast flowing runs	No, sheltered site
Water up to 1.2 m deep	No: dredged marina Yes: water up to 1.2 m deep does occur further west of Peck's Marina, mostly more than 120 m from the A site.
Rock/Gravel Bottom for nest building	No, mucky silty clay
In Stream Cover (large rocks, logs, vegetation, overhanging banks)	Yes, a mix of aquatic macrophytes including milfoil, tapegrass, Elodea, Potamogeton sp., and Chara.

Adjacent to the B Site as it relates to Cutlip Minnow habitat preferences	
Habitat preference	**Adjacent A Site Features**
Small to Moderate sized stream	No
St. Lawrence River, fast flowing runs	No, sheltered bay
Water up to 1.2 m deep	Yes
Rock/Gravel Bottom for nest building	In some locations
In Stream Cover (large rocks, logs, vegetation, overhanging banks)	A mix of aquatic macrophytes including milfoil, tapegrass, Elodea, Potamogeton sp., and Chara.

Pugnose Shiner (**THR**): We refer to COSEWIC (2013), the provincial Pugnose Shiner website (https://www.ontario.ca/page/pugnose-shiner), and McCusker et al. (2014), whose work included fish sampling within proximity to McRae Bay. From their St. Lawrence river sampling data, McCusker et al. (2014) developed Pugnose Shiner habitat probability models based on depth, velocity, and vegetation. From that work, they deduced that the closest area with the highest probability of containing Pugnose Shiners were Eel Bay to the southwest, a swimming distance of approximately 6 km, and Thompson Bay to the east, a swimming distance of about 9 km. McRae Bay itself was shown to have the lowest probability of Pugnose Shiner occurrence levels in the McCusker (2014) study. From a fish habitat compensation perspective, Josh Van Wieren (Park Ecologist, Saint Lawrence Islands National Park) has proposals that could be considered for Thompson Bay where Pugnose Shiners are known.

Notable features observed at the A and B sites that would reduce their suitability for Pugnose Shiner were high levels of turbidity and sediment coatings on vegetative substrates. Turbidity in aquatic environments is an indication of total suspended solids (TSS) and other light-occluding material. Elevated TSS levels are a concern for the well being of aquatic biota as detailed by the Canadian Council of Ministers of the Environment (CCME 2002). Major concerns with elevated levels of TSS include impaired gills function, impaired respiration of eggs and larvae and impairment of the invertebrate food sources, among others. From the perspective of possible Pugnose Shiner spawning, deposited sediments will decrease egg survival rates. For the protection of aquatic life in areas such as McRae Bay, the CCME (2002) guidelines recommends the turbidity should not exceed a change of 8 NTU for short-term exposure (e.g.,24 hr) and 2 NTU for long-term exposure (e.g., 30 d).

Turbidity has been listed by many authors as a key factor for limiting Pugnose Shiner distribution in Canada. We refer to research by McCusker et al. (2014), Gray et al. (2014 and 2016), Holm and Mandrak (2002), and COSEWIC (2013). Turbidity is also highlighted as a Pugnose Shiner risk factor in the Canadian Species at Risk Public Registry. Due to near constant Kehoe Marine Construction activity at the A and B sites turbidity is often present, such as seen in this July 24, 2020 B site image.



Visually observed turbidity at the A and B sites was notable during all site visits, such as shown in the above image. Turbidity at the Kehoe site was measured at 15-minute intervals, 24 hours per day, over a 21day period from 17 August to 8 September 2020 with an AML MINOS-X sonde equipped with a TU EXCHANGE turbidity sensor. Peaks in turbidity ranged from 8 to 35 NTU during the day, which are well above CCME (2002) guidelines. These are also above the research exposure of 5 NTU used by Gray et al. (2014) that showed reduced schooling behavior and swimming performance. Some of the sampling data is presented in the adjacent figure where turbidity typically peaked at mid-day corresponding with boat/barge associated marine activities. It is expected that fish would be be deterred from the marina area during these times, and favor the clearer, vegetatively rich waters of the inner bay.

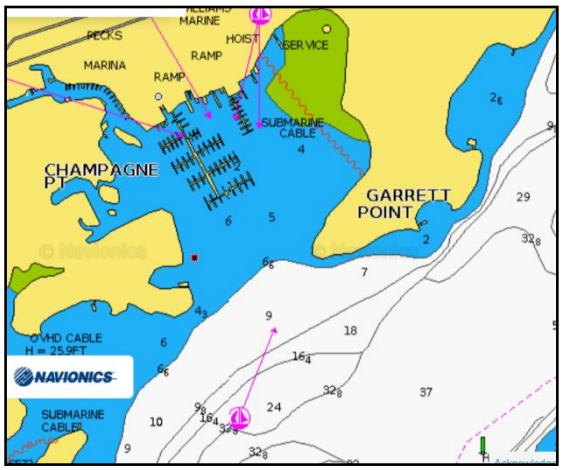
In our opinion, the deeper water depths (~ 3 m) of the A site, along with the high daytime turbidity, sediment coated vegetation, and the near constant daytime marine activity make it unsuitable as Pugnose Shiner habitat. Likewise, the lack of aquatic vegetation (~ 5% coverage) at the B site, the high daytime turbidity, sediment coated vegetation, and the near constant daytime marine activity make it unsuitable as Pugnose Shiner habitat.

Lake Sturgeon (END)
(Note: McCrae Bay Lake Sturgeon analysis below was provided by John Casselman)

At one time, lake sturgeon were abundant and fished commercially in the upper St. Lawrence River. However, the population declined dramatically, and the fishery was closed in the mid-1980s. This population is now designated as Endangered under the Ontario Endangered Species Act and by COSEWIC. Nevertheless, since the early 1990s, there has been a considerable resurgence in the upper St. Lawrence River and eastern Lake Ontario (Heuvel and Edwards 1996), either the result of stocking in U.S. waters or from natural recruitment from the remnant population as local populations developed new spawning habitats and behaviours after river fractionation in the late 1950s. Sturgeon in the upper St. Lawrence River currently spawn below the control dam at Iroquois or in the Oswegatchie River, New York (confirmed by manual locating telemetry), or farther west in eastern Lake Ontario in the Trent (CA) and Black (U.S.) rivers.

Species at Risk Ontario funded acoustic-telemetry studies in 2011 to 2014 to examine population abundance, movement, and habitat association of sturgeon in a historic population area in the river between Butternut Bay and Brown's Bay (Casselman and Marcogliese 2015). This study of the resident population in its historic core-population area provided insights that can be used to examine possible associations of sturgeon with McCrae Bay. The primary factors involve depth distribution and current velocity associations. Over the 4-year telemetry study, some 1,172 precise locatings (within 1 m) of 33 resident sturgeon confirmed that sturgeon were not usually detected in water shallower than 9 m (approximately 9%) and were never located in < 7 m of water. Sturgeon were in shallow water (< 9 m) only when feeding or spawning downriver. Mean depth of the resident population in the open river in daytime was 17.6 m and at nighttime 16.7 m. Sturgeon were invariably well off the bottom, 14.3% above the bottom in daytime and 20.4% in nighttime, confirming that sturgeon were suspended in the water column. Observations indicated that they were gliding, using quite specific current velocities. Resident sturgeon were invariably at a current velocity of 0.15 ± 0.03 m/sec. They were found only at higher velocities during spawning and at lower velocities when moving actively, hence flowing water and current velocity are important factors in determining microhabitat associations of St. Lawrence River sturgeon.

These two habitat and environmental features are important in assessing habitat use and locating resident riverine sturgeon. Sturgeon would rarely, if ever, utilize McCrae Bay since it is shallow (< 4 m even at the mouth, see bathymetric survey in adjacent figure) and confined and would not have substantial river-induced currents. Current velocity in the inshore waters of the open river can reach 0.16 ± 0.08 m/sec (Burliuk 2018), but it is unlikely these velocities would be reached in McCrae Bay since any currents created would be almost entirely wind-driven. As such, these currents would be extremely variable and would not provide consistent habitat conditions.



Navionics chart showing depth distribution (ft.) McCrae Bay area. From www.nationalprostaff.com.

Therefore, it is highly unlikely that sturgeon would ever frequent McCrae Bay. Sturgeon in the upper St. Lawrence River are in shallow water only at spawning time and use locations that have very high current velocity at that time (e.g., Oswegatchie River and high-discharge areas such as below the Iroquois control dam, where spawning has been documented). A small tributary stream flows into McCrae Bay (see chart above); however, it is ephemeral and would have relatively low flows, inadequate to attract spawning sturgeon in spring (May). Furthermore, McCrae Bay has considerable suspended solids, which recirculate, depending upon winds and anthropogenic activity. This would be detrimental to sturgeon and no doubt to overall benthic productivity and production of important macroinvertebrate prey items (Jones et al. 2011). This degree of turbidity is not seen in the open river, which resident sturgeon frequent.

American Eel (END)
(Note: McCrae Bay American Eel analysis below provided by John Casselman)

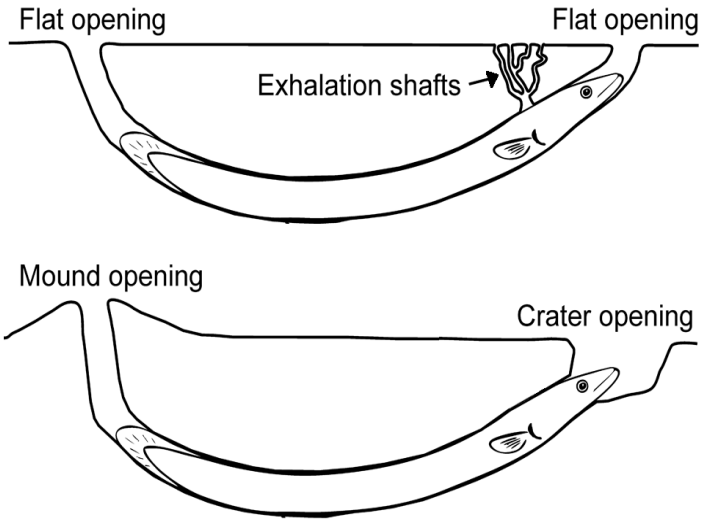
American eels were once extremely abundant in the upper St. Lawrence River and Lake Ontario, but numbers declined precipitously in the 1990s to the point where they became rare and stocking was conducted (2006 to 2010). Eels that currently exist in the upper St. Lawrence River are invariably stocked individuals. Eels are designated as Endangered under the Ontario Endangered Species Act and as

Threatened by COSEWIC. American eels have been considered to be habitat generalists, occupying shallow freshwater habitat usually < 10 m deep, with small, young yellow eels having an optimum temperature for growth of 28 ℃ (MacGregor et al. 2013). Older, larger eels may prefer somewhat lower temperatures. However, recent telemetry studies confirm very specific habitat associations and use (Casselman and Burliuk 2016, Burliuk 2018).

A detailed telemetry study was conducted recently on resident yellow eels in the Canadian waters of the upper St. Lawrence River from Rockport to Jones Creek. A total of 33 large yellow eels (≳ 60 cm) were implanted with dual-purpose acoustic-radio transmitters and located throughout the year from 2014 to 2017 (Casselman and Burliuk 2016, Burliuk 2018). A total of 1,613 precise locations (within ± 0.57 m) documented seasonal changes in movement, depth distribution, and microhabitat associations, documenting environmental and habitat selection and requirements. This study provides important insights that can be used to evaluate eel habitat use associated with McCrae Bay.

Eels are photo-negative and occupy cover during the daytime and actively feed crepuscularly at dawn, dusk, and nighttime. For larger yellow eels, daytime cover normally involves soft substrate (80% occurrence) or the interstitial spaces of rock rubble (20% occurrence). Large yellow eels that are present in the upper St. Lawrence River require rather large interstitial spaces that are found only in large rock rubble (size 30–80 cm). A habitat survey of McCrae Bay indicates that very little of this rock substrate is present; the substrate is primarily soft and silty, typical of a eutrophic growth habitat. The telemetry study confirmed that soft substrate used by eels during the open-water period is invariably covered by aquatic vegetation, quite commonly the green algae Chara. Quantitative sampling in July of this vegetative cover (Burliuk 2018) associated with eels documented an average composition of 70% Chara, 10% Eurasian milfoil, 9% eelgrass, 7% Richardson's pondweed, and 10 other less abundant species constituting 3%. Less than 1% of the eel habitat was barren soft substrate.

Eels occupy rather distinct burrows in the soft substrate (see adjacent illustration) under this vegetative cover, which they inhabit in daytime, leave to forage during the night, and return to the following morning. It appears that eels use these burrows until available prey in the immediate vicinity have been reduced or have moved (Burliuk 2018). Eels then move to a location where prey densities are greater and establish a new burrow. Indeed, it is common to see holes in the mats of Chara that eels have used to access these burrows.



American eel burrows in soft sediment, showing flat, mound, and crater types (from Tomie et al. 2013). Natural burrows in soft substrate were found to be at a maximum depth of 18–30 cm for Japanese eels (Aoyama et al. 2011) and at 20–25 cm for American eels in the upper St. Lawrence River (Casselman and Burliuk 2016).

The habitat survey conducted in July in McCrae Bay documented that Chara, which is an important cover in eel habitat, was common (see habitat survey); however, it was heavily silted since suspended solids and

associated turbidity are common. In eel habitat studies in the upper St. Lawrence River, this vegetation is invariably lush and green, with little to no evidence of particulate silt other than marl on the filaments. The heavy loading of suspended solids, which are present in McCrae Bay and may be recycling because of boat traffic and wind-driven currents, would be detrimental to burrowed eels.

The eel habitat-association study confirmed that eels occupied soft substrate that had an organic content > 10%, was soft, and had considerable depth. Substrate density was found to be an important factor and was quantified, using an impact penetrometer depth of > 50 cm measured using 1.8 MP of pressure applied to a 60° 72-mm diameter piercing cone (Casselman and Burliuk 2016). There is some evidence that soft substrate of this type or depth does not exist in the proposed shoreline upgrade sites A or B or immediately adjacent to these areas (see habitat survey for qualitative estimates of maximum depth of soft substrate ≈ 15 cm). Although direct measurements of the substrate have not been conducted, there is some evidence that the current substrate in the proposed shoreline upgrade area would not provide suitable burrowing habitat for eels.

McCrae Bay is an appropriate depth to be occupied by eels in spring, summer, and fall. The telemetry survey of eels in the upper St. Lawrence River indicated that eels occupied a depth zone ranging from 1.7 to 3.8 m, were shallowest in spring (May) and deepest during winter dormancy (Casselman and Burliuk 2016). For the winter, eels burrowed near an area of drop-off, where there was increased current flow and the water was well oxygenated. This would be available only near the mouth of the bay because no doubt during winter conditions of ice cover, there would be oxygen depression in McCrae Bay. McCrae Bay probably does not provide suitable winter habitat for eels. Although continuously recorded water temperature was not available, in McCrae Bay it probably exceeds 23 ℃ in midsummer during most years. At temperatures > 22 ℃, eels move deeper and do not occupy the inshore waters (Burliuk 2018). Depth, temperature, and oxygen concentration in McCrae Bay do not provide productive, or even suitable, habitat for eels, but more importantly, turbidity would negatively affect their occurrence. It is well documented that turbidity associated with suspended solids would negatively impact eel occurrence and productivity and that turbidity caused by anthropogenic suspended solids and silt is a major threat for eels, particularly because of their extensive use and occupancy of soft benthic habitat for burrowing (Chaput et al. 2013, Pratt et al. 2013, Chaput et al. 2014). Recirculation and deposition of sediment, which is prevalent in McCrae Bay (see habitat survey), would negatively affect eels that have burrowed. Suspended sediment no doubt produces a biological oxygen demand that would depress the oxygen content of the water under the vegetative cover and around the burrow. Any depression of oxygen concentration in the water would directly affect metabolism, growth, and even survival of fish (Casselman and Harvey 1975). The physical deposition of sediment could negatively impact and deter burrowing by directly settling out in the head entrance or crater opening of the burrow (see illustration above).

Quite importantly, sedimentation can negatively affect a number of prey species used by eels, creating an environment that would be less productive and even avoided as productive growth habitat. Yellow perch (*Perca flavescens*), particularly small individuals, are important prey fish for eels. It is well documented that their occurrence and abundance are decreased where suspended solids are prevalent and where sedimentation deposition and cycling occur (Ritchie 1972). Smaller eels and, in some cases, larger individuals, prey rather heavily on macroinvertebrates. It is well documented that benthic invertebrate production is negatively affected and reduced by sedimentation, particularly larger species such as the Emphemoptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) (Jones et al. 2011). These species, along with others such as Anisoptera (dragonflies) and Zygoptera (damselflies), are very important prey species of yellow eels in the upper St. Lawrence River (Moffatt and Casselman, unpublished 2020 4th-year undergraduate thesis).

Detailed telemetry locating of eels in the upper St. Lawrence River provides new quantitative microhabitat association criteria for assessing possible eel habitat in McCrae Bay. Quantitative measures

of substrate, density, and depth would provide more definitive evidence; however, that study, along with eel microhabitat use elsewhere in the upper St. Lawrence River, suggests that environmental habitat conditions in McCrae Bay at the present time do not provide quality, or possibly even suitable, eel habitat and would be little used, given surrounding waters. The quantity of suspended solids and sediment in circulation because of anthropogenic activities, particularly boat traffic, would be an important and major deterrent to the occurrence of eels.

Piping Plover (END): These birds are not found in McCrae Bay, and are only included here because of an older reference in the MNRF NHIC web site. McCrae Bay lacks Piping Plover habitat and there have been no Plover sightings east of Kingston for many decades. All listed sightings in the province are for Lake Ontario and Lake Erie beach sites, with the closest in Prince Edward County.

Henslow Sparrow (END): These birds are not found in McCrae Bay, and are only included here because of an older reference in the MNRF NHIC web site. This is a grassland associated species and it has been largely extirpated from the province, with only a few rare sightings in Southwestern Ontario over the last few decades.

Least Bittern (THR): Least Bittern are a wetland obligate species and as such, they will not be in uplands or the A and B sites. From the Environment Canada, Species at Risk Public Registry:

> *The presence of stands of dense vegetation is essential for nesting because the nests of Least Bittern sit on platforms of stiff stems. The nests are almost always within 10 m of open water. Open water is also needed for foraging, because Least Bitterns forage by ambushing their prey in shallow water near marsh edges, often from platforms that they construct out of bent vegetation. Access to clear water is essential for the birds to see their prey. This small heron prefers large marshes that have relatively stable water levels throughout the nesting period.*

In this regard, we might expect to find them in association with the cattail swales mostly more than 120 m to the east and west of the A and B sites. As a result of this potential, searching for them was a primary focus of the birding work by Kurt Hennige for this EIA. Mr. Hennige is a well-respected Eastern Ontario birder, a past president of the Kingston Field Naturalists who has undertaken many birding surveys for the Canadian Wildlife Service, and is the eBird reviewer for Lennox and Addington, Frontenac, and Leeds and Grenville counties.

No Least Bittern were observed during any of the field work visits, including those by Mr. Hennige, and there are no eBird sightings nearby. The closest sighting in eBird is a roadkill more than 7 km further east. Most of the known breeding sites are in association with Lake Ontario wetlands.

Red-headed Woodpecker (THR). The closest eBird record is from June 8, 2014 from a site west of Gananoque. Most of the sightings that we are aware of are for wooded areas near water, with a preference for mature oak/beech woodlands. Consequently, the wooded areas to the south of the A and B sites provide potential habitat. However, these areas are more than 120 m from the A and B sites, and no Red-headed Woodpecker were observed during the field work.

Henson and Brodribb (2005) identified several potential SAR species for the Westport Ecoregion (6E-10) which includes McCrae Bay, as follows:

> **Purple Twayblade (THR):** We discovered a patch of this orchid growing in Frontenac Park, which to our understanding is the only listing of this species in Eastern Ontario. The A and B sites and adjacent lands lack appropriate habitat features for this species.

American Ginseng (END): We have identified many patches of this plant in Eastern Ontario, all in association with south facing slopes that include maidenhair fern and butternut trees. The A and B sites and adjacent lands lack appropriate habitat features for this species.
Deerberry (THR): We have contributed to the Deerberry recovery strategy for the Thousands Islands population, by germinating and establishing seedlings for transplanting to the island population sites within St. Lawrence Islands National Park. The A and B sites and adjacent lands lack appropriate habitat features for this species.
Blunt-lobed Woodsia (END): The closest known sighting that we are aware of is in association with the Landons Bay/Fitzsimmons Mountain ANSI where it grows on steep rock faces. The A and B sites and adjacent lands lack appropriate habitat features for this species.
Spiny Softshell (END): We find the inclusion of this species by Henson and Brodribb (2005) unusual as the MECP Species at Risk information web page lists them as being only in Southwestern Ontario.
Gray Ratsnake (THR): Well known to this region, we always give them consideration for any development project in this region during the field work. No snakes of any species were found in the Kehoe property, which is not surprising because it is an actively used site with no favorable habitat features.

Butternut (Endangered): No Butternut were observed on site or in the adjacent lands.

5.1 Wetland

The Ivy Lea wetland was first surveyed by Peter Mabee and Peter McIntyre in 1982 with the first edition of the wetland evaluation manual. A second evaluation was completed in 1991 with the second edition of the wetland evaluation manual (MNR 1984) by Jann Atkinson and Ron Huizer, who also did many wetland evaluations in Eastern Ontario in the late 1980's and 1990's. As part of the evaluation, Atkinson and Huizer (1991) combined the Ivy Lea wetland mapped by Mabee and McIntyre in 1982 with the Knight's Creek wetland further west to make what we now know as the Ivy Lea Wetland Complex. This new evaluation changed the scoring of the wetland so that it went from a regionally significant wetland to a provincially significant wetland. McCrae's Bay is located in the eastern half of the Ivy Lea Wetland Complex.

Wetlands in the province are now evaluated with the 3rd edition of the wetland evaluation manual. There are some components in the 2nd edition scoring by Atkinson and Huizer (1991) that would not apply today and one might surmise that this relatively small wetland (76 ha) would not be considered significant under the 3rd edition of the manual. However, we speculate that it would still be significant, as the presence of just a single SAR within a wetland automatically imparts significance under the 3rd edition, and although it is not a wetland species per se, one could make an argument that the Gray Ratsnake (THR) inhabit some of the swamp portions of the Knights Creek component of the wetland.

The open waters of McCrae bay were mapped as suW1 by Atkinson and Huizer (1991), in which they state that pondweeds were the dominant species followed by milfoil. A more accurate suW1 representation in 2020 would be *Chara*, *Elodea*, milfoil, eelgrass, and pondweeds. There may be two reasons for the difference in the 1991 mapping vs. the 2020 perspective.

1. The ecology of the bay may have changed since 1991, with *Chara*, *Elodea*, and eelgrass moving in resulting in the greater diversity of species. This suggests that the ecology of the bay has

improved since that time, despite there being a greater level of marina activity since that time. However, in our opinion, the difference is more likely due to the following reason.

2. A thorough investigation of the vegetation community in the bay was likely not undertaken in 1991. This is not a criticism of the work by Atkinson and Huizer as the internal vegetation mapping was not given a high priority within the 2nd edition manual instructions, and Atkinson and Huizer spent only 8 hours surveying the entire wetland that stretched over a distance of 4 km, and contained 11 sub-wetlands, 24 different wetland community types, and 60 wetland vegetation communities. This suggests that Atkinson and Huizer would have had less than 8 minutes to assess McCrae Bay for its wetland features. This does not even account for the travel time that would be needed to cover all the communities within the 4 km. At best, they would only have been able to do a quick spot check, which is an insufficient amount of time to accurately assess the vegetation community in the bay, including water depths and percent vegetation coverage.

It is worthwhile discussing whether the marina should have been included in the wetland mapping. Aside from the limited amount of tune likely spent to accurately determine the extent of wetland in the bay, there are three factors to consider here as per instructions from the wetland manual provided below in italics, followed by our analysis.

1. *As a rule, wetland areas effectively converted to other uses through clearing, draining, dredging, etc. should not be considered as wetlands.*

A marina had been established here long before wetland policies were enacted in the province, and well before wetland evaluations began, and in our opinion, it should not have been included in the evaluation. As a wetland evaluator of long-standing, having completed over 100 wetland evaluations in the eastern Ontario since 1985, we were always aware of this rule, and excluded marinas during any wetland mapping that we undertook.

2. Many wetlands border on lakes, rivers, streams and reservoirs. The deep-water boundary of such wetlands should be drawn at the 2 meter depth.

There were areas that we measured within and outside the marina boundary that were more than 2 m deep and were included in the wetland mapping. As well, from many years of dredging that started well before the wetland evaluation was completed, there is a >2m deep area associated within the marina that should not have been included in the mapping.

3. The 2nd edition of the wetland manual required at least 25% bottom coverage of submergent plants in water less than 2 m to be considered wetland, whereas the 3rd edition requires at least 10% in water less than 2 m. The B site is in water that is less than 2 m deep but contains less than 10% vegetation. As well, portions of the A and B sites include concrete ramps that should not have been included in the wetland mapping. Again, this is not intended as a criticism of the evaluators, but again note how little time they likely would have spent on site during the field work portion of their work.

Wetland Impacts

In assessing whether proposed work will have negative wetland impact in regard to the OP and the PPS, we are required to consider relevant wetland features and functions. These are discussed below under the headings of wetland biodiversity, species at risk, fish habitat, and flood and pollution attenuation.

Wetland Biodiversity: The biodiversity of a wetland is partly determined by the vegetation growth patterns, and vegetation edge patterns (i.e., interspersion), and by the wetland species. The significance score for this wetland was largely on the strength of the Biological Component and the Special Features Components. For the former, the scores were largely derived from the breadth of the wetland across many habitats, that included many habitat types which imparts a high value of wetland biodiversity. Most of these biodiversity features are than 120 m away from the A and B site and are at no risk from the A and B site shoreline upgrade.

Vegetation Growth Patterns**:** Wetland biodiversity can be characterised by vegetation growth patterns, where a complex array of growth patterns can provide greater diversity of animal and plant species because it provides more exploitable micro-habitats. For example, a mature forest with a ground layer, a shrub layer, a young tree layer, and a super canopy layer has a more complex vegetation growth pattern than a forest with park like setting of just ground vegetation and a super canopy layer.

The growth pattern in McCrae Bay is provided by a single type, submergent wetland (suW1). The plants in the suW1 areas that are adjacent to the marina are in a good state of health despite being adjacent to an operating marina for many years. This suggests that a nearby marina does not constitute a significant impact. It can also be a testament to the robust nature of the submergent plant species found here, many of which are aggressive colonizers with impressive evolutionary strategies for establishing and maintaining their presence. Three of the dominant species present (milfoil, eelgrass, and *Elodea*) have been the focus of research articles in the Nuisance Plant Series presented by the Canadian Journal of Plant Sciences, where their many robust attributes are described. The term nuisance should not belie the ecological value that these plants provide, but it does highlight their robust nature, including their ability to withstand impacts. The adjacent suW1 habitat will continue to exist as suW1 after the A and B site construction is finished and therefore this feature will not be impacted from a wetland diversity perspective.

Under current operations, Kehoe marine work barges load on unstable shorelines of rock rubble at the A and B sites, as well as in shallow water at the B site. This can result in materials being deposited into the river and loading at the shallow B site can result in turbidity plumes during loading. It can also result in soil laden stormwater runoff affecting nearshore turbidity and suspended solids.

The construction of stable shoreline walls and other shoreline enhancements at the A and B sites should help reduce these impacts.

Interspersion: The value of interspersion as a wetland feature is discussed by Schummer et al. (2012). A wetland with many different vegetation habitat sub-types, along with a complex boundary pattern would have a high interspersion. The Ivy Lea complex has many different habitat types existing in an array of patterns, which provides it with high interspersion. However, this mostly occurs more than 120 m from the A and B sites. The suW1 type that comprises most of the wetland within 120 m is a single habitat type that does not represent high interspersion by itself. An interspersion impact would only occur from the A and B construction if the entire suW1 wetland in the bay was eliminated. This is not going to happen as a result of the construction because it is removed from the main parts of this wetland and because of the robust nature of the plants in the bay.

Wetland Species at Risk: We do not anticipate negative impacts to wetland species at risk. For more details please see Section 5.0 Threatened or Endangered Species, although we do discuss two wetland species below that were covered by Atkinson and Huizer (1991).

The Gray Ratsnake and Marsh Wren are two species that comprised an important part of the scoring of the Special Features component by Atkinson and Huizer (1991), and if these two species were not included in the evaluation, the wetland would not have garnered enough points to be provincially significant. Gray Ratsnakes are not found in McCrae Bay and so would not be at risk from the A and B shoreline upgrades. Marsh Wren are no longer given scoring value in wetland evaluations as it has since been determined that this species is not at risk in the province. Nevertheless, we did survey for both species. The closest suitable Marsh Wren habitat to the A and B sites, are the cattails about 117 m to the east of the B site, but no Marsh Wrens were observed here. We did hear two Marsh Wrens calling from the cattails more than 120 m to the west of the A site early in the field season. They were not observed during any of the later site visits and we concluded that these two were either migrants that were passing through at this early time, or were checking out prospective habitat and did not find this site to their liking, or had met an untimely end. Nevertheless, as the east and west cattail zones are mostly more than 120 m from the A and B sites, the risk to any future habitation by Marsh Wrens would be negligible.

Wetland Fish Habitat: We do not anticipate negative impacts to wetland fish habitat. For more details please see Section 5.5 Fish Habitat.

Flood and Pollution Attenuation: In an accompanying summary of their wetland evaluation Atkinson and Huizer (1991) correctly noted the extreme low value of the wetland in regard to these two wetland functions due to its location on one of the major rivers in the province. The proposed A and B work will not impact the flood attenuation function, and the A and B sites currently have no value in pollution attenuation. The upgrade of the shoreline walls at the A and B sites will likely reduce debris from entering the river and reduce future barge loading plumes, and thus be a benefit to the adjacent wetland.

In conclusion, it is our opinion that the proposed work will not impact the adjacent PSW, and the proposed work will be consistent with the PPS and the OP.

5.2 Area of Natural and Scientific Interest (ANSI)

The nearest ANSI to the proposed work area is Landson's Bay/Fitzsimmons Mountain, located about 850 north of the proposed work area.

As there are no ANSI's within 120 m of the proposed work area, we refer to the following excerpt from Section 4.4 of the Natural Heritage Reference Manual.

> *The need to evaluate the ecological function of adjacent lands (i.e., undertake an EIS or equivalent study) would be removed if proponents choose to avoid having proposed work and site alteration occur within the extent of adjacent lands.*

Accordingly, no further analysis is warranted regarding ANSI's.

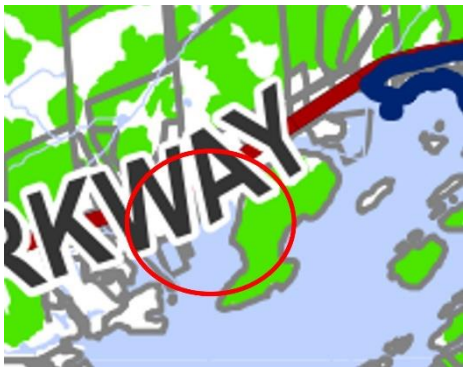
5.2 Woodlands

From Section 5.5.8 of the OP:

> *Woodlands are identified on Schedule 'A3' of this Plan, based on available provincial mapping which has not been groundtruthed at the Counties or Township levels. There may be areas identified as woodlands where they may not exist, as well as areas which may be woodlands but have not been mapped, or their boundaries have changed over time.*

There are a few scattered nearshore trees within the Kehoe Marine property, mostly consisting of non-native (e.g., Norway Maple, Crack Willow) or weedy species (e.g., Manitoba Maple). Their function is similar to that of urban trees and they do not constitute a woodland.

In the adjacent cutout from Schedule A3, there are no woodlands shown for the proposed work area, but there is woodland shown on the nearby point of land, sometimes referred to as Garret Point. This woodland is more than 120 m from the proposed work area. There are also no other woodlands to the north of the proposed work area that are within 120 m.



As there are no woodlands within 120 m of the proposed work area, we refer to the following excerpt from Section 4.4 of the Natural Heritage Reference Manual.

> *The need to evaluate the ecological function of adjacent lands (i.e., undertake an EIS or equivalent study) would be removed if proponents choose to avoid having proposed work and site alteration occur within the extent of adjacent lands.*

Accordingly, no further analysis is warranted regarding woodlands.

5.3 Valleylands

From Section 5.5.7 of the OP:

A valleyland is a natural area that occurs in a valley or other landform depression that has water flowing through or standing for some period of the year. Based on available information, there are no identified significant valleylands within the Township at the time that this Plan was prepared. The locations of significant valleylands must be determined on a site-specific basis, in accordance with the criteria for determining significance provided in the Ministry of Natural Resources and Forestry's Natural Heritage Reference Manual, as amended from time to time.

There are no valleylands within 120 m of the proposed proposed work. In this regard, we refer to the following excerpt from Section 4.4 of the Natural Heritage Reference Manual.

> *The need to evaluate the ecological function of adjacent lands (i.e., undertake an EIS or equivalent study) would be removed if proponents choose to avoid having proposed work and site alteration occur within the extent of adjacent lands.*

Accordingly, no further analysis is warranted regarding valleylands.

5.4 Wildlife Habitat

The Significant Wildlife Habitat Criteria for Site Region 6E (MNR 2012) describes in detail the habitat and wildlife requirements and thresholds. Each wildlife habitat type was considered during the site investigation and is described in detail below.

Seasonal Concentration Areas:

Habitats of seasonal concentrations occur when animals are in relatively high densities for specific periods of their life cycles and/or in particular seasons. These are generally localized and small in relation to the area of habitat used at other times of the year. MNR (2015) lists 16 types of seasonal concentration habitats, discussed below.

Waterfowl stopover and staging areas (terrestrial): Requires seasonally flooded cultural meadow and thicket communities, which are not present.

Waterfowl stopover and staging areas (aquatic): Migrating waterfowl require stopover areas to rest and feed before continuing with migration. There are significant rafts of migrating waterfowl found in many Lake Ontario coastal wetlands, such as in Kingston, Oshawa, Toronto, and Hamilton. One common feature of these known significant stopover wetlands is that they are much larger than the wetlands of McCrae Bay.

The wetlands west and east of the proposed work area have appropriate waterfowl stopover and staging (aquatic) features. However, to be significant, specific numbers of listed species including Canada Goose, Cackling Goose, Snow Goose, American Black Duck, Northern Pintail, Northern Shoveler, American Wigeon, Gadwall, Green-winged Teal, Blue-winged Teal, Hooded Merganser, Common Merganser, Lesser Scaup, Greater Scaup, Long-tailed Duck, Surf Scoter, White-winged Scoter, Black Scoter, Ring-necked duck, Common Goldeneye, Bufflehead, Redhead, Ruddy Duck, Red-breasted Merganser, Brant, Canvasback, and Ruddy Duck are required.

Based on our field work (eg., see Table 3) and eBird observations, the appropriate threshold numbers of listed species are not met. This is not surprising given the relatively small size of McCrae Bay, distance from the main Lake Ontario migration routes, and the associated marina activity in the bay.

It may also be helpful to note that in their wetland evaluation Atkinson and Huizer (1991) rated the stopover potential of entire Ivy Lea wetland, that included McCrae Bay, as low. This conclusion was made in consultation with MNR Brockville (now closed) biologist Ross Cholmondely.

Shorebird migratory stopover area*:* There are only a few known significant shorebird stopover areas in Eastern Ontario, and a common element of all are large beach area/mudflats in association with wetland habitat. To be significant a site must support 3 or more of 22 listed shorebird species with more than 1000 shorebird use days during the fall and migration period. Only 1 sighting (May 24) of one of the 22 species was made (Spotted Sandpiper) during the field work and this does not meet the threshold for significance.

Raptor wintering area*:* This habitat type includes a combination of fields (CUM, CUT) and woodlands (FOD, FOM, FOC) that provide roosting, foraging and resting habitat for wintering raptors. Field areas need productive small mammal populations such as open fields, agricultural lands (i.e., hayfields, pasture) and meadows. This combination of ELC types are not present in association with the proposed work area.

Table 3. Bird focused survey results.					
04-Jul		13-Jul		24-May	
American Crow	2	American Crow	4	American Crow	1
American Goldfinch	3	American Goldfinch	3	American Goldfinch	2
American Robin	2	American Robin	5	American Robin	3
Bald Eagle, flyby	1	Barn Swallow	6	Baltimore Oriole	1
Barn Swallow	8	Black-capped Chickadee	2	Barn Swallow	3
Belted Kingfisher	1	Blue Jay	2	Blue Jay	2
Canada Goose	4	Canada Goose	9	Canada Goose	20
Chipping Sparrow	1	Caspian Tern	4	Caspian Tern	1
Common Grackle	8	Cedar Waxwing	4	Chipping Sparrow	1
Common Yellowthroat	2	Chipping Sparrow	2	Common Grackle	12
Double-crested Cormorant	1	Common Grackle	11	Common Yellowthroat	3
Downy Woodpecker	1	Common Yellowthroat	2	Double-crested Cormorant	2
Eastern Kingbird	1	Double-crested Cormorant	5	Eastern Kingbird	1
Eastern Phoebe	2	Eastern Kingbird	2	Eastern Phoebe	2
Eastern Wood-Pewee >120 m	1	Eastern Phoebe	3	European Starling	2
European Starling	4	European Starling	2	Gray Catbird	1
Gray Catbird	1	Gray Catbird	2	Great Blue Heron	1
Great Blue Heron	1	Great Blue Heron	1	Great Crested Flycatcher	1
House Wren	1	Hairy Woodpecker	1	House Sparrow	1
Killdeer	1	Herring Gull	1	House Wren	1
Marsh Wren	2	House Wren	1	Mallard	1
Mourning Dove	3	Mallard	12	Mourning Dove	2
Mute Swan	5	Merlin, flyby	1	Northern Cardinal	1
Northern Cardinal	1	Mourning Dove	2	Osprey, flyby	1
Northern Flicker	1	Mute Swan	8	Pileated Woodpecker	1
Osprey, flyby	2	Northern Cardinal	1	Red-winged Blackbird	16
Pileated Woodpecker	1	Northern Flicker	1	Ring-billed Gull	5
Red-bellied Woodpecker	2	Osprey, flyby	1	Rose-breasted Grosbeak	1
Red-eyed Vireo	2	Red-bellied Woodpecker	1	Song Sparrow	3
Red-winged Blackbird	35	Red-eyed Vireo	1	Spotted Sandpiper	1
Ring-billed Gull	5	Red-winged Blackbird	16	Swamp Sparrow	3
Song Sparrow	3	Ring-billed Gull	30	Yellow Warbler	2
Swamp Sparrow	4	Rock Pigeon (Feral Pigeon)	2		
Warbling Vireo	1	Song Sparrow	3		
Wood Thrush >120 m	1	Swamp Sparrow	3		
Yellow Warbler	2	Warbling Vireo	1		
		Wood Duck	18		
		Yellow Warbler	1		

Bat hibernacula*:* These are found in crevice and cave ecosites (CCR and CCA). There are no cavern or crevice ELC ecosites on or within 120 m of the proposed work area.

Bat Maternity Colonies: To be considered as significant wildlife habitat, maternity sites require large/old diameter trees in various states of health. These are not present in sufficient numbers within 120 m of the proposed work area. Accordingly, bat acoustic monitoring efforts were not required.

Bat Migratory Stopover Area: The only place in the province currently identified as SWH for bat movement corridors is Long Point (Ecoregion 7E) for silver-haired bats

Turtle Wintering Areas*:* The wetland areas of McCrae Bay east and west of the Kehoe and Peck's marina have appropriate features for turtle overwintering. Overwintering typically occurs in areas where normal summer concentrations occur, and during our field work, turtle numbers in the bay were low. This is not surprising because there is a lack of basking features, and the marina associated disturbance activity could inhibit turtle use.

Overwintering is not expected in association with the A and B proposal sites, as these sites are actively used well into the initiation of the overwintering period in late September. Barges typically come and go to the A and B sites and this would inhibit turtles from initiating hibernation at these sites.

Although it is our opinion that significant overwintering is not occurring in McCrae Bay, the likely locations for overwintering are more than 120 m west of the A site. Possible locations for overwintering in the B site, start about 10 m east of the B site.

Conversion of the B site from its current shallow silty run-up to a more permanent structure has the potential to improve adjacent overwintering conditions as it will reduce potential sediment drift that can occur whenever a barge comes in for loading. Nevertheless, it is recommended that an anchored silt curtain be installed along the eastern edge of the B site during upgrade work. Aside from acting as a siltation barrier, the purpose of this barrier would also be intended to inhibit nearshore turtle movement into the B site.

Reptile Hibernaculum: No snakes were observed during the field work, nor were they expected due to the cultural features (e.g., parking lots) that dominate the site.

Colonially -Nesting Bird Breeding Habitat (Bank and Cliff): Requires eroding banks/cliffs, sandy hills, pits, steep slopes, and rock faces and these are not present.

Colonially -Nesting Bird Breeding Habitat (Trees/Shrubs): Nesting occurs in swamp and fen habitats, which are not present.

Colonially -Nesting Bird Breeding Habitat (Ground): Nesting occurs on rocky islands or peninsula within a lake or large river. These features are not present.

Butterfly Migratory Route/stopover Areas*:* For consideration, a site needs to be located within 5 km of Lake Ontario, which is not the case here.

Landbird Migratory Stopover Areas*:* For consideration, a site needs to be located within 5 km of Lake Ontario, which is not the case here.

Deer Yarding Areas: No deer yarding area features occur within 120 m of A and B sites.

Deer Winter Congregation areas*:* No deer winter congregation features occur within 120 m of A and B sites.

Rare Vegetation Communities:

Rare vegetation community types are those with SRANKS of S1 to S3 (i.e., extremely rare - rare - uncommon in Ontario). Henson and Brodribb (2005) identify one provincially rare vegetation community within the Westport Ecodistrict 6E-10, a Pitch Pine Treed Granite Barren Type. This community is not within 120 m of the proposed work area

OMNR (2015) considers Cliffs and Talus Slopes, Alvar, Sand Barrens, Old Growth Forest, Savannah, and Tall Grass Prairies, which are not present.

Specialized Habitats for Wildlife:

The *Ecoregion Criteria Schedules* (MNR 2012) lists five categories of specialized habitat for wildlife for Site Region 6E. Each of these is discussed below:

Waterfowl Nesting Area*:* Any upland habitat adjacent to a PSW has the potential to have significant waterfowl nesting. Significance is met if 3 or more of the criteria species is nesting next to the wetland. Only wood ducks were observed to be potentially nesting, but in woodlands more than 120 m from the A and B sites. As a result, the threshold for significance was not met.

Bald Eagle and Osprey Nesting, Foraging and Perching Habitat: Refers to sites with ELC designations FOD, FOM, SWD, SWM, and SWC that are associated with lakes and rivers. None of these ELC exist within 120 m of the A and B sites. The Osprey and Bald Eagle that were noted in the field work were flybys. This is not unusual as both species are known to frequent the Thousand Islands area.

Woodland Raptor Nesting Habitat*:* All habitat types if they contain Northern Goshawk Cooper's Hawk, Sharp-shinned Hawk, Red-shouldered Hawk, Barred Owl, and Broad-winged Hawk nesting. None of these birds was observed or expected due to a lack of appropriate habitat features.

Seeps and Springs*:* No seeps or springs are present.

Turtle Nesting Areas*:* Refers to good turtle nesting that is close to water and away from roads, and provides sand and gravel in open sunny areas that turtles can dig in. The marina shoreline areas are unsuitable for turtle nesting due to a combination of unsuitable substrates and access restrictions. The closest suitable turtle nesting area would be the back lawn and gravel verge of the residence at the east end of McCrae Bay, starting about 80 m from the B site. No turtle nesting, or evidence of turtle nesting was observed here. Regardless, this site is well removed from an B site impact potential.

***Amphibian Breeding Habitat* (woodland):** There are no woodlands within 120 m of the proposed work area that contain ephemeral ponding for amphibian breeding.

***Amphibian breeding habitat* (wetland):** Marsh monitoring took place next to the proposed work area, and in wetland areas east and west of the proposed work area. Results of that work are presented in the following table. To be considered significant as per MNRF (2015), 2 or more of the listed frog/toad species with Call Level Codes of 3 or; with confirmed breeding bullfrogs are significant. Call level codes of 3 were only met for American Toads west of Pecks Marina, and therefore these wetland areas are not considered significant for this aspect of amphibian breeding. Bullfrogs were heard calling more than once from the Pecks Marina wetland and this constitutes significant amphibian breeding. However, this wetland area is more than 120 m from the proposed work area and therefore there is no significant amphibian breeding in association with the proposed work area.

Marsh Monitoring Results from May 14, and 24, June 9 2020 (AT- American Toad, GR – Grey Tree Frog, SP-Spring Peeper, BU-Bull Frog, GRF-Green Frog, NL- Northern Leopard Frog).

Site	Beaufort Scale	Noise Code	Call Level Code
Pecks Marina	0,0,0	0,1,1 (Traffic noise)	May 14: no calls May 24: SP-1, AT-3, BU-1, NL-1 June 9: BU-2, GRF-2
East Side Kehoe Marine	0,0,0	0,1,1 (Traffic noise)	May 14: no calls May 24: AT-3, GRF-1 June 9: GRF-2
Proposed Work Area	0,0,0	0,1,1 (Traffic noise)	May 14: no calls May 24: no calls June 9: no calls

Habitat for Species of Conservation Concern:

Categories of habitat that support species of conservation concern are listed in MNR (2015) for Site Region 6E. Each of these is discussed below.

Marsh Bird Breeding Habitat: Requires criteria species American Bittern, Virginia Rail, Sora, Common Moorhen, American Coot, Pied-billed Grebe, Marsh Wren, Sedge Wren, Common Loon Sandhill Crane, Green Heron, Trumpeter Swan, Black Tern, and Yellow Rail. These species were not observed during any part of the field work including the 3 avifauna focused surveys.

Woodland Area Sensitive Bird Breeding Habitat: Refers to mature (>60 years old) natural forest (non-plantation) stands 30 ha or greater in size and with at least 10 ha interior habitat assuming 100 m buffer at edge of forest are to be considered for this criterion. There is no woodland with these features associated with the proposed work area.

Open Country Bird Breeding Habitat: Requires grassland habitat 30 ha or larger in size, that is not being actively used for farming. There is no grassland habitat of this size associated with the proposed work area.

Shrub/early Successional Bird Breeding Habitat: Requires >10 ha shrubland or successional fields, which are not present.

Terrestrial Crayfish: These only occur in SW Ontario.

Rare Species*:* Refers to provincially rare (S1 to S3 and SC) species provided by the following information sources and outlined in the following table. Only species observed within 120 m require discussion.

1. NHIC
2. Westport Ecodistrict 6E-10, Henson and Brodribb (2005)
3. Ecological Services work.
4. Other sources (e.g., anecdotal reports, eBirds, research papers etc.).

List of potential rare species that are not endangered or threatened. If seen, they are discussed after the table.				
Species	Preferred Habitat	Good Habitat < 120 m	Source	Seen <120 m
Reptiles				
Stinkpot Turtle (SC)	Open water wetlands with lily pads.	Yes	1,2	No
Map Turtle (SC)	Open water wetlands with lily pads.	Yes	1,3	No
Snapping Turtle (SC)	Wetland	Yes	1,2,3	No
Five-lined Skink (SC)	Rock barrens	No	4	
Birds				
Black Tern (SC)	Colonies in shallow marshes, especially in cattails.	Yes	4	No
Wood Pewee (SC)	Woodlands	No	3	No
Wood Thrush (SC)	Woodlands	No	3	No
Bald Eagle (SC)	Shoreline woodlands	No	3	No
Golden Winged Warbler (SC)	Scrub Habitat	No	4	No
Fish				
Grass Pickerel	Wetland	Yes	4	No
Greater Redhorse S3	Large streams and riffles with clean gravel, sand, or boulders.	No	1	No
Plants				
Fogg's Goosefoot S2	Woodlands and rock barrens	No	2	No
Eastern Mosquito Fern S1/S2	Sheltered wetlands	Yes	2,4	No

Animal Movement Corridors

Site Region 6E, MNR (2015) denotes amphibian movement corridors and deer movement corridors as areas of potential significant wildlife habitat.

Amphibian movement corridors*:* Amphibian movement corridors provide a link between breeding habitat and summer habitat for criteria species and threshold numbers. Corridor significance can only be met if there is associated significant wetland breeding habitat, which is not present.

Deer movement corridors*:* Associated with significant deer wintering habitat (MNR 2012). There are no habitat features on or within the proposed proposed work property that support significant deer winter use and therefore it does not constitute a significant deer movement corridor.

5.5 Fish Habitat

An aquatic macrophyte survey was undertaken on July24, 2020 to assess fish habitat associated with the proposed shoreline A and B work by Kehoe Marine. Surveys were completed using a combination of dock/shoreline observations, boat observations, and underwater observations.

Based on an assessment of aquatic vegetation in and around the proposed A and B work areas, it appears that turbidity, a lack of aquatic macrophytes, and ongoing Kehoe Marine work activity does not provide for good quality fish habitat within these proposed work areas. The best fish habitat in McRae Bay is further east of the proposed Area B.

The Department of Fisheries and Oceans (DFO) did not permit fish sampling for the project due to potential risks to the Pugnose Shiner (THR), as the approximate 50 km of shoreline between Mallorytown and the west end of Howe Island is considered possible Pugnose Shiner habitat. Minnows sp., and pumpkinseed were observed during boat surveys in the east end of McCrae Bay, but no fish were observed near the A and B sites during the surveys.

In their wetland evaluation for the Ivy Lea wetland Atkinson and Huizer (1991) rated the fish habitat in the 4 km long wetland as good, but not exceptional. This conclusion was undertaken in consultation with the Brockville MNRF office (now closed). A high-quality fish habitat comparator given by Atkinson and Huizer (1991) was Landon's Bay, located approximately 4 km to the west of McCrae Bay. Fish observed in the overall Ivy Lea wetland by Atkinson and Huizer (1991) included typical species of the region including smallmouth bass, yellow perch, sunfish, carp, and minnow sp.

The lack of fish observations in and around the A and B sites was not surprising given the heavy use of the shoreline that facilitates Kehoe Marine Construction activities. Aside from direct physical disturbances by the barges themselves, there is often loud maintenance and disruptive loading activity on the barges that could inhibit fish activity. Furthermore, the deeper water depths at Site A and the lack of vegetation at Site B do not provide for favorable fish habitat features for those species that normally inhabit near shore areas or wetlands. Finally, the effects of turbidity and siltation cannot be underestimated. We have observed highly turbid waters at the A and B sites during several of our site visits, and the results of this are evident in the heavy coatings of silt on the associated aquatic plants. The literature on the negative impacts of turbidity and siltation is extensive and this is well summarized in a review article for the Ministry of Natural Resources by Kerr (1995), and reviews by DFO (2001) and STC (2017). Impacts can include decreased primary productivity, physiological changes, feeding impairment, behavioural changes, and egg failure. Accordingly, we rate the bulk of the A and B sites as poor-quality fish habitat, but fish habitat, nevertheless. As a result, we recommend that compensating fish habitat be considered for this project. There are opportunities to create better quality habitat within McCrae Bay, and Josh Van Wieren (Park Ecologist) of St. Lawrence Islands National Park has proposals for Thompson Bay. As with all in-water work, turbidity curtains are recommended to prevent off-site siltation during shoreline upgrade work, and to exclude species from entering the work areas.

The results of the field work are presented below. The sampling sites are presented in Figure 1, and the sampling results are provided in Table 1 and 2.

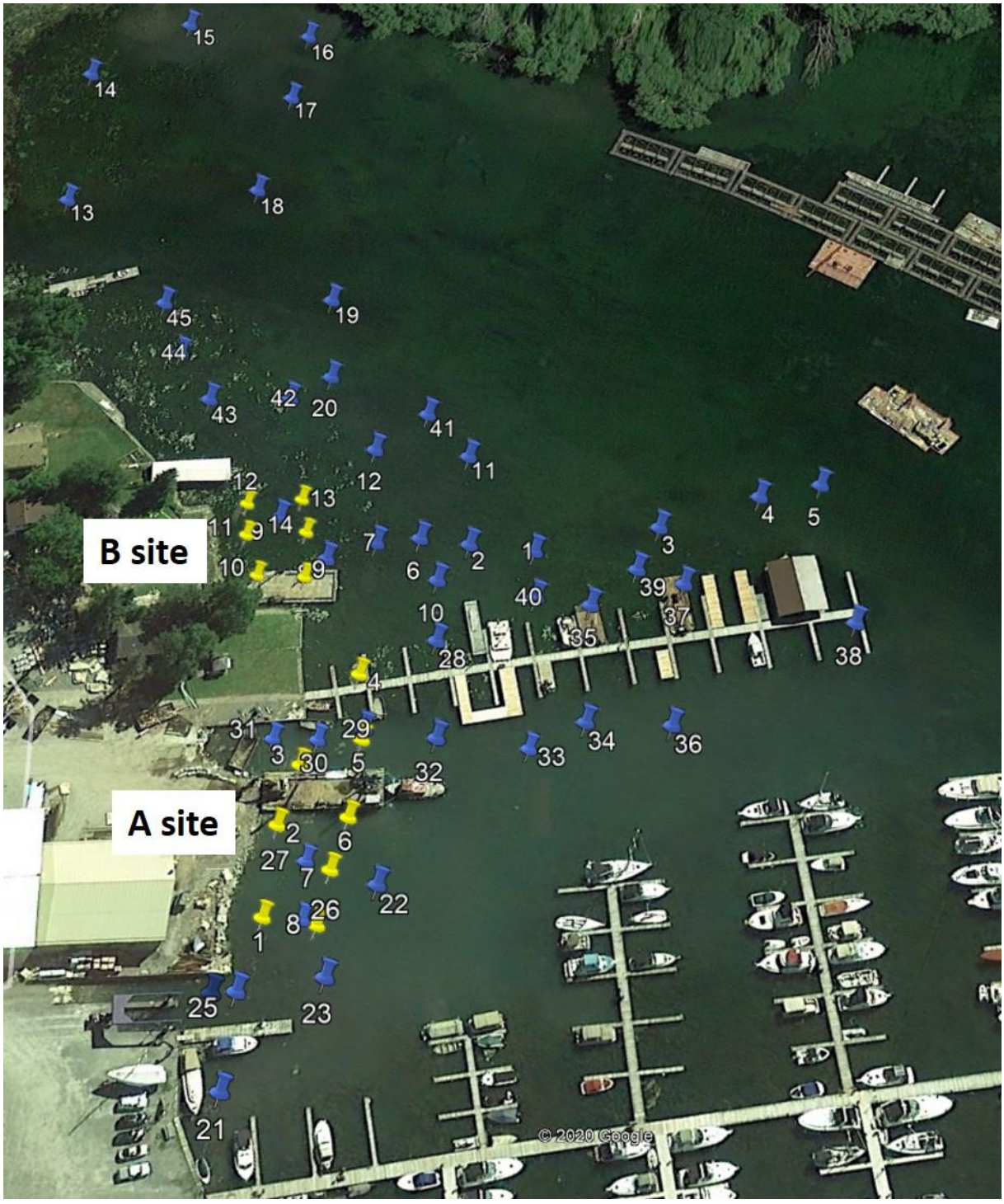


Figure 1. Boat/dock sampling locations are marked with blue push pins, and underwater sampling sites are shown with yellow pins. The dock and barge locations in this Google image are not representative of their locations on July 23, 2020.

Table 1. Sample Plots on the A side of the marina.		
Within Proposed Site A work area. Underwater sample sites are highlighted in yellow.		
Site	**% bottom coverage by submergents**	**Proportional species composition**
1	40%	~ equal mix of eelgrass and milfoil, notable turbidity
2	20%	~ equal mix of eelgrass and milfoil, notable turbidity
3	5%	Vegetation too degraded for ID **(distinct covering of sediment on plants)**
24	90%	20% water lily 90% ~ mix of milfoil/Elodea/eelgrass/pondweed sp./coontail
25	50%	~ equal mix of milfoil/Elodea/ eelgrass/pondweed sp./coontail
30	Too turbid to accurately assess veg coverage (barge/work area)	
31	5%	Much debris and rock rubble. Very turbid. Aquatic macrophytes heavily degraded but Chara and Elodea were evident in about equal numbers.
Within 20 m of Site A. Underwater sample sites are highlighted in yellow.		
4	50% (boat slip)	90% Chara **(distinct covering of sediment on plants)** 10% milfoil/Elodea/pondweed sp.
5	5%	~ sporadic submergents. ID difficult due to sedimentation, turbidty, and plant condition. Eelgrass, Elodea, and Chara are present. **(distinct covering of sediment on plants)**
6	50%	~ equal mix of eelgrass and milfoil, notable turbidity
7	50%	~ equal mix of eelgrass and milfoil, notable turbidity
8	50%	~ equal mix of eelgrass and milfoil, notable turbidity
21	90%	90% milfoil/Elodea/eelgrass, 10% Chara/pondweed sp.
22,23 26,27	Too turbid and deep to accurately assess veg coverage from surface	
24	90%	20% water lily, 90% ~ mix of milfoil/Elodea/eelgrass/pondweed sp./coontail
25	50%	~ equal mix of milfoil/Elodea/eelgrass/pondweed sp./coontail
29	20%	Very turbid, but Elodea and Chara were evident in about equal numbers.
Greater than 20m from A site upgrade work on A side of marina.		
32,33 34,36,	Too turbid to accurately assess veg coverage (barge access route)	
38	90% (boat slip)	90% Chara, 10% milfoil/Elodea/pondweed sp.

Table 2. Sample Plots on the B side of the marina.		
Within Proposed Site B work area. Underwater sample sites are highlighted in yellow.		
Site	**% bottom coverage by macrophytes**	**Proportional species composition**
9	0%	
10	5%	A few scattered macrophytes **(distinct covering of sediment on plants)**
11	5%	A few scattered macrophytes **(distinct covering of sediment on plants)**
12	10%	Diffuse scattered eelgrass, Elodea, and Chara **(distinct covering of sediment on plants)**
13	5%	Diffuse scattered eelgrass, Elodea, and Chara
14	5%	Diffuse scattered of eelgrass, Elodea, and Chara **(distinct covering of sediment on plants)**
8	5%	~ equal mix of Elodea/eelgrass and Chara **(distinct covering of sediment on plants)**
9	5%	~ equal mix of Elodea and Chara **(distinct covering of sediment on plants)**
Within 20 m of Site B. Underwater sample sites are highlighted in yellow.		
7	10% (barge access route)	~ equal mix of Elodea/eelgrass and Chara **(distinct covering of sediment on plants)**
Greater than 20m from B site construction on B side of marina.		
1	100% (barge route)	90% Chara, 10% milfoil/Elodea/pondweed sp.
2	Too turbid to accurately assess veg coverage (barge access route) although Milfoil was present.	
3	50% (barge route)	90% Chara, 10% milfoil/Elodea/pondweed sp.
4,5	Too deep and turbid to accurately assess veg coverage (edge of dock)	
6	20% (barge route)	~ = mix of Elodea/eelgrass and Chara**(distinct covering of sediment on plants)**
10	20% (barge route)	~ equal mix of Elodea/eelgrass and Chara
11	90%	90% Chara, 10% milfoil/Elodea/pondweed sp.
12	100%	90% Chara, 10% milfoil/Elodea/pondweed sp.
13	100%	90% milfoil/Elodea/pondweed sp., 10% Chara, 40% white/yellow water lily
14	100%	90% milfoil/Elodea/pondweed sp., 10% Chara, 40% white/yellow water lily
15	5% (firm bottom)	Chara/Elodea/pondweed sp.
16	5% (firm bottom)	Chara/Elodea/pondweed sp.
17	10% (firm bottom)	Chara/Elodea/pondweed sp.
18	100%	90% Chara, 10% milfoil/Elodea/pondweed sp.
19	100%	90% Chara, 10% milfoil/Elodea/pondweed sp.
20	100%	90% Chara, 10% milfoil/Elodea/pondweed sp.
28	70% (boat slip)	90% Chara, 10% milfoil/Elodea/pondweed sp.
35	80% (boat slip)	90% Chara, 10% milfoil/Elodea/pondweed sp.
37	90% (boat slip)	90% Chara, 10% milfoil/Elodea/pondweed sp.
39	100% (boat slip)	90% Chara, 10% milfoil/Elodea/pondweed sp.
40	90% (boat slip)	90% Chara, 10% milfoil/Elodea/pondweed sp.
41	100%	90% Chara, 10% milfoil/Elodea/pondweed sp.
42	100%	90% Chara, 10% milfoil/Elodea/pondweed sp. 10% white/yellow water lily
43	100%	90% Chara, 10% milfoil/Elodea/pondweed sp. 10% white/yellow water lily
44	100%	~ equal/diffuse mix of milfoil/Elodea/pondweed sp./Chara 30% white/yellow water lily

Data Analysis

Area B: Area B was largely free (~5%) of submergent macrophytes. The nearshore areas contained much metal and wood debris on the bottom (e.g., see I-beam in adjacent image taken at yellow pin 11 of Figure 1).

There was no dominant aquatic macrophyte in the B site. It contains a diffuse cover that varies from 0 to 5% coverage primarily of eelgrass, *Elodea*, and *Chara* that are heavily coated in sediments. This coating may explain the general appearance of low vegetative vigor that was apparent during the underwater work. Research has shown that Chara (see Blindow and Schutte 2007, Guha 1995) and eelgrass (see Doyle and Smart 2001) are negatively impacted by turbidity, and it is logical that plants would be negatively influenced by anything that reduces their photosynthetic ability. Interestingly, the blue green algae did not appear to be negatively impacted, perhaps because their diffuse nature allowed sediment particles to pass through them.

Right Image: One of the sporadic vegetative patches in Area B. In this case, it is algae coated *Elodea* and *Chara*. The image was taken near yellow pin 14 of Figure 1.

Blue green algae were a dominant bottom cover in the proposed Area B work site with a variable bottom coverage of 0 to 60%. Image to the left was taken near yellow pin 9 of Figure 1.

The bottom sediment of Area B is a silty clay that was easily disturbed. We sunk to a depth of about 15 cm. when standing in it. The adjacent image was taken near yellow pin 14 of Figure 1.

Area A: The deeper water depths and marine activity at the A site appear to be significant factors influencing aquatic macrophyte growth.

Immediately offshore where proposed Area A wall construction will take place, there is a steep drop off where the old shoreline wall has failed, leaving behind rock rubble. The adjacent image was taken between yellow pin 1 and 2 of Figure 1.

The deeper waters offshore of Area A were dominated by milfoil and eelgrass, with about a 50% bottom coverage as determined by underwater assessment. It was not possible to estimate bottom coverage from the surface due to water depth and turbidity. The adjacent image was taken near blue pin 27 of Figure 1. Note the poor vigor of the plants, including the silt covering, and chlorosis.

Further west, but still within the proposed Area A construction zone, the aquatic macrophyte coverage and diversity was greater (see Table 1). The bottom sediment of Area A was firmer than that of Area B, and we estimate a soft sediment layer of less than 5 cm on average.

Barge Access Route and Work Area: The work areas and access routes to Area A and Area B are separated by an intervening boat slip dock that extends southward about 110 meters. Within both access routes, aquatic macrophyte coverage starts at near zero close to shore in both A and B sites and increases to a variable range of 50-100% starting about 40 m south from shore. It is assumed that the increasing density of aquatic vegetation further from shore is a result of a decreasing influence of barge and work activity further from shore. There is no clear dominant vegetation type within the access routes, and the species found here can be found throughout McCrae Bay. Aquatic macrophyte vigor appears to increase with distance from shore.

Boat Slips: Aquatic macrophyte coverage increases to a variable range of about 80-100% coverage (primarily *Chara*) further offshore in those areas not influenced by barge activity, namely in and around the dock slips. The aquatic macrophytes in the first 20 m of shore within the boat slips are covered with a coating of silt (see adjacent image taken at yellow pin 4 of Figure 1). Note the lack of vigor in the plants that includes deformed leaves, and chlorosis. Presumably, the siltation is limiting photosynthetic activity. It is also important to note that fish eggs are susceptible to the settling of suspended particles as reviewed by CCME (2002).

Fish Observations: Fish or evidence of fish activity was lacking within about 40 m of the A and B areas during surface and underwater assessment. Fish and evidence of fish activity was observed in association with the Kehoe marine dock slips starting at about 40 m from the A and B areas, as well as in association with the Pecks Marine boat slips. Only Pumpkinseeds could confidently be identified from the surface. No fish were observed during the underwater work, which is unusual as we would at least expect to see Round Gobies.

The best quality fish habitat, and the most fish activity observed occurred further east in the dense submergent macrophyte beds that start about 10 m east of Area B and extend to the end of the bay. The aquatic macrophytes in this part of the bay appear to have good vigor (see adjacent image taken near blue pin 44 in Figure 1). A comparison of the aquatic vegetation in the above two images is informative.

Unvegetated Area: There was a large non-vegetated area (sites 15-17, Figure 1) in the southeast corner of McCrae Bay that does not get boat traffic. The water is clear and about a meter deep, and there is no over shading. The bottom consists of a firmly packed silt/sand substrate.

6. Summary of Statements and Recommendations

Turtle Wintering Areas
It is recommended that an anchored silt curtain be installed along the eastern edge of the B site during the upgrade work. Aside from acting as a siltation barrier, the purpose of this barrier would also be intended to inhibit nearshore turtle movement into the B site.

Fish Habitat
It is recommended that compensating fish habitat be considered for this project. There are opportunities to create better quality habitat within McCrae Bay, and Josh Van Wieren (Park Ecologist) of St. Lawrence Islands National Park has proposals for Thompson Bay. As with all in-water work, turbidity curtains are recommended to prevent off-site siltation during construction, and to exclude species from entering the work areas.

7. References

Aiken, S., P. Newroth, and I. Wile. 1979. The biology of Canadian weeds. 34. *Myriophyllum spicatum*. Canadian Journal of Plant Sciences 59: 201-215.

Aoyama, J., A. Shinoda, S. Sasai, M. J. Miller, and K. Tsukamoto. 2005. First observations of the burrows of Anguilla japonica. Journal of Fish Biology 67:1534–1543. doi:10.1111/j.1095-8649.2005.00860.x

Atkinson, J., and R. Huizer. 1991. Ivy Lea Wetland Complex evaluation. Completed under the 2nd edition of the wetland evaluation manual on behalf of the Kemptville Ministry of Natural Resources.

Blindow I., and M. Schütte. 2007. Elongation and mat formation of *Chara aspera* under different light and salinity conditions. In: Gulati R.D., Lammens E., De Pauw N., Van Donk E. (eds) Shallow Lakes in a Changing World. Developments in Hydrobiology, vol 196.

Burliuk, C.M.M. 2018. Seasonal activity, depth distribution, and microhabitat associations of resident yellow-phase American eels (*Anguilla rostrata*) in the upper St. Lawrence River. M.Sc. thesis, Department of Biology, Queen's University, Kingston, Ontario. 127 pages. (Abstract available, Queen's University. MS in preparation.)

Cadman M. and N. Kopysh. 2001. Ontario Breeding Bird Atlas Guide for Participants. Bird Studies Canada, Environment Canada: Canadian Wildlife Service, Federation of Ontario Naturalists, OFO, Ontario Ministry of Natural Resources.

Casselman, J. Personal communication in 2019. Dr. Casselman is an adjunct professor, Department of Biology, Queen's University, a retired senior scientist with Fisheries Research, Ontario Ministry of Natural Resources, and supervisor of the Lake Ontario Research Unit. He has received numerous awards including the American Fisheries Society Award of Excellence.

Casselman, J.M., and H.H. Harvey. 1975. Selective fish mortality resulting from low winter oxygen. International Association of Theoretical and Applied Limnology Proceedings 19:24-18-2429.

Casselman, J.M., and C.M.M. Burliuk. 2016. Winter habitat of the American eel in Ontario: Good stewards will know! Completion report. Conducted by AFishESci Inc. for, and with financial support provided by, Ontario Species at Risk Stewardship Fund, 4-14-AFishESci2. Ver. II, 209 pages including 8 appendices + 7 stewardship activities and games software programs. (SARO, uncirculated report. MS in preparation.)

Casselman, J.M., and L.A. Marcogliese. 2015. Lake sturgeon (Acipenser fulvescens) of the upper St. Lawrence River – Abundance, distribution, and microhabitat associations, 2011–2014. Conducted by AFishESci Inc. for, and with financial support provided by, Ontario Species at Risk Stewardship Fund, 120-13-AFES2. Second-Year Final Report, April 2015. 72 pages. (SARO, uncirculated report. MS in preparation.)

CCME (Canadian Council of Ministers of the Environment). 2002. Canadian water quality guidelines for the protection of aquatic life: Total particulate matter. In: Canadian water quality guidelines, 1999, Canadian Council of Ministers of the Environment , Winnipeg.

Chaput, G., D.K. Cairns, S. Bastien-Daigle, C. LeBlanc, L. Robichaud, J. Turple, and C. Girard. 2014. Recovery potential assessment for the American Eel (*Anguilla rostrata*) for eastern Canada: mitigation options. Fisheries and Oceans Canada, Canadian Science Advisory Secretariat, Research Document 2013/133. v + 30 pages.

Chaput, G., T.C. Pratt, D.K. Cairns, K.D. Clarke, R.G. Bradford, A. Mathers, G. and Verreault, G. 2014. Recovery potential assessment for the American Eel (*Anguilla rostrata*) for eastern Canada: description and quantification of threats. Fisheries and Oceans Canada, Canadian Science Advisory Secretariat, Research Document 2013/135. vi + 90 p.

Chaput, G., T. Pratt, D. Cairns, K. Clarke, R. Bradford, A. Mathers, and G. Verreault. 2014. Recovery Potential Assessment for the American Eel (Anguilla rostrata) for eastern Canada: description and quantification of threats. DFO Canadian Science Advisory Secretariat Resource.

COSEWIC (Committee on the Committee on the Status of Endangered Wildlife in Canada). 2013. COSEWIC assessment and status report on the Cutlip Minnow *Exoglossum maxillingua*, in Canada. Ottawa, ON: Committee on the Status of Endangered Wildlife in Canada.

COSEWIC (Committee on the Committee on the Status of Endangered Wildlife in Canada). 2013. COSEWIC assessment and status report on the Pugnose Shiner *Notropis anogenus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 32 pp

DFO (Department of Fisheries and Oceans). 2001. DFO Pacific Region Habitat Status Report 2000/01 E.

Doyle R., and R. Smart. 2001. Impacts of Water Column Turbidity on the Survival and Growth of *Vallisneria americana* Winterbuds and Seedlings, Lake and Reservoir Management, 17:1, 17-28

Gleason, Henry A. and Arthur Cronquist. 1991. Manual of the Vascular Plants of Northeastern United States and Adjacent Canada, Second Edition. D. Van Nostrand, N.Y

Guha, P. 1995. Exploring ecological control of Chara. Crop Protection 14: 527-528.

Gray, S., M. Bieber, L. McDonnell, L. Chapman, and N. Mandrak. 2014. Experimental evidence for species-specific response to turbidity in imperilled fishes. Aquatic Conservation: Marine and Freshwater Ecosystems. 24: 546-560.

Gray, S. L. McDonnell, N. Mandrak, and L. Chapman. 2016. Species-specific effects of turbidity on the physiology of imperiled blackline shiners Notropis spp. In the Laurentian Great Lakes. Endangered Species Research 31:271-277.

Henson, B.L. and K.E. Brodribb *2005. Great Lakes Conservation Blueprint for Terrestrial Biodiversity, Volume 2: Ecodistrict Summaries*. Nature Conservancy of Canada.

Heuvel, E., and P. Edwards. 1996. Lake Sturgeon rehabilitation within the Bay of Quinte. Special Report of the Bay of Quinte Remedial Action Plan. 44 pages.

Holm, E. and N.E. Mandrak. 2002. Update COSEWIC status report on pugnose shiner Notropis anogenus. Update status report prepared for the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

Jobin, B., R. Bazin, L. Maynard, A. McConnell and J. Stewart. 2010. National Least Bittern Survey Protocol. Environment Canada, Canadian Wildlife Service. Québec Region. Unpublished report. 26 p.

Jones, J.I., J.F. Murphy, A.L. Collins, D.A. Sear, P.S. Naden, and P.D. Armitage. 2011. The Impact of fine sediment on macro-invertebrates. River Research and Applications. 28(8):1055–1071. https://doi.org/10.1002/rra.1516

Kerr, S.J. 1995. Silt, turbidity and suspended sediments in the aquatic environment: an annotated bibliography and literature review. Ontario Ministry of Natural Resources, Southern Region Science & Technology Transfer Unit Technical Report TR-008. 277 pp.

King, S., D. Osmond, J. Smith, M. Burchell, M. Dukes, R. Evans, S. Knies, and S. Kunickis. 2016. Effects of riparian buffer vegetation and width: a 12 year longitudinal study. Journal of Environmental Quality. 45: 1243-1251.

Kurta, A., C. Schumacher, M. Kurta, and S. Demers. 1999. Roost sites of an eastern pipistrelle during late-summer swarming. Bat Research News 40:8–9.

Law, B., J. Anderson, and M. Chidel. 1998. A bat survey in state forests on the south-west slopes region of New South Wales with suggestions of improvements for future surveys. Australian Zoologist. 30: 467-479.

Lee, H., W. Bakowsky, J. Riley, J. Bowles, M. Puddister, P. Uhlig, and S. McMurray. 1998. Ecological Land Classification for Southern Ontario. Natural Heritage Information Centre.

MacGregor, R., J. Casselman, L. Greig, J. Dettmers, W.A. Allen, L. McDermott, and T. Haxton. 2013. Recovery Strategy for the American Eel (Anguilla rostrata) in Ontario. Ontario Recovery Strategy Series. Prepared for Ontario Ministry of Natural Resources, Peterborough, Ontario. x + 119 pages.

McCusker, M., N. Mandrak, S. Doka, E. Gertzen, J. van Wieren, J. McKenna, D. Carlson, and N. Lovejoy. 2014. Estimating the distribution of the imperiled pugnose shiner (*Notropis anogenus*) in the St. Lawrence River using a habitat model. Journal of Great Lakes Research 40: 980-988.

Meeks, R., and G. Ultsch. 1990. Overwintering behavior of Snapping Turtles. Copeia 3:880-884.

MNR (Ministry of Natural Resources). 1984. A Wetland Evaluation System for Wetlands of Ontario South of the Precambrian Shield. 2nd ed. Wildlife Branch Ontario Ministry of Natural Resources and Canadian Wildlife Service, Environment Canada.

MNR (Ministry of Natural Resources). 2000. Significant Wildlife Habitat Technical Guide. 151 pp. Fish and Wildlife Branch, Technical Section.

MNR (Ministry of Natural Resources 2010. Natural Heritage Reference Manual for Natural Heritage Policies of the Provincial Policy Statement, 2005. Second Edition.

MNR (Ministry of Natural Resources). 2013. Ontario Wetland Evaluation System. Southern Manual, 3rd Ed., Version 3.2.

MNRF (Ministry of Natural Resources and Forestry). 2018. Natural heritage information request guide. Regional Operations Division.

MNR (Ontario Ministry of Natural Resources). 2015. Significant Wildlife Habitat Ecoregion 6E Criterion Schedule. Draft.

MNRF (Ministry of Natural Resources and Forestry). 2015. Survey Protocol for Blanding's Turtle (*Emydoidea blandingii*) in Ontario. Species Conservation Policy Branch. Peterborough, Ontario. ii + 16 pp.

Newton, E.J., and T. Herman. 2009. Habitat, movements, and behaviour of overwintering Blanding's turtles (*Emydoidea blandingii*) in Nova Scotia. Canadian Journal of Zoology 87: 299–309.

Obbard, M, and R. Brooks. 1981. Nesting migrations of the Snapping Turtle (*Chelydra serpentina*). Herpetologica 36:158-162.

Picard, G., M. Carriere, and G. Blouin-Demers. 2011. Common Musk Turtles (*Sternotherus odoratus*) select habitats of high thermal quality at the northern extreme of their range. Amphibia-Reptilia 32: 83-92.

Pluto, T., and E. Bellis. 1988. Seasonal and annual movements of riverine Map Turtles, *Graptemys geographica*. Journal of Herpetology 22: 152-58.

Pratt, T.C., R.G. Bradford, D.K. Cairns, M. Castonguay, G. Chaput, K.D. Clarke, and A. Mathers. 2014. Recovery potential assessment for the American Eel (*Anguilla rostrata*) in eastern Canada: functional description of habitat. Fisheries and Oceans Canada, Canadian Science Advisory Secretariat, Research Document 2013/132. v + 49 pages.

Ritchie, J.C. 1972. Sediment, fish and fish habitat. Journal of Soil and Water Conservation 27(3):124–125.

Rowe, J., G. Lehr, P. McCarthy, M. McCarthy, and P. Converse. 2009. Activity movements and activity area size in Stinkpot Turtles (*Sternotherus odoratus*) in a Southwestern Michigan Lake. The American Midland Naturalist, 162: 266-275.

Rowe, J., and E. Moll. 1991. A radiotelemetric study of activity and movements of the Blanding's turtle (*Emydoidea blandingi*) in northeastern Illinois Journal of Herpetology, Vol. 25, No. 2, pp. 178-185.

Rowe, J., and S. Dalgarn. 2010. Home range size and daily movements of Midland Painted Turtles (*Chrysemys picta marginata*) in relation to body size, sex, and weather patterns. Herpetological Conservation and Biology 5: 461-473.

Schummer, M., J. Palframan, E. McNaughton, T. Barney, and S. Petrie. 2012. Comparisons of bird, aquatic macroinvertebrate, and plant communities among dredged ponds and natural wetland habitats at Long Point, Lake Erie, Ontario. Wetlands 32:945-953.

Scott, W., and E. Crossman. 1973. Freshwater fishes of Canada. Bulletin 184. Fisheries Research Board of Canada, Ottawa.

Seilheimer, T.S. and P. Chow-Fraser. 2006. Proposed work and use of the Wetland Fish Index to assess the quality of coastal wetlands in the Laurentian Great Lakes. Canadian Journal of Fish and Aquatic Sciences. 63:354-366.

Smith, C. and J. Barko. 1990. Ecology of Eurasian watermilfoil. Journal of Aquatic Plant Management 28: 55-64.

Snider, J., and M. Linck. 2011. Habitat use and movement patters of Blanding's Turtles (*Emydoidea blandingii*) in Minnesota, USA: A landscape approach to species conservation. Herpetological Conservation and Biology 7:185-195.

Spicer, K., and P. Catling. 1988. The biology of Canadian weeds. 88. *Elodea canadensis*. Canadian Journal of Plant Science. 68: 1035-1051.

STC (Salmon and Trout Conservation). 2017. The impact of excess fine sediment on invertebrates and fish in riverine systems. Literature Review.

Tomie, J.P.N., D.K. Cairns, and S.C. Courtenay. 2013. How American eels *Anguilla rostrata* construct and respire in burrows. Aquatic Biology 19:287–296.

TRCA (Toronto and Region Conservation Authority). 2011. Wetland Amphibian Monitoring Protocol - Terrestrial Long-term Fixed Plot Monitoring Program – Regional Watershed Monitoring and Reporting.

Trebitz, A., J. Brazner, V. Brady, R. Axler, and D. Tanner. 2007. Turbidity tolerances of Great Lakes coastal wetland fishes. 27:619-633.