Biodiversity and Water Quality Indicators of Putative Beneficial Use Impairments in Wetlands of the Massena (New York) Area of Concern

Final Report

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Executive Summary

This report provides the results of a study to address two Beneficial Use Impairments (BUIs): “Loss of fish and wildlife habitat” and “Degradation of fish and wildlife populations” in the St. Lawrence River Area of Concern (AOC) at Massena, NY.

In the Stage I and Stage II of the Remedial Action Plan (RAP) and subsequent updates, the status of the “Loss of fish and wildlife habitat” BUI was listed as “Impaired” due to the physical disturbance caused by the dam and shipping seaway and chemical contamination of the water and sediments. The status of the “Degradation of fish and wildlife populations” BUI was listed as “Likely-impaired” due to its direct association with impaired habitats. Both BUIs have been addressed through various actions promoted by the RAP such as removal of contaminated sediments, remediation of industrial sites, monitoring of fish and wildlife populations, and habitat improvement projects. However there is still a lack of information as to whether habitats in the AOC, especially habitats directly associated with the rivers, can support healthy and diverse wildlife populations comparable to habitats outside the AOC and whether environmental mitigation projects have been successful enough to restore the beneficial uses.

The objective of our study was to evaluate the current state the two above described BUIs by surveying biological indicators of wetland quality and water quality indicators within a representative sample of wetlands in the Massena AOC and a comparable set of reference wetlands form outside the AOC. Our data are intended to address information needs for evaluating whether specific RAP delisting criteria have been met and thus justifying the eventual delisting of the two BUIs, or else indicating that further mitigation is needed.

We assessed five biotic indicators and fourteen water quality indicators during the summer of 2012 and spring of 2013. We also evaluated 9 landscape variables. Out of the 26 biotic metrics and 30 water quality metrics assessed, only 10 were found to be significantly different between the two study areas. Most significantly, we found that reference wetlands outside the AOC are larger, are surrounded by a higher percentage of woody wetlands, and support higher fish abundance, while wetlands in the Massena AOC are covered by a higher percentage of invasive plant species.

We conclude that overall, there remain wetland habitats in the Massena AOC that support a diversity of wetland-associated animal and plant species, as well as good water quality. However certain management actions can ensure that these habitats continue to provide essential ecosystem functions. We suggest that wetlands in the Massena AOC be enhanced and maintained through the removal of invasive plants species and creation of vegetative buffers. Additionally, based on the success of the local ALCOA wetland restoration, we suggest efforts to increase wetland area both in the Massena AOC and greater watershed. Finally, long-term wildlife and habitat monitoring programs can provide the most comprehensive information on the state of the ecological resources in the AOC.

Introduction

The Northeast Lake Ontario-St. Lawrence River Basin is the second largest in New York State, and one of the most important waterways in North America. Thanks to the benefits provided by this large water system, the river and adjacent valley have been used by humans for at least 10,000 years (Thompson et al. 2002). Over the past 50 years, the natural wetlands, and associated wildlife communities along the international section of the St. Lawrence River have been impacted by major habitat alteration and industrial pollution that occurred as a consequence of the St. Lawrence Seaway Project, Moses-Saunders Power Project, and industrial development. Major industrial dischargers along the St. Lawrence River in New York included: the Aluminum Company of America (ALCOA), Reynolds Metal Company (now ALCOA), and a General Motors (GM) Facility (now closed). In 1987 the Great Lakes Water Quality Agreement identified the sector of the St. Lawrence River near Cornwall Ontario, Massena New York, and the Mohawk Territory of Akwesasne as an environmental area of concern (AOC) based on high levels of PCBs in the waters and sediments of the St. Lawrence River and local tributaries (NYSDEC 1990). The St. Lawrence AOC is one of the six currently-listed AOCs in New York State. It is also one of five bi-national AOC's consisting of Massena AOC in New York and Cornwall AOC in Ontario, Canada.

The aquatic, shore, and wetland habitats in Massena have been identified as important spawning areas for warm water fish; wintering, nesting, and feeding habitat for waterfowl; and significant habitat for many other species including the threatened Blanding's Turtle *Emydoidea blandingii* (NYSDEC 1990). Wetlands are an essential connection between aquatic and terrestrial environments and as a result serve important ecological functions. Because wetlands slow down water, retain nutrients, and are either permanently or semi-permanently inundated by water, they provide habitat to a great diversity of species. Reptiles and amphibians require the semi-aquatic state of wetlands as part of their life cycle. Fish use wetlands as spawning, feeding, and sheltering areas. Migratory birds, waterfowl, raptors, and passerines use wetlands as feeding and nesting grounds. Wetlands also provide other essential ecological and economic ecosystem services such as flood protection, nutrient and pollution attenuation, groundwater recharge, and commercial fish and crustacean nursery habitat (Mitsch and Gosselink 2007; Lewis 2001; Van der Valk 2012).

Wetland loss and impairment as a result of human activities is a common thread in the natural resource histories of most states (Dahl 1990, Dahl 2011). New York State is estimated to have lost approximately 60% of its wetlands since the late 18th century. Although both federal and state regulations currently protect wetlands from direct destruction and loss, historical impacts and present land use practices still affect the structure and function of these habitats. At the Massena AOC, the dredging, water level changes, and lock operations ensuing from the construction of the St. Lawrence Seaway and Moses-Saunders Power Project resulted in unfavorable habitat for macrophytic aquatic plant growth and associated wetland development (NYSDEC 1990). These habitat changes may have played an important role in structuring aquatic and terrestrial wildlife communities.

Since the designation of the St. Lawrence AOC, Remedial Action Plans (RAPs) have been implemented for both Massena and Cornwall. Each RAP addresses the remediation of fifteen designated and previously evaluated beneficial uses. At the Massena AOC, three of the

fifteen beneficial uses are identified as impaired and five are subject to further review. One listed Beneficial Use Impairment (BUI) (Loss of fish and wildlife habitat) and one potential BUI (Degradation of fish and wildlife populations) are directly related to wetland habitat degradation. The habitat BUI is directly associated with the physical disturbances caused by the seaway and power construction projects. The wildlife population BUI is linked to the loss and degradation of habitat as well as to contamination by PCBs, DDE, and mercury (NYSDEC 2006).

In recent years, various environmental restoration and remediation projects have been implemented in the Massena and Cornwall sectors of the AOC. The United States Environmental Protection Agency (USEPA) required remediation actions at each of the three industrial facilities as well as for contaminated river sediments, to primarily address the release and persistence of PCBs. To date, a majority of the remediation actions have been completed. Various Habitat Improvement Projects (HIPs) funded by the FERC-relicensing agreement (2003) with the New York Power Authority (NYPA) have also been completed. Some of these include restoration of spawning beds, water level management structures, and bird nesting programs. Additionally, land use and nonpoint source pollution management actions, including improved wastewater treatment systems and regulation of Concentrated Animal Feeding Operations (CAFOs), have been implemented in Massena. For many years NYSDEC and various other agencies have been monitoring wildlife populations and aquatic habitats in the Massena AOC and neighboring locations. However, there is a recognized information gap for wetland habitats.

The objective of our study was to evaluate the current state of one listed BUI (Loss of fish and wildlife habitat) and one potential BUI (Degradation of fish and wildlife populations) by surveying biological indicators of wetland quality and water quality indicators within a representative sample of wetlands in the Massena AOC and a comparable set of reference wetlands form outside nearby the AOC. We attempted to address our objectives by:

- Surveying the species diversity of wetland-associated bird species.
- Surveying abundance and species diversity of anuran (frog and toad) species.
- Surveying the abundance and taxonomic diversity of macroinvertebrates.
- Surveying the abundance and taxonomic diversity of small fish.
- Surveying the abundance and species diversity of submerged, riparian and upland vegetation.
- Analyzing water samples for water quality parameters including pH, alkalinity, chlorophyll-a, turbidity, CDOM, total phosphorus, nitrate, silicate, temperature, conductivity and phytoplankton community composition.
- Performing statistical analyses to determine if the ecological indicator taxonomic diversity and abundance in the Massena AOC differ from reference wetlands.
- Performing statistical and GIS analyses to deduce associations between landscape and land use components and ecological indicators.

This biological assessment of the quality of wetland habitats in the AOC will (1) aid in understanding the state of fish and wildlife populations that may have been impacted by physical alterations as well as water and sediment contamination, (2) be an indicator of the success of various completed HIPs, (3) contribute to the existing knowledge about the area's ecological resources. Our data are specifically intended to address and supplement information

needs for evaluating whether specific RAP endpoints have been achieved (as specified in the 2001 *Restoring United States Areas of Concern: Delisting Principles & Guidelines*). The information provided by this study can be used to help evaluate whether the St. Lawrence River at Massena AOC BUIs warrant delisting, or else indicate whether further mitigation and HIPs are needed to meet delisting criteria.

Methods

The study area is located in St. Lawrence County, NY in the towns of Massena and Louisville. Both towns are located on the shore of the St. Lawrence River and together encompass approximately 310 km^2. The land cover of the area is dominated by a mix of deciduous and evergreen forest. The town of Massena has a significantly larger proportion of developed land cover (15%) than Louisville (4%). Both towns have equal proportions of agricultural land cover (11%). The predominant body of water in the area is the St. Lawrence River, which receives local tributary inputs from the Raquette River, St. Regis River and Grasse River. Woody and emergent wetlands make up approximately 18% of the total landscape.

Seventeen wetlands were selected within the study area in the Massena AOC and ten reference sites were selected from outside of the AOC in Louisville, NY (Figure 1, Table 1). We chose the town of Louisville as a reference location because of its proximity to the Massena AOC, thus ensuring a similar geological, climatic, and ecological setting. Louisville, like Massena, is located along the St. Lawrence River but its upstream and prevailing upwind location makes it unlikely that habitats in this area were influenced by the contamination associated with the AOC. Wetlands in both towns, as are all river sites, are expected to be affected by the water level fluctuations associated with historical modification of the river channel.

We attempted to include a fully representative range of wetland sizes, disturbance and mitigation histories, and surrounding land uses. Due to extensive shoreline development, we did not identify any accessible wetland sites along the Grasse or Raquette rivers. Due to access issues, we did not include wetlands located in St. Regis Mohawk territory at Akwesasne or on islands on the St. Lawrence River. Wetlands were located using New York State Department of Conservation regulatory freshwater wetland maps, U.S. Fish and Wildlife Service National Wetland Inventory maps, USGS National Land Cover Database raster file, and digital orthoimagery (aerial photos). Site selection was finalized based on site visits. Sites were selected based on one of four wetland types (Table 1), distance from the St. Lawrence River, and accessibility. Preference was given to sites located directly on or closest to the St. Lawrence River (Figure 1). Wetland types surveyed included emergent wetlands, shrub/scrub wetlands, and woody wetlands (Table 1).

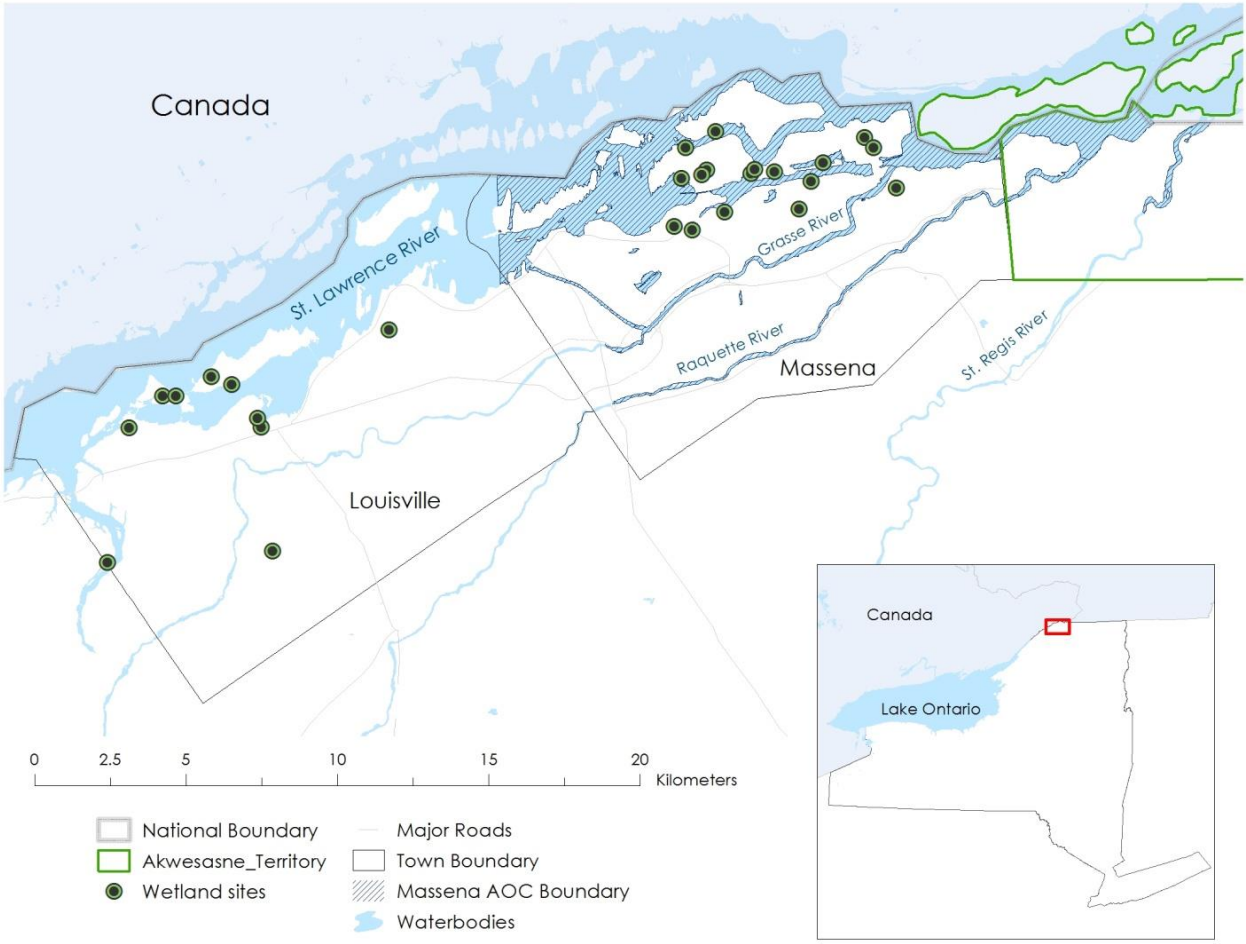


Figure 1: All sampled wetland site locations in both Massena AOC and reference Louisville.

Table 1: Location, type, and geographic coordinates for all wetland study sites. Wetlands were assigned a unique ID where; MAW = Massena wetland, LOW = Louisville wetland, 12 = year reference, XX = wetland number. Specific coordinates are for the locations of bird survey points along the wetland edge. Wetland classes are based on the classification by Cowardin and others (1979). UTM units are based on NAD1983 zone 18N.

Wetland ID	Wetland Location	Wetland Area (ha)	Wetland Class	UTM E	UTM N
MAW12-01	Massena AOC	11.75	Palustrine Forested	518200	4980782
MAW12-02	Massena AOC	0.40	Palustrine Forested	511087	4981098
MAW12-03	Massena AOC	4.63	Palustrine Emergent	513519	4981409
MAW12-04	Massena AOC	0.49	Palustrine Emergent	512514	4980000
MAW12-05	Massena AOC	0.37	Palustrine Emergent	513386	4981252
MAW12-06	Massena AOC	2.74	Palustrine Emergent	515380	4980995
MAW12-07	Massena AOC	3.19	Palustrine Shrub	510849	4979521

Wetland ID	Wetland Location	Wetland Area (ha)	Wetland Class	UTM E	UTM N
MAW12-08	Massena AOC	3.71	Palustrine Emergent	511443	4979389
MAW12-09	Massena AOC	0.37	Palustrine Emergent	511232	4982120
MAW12-10	Massena AOC	0.22	Palustrine Emergent	512218	4982660
MAW12-11	Massena AOC	0.28	Palustrine Emergent	514169	4981315
MAW12-12	Massena AOC	2.11	Palustrine Shrub	517439	4982125
MAW12-13	Massena AOC	2.64	Palustrine Emergent	515769	4981614
MAW12-14	Massena AOC	0.22	Palustrine Emergent	517137	4982455
MAW12-15	Massena AOC	0.63	Palustrine Forested	511914	4981383
MAW12-16	Massena AOC	1.67	Palustrine Emergent	511770	4981229
MAW12-17	Massena AOC	0.38	Palustrine Emergent	514978	4980088
LOW12-01	Louisville	1.26	Palustrine Emergent	497087	4973181
LOW12-02	Louisville	3.48	Palustrine Emergent	496236	4974303
LOW12-03	Louisville	0.45	Palustrine Emergent	495557	4974556
LOW12-04	Louisville	21.74	Palustrine Emergent	492831	4972865
LOW12-05	Louisville	6.24	Palustrine Emergent	492127	4968415
LOW12-06	Louisville	15.27	Palustrine Emergent	497574	4968795
LOW12-07	Louisville	0.63	Palustrine Emergent	497196	4972882
LOW12-08	Louisville	38.86	Palustrine Emergent	494387	4973925
LOW12-09	Louisville	2.41	Palustrine Forested	493941	4973924
LOW12-10	Louisville	104.61	Palustrine Forested	501420	4976106

Table 2: Data collection schedule for the 2012/2013 seasons.

Task	Date
Site surveys	7-11 May, 2012
Bird surveys	24-31 May, 14-21 June, 28 June - 6 July, 2012
Anuran surveys	29-31 May, 20-22 June, 2012, 23-26 April, 2013
Macroinvertebrate surveys	5-8 and 25-28 June, 10-13 July, 2012
Water sample collection and analysis	17-24 July, 2012, 7-8and 14-17 May, 2013
Fish surveys	25 July - 16 August, 2012
Plant surveys	7-16 August, 2012

Bird point count and callback surveys

Bird surveys were completed on three different occasions in the spring and summer of 2012. Survey times were scheduled to overlap peak bird breeding periods. Surveys were conducted on May 24-30, June 18-22, and June 28-July 3 (Table 2). Each wetland was surveyed one time during a survey period during the two hours after sunrise. Both study and reference sites were

surveyed each day. The order of survey sites was kept constant across all three survey periods. Survey points in each wetland were generally located on the open water-emergent vegetation interface. Monitoring techniques were based on the Standardized North American Marsh Bird Monitoring Protocol and other survey protocols (Conway, 2011; Matthew, 2006; Bibby, et al. 2000). Marsh-nesting birds, including Species of Greatest Conservation Need, and other birds were surveyed at each wetland via single 10-minute, 100 m radius point counts. Cryptic Marsh-nesting birds (Sora, American Coot, Virginia Rail, Marsh Wren, Sedge Wren, Common Moorhen, American Bittern, Least Bittern, King Rail, Yellow Rail, Pied-billed Grebe) were also surveyed via playbacks of vocalizations during the same site visits. The broadcast sequence included 30 seconds of calls of each of the ten focal marsh bird species followed with 30 seconds of silence. The entire broadcast was followed with a final 5 minute listening and point count period.

Bird assemblage metrics measured included species richness of all birds and exclusively waterbirds. Bird species richness was defined as the sum of all unique species detected within the 100 m radius across all three survey periods in each wetland. Waterbirds are defined as those listed as obligate or facultative wetland species by Brooks and Croonquist (1990). SGCN are those species identified by the New York State Comprehensive Wildlife Conservation Strategy – State Wildlife Action Plan (NYSDEC 2005).

Anuran call surveys

Nighttime anuran calling surveys were conducted on three different occasions in the spring and summer of 2012 and in the early spring of 2013. Survey times were scheduled to overlap peak anuran breeding periods coinciding with three air temperature ranges (5-9°C, 10-16°C, and >16 °C). Surveys were conducted on 29-31 May 2012, 20-22 June 2012, and 23-26 April 2013 (Table 2). Both study and reference sites were surveyed each day. The order of survey sites was kept constant across the three survey periods. Survey points in each wetland were located in the same areas as bird monitoring survey points, on the open water-emergent vegetation interface. Monitoring techniques were based on those described by Heyer et al. (1994) and the Marsh Monitoring Program (2009). Each wetland was surveyed one time during a survey period between 9:00 -11:00 pm. Anurans at each site were surveyed by active listening to species calls for 3 minutes following a 2 minute quiet period. Frogs were identified to species based on their vocalizations. Additionally, the intensity of frog chorusing effort was estimated on a three point scale (1-3). A higher code indicated greater numbers of calling individuals, and thus served as an estimate of the relative abundance of chorusing males. Anuran assemblage metrics included species richness (cumulative number of species detected) and an index of relative abundance calculated by summing the highest recorded call code per species across all surveys per site.

Macroinvertebrate survey

Macroinvertebrates were surveyed using two techniques: a quadrat sampling method for gastropods and an artificial substrate method (Hester-Dendy samplers) for benthic macroinvertebrates. Each wetland was surveyed one time using each technique and both study and reference sites were surveyed each day. Monitoring techniques for both gastropods and macroinvertebrates were adapted from various protocols including the USEPA (1990) *Macroinvertebrate Field and Laboratory Methods for Evaluating the Biological Integrity of*

Surface Waters. Gastropod surveys were conducted on 25, 26 and 28 June, 2012 (Table 2). Gastropods were sampled using $1m^2$ quadrats. One quadrat was placed along the land-water interface of each wetland, and all gastropods inside the quadrat were collected using a dip net or hand collection and counted and identified down to the lowest taxonomic level.

Benthic macroinvertebrate collection devices were deployed on 5-8 June, 2012 and collected on 20-13 July, 2012. Benthic macroinvertebrates were surveyed using a multi plate artificial substrate sampler (Hester-Dendy). The samplers consisted of fourteen round tempered hardboard plates with a 7.6 cm diameter. The plates are separated by spacers at decreasing space intervals. The total sampler exposes approximately 1,160 cm^2 of surface area (USEPA 1990). Each wetland was sampled using two Hester-Dendy samplers placed in the euphotic zone (approximately 1 m depth). The location of each sampler varied between wetlands and was designed to encompass maximum habitat variety. Each sampler was attached to a wire or bamboo stand. The stand was pressed into the wetland substrate so that the sampler could be submerged at least 30 cm below the water surface. Samplers were left in each wetland for 6 weeks. Samplers were removed from each wetland by lifting them out of the water and placing them in polyethylene bags. Samplers were transported back to the laboratory in a cooler. In the laboratory, each sampler was disassembled by taking apart each plate and spacer. The plates, spacers, and bolts were scraped gently with brushes to remove all colonizing organisms. Macroinvertebrates scraped from the samplers were identified to the lowest taxonomic level, and counted. Only 20 out of 27 sites were sampled for benthic macroinvertebrates due to low or absent water levels in some sites. Out of the 20 sampled sites, 10 were affected by seasonal drought and drastically lowered water levels, loss of samplers, or falling over of samplers. Macroinvertebrate metrics measured included species richness, abundance, and Shannon-Wiener Index of diversity.

Small fish survey

Fish surveys were conducted from 25 July to 16 August, 2012 (Table 2). Each wetland was sampled once. Small fish were surveyed using baited funnel traps. The trap dimensions were approximately 40 cm in length, 23 cm in diameter at the middle, 19 cm in diameter at the ends, and a 3 cm diameter entry opening. Three funnel traps, baited with cat food pellets in perforated plastic containers, were placed in the littoral zone of each wetland at approximately 1 m depth. Traps were placed amid submerged macrophytes along the perimeter of the wetland. Traps were left in each wetland for 4 nights totaling 12 trap nights per wetland. Each trap was checked daily. Fish were temporarily held in a bucket, identified down to species using Werner (2004) *Freshwater Fishes of the Northeastern United States* (2004), and counted. Due to low or absent water levels, only 19 out of 27 sites were sampled for fish. Fish assemblage metrics measured included species richness, abundance, and the Shannon-Wiener Index of diversity. Metrics were calculated by combining all individuals caught within a site over the sampling period.

Plant survey

Submerged, emergent, and upland herbaceous wetland vegetation was surveyed on one occasion from 7-16 August, 2012 (Table 2) using a transect-plot method. Three transect locations were selected at the water's edge. The first transect was located at the vantage point used for bird and anuran surveys. Transects two and three were located at 50 m intervals away

from the first transect. One meter squared quadrats were placed at three elevations (+20 cm, 0 cm, -20 cm) along each of the three transect. The 0 cm elevation was estimated by observing field indicators of the maximum spring water level line (U.S. Army Corps of Engineers 1987). At each elevation level, quadrats were tossed arbitrarily to the left of the surveyor. At each plot, all present plants were identified down to the lowest taxonomic level and percent cover was recorded for each plant taxon. If field identification was not possible, specimens were bagged and identified in the laboratory. Plant identifications were confirmed by regional botanist Anne Johnson.

Vegetation assemblage metrics calculated per quadrat included species richness, percent cover of each species, the Shannon-Wiener Index of diversity, and the species richness and coverage of invasive species. Species richness was calculated by summing the number of plant species per quadrat. The Shannon-Wiener Index of diversity was calculated using the relative cover of each plant species, rather than the number of individuals. Species were categorized as invasive based on information from the USDA Plants Database (USDA 2013).

Water quality analysis

Water sampling and analysis was conducted on two occasions to capture the seasonal variability in water quality. Sampling was conducted from 17-24 July, 2012 and again on 7-8 and 14-17 May, 2013 (Table 2). Water samples from each wetland were collected using clean sampling techniques modeled after USDA's *Field Guide for Surface Water Sample and Data Collection* (Turk and Dipper 2001) and other protocols. Each wetland was sampled in two locations using 1-L acid washed polyethylene bottles. For every 10 samples, a field duplicate was collected. At each site, the sample collector waded in to approximately 1 m depth and collected a sample from the middle of the water column. Collected water samples were transported back to the laboratory in a cooler to maintain the approximate temperature of the water. In situ measurements of specific conductivity and temperature were made using a multi-sensor probe (YSI Model 600XL). Due to low or absent water levels, water samples were collected for only 20 out of 27 wetlands in the summer of 2012 (44 samples), and only 23 out of 27 wetlands in the spring of 2013 (50 samples). Water samples were returned to the laboratory and processed on the same day. Chlorophyll-a, total phosphorus, dissolved (<0.2 µm) silicate, and nitrate samples were stored in a refrigerator (at 4°C) and analyzed several days after collection. All water quality measurements were averaged for the two samples collected from each wetland.

Total Chlorophyll-a

Total Chlorophyll-a concentrations were measured by filtering 25 ml of water onto 0.2-µm pore-sized polycarbonate filters. Samples were filtered in triplicate. Filters were stored at 4º C in the dark for 24-72 hours before extraction. Chlorophyll-a, from phytoplankton retained on the filters, was extracted in 10 ml of 90% acetone at 4º C in the dark for 8 to 24 hours. Extracted Chlorophyll-a concentrations were determined fluorimetrically using the Welschemeyer (1994) technique with a calibrated fluorimeter (TD-700, Turner Designs).

Phytoplankton

Phytoplankton composition was characterized using a FluoroProbe (bbe Moldaenke, GmbH), a submersible fluorimeter that is able to assess phytoplankton communities through the measure of photosynthetic pigment fluorescence. The FluoroProbe was used in the laboratory to analyze

25 ml water samples. The output is the concentration of chlorophyll-a partitioned among four categories of phytoplankton; Chlorophyta & Euglenophyta (green algae), Phycocyanin-rich Cyanobacteria (PC-rich cyanobacteria), Heterokontophyta & Dinophyta (diatoms and dinoflagellates), and Phycoerythrin-rich Cyanobacteria & Cryptophyta (cryptophyta and PE-rich cyanobacteria). The FluoroProbe was corrected for dissolved yellow substances using filtered (0.2-µm syringe filters) from each individual water sample. The FluoroProbe was programmed to measure continuously every second for a total of approximately 120 measurements. The measurements for each phytoplankton class were averaged for the mean class concentration.

CDOM

Water, filtered through a 0.2-µm pore-sized syringe filter was analyzed for CDOM content using a flow-through quartz cell in a fluorimeter (10-AU; Turner Designs). The fluorimeter was calibrated using Suwanee River fulvic acid (IHSS, St. Paul, MN) and CDOM is expressed as mg/L of equivalent fulvic acid.

Total Phosphorus

Duplicates of 35 ml of unfiltered water samples and standards were oxidized using a fresh solution of 0.7% potassium persulfate and autoclaved for 10 minutes at 121 °C. Standards (0, 100, 200, 500, 1,000, and 2,000 nM) were prepared using a 10,000 nM P stock solution and standards (4,000, 8,000, and 16,000 nM) were prepared using a 1.005 mM P stock solution. Standard intervals were obtained from literature. Phosphorus concentrations were determined using colorimetric analysis (Wetzel and Likens, 2000). Absorbance at 885 nm in a spectrophotometer (Genesys 20, Thermo Scientific) was measured using a 5 cm pathlength cuvette.

Dissolved Silica (SiO_2)

Duplicates of 2 ml water samples were filtered through a 0.2-µm pore-sized syringe filter and treated with 0.25N HCl, 5% ammonium molybdate, 1% disodium EDTA, and 17% sodium sulfite (Wetzel & Likens 2000). Silica standards (0, 2.5, 5, 10, 15 and 20 nM) and samples were prepared using a 50mg/L SiO_2 stock solution. Absorbance of samples was determined at 700 nm in a spectrophotometer (Genesys 20, Thermo Scientific) using a 5 cm pathlength cuvette.

Turbidity

Turbidity was determined by analyzing a sample of unfiltered water by light spectroscopy using a spectrophotometer (Genesys 20, Thermo Scientific) in a 5 cm path-length cuvette at 550 nm wavelength.

Nitrate (NO_3^-), Chloride (Cl^-), and Sulfate (SO_4^{2-})

30 ml samples filtered through a 0.2-µm pore-sized syringe filter were analyzed for nitrate, chloride, and sulfate by ion chromatography (CARES analytical laboratory, Clarkson University). In 2012 samples were analyzed in duplicate for nitrate only; in 2013 samples were analyzed only once and for all three anions.

Alkalinity and pH

Alkalinity and pH were measured in the laboratory using a Mettler Toledo S220 SevenCompact™ pH/Ion meter. A pH reading for each sample was made prior to proceeding with alkalinity analysis. Alkalinity was measured using the Gran titration method by adding known concentrations (25-150 µL) of 0.1 M hydrochloric acid (HCl) to 50 ml of unfiltered sample

water. Each sample was titrated beyond the equivalence point (pH 3.5). pH values were read and acid was added at 30 second intervals. The alkalinity and concentration of calcium carbonate (CaCO3) were then extrapolated using the Gran function. For the 2012 samples, 16 out of 44 samples were excluded from alkalinity analysis due to laboratory error. For the 2013 samples, only a single sample per wetland was analyzed for alkalinity.

Data Analysis

Indicator metrics were compared between the AOC and reference wetlands using a two-sample t-test, assuming equal variances and normal distribution, to determine if wetland use patterns were similar between the two areas. Non-parametric Welch's test and Mann-Whitney test were used for metrics that did not meet normality assumptions. We used Bartlett's test to confirm homogeneity of variance, and Anderson-Darling test to detect deviations from normality. We report means ± SD in the text. All statistical tests were assessed at $\alpha = 0.05$. Statistical analyses were completed using SigmaPlot 11.0 (Systat Software, San Jose, CA) and R version 2.15.1 (R Core Team 2012).

Geographic Information System (GIS) analysis (ArcGIS 10.1) was used to determine if the landscape variables in the area surrounding the study sites had an effect on the diversity or abundance of indicators, as well as the water quality parameters. Wetland sites were digitized into polygons by outlining the wetland boundary using high resolution orthoimages. A buffer of 1,000 meters was delineated around the centroid of each wetland polygon. The 2006 USGS National Land Cover Database (30-m raster) was used to calculate the proportion of each land cover type within the buffer. Some very similar land cover types were grouped together. Additionally, road density (km/km^2), wetland area (hectares), and distance to nearest wetland (meters) were calculated for each wetland site/buffer. Each landscape variable was then plotted against each indicator and water quality metric to assess their degree of correlation. Pearson's and Spearman's rank correlation analysis were then conducted to determine associations between variables.

Results

Birds

A total of 84 bird species were detected at the 27 wetland survey sites. An additional 18 species were observed and heard outside the 100 meter radius. 78 species were detected in the Massena AOC sites and 64 species were detected in the Louisville reference wetlands. Total species richness per site ranged from 15 to 35 species with a mean of 26 ± 6.1 species. Total species richness in Massena ranged from 17 to 35 species with a mean of 27 ± 4.6 species. Total species richness in Louisville ranged from 15 to 32 species with a mean of 26 ± 5.7 species (Figure 2). The Cedar Waxwing (*Bombycilla cedrorum*), Chestnut-sided Warbler (*Dendroica pensylvanica*), Common Yellowthroat (*Geothlypis trichas*), and Yellow Warbler (*Dendroica petechia*) were the most commonly observed birds, detected at all 27 wetland sites.

A total of 11 Species of Greatest Conservation Need (SGCN) were detected at the 27 surveyed wetland sites. Eight SGCN species were found in Massena and 7 SGCN species were found in Louisville. 4 SGCN species (Black-crowned Night Heron, Osprey, Scarlet Tanager, and

Wood Thrush) were only found in Massena and 3 SGCN species (Bobolink, Least Bittern, and Pied-billed Grebe) were only found in Louisville (Table 3).

Avian species richness did not significantly differ between Massena AOC and reference Louisville wetlands (Student's t-test, t (25) = 0.54, p-value = 0.59). There was also no significant difference in waterbird species richness between the Massena AOC and reference wetlands (Student's t-test, t (25) = -0.22, p-value = 0.83).

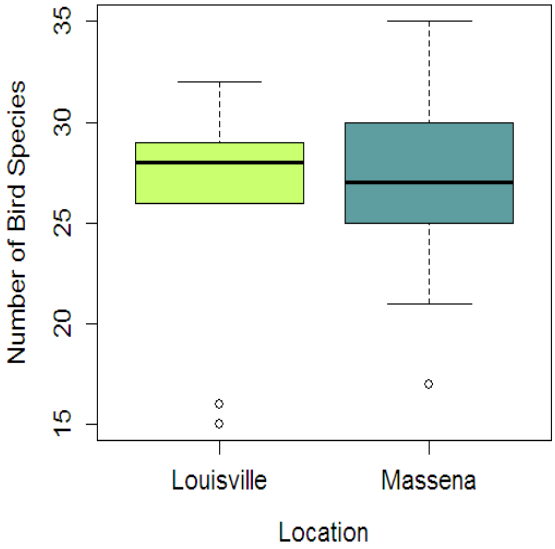


Figure 2: Data distribution of bird species richness in Massena AOC and Louisville.

Table 3: Species of Greatest Conservation Need (SGCN) found in Massena AOC and the reference site in Louisville, NY.

Massena AOC	Massena AOC Outside of 100 m Range	Louisville	Louisville Outside of 100 m Range
American Bittern	Black-billed Cuckoo	American Bittern	Caspian Tern
Black Crowned Night Heron	Greater Yellowlegs	Bobolink	Cooper's Hawk
Brown Thrasher	Common Loon	Brown Thrasher	Common Loon
Common Tern	Pied-billed Grebe	Common Tern	Northern Harrier
Osprey		Least Bittern	Osprey
Scarlet Tanager		Pied-billed Grebe	Scarlet Tanager
Willow Flycatcher		Willow Flycatcher	Wood Thrush
Wood Thrush			

Fish

A total of 600 individual fish of 15 species were observed at the 19 wetlands surveyed. Twelve fish species were detected in Massena and 10 species were detected in Louisville. Species richness per wetland in Massena ranged from 0 to 7 species with a mean of 3.2 ± 2.5 species (Figure 3). Species richness per wetland in Louisville ranged from 1 to 5 species with a mean of 3.4 ± 1.4 species. The highest number of species (7 species) was detected in the restored

ALCOA wetland (D1) in Massena and the lowest number of species (0 species) was detected in two Massena AOC wetlands. Fish abundance in Massena averaged 19 ± 37 fish per wetland and 53.1 ± 51 fish per wetland in Louisville. The most abundant fish in both locations was the Pumpkinseed (*Lepomis gibbous*).

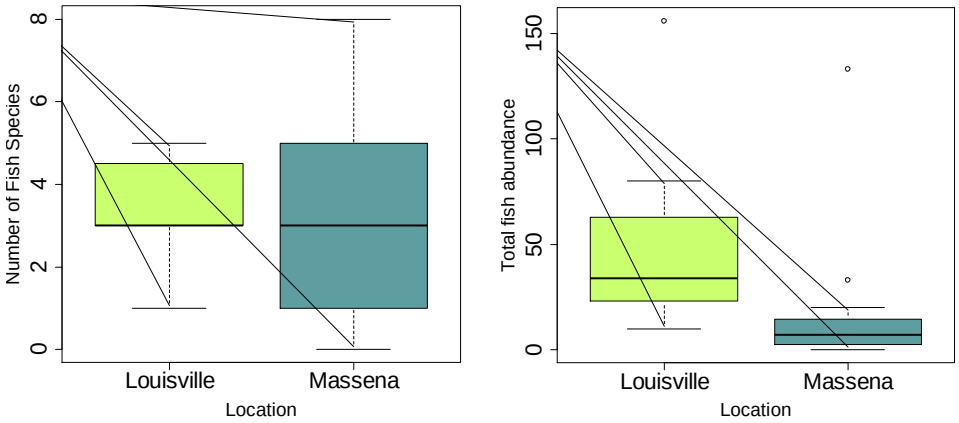


Figure 3: Data distribution of fish species richness and abundance in Massena AOC and Louisville.

Fish abundance was found to be significantly greater in Louisville (Welch's two-sample t-test, t(15) = 2.4, p-value = 0.03). No significant difference in fish species richness (Welch's two-sample t-test, t(17) = 0.29, p-value = 0.8) or Shannon-Wiener Diversity Index (Welch's two-sample t-test, t(11)= -1.9, p-value = 0.08) was observed between Massena AOC and Louisville.

Anuran calls

A total of 8 frog species were detected at the surveyed wetlands. The Mink Frog (*Rana septentrionalis)* was detected only in Louisville, but only in one site. The Boreal Chorus Frog (*Pseudacris maculata; Lemmon 2007)* was detected only in Massena, at multiple wetland sites. The Spring Peeper (*Pseudacris crucifer*), Bullfrog (*Rana catesbeiana),* and Green Frog (*Rana clamitans*) were the most common species detected. Louisville had a significantly higher abundance and species richness during the first survey period (May 2012) (Wilcoxon rank-sum test, W = 124.5, p-value = 0.047). Total frog abundance and total species richness did not significantly differ between Massena AOC and Louisville (Student's t-test, all $t \geq 0.95$, all p-values ≥ 0.3).

Benthic macroinvertebrates

A total of 4 phyla, 13 orders, and 24 families of macroinvertebrates were detected and identified in the samples from both Massena AOC and Louisville. Total richness in Massena ranged from 1 to 9 taxa with a mean of 6.4 ± 3.3. Total richness in Louisville ranged from 1 to 12 taxa with a mean of 5.7 ± 3.2. Macroinvertebrate abundance in Massena averaged 15.5 ± 8.4 versus 20.5 ± 18.4 in Louisville. There was no significant difference in macroinvertebrate abundance (W=48), richness (W=36), or Shannon-Wiener diversity index (W=23.5) between Massena AOC and Louisville (Wilcoxon rank-sum test, all p-values ≥ 0.3).

A total of 5 gastropod snail families were detected among all the study sites. Mean gastropod family richness in Massena AOC was 1.2 ± 1.3 and in Louisville 1.4 ± 1. Mean gastropod abundance per wetland in Massena AOC was 5.6 ± 8.8 and in Louisville 2.7 ± 2.

There was no significant difference in gastropod family richness, abundance (Student's t-test, all t-values $\geq$ 0.1, all p-values $\geq$ 0.4), or Shannon-Wiener diversity index (Wilcoxon rank-sum test, W=76, p-value = 0.8) between Massena AOC and Louisville sites.

Vascular Plants

A total of 159 vascular plants species, including 30 invasive species, were identified in the 27 wetland sites. The most frequently occurring plants in all wetlands were Purple Loosestrife (*Lythrum salicaria*) in 41% of plots, Reed Canary grass (*Phalaris arundinacea*) in 40% of plots, and Broadleaf Cattail (*Typha latifolia*) in 32% of plots. We detected 128 plant species in Massena, 25 of which were invasive. We detected 104 plant species in Louisville, 16 of which were invasive.

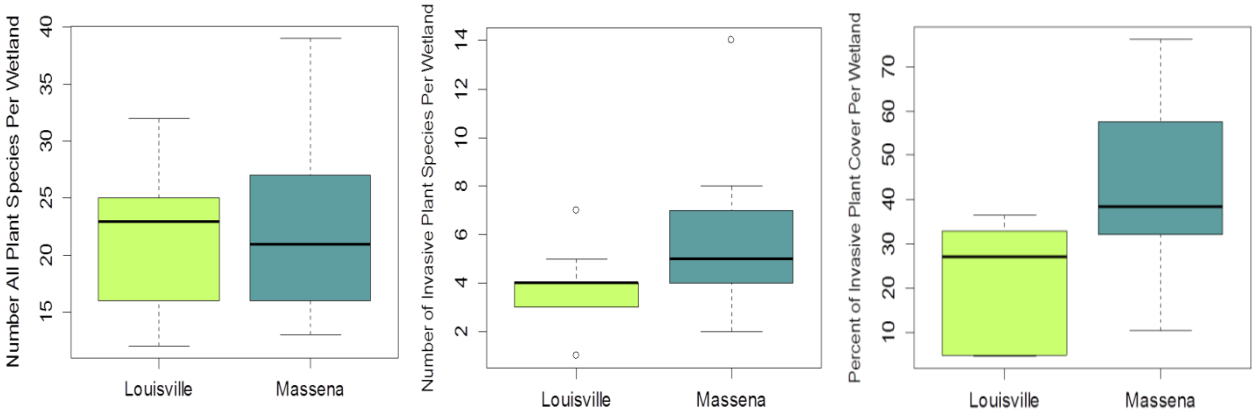


Figure 4: Data distribution of total species richness, invasive species richness, and invasive species cover for Massena AOC and Louisville. Bold line represents median.

Table 4: Summary data and results of statistical tests comparing plant assemblage metrics between wetlands in Massena AOC and reference wetlands in Louisville. Significant results ($p < 0.05$) are indicated by an *.

Metric	Massena AOC			Louisville (Reference)			*p*
	Range	Mean	SD	Range	Mean	SD	
Species Richness	13-39	22.4	7.3	12-32	21.5	6.26	0.71
Native Species Richness	10-18	16.9	5.5	10-28	17.7	5.7	0.71
Shannon-Wiener Index	0-2.2	1.1	0.48	0-2.0	1.1	0.48	0.9
Invasive Richness	2-14	5.5	2.7	1-7	3.8	1.6	0.06
Invasive Cover	0.11-0.76	0.44	0.20	0.05-0.37	0.23	0.13	0.006*

The most commonly occurring plant in Massena was Reed Canary grass and the most commonly occurring plant in Louisville was Purple Loosestrife, both invasive. Massena averaged 22.4 ± 7.3 total species, 5.5 ± 2.7 invasive species, and 43.5% ± 19.6% invasive cover per wetland. Louisville averaged 21.5 ± 6.3 total species, 3.8 ± 1.5 invasive species, and 22.5% ± 12.8% invasive cover per wetland (Figure 4, Table 4). Common Reed (*Phragmites*

australis) was detected only in Massena AOC wetlands, although it was observed, though not found within the sample quadrats, in two Louisville wetlands.

Total species richness, native species richness, and Shannon-Wiener diversity index did not significantly differ between Massena AOC and Louisville wetlands. Invasive plant cover was significantly greater in Massena AOC wetlands, and there was a trend for higher invasive species richness in Massena (Table 4).

Water Quality

In the summer of 2012, a total of 44 water samples were collected from 20 of the 27 study sites. CDOM (colored dissolved organic matter) concentrations across all sites ranged from 2.5 mg/L to 46.5 mg/L. Mean CDOM concentration in Louisville (23.8 ± 11.7 mg/L) was almost double that of Massena AOC (14.6 ± 13.2 mg/L). Mean specific conductivity in Massena AOC (379.6 ± 159.7µmho/cm/s) was significantly greater than in Louisville (262.2 ± 47.1µmho/cm/s) (Table 5). No significant difference in water temperature, pH, alkalinity, total phosphorus, turbidity, dissolved silica, nitrate, and chlorophyll-a was detected between wetlands in Massena AOC and Louisville (Table 5).

In the spring of 2013 a total of 50 water samples were collected from 23 out of the 27 study sites. CDOM concentrations across all sites ranged from 3.7mg/L to 47.7 mg/L. Mean CDOM concentration in Louisville (28.5 ± 14.7mg/L) was again twice that of Massena AOC (13.2 ± 9.7 mg/L). There was no significant difference in water temperature, pH, alkalinity, total phosphorus, turbidity, specific conductivity, dissolved silica, chlorophyll-a, chloride, nitrate, and sulfate between wetlands in Massena AOC and Louisville (Table 6). When comparing water samples between the spring and summer seasons, we found significant differences in the water temperature (unsurprisingly), pH, and nitrate concentrations. In the spring of 2013 mean water temperature was lower by 10 °C in Massena AOC wetlands and by 11.9 °C in Louisville wetlands. Mean pH decreased by 0.6 in Massena AOC wetlands and by 0.9 in Louisville wetlands. Mean nitrate concentrations increased by 0.32 mg/L in Massena AOC wetlands and by 0.03 mg/L in Louisville wetlands (Tables 5 and 6).

Out of the 44 samples collected in the summer of 2012, only 30 samples were analyzed for phytoplankton profiles. The concentration of PC-rich cyanobacteria was significantly greater in Massena AOC wetlands (Mann Whitney rank-sum test, p-value=0.007). There was no significant difference in green algae, diatom & dinoflagellate, and cryptophyta & PE-rich cyanobacteria concentrations (Figure 5, Table 5). All of spring 2013 samples were analyzed for phytoplankton profiles. The concentration of cryptophyta & PE-rich cyanobacteria was significantly greater in Louisville (Mann Whitney rank-sum test, p-value <0.05). There was no significant difference in green algae, PC-rich cyanobacteria, and diatom & dinoflagellate concentrations between Massena AOC and Louisville wetlands (Figure 5, Table 6). When comparing phytoplankton metrics between the spring and summer seasons we found that diatom & dinoflagellate and green algae concentrations in Massena wetlands significantly decreased in the spring. Similarly, the concentrations of green algae and PC-rich cyanobacteria in Louisville wetlands significantly decreased in the spring.

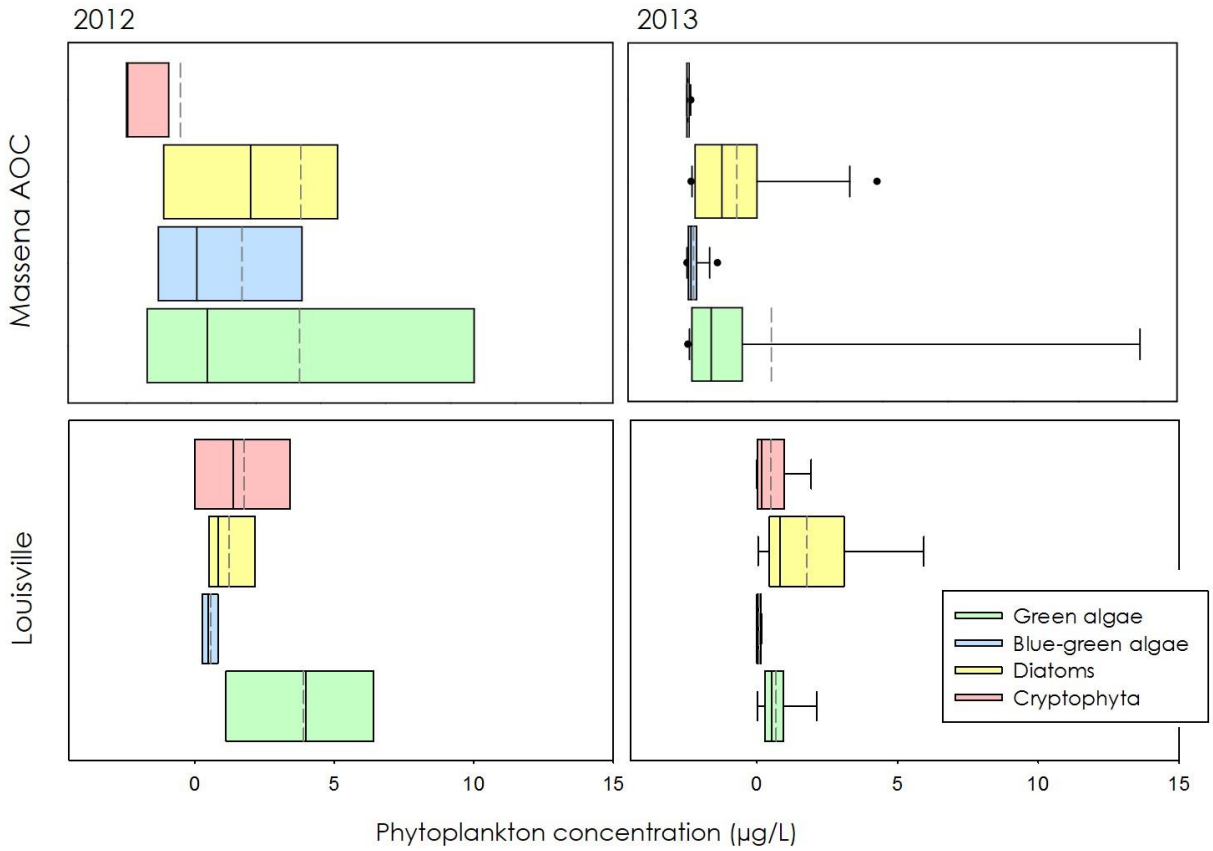


Figure 5: Comparison of phytoplankton concentrations per phytoplankton class, per location, per year. Mean concentrations per location are denoted by a gray dashed line.

Additional landscape analyses

The mean wetland study site area in Massena (2.1 ± 2.9 ha) was significantly smaller than mean wetland area in Louisville (19.5 ± 32.3 ha) (Figure 6). The landscape within 1,000 meters of both the Massena and Louisville wetland sites was dominated by a mix of open water and forest cover (Figure 6). Forest cover was significantly greater in the landscape surrounding Massena wetlands. Woody wetland cover was significantly greater in the landscape surrounding Louisville wetlands (Figure 6). The mean road density in Massena was 2.0 km/km^2 and in Louisville 1.5 km/km^2. The mean distance to the next nearest freshwater wetland to a sampled wetland in Massena was 88.9 ± 110.1 meters and in Louisville 32.0 ± 45.1 meters (Figure 6).

The percent cover of cultivated lands was significantly and negatively correlated with waterbird species richness. The percent cover of developed land uses was significantly and positively correlated with invasive species richness. The percent cover of woody wetlands was negatively correlated with invasive plant cover and nitrate concentrations and positively correlated with fish abundance (Table 7). Water temperature was positively correlated with waterbird species richness and fish species richness. Chlorophyll-a and total phosphorus concentrations were negatively correlated with invasive plant cover. Nitrate concentrations were negatively correlated with fish abundance (Table 8).

Table 5: 2012 summary data and results of statistical tests comparing water quality metrics between wetlands in Massena AOC and reference wetlands in Louisville in the summer of 2012. Significant results ($p < 0.05$) are indicated by an *.

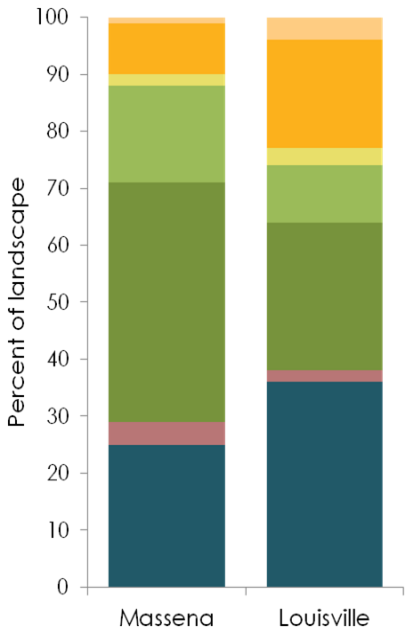
Metric	Massena AOC			Louisville (Reference)			Test	Avg. Mean Difference	*p*
	Range	Mean	SD	Range	Mean	SD			
Nitrate (mg/L)	0.0025-0.53	0.096	0.16	0.0035-0.045	0.012	0.016	Wilcoxon rank-sum	0.084	0.08
CDOM (mg/L)	2.5-44.0	14.6	13.2	10.0-46.5	23.8	11.7	Student's t-test	-9.2	0.0496*
Temperature (C°)	19.5-28.8	24.5	2.8	20.3-30.9	25.2	3.2	Student's t-test	-0.7	0.61
Conductivity (µmho/cm/s)	194.5-712	379.6	159.7	191.5-324	262.2	47.1	Student's t-test	117.4	0.0496*
Turbidity	0-0.27	0.064	0.088	0.007-0.051	0.021	0.015	Wilcoxon rank-sum	0.043	0.72
Total Phosphorus (µg/L)	9.2-218.1	61.2	68.6	18.6-69.3	37.3	17.8	Welch's t-test	23.9	0.83
Dissolved Silica (µg/L)	0.054-1.2	0.29	0.34	0.017-0.87	0.22	0.28	Student's t-test	0.07	0.51
pH	7.4-8.9	8.3	0.47	7.3-8.9	8.2	0.6	Student's t-test	0.1	0.73
Alkalinity ($CaCO_3$ mg/L)	69.2-111.7	96.2	14.6	73.6-172.1	103.9	32.0	Wilcoxon rank-sum	-7.7	0.90
Chlorophyll-a (µg/L)	0.37-55	12.2	17.1	1.4-10.3	5.4	3.3	Welch's t-test	6.8	0.71
Phytoplankton (µg/L)									
Green algae	0.3-17.4	5.4	6.3	0.4-7.6	3.9	3	Wilcoxon rank-sum	1.4	0.9
PC-rich cyanobacteria	0.8-11.4	5.6	3.6	0.2-1.3	0.57	0.38	Wilcoxon rank-sum	3	0.007*
Diatoms & dinoflagellates	0.9-19.9	5.4	6.2	0.5-7.4	1.2	0.9	Wilcoxon rank-sum	4.2	0.06
Cryptophyta & PE-rich cyanobacteria	0-11.2	1.7	3.9	0-5	1.8	1.9	Wilcoxon rank-sum	-0.1	0.3

Table 6: 2013 summary data and results of statistical tests comparing water quality metrics between wetlands in Massena AOC and reference wetlands in Louisville in the summer of 2012. Significant results ($p < 0.05$) are indicated by an *.

Metric	Massena AOC			Louisville (Reference)			Test	Avg. Mean Difference	*p*
	Range	Mean	SD	Range	Mean	SD			
Nitrate (mg/L)	0.03-1.1	0.4	0.5	0.03-0.1	0.04	0.03	Wilcoxon rank-sum	0.4	0.10
Chloride (mg/L)	0.6-70.5	24.7	19.5	1.04-146	38.2	51.7	Wilcoxon rank-sum	-13.5	0.97
Sulfate (mg/L)	2.5-102	22.6	24.6	3.1-31.2	14.5	11.2	Wilcoxon rank-sum	8.1	0.71
CDOM (mg/L)	3.7-31	13.2	9.7	11.2-47.7	28.5	14.7	Student's t-test	-15.3	0.03*
Temperature (C°)	8.0-25.5	14.5	4.8	9.5-18.5	13.3	2.9	Student's t-test	1.2	0.52
Conductivity (µmho/cm/s)	158.5-939.5	410.4	240.9	161-1213.5	375.4	325.	Wilcoxon rank-sum	35.0	0.34
Turbidity	0.0-0.093	0.021	0.021	0.002-0.054	0.02	0.016	Wilcoxon rank-sum	0	0.77
Total Phosphorus (µg/L)	9.5-89.3	35.4	25.1	15-191.1	58.5	52.2	Student's t-test	-23.1	0.12
Dissolved Silica (µg/L)	0.02-1.52	0.33	0.42	0.02-0.86	0.25	0.34	Student's t-test	0.07	0.72
pH	7.0-8.8	7.7	0.5	6.5-8.0	7.3	0.5	Student's t-test	0.4	0.14
Alkalinity ($CaCO_3$ mg/L)	66.7-391.5	149.9	95.5	26-300.4	110.3	82.2	Wilcoxon rank-sum	39.5	0.16
Chlorophyll-a (µg/L)	0.5-21.3	5.8	6.2	1.4-17.3	6.4	4.8	Student's t-test	-0.6	0.35
Phytoplankton (µg/L)									
Green algae	0.03-19.7	2.6	5.3	0.007-2.1	0.68	0.65	Wilcoxon rank-sum	1.91	0.87
PC-rich cyanobacteria	0.005-0.9	0.2	0.2	0-0.2	0.07	0.07	Wilcoxon rank-sum	0.14	0.10
Diatoms & dinoflagellates	0.1-5.8	1.5	1.7	0.03-5.9	1.8	2.0	Wilcoxon rank-sum	-0.25	0.97
Cryptophyta & PE-rich cyanobacteria	0-0.1	0.04	0.04	0.002-1.9	0.5	0.7	Wilcoxon rank-sum	-0.45	0.046

Table 7: Spearman rank sum correlations coefficients for water quality metrics and biotic indicators. Significant correlations are in bold and indicated by an *.

Metric	Green algae	CDOM	Temperature	Specific conductivity	Chlorophyll-a	Total phosphorus	pH	Nitrate
Waterbird species richness	0.33	-0.29	**0.41***	**-0.48***	0.29	-0.15	0.089	0.0034
Fish species richness	0.046	-0.21	**0.48***	-0.12	0.095	-0.16	0.17	-0.17
Fish abundance	0.25	0.34	0.14	**-0.47***	0.27	0.23	-0.18	**-0.58***
Frog species richness	**0.51***	0.097	0.38	-0.20	0.28	0.36	-0.059	-0.34
Invasive plant cover	-0.14	-0.37	-0.23	0.23	**-0.50***	**-0.47***	0.083	0.40
Invasive plant richness	-0.047	**-0.46***	0.061	0.063	-0.065	-0.23	**0.50***	0.28



Metric	Massena AOC mean	Louisville (Reference) mean	p
Wetland area (ha)	2.1	19.5	0.02*
% Open water	24.9	35.6	0.2
% Developed	3.5	2.0	0.09
% Forest	42.1	25.3	0.004*
% Cultivated	2.2	2.7	0.9
% Woody wetland	9.3	19.3	0.00008*
% Emergent wetland	1.4	3.8	0.4
Distance to nearest wetland (m)	89.0	32.0	0.1
Road density (km/km^2)	2.0	1.5	0.06

Figure 6: Characterization of land cover types and other landscape metrics within 1,000 m of wetland sites in Massena AOC and Louisville. Total Percent cover for each study area was calculated as a sum of cover types within all 1,000 m buffers in a location. Summary of statistical tests between Massena AOC and Louisville also provided. Significant results ($p < 0.05$) are indicated by an *.

Table 8: Spearman rank sum correlations coefficients between landscape metrics and biotic and water quality indicators. Significant correlations are in bold and indicated by a *.

Metric	Wetland Area (Ha)	Percent Cultivated	Percent Developed	Distance to nearest wetland (m)	Percent Woody Wetlands
Waterbird species richness	0.16	**-0.46***	-0.14	0.12	0.31
Fish abundance	**0.48***	-0.25	-0.20	-0.30	**0.77***
Frog species richness	**0.52***	-0.21	-0.25	-0.15	0.30
Frog abundance	**0.50***	-0.20	-0.18	-0.13	0.36
Invasive plant cover	**-0.55***	0.25	0.29	0.29	**-0.47***
Invasive plant richness	-0.32	0.056	**0.41***	0.32	-0.37
CDOM	**0.63***	0.16	-0.14	-0.29	**0.47***
Specific conductivity	-0.26	**0.55***	0.32	0.14	-0.19
Nitrate	**-0.61***	-0.16	-0.042	**0.52**	**-0.54***

Discussion

The most significant differences between Massena AOC and the reference Louisville wetlands and their surrounding landscapes include larger wetlands, more woody wetlands, and higher fish abundance in reference study sites, and higher cover of invasive plant species in Massena AOC sites. The most significant environmental indicators that did not differ between sites include bird, frog, fish, macroinvertebrate, and total plant species richness. Additionally, eleven of the fourteen water quality metrics did not significantly differ between Massena AOC and Louisville wetlands. Overall, results from this study indicate that the diversity and abundance of the ecological indicators as well as the state of the water quality in Massena AOC wetlands are comparable to that of reference wetlands in Louisville.

Birds

Both AOC and reference sites provided habitat for a large number of bird species including Species of Greatest Conservation Need (SGCN). The most frequently observed SGCN species were the Common Tern, Wood Thrush, American Bittern, and Brown Thrasher. Both upland and wetland dependent species were observed at all wetlands. Even though the total wetland site area was significantly greater in the reference Louisville location, bird species richness did not seem to respond to this factor. It is likely that bird communities in the area may be responding to larger scale landscape factors, such as the proximity of the St. Lawrence River or watershed land use patterns, rather than wetland size. Waterbird species richness responded negatively to the percentage of cultivated lands within 1,000 m of a wetland (Table 8). It is unclear if this specific bird group is responding to the potential water quality changes or the alteration of the structural complexity of the landscape associated with this land use type. Overall, the variety of life histories and habitat requirements of the observed birds, and especially the SGCN species, suggest that wetlands in the Massena AOC may play an important and diverse role in sustaining bird populations.

Anurans

We did not find a difference in the total richness and abundance of calling frogs between Massena AOC and reference wetlands. We did however find that frog abundance and richness was higher in Louisville during the early summer survey period. This survey period is characterized by the calls of bullfrogs, green frogs, and grey treefrogs. The difference in abundance was dictated by a higher number of bullfrogs in Louisville wetlands, while the difference in species richness may be caused by the lack of frog observations in several Massena wetlands. These wetlands were characterized by either the lack of permanent surface water or a sparse to absent emergent vegetation component. The hydroperiod duration of a wetland has been found to have a positive influence on the diversity and abundance of amphibian larvae (Snodgrass et al. 2000) and may be particularly important to bullfrogs. Bullfrog larvae require over one year to develop and permanent surface water is necessary for their reproduction (Gibbs et al., 2007). Additionally, the absence of an extensive emergent vegetation community may be contributing to an ineffective reduction of river current strength and an associated low success in egg development (Armellin 2006). Both frog abundance and richness

seem to be responsive to wetland size (Table 8) and the overall larger wetlands in Louisville may be the driver of the differences in anuran community structure, especially for bullfrogs.

In general, both Massena AOC and Louisville wetlands support a diverse and abundant assemblage of calling frogs. The Boreal Chorus Frog (*Pseudacris maculata*) an SGCN species was found in 8 of the 17 Massena AOC wetlands. This species of frog breeds in ephemeral wetlands associated with grasslands and meadows and the wetlands where this frog was detected were indeed characterized by the proximity of meadow-like areas and a generally absent connection to the St. Lawrence River. The Boreal Chorus Frog was not identified in any of the reference wetlands. The status of the Boreal Chorus Frog in New York State is not well understood (Breisch 2006) but the presence of this species in such a high number of wetlands in the Massena AOC is a good indicator of ecosystem health. The conservation of the specific habitat type required by this species is important for the preservation of this rare frog.

Fish

Historic and more recent records indicate that the section of the St. Lawrence River from Lake Ontario to Cornwall is inhabited by approximately 85 species of fish (Lafontaine et al. 2006; LaPan et al. 2001). We identified a total of 15 fish species in 17 wetland sites. We did not find a difference in fish species richness between Massena AOC and reference wetlands; however, we did find a significantly greater abundance of fish in reference wetlands. Reference wetlands with the greatest abundance of fish were characterized by extensive coverage of emergent vegetation. Most of these wetlands were also directly connected to the St. Lawrence River. The landscape around Louisville wetlands was also dominated by open water (Figure 6). Fish may be responding to all of these factors.

Observed differences in abundance may also be an artefact of our sampling method. The minnow traps used during our surveys capture only very small fish (approximately 3 cm diameter). This method may have biased our sample of the overall fish assemblage structure in the wetlands. It may however have provided a snapshot of the community structure of juvenile fish using these sites. Many juvenile fish are dependent on wetlands for food and shelter. Their presence and abundance in a wetland can be an indicator of the quality of habitat that these fish require. Overall, our results indicate that Massena AOC wetlands provide habitat to a diversity of fish species. To better understand fish community structure and dynamics however, our study should be supplemented with information from other fish surveys being conducted on the four rivers within the Massena AOC.

Vascular Plants

We did not find a difference in plant species richness metrics between wetlands of the Massena AOC and reference wetlands. However we did find that Massena AOC wetlands had a significantly greater coverage of invasive plant species. A total of 30 invasive plant species were identified in all surveyed wetlands. On average, almost half of the area sampled in each Massena AOC wetland was covered by invasive species. The most commonly observed invasives were Purple Loosestrife, Reed Canarygrass, and Broadleaf Cattail. All three of these species are classified as aggressive invaders. Common Reed was also more frequently found in Massena AOC wetlands. High invasive species coverage is commonly an indication of impaired habitat quality, nutrient enrichment, impaired hydrology, and excessive sedimentation. In turn,

invasive plant dominance results in lower species diversity of other biota occupying the ecosystem (Craft et al. 2007; Lavoie et al. 2003; Wilcox et al. 2007; Wilcox et al. 2008). Habitat management plans for Massena AOC wetlands should include control of the spread of invasive plant species. This may include active removal of plants, landscape management to prevent the spread and dominance of invasive species, and public community outreach and education.

Water Quality

We measured a total of 14 different water quality metrics, including 4 phytoplankton classes, during two different seasons. We found that CDOM was significantly higher in Louisville wetlands both in the spring and summer seasons. Specific conductivity was higher in Massena wetlands in the summer of 2012. CDOM is a product of the breakdown and export of organic material in the landscape and affects light penetration through the water column. CDOM can be associated with nutrient enrichment and increased ecosystem productivity because it is the direct result of increased productivity and microbial activity (Wetzel 2001; Kalff 2002). CDOM was positively correlated with the coverage of woody wetlands in the landscape (Table 8). The higher woody wetland cover in Louisville, and not anthropogenic activity, may be a source of the higher CDOM in reference wetlands.

Specific conductivity is a function of the ions present in the water. It is often correlated with other indicators of ionic strength such as chloride, nitrate, and sulfates (Trebitz et al. 2007). High specific conductivity can be a product of the soil and rock composition of the watershed but can also be associated with anthropogenic activities such as road salt use and atmospheric deposition caused by industrial and domestic pollution (Kalff 2001; Wetzel 2001). Specific conductivity was positively correlated with percent cover of cultivated lands (Table 8) and may be representative of the runoff from this land use type.

Phytoplankton community structure differed slightly between Massena AOC and reference wetlands, and also changed between seasons. The concentration of PC-rich cyanobacteria was greater in Massena AOC wetlands in the summer of 2012 while the concentration of cryptophyta & PE-rich cyanobacteria was greater in Louisville wetlands in the spring 2013. Phytoplankton responds to a variety of factors such as precipitation, runoff, water variability, and predator-prey relationships. PC-rich cyanobacteria (commonly referred to as blue-green algae) are generally associated with nutrient runoff and enrichment because of their ability to fix nitrogen and take advantage of excess phosphorus in nitrogen poor environments (Kalff 2002). Cyanobacteria also often dominate the water column in the summer when low water mixing leads to nutrient accumulation (Kalff 2002). Our observations of high PC-rich cyanobacteria concentrations in the summer may be an indication of potential nutrient enrichment or a result of poor water mixing. Wetlands with high PC-rich cyanobacteria concentrations were characterized by stagnant, standing water and no direct connection to the river. The highest PC-rich cyanobacteria concentration was observed in a slow moving stream adjacent to a large residential lawn without a vegetative buffer. The cryptophyta & PE-rich cyanobacteria category is characterized by red pigmented cyanobacteria and cryptomonads. Little is known about the ecology of cryptomonads but they are found to dominate in low light conditions (Wetzel 2001). The two wetlands with the highest cryptophyta concentrations had the highest CDOM concentrations in the sample set suggesting that this phytoplankton group may be responding to increases in organic carbon and reduction in light penetration.

Water quality standards for wetlands are difficult to establish due to the variability in wetland types and regional differences in wetland assemblages. Wetland water quality can be naturally very different from that of flowing streams and rivers. For all these reasons, wetland water quality standards do not exist for the state of New York. We can only hope to compare our results with other regional wetland sampling efforts. Our results fall within the ranges observed in Great Lakes coastal wetlands and inshore areas and previous studies of the St. Lawrence River at Massena (Trebitz et al. 2007; Twiss and MacLeod 2008; NYSDEC 2009). Overall, our results indicate that water quality in Massena AOC wetlands is comparable to that of reference Louisville wetlands and does not indicate any significant impairment that would affect the diversity, community structure, and abundance of wetland biota.

Landscape Context

Wetland sites in the Massena AOC were in general smaller than reference sites (Figure 6). Although it is known that wetland size affects species richness (Brown and Dinsmore 1986; Semlitsch and Bodie 1998) the size differences between the Massena AOC and Louisville wetlands seemed to have little effect on the species richness of the assemblages we studied. It is likely that factors such as structural features, population dynamics, and the overall landscape setting in both study areas play a more significant role in structuring biotic communities than does wetland size. Additionally, even small wetlands may serve an important function to some organisms such as migrating or wetland dependent birds, sessile species, and wetland dependent amphibians. The land cover surrounding the wetlands in Massena AOC was dominated by forest and open water. The land cover surrounding the reference wetlands in Louisville was dominated by open water, forest, and woody wetlands. Reference sites were surrounded by a significantly higher proportion of wetlands than Massena AOC study sites (Figure 6). Although the Massena AOC has experienced considerable habitat impacts as a result of human development, both study areas exhibited a low degree of development overall. The generally rural and forested setting and the proximity to the St. Lawrence River system may play a mitigating role to more localized impact events.

Additional comments

Wetlands in the Massena AOC were perceptibly affected by human activities, such as shoreline development and modification, water level variability in the St. Lawrence River, and the general modification of the landscape resulting from the construction of the dams, channels, and lock systems. The Massena Remediation Action Plan (RAP) has included extensive restoration and mitigation actions for wetlands and sediments affected by historic PCB discharges. Additionally the FERC New York Power Authority re-licensing agreement included the restoration and management of habitats important for wildlife reproduction. However, many wetlands in Massena remain permanently affected by the development of the St. Lawrence Seaway (NYSDEC, 2006). Our results indicate that despite the history of stress, and the changes to the St. Lawrence River shoreline, the wetlands in the Massena AOC still serve an important habitat function to the biotic communities. Even the smallest Massena AOC wetlands may be an important source of food, shelter, and breeding/nesting/spawning habitat to organisms that are adapted to the aquatic system and those using the St. Lawrence River. It is likely that the remediation efforts and the removal of contaminants (PCB, DDE, Mercury, etc.) from the area

have had a positive effect on the habitats and wildlife communities in the Massena AOC. The communities of ecological indicators observed in this study do not seem to be affected by the history of contamination. Sediment toxicity tests and reproductive studies for a variety of organisms may be used to confirm our observations.

The restored wetland on the Aluminum Company of America (ALCOA) property in the Massena AOC exhibited the highest diversity of bird species, fish species, native plant species, as well as some of the highest abundances of sampled taxa. The restoration is approximately 10 years old and wildlife monitoring has been periodically performed there. The high species diversity here emphasizes the value of successful wetland restoration projects. Although it is possible that the high species diversity at this wetland is a temporary response to the drastic changes initiated by the restoration effort, the age of the project and the overall quality of this wetland indicates that this restoration was in fact very successful and the wetland is very much used by many biotic communities. This wetland alone was used by four bird SGCN species including the only observation of the Black-crowned Night Heron.

One of our reference study sites was a wetland recently remediated under the FERC relicensing agreement. This wetland was located in Coles Creek State park, along Coles Creek, a small tributary to the St. Lawrence River. This site was characterized by intermediate species richness and abundance and low to intermediate water quality indicator levels. The recent completion of this project makes inferences about its success difficult. Periodic monitoring should continue here to gain a better understanding of the state of habitat quality of this wetland. We did not specifically sample any other HIP wetlands, but the overall high diversity and abundance of indicators in both Massena AOC and Louisville can be looked at as an indicator of the regional success of these projects. However since all HIPs are less than a decade old, additional assessments of these projects may be more useful in ascertaining their effects on regional habitat quality.

We did not sample wetlands in the St. Regis Mohawk territory at Akwesasne, along the Raquette, Grasse, or St. Regis rivers, or on islands along the St. Lawrence River. These gaps may have implications for generalizing conclusions about wetland habitat quality in the entire Massena AOC. While the St. Lawrence River is the focus of the AOC and our study sites were selected to reflect this, further studies may consider evaluating additional wetland habitats in these unsampled areas.

Our study also did not address the reproductive success or survivorship trends of the wildlife indicators. This type of information may be necessary to understand whether wildlife populations in the area are growing or declining, how they are responding to any habitat improvement projects, and whether, as a response to landscape alterations, organisms are being driven into ecological traps. Future wildlife monitoring and management efforts should include these aspects of population ecology.

Management recommendations:

Our results indicate that Massena AOC wetlands are being used by a diverse wildlife community, both aquatic and terrestrial. Surprisingly, even the smallest wetlands were being used by wildlife and seem to serve an important habitat function in the landscape. Nevertheless, mean wetland size in Massena AOC was much smaller than reference wetland size and AOC wetlands were plagued by a high percent cover of invasive plant species. We observed that the

wildlife indicators used for this study exhibited a variety of life histories and habitat requirements. Several species were classified as SGCN and required very specific habitat types. This observation leads us to believe that wildlife populations are using all the wetland habitats available to them including forested, emergent, and shrub wetlands, coastal and inland wetlands, and both large and small wetland sizes. Management decisions for the Massena AOC should include preserving all of the existing wetland habitat types because they are being actively used by wildlife. Specific management actions can include remediation, if necessary, of historic chemical contamination, removal of invasive plant species, and establishment of protective vegetative buffers around wetlands.

To ensure the long term maintenance of good habitat quality and a healthy and diverse wildlife community, management options should also include increasing wetland area both locally and in the watershed. Increasing wetland area can mitigate the effect of hydrological modifications caused by the construction of the dams and seaway. These actions are irreversible and coastal wetlands along the St. Lawrence will continue to be affected by the altered water level fluctuations and sediment transport dynamics. Creating or restoring wetlands in other areas of the Massena AOC, including inland areas, can provide the habitat alternatives needed by species responding adversely to the modifications of the St. Lawrence River. The wetland restoration at the ALCOA West plant is a great example of an ecologically important and successful restoration project at the local level. At the watershed scale, environmental impacts can eventually trickle down and affect localized areas along the river. Alternately, small mitigation actions at the watershed level or higher along stream reaches can have large and positive effects downstream. Environment Canada (2013) issued a habitat guidance document, based on a review of a large body of scientific literature on the Great Lakes, which suggests a minimum wetland coverage of 10% of the watershed. Habitat evaluation in the Massena AOC should include the assessment of wetland coverage at the watershed level and a strategy to either conserve or restore this habitat.

Our results provide only a snapshot of the current wetland habitat quality and state of wildlife populations. Continuous and periodic wildlife population monitoring will be the best indicator of the overall quality of wetland habitats in the area and how changes to these habitats, both positive and negative, impact wildlife communities and especially SGCN species. To best develop monitoring plans and to understand long term trends of wildlife populations and habitat quality, historical information on wildlife and habitats in the area should be reviewed. In addition, the establishment of baseline habitat and wildlife conditions is a critical component of any monitoring effort. Our results include the description of the diversity and abundance of wildlife in a suite of un-impacted reference wetlands. This information could be used as a baseline for future wetland monitoring and assessment projects. Baseline conditions should be established for any other habitats and wildlife populations prior to the implementation and interpretation of long term monitoring protocols. Further and more detailed surveys, including reproductive success and survivorship, may also be advised for species of greatest conservation need or those benefiting from specific wetland management actions.

Since 1995, the Canadian counterpart to the Massena AOC, at Cornwall ON, has been performing annual marsh monitoring surveys for birds and amphibians on multiple coastal and inland wetlands (Timmermans et al. 2004). The Marsh Monitoring Program (MMP) is a relatively simple, volunteer based, monitoring protocol that allows for long term and large scale monitoring

of habitat quality and wildlife communities. Establishing permanent marsh monitoring routes in wetlands of the Massena AOC may be a cost effective method to monitor wildlife communities and associated habitats over the long term. It can also serve as a great community outreach and education program.

Our study addressed the quality of a specific habitat type; wetlands. We chose this habitat type because of the variety of ecologic functions that it provides and the fact that wetlands are directly affected by the historic aquatic impacts associated with the AOC and the St. Lawrence River. Wetlands however are not the only habitat type represented within the Massena AOC. For a more complete assessment of the two BUIs addressed by this study, and for greater confidence in the delisting process, other habitat types should be evaluated. For example, the Canadian counterpart of the Massena AOC at Cornwall ON used the assessment of forest cover in the area as one of the habitat evaluation techniques (Environment Canada 2013; Dreier et al. 1997; Hickey 2002; Gillespie 1998). The 2013 Environment Canada guidance document makes suggestions for the minimum coverage of a variety of habitats including forests, riparian areas, and grasslands. This document may be used to develop and meet delisting criteria for habitats other than wetlands.

Conclusions

Overall, there remain 36 ha of wetlands in the Massena AOC that support a diversity of animal and plant species, as well as good water quality. Although we did not assess the reproductive success or population densities of the surveyed assemblages, the diversity, abundance, and distribution information provided by our data indicates that the two addressed BUIs may not be impaired with regard to wetland habitat. Future monitoring as well as habitat improvement projects should continue, to ensure that wetland habitat in the Massena AOC continues to provide important functions to wildlife communities.

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Appendix A

Table 1: Summary data and results of statistical tests comparing biotic metrics between wetlands in Massena AOC and reference wetlands in Louisville. Significant results ($p < 0.05$) are indicated by an *.

Metric	N	Massena AOC			Louisville (Reference)			Test	*p*
		Mean	95% CI	SD	Mean	95% CI	SD		
Bird species richness	27	26.9	2.4	4.6	25.8	4.1	5.7	Student's t-test	0.79
Water-bird species richness	27	10.5	1.4	2.7	10.8	2.5	3.5	Student's t-test	0.82
Fish species richness	19	3.1	1.5	2.4	3.4	1.3	1.4	Welch's t-test	0.77
Fish abundance	19	19.0	23.6	37.1	53.1	47.0	50.	Welch's t-test	0.03*
Fish Shannon diversity	14	1.1	0.28	0.34	0.7	0.36	0.3	Welch's t-test	0.09
Fish Shannon evenness	14	0.75	0.12	0.15	0.52	0.20	0.2	Welch's t-test	0.04*
Frog 1st survey species richness	27	1.1	0.57	1.1	2	0.58	0.8	Wilcoxon rank-sum	0.045*
Frog 1st survey abundance	27	7.3	4.5	8.8	14.8	6.8	9.5	Wilcoxon rank-sum	0.047*
Frog 2nd survey species richness	27	1.2	0.50	0.97	1.4	0.84	1.2	Wilcoxon rank-sum	0.72
Frog 2nd survey abundance	27	4.2	2.6	5.0	6.8	4.1	5.7	Wilcoxon rank-sum	0.21
Frog 3rd survey species richness	27	1.7	0.70	1.4	1.7	0.68	0.9	Student's t-test	0.99
Frog 3rd survey abundance	27	16.4	7.4	14.4	13.7	5.8	8.1	Student's t-test	0.60
Frog total species richness	27	4.1	1.3	2.5	5.1	1.6	2.2	Student's t-test	0.28
Frog total abundance	27	27.8	10.6	20.6	35.3	12.8	18.0	Student's t-test	0.35
Macroinvertebrate taxa richness	19	6.4	2.8	3.3	5.7	2.2	3.3	Wilcoxon rank-sum	0.53
Macroinvertebrate abundance	19	15.5	7.0	8.4	20.5	12.4	18.4	Wilcoxon rank-sum	0.77
Macroinvertebrate Shannon diversity	17	1.3	0.33	0.46	1.5	0.60	0.6	Wilcoxon rank-sum	0.28
Macroinvertebrate Shannon evenness	17	0.77	0.10	0.14	0.82	0.15	0.16	Wilcoxon rank-sum	0.43
Gastropod family richness	27	1.2	0.69	1.3	1.4	0.78	1.0	Student's t-test	0.45
Gastropod abundance	27	5.6	4.5	8.8	2.7	1.5	2	Student's t-test	0.89
Gastropod Shannon diversity	27	0.26	0.23	0.45	0.31	0.37	0.4	Wilcoxon rank-sum	0.77
Plant total species richness	27	22.4	3.8	7.4	21.5	4.5	6.3	Student's t-test	0.75
Native plant species richness	27	16.9	2.9	5.5	17.7	4.1	5.7	Student's t-test	0.72
Invasive plant species richness	27	5.5	1.4	2.7	3.8	1.1	1.5	Wilcoxon rank-sum	0.06
Invasive plant percent cover	27	43.6	10.1	19.6	22.2	9.2	12.8	Wilcoxon rank-sum	0.006*

Table 2: Summary data and results of statistical tests comparing landscape metrics between wetlands in Massena AOC and reference wetlands in Louisville. Significant results ($p < 0.05$) are indicated by an *.

Metric	N	Massena AOC			Louisville (Reference)			Test	*p*
		Mean	95% CI	SD	Mean	95% CI	SD		
Wetland area (ha)	27	2.1	1.5	2.9	19.5	23.1	32.3	Wilcoxon rank-sum	0.02*
Percent open water	27	24.9	6.0	11.6	35.6	17.7	24.4	Welch's t-test	0.2
Percent developed	27	3.5	1.1	2.1	2.0	1.5	2.0	Wilcoxon rank-sum	0.09
Percent forest	27	42.1	3.1	6.1	25.3	10.1	14.2	Welch's t-test	0.004*
Percent cultivated	27	2.2	1.7	3.2	2.7	3.8	5.3	Wilcoxon rank-sum	0.9
Percent woody wetland	27	9.3	3.6	7.0	19.3	4.1	5.7	Welch's t-test	0.00008*
Percent emergent wetland	27	1.4	0.5	1.0	3.8	3.1	4.3	Welch's t-test	0.4
Distance to nearest wetland (m)	27	89.0	56.6	110.1	32.0	32.2	45.1	Wilcoxon rank-sum	0.1
Road density (km/km^2)	27	2.0	0.5	1.0	1.5	0.3	0.4	Welch's t-test	0.06

Appendix B

Table 1: Scientific and common names of all bird species identified in the study wetlands. This list includes birds observed outside of the designated 100 meter survey radius. Highlighted are SGCN species.

Common Name	***Scientific Name***
Alder Flycatcher	*Empidonax alnorum*
American Bittern	*Botaurus lentiginosus*
American Coot	*Fulica americana*
American Crow	*Corvus brachyrhynchos*
American Goldfinch	*Carduelis tristis*
American Kestrel	*Falco sparverius*
American Redstart	*Setophaga ruticilla*
American Robin	*Turdus migratorius*
American Tree Sparrow	*Spizella arborea*
Barn Swallow	*Hirundo rustica*
Belted Kingfisher	*Ceryle alcyon*
Black-and-white Warbler	*Mniotilta varia*
Black-billed Cuckoo	*Coccyzus erythropthalmus*
Black-capped Chickadee	*Poecile atricapilla*
Black-crowned Night Heron	*Nycticorax nycticorax*
Blackpoll Warbler	*Dendroica striata*
Black-throated Green Warbler	*Dendroica virens*
Blue Jay	*Cyanocitta cristata*
Bobolink	*Dolichonyx oryzivorus*
Brown Creeper	*Certhia americana*
Brown-headed Cowbird	*Molothrus ater*
Brown Thrasher	*Toxostoma rufum*
Canada Goose	*Branta canadensis*
Caspian Tern	*Sterna caspia*
Cedar Waxwing	*Bombycilla cedrorum*
Chestnut-sided Warbler	*Dendroica pensylvanica*
Chipping Sparrow	*Spizella passerina*
Cliff Swallow	*Petrochelidon pyrrhonota*
Northern Flicker	*Colaptes auratus*
Common Grackle	*Quiscalus quiscula*

Common Name	***Scientific Name***
Common Loon	*Gavia immer*
Common Merganser	*Mergus merganser*
Common Moorhen	*Gallinula chloropus*
Common Raven	*Corvus corax*
Common Tern	*Sterna hirundo*
Common Yellowthroat	*Geothlypis trichas*
Coopers Hawk	*Accipiter cooperii*
Double-crested Cormorant	*Phalacrocorax auritus*
Downy Woodpecker	*Picoides pubescens*
Eastern Kingbird	*Tyrannus tyrannus*
Eastern Meadowlark	*Sturnella magna*
Eastern Phoebe	*Sayornis phoebe*
Eastern Wood-Peewee	*Contopus virens*
European Starling	*Sturnus vulgaris*
Field Sparrow	*Spizella pusilla*
Gray Catbird	*Dumetella carolinensis*
Great Blue Heron	*Ardea herodias*
Great-crested Flycatcher	*Myiarchus tyrannulus*
Greater Yellowlegs	*Tringa melanoleuca*
Green Heron	*Butorides virescens*
Green-winged Teal	*Anas crecca*
Hairy Woodpecker	*Picoides villosus*
Herring Gull	*Larus argentatus*
House Sparrow	*Passer domesticus*
House Wren	*Troglodytes aedon*
Indigo Bunting	*Passerina cyanea*
Killdeer	*Charadirus vociferus*
Least Bittern	*Ixobrychus exilis*
Least Flycatcher	*Empidonax minimus*
Mallard	*Anas platyrhynchos*
Marsh Wren	*Cistothorus palustris*
Mourning Dove	*Zenaida macroura*
Northern Cardinal	*Cardinalis cardinalis*

Common Name	***Scientific Name***
Northern Harrier	*Circus cyaneus*
Baltimore Oriole	*Icterus galbula*
Osprey	*Pandion haliaetus*
Ovenbird	*Seiurus aurocapillus*
Pied-billed Grebe	*Podilymbus podiceps*
Pileated Woodpecker	*Dryocopus pileatus*
Pine Warbler	*Dendroica pinus*
Spotted Sandpiper	*Actitis macularia*
Purple Finch	*Carpodacus purpureus*
Purple Martin	*Progne subis*
Red-eyed Vireo	*Vireo olivaceus*
Red-winged Blackbird	*Agelaius phoeniceus*
Red-tailed Hawk	*Buteo jamaicensis*
Ring-billed Gull	*Larus delawarensis*
Rock Dove	*Columba livia*
Rose-breasted Grosbeak	*Pheucticus ludovicianus*
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*
Eastern Towhee	*Pipilo erythrophthalmus*
Savannah Sparrow	*Passerculus sandwichensis*
Scarlet Tanager	*Piranga olivacea*
Song Sparrow	*Melospiza melodia*
Swamp Sparrow	*Melospiza georgiana*
Tree Swallow	*Tachycienta bicolor*
Turkey Vulture	*Cathartes aura*
Veery	*Catharus fuscescens*
Virginia Rail	*Rallus limicola*
Warbling Vireo	*Vireo gilvus*
White-breasted Nuthatch	*Sitta carolinensis*
White-throated Sparrow	*Zonotrichia albicollis*
Wild Turkey	*Meleagris gallopavo*
Willow Flycatcher	*Empidonax traillii*
Common Snipe	*Gallinago gallinago*
Wood Duck	*Aix sponsa*

Common Name	***Scientific Name***
Wood Thrush	*Hylocichla mustelina*
Yellow-bellied Sapsucker	*Sphyrapicus varius*
Yellow-billed Cuckoo	*Coccyzus americanus*
Yellow-throated Vireo	*Vireo flavifrons*
Yellow Warbler	*Dendroica petechia*
Yellow-rumped Warbler	*Dendroica coronata*

Table 2: Scientific and common names of the fish species identified in the study wetlands.

Common Name	***Scientific Name***
Bluegill	*Lepomis macrochirus*
Bluntnose Minnow	*Pimephales notatus*
Brook Stickleback	*Culaea inconstans*
Brown Bullhead	*Ictalurus nebulosus*
Central Mudminnow	*Umbra limi*
Channel Darter	*Percina copelandi*
Emerald Shiner	*Notropis atherinoides*
Fathead Minnow	*Pimephales promelas*
Largemouth Bass	*Micropterussalmoides*
Longnose Dace	*Rhinichthys cataractae*
Northern Redbelly Dace	Phoxinus eos
Pumpkinseed	*Lepomis gibbosus*
Rock Bass	*Ambloplites rupestris*
Smallmouth Bass	*Micropterus dolomieui*
Yellow Perch	*Perca flavescens*

Table 3: Scientific and common names of all frog species identified in the study wetlands. Highlighted are SGCN species.

Common Name	***Scientific Name***
American toad	*Bufo americanus*
Boreal chorus frog	*Pseudacris maculata*
Bullfrog	*Rana catesbeiana*
Green frog	*Rana clamitans*
Grey treefrog	*Hyla versicolor*
Mink frog	*Rana septentrionalis*
Northern leopard frog	*Rana pipiens*
Spring peeper	*Pseudacris crucifer*

Table 4: Scientific and common names of the macroinvertebrate and gastropod families identified in the study wetlands.

Common Name	Scientific Name (Family)
Backswimmer	Notonectidae
Biting midge	Ceratopogonidae
Black fly	Simuliidae
Crawling water beetle	Haliplidae
Darner dragonfly	Aeshnidae
Diving beetle	Dytiscidae
Dobsonfly	Corydalidae
Faucet snail	Bithyniidae
Flathead mayfly	Heptageniidae
Mosquito	Culicidae
Narrowwinged damselfly	Coenagrionidae
Non-biting midge	Chironomidae
Pea clam	Sphaeriidae
Physid snail	Phisidae
Pond snail	Lymnaeidae
Ramshorn snail	Planorbidae
Riffle beetle	Elmidae
Skimmer dragonfly	Libellulidae
Soldier fly	Stratiomyidae
Sow bug	Asellidae
Squaregill mayfly	Caenidae
Valve snail	Valvatidae
Water scavenger beetle	Hydrophilidae
Water treader	Gerridae
Zebra mussel	Dreissenidae

Table 5: Scientific and common names of the vascular plant species identified in the study wetlands. Highlighted are species classified as invasive by the USDA Plants Database (USDA 2013).

Common Name	*Latin Name*
Alfalfa	*Medicago sativa L.*
Allegheny monkeyflower	*Mimulus ringens L.*
American hogpeanut	*Amphicarpaea bracteata (L.) Fernald*
American water horehound	*Lycopus americanus Muhl. ex W.P.C. Barton*
American white waterlily	*Nymphaea odorata Aiton ssp. Odorata*
American basswood	*Tilia americana L.*
American beech	*Fagus grandifolia Ehrh.*
American eelgrass	*Vallisneria americana Michx.*
American hazelnut	*Corylus americana Walter*
American hornbeam	*Carpinus caroliniana Walter*
American red raspberry	*Rubus idaeus L.*
Arrowleaf tearthumb	*Polygonum sagittatum L.*
Bald spikerush	*Eleocharis erythropoda Steud.*
Balsam groundsel	*Packera paupercula (Michx.) Á. Löve & D. Löve*
Bebb's willow	*Salix bebbiana Sarg.*
Bebb's sedge	*Carex bebbii Olney ex Fernald*
Bird vetch	*Vicia cracca L.*
Bird's-foot trefoil	*Lotus corniculatus L.*
Blue skullcap	*Scutellaria lateriflora L.*
Blunt broom sedge	*Carex tribuloides Wahl.*
Blunt spikerush	*Eleocharis obtusa (Willd.) Schult.*
Bog goldenrod	*Solidago uliginosa Nutt.*
Bristly dewberry	*Rubus hispidus L.*
Brittlestem hempnettle	*Galeopsis tetrahit L.*
Broadfruit burreed	*Sparganium eurycarpum Engelm.*
Broadleaf arrowhead	*Sagittaria latifolia Willd.*
Broadleaf cattail	*Typha latifolia L.*
Broom sedge	*Carex scoparia Schkuhr ex Willd.*
Bulblet-bearing water hemlock	*Cicuta bulbifera L.*
Calico aster	*Symphyotrichum lateriflorum (L.) Á. Löve & D. Löve var. lateriflorum*
Canada goldenrod	*Solidago altissima L.*

Canada goldenrod	*Solidago canadensis L.*
Canadian horseweed	*Conyza canadensis (L.) Cronquist*
Canadian rush	*Juncus canadensis J. Gay ex Laharpe*
Canadian waterweed	*Elodea canadensis Michx.*
Climbing nightshade	*Solanum dulcamara L.*
Codlins and cream	*Epilobium hirsutum L.*
Common boneset	*Eupatorium perfoliatum L.*
Common buckthorn	*Rhamnus cathartica L.*
Common cinquefoil	*Potentilla simplex Michx.*
Common dandelion	*Taraxacum officinale F.H. Wigg.*
Common duckmeat	*Spirodela polyrhiza (L.) Schleid.*
Common duckweed	*Lemna minor L.*
Common frogbit	*Hydrocharis morsus-ranae L.*
Common milkweed	*Asclepias syriaca L.*
Common plantain	*Plantago major L.*
Common reed	*Phragmites australis (Cav.) Trin. ex Steud.*
Common selfheal	*Prunella vulgaris L*
Common spikerush	*Eleocharis palustris (L.) Roem. & Schult.*
Coon's tail	*Ceratophyllum demersum L.*
Crack willow	*Salix fragilis L*
Crested sedge	*Carex cristatella Britton*
Curly dock	*Rumex crispus L.*
Curly pondweed	*Potamogeton crispus L.*
Curlytop knotweed	*Polygonum lapathifolium L.*
Cypress-like sedge	*Carex pseudocyperus L.*
Devil's beggatick	*Bidens frondosa L.*
Dotted howthorn	*Crataegus punctata Jacq.*
Dudley's rush	*Juncus dudleyi Wiegand*
Earth loosestrife	*Lysimachia terrestris (L.) Britton, Sterns & Poggenb.*
Eastern daisy fleabane	*Erigeron annuus (L.) Pers.*
Eastern marsh fern	*Thelypteris palustris Schott*
Eastern poison ivy	*Toxicodendron radicans (L.) Kuntze*
Eurasian watermilfoil	*Myriophyllum spicatum L.*

European burreed	*Sparganium emersum Rehmann*
False baby's breath	*Galium mollugo L.*
Field bindweed	*Convolvulus arvensis L.*
Field horsetail	*Equisetum arvense L.*
Flatstem pondweed	*Potamogeton zosteriformis Fernald*
Flat-top goldenrod	*Euthamia graminifolia (L.) Nutt. var. graminifolia*
Floating pondweed	*Potamogeton natans L.*
Flowering rush	*Butomus umbellatus L.*
Fowl bluegrass	*Poa palustris L.*
Fox sedge	*Carex vulpinoidea Michx.*
Fragrant bedstraw	*Galium triflorum Michx.*
Fringed loosestrife	*Lysimachia ciliata L.*
Giant goldenrod	*Solidago gigantea Aiton*
Golden zizia	*Zizia aurea (L.) W.D.J. Koch*
Gray dogwood	*Cornus racemosa Lam.*
Green alder	*Alnus viridis (Chaix) DC.*
Green ash	*Fraxinus pennsylvanica Marshall*
Green bulrush	*Scirpus atrovirens Willd.*
Groundnut	*Apios americana Medick.*
Hairy goldenrod	*Solidago hispida Muhl. ex Willd.*
Hedge false bindweed	*Calystegia sepium (L.) R. Br.*
Intermediate woodfern	*Dryopteris intermedia (Muhl. ex Willd.) A. Gray*
Interrupted fern	*Osmunda claytoniana L.*
Jewelweed	*Impatiens capensis Meerb.*
Jointleaf rush	*Juncus articulatus L.*
Knotted rush	*Juncus nodosus L.*
Large St. Johnswort	*Hypericum majus (A. Gray) Britton*
Leafy pondweed	*Potamogeton foliosus Raf.*
Little green sedge	*Carex viridula Michx.*
Longhair sedge	*Carex comosa Boott*
Marsh seedbox	*Ludwigia palustris (L.) Elliot*
Marsh skullcap	*Scutellaria galericulata L.*
Meadow willow	*Salix petiolaris Sm.*

Missouri river willow	*Salix eriocephala Michx.*
Narrowleaf cattail	*Typha angustifolia L.*
Needle spikerush	*Eleocharis acicularis (L.) Roem. & Schult.*
Northern green rush	*Juncus alpinoarticulatus Chaix*
Northern water plantain	*Alisma triviale Pursh*
Northern wildrice	*Zizania palustris L.*
Poverty oatgrass	*Danthonia spicata (L.) P. Beauv. ex Roem. & Schult.*
Purple loosestrife	*Lythrum salicaria L.*
Pussy willow	*Salix discolor Muhl.*
Queen Anne's lace	*Daucus carota L.*
Red clover	*Trifolium pratense L.*
Red maple	*Acer rubrum L.*
Redosier dogwood	*Cornus sericea L.*
Reed canarygrass	*Phalaris arundinacea L.*
Rice cutgrass	*Leersia oryzoides (L.) Sw.*
Riverbank grape	*Vitis riparia Michx.*
Rough avens	*Geum laciniatum Murray*
Roundleaf dogwood	*Cornus rugosa Lam.*
Sensitive fern	*Onoclea sensibilis L.*
Shortspike watermilfoil	*Myriophyllum sibiricum Kom.*
Showy goldenrod	*Solidago erecta Pursh.*
Silky dogwood	*Cornus amomum Mill.*
Silverweed cinquefoil	Argentina anserina (L.) Rydb.
Slenderleaf false foxglove	*Agalinis tenuifolia (Vahl) Raf. var. parviflora (Nutt.) Pennell*
Smallflower false foxglove	*Agalinis paupercula (A. Gray) Britton var. borealis Pennell*
Smallspike false nettle	*Boehmeria cylindrica (L.) Sw.*
Smooth blackberry	*Rubus canadensis L.*
Softstem bulrush	*Scirpus tabernaemontani C.C. Gmel.*
Spotted joe pye weed	*Eupatorium maculatum (L.) E.E. Lamont*
Spotted lady's thumb	*Polygonum persicaria L.*
Steeplebush	*Spiraea tomentosa L.*
Strawcolored flatsedge	*Cyperus strigosus L.*
Sulphur cinquefoil	*Potentilla recta L.*

Swamp fly honesuckle	*Lonicera oblongifolia (Goldie) Hook.*
Swamp milkweed	*Asclepias incantata L.*
Swamp thistle	*Cirsium muticum Michx.*
Swamp verbena	*Verbena hastata L.*
Swamp white oak	*Quercus bicolor Willd.*
Sweet crab apple	*Malus coronaria (L.) Mill.*
Three lobe beggatick	*Bidens tripartita L.*
Three petal bedstraw	*Galium trifidum L.*
Timothy	*Phleum pratense L.*
Trumpet creeper	*Campsis radicans (L.) Seem. ex Bureau*
Variable leaf pondweed	*Potamogeton gramineus L.*
Variegated scouringrush	*Equisetum variegatum Schleich. ex F. Weber & D. Mohr var. variegatum*
Virginia marsh St. Johnswort	*Triadenum virginicum (L.) Raf.*
Virginia strawberry	*Fragaria virginiana Duchesne*
Virginia threeseed mercury	*Acalypha Virginica L.*
Virginia water horehound	*Lycopus virginicus L.*
Water horsetail	*Equisetum fluviatile L.*
Water knotweed	*Polygonum amphibium L.*
Water shield	*Brasenia schreberi Gmel.*
White rod	*Viburnum nudum L. var. cassinoides (L.) Torr. & A. Gray*
White meadowsweet	*Spiraea alba Du Roi*
White panicle aster	*Symphyotrichum lanceolatum (Willd.) G.L. Nesom ssp. lanceolatum var. lanceolatum*
Wild parsnip	*Pastinaca sativa L.*
Willowleaf aster	*Symphyotrichum praealtum (Poir.) G.L. Nesom var. praealtum*
Woodbine	*Parthenocissus vitacea (Knerr) Hitchc.*
Wool grass	*Scirpus cyperinus (L.) Kunth*
Woolly sedge	*Carex pellita Muhl. ex Willd.*
Wrinkle leaf goldenrod	*Solidago rugosa Mill.*
Yellowfruit sedge	*Carex annectens (E.P. Bicknell) E.P. Bicknell*

Appendix C

MAW12-01

UTM E 518200
UTM N 4980782
Class: Palustrine Forested
Size: 11.5 ha
Location: Alcoa East, Approximately 800 meters west of plant on Haverstock Rd. South side of road.

Key

	Species of Greatest Conservation Need (SGCN)
	Invasive species

Birds

Within 100m radius

American Bittern	*Botaurus lentiginosus*
American Goldfinch	*Carduelis tristis*
American Redstart	*Setophaga ruticilla*
American Robin	*Turdus migratorius*
Baltimore Oriole	*Icterus galbula*
Black-capped Chickadee	*Poecile atricapilla*
Black-crowned Night Heron	*Nycticorax nycticorax*
Brown-headed Cowbird	*Molothrus ater*
Cedar Waxwing	*Bombycilla cedrorum*
Chestnut-sided Warbler	*Dendroica pensylvanica*
Common Grackle	*Quiscalus quiscula*
Common Tern	*Sterna hirundo*
Common Yellowthroat	*Geothlypis trichas*
Eastern Kingbird	*Tyrannus tyrannus*
European Starling	*Sturnus vulgaris*
Gray Catbird	*Dumetella carolinensis*
Great-crested Flycatcher	*Myiarchus tyrannulus*
Green Heron	*Butorides virescens*
Hairy Woodpecker	*Picoides villosus*
House Wren	*Troglodytes aedon*
Mallard	*Anas platyrhynchos*
Northern Flicker	*Colaptes auratus*
Pileated Woodpecker	*Dryocopus pileatus*
Red-winged Blackbird	*Agelaius phoeniceus*
Song Sparrow	*Melospiza melodia*
Swamp Sparrow	*Melospiza georgiana*
Tree Swallow	*Tachycienta bicolor*
Veery	*Catharus fuscescens*
Virginia Rail	*Rallus limicola*
Warbling Vireo	*Vireo gilvus*
White-breasted Nuthatch	*Sitta carolinensis*
Wood Duck	*Aix sponsa*
Wood Thrush	*Hylocichla mustelina*
Yellow Warbler	*Dendroica petechia*
Yellow-bellied Sapsucker	*Sphyrapicus varius*

Outside 100m radius

American Crow	*Corvus brachyrhynchos*
American Redstart	*Setophaga ruticilla*
Belted Kingfisher	*Ceryle alcyon*
Black-crowned Night Heron	*Nycticorax nycticorax*
European Starling	*Sturnus vulgaris*
Great Blue Heron	*Ardea herodias*
Green Heron	*Butorides virescens*
Mallard	*Anas platyrhynchos*
Northern Flicker	*Colaptes auratus*
Pied-billed Grebe	*Podilymbus podiceps*
Red-eyed Vireo	*Vireo olivaceus*
Ring-billed Gull	*Larus delawarensis*
Rock Dove	*Columba livia*
Scarlet Tanager	*Piranga olivacea*
Tree Swallow	*Tachycienta bicolor*
Wood Duck	*Aix sponsa*
Yellow-billed Cuckoo	*Coccyzus americanus*

Fish

Bluegill	*Lepomis macrochirus*
Brown Bullhead	*Ictalurus nebulosus*
Central Mudminnow	*Umbra limi*
Emerald Shiner	*Notropis atherinoides*
Fathead Minnow	*Pimephales promelas*
Pumpkinseed	*Lepomis gibbosus*
Smallmouth Bass	*Micropterus dolomieui*

Frogs

American toad	*Bufo americanus*
Bullforg	*Rana catesbeiana*
Green frog	*Rana clamitans*
Northern Leopard frog	*Rana pipiens*
Spring peeper	*Pseudacris crucifer*

Macroinvertebrates

Diving beetle	Coleoptera Dytiscidae
Non-biting midge	Diptera Chironomidae
Pond snail	Gastropoda Lymnaeidae
Ramshorn snail	Gastropoda Planorbidae
Squaregill mayfly	Ephemeroptera Caenidae

Plants

Amerian water horehound	*Lycopus americanus*
Bird's foot Trefoil	*Lotus corniculatus*
Blunt Spikerush	*Eleocharis obtusa*
Broadfruit Burreed	*Sparganium eurycarpum*
Broadleaf Cattail	*Typha latifolia*
Broom Sedge	*Carex scoparia*
Bulblet Bearing Water Hemlock	*Cicuta bulbifera*
Canada goldenrod	*Solidago altissima*
Canadian Waterweed	*Elodea canadensis*
Common Duckmeat	*Spirodela polyrhiza*
Common Duckweed	*Lemna minor*
Common Frogbit	*Hydrocharis morsus ranae*
Coon's Tail	*Ceratophyllum demersum*
False baby's breath	*Galium mollugo*
Field Horsetail	*Equisetum arvense*
Fox sedge	*Carex vulpinoidea*
Gray Dogwood	*Cornus racemosa*
Green Bulrush	*Scirpus atrovirens*
Jewelweed	*Impatiens capensis*
Missouri River willow	*Salix eriucephila*
Narrowleaf Cattail	*Typha angustifolia*
Northern water plantain	*Alisma triviale*
Purple Loosestrife	*Lythrum salicaria*
Redosier dogwood	*Cornus sericea*
Reed Canarygrass	*Phalaris arundinacea*
Rice Cutgrass	*Leersia oryzoides*
Sensitive Fern	*Onoclea sensibilis*
Softstem Bulrush	*Scirpus tabernaemontani*
Swamp milkweed	*Asclepias incantata*
Swamp Verbena	*Verbena hastata*
Threepetal bedstraw	*Galium trifidum*
Variableleaf pondweed	*Potamogeton gramineus*
Wool Grass	*Scirpus cyperinus*

Water Quality

	2012	2013
CDOM mg/L	3.87	15.5
Temperature °C	27.2	25.5
Specific Conductance µS/cm	305	258
Turbidity	0.043	0.063
Total phosphorus µg/L	27.5	32.9
Silicate µg/L	0.054	0.042
pH	8.65	8.85
Alkalinity (CaCO3) mg/L	NA	103.3
Chlorophyll-a µg/L	0.79	21.3
Nitrate mg/L	0.051	0.03
Chloride mg/L	NA	0.03
Sulfate mg/L	NA	6.57
Green algae µg/L	6.22	19.70
Blue-green algae µg/L	11.41	0.01
Diatoms µg/L	4.96	1.98
Cryptophyta µg/L	0.00	0.00

MAW12-02

UTM E 511087
UTM N 4981098
Class: Palustrine Forested
Size: 0.4 ha
Location: Peninsula on Barnhart Island. Unnamed road branching south from Campground Rd. and terminating in yellow gate. Approximately 1,000 meters NW of Eisenhower Lock.

Key	
	Species of Greatest Conservation Need (SGCN)
	Invasive species

Birds

Within 100m radius

Alder Flycatcher	*Empidonax alnorum*
American Goldfinch	*Carduelis tristis*
Baltimore Oriole	*Icterus galbula*
Cedar Waxwing	*Bombycilla cedrorum*
Chestnut Sided Warbler	*Dendroica pensylvanica*
Common Grackle	*Quiscalus quiscula*
Common Tern	*Sterna hirundo*
Common Yellowthroat	*Geothlypis trichas*
Eastern Kingbird	*Tyrannus tyrannus*
Gray Catbird	*Dumetella carolinensis*
Great Blue Heron	*Ardea herodias*
Great-crested Flycatcher	*Myiarchus tyrannulus*
Mallard	*Anas platyrhynchos*
Rose-breasted Grosbeak	*Pheucticus ludovicianus*
Song Sparrow	*Melospiza melodia*
Spotted Sandpiper	*Actitis macularia*
Swamp Sparrow	*Melospiza georgiana*
Veery	*Catharus fuscescens*
Yellow Warbler	*Dendroica petechia*
Yellow-throated Vireo	*Vireo flavifrons*

Outside 100m radius

American Crow	*Corvus brachyrhynchos*
American Goldfinch	*Carduelis tristis*
American Redstart	*Setophaga ruticilla*
American Robin	*Turdus migratorius*
Barn Swallow	*Hirundo rustica*
Black-and-white Warbler	*Mniotilta varia*
Black-billed Cuckoo	*Coccyzus erythropthalmus*
Blue Jay	*Cyanocitta cristata*
Canada Goose	*Branta canadensis*
Chestnut-sided Warbler	*Dendroica pensylvanica*
Cliff Swallow	*Petrochelidon pyrrhonota*
Common Loon	*Gavia immer*
Common Tern	*Sterna hirundo*
Double-crested Cormorant	*Phalacrocorax auritus*
Red-eyed Vireo	*Vireo olivaceus*
Ring-billed Gull	*Larus delawarensis*
Savannah Sparrow	*Passerculus sandwichensis*
Tree Swallow	*Tachycienta bicolor*
Warbling Vireo	*Vireo gilvus*

Fish

No fish captured

Frogs

American toad	*Bufo americanus*

Macroinvertebrates

Biting midge	Diptera Ceratopogonidae
Blackfly	Diptera Simuliidae
Flathead mayfly	Ephemeroptera Heptageniidae
Non-biting midge	Diptera Chironomidae
Pond snail	Gastropoda Lymnaeidae
Scud	Crustacea Amphipoda
Zebra mussel	Bivalvia Dreisseniidae

Vegetation

Allegheny monkeyflower	*Mimulus ringens*
Amerian water horehound	*Lycopus americanus*
American beech	*Fagus grandifolia*
American eelgrass	*Vallisneria americana*
Climbing nightshade	*Solanum dulcamara*
Codlins and cream	*Epilobium hirsutum*
Common Boneset	*Eupatorium perfoliatum*
Curly Dock	*Rumex crispus*
Eurasian water milfoil	*Myriophyllum spicatum*
Fringed loostrife	*Lysimachia ciliata*
Gray Dogwood	*Cornus racemosa*
Green ash	*Fraxinus pennsylvanica*
Hedge False Bindweed	*Calystegia sepium*
Jewelweed	*Impatiens capensis*
Meadow Willow	*Salix petiolaris*
Purple Loosestrife	*Lythrum salicaria*
Reed Canarygrass	*Phalaris arundinacea*
Rice Cutgrass	*Leersia oryzoides*
Riverbank grape	*Vitis riparia*
Sensitive Fern	*Onoclea sensibilis*
Silky dowgood	*Cornus amomum*
Smallspike false nettle	*Boehemeria cylindrica*
Sweet crab apple	*Malus coronaria*
Threepetal bedstraw	*Galium trifidum*
Virginia strawberry	*Fragaria virginiana*
White panicle aster	*Symphyotrichum lanceolatum*
Woodbine	*Parthenocissus vitacea*

Water Quality

	2012	2013
CDOM mg/L	3.94	4.01
Temperature °C	22.0	10.0
Specific Conductance µS/cm	339	316
Turbidity	0.0003	0.003
Total phosphorus µg/L	10.5	14.0
Silicate µg/L	0.226	0.043
pH	8.21	8.02
Alkalinity (CaCO3) mg/L	111.7	82.2
Chlorophyll-a µg/L	0.50	1.21
Nitrate mg/L	0.23	1.13
Chloride mg/L	NA	22.2
Sulfate mg/L	NA	23.7
Green algae µg/L	NA	0.16
Blue-green algae µg/L	NA	0.08
Diatoms µg/L	NA	0.45
Cryptophyta µg/L	NA	0.07

MAW12-03

UTM E 513519
UTM N 4981409
Class: Palustrine Emergent
Size: 4.63 ha
Location: River oxbow on Barnhart Island. On Robinson Bay Rd. 1.5 km from Barnhart Island Rd. North side of road.

Key

	Species of Greatest Conservation Need (SGCN)
	Invasive species

Birds

Within 100m radius

Alder Flycatcher	*Empidonax alnorum*
American Goldfinch	*Carduelis tristis*
American Redstart	*Setophaga ruticilla*
American Robin	*Turdus migratorius*
Baltimore Oriole	*Icterus galbula*
Black-capped Chickadee	*Poecile atricapilla*
Cedar Waxwing	*Bombycilla cedrorum*
Chestnut-sided Warbler	*Dendroica pensylvanica*
Common Grackle	*Quiscalus quiscula*
Common Yellowthroat	*Geothlypis trichas*
Downy Woodpecker	*Picoides pubescens*
Gray Catbird	*Dumetella carolinensis*
Great-crested Flycatcher	*Myiarchus tyrannulus*
Marsh Wren	*Cistothorus palustris*
Red-winged Blackbird	*Agelaius phoeniceus*
Rose-breasted Grosbeak	*Pheucticus ludovicianus*
Song Sparrow	*Melospiza melodia*
Swamp Sparrow	*Melospiza georgiana*
Virginia Rail	*Rallus limicola*
Warbling Vireo	*Vireo gilvus*
Wood Thrush	*Hylocichla mustelina*
Yellow Warbler	*Dendroica petechia*

Outside 100m radius

American Crow	*Corvus brachyrhynchos*
American Robin	*Turdus migratorius*
Black-capped Chickadee	*Poecile atricapilla*
Blue Jay	*Cyanocitta cristata*
Canada Goose	*Branta canadensis*
Common Raven	*Corvus corax*
Common Tern	*Sterna hirundo*
Downy Woodpecker	*Picoides pubescens*
Herring Gull	*Larus argentatus*
Mallard	*Anas platyrhynchos*
Mourning Dove	*Zenaida macroura*
Red-eyed Vireo	*Vireo olivaceus*
Ring-billed Gull	*Larus delawarensis*
Veery	*Catharus fuscescens*
Warbling Vireo	*Vireo gilvus*
White-breasted Nuthatch	*Sitta carolinensis*
Wood Thrush	*Hylocichla mustelina*

Fish

Central Mudminnow	*Umbra limi*
Emerald Shiner	*Notropis atherinoides*

Frogs

Bullforg	*Rana catesbeiana*
Green frog	*Rana clamitans*
Northern Leopard frog	*Rana pipiens*
Spring peeper	*Pseudacris crucifer*

Macroinvertebrates

Caddisfly	Trichoptera
Faucet snail	Gastropoda Bithyniidae
Leech	Annelida Hirudinea
Physid snail	Gastropoda Phisidae
Pond snail	Gastropoda Lymnaeidae
Ramshorn snail	Gastropoda Planorbidae

Vegetation

Amerian white waterlily	*Nymphaea odorata*
Broadleaf Cattail	*Typha latifolia*
Bulblet Bearing Water Hemlock	*Cicuta bulbifera*
Canadian Waterweed	*Elodea canadensis*
Climbing nightshade	*Solanum dulcamara*
Common Duckweed	*Lemna minor*
Common Frogbit	*Hydrocharis morsus ranae*
Coon's Tail	*Ceratophyllum demersum*
Cypress-like sedge	*Carex pseudocyperus*
Field Horsetail	*Equisetum arvense*
Flatstem pondweed	*Potamogeton zosteriformis*
Purple Loosestrife	*Lythrum salicaria*
Reed Canarygrass	*Phalaris arundinacea*
Threepetal bedstraw	*Galium trifidum*
Woodbine	*Parthenocissus vitacea*

Water Quality

	2012	2013
CDOM mg/L	5.2	14.6
Temperature °C	23.3	11.5
Specific Conductance µS/cm	273	240
Turbidity	0.009	0.025
Total phosphorus µg/L	19.5	58.2
Silicate µg/L	0.161	0.336
pH	8.85	7.13
Alkalinity (CaCO3) mg/L	69.2	132.0
Chlorophyll-a µg/L	0.37	8.31
Nitrate mg/L	0.0	0.1
Chloride mg/L	NA	41.7
Sulfate mg/L	NA	13.7
Green algae µg/L	1.07	1.03
Blue-green algae µg/L	0.89	0.22
Diatoms µg/L	2.70	2.65
Cryptophyta µg/L	0.00	0.00

MAW12-04

UTM E 512514
UTM N 4980000
Class: Palustrine Emergent
Size: 0.49 ha
Location: Unnamed construction road branching east from Barnhart Rd, approximately 30 meters north of State Highway 131. Wetland is 1,000 meters down construction road, on left.

Key

	Species of Greatest Conservation Need (SGCN)
	Invasive species

Birds

Within 100m radius

American Goldfinch	*Carduelis tristis*
Baltimore Oriole	*Icterus galbula*
Barn Swallow	*Hirundo rustica*
Canada Goose	*Branta canadensis*
Cedar Waxwing	*Bombycilla cedrorum*
Chestnut-sided Warbler	*Dendroica pensylvanica*
Common Grackle	*Quiscalus quiscula*
Common Snipe	*Gallinago gallinago*
Common Tern	*Sterna hirundo*
Common Yellowthroat	*Geothlypis trichas*
Eastern Kingbird	*Tyrannus tyrannus*
Gray Catbird	*Dumetella carolinensis*
Great Blue Heron	*Ardea herodias*
Herring Gull	*Larus argentatus*
Mallard	*Anas platyrhynchos*
Red-winged Blackbird	*Agelaius phoeniceus*
Savannah Sparrow	*Passerculus sandwichensis*
Song Sparrow	*Melospiza melodia*
Swamp Sparrow	*Melospiza georgiana*
Tree Swallow	*Tachycienta bicolor*
Veery	*Catharus fuscescens*
Warbling Vireo	*Vireo gilvus*
Yellow Warbler	*Dendroica petechia*

Outside 100m radius

American Crow	*Corvus brachyrhynchos*
American Redstart	*Setophaga ruticilla*
American Robin	*Turdus migratorius*
Baltimore Oriole	*Icterus galbula*
Black-and-white Warbler	*Mniotilta varia*
Blue Jay	*Cyanocitta cristata*
Brown-headed Cowbird	*Molothrus ater*
Canada Goose	*Branta canadensis*
Common Tern	*Sterna hirundo*
Double-crested Cormorant	*Phalacrocorax auritus*
Downy Woodpecker	*Picoides pubescens*
Great Blue Heron	*Ardea herodias*
Green Heron	*Butorides virescens*
Killdeer	*Charadirus vociferus*
Northern Flicker	*Colaptes auratus*
Pileated Woodpecker	*Dryocopus pileatus*
Red-eyed Vireo	*Vireo olivaceus*
Ring-billed Gull	*Larus delawarensis*
Scarlet Tanager	*Piranga olivacea*
Warbling Vireo	*Vireo gilvus*
White-throated Sparrow	*Zonotrichia albicollis*
Willow Flycatcher	*Empidonax traillii*
Wood Duck	*Aix sponsa*
Wood Thrush	*Hylocichla mustelina*

Fish

Brown Bullhead	*Ictalurus nebulosus*
Pumpkinseed	*Lepomis gibbosus*
Yellow Perch	*Perca flavescens*

Frogs

Boreal Chorus frog	*Pseudacris maculata*
Spring peeper	*Pseudacris crucifer*

Macroinvertebrates

Aquatic earthworm	Oligochaeta
Caddisfly	Trichoptera
Leech	Annelida Hirudinea
Non-biting midge	Diptera Chironomidae
Physid snail	Gastropoda Phisidae
Scud	Crustacea Amphipoda
Sow bug	Isopoda Asellidae
Zebra mussel	Bivalvia Dreisseniidae

Vegetation

Bird Vetch	*Vicia cracca*
Broadleaf Cattail	*Typha latifolia*
Canadian Waterweed	*Elodea canadensis*
Coon's Tail	*Ceratophyllum demersum*
Eurasian water milfoil	*Myriophyllum spicata*
Flatstem pondweed	*Potamogeton zosteliformis*
Hedge False Bindweed	*Calystegia sepium*
Jewelweed	*Impatiens capensis*
Marsh skullcap	*Scutellaria galericulata*
Narrowleaf Cattail	*Typha angustifolia*
Reed Canarygrass	*Phalaris arundinacea*
Silky dowgood	*Cornus amomum*
Spotted joe pye weed	*Eutrochium maculatum*
Swamp thistle	*Cirsium muticum*

Water Quality

	2012	2013
CDOM mg/L	2.51	4.01
Temperature °C	23.8	12.5
Specific Conductance µS/cm	345	271
Turbidity	0	0.013
Total phosphorus µg/L	9.2	21.6
Silicate µg/L	0.077	0.028
pH	8.43	8.27
Alkalinity (CaCO3) mg/L	103.6	84.1
Chlorophyll-a µg/L	0.47	10.55
Nitrate mg/L	0.53	0.57
Chloride mg/L	NA	22.9
Sulfate mg/L	NA	23.7
Green algae µg/L	NA	1.62
Blue-green algae µg/L	NA	0.00
Diatoms µg/L	NA	4.15
Cryptophyta µg/L	NA	0.00

MAW12-05

UTM E 513386
UTM N 4981252
Class: Palustrine Emergent
Size: 0.37 ha
Location Peninsula directly across Robinson Bay Road from wetland 641

Key

	Species of Greatest Conservation Need (SGCN)
	Invasive species

Birds

Within 100m radius

Alder Flycatcher	*Empidonax alnorum*
American Goldfinch	*Carduelis tristis*
American Redstart	*Setophaga ruticilla*
Baltimore Oriole	*Icterus galbula*
Brown-headed Cowbird	*Molothrus ater*
Cedar Waxwing	*Bombycilla cedrorum*
Chestnut-sided Warbler	*Dendroica pensylvanica*
Common Grackle	*Quiscalus quiscula*
Common Tern	*Sterna hirundo*
Common Yellowthroat	*Geothlypis trichas*
Downy Woodpecker	*Picoides pubescens*
Eastern Kingbird	*Tyrannus tyrannus*
Gray Catbird	*Dumetella carolinensis*
Great Blue Heron	*Ardea herodias*
Hairy Woodpecker	*Picoides villosus*
Mallard	*Anas platyrhynchos*
Northern Cardinal	*Cardinalis cardinalis*
Northern Flicker	*Colaptes auratus*
Red-eyed Vireo	*Vireo olivaceus*
Red-winged Blackbird	*Agelaius phoeniceus*
Song Sparrow	*Melospiza melodia*
Swamp Sparrow	*Melospiza georgiana*
Tree Swallow	*Tachycienta bicolor*
Veery	*Catharus fuscescens*
Yellow Warbler	*Dendroica petechia*
Yellow-bellied Sapsucker	*Sphyrapicus varius*

Outside 100m radius

Alder Flycatcher	*Empidonax alnorum*
American Crow	*Corvus brachyrhynchos*
American Robin	*Turdus migratorius*
American Tree Sparrow	*Spizella arborea*
Black-capped Chickadee	*Poecile atricapilla*
Blue Jay	*Cyanocitta cristata*
Canada Goose	*Branta canadensis*
Common Grackle	*Quiscalus quiscula*
Double-crested Cormorant	*Phalacrocorax auritus*
Killdeer	*Charadirus vociferus*
Northern Cardinal	*Cardinalis cardinalis*
Pied-billed Grebe	*Podilymbus podiceps*
Ring-billed Gull	*Larus delawarensis*
Veery	*Catharus fuscescens*
Warbling Vireo	*Vireo gilvus*
Wild Turkey	*Meleagris gallopavo*
Wood Thrush	*Hylocichla mustelina*
Yellow-billed Cuckoo	*Coccyzus americanus*

Fish

Channel Darter	*Percina copelandi*
Emerald Shiner	*Notropis atherinoides*
Pumpkinseed	*Lepomis gibbosus*
Rock Bass	*Ambloplites rupestris*
Yellow Perch	*Perca flavescens*

Frogs

Bullforg	*Rana catesbeiana*
Green frog	*Rana clamitans*

Macroinvertebrates

Aquatic earthworm	Oligochaeta
Darner dragonfly	Odonata Aeshnidae
Dobsonfly larvae	Megaloptera Corydalidae
Fingernail clam	Bivalvia Sphaeriidae
Flatworm	Turbellaria
Narrowwinged damselfly	Odonata Coenagrionidae
Non-biting midge	Diptera Chironomidae
Pond snail	Gastropoda Lymnaeidae
Scud	Crustacea Amphipoda
Skimmer dragonfly	Odonata Libellulidae
Sow bug	Isopoda Asellidae
Squaregill mayfly	Ephemeroptera Caenidae
Zebra mussel	Bivalvia Dreisseniidae

Vegetation

Amerian water horehound	*Lycopus americanus*
Arrow Leaf Tear Thumb	*Polygonum sagittatum*
Bird Vetch	*Vicia cracca*
Bog goldenrod	*Solidago uliginosa*
Broadleaf Cattail	*Typha latifolia*
Canadian horseweed	*Conyza canadensis*
Canadian Waterweed	*Elodea canadensis*
Coon's Tail	*Ceratophyllum demersum*
Curly pondweed	*Potamogeton crispus*
Eurasian water milfoil	*Myriophyllum spicatum*
Field bindweed	*Convolvulus arvensis*
Field Horsetail	*Equisetum arvense*
Flat-top goldenrod	*Euthamia graminifolia*
Fox sedge	*Carex vulpinoidea*
Giant Goldenrod	*Solidago gigantea*
Green Bulrush	*Scirpus atrovirens*
Jewelweed	*Impatiens capensis*
Leafy pondweed	*Potamogeton foliosus*
Meadow Willow	*Salix petiolaris*
Purple Loosestrife	*Lythrum salicaria*
Queen Anne's Lace	*Daucus carota*
Reed Canarygrass	*Phalaris arundinacea*
Spotted joe pye weed	*Eupatorium maculatum*
Swamp thistle	*Cirsium muticum*
White panicle aster	*Symphyotrichum lanceolatum*

Water Quality

	2012	2013
CDOM mg/L	24.4	3.7
Temperature °C	28.8	16.0
Specific Conductance µS/cm	382	309
Turbidity	0.014	0.020
Total phosphorus µg/L	35.0	19.5
Silicate µg/L	0.242	0.029
pH	8.41	7.94
Alkalinity (CaCO3) mg/L	NA	89.8
Chlorophyll-a µg/L	7.02	2.90
Nitrate mg/L	0.003	0.970
Chloride mg/L	NA	23.9
Sulfate mg/L	NA	24.2
Green algae µg/L	0.32	0.33
Blue-green algae µg/L	2.20	0.15
Diatoms µg/L	1.57	1.02
Cryptophyta µg/L	0.07	0.12

MAW12-06

UTM E 515380
UTM N 4980995
Class: Palustrine Emergent
Size: 2.7 ha
Location: Dead-end of Kinnie Road. Gravel road continues past gate onto NYPA property. Wetland is past the barbed wire fence, on right.

Key

	Species of Greatest Conservation Need (SGCN)
	Invasive species

Birds

Within 100m radius

Alder Flycatcher	*Empidonax alnorum*
American Crow	*Corvus brachyrhynchos*
American Goldfinch	*Carduelis tristis*
American Redstart	*Setophaga ruticilla*
American Robin	*Turdus migratorius*
Baltimore Oriole	*Icterus galbula*
Black-capped Chickadee	*Poecile atricapilla*
Blue Jay	*Cyanocitta cristata*
Brown Thrasher	*Toxostoma rufum*
Cedar Waxwing	*Bombycilla cedrorum*
Chestnut-sided Warbler	*Dendroica pensylvanica*
Common Grackle	*Quiscalus quiscula*
Common Yellowthroat	*Geothlypis trichas*
Double-crested Cormorant	*Phalacrocorax auritus*
Eastern Kingbird	*Tyrannus tyrannus*
Eastern Towhee	*Pipilo erythrophthalmus*
Gray Catbird	*Dumetella carolinensis*
Great-crested Flycatcher	*Myiarchus tyrannulus*
Green Heron	*Butorides virescens*
Least Flycatcher	*Empidonax minimus*
Northern Flicker	*Colaptes auratus*
Red-winged Blackbird	*Agelaius phoeniceus*
Song Sparrow	*Melospiza melodia*
Tree Swallow	*Tachycienta bicolor*
Veery	*Catharus fuscescens*
Warbling Vireo	*Vireo gilvus*
White-breasted Nuthatch	*Sitta carolinensis*
Wood Duck	*Aix sponsa*
Wood Thrush	*Hylocichla mustelina*
Yellow Warbler	*Dendroica petechia*
Yellow-bellied Sapsucker	*Sphyrapicus varius*
Yellow-throated Vireo	*Vireo flavifrons*

Outside 100m radius

American Crow	*Corvus brachyrhynchos*
American Robin	*Turdus migratorius*
Canada Goose	*Branta canadensis*
Common Loon	*Gavia immer*
Common Tern	*Sterna hirundo*
Downy Woodpecker	*Picoides pubescens*
Great Blue Heron	*Ardea herodias*
Mallard	*Anas platyrhynchos*
Ring-billed Gull	*Larus delawarensis*
Veery	*Catharus fuscescens*
White-throated Sparrow	*Zonotrichia albicollis*

Fish

Brook Stickleback	*Culaea inconstans*
Brown Bullhead	*Ictalurus nebulosus*
Central Mudminnow	*Umbra limi*

Frogs

Bullforg	*Rana catesbeiana*
Green frog	*Rana clamitans*
Grey treefrog	*Hyla versicolor*
Spring peeper	*Pseudacris crucifer*

Macroinvertebrates

Biting midge	Diptera Ceratopogonidae
Blackfly	Diptera Simuliidae
Caddisfly	Trichoptera
Leech	Annelida Hirudinea
Mosquito	Diptera Culicidae
Pond snail	Gastropoda Lymnaeidae
Water scavenger beetle	Coleoptera Hydrophilidae
Water treader	Hemiptera Gerridae

Vegetation

Amerian water horehound	*Lycopus americanus*
Bald spikerush	*Eleocharis erythropoda*
Bird Vetch	*Vicia cracca*
Broadleaf Arrowhead	*Sagittaria latifolia*
Broadleaf Cattail	*Typha latifolia*
Bulblet Bearing Water Hemlock	*Cicuta bulbifera*
Canada Goldenrod	*Solidago canadensis*
Canadian Waterweed	*Elodea canadensis*
Climbing nightshade	*Solanum Dulcamara*
Common buckthorn	*Rhamnus cathartica*
Common dandelion	*Taraxacum officinale*
Common Duckweed	*Lemna minor*
Common plantain	*Plantago major*
Coon's Tail	*Ceratophyllum demersum*
Dotted howthorn	*Crategus punctata*
Eurasian water milfoil	*Myriophyllum spicatum*
European bur-reed	*Sparganium emersum*
Field Horsetail	*Equisetum arvense*
Floating Pondweed	*Potamogeton natans*
Fowl Bluegrass	*Poa palustris*
Gray Dogwood	*Cornus racemosa*
Hedge False Bindweed	*Calystegia sepium*
Narrowleaf Cattail	*Typha angustifolia*
Northern water plantain	*Alisma triviale*
Purple Loosestrife	*Lythrum salicaria*
Pussy willow	*Salix discolor*
Queen Anne's Lace	*Daucus carota*
Red Clover	*Trifolium pratense*
Reed Canarygrass	*Phalaris arundinacea*
Rice Cutgrass	*Leersia oryzoides*
Swamp white oak	*Quercus bicolor*
Threelobe beggaticks	*Bidens tripartita*
Threepetal bedstraw	*Galium trifidum*
Timothy	*Phleum pratense*
Wild parsnip	*Pastinaca sativa*
Yellowfruit Sedge	*Carex annectens*

Water Quality

	2012	2013
CDOM mg/L	4.22	14.7
Temperature °C	28.2	19.0
Specific Conductance µS/cm	304	646
Turbidity	0.069	0.017
Total phosphorus µg/L	37.7	28.3
Silicate µg/L	0.061	0.251
pH	8.78	8.03
Alkalinity (CaCO3) mg/L	NA	261
Chlorophyll-a µg/L	5.29	5.16
Nitrate mg/L	0.046	52.4
Chloride mg/L	NA	0.03
Sulfate mg/L	NA	10.6
Green algae µg/L	1.02	1.23
Blue-green algae µg/L	1.26	0.31
Diatoms µg/L	0.89	1.52
Cryptophyta µg/L	1.59	0.02

MAW12-07

UTM E 510849
UTM N 4979521
Class: Palustrine Shrub
Size: 3.2 ha
Location: On State Highway 131, 1,000 meters west of Barnhart Island Rd. Yellow gate marks path to wetland. Wetland is approximately 400 meters up the path on west side.

Key

- Species of Greatest Conservation Need (SGCN)
- Invasive species

Birds

Within 100m radius

Alder Flycatcher	*Empidonax alnorum*
American Coot	*Fulica americana*
American Goldfinch	*Carduelis tristis*
American Robin	*Turdus migratorius*
Baltimore Oriole	*Icterus galbula*
Black-capped Chickadee	*Poecile atricapilla*
Brown-headed Cowbird	*Molothrus ater*
Cedar Waxwing	*Bombycilla cedrorum*
Chestnut-sided Warbler	*Dendroica pensylvanica*
Cliff Swallow	*Petrochelidon pyrrhonota*
Common Grackle	*Quiscalus quiscula*
Common Tern	*Sterna hirundo*
Common Yellowthroat	*Geothlypis trichas*
Downy Woodpecker	*Picoides pubescens*
Eastern Kingbird	*Tyrannus tyrannus*
Gray Catbird	*Dumetella carolinensis*
Great Blue Heron	*Ardea herodias*
Great-crested Flycatcher	*Myiarchus tyrannulus*
Green Heron	*Butorides virescens*
Hairy Woodpecker	*Picoides villosus*
Mallard	*Anas platyrhynchos*
Northern Flicker	*Colaptes auratus*
Pileated Woodpecker	*Dryocopus pileatus*
Red-winged Blackbird	*Agelaius phoeniceus*
Song Sparrow	*Melospiza melodia*
Swamp Sparrow	*Melospiza georgiana*
Tree Swallow	*Tachycienta bicolor*
Veery	*Catharus fuscescens*
Virginia Rail	*Rallus limicola*
White-throated Sparrow	*Zonotrichia albicollis*
Wood Duck	*Aix sponsa*
Yellow Warbler	*Dendroica petechia*

Outside 100m radius

Alder Flycatcher	*Empidonax alnorum*
American Crow	*Corvus brachyrhynchos*
American Redstart	*Setophaga ruticilla*
American Robin	*Turdus migratorius*
Black-and-white Warbler	*Mniotilta varia*
Black-capped Chickadee	*Poecile atricapilla*
Blue Jay	*Cyanocitta cristata*
Brown-headed Cowbird	*Molothrus ater*
Canada Goose	*Branta canadensis*
Common Tern	*Sterna hirundo*
Common Yellowthroat	*Geothlypis trichas*
European Starling	*Sturnus vulgaris*
Great-crested Flycatcher	*Myiarchus tyrannulus*
Killdeer	*Charadirus vociferus*
Mourning Dove	*Zenaida macroura*
Northern Flicker	*Colaptes auratus*
Ring-billed Gull	*Larus delawarensis*
Rose-breasted Grosbeak	*Pheucticus ludovicianus*
Scarlet Tanager	*Piranga olivacea*
Veery	*Catharus fuscescens*
Virginia Rail	*Rallus limicola*
Warbling Vireo	*Vireo gilvus*
Yellow-bellied Sapsucker	*Sphyrapicus varius*

Fish

Central Mudminnow	*Umbra limi*

Frogs

Bullforg	*Rana catesbeiana*
Green frog	*Rana clamitans*

Macroinvertebrates

Non-biting midge	Diptera Chironomidae
Physid snail	Gastropoda Physidae
Pond snail	Gastropoda Lymnaeidae
Ramshorn snail	Gastropoda Planorbidae
Scud	Crustacea Amphipoda
Soldier fly	Diptera Stratiomyidae
Squaregill mayfly	Ephemeroptera Caenidae
Valve snail	Gastropoda Valvitidae
Water mite	Arachnida
Water scavenger beetle	Coleoptera Hydrophilidae

Vegetation

Amerian water horehound	*Lycopus americanus*
Arrow Leaf Tear Thumb	*Polygonum sagittatum*
Bird Vetch	*Vicia cracca*
Blue skullcap	*Scutellaria lateriflora*
Broadfruit Burreed	*Sparganium eurycarpum*
Broadleaf Arrowhead	*Sagittaria latifolia*
Broadleaf Cattail	*Typha latifolia*
Bulblet Bearing Water Hemlock	*Cicuta bulbifera*
Climbing nightshade	*Solanum Dulcamara*
Common Duckmeat	*Spirodela polyrrhiza*
Common Frogbit	*Hydrocharis morsus ranae*
Coon's Tail	*Ceratophyllum demersum*
Cypress-like sedge	*Carex pseudocyperus*
Devil's beggatick	*Bidens frondosa*
Field Horsetail	*Equisetum arvense*
Green ash	*Fraxinus pennsylvenica*
Interrupted fern	*Osmunda calytoniana*
Jewelweed	*Impatiens capensis*
Meadow Willow	*Salix petiolaris*
Purple Loosestrife	*Lythrum salicaria*
Reed Canarygrass	*Phalaris arundinacea*
Rice Cutgrass	*Leersia oryzoides*
Sensitive Fern	*Onoclea sensibilis*
Spotted joe pye weed	*Eutrochium maculatum*

Water Quality

	2012	2013
CDOM mg/L	43.9	24.6
Temperature °C	25.3	11.5
Specific Conductance µS/cm	712	159
Turbidity	0.114	0.012
Total phosphorus µg/L	182	39.8
Silicate µg/L	1.18	0.024
pH	7.61	7.42
Alkalinity (CaCO3) mg/L	NA	66.7
Chlorophyll-a µg/L	55	4.73
Nitrate mg/L	0.016	0.03
Chloride mg/L	NA	18.9
Sulfate mg/L	NA	5.26
Green algae µg/L	3.92	1.23
Blue-green algae µg/L	2.15	0.46
Diatoms µg/L	5.05	1.14
Cryptophyta µg/L	0.45	0.00

MAW12-08

UTM E 511443
UTM N 4979389
Class: Palustrine Emergent
Size: 3.7 ha
Location: On Horton Road, 300 meters south of State Highway 131. Wetland can be seen from road.

Key

- Species of Greatest Conservation Need (SGCN)
- Invasive species

Birds

Within 100m radius

American Bittern	*Botaurus lentiginosus*
American Goldfinch	*Carduelis tristis*
American Redstart	*Setophaga ruticilla*
American Robin	*Turdus migratorius*
Baltimore Oriole	*Icterus galbula*
Belted Kingfisher	*Ceryle alcyon*
Brown-headed Cowbird	*Molothrus ater*
Canada Goose	*Branta canadensis*
Cedar Waxwing	*Bombycilla cedrorum*
Chestnut-sided Warbler	*Dendroica pensylvanica*
Common Grackle	*Quiscalus quiscula*
Common Tern	*Sterna hirundo*
Common Yellowthroat	*Geothlypis trichas*
Eastern Kingbird	*Tyrannus tyrannus*
European Starling	*Sturnus vulgaris*
Gray Catbird	*Dumetella carolinensis*
Mallard	*Anas platyrhynchos*
Northern Flicker	*Colaptes auratus*
Red-eyed Vireo	*Vireo olivaceus*
Red-winged Blackbird	*Agelaius phoeniceus*
Rose-breasted Grosbeak	*Pheucticus ludovicianus*
Song Sparrow	*Melospiza melodia*
Tree Swallow	*Tachycienta bicolor*
Veery	*Catharus fuscescens*
White-breasted Nuthatch	*Sitta carolinensis*
Wood Duck	*Aix sponsa*
Yellow Warbler	*Dendroica petechia*
Yellow-bellied Sapsucker	*Sphyrapicus varius*

Outside 100m radius

American Crow	*Corvus brachyrhynchos*
American Redstart	*Setophaga ruticilla*
American Robin	*Turdus migratorius*
Blue Jay	*Cyanocitta cristata*
Chipping Sparrow	*Spizella passerina*
Double-crested Cormorant	*Phalacrocorax auritus*
Green Heron	*Butorides virescens*
Mourning Dove	*Zenaida macroura*
Northern Cardinal	*Cardinalis cardinalis*
Ring-billed Gull	*Larus delawarensis*

Fish

Bluegill	*Lepomis macrochirus*
Pumpkinseed	*Lepomis gibbosus*
Smallmouth Bass	*Micropterus dolomieui*

Frogs

Bullforg	*Rana catesbeiana*
Green frog	*Rana clamitans*
Northern Leopard frog	*Rana pipiens*
Spring peeper	*Pseudacris crucifer*

Macroinvertebrates

Samplers lost

Vegetation

Amerian water horehound	*Lycopus americanus*
American hazelnut	*Corylus americana*
American red raspberry	*Rubus idaeus*
Arrow Leaf Tear Thumb	*Polygonum sagittatum*
Bird Vetch	*Vicia cracca*
Broadleaf Cattail	*Typha latifolia*
Canada goldenrod	*Solidago altissima*
Common Duckmeat	*Spirodela polyrhiza*
Curlytop Knotweed	*Polygonum lapathifolium*
European bur-reed	*Sparganium emersum*
Flat-top goldenrod	*Euthamia graminifolia*
Jewelweed	*Impatiens capensis*
Reed Canarygrass	*Phalaris arundinacea*
Rice Cutgrass	*Leersia oryzoides*
Riverbank grape	*Vitis riparia*
Rough avens	*Geum lacinatum*
Sensitive Fern	*Onoclea sensibilis*
Spotted joe pye weed	*Eutrochium maculatum*
Swamp Verbena	*Verbena hastata*
Virginia water horehound	*Lycopus virginicus*
Wild parsnip	*Pastinaca sativa*
Wrinkle Leaf Goldenrod	*Solidago rugosa*

Water Quality

	2012	2013
CDOM mg/L	18.2	15.5
Temperature °C	25.1	22.0
Specific Conductance µS/cm	526	601
Turbidity	0.021	0.093
Total phosphorus µg/L	44.9	89.3
Silicate µg/L	0.434	0.321
pH	8.27	7.75
Alkalinity (CaCO3) mg/L	85.2	143
Chlorophyll-a µg/L	6.99	15.2
Nitrate mg/L	0.010	0.03
Chloride mg/L	NA	70.5
Sulfate mg/L	NA	21.1
Green algae µg/L	17.41	8.03
Blue-green algae µg/L	5.93	0.94
Diatoms µg/L	6.99	5.82
Cryptophyta µg/L	0.00	0.00

MAW12-09

UTM E 511232
UTM N 4982120
Class: Palustrine Emergent
Size: 0.37 ha
Location: On Barnhart Island. Unknown gravel road, branching north from Campround Rd, leading to bottom of Long Sault Dam. Wetland is 300 meters east of dam on southern bank of river.

Key

Species of Greatest Conservation Need (SGCN)
Invasive species

Birds

Within 100m radius

Alder Flycatcher	*Empidonax alnorum*
American Goldfinch	*Carduelis tristis*
American Redstart	*Setophaga ruticilla*
American Robin	*Turdus migratorius*
Baltimore Oriole	*Icterus galbula*
Barn Swallow	*Hirundo rustica*
Black-capped Chickadee	*Poecile atricapilla*
Blue Jay	*Cyanocitta cristata*
Cedar Waxwing	*Bombycilla cedrorum*
Chestnut-sided Warbler	*Dendroica pensylvanica*
Cliff Swallow	*Petrochelidon pyrrhonota*
Common Tern	*Sterna hirundo*
Common Yellowthroat	*Geothlypis trichas*
Eastern Kingbird	*Tyrannus tyrannus*
Gray Catbird	*Dumetella carolinensis*
Great-crested Flycatcher	*Myiarchus tyrannulus*
Mallard	*Anas platyrhynchos*
Northern Flicker	*Colaptes auratus*
Pileated Woodpecker	*Dryocopus pileatus*
Purple Finch	*Carpodacus purpureus*
Red-winged Blackbird	*Agelaius phoeniceus*
Song Sparrow	*Melospiza melodia*
Swamp Sparrow	*Melospiza georgiana*
Tree Swallow	*Tachycienta bicolor*
Veery	*Catharus fuscescens*
Warbling Vireo	*Vireo gilvus*
Yellow Warbler	*Dendroica petechia*
Yellow-throated Vireo	*Vireo flavifrons*

Outside 100m radius

American Crow	*Corvus brachyrhynchos*
Baltimore Oriole	*Icterus galbula*
Barn Swallow	*Hirundo rustica*
Black-and-white Warbler	*Mniotilta varia*
Black-billed Cuckoo	*Coccyzus erythropthalmus*
Blue Jay	*Cyanocitta cristata*
Canada Goose	*Branta canadensis*
Cliff Swallow	*Petrochelidon pyrrhonota*
Common Loon	*Gavia immer*
Common Tern	*Sterna hirundo*
Double-crested Cormorant	*Phalacrocorax auritus*
Downy Woodpecker	*Picoides pubescens*
European Starling	*Sturnus vulgaris*
Greater Yellowlegs	*Tringa melanoleuca*
Hairy Woodpecker	*Picoides villosus*
Herring Gull	*Larus argentatus*
Mallard	*Anas platyrhynchos*
Northern Flicker	*Colaptes auratus*
Red-eyed Vireo	*Vireo olivaceus*
Red-winged Blackbird	*Agelaius phoeniceus*
Ring-billed Gull	*Larus delawarensis*
Scarlet Tanager	*Piranga olivacea*
Tree Swallow	*Tachycienta bicolor*
Warbling Vireo	*Vireo gilvus*
Yellow-bellied Sapsucker	*Sphyrapicus varius*

Fish

Bluegill	*Lepomis macrochirus*
Channel Darter	*Percina copelandi*
Yellow Perch	*Perca flavescens*

Frogs

American toad	*Bufo americanus*
Boreal Chorus frog	*Pseudacris maculata*
Grey treefrog	*Hyla versicolor*
Northern Leopard frog	*Rana pipiens*
Spring peeper	*Pseudacris crucifer*

Macroinvertebrates

Non-biting midge	Diptera Chironomidae
Pond snail	Gastropoda Lymnaeidae
Sow bug	Isopoda Asellidae

Vegetation

Silverweed cinquefoil	*Argentina anserina*
Amerian water horehound	*Lycopus americanus*
ater horsetail	*Equisetum fluviatile*
Bird Vetch	*Vicia cracca*
Bird's foot Trefoil	*Lotus corniculatus*
Broadleaf Arrowhead	*Sagittaria latifolia*
Canada Goldenrod	*Solidago canadensis*
Common Boneset	*Eupatorium perfoliatum*
Common dandelion	*Taraxacum officinale*
Common reed	*Phragmites australis*
Field bindweed	*Convolvulus arvensis*
Flat-top goldenrod	*Euthamia graminifolia*
Fragrant bedstraw	*Galium triflorum*
Gray Dogwood	*Cornus racemosa*
Hedge False Bindweed	*Calystegia sepium*
Jewelweed	*Impatiens capensis*
Meadow Willow	*Salix petiolaris*
Purple Loosestrife	*Lythrum salicaria*
Redosier dogwood	*Cornus sericea*
Reed Canarygrass	*Phalaris arundinacea*
Variegated scouringrush	*Equisetum variegatum*
Virginia strawberry	*Fragaria virginiana*
White Meadowsweet	*Spiraea alba*

Water Quality

	2012	2013
CDOM mg/L	16.7	3.69
Temperature °C	26.4	12
Specific Conductance µS/cm	629	239
Turbidity	0.203	0.003
Total phosphorus µg/L	218	14.8
Silicate µg/L	0.724	0.269
pH	7.75	7.94
Alkalinity (CaCO3) mg/L	NA	99.4
Chlorophyll-a µg/L	35.2	0.492
Nitrate mg/L	0.037	0.82
Chloride mg/L	NA	24.6
Sulfate mg/L	NA	24.3
Green algae µg/L	NA	0.13
Blue-green algae µg/L	NA	0.08
Diatoms µg/L	NA	0.19
Cryptophyta µg/L	NA	0.08

MAW12-10

UTM E 512218
UTM N 4982660
Class: Palustrine Emergent
Size: 0.22 ha
Location: On Barnhart Island. Off Beach Marina Rd. Gravel road leading under Barnhart Island Bridge. Wetland is 30 meters east of bridge on north bank of river.

Key

Species of Greatest Conservation Need (SGCN)
Invasive species

Birds

Within 100m radius

American Goldfinch	*Carduelis tristis*
American Redstart	*Setophaga ruticilla*
American Robin	*Turdus migratorius*
Baltimore Oriole	*Icterus galbula*
Barn Swallow	*Hirundo rustica*
Canada Goose	*Branta canadensis*
Cedar Waxwing	*Bombycilla cedrorum*
Chestnut-sided Warbler	*Dendroica pensylvanica*
Common Grackle	*Quiscalus quiscula*
Common Merganser	*Mergus merganser*
Common Tern	*Sterna hirundo*
Common Yellowthroat	*Geothlypis trichas*
Double-crested Cormorant	*Phalacrocorax auritus*
Downy Woodpecker	*Picoides pubescens*
Eastern Kingbird	*Tyrannus tyrannus*
Eastern Wood-Peewee	*Contopus virens*
Least Flycatcher	*Empidonax minimus*
Northern Flicker	*Colaptes auratus*
Red-winged Blackbird	*Agelaius phoeniceus*
Song Sparrow	*Melospiza melodia*
Spotted Sandpiper	*Actitis macularia*
Veery	*Catharus fuscescens*
Warbling Vireo	*Vireo gilvus*
White-breasted Nuthatch	*Sitta carolinensis*
Wild Turkey	*Meleagris gallopavo*
Wood Thrush	*Hylocichla mustelina*
Yellow Warbler	*Dendroica petechia*
Yellow-bellied Sapsucker	*Sphyrapicus varius*

Outside 100m radius

American Crow	*Corvus brachyrhynchos*
American Robin	*Turdus migratorius*
Baltimore Oriole	*Icterus galbula*
Black-capped Chickadee	*Poecile atricapilla*
Common Loon	*Gavia immer*
Common Merganser	*Mergus merganser*
Common Raven	*Corvus corax*
Common Tern	*Sterna hirundo*
Double-crested Cormorant	*Phalacrocorax auritus*
Eastern Phoebe	*Sayornis phoebe*
Great Blue Heron	*Ardea herodias*
Green Heron	*Butorides virescens*
Mallard	*Anas platyrhynchos*
Pileated Woodpecker	*Dryocopus pileatus*
Red-eyed Vireo	*Vireo olivaceus*
Ring-billed Gull	*Larus delawarensis*
Swamp Sparrow	*Melospiza georgiana*
Yellow-billed Cuckoo	*Coccyzus americanus*

Fish

Channel Darter	*Percina copelandi*

Frogs

No frogs

Macroinvertebrates

Non-biting midge	Diptera Chironomidae
Physid nail	Gastropoda Phisidae
Scud	Crustacea Amphipoda
Sow bug	Isopoda Asellidae

Vegetation

Amerian water horehound	*Lycopus americanus*
American hornbeam	*Carpinus caroliniana*
ater horsetail	*Equisetum fluviatile*
Bebb willow	*Salix bebbiana*
Bird Vetch	*Vicia cracca*
Common reed	*Phragmites australis*
Field Horsetail	*Equisetum arvense*
Flat-top goldenrod	*Euthamia graminifolia*
Giant Goldenrod	*Solidago gigantea*
Groundnut	*Apios americana*
Jewelweed	*Impatiens capensis*
Meadow Willow	*Salix petiolaris*
Purple Loosestrife	*Lythrum salicaria*
Queen Anne's Lace	*Daucus carota*
Reed Canarygrass	*Phalaris arundinacea*
Rice Cutgrass	*Leersia oryzoides*
Silverweed cinquefoil	*Argentina anserina*
Softstem Bulrush	*Scirpus tabernaemontani*
Virginia strawberry	*Fragaria virginiana*

Water Quality

	2012	2013
CDOM mg/L	29.5	3.88
Temperature °C	19.5	13
Specific Conductance µS/cm	227	257
Turbidity	0.023	0.001
Total phosphorus µg/L	60.9	9.51
Silicate µg/L	0.160	0.046
pH	7.43	7.42
Alkalinity (CaCO3) mg/L	107	85.5
Chlorophyll-a µg/L	15.6	0.837
Nitrate mg/L	0.005	1.03
Chloride mg/L	NA	29.5
Sulfate mg/L	NA	25
Green algae µg/L	NA	0.03
Blue-green algae µg/L	NA	0.04
Diatoms µg/L	NA	0.13
Cryptophyta µg/L	NA	0.04

MAW12-11

UTM E 514169
UTM N 4981315
Class: Palustrine Emergent
Size: 0.28 ha
Location: On Barnhart Island. South of Robinson Bay Road 2 km east of Barnhart Islad Road.

Key

- Species of Greatest Conservation Need (SGCN)
- Invasive species

Birds

Within 100m radius

American Crow	*Corvus brachyrhynchos*
American Goldfinch	*Carduelis tristis*
Barn Swallow	*Hirundo rustica*
Belted Kingfisher	*Ceryle alcyon*
Brown-headed Cowbird	*Molothrus ater*
Canada Goose	*Branta canadensis*
Cedar Waxwing	*Bombycilla cedrorum*
Chestnut-sided Warbler	*Dendroica pensylvanica*
Common Grackle	*Quiscalus quiscula*
Common Merganser	*Mergus merganser*
Common Tern	*Sterna hirundo*
Common Yellowthroat	*Geothlypis trichas*
Eastern Kingbird	*Tyrannus tyrannus*
Gray Catbird	*Dumetella carolinensis*
Mallard	*Anas platyrhynchos*
Mourning Dove	*Zenaida macroura*
Red-winged Blackbird	*Agelaius phoeniceus*
Ring-billed Gull	*Larus delawarensis*
Song Sparrow	*Melospiza melodia*
Swamp Sparrow	*Melospiza georgiana*
Veery	*Catharus fuscescens*
Warbling Vireo	*Vireo gilvus*
Wood Duck	*Aix sponsa*
Yellow Warbler	*Dendroica petechia*

Outside 100m radius

Alder Flycatcher	*Empidonax alnorum*
American Crow	*Corvus brachyrhynchos*
American Robin	*Turdus migratorius*
Black-capped Chickadee	*Poecile atricapilla*
Canada Goose	*Branta canadensis*
Common Grackle	*Quiscalus quiscula*
Common Tern	*Sterna hirundo*
Common Yellowthroat	*Geothlypis trichas*
Double-crested Cormorant	*Phalacrocorax auritus*
Eastern Towhee	*Pipilo erythrophthalmus*
Great Blue Heron	*Ardea herodias*
Green Heron	*Butorides virescens*
Herring Gull	*Larus argentatus*
Ring-billed Gull	*Larus delawarensis*
Swamp Sparrow	*Melospiza melodia*
Tree Swallow	*Tachycienta bicolor*
Veery	*Catharus fuscescens*
Warbling Vireo	*Vireo gilvus*
White-throated Sparrow	*Zonotrichia albicollis*
Wood Duck	*Aix sponsa*

Fish

Bluegill	*Lepomis macrochirus*
Channel Darter	*Percina copelandi*
Emerald Shiner	*Notropis atherinoides*
Longnose Dace	*Rhinichthys cataractae*
Pumpkinseed	*Lepomis gibbosus*

Frogs

Bullforg	*Rana catesbeiana*
Grey treefrog	*Hyla versicolor*

Macroinvertebrates

Samplers lost

Vegetation

Amerian hogpeanut	*Amphicarpaea bracteata*
Blue skullcap	*Scutellaria lateriflora*
Canada Goldenrod	*Solidago canadensis*
Canadian Waterweed	*Elodea canadensis*
Common reed	*Phragmites australis*
Coon's Tail	*Ceratophyllum demersum*
Eurasian water milfoil	*Myriophyllum spicatum*
Gray Dogwood	*Cornus racemosa*
Hedge False Bindweed	*Calystegia sepium*
Jewelweed	*Impatiens capensis*
Purple Loosestrife	*Lythrum salicaria*

Water Quality

	2012	2013
CDOM mg/L	19.4	3.79
Temperature °C	23.1	15.5
Specific Conductance µS/cm	195	303
Turbidity	0.272	0.008
Total phosphorus µg/L	78.9	9.89
Silicate µg/L	0.062	0.190
pH	8.78	7.01
Alkalinity (CaCO3) mg/L	99.7	90.5
Chlorophyll-a µg/L	19.1	1.55
Nitrate mg/L	0.006	0.87
Chloride mg/L	NA	22.4
Sulfate mg/L	NA	29.3
Green algae µg/L	0.51	0.14
Blue-green algae µg/L	0.78	0.05
Diatoms µg/L	1.01	0.75
Cryptophyta µg/L	0.00	0.06

MAW12-12

UTM E 517439
UTM N 4982125
Class: Palustrine Shrub
Size: 2.1 ha
Location: On Barnhart Island. Off Robinson Bay Road approximately 6 km from Barnhart Island Road. East side of road.

Key

	Species of Greatest Conservation Need (SGCN)
	Invasive species

Birds

Within 100m radius

Alder Flycatcher	*Empidonax alnorum*
American Goldfinch	*Carduelis tristis*
American Robin	*Turdus migratorius*
Baltimore Oriole	*Icterus galbula*
Blackpoll Warbler	*Dendroica striata*
Cedar Waxwing	*Bombycilla cedrorum*
Chestnut-sided Warbler	*Dendroica pensylvanica*
Common Grackle	*Quiscalus quiscula*
Common Moorhen	*Gallinula chloropus*
Common Yellowthroat	*Geothlypis trichas*
Downy Woodpecker	*Picoides pubescens*
Eastern Kingbird	*Tyrannus tyrannus*
Gray Catbird	*Dumetella carolinensis*
Great-crested Flycatcher	*Myiarchus tyrannulus*
Hairy Woodpecker	*Picoides villosus*
Indigo Bunting	*Passerina cyanea*
Mallard	*Anas platyrhynchos*
Northern Flicker	*Colaptes auratus*
Red-winged Blackbird	*Agelaius phoeniceus*
Song Sparrow	*Melospiza melodia*
Swamp Sparrow	*Melospiza georgiana*
Tree Swallow	*Tachycienta bicolor*
Veery	*Catharus fuscescens*
Virginia Rail	*Rallus limicola*
Warbling Vireo	*Vireo gilvus*
White-breasted Nuthatch	*Sitta carolinensis*
Wood Duck	*Aix sponsa*
Wood Thrush	*Hylocichla mustelina*
Yellow Warbler	*Dendroica petechia*
Yellow-bellied Sapsucker	*Sphyrapicus varius*

Outside 100m radius

American Crow	*Corvus brachyrhynchos*
Canada Goose	*Branta canadensis*
Mourning Dove	*Zenaida macroura*
Pileated Woodpecker	*Dryocopus pileatus*
Red-eyed Vireo	*Vireo olivaceus*
Ring-billed Gull	*Larus delawarensis*
Tree Swallow	*Tachycienta bicolor*
White-breasted Nuthatch	*Sitta carolinensis*
Wild Turkey	*Meleagris gallopavo*
Yellow-bellied Sapsucker	*Sphyrapicus varius*
Yellow-billed Cuckoo	*Coccyzus americanus*

Fish

No fish captured

Frogs

Boreal Chorus frog	*Pseudacris maculata*
Bullforg	*Rana catesbeiana*
Green frog	*Rana clamitans*
Grey treefrog	*Hyla versicolor*
Northern Leopard frog	*Rana pipiens*
Spring peeper	*Pseudacris crucifer*

Macroinvertebrates

Darner dragonfly	Odonata Aeshnidae
Fingernail clam	Bivalvia Sphaeriidae
Pond snail	Gastropoda Lymnaeidae

Vegetation

Amerian water horehound	*Lycopus americanus*
Bird Vetch	*Vicia cracca*
Broadleaf Cattail	*Typha latifolia*
Bulblet Bearing Water Hemlock	*Cicuta bulbifera*
Canada Goldenrod	*Solidago canadensis*
Climbing nightshade	*Solanum dulcamara*
Eastern marsh fern	*Thelypteris palustris*
Flowering rush	*Butomus umbellatus*
Hedge False Bindweed	*Calystegia sepium*
Jewelweed	*Impatiens capensis*
Marsh skullcap	*Scutellaria galericulata*
Meadow Willow	*Salix petiolaris*
Narrowleaf Cattail	*Typha angustifolia*
Purple Loosestrife	*Lythrum salicaria*
Reed Canarygrass	*Phalaris arundinacea*
Sensitive Fern	*Onoclea sensibilis*

Water Quality

	2012	2013
CDOM mg/L	3.40	17.4
Temperature °C	21.5	14
Specific Conductance µS/cm	320	940
Turbidity	0.004	0.015
Total phosphorus µg/L	9.79	67.1
Silicate µg/L	0.064	0.760
pH	8.24	7.14
Alkalinity (CaCO3) mg/L	96.5	392
Chlorophyll-a µg/L	0.405	5.04
Nitrate mg/L	0.219	0.1
Chloride mg/L	NA	11.5
Sulfate mg/L	NA	102
Green algae µg/L	12.23	1.94
Blue-green algae µg/L	3.87	0.10
Diatoms µg/L	19.85	1.12
Cryptophyta µg/L	11.20	0.00

MAW12-13

UTM E 515769
UTM N 4981614
Class: Palustrine Emergent
Size: 2.6 ha
Location: On Barnhart Island. Off Robinson Bay Road approximately 4.5 km from Barnhart Island Road. Approximately 30 meters down unknown access road behind gate. Wetland is directly under power lines.

Key	
	Species of Greatest Conservation Need (SGCN)
	Invasive species

Birds

Within 100m radius

American Goldfinch	*Carduelis tristis*
American Robin	*Turdus migratorius*
Barn Swallow	*Hirundo rustica*
Brown Thrasher	*Toxostoma rufum*
Cedar Waxwing	*Bombycilla cedrorum*
Chestnut-sided Warbler	*Dendroica pensylvanica*
Common Yellowthroat	*Geothlypis trichas*
Eastern Kingbird	*Tyrannus tyrannus*
European Starling	*Sturnus vulgaris*
Great Blue Heron	*Ardea herodias*
Osprey	*Pandion haliaetus*
Red-winged Blackbird	*Agelaius phoeniceus*
Song Sparrow	*Melospiza melodia*
Swamp Sparrow	*Melospiza georgiana*
Tree Swallow	*Tachycienta bicolor*
Willow Flycatcher	*Empidonax traillii*
Yellow Warbler	*Dendroica petechia*

Outside 100m radius

American Crow	*Corvus brachyrhynchos*
American Robin	*Turdus migratorius*
Blue Jay	*Cyanocitta cristata*
Canada Goose	*Branta canadensis*
Double-crested Cormorant	*Phalacrocorax auritus*
European Starling	*Sturnus vulgaris*
Field Sparrow	*Spizella pusilla*
Gray Catbird	*Dumetella carolinensis*
Great Blue Heron	*Ardea herodias*
Northern Flicker	*Colaptes auratus*
Ring-billed Gull	*Larus delawarensis*
Yellow-bellied Sapsucker	*Sphyrapicus varius*

Fish

Not sampled

Frogs

American toad	*Bufo americanus*
Boreal Chorus frog	*Pseudacris maculata*
Bullforg	*Rana catesbeiana*
Green frog	*Rana clamitans*
Northern Leopard frog	*Rana pipiens*
Spring peeper	*Pseudacris crucifer*

Macroinvertebrates

Not sampled with Hester Dendy

Pond snail	Gastropoda Lymnaeidae
Ramshorn snail	Gastropoda Planorbidae

Vegetation

Amerian water horehound	*Lycopus americanus*
Balsma groundsel	*Packera paupercula*
Bird Vetch	*Vicia cracca*
Canada Goldenrod	*Solidago canadensis*
Common reed	*Phragmites australis*
Field Horsetail	*Equisetum arvense*
Flat-top goldenrod	*Euthamia graminifolia*
Giant Goldenrod	*Solidago gigantea*
Little green sedge	*Carex viridula*
Meadow Willow	*Salix petiolaris*
Northern green rush	*Juncus alpinoarticulatus*
Poverty oatgrass	*Danthonia spicata*
Purple Loosestrife	*Lythrum salicaria*
Redosier dogwood	*Cornus sericea*
Variegated scouringrush	*Equisetum variegatum*
Virginia strawberry	*Fragaria virginiana*
White panicle aster	*Symphyotrichum lanceolatum*

Water Quality

No samples collected

MAW12-14

UTM E 517137
UTM N 4982455
Class: Palustrine Emergent
Size: .22 ha
Location: On Barnhart Island. Off Robinson Bay Road approximately 5.5 km from Barnhart Island Road. West side of road.

Key

	Species of Greatest Conservation Need (SGCN)
	Invasive species

Birds

Within 100m radius

Alder Flycatcher	*Empidonax alnorum*
American Goldfinch	*Carduelis tristis*
American Robin	*Turdus migratorius*
Baltimore Oriole	*Icterus galbula*
Black-capped Chickadee	*Poecile atricapilla*
Blackpoll Warbler	*Dendroica striata*
Blue Jay	*Cyanocitta cristata*
Cedar Waxwing	*Bombycilla cedrorum*
Chestnut-sided Warbler	*Dendroica pensylvanica*
Common Grackle	*Quiscalus quiscula*
Common Yellowthroat	*Geothlypis trichas*
Downy Woodpecker	*Picoides pubescens*
Eastern Kingbird	*Tyrannus tyrannus*
European Starling	*Sturnus vulgaris*
Gray Catbird	*Dumetella carolinensis*
Great-crested Flycatcher	*Myiarchus tyrannulus*
House Wren	*Troglodytes aedon*
Northern Flicker	*Colaptes auratus*
Red-winged Blackbird	*Agelaius phoeniceus*
Song Sparrow	*Melospiza melodia*
Swamp Sparrow	*Melospiza georgiana*
Veery	*Catharus fuscescens*
Warbling Vireo	*Vireo gilvus*
White-breasted Nuthatch	*Sitta carolinensis*
Yellow Warbler	*Dendroica petechia*
Yellow-bellied Sapsucker	*Sphyrapicus varius*

Outside 100m radius

American Crow	*Corvus brachyrhynchos*
American Robin	*Turdus migratorius*
Black-billed Cuckoo	*Coccyzus erythropthalmus*
Blue Jay	*Cyanocitta cristata*
Canada Goose	*Branta canadensis*
Chestnut-sided Warbler	*Dendroica pensylvanica*
Common Grackle	*Quiscalus quiscula*
House Wren	*Troglodytes aedon*
Mallard	*Anas platyrhynchos*
Pileated Woodpecker	*Dryocopus pileatus*
Red-tailed Hawk	*Buteo jamaicensis*
Ring-billed Gull	*Larus delawarensis*
Scarlet Tanager	*Piranga olivacea*
Wild Turkey	*Meleagris gallopavo*

Fish

Not sampled

Frogs

Boreal Chorus frog	*Pseudacris maculata*
Grey treefrog	*Hyla versicolor*

Macroinvertebrates

Not sampled with Hester Dendy

Pond snail	Gastropoda Lymnaeidae

Vegetation

Amerian water horehound	*Lycopus americanus*
Bird Vetch	*Vicia cracca*
Broadleaf Cattail	*Typha latifolia*
Canada Goldenrod	*Solidago canadensis*
Field Horsetail	*Equisetum arvense*
Flat-top goldenrod	*Euthamia graminifolia*
Fowl Bluegrass	*Poa palustris*
Jewelweed	*Impatiens capensis*
Purple Loosestrife	*Lythrum salicaria*
Reed Canarygrass	*Phalaris arundinacea*
Rice Cutgrass	*Leersia oryzoides*
Riverbank grape	*Vitis riparia*
Roundleaf dogwood	*Cornus rugosa*
Sensitive Fern	*Onoclea sensibilis*
Spotted joe pye weed	*Eutrochium maculatum*
Swamp milkweed	*Asclepias syriaca*
Swamp thistle	*Cirsium muticum*
Wild parsnip	*Pastinaca sativa*
Woodbine	*Parthenocissus vitacea*

Water Quality

No samples collected

MAW12-15

UTM E 511914
UTM N 4981383
Class: Palustrine Forested
Size: 0.65 ha
Location: On Barnhart Island. Off Barnhart Island Road. 0.5 km north of Eisenhower Lock. East side of road.

Key

- Species of Greatest Conservation Need (SGCN)
- Invasive species

Birds

Within 100m radius

Alder Flycatcher	*Empidonax alnorum*
American Goldfinch	*Carduelis tristis*
American Redstart	*Setophaga ruticilla*
American Robin	*Turdus migratorius*
Baltimore Oriole	*Icterus galbula*
Brown-headed Cowbird	*Molothrus ater*
Cedar Waxwing	*Bombycilla cedrorum*
Chestnut-sided Warbler	*Dendroica pensylvanica*
Cliff Swallow	*Petrochelidon pyrrhonota*
Common Grackle	*Quiscalus quiscula*
Common Yellowthroat	*Geothlypis trichas*
Downy Woodpecker	*Picoides pubescens*
Gray Catbird	*Dumetella carolinensis*
Great-crested Flycatcher	*Myiarchus tyrannulus*
Hairy Woodpecker	*Picoides villosus*
Pileated Woodpecker	*Dryocopus pileatus*
Red-tailed Hawk	*Buteo jamaicensis*
Red-winged Blackbird	*Agelaius phoeniceus*
Song Sparrow	*Melospiza melodia*
Swamp Sparrow	*Melospiza georgiana*
Veery	*Catharus fuscescens*
Warbling Vireo	*Vireo gilvus*
White-breasted Nuthatch	*Sitta carolinensis*
Yellow Warbler	*Dendroica petechia*
Yellow-billed Cuckoo	*Coccyzus americanus*

Outside 100m radius

American Crow	*Corvus brachyrhynchos*
American Robin	*Turdus migratorius*
Baltimore Oriole	*Icterus galbula*
Black-capped Chickadee	*Poecile atricapilla*
Blue Jay	*Cyanocitta cristata*
Canada Goose	*Branta canadensis*
Chestnut-sided Warbler	*Dendroica pensylvanica*
Common Tern	*Sterna hirundo*
Downy Woodpecker	*Picoides pubescens*
Great-crested Flycatcher	*Myiarchus tyrannulus*
House Wren	*Troglodytes aedon*
Northern Flicker	*Colaptes auratus*
Ring-billed Gull	*Larus delawarensis*
Scarlet Tanager	*Piranga olivacea*
Warbling Vireo	*Vireo gilvus*
White-breasted Nuthatch	*Sitta carolinensis*
White-throated Sparrow	*Zonotrichia albicollis*
Yellow-bellied Sapsucker	*Sphyrapicus varius*

Fish

Not sampled

Frogs

Boreal Chorus frog	*Pseudacris maculata*
Spring peeper	*Pseudacris crucifer*

Macroinvertebrates

Not sampled with Hester Dendy

Physid snail	Gastropoda Physidae
Pond snail	Gastropoda Lymnaeidae
Ramshorn snail	Gastropoda Planorbidae

Vegetation

Broadleaf Cattail	*Typha latifolia*
Canada goldenrod	*Solidago altissima*
Field Horsetail	*Equisetum arvense*
Meadow Willow	*Salix petiolaris*
Northern water plantain	*Alisma triviale*
Purple Loosestrife	*Lythrum salicaria*
Red Maple	*Acer rubrum*
Reed Canarygrass	*Phalaris arundinacea*
Softstem Bulrush	*Scirpus tabernaemontani*
Threepetal bedstraw	*Galium trifidum*
Whire rod	*Viburnum nudum*

Water Quality

	2012	2013
CDOM mg/L	No samples collected	31.0
Temperature °C		8.00
Specific Conductance µS/cm		815
Turbidity		0.007
Total phosphorus µg/L		25.3
Silicate µg/L		0.720
pH		7.68
Alkalinity (CaCO3) mg/L		260
Chlorophyll-a µg/L		1.27
Nitrate mg/L		0.030
Chloride mg/L		0.600
Sulfate mg/L		4.47
Green algae µg/L		0.47
Blue-green algae µg/L		0.15
Diatoms µg/L		0.28
Cryptophyta µg/L		0.00

MAW12-16

UTM E 511770
UTM N 4981229
Class: Palustrine Emergent
Size: 1.7
Location: On Barnhart Island. Off Barnhart Island Road. 0.5 km north of Eisenhower Lock. Across the road from wetland 1058.

Key

- Species of Greatest Conservation Need (SGCN)
- Invasive species

Birds

Within 100m radius

Alder Flycatcher	*Empidonax alnorum*
American Bittern	*Botaurus lentiginosus*
American Golfinch	*Carduelis tristis*
American Redstart	*Setophaga ruticilla*
American Robin	*Turdus migratorius*
Baltimore Oriole	*Icterus galbula*
Brown-headed Cowbird	*Molothrus ater*
Cedar Waxwing	*Bombycilla cedrorum*
Chestnut-sided Warbler	*Dendroica pensylvanica*
Common Yellowthroat	*Geothlypis trichas*
Downy Woodpecker	*Picoides pubescens*
Eastern Kingbird	*Tyrannus tyrannus*
Gray Catbird	*Dumetella carolinensis*
Great-crested Flycatcher	*Myiarchus tyrannulus*
Hairy Woodpecker	*Picoides villosus*
Least Flycatcher	*Empidonax minimus*
Red-winged Blackbird	*Agelaius phoeniceus*
Rose-breasted Grosbeak	*Pheucticus ludovicianus*
Scarlet Tanager	*Piranga olivacea*
Song Sparrow	*Melospiza melodia*
Swamp Sparrow	*Melospiza georgiana*
Veery	*Catharus fuscescens*
Warbling Vireo	*Vireo gilvus*
Yellow Warbler	*Dendroica petechia*
Yellow-throated Vireo	*Vireo flavifrons*

Outside 100m radius

American Crow	*Corvus brachyrhynchos*
American Robin	*Turdus migratorius*
Blue Jay	*Cyanocitta cristata*
Canada Goose	*Branta canadensis*
Common Tern	*Sterna hirundo*
Double-crested Cormorant	*Phalacrocorax auritus*
Downy Woodpecker	*Picoides pubescens*
Gray Catbird	*Dumetella carolinensis*
Great Crested Flycatcher	*Myiarchus tyrannulus*
House Wren	*Troglodytes aedon*
Mourning Dove	*Zenaida macroura*
Northern Flicker	*Colaptes auratus*
Ring-billed Gull	*Larus delawarensis*
Tree Swallow	*Tachycienta bicolor*
Veery	*Catharus fuscescens*

Fish

Not sampled

Frogs

Boreal Chorus frog	*Pseudacris maculata*
Green frog	*Rana clamitans*

Macroinvertebrates

Not sampled

Vegetation

Amerian water horehound	*Lycopus americanus*
Bird Vetch	*Vicia cracca*
Brittlestem hempnettle	*Galeopsis tetrahit*
Broadleaf Cattail	*Typha latifolia*
Bulblet Bearing Water Hemlock	*Cicuta bulbifera*
Climbing nightshade	*Solanum Dulcamara*
Common dandelion	*Taraxacum officinale*
Jewelweed	*Impatiens capensis*
Marsh Seedbox	*Ludwigia palustris*
Purple Loosestrife	*Lythrum salicaria*
Reed Canarygrass	*Phalaris arundinacea*
Rice Cutgrass	*Leersia oryzoides*
Swamp thistle	*Cirsium muticum*
Threepetal bedstraw	*Galium trifidum*
Willowleaf aster	*Symphyotrichum praealtum*

Water Quality

No samples collected

MAW12-17

UTM E 514978
UTM N 4980088
Class: Palustrine Emergent
Size: 0.38 ha
Location: On private property: 863 Couty Route 42. Contact is Eleanor Maxwell: 315-778-4174. Access from Kinnie Road. Unmarked access road branching west from Kinnie Road; directly under power lines. Wetland is on both sides of road approximately 0.5 km from Kinnie Rd.

Key

	Species of Greatest Conservation Need (SGCN)
	Invasive species

Birds

Within 100m radius

Alder Flycatcher	*Empidonax alnorum*
American Goldfinch	*Carduelis tristis*
American Redstart	*Setophaga ruticilla*
American Robin	*Turdus migratorius*
Baltimore Oriole	*Icterus galbula*
Black-and-white Warbler	*Mniotilta varia*
Blue Jay	*Cyanocitta cristata*
Brown-headed Cowbird	*Molothrus ater*
Canada Goose	*Branta canadensis*
Cedar Waxwing	*Bombycilla cedrorum*
Chestnut-sided Warbler	*Dendroica pensylvanica*
Common Yellowthroat	*Geothlypis trichas*
Downy Woodpecker	*Picoides pubescens*
Eastern Kingbird	*Tyrannus tyrannus*
Eastern Towhee	*Pipilo erythrophthalmus*
Eastern Wood-Peewee	*Contopus virens*
Gray Catbird	*Dumetella carolinensis*
Hairy Woodpecker	*Picoides villosus*
House Wren	*Troglodytes aedon*
Ovenbird	*Seiurus aurocapillus*
Red-winged Blackbird	*Agelaius phoeniceus*
Rose-breasted Grosbeak	*Pheucticus ludovicianus*
Scarlet Tanager	*Piranga olivacea*
Song Sparrow	*Melospiza melodia*
Swamp Sparrow	*Melospiza georgiana*
Veery	*Catharus fuscescens*
Warbling Vireo	*Vireo gilvus*
White-breasted Nuthatch	*Sitta carolinensis*
White-throated Sparrow	*Zonotrichia albicollis*
Wood Thrush	*Hylocichla mustelina*
Yellow Warbler	*Dendroica petechia*

Outside 100m radius

American Crow	*Corvus brachyrhynchos*
American Robin	*Turdus migratorius*
Blue Jay	*Cyanocitta cristata*
Canada Goose	*Branta canadensis*
European Starling	*Sturnus vulgaris*
Mallard	*Anas platyrhynchos*
Mourning Dove	*Zenaida macroura*
Northern Flicker	*Colaptes auratus*
Ovenbird	*Seiurus aurocapillus*
Red-eyed Vireo	*Vireo olivaceus*
Red-tailed Hawk	*Buteo jamaicensis*
Ring-billed Gull	*Larus delawarensis*
Veery	*Catharus fuscescens*
White-throated Sparrow	*Zonotrichia albicollis*
Wood Thrush	*Hylocichla mustelina*
Yellow-bellied Sapsucker	*Sphyrapicus varius*

Fish

Not sampled

Frogs

Boreal Chorus frog	*Pseudacris maculata*
Green frog	*Rana clamitans*
Grey treefrog	*Hyla versicolor*
Northern Leopard frog	*Rana pipiens*
Spring peeper	*Pseudacris crucifer*

Macroinvertebrates

Mayfly	Ephemeroptera

Vegetation

Amerian water horehound	*Lycopus americanus*
American red raspberry	*Rubus idaeus*
Broom Sedge	Carex scoparia
Canada Goldenrod	*Solidago canadensis*
Eastern marsh fern	*Thelypteris palustris*
Field Horsetail	*Equisetum arvense*
Fowl Bluegrass	*Poa palustris*
Gray Dogwood	*Cornus racemosa*
Intermediate woodfern	*Dryopteris intermedia*
Knotted Rush	*Juncus nodosus*
Narrowleaf Cattail	*Typha angustifolia*
Purple Loosestrife	*Lythrum salicaria*
Reed Canarygrass	*Phalaris arundinacea*
Swamp thistle	*Cirsium muticum*
Woolly sedge	Carex pellita

Water Quality

	2012	2013
CDOM mg/L	No samples collected	28.1
Temperature °C		12.0
Specific Conductance µS/cm		396
Turbidity		0.022
Total phosphorus µg/L		65.5
Silicate µg/L		1.52
pH		7.06
Alkalinity (CaCO3) mg/L		210
Chlorophyll-a µg/L		2.40
Nitrate mg/L		0.110
Chloride mg/L		1.68
Sulfate mg/L		2.47
Green algae µg/L		0.20
Blue-green algae µg/L		0.30
Diatoms µg/L		0.19
Cryptophyta µg/L		0.11

LOW12-01

UTM E 497087
UTM N 4973181
Class: Palustrine Emergent
Size: 1.3 ha
Location: Wilson Hill Wildlife Management Area. Off Louisville-Wilson Hill Rd. Access from outside WMA approximately 500 meters from Rout 37. Location of annual DEC goose tagging event.

Key

- Species of Greatest Conservation Need (SGCN)
- Invasive species

Birds

Within 100m radius

American Bittern	*Botaurus lentiginosus*
American Goldfinch	*Carduelis tristis*
American Robin	*Turdus migratorius*
Baltimore Oriole	*Icterus galbula*
Barn Swallow	*Hirundo rustica*
Black-and-white Warbler	*Mniotilta varia*
Black-capped Chickadee	*Poecile atricapilla*
Brown Thrasher	*Toxostoma rufum*
Canada Goose	*Branta canadensis*
Cedar Waxwing	*Bombycilla cedrorum*
Chestnut-sided Warbler	*Dendroica pensylvanica*
Common Grackle	*Quiscalus quiscula*
Common Tern	*Sterna hirundo*
Common Yellowthroat	*Geothlypis trichas*
Downy Woodpecker	*Picoides pubescens*
Eastern Kingbird	*Tyrannus tyrannus*
Gray Catbird	*Dumetella carolinensis*
Great-crested Flycatcher	*Myiarchus tyrannulus*
Green-winged Teal	*Anas crecca*
Least Flycatcher	*Empidonax minimus*
Pied-billed Grebe	*Podilymbus podiceps*
Red-eyed Vireo	*Vireo olivaceus*
Red-winged Blackbird	*Agelaius phoeniceus*
Song Sparrow	*Melospiza melodia*
Swamp Sparrow	*Melospiza georgiana*
Tree Swallow	*Tachycienta bicolor*
Veery	*Catharus fuscescens*
Warbling Vireo	*Vireo gilvus*
White-breasted Nuthatch	*Sitta carolinensis*
Yellow Warbler	*Dendroica petechia*
Yellow-bellied Sapsucker	*Sphyrapicus varius*

Outside 100m radius

American Crow	*Corvus brachyrhynchos*
Black-capped Chickadee	*Poecile atricapilla*
Blue Jay	*Cyanocitta cristata*
Bobolink	*Dolichonyx oryzivorus*
Canada Goose	*Branta canadensis*
Common Tern	*Sterna hirundo*
Double-crested Cormorant	*Phalacrocorax auritus*
Killdeer	*Charadirus vociferus*
Mallard	*Anas platyrhynchos*
Northern Flicker	*Colaptes auratus*
Pied-billed Grebe	*Podilymbus podiceps*
Pileated Woodpecker	*Dryocopus pileatus*
Ring Billed Gull	*Larus delawarensis*
Tree Swallow	*Tachycienta bicolor*
Veery	*Catharus fuscescens*

Fish

Bluegill	*Lepomis macrochirus*
Brown Bullhead	*Ictalurus nebulosus*
Pumpkinseed	*Lepomis gibbosus*
Smallmouth Bass	*Micropterus dolomieui*

Frogs

American toad	*Bufo americanus*
Bullforg	*Rana catesbeiana*
Green frog	*Rana clamitans*
Grey treefrog	*Hyla versicolor*
Northern Leopard frog	*Rana pipiens*
Spring peeper	*Pseudacris crucifer*

Macroinvertebrates

Fingernail clam	Bivalvia Sphaeriidae
Pond snail	Gastropoda Lymnaeidae
Ramshorn snail	Gastropoda Planorbidae
Valve snail	Gastropoda Valvatidae

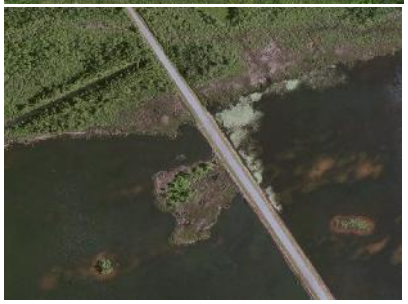
Vegetation

Bebb willow	*Salix bebbiana*
Bird Vetch	*Vicia cracca*
Blue skullcap	*Scutellaria laterifolia*
Broadfruit bur-reed	*Sparganium eurycarpum*
Broadleaf Arrowhead	*Sagittaria latifolia*
Broadleaf Cattail	*Typha latifolia*
Bulblet Bearing Water Hemlock	*Cicuta bulbifera*
Canadian Waterweed	*Elodea canadensis*
Common Duckweed	*Lemna minor*
Common Frogbit	*Hydrocharis morsus ranae*
Cypress-like sedge	*Carex pseudocyperus*
Eurasian water milfoil	*Myriophyllum spicatum*
Jewelweed	*Impatiens capensis*
Purple Loosestrife	*Lythrum salicaria*
Reed Canarygrass	*Phalaris arundinacea*
Shortspike watermilfoil	*Myriophyllum sibiricum*
Threepetal bedstraw	*Galium trifidum*
Trumpet creeper	*Campsis radicans*
Water shield	*Brasenia schreberi*

Water Quality

	2012	2013
CDOM mg/L	30.9	11.2
Temperature °C	26.3	12.0
Specific Conductance µS/cm	316	244
Turbidity	0.028	0.004
Total phosphorus µg/L	32.6	29.2
Silicate µg/L	0.171	0.023
pH	7.30	7.85
Alkalinity (CaCO3) mg/L	95.0	73.3
Chlorophyll-a µg/L	7.18	3.76
Nitrate mg/L	0.004	NA
Chloride mg/L	NA	NA
Sulfate mg/L	NA	NA
Green algae µg/L	NA	0.52
Blue-green algae µg/L	NA	0.05
Diatoms µg/L	NA	0.18
Cryptophyta µg/L	NA	0.01

LOW12-02



UTM E 496236
UTM N 4974303
Class: Palustrine Emergent
Size: 3.5 ha
Location: Wilson Hill Wildlife Management Area. Either side of Louisville-Wilson Hill Rd. Approximately 1 km from entrance.

Key

	Species of Greatest Conservation Need (SGCN)
	Invasive species

Birds

Within 100m radius

Alder Flycatcher	*Empidonax alnorum*
American Goldfinch	*Carduelis tristis*
American Robin	*Turdus migratorius*
Baltimore Oriole	*Icterus galbula*
Barn Swallow	*Hirundo rustica*
Cedar Waxwing	*Bombycilla cedrorum*
Chestnut-sided Warbler	*Dendroica pensylvanica*
Common Grackle	*Quiscalus quiscula*
Common Yellowthroat	*Geothlypis trichas*
Eastern Kingbird	*Tyrannus tyrannus*
European Starling	*Sturnus vulgaris*
Gray Catbird	*Dumetella carolinensis*
Great Blue Heron	*Ardea herodias*
Marsh Wren	*Cistothorus palustris*
Mourning Dove	*Zenaida macroura*
Northern Flicker	*Colaptes auratus*
Pied-billed Grebe	*Podilymbus podiceps*
Red-eyed Vireo	*Vireo olivaceus*
Red-winged Blackbird	*Agelaius phoeniceus*
Song Sparrow	*Melospiza melodia*
Swamp Sparrow	*Melospiza georgiana*
Tree Swallow	*Tachycienta bicolor*
Veery	*Catharus fuscescens*
Virginia Rail	*Rallus limicola*
Warbling Vireo	*Vireo gilvus*
Yellow Warbler	*Dendroica petechia*

Outside 100m radius

American Crow	*Corvus brachyrhynchos*
American Robin	*Turdus migratorius*
Belted Kingfisher	*Ceryle alcyon*
Black-capped Chickadee	*Poecile atricapilla*
Canada Goose	*Branta canadensis*
Caspian Tern	*Sterna caspia*
Common Loon	*Gavia immer*
Common Tern	*Sterna hirundo*
European Starling	*Sturnus vulgaris*
Great Blue Heron	*Ardea herodias*
House Wren	*Troglodytes aedon*
Killdeer	*Charadirus vociferus*
Mallard	*Anas platyrhynchos*
Mourning Dove	*Zenaida macroura*
Northern Flicker	*Colaptes auratus*
Osprey	*Pandion haliaetus*
Pied-billed Grebe	*Podilymbus podiceps*
Purple Martin	*Progne subis*
Ring-billed Gull	*Larus delawarensis*
Tree swallow	*Tachycienta bicolor*
Veery	*Catharus fuscescens*
Warbling Vireo	*Vireo gilvus*
Wood Duck	*Aix sponsa*
Yellow-bellied Sapsucker	*Sphyrapicus varius*

Fish

Bluegill	*Lepomis macrochirus*
Emerald Shiner	*Notropis atherinoides*
Largemouth Bass	*Micropterussalmoides*
Pumpkinseed	*Lepomis gibbosus*
Smallmouth Bass	*Micropterus dolomieui*

Frogs

Bullforg	*Rana catesbeiana*
Spring peeper	*Pseudacris crucifer*
Green frog	*Rana clamitans*
Northern Leopard frog	*Rana pipiens*

Macroinvertebrates

Scud	Crustacea Amphipoda
Caddisfly	Trichoptera
Aquatic earthworm	Oligochaeta
Water mite	Arachnida
Biting midge	Diptera Ceratopogonidae
Leech	Annelida Hirudinea
Backswimmer	Heteroptera Notonectidae
Mayfly	Ephemeroptera
Ramshorn snail	Gastropoda Planorbidae

Vegetation

Virginia threeseed mercury	*Acalypha virginica*
Slenderleaf false foxglove	*Agalinis tenuifolia*
Devil's beggatick	*Bidens frondosa*
Coon's Tail	*Ceratophyllum demersum*
Strawcolored flatsedge	*Cyperus strigosus*
Canadian Waterweed	*Elodea canadensis*
Eastern daisy fleabane	*Erigeron annuus*
Spotted joe pye weed	*Eutrochium maculatum*
Common Frogbit	*Hydrocharis morsus ranae*
Jewelweed	*Impatiens capensis*
Dudley's Rush	*Juncus dudleyi*
Amerian water horehound	*Lycopus americanus*
Purple Loosestrife	*Lythrum salicaria*
Allegheny monkeyflower	*Mimulus ringens*
Spotted Lady's Thumb	*Polygonum persicaria*
Floating Pondweed	*Potamogeton natans*
Sulphur cinquefoil	*Potentilla recta*
Broadleaf Arrowhead	*Sagittaria latifolia*
Blue skullcap	*Scutellaria lateriflora*
Broadleaf Cattail	*Typha latifolia*

Water Quality

	2012	2013
CDOM mg/L	28.4	11.4
Temperature °C	30.9	11.0
Specific Conductance µS/cm	192	239
Turbidity	0.027	0.016
Total phosphorus µg/L	44.8	39.7
Silicate µg/L	0.147	0.134
pH	8.78	7.75
Alkalinity (CaCO3) mg/L	73.6	72.7
Chlorophyll-a µg/L	2.36	6.08
Nitrate mg/L	0.045	0.030
Chloride mg/L	NA	55.3
Sulfate mg/L	NA	31.2
Green algae µg/L	2.16	2.12
Blue-green algae µg/L	0.45	0.18
Diatoms µg/L	1.98	1.81
Cryptophyta µg/L	0.01	0.00

LOW12-03

UTM E 495557
UTM N 4974556
Class: Palustrine Emergent
Size: 0.45 ha
Location: Wilson Hill Wildlife Management Area. Potholes on south side of unknown road, approximately 600 meters west of Louisville-Wilson Hill Rd.

Key
- Species of Greatest Conservation Need (SGCN)
- Invasive species

Birds

Within 100m radius

American Goldfinch	*Carduelis tristis*
American Redstart	*Setophaga ruticilla*
American Robin	*Turdus migratorius*
Baltimore Oriole	*Icterus galbula*
Black-and-white Warbler	*Mniotilta varia*
Black-capped Chickadee	*Poecile atricapilla*
Blue Jay	*Cyanocitta cristata*
Bobolink	*Dolichonyx oryzivorus*
Brown-headed Cowbird	*Molothrus ater*
Cedar Waxwing	*Bombycilla cedrorum*
Chestnut-sided Warbler	*Dendroica pensylvanica*
Common Grackle	*Quiscalus quiscula*
Common Yellowthroat	*Geothlypis trichas*
Downy Woodpecker	*Picoides pubescens*
Eastern Towhee	*Pipilo erythrophthalmus*
Eastern Wood-Peewee	*Contopus virens*
Gray Catbird	*Dumetella carolinensis*
Green Heron	*Butorides virescens*
Hairy Woodpecker	*Picoides villosus*
Mallard	*Anas platyrhynchos*
Northern Flicker	*Colaptes auratus*
Red-eyed Vireo	*Vireo olivaceus*
Red-winged Blackbird	*Agelaius phoeniceus*
Song Sparrow	*Melospiza melodia*
Swamp Sparrow	*Melospiza georgiana*
Tree Swallow	*Tachycienta bicolor*
Warbling Vireo	*Vireo gilvus*
Yellow Warbler	*Dendroica petechia*
Yellow-bellied Sapsucker	*Sphyrapicus varius*
Yellow-throated Vireo	*Vireo flavifrons*

Outside 100m radius

American Crow	*Corvus brachyrhynchos*
American Robin	*Turdus migratorius*
Black-capped Chickadee	*Poecile atricapilla*
Blue Jay	*Cyanocitta cristata*
Brown-headed Cowbird	*Molothrus ater*
Canada Goose	*Branta canadensis*
Common Raven	*Corvus corax*
Common Tern	*Sterna hirundo*
Mallard	*Anas platyrhynchos*
Northern Cardinal	*Cardinalis cardinalis*
Osprey	*Pandion haliaetus*
Purple Martin	*Progne subis*
Red-eyed Vireo	*Vireo olivaceus*
Ring Billed Gull	*Larus delawarensis*
Swamp Sparrow	*Melospiza georgiana*
Tree Swallow	*Tachycienta bicolor*

Fish

Bluntnose Minnow	*Pimephales notatus*
Brook Stickleback	*Culaea inconstans*
Central Mudminnow	*Umbra limi*

Frogs

Spring peeper	*Pseudacris crucifer*
Grey treefrog	*Hyla versicolor*
Green frog	*Rana clamitans*

Macroinvertebrates

Hester Dendy samplers lost	
Ramshorn snail	Gastropoda Planorbidae

Vegetation

Silverweed cinquefoil	*Argentina anserina*
Crested Sedge	*Carex cristatella*
Field Horsetail	*Equisetum arvense*
Common Boneset	*Eupatorium perfoliatum*
Flat-top goldenrod	*Euthamia graminifolia*
Bird's foot Trefoil	*Lotus corniculatus*
Purple Loosestrife	*Lythrum salicaria*
Reed Canarygrass	*Phalaris arundinacea*
Water knotweed	*Polygonum amphibium*
Green Bulrush	*Scirpus atrovirens*
Softstem Bulrush	*Scirpus tabernaemontani*
Broadleaf Cattail	*Typha latifolia*

Water Quality

	2012	2013
CDOM mg/L	23.8	14.3
Temperature °C	27.3	14.0
Specific Conductance µS/cm	231	466
Turbidity	0.051	0.002
Total phosphorus µg/L	69.3	15.0
Silicate µg/L	0.16	0.86
pH	8.17	7.80
Alkalinity (CaCO3) mg/L	NA	180
Chlorophyll-a µg/L	10.3	1.35
Nitrate mg/L	0.006	0.030
Chloride mg/L	NA	1.04
Sulfate mg/L	NA	13.8
Green algae µg/L	5.84	0.56
Blue-green algae µg/L	0.68	0.01
Diatoms µg/L	0.58	0.70
Cryptophyta µg/L	0.00	0.01

LOW12-04

UTM E 495557
UTM N 4974556
Class: Palustrine Emergent
Size: 21.7 ha
Location: Wilson Hill Wildlife Management Area. Far western end of park. Series of culverts. Wetland is on either side of gravel culvert.

Key

- Species of Greatest Conservation Need (SGCN)
- Invasive species

Birds

Within 100m radius

American Goldfinch	*Carduelis tristis*
Baltimore Oriole	*Icterus galbula*
Barn Swallow	*Hirundo rustica*
Blue Jay	*Cyanocitta cristata*
Brown Thrasher	*Toxostoma rufum*
Brown-headed Cowbird	*Molothrus ater*
Chestnut-sided Warbler	*Dendroica pensylvanica*
Common Grackle	*Quiscalus quiscula*
Common Moorhen	*Gallinula chloropus*
Common Yellowthroat	*Geothlypis trichas*
Downy Woodpecker	*Picoides pubescens*
Eastern Kingbird	*Tyrannus tyrannus*
Great-crested Flycatcher	*Myiarchus tyrannulus*
Green Heron	*Butorides virescens*
Least Bittern	*Ixobrychus exilis*
Least Flycatcher	*Empidonax minimus*
Marsh Wren	*Cistothorus palustris*
Mourning Dove	*Zenaida macroura*
Pied-billed Grebe	*Podilymbus podiceps*
Red-winged Blackbird	*Agelaius phoeniceus*
Rose-breasted Grosbeak	*Pheucticus ludovicianus*
Song Sparrow	*Melospiza melodia*
Swamp Sparrow	*Melospiza georgiana*
Tree Swallow	*Tachycienta bicolor*
Veery	*Catharus fuscescens*
Virginia Rail	*Rallus limicola*
Warbling Vireo	*Vireo gilvus*
Yellow Warbler	*Dendroica petechia*
Yellow-bellied Sapsucker	*Sphyrapicus varius*

Outside 100m radius

American Robin	*Turdus migratorius*
Baltimore Oriole	*Icterus galbula*
Black-capped Chickadee	*Poecile atricapilla*
Blue Jay	*Cyanocitta cristata*
Canada Goose	*Branta canadensis*
Chestnut-sided Warbler	*Dendroica pensylvanica*
Common Grackle	*Quiscalus quiscula*
Common Tern	*Sterna hirundo*
Great Blue Heron	*Ardea herodias*
Mourning Dove	*Zenaida macroura*
Northern Flicker	*Colaptes auratus*
Pied-billed Grebe	*Podilymbus podiceps*
Ring-billed Gull	*Larus delawarensis*
Scarlet Tanager	*Piranga olivacea*
Tree Swallow	*Tachycienta bicolor*
Veery	*Catharus fuscescens*
Warbling Vireo	*Vireo gilvus*
Wood Duck	*Aix sponsa*
Yellow-bellied Sapsucker	*Sphyrapicus varius*

Fish

Brown Bullhead	*Ictalurus nebulosus*
Central Mudminnow	*Umbra limi*
Northern Redbelly Dace	*Phoxinus eos*

Frogs

Bullforg	*Rana catesbeiana*
Spring peeper	*Pseudacris crucifer*
Green frog	*Rana clamitans*
Northern Leopard frog	*Rana pipiens*

Macroinvertebrates

Non-biting midge	Diptera Chironomidae
Ramshorn snail	Gastropoda Planorbidae

Vegetation

Cypress-like sedge	*Carex pseudocyperus*
Needle Spikerush	*Eleocharis acicularis*
Blunt Spikerush	*Eleocharis obtusa*
Common Frogbit	*Hydrocharis morsus ranae*
Knotted Rush	*Juncus nodosus*
Rice Cutgrass	*Leersia oryzoides*
Purple Loosestrife	*Lythrum salicaria*
Curly Dock	*Rumex crispus*
Broadleaf Arrowhead	*Sagittaria latifolia*
Meadow Willow	*Salix petiolaris*
Softstem Bulrush	*Scirpus tabernaemontani*
Broadleaf Cattail	*Typha latifolia*

Water Quality

	2012	2013
CDOM mg/L	15.3	39.7
Temperature °C	23.8	18.5
Specific Conductance µS/cm	275	322
Turbidity	0.007	0.018
Total phosphorus µg/L	24.4	45.0
Silicate µg/L	0.053	0.031
pH	7.57	7.21
Alkalinity (CaCO3) mg/L	96.8	87.7
Chlorophyll-a µg/L	1.41	5.48
Nitrate mg/L	0.004	0.030
Chloride mg/L	NA	40.6
Sulfate mg/L	NA	9.24
Green algae µg/L	1.35	0.52
Blue-green algae µg/L	1.26	0.00
Diatoms µg/L	0.52	1.44
Cryptophyta µg/L	1.77	0.18

LOW12-05

UTM E 492127
UTM N 4968415
Class: Palustrine Emergent
Size: 6.2 ha
Location: Coles Creek State Park. Northern side of Coles Creek where creek corsses Coles Creek Road. Bordered on north side by farm. One of NYPA relicensing HIP projects.

Key

	Species of Greatest Conservation Need (SGCN)
	Invasive species

Birds

Within 100m radius

American Robin	*Turdus migratorius*
Barn Swallow	*Hirundo rustica*
Belted Kingfisher	*Ceryle alcyon*
Canada Goose	*Branta canadensis*
Cedar Waxwing	*Bombycilla cedrorum*
Chestnut-sided Warbler	*Dendroica pensylvanica*
Common Grackle	*Quiscalus quiscula*
Common Tern	*Sterna hirundo*
Eastern Kingbird	*Tyrannus tyrannus*
European Starling	*Sturnus vulgaris*
Mallard	*Anas platyrhynchos*
Red-winged Blackbird	*Agelaius phoeniceus*
Song Sparrow	*Melospiza melodia*
Swamp Sparrow	*Melospiza georgiana*
Tree Swallow	*Tachycienta bicolor*
Yellow Warbler	*Dendroica petechia*

Outside 100m radius

American Crow	*Corvus brachyrhynchos*
American Goldfinch	*Carduelis tristis*
American Kestrel	*Falco sparverius*
American Robin	*Turdus migratorius*
Baltimore Oriole	*Icterus galbula*
Black-throated Green Warbler	*Dendroica virens*
Brown-headed Cowbird	*Molothrus ater*
Canada Goose	*Branta canadensis*
Chestnut-sided Warbler	*Dendroica pensylvanica*
Common Grackle	*Quiscalus quiscula*
Double-crested Cormorant	*Phalacrocorax auritus*
Eastern Kingbird	*Tyrannus tyrannus*
European Starling	*Sturnus vulgaris*
Great Blue Heron	*Ardea herodias*
House Sparrow	*Passer domesticus*
Killdeer	*Charadirus vociferus*
Mourning Dove	*Zenaida macroura*
Northern Flicker	*Colaptes auratus*
Ovenbird	*Seiurus aurocapillus*
Red-eyed Vireo	*Vireo olivaceus*
Ring-billed Gull	*Larus delawarensis*
Rock Dove	*Columba livia*
Savannah Sparrow	*Passerculus sandwichensis*
Scarlet Tanager	*Piranga olivacea*
Turkey Vulture	*Cathartes aura*
Warbling Vireo	*Vireo gilvus*
Yellow-bellied Sapsucker	*Sphyrapicus varius*

Fish

Bluegill	*Lepomis macrochirus*

Frogs

Bullforg	*Rana catesbeiana*
Grey treefrog	*Hyla versicolor*

Macroinvertebrates

Narrowwinged damselfly	Odonata Coenagrionidae
Scud	Crustacea Amphipoda
Squaregill mayfly	Ephemeroptera Caenidae
Biting midge	Diptera Ceratopogonidae
Non-biting midge	Diptera Chironomidae
Physid snail	Gastropoda Phisidae
Flatworm	Turbellaria
Pond snail	Gastropoda Lymnaeidae

Vegetation

Flowering rush	*Butomus umbellatus*
Fox sedge	*Carex vulpinoidea*
Coon's Tail	*Ceratophyllum demersum*
Canadian Waterweed	*Elodea canadensis*
Common Boneset	*Eupatorium perfoliatum*
Threepetal bedstraw	*Galium trifidum*
Jewelweed	*Impatiens capensis*
Northern green rush	*Juncus alpinoarticulatus*
Canadian rush	*Juncus canadensis*
Rice Cutgrass	*Leersia oryzoides*
Amerian water horehound	*Lycopus americanus*
Purple Loosestrife	*Lythrum salicaria*
Amerian white waterlily	*Nymphaea odorata*
Reed Canarygrass	*Phalaris arundinacea*
Curly pondweed	*Potamogeton crispus*
Leafy pondweed	*Potamogeton foliosus*
Green Bulrush	Scirpus atrovirens
Softstem Bulrush	*Scirpus tabernaemontani*
Canada goldenrod	*Solidago altissima*

Water Quality

	2012	2013
CDOM mg/L	13.7	19.0
Temperature °C	20.3	14.0
Specific Conductance µS/cm	324	277
Turbidity	0.013	0.027
Total phosphorus µg/L	18.6	51.6
Silicate µg/L	0.871	0.057
pH	8.87	8.01
Alkalinity (CaCO3) mg/L	172	102
Chlorophyll-a µg/L	4.24	10.2
Nitrate mg/L	0.004	NA
Chloride mg/L	NA	NA
Sulfate mg/L	NA	NA
Green algae µg/L	NA	1.33
Blue-green algae µg/L	NA	0.12
Diatoms µg/L	NA	5.92
Cryptophyta µg/L	NA	0.46

LOW12-06

UTM E 497574
UTM N 4968795
Class: Palustrine Emergent
Size: 15.3 ha
Location: Private property: 716 County Route 36, Norfolk, NY 13667. Contact: William Kirnie: 315-705-4407. Shares wetland with neighbor John Scott (deceased) and Marjorie Scott.

Key	
	Species of Greatest Conservation Need (SGCN)
	Invasive species

Birds

Within 100m radius

Alder Flycatcher	*Empidonax alnorum*
American Bittern	*Botaurus lentiginosus*
American Goldfinch	*Carduelis tristis*
American Robin	*Turdus migratorius*
Baltimore Oriole	*Icterus galbula*
Barn Swallow	*Hirundo rustica*
Cedar Waxwing	*Bombycilla cedrorum*
Chestnut-sided Warbler	*Dendroica pensylvanica*
Common Grackle	*Quiscalus quiscula*
Common Tern	*Sterna hirundo*
Common Yellowthroat	*Geothlypis trichas*
Eastern Kingbird	*Tyrannus tyrannus*
Gray Catbird	*Dumetella carolinensis*
Great-crested Flycatcher	*Myiarchus tyrannulus*
Mallard	*Anas platyrhynchos*
Pine Warbler	*Dendroica pinus*
Red-eyed Vireo	*Vireo olivaceus*
Red-winged Blackbird	*Agelaius phoeniceus*
Song Sparrow	*Melospiza melodia*
Swamp Sparrow	*Melospiza georgiana*
Tree Swallow	*Tachycienta bicolor*
Veery	*Catharus fuscescens*
Virginia rail	*Rallus limicola*
Warbling Vireo	*Vireo gilvus*
White-breasted Nuthatch	*Sitta carolinensis*
Wood Duck	*Aix sponsa*
Yellow Warbler	*Dendroica petechia*
Yellow-rumped Warbler	*Dendroica coronata*

Outside 100m radius

Alder Flycatcher	*Empidonax alnorum*
American Crow	*Corvus brachyrhynchos*
American Robin	*Turdus migratorius*
Blue Jay	*Cyanocitta cristata*
Canada Goose	*Branta canadensis*
Cedar Waxwing	*Bombycilla cedrorum*
Common Snipe	*Gallinago gallinago*
Eastern Wood-Peewee	*Contopus virens*
Great Blue Heron	*Ardea herodias*
Green Heron	*Butorides virescens*
Mallard	*Anas platyrhynchos*
Scarlet Tanager	*Piranga olivacea*
Turkey Vulture	*Cathartes aura*
Veery	*Catharus fuscescens*
Wood Thrush	*Hylocichla mustelina*
Yellow-bellied Sapsucker	*Sphyrapicus varius*

Fish

Brown Bullhead	*Ictalurus nebulosus*
Central Mudminnow	*Umbra limi*
Emeral Shiner	*Notropis atherinoides*
Pumpkinseed	*Lepomis gibbosus*
Smallmouth Bass	*Micropterus dolomieui*

Frogs

Bullforg	*Rana catesbeiana*
Spring peeper	*Pseudacris crucifer*
Grey treefrog	*Hyla versicolor*
Green frog	*Rana clamitans*
Northern Leopard frog	*Rana pipiens*
Mink frog	*Rana septentrionalis*

Macroinvertebrates

Scud	Crustacea Amphipoda
Water scavenger beetle	Coleoptera Hydrophilidae
Squaregill mayfly	Ephemeroptera Caenidae
Caddisfly	Trichoptera
Darner dragonfly	Odonata Aeshnidae
Ramshorn snail	Gastropoda Planorbidae
Diving beetle	Coleoptera Dytiscidae
Non-biting midge	Diptera Chironomidae
Crawling water beetle	Coleoptera Haliplidae
Pond snail	Gastropoda Lymnaeidae

Vegetation

Longhair Sedge	*Carex comosa*
Coon's Tail	*Ceratophyllum demersum*
Bulblet Bearing Water Hemlock	*Cicuta bulbifera*
Common Spikerush	*Eleocharis palustris*
Canadian Waterweed	*Elodea canadensis*
Field Horsetail	*Equisetum arvense*
Threepetal bedstraw	*Galium trifidum*
Jewelweed	*Impatiens capensis*
Rice Cutgrass	*Leersia oryzoides*
Earth loostrife	*Lysimachia terrestris*
Purple Loosestrife	*Lythrum salicaria*
Sensitive Fern	*Onoclea sensibilis*
Common cinquefoil	*Potentilla simplex*
Common selfheal	*Prunella vulgaris*
Smooth blackberry	*Rubus canadensis*
Broadleaf Arrowhead	*Sagittaria latifolia*
Crack willow	*Salix fragilus*
Meadow Willow	*Salix petiolaris*
Hairy goldenrod	*Solidago hispida*
White Meadowsweet	*Spiraea alba*
Common Duckmeat	*Spirodela polyrrhiza*
Calico aster	*Symphyotrichum lateriflorum*
American basswood	*Tilia americana*
Eastern poison ivy	*Toxicodendron radicans*
Swamp Verbena	*Verbena hastata*
Bird Vetch	*Vicia cracca*
Northern wildrice	*Zizania palustris*
Golden zizia	*Zizia aurea*

Water Quality

	2012	2013
CDOM mg/L	21.8	29.5
Temperature °C	22.6	16.0
Specific Conductance µS/cm	252	208
Turbidity	0.010	0.013
Total phosphorus µg/L	29.9	57.2
Silicate µg/L	0.017	0.147
pH	7.86	7.07
Alkalinity (CaCO3) mg/L	89.4	86.5
Chlorophyll-a µg/L	6.22	3.83
Nitrate mg/L	0.005	0.110
Chloride mg/L	NA	5.60
Sulfate mg/L	NA	3.10
Green algae µg/L	6.02	0.49
Blue-green algae µg/L	0.22	0.16
Diatoms µg/L	1.10	0.81
Cryptophyta µg/L	5.00	0.01

LOW12-07

UTM E 497196
UTM N 4972882
Class: Palustrine Emergent
Size: 0.63 ha
Location: Private property: 51 Wilson Hill Road, Louisville, NY. Property is a vacant lot, trailer on corner of Wilson Hill Road and State Highway 37. Owner lives in Massena. Contact: Richard Medve: 43 Sycamore St, Massena, NY 13662. Home: 315-769-6129. Cell: 315-212-2362.

Key
- Species of Greatest Conservation Need (SGCN)
- Invasive species

Birds

Within 100m radius

Barn Swallow	*Hirundo rustica*
Bobolink	*Dolichonyx oryzivorus*
Chestnut-sided Warbler	*Dendroica pensylvanica*
Common Grackle	*Quiscalus quiscula*
Common Yellowthroat	*Geothlypis trichas*
Eastern Kingbird	*Tyrannus tyrannus*
Eastern Meadowlark	*Sturnella magna*
Gray Catbird	*Dumetella carolinensis*
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*
Red-winged Blackbird	*Agelaius phoeniceus*
Savannah Sparrow	*Passerculus sandwichensis*
Song Sparrow	*Melospiza melodia*
Swamp Sparrow	*Melospiza georgiana*
Tree Swallow	*Tachycienta bicolor*
Yellow Warbler	*Dendroica petechia*

Outside 100m radius

Alder Flycathcer	*Empidonax alnorum*
American Crow	*Corvus brachyrhynchos*
American Redstart	*Setophaga ruticilla*
American Robin	*Turdus migratorius*
Baltimore Oriole	*Icterus galbula*
Blue Jay	*Cyanocitta cristata*
Canada Goose	*Branta canadensis*
Cedar Waxwing	*Bombycilla cedrorum*
Common Grackle	*Quiscalus quiscula*
Common Yellowthroat	*Geothlypis trichas*
Coopers Hawk	*Accipiter cooperii*
Eastern Kingbird	*Tyrannus tyrannus*
European Starling	*Sturnus vulgaris*
Gray Catbird	*Dumetella carolinensis*
Great Blue Heron	*Ardea herodias*
Green Heron	*Butorides virescens*
Killdeer	*Charadirus vociferus*
Mourning Dove	*Zenaida macroura*
Northern Flicker	*Colaptes auratus*
Ring-billed Gull	*Larus delawarensis*
Tree Swallow	*Tachycienta bicolor*
Warbling Vireo	*Vireo gilvus*
Yellow Warbler	*Dendroica petechia*

Fish

Not sampled

Frogs

Spring peeper	*Pseudacris crucifer*

Macroinvertebrates

Pond snail	Gastropoda Lymnaeidae
Ramshorn snail	Gastropoda Planorbidae
Fingernail clam	Bivalvia Sphaeriidae
Riffle beetle	Coleoptera Elmidae
Aquatic earthworm	Oligochaeta
Physid snail	Gastropoda Physidae

Vegetation

Bebb's sedge	*Carex bebbii*
Woolly sedge	Carex pellita
Blunt broom sedge	*Carex tribuloides*
Bulblet Bearing Water Hemlock	*Cicuta bulbifera*
Field bindweed	*Convolvulus arvensis*
ater horsetail	*Equisetum fluviatile*
Common Boneset	*Eupatorium perfoliatum*
False baby's breath	*Galium mollugo*
Dudley's Rush	*Juncus dudleyi*
Rice Cutgrass	*Leersia oryzoides*
Amerian water horehound	*Lycopus americanus*
Earth loostrife	*Lysimachia terrestrio*
Purple Loosestrife	*Lythrum salicaria*
Alfalfa	*Medicago sativa*
Reed Canarygrass	*Phalaris arundinacea*
Fowl Bluegrass	*Poa palustris*
Broadleaf Arrowhead	*Sagittaria latifolia*
Crack willow	*Salix fragilis*
Showy goldenrod	*Solidago erecta*
Broadleaf Cattail	*Typha latifolia*
Bird Vetch	*Vicia cracca*

Water Quality

	2012	2013
CDOM mg/L	No samples collected	47.7
Temperature °C		10.0
Specific Conductance µS/cm		1214
Turbidity		0.032
Total phosphorus µg/L		191
Silicate µg/L		0.831
pH		7.18
Alkalinity (CaCO3) mg/L		300
Chlorophyll-a µg/L		6.28
Nitrate mg/L		0.030
Chloride mg/L		146
Sulfate mg/L		29.3
Green algae µg/L		0.01
Blue-green algae µg/L		0.00
Diatoms µg/L		0.03
Cryptophyta µg/L		1.49

LOW12-08

UTM E 494387
UTM N 4973925
Class: Palustrine Emergent
Size: 38.9 ha
Location: Wilson Hill Wildlife Management Area, Bradford Island. Approximately 2 km from entrance, heading west. Wetland on either side of unknown gravel road that breaks south of main gravel road.

Key
- Species of Greatest Conservation Need (SGCN)
- Invasive species

Birds

Within 100m radius

Alder Flycatcher	*Empidonax alnorum*
American Goldfinch	*Carduelis tristis*
American Robin	*Turdus migratorius*
Baltimore Oriole	*Icterus galbula*
Black-capped Chickadee	*Poecile atricapilla*
Blue Jay	*Cyanocitta cristata*
Cedar Waxwing	*Bombycilla cedrorum*
Chestnut-sided Warbler	*Dendroica pensylvanica*
Common Grackle	*Quiscalus quiscula*
Common Yellowthroat	*Geothlypis trichas*
Downy Woodpecker	*Picoides pubescens*
Eastern Kingbird	*Tyrannus tyrannus*
Gray Catbird	*Dumetella carolinensis*
Great-crested Flycatcher	*Myiarchus tyrannulus*
Hairy Woodpecker	*Picoides villosus*
Marsh Wren	*Cistothorus palustris*
Mourning Dove	*Zenaida macroura*
Northern Flicker	*Colaptes auratus*
Red-eyed Vireo	*Vireo olivaceus*
Red-winged Blackbird	*Agelaius phoeniceus*
Song Sparrow	*Melospiza melodia*
Swamp Sparrow	*Melospiza georgiana*
Tree Swallow	*Tachycienta bicolor*
Veery	*Catharus fuscescens*
Warbling Vireo	*Vireo gilvus*
Willow Flycatcher	*Empidonax traillii*
Yellow Warbler	*Dendroica petechia*
Yellow-bellied Sapsucker	*Sphyrapicus varius*

Outside 100m radius

American Crow	*Corvus brachyrhynchos*
American Goldfinch	*Carduelis tristis*
Blue Jay	*Cyanocitta cristata*
Canada Goose	*Branta canadensis*
Common Snipe	*Gallinago gallinago*
Common Tern	*Sterna hirundo*
Great Blue Heron	*Ardea herodias*
Mallard	*Anas platyrhynchos*
Mourning Dove	*Zenaida macroura*
Osprey	*Pandion haliaetus*
Pied-billed Grebe	*Podilymbus podiceps*
Pileated Woodpecker	*Dryocopus pileatus*
Ring-billed Gull	*Larus delawarensis*
Tree Swallow	*Tachycienta bicolor*
Veery	*Catharus fuscescens*
Yellow-bellied Sapsucker	*Sphyrapicus varius*

Fish

Brown Bullhead	*Ictalurus nebulosus*
Central Mudminnow	*Umbra limi*
Pumpkinseed	*Lepomis gibbosus*

Frogs

Bullforg	*Rana catesbeiana*
Spring peeper	*Pseudacris crucifer*
Grey treefrog	*Hyla versicolor*
Green frog	*Rana clamitans*

Macroinvertebrates

Blackfly	Diptera Simuliidae
Ramshorn snail	Gastropoda Planorbidae
Non-biting midge	Diptera Chironomidae
Physid snail	Gastropoda Phisidae

Vegetation

Green alder	*Alnus viridis*
Gray Dogwood	*Cornus racemosa*
Blunt Spikerush	*Eleocharis obtusa*
Field Horsetail	*Equisetum arvense*
Common Frogbit	*Hydrocharis morsus-ranae*
Jewelweed	*Impatiens capensis*
Jointleaf Rush	*Juncus articulatus*
Swamp fly honesuckle	*Lonicera oblonquifolia*
Amerian water horehound	*Lycopus americanus*
Purple Loosestrife	*Lythrum salicaria*
Sensitive Fern	*Onoclea sensibilis*
Smooth blackberry	*Rubus canadensis*
American red raspberry	*Rubus idaeus*
Broadleaf Arrowhead	*Sagittaria latifolia*
Bebb willow	*Salix bebbiana*
Meadow Willow	*Salix petiolaris*
Softstem Bulrush	*Scirpus tabernaemontani*
Blue skullcap	*Scutellaria lateriflora*
Steeplebush	*Spiraea tomentosa*
Broadleaf Cattail	*Typha latifolia*
Bird Vetch	*Vicia cracca*
Riverbank grape	*Vitis riparia*

Water Quality

	2012	2013
CDOM mg/L	46.5	44.0
Temperature °C	24.7	14.5
Specific Conductance µS/cm	220	161
Turbidity	0.025	0.054
Total phosphorus µg/L	55.6	67.3
Silicate µg/L	0.254	0.067
pH	8.25	6.52
Alkalinity ($CaCO_3$) mg/L	90.2	26.0
Chlorophyll-a µg/L	9.36	17.3
Nitrate mg/L	0.030	0.035
Chloride mg/L	NA	8.21
Sulfate mg/L	NA	5.86
Green algae µg/L	0.44	0.36
Blue-green algae µg/L	0.28	0.00
Diatoms µg/L	0.48	4.36
Cryptophyta µg/L	0.96	1.93

LOW12-09

UTM E 493941
UTM N 4973924
Class: Palustrine Forested
Size: 2.4 ha
Location: Wilson Hill Wildlife Management Area, Bradford Island. Approximately 2.5 km from entrance, heading west. Wetland on north side of road at sharp bend.

Key
- Species of Greatest Conservation Need (SGCN)
- Invasive species

Birds

Within 100m radius

American Goldfinch	*Carduelis tristis*
American Redstart	*Setophaga ruticilla*
American Robin	*Turdus migratorius*
Baltimore Oriole	*Icterus galbula*
Black-capped Chickadee	*Poecile atricapilla*
Cedar Waxwing	*Bombycilla cedrorum*
Chestnut-sided Warbler	*Dendroica pensylvanica*
Common Grackle	*Quiscalus quiscula*
Common Yellowthroat	*Geothlypis trichas*
Downy Woodpecker	*Picoides pubescens*
Eastern Kingbird	*Tyrannus tyrannus*
Gray Catbird	*Dumetella carolinensis*
Great-crested Flycatcher	*Myiarchus tyrannulus*
Hairy Woodpecker	*Picoides villosus*
Least Flycatcher	*Empidonax minimus*
Red-winged Blackbird	*Agelaius phoeniceus*
Rose-breasted Grosbeak	*Pheucticus ludovicianus*
Song Sparrow	*Melospiza melodia*
Swamp Sparrow	*Melospiza georgiana*
Tree Swallow	*Tachycienta bicolor*
Veery	*Catharus fuscescens*
Virginia Rail	*Rallus limicola*
Warbling Vireo	*Vireo gilvus*
Yellow Warbler	*Dendroica petechia*
Yellow-bellied Sapsucker	*Sphyrapicus varius*

Outside 100m radius

American Crow	*Corvus brachyrhynchos*
American Robin	*Turdus migratorius*
Baltimore Oriole	*Icterus galbula*
Canada Goose	*Branta canadensis*
Common Snipe	*Gallinago gallinago*
Common Tern	*Sterna hirundo*
Great Blue Heron	*Ardea herodias*
Great-crested Flycatcher	*Myiarchus tyrannulus*
Mallard	*Anas platyrhynchos*
Mourning Dove	*Zenaida macroura*
Northern Flicker	*Colaptes auratus*
Northern Harrier	*Circus cyaneus*
Pied-billed Grebe	*Podilymbus podiceps*
Ring-billed Gull	*Larus delawarensis*
Scarlet Tanager	*Piranga olivacea*
Veery	*Catharus fuscescens*
Warbling Vireo	*Vireo gilvus*
Yellow-bellied Sapsucker	*Sphyrapicus varius*
Yellow-billed Cuckoo	*Coccyzus americanus*

Fish

Not sampled

Frogs

Bullforg	*Rana catesbeiana*
Spring peeper	*Pseudacris crucifer*
Green frog	*Rana clamitans*
Northern Leopard frog	*Rana pipiens*

Macroinvertebrates

Physid snail	Gastropoda Phisidae
Ramshorn snail	Gastropoda Planorbidae
Scud	Crustacea Amphipoda
Non-biting midge	Diptera Chironomidae
Biting midge	Diptera Ceratopogonidae
Soldier fly	Diptera Stratiomyidae
Darner dragonfly	Odonata Aeshnidae
Squaregill mayfly	Ephemeroptera Caenidae
Water scavenger beetle	Coleoptera Hydrophilidae
Pond snail	Gastropoda Lymnaeidae

Vegetation

Red Maple	*Acer rubrum*
Groundnut	*Apios americana*
Devil's beggatick	*Bidens frondosa*
Bulblet Bearing Water Hemlock	*Cicuta bulbifera*
Blunt Spikerush	*Eleocharis obtusa*
Field Horsetail	*Equisetum arvense*
Virginia strawberry	*Fragaria virginiana*
Threepetal bedstraw	*Galium trifidum*
Common Frogbit	*Hydrocharis morsus ranae*
Large St. Johnswort	*Hypericum majus*
Jewelweed	*Impatiens capensis*
Amerian water horehound	*Lycopus americanus*
Purple Loosestrife	*Lythrum salicaria*
Sensitive Fern	*Onoclea sensibilis*
Reed Canarygrass	*Phalaris arundinacea*
Bristly dewberry	*Rubus hispidus*
Broadleaf Arrowhead	*Sagittaria latifolia*
Pussy willow	*Salix discolor*
Meadow Willow	*Salix petiolaris*
White Meadowsweet	*Spiraea alba*
Virginia marsh St. Johnswort	*Triadenum virginicum*
Broadleaf Cattail	*Typha latifolia*
Bird Vetch	*Vicia cracca*
Riverbank grape	*Vitis riparia*

Water Quality

Water Quality	2012	2013
CDOM mg/L	10.0	39.4
Temperature °C	25.9	9.50
Specific Conductance µS/cm	289	250
Turbidity	0.007	0.013
Total phosphorus µg/L	22.8	30.5
Silicate µg/L	0.057	0.114
pH	8.81	6.71
Alkalinity (CaCO3) mg/L	110	64.7
Chlorophyll-a µg/L	2.53	2.93
Nitrate mg/L	0.004	0.040
Chloride mg/L	NA	10.6
Sulfate mg/L	NA	9.22
Green algae µg/L	7.62	0.19
Blue-green algae µg/L	0.53	0.08
Diatoms µg/L	2.73	0.79
Cryptophyta µg/L	2.88	0.27

LOW12-10

UTM E 501420
UTM N 4976106
Class: Palustrine Forested
Size: 104.6 ha
Location: Private property: 592 State Highway 131, Massena, NY 13662. Contact: Bruce and Rosalie Smith. Home: 315-769-6223. Cell: 315-322-3982. Email: bricerosaliesmith@gmail.com

Key	
	Species of Greatest Conservation Need (SGCN)
	Invasive species

Birds

Within 100m radius

Alder Flycatcher	*Empidonax alnorum*
American Crow	*Corvus brachyrhynchos*
American Goldfinch	*Carduelis tristis*
American Redstart	*Setophaga ruticilla*
American Robin	*Turdus migratorius*
Baltimore Oriole	*Icterus galbula*
Black-capped Chickadee	*Poecile atricapilla*
Brown Creeper	*Certhia americana*
Brown-headed Cowbird	*Molothrus ater*
Cedar Waxwing	*Bombycilla cedrorum*
Chestnut-sided Warbler	*Dendroica pensylvanica*
Common Grackle	*Quiscalus quiscula*
Common Snipe	*Gallinago gallinago*
Common Yellowthroat	*Geothlypis trichas*
Downy Woodpecker	*Picoides pubescens*
Gray Catbird	*Dumetella carolinensis*
Great-crested Flycatcher	*Myiarchus tyrannulus*
Ovenbird	*Seiurus aurocapillus*
Red-eyed Vireo	*Vireo olivaceus*
Red-winged Blackbird	*Agelaius phoeniceus*
Rose-breasted Grosbeak	*Pheucticus ludovicianus*
Swamp Sparrow	*Melospiza georgiana*
Tree Swallow	*Tachycienta bicolor*
Veery	*Catharus fuscescens*
Warbling vireo	*Vireo gilvus*
White-breasted Nuthatch	*Sitta carolinensis*
Yellow Warbler	*Dendroica petechia*
Yellow-bellied Sapsucker	*Sphyrapicus varius*

Outside 100m radius

American Crow	*Corvus brachyrhynchos*
American Robin	*Turdus migratorius*
Common Snipe	*Gallinago gallinago*
Common Tern	*Sterna hirundo*
Eastern Kingbird	*Tyrannus tyrannus*
Eastern Wood-Peewee	*Contopus virens*
European Starling	*Sturnus vulgaris*
Mourning Dove	*Zenaida macroura*
Northern Cardinal	*Cardinalis cardinalis*
Northern Flicker	*Colaptes auratus*
Scarlet Tanager	*Piranga olivacea*
Veery	*Catharus fuscescens*

Fish

Not sampled

Frogs

American toad	*Bufo americanus*
Bullforg	*Rana catesbeiana*
Green frog	*Rana clamitans*
Northern Leopard frog	*Rana pipiens*
Spring peeper	*Pseudacris crucifer*

Macroinvertebrates

Not sampled

Vegetation

Interrupted fern	*Osmunda calytoniana*
Marsh skullcap	*Scutellaria galericulata*
Meadow Willow	*Salix petiolaris*
Narrowleaf Cattail	*Typha angustifolia*
Sensitive Fern	*Onoclea sensibilis*
Smallflower false foxglove	*Agalinis paupercula*
Threepetal bedstraw	*Galium trifidum*
White Meadowsweet	*Spiraea alba*

Water Quality

No samples collected