

Chapter 2 Niagara River Greenway: Existing Ecological Conditions

2.1 Context

Biodiversity features and conservation opportunities within the project area vary according to three major geographies: the upper river including the stream drainages above Niagara Falls; the lower river, including the Niagara Gorge; and the unpopulated islands. Niagara Falls was the historic natural barrier between the four Upper Great Lakes and the lower Lake Ontario-St. Lawrence River ecosystems. Fish species like Atlantic Salmon (*Salmo salar*) and American Eel (*Anguilla rostrata*) migrated to and from the Atlantic Ocean as far inland as Niagara's falls, but no further. Canals like the Erie Canal changed migration patterns, enabling passage around the barrier of the falls. However, even today the assemblages and genotypes of some upper river-Lake Erie aquatic species differ from those in the lower river-Lake Ontario system.

Direct local drainage to the upper river includes the lower Buffalo River, Scajaquada Creek, Twomile Creek, Tonawanda Creek, Cayuga Creek, and Gill Creek tributaries. Direct local drainage to the lower river is mainly provided by Fish Creek and the power plant outfalls at Lewiston. Shoreline and riparian areas have been highly modified by navigational dredging, diversions (Ontario and New York power plants and the Erie Canal), industrialization, power infrastructure, landfills, and waste discharges. The land disturbance and contamination caused by this history has led to significant loss and degradation of habitat. According to the *Great Lakes Environmental Atlas and Resource Book*, over two thirds of Great Lakes coastal wetlands have been lost—and likely a much higher proportion along the heavily industrialized Niagara River (EC and EPA, 1995). Island habitat has been decreased by quarrying (Strawberry), infilling of channels (Rattlesnake), removal (Bird), and park development (Three Sisters).

Despite this history, the Niagara River Greenway is the most biodiverse of all the tributary sub-basins in the Niagara River watershed, in part because of the river corridor's key role in the migratory cycles of many Great Lakes and global species. Globally significant numbers of Bonaparte's Gulls (*Chroicocephalus philadelphia*), Common Terns (*Sterna hirundo*), and Lesser Scaup (*Aythya affinis*) winter here. Availability of open water year round, mostly found along the rapids located above and below Niagara Falls, is vital to the success of these and many other waterbirds in the region. The islands and shoreline areas support breeding colonies of Black-crowned Night Heron (*Nycticorax nycticorax*), Great Egret (*Ardea alba*), and Great Blue Heron (*Ardea herodias*), as well as nesting Osprey (*Pandion haliaetus*), Bald Eagle (*Haliaeetus leucocephalus*), and Peregrine Falcon (*Falco peregrinus*). Lake Sturgeon (*Acipenser fulvescens*) are found in increasing numbers in both the upper and lower river, likely representing two different genetic variants from Lake Erie and Lake Ontario. Key species like the Emerald Shiner (*Notropis atherinoides*) support many of these resident and migratory species. The Niagara Gorge, once considered one of the most botanically diverse places in North America, still supports many rare plants and communities.

The purpose of this chapter is to assess the health or viability of the major elements for a suite of biodiversity features as a basis for developing focused conservation strategies that will help restore biological integrity and ecological function to the Niagara River Greenway.

2.2 Biodiversity Features

The project team selected seven biodiversity features that generally correspond with those used in the Conservation Action Plans for the Niagara River watershed and the surrounding watersheds of Lake Erie, Lake Ontario, and the Niagara River Corridor in Ontario. These features were chosen to represent the major habitat types found within the project area that serve as a foundation for all analyses and recommendations generated during the remainder of the CAP process. Terrestrial feature descriptions and amounts are generally based on compiled 2010 NOAA land use/land cover categories.

What is Biodiversity?

Biological diversity, or biodiversity, refers to the variety of life, as expressed through genes, species and ecosystems that is shaped by ecological and evolutionary processes. The full spectrum of biodiversity is essential to maintaining the ecological functions that sustain us. When we conserve biodiversity we also conserve these benefits, such as clean water and air, hunting and fishing opportunities, productive soils, crop pollination, resilience to weather extremes, and flood and pest control (Taylor et al., 2010).

Open Water/Aquatic Habitat

Description: Niagara River and tributary open water aquatic habitat.

Wetlands

Description: Emergent, scrub/shrub, and forested wetlands including coastal, floodplain, and headwater wetlands; and springs and seeps within the project area.

Woodlands

Description: Deciduous, evergreen, and mixed forest.

Grasslands/Shrublands

Description: Grassland/herbaceous and scrub/shrub, plus selected capped landfills.

Natural Areas

Description: Land covers supporting terrestrial habitat connectivity and/or stream function.

Niagara Gorge

Description: Including six miles of cliffs, talus slope, bedrock shoreline, and vegetated rim between the falls and the northern edge of the Niagara Escarpment at Lewiston.

Islands

Description: Natural and manmade islands, breakwalls, and surrounding shallow water habitat.

Niagara River Greenway Project Area Baseline Data:

Total Size: 83,743 acres

Total Waterways: 35 miles along river, 390 miles along tributaries (NHD)

Aquatic Habitat: 1,298 acres of shallow (<6 ft) vs 11,765 acres of deepwater (>6ft) habitat

Wetlands: 14,545 acres (17% of project area)

Woodlands: 6,847 acres (8% of project area)

Grass/Shrublands: 1,785 acres (2% of project area)

Natural Areas: 23,157 acres (28% of project area)

Islands: 521 acres

Niagara Gorge: 702 acres terrestrial + 6 miles of mostly deep water habitat

*Note: Data for aquatic habitat only includes area within the river assessed during NYPA relicensing (Stantec Consulting Services, Inc. et. al, 2004).

2.3 Viability Assessment

Understanding the current health and desired future condition of biodiversity features is an important step in determining where to focus efforts and measure progress towards achieving the desired status. Consensus from the TAC determined that conservation strategies should address those features and sites at the threshold between “Fair” and “Good” as the best candidates for restoration, and features/sites assessed as “Good” to “Very Good” as best candidates for protection.

Each biodiversity feature’s current health status or viability was evaluated by defining a set of indicators representing its **size, condition, landscape context, and species assemblages**. Where possible, indicators were assigned thresholds defining acceptable ranges of variation.

All “listed” animal species indicators include presence and trends of species listed in NYS as endangered, threatened, rare, or “of concern” as identified in the New York State Comprehensive Wildlife Conservation Strategy (CWCS) for the Erie-Niagara Basin combined with species documented by the Natural Heritage Program (NHP) within the Greenway. Presence of species within the Greenway was determined through documentation in the database of regional documents, NHP records, Breeding Bird Atlas and E-bird data, along with anecdotal sightings where applicable (Table 2.8). Trend data was derived from both sources used to compile the species table, along with information from the DEC. Where conflicts existed, the more conservative trend was used. Trend data is expressed using the following abbreviations: increasing- i, decreasing- d, stable- s, unknown- u. Nested features are used in the CAP process in cases where specific species that are not well captured by targets of a coarse scale warrant individual attention (TNC, 2007). These include species whose population trends indicate viability of a particular variable, e.g., presence of Northern Pike (*Esox lucius*) across all age groups indicates tributary access to spawning areas.

All analyses involving land covers use 2010 NOAA data.

Assessing Viability of Biodiversity Features

Key Terms:

- **Size:** Abundance of a biodiversity feature or of a species population size.
- **Condition:** Measures of biological composition, structure, and biotic integrity. For example, presence of representative or historic native communities or at-risk species.
- **Landscape Context:** The environmental and ecological processes that maintain a biodiversity feature and keep it functional. For example, connectivity between natural areas keeps them functional as wildlife corridors.

Ranking Scale:

- **VERY GOOD:** Ecologically desirable status; requires little intervention for maintenance.
- **GOOD:** Indicator within acceptable range of variation; some intervention required for maintenance.
- **FAIR:** Outside acceptable range of variation; requires human intervention.
- **POOR:** Restoration increasingly difficult; may result in extirpation of target.

In completing the viability analysis, the project team made every effort to obtain the best available data using information from the project's database of regional documents, local and regional experts, and GIS mapping and analyses. Across the Greenway, the team found large gaps in data and a critical need for more extensive site-level information collection. Accordingly, the indicators selected for use in the Strategy are developed to the extent that existing data reasonably supports. In cases of absent data, indicators were either discarded as unusable or included only as a secondary screening factor when evaluating overall biodiversity health.

Many of the values for ranking indicators were derived from already completed CAPs within the Great Lakes region including Lake Erie and Lake Ontario, providing comparability and consistency between plans. Information on each indicator and viability ranking along with overall significance, status, and desired status of the biodiversity feature is located below each table. It should be noted that many of these thresholds are meant to be applied to functional boundaries like a watershed or sub-watershed. Although the Greenway boundary is defined by the extent of municipalities along the Niagara River, it largely corresponds to the geographic extent of the Niagara River sub-basin.

Open Water Aquatic Habitat

Open water aquatic habitat includes all aquatic areas within the Niagara River and its tributaries. As previously noted, aquatic habitat varies greatly between the upper and lower river. The Upper Niagara River is comparatively shallow with depths under 6 feet (about 11%) or between 6 and 20 feet (67%). Only 22% is greater than 20 feet in depth compared to well over 85% of the lower river (Stantec Consulting Services, Inc. et al., 2004 —not including gorge). Most of the existing data focuses on shallow water habitat in the upper river. However, even here, ecosystem relationships are only beginning to be understood. Current research on the viability and trends of keystone prey fish like the Emerald Shiner, top predators like Muskellunge (*Esox masquinongy*), and rare, threatened, endangered (RTE), or “of concern” species like Lake Sturgeon, Longear Sunfish (*Lepomis megalotis*), and Map Turtle (*Graptemys geographica*) will provide valuable information on the actual state of aquatic habitat in the Niagara River and its immediate tributaries.

Overall ranking: FAIR - Based on low Biological Assessment Profile (BAP) scores, a large amount of impermeable surface within the project area, and evidence of priority contaminants in some biota. However, remnants of Niagara’s historic aquatic species diversity remain and are of critical importance to significant populations of resident and migratory fish-eating birds, so the potential is great to achieve a ranking of “GOOD” with focused conservation efforts.

Table 2.1 Open Water Aquatic Habitat Viability Ranking

ATTRIBUTE	INDICATOR	POOR	FAIR	GOOD	VERY GOOD	GREENWAY RANK
CONDITION	Predicted BAP scores-benthic community health	0-2.5	2.5-5.0	5.0-7.5	7.5-10	76% Fair, 24% Good
“	% of impervious surface	>25%	15-25%	5-15%	< 5%	26.8%
“	WQI (from Riverwatch)	<69	70-79	80-89	>89	77.3
“	Presence of priority contaminants in biota	Yes			No	Yes. 10 sites above threshold levels
“	Channel condition/shoreline hardening	>40% hard	30-40%	20-30%	<20% hard	Upper river: 82.5% hard Lower river: 14.6% hard Total average: 24% hard
LANDSCAPE CONTEXT	% of tributary free of barriers (culverts, dams)	<25%	25-50% 46%	50-75%	>75%	Total stream length: 561,646 ft. Total accessible: 257,563 ft.
NESTED FEATURE: NATIVE MUSSELS	Population trends of native mussel species	Absent - 2 spp	3-5 spp	6-15 spp	>15 spp	10 spp: population trend unknown
NESTED FEATURE: NATIVE MIGRATORY FISH	Population trends of Northern Pike	Abundance below some minimum threshold/ too few to estimate pop. abundance	Abundance above some minimum threshold, self-sustaining, but decreasing	Abundance above some minimum threshold, self-sustaining, and increasing	Abundant, self-sustaining, and relatively stable over time	Self-sustaining, at a depressed level

Indicators:

- **Predicted BAP scores- benthic community health:** BAP scores and rankings are provided by the DEC Rotating Intensive Basin Studies (RIBS) Program, which scores stream sampling sites according to the amount, diversity, and composition of benthic macroinvertebrate communities. TNC and NHP also developed predicted BAP scores for whole stream segments based on existing BAP scores and over 100 other indicators of stream health. See Map 2.1.
- **Percent of impervious surface cover:** This assessment provides an indirect way to assess the threat of runoff to stream health. Metrics for the amount of impervious surface relative to aquatic health impairments are based on Environment Canada (2013) and Center for Watershed Protection guidelines. The current amount of impervious surface within the project area is derived from NOAA land cover categories. According to Environment Canada, “urbanizing watersheds should maintain less than 10% impervious surface land cover in order to preserve the abundance and biodiversity of aquatic species” (2013).
- **BNR Water Quality Indicator (WQI):** Buffalo Niagara Riverkeeper measures and completes trends analysis for basic water quality indicators. Average from 29 sites in the Greenway. Data from 2013 sampling.
- **Presence of priority contaminants in biota:** Ontario Ministry of Environment (OMOE) and DEC measure trends for toxic contaminants in biota at levels above safe thresholds for fish-consuming wildlife by testing caged mussels and young-of-year fish at several sites throughout the Greenway downstream of sites known to be contaminated where remediation programs are either ongoing or completed. Presence/absence is used to rank this indicator. Thirty-year trend reports released in 2011 (last sampling in 2009) indicate that remedial actions have been effective in decreasing contaminant levels in Niagara River biota; however, relatively high concentrations of priority toxic substances continue to be found in the Greenway, mainly in the upper river and near the mouth of Bloody Run Creek in the lower river (Richman et al.). See Map 2.2 for locations of sites with contaminant levels above thresholds for fish-consuming wildlife.
- **Channel condition/shoreline hardening:** This indicator looks at the amount of shoreline that consists of artificial structures (i.e. rip rap, bulkheads) to prevent erosion. Hardening of shoreline disrupts overall natural coastal processes, extent of nearshore habitats, and shoreline community structures. The current condition of shorelines within the Greenway was derived from a desktop shoreline analysis using aerial photos and a Remedial Action Plan (RAP) delisting goal that a minimum of 25% of the AOC shoreline should have natural slope, shallows, and native vegetation. A Stream Visual Assessment conducted on selected tributaries helps further rank channel and in-stream conditions (see Chapter 3). The full indicator ranking values come from *An International Biodiversity Conservation Strategy for Lake Erie* (Lake Erie Strategy) that is loosely based on a State of Our Lakes Ecosystem Conference indicator (Pearsall et al., 2012). When looking at the upper river alone, there is much room for improvement with 82.5% of shoreline in hardened condition.
- **Percent of tributary free of barriers:** The current percentage of tributary streams accessible to migratory fish was derived by GIS analysis and field investigations completed by E & E. Stream

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miles are based on USGS National Hydrography Dataset (NHD+). The source of the indicator ranking is the Lake Erie Strategy with vetting from expert opinion.

- **Population trends of native mussel species:** Native mussel species found to currently exist within the Niagara River include: Eastern Pondmussel (*Ligumia nasuta*), Elktote (*Alasmodonta marginata*), Fragile Papershell (*Leptodea fragilis*), Hickorynut (*Obovaria olivaria*), Kidneyshell (*Ptychobranhus fasciolaris*), Pink Heelsplitter (*Potamilus alatus*), Rainbow (*Villosa iris*), Round Pigtoe (*Pleurobema sintoxia*), Slippershell Mussel (*Alasmodonta viridis*), Threeridge (*Amblema plicata*), and Wabash Pigtoe (*Fusconaia flava*). According to CWCS there are 17 species of mussels that occurred historically within the Lake Erie basin that are no longer found there (DEC, 2005). The source of the indicator ranking is the Lake Erie Strategy (Pearsall et al., 2012).
- **Population trends of Northern Pike:** Northern Pike population metric and ranking is from TAC expert opinion. Northern Pike were chosen as an indicator of native migratory fish species because they are a species of concern and rely on wet meadow and wetland habitats located in tributaries for spawning. Population abundance levels have not been studied for Northern Pike within the Niagara River Greenway.

Wetlands

Wetlands provide important fish and wildlife habitat and ecosystem services based on their ability to absorb pollutants, attenuate floods, recharge groundwater, and protect shores from eroding.

NOAA wetlands are based on aerial image land cover interpretation only and include “palustrine emergent,” “palustrine forested,” and “palustrine scrub/shrub wetlands.” These wetlands are not necessarily regulated and would require ground delineation to be regulated. Additional wetland areas considered during the assessment of this indicator are those designated by the National Wetlands Inventory (NWI) which do not hold any regulatory protections but are considered by the U.S. Army Corps of Engineers (USACE) in their permit review process. Regulated wetlands are ground-truthed and mapped by the DEC. NYS-designated wetlands are considered here to be the most protected. They have been field delineated (including 100-foot buffer areas) based on soils, elevation, and plant types; and ranked Class 1, 2, or 3 based on quality, including size, resident species, and aquifer connections. Basic development restrictions apply which may be further specified in a wetlands permit.

Overall ranking: FAIR - Although wetland obligate animal populations are decreasing due to a major wetlands deficit in the river corridor compared to historic cover, amphibian and marsh bird Indices of Biotic Integrity (IBIs) derived from data collected at existing protected coastal wetlands demonstrate better than average abundance and diversity, indicating good potential for species to benefit from wetland conservation.

Table 2.2 Wetland Viability Ranking

ATTRIBUTE	INDICATOR	POOR	FAIR	GOOD	VERYGOOD	GREENWAY RANK
SIZE	% Semi-protected (DEC) compared to all mapped wetlands (DEC + NWI)	<25%	25-37%	38-50%	>50%	29% (4,141 acres out of 14,267)
CONDITION	Population trends of listed wetland animal species	<25%	<50%	>50%	>75%	Of 11 listed species, 1 (9%) is known to be increasing
"	Abundance and diversity of wetland-dependent bird species (Marsh Bird IBI)	<20	20-39	40-59	>60	48.44 average for all NR AOC sites 1998-2010
"	Abundance and diversity of amphibians (Amphibian IBI)	<25	25-49	50-74	>75	50.17 average for all NR AOC sites 1998-2010
LANDSCAPE CONTEXT	% natural land cover within 500 m of mapped wetlands	<20	20-39	40-69	>70	13.27%

Indicators:

- Percent semi-protected (DEC) wetlands compared to NWI wetlands:** There are 61 (4,141 acres) DEC-regulated wetlands within the project area. By conservation law DEC wetlands must be >12.4 acres and must be field delineated by a DEC wetlands biologist. Activities within these wetland and surrounding buffer areas are restricted by individual wetland permits. By comparison, the NWI maps (USFWS) include wetlands of any size and are based on aerial image analysis only. For this analysis NWI wetlands are used to indicate potential wetlands for state protection. Field delineation may be requested by a community or landowner petition to the DEC. Map 2.3 depicts the extent of both state and federal wetlands within the Greenway. Ranking for this indicator is derived from expert opinion.
- Presence/trends of listed wetland animal species:** Listed species documented within the Greenway include: American Bittern (*Botaurus lentiginosus*- d), Black-crowned Night Heron (d), Black Tern (*Chlidonias niger*- d), Great Blue Heron (i), King Rail (*Rallus elegans*- d), Least Bittern (*Ixobrychus exilis*- d), Pied-billed Grebe (*Podilymbus podiceps*- d), Yellow Rail (*Coturnicops noveboracensis*- u), Common Mudpuppy (*Necturus maculosus*- d), Snapping Turtle (*Chelydra serpentina*- u), and Western Chorus Frog (*Pseudacris triseriata*- d).
- Abundance and diversity of wetland-dependent bird species (Marsh Bird IBI):** Bird Studies Canada's Marsh Monitoring Program was established to provide baseline surveys of marsh bird and amphibian populations and their habitats in marshes within Great Lakes AOCs. Through this effort, IBIs are used to measure marsh habitat quality. The results are from data collected between 1998 and 2010 at 9 sites within the Greenway. Averaged scores for 13 years of data collection at these sites is 48.44 on a scale of 0-100 which is considered "good." Sunken Island scored the highest of all

sites due to the abundance and richness of marsh-obligate species, followed by Tifft Nature Preserve. Overall values for marsh-nesting and indicator bird species across sites were below average compared to non-AOC sites when looking at data between 2003 and 2010; however, most sites exhibited no impairment in terms of their ability to support marsh-dependent species (Archer and Rankin, 2011). The source of the ranking for this indicator comes from the Lake Erie Strategy (Pearsall et al., 2012). See Map 2.4 for site locations and IBI scores.

- ***Abundance and diversity of amphibians (Amphibian IBI):*** See above marsh bird IBI. Overall average for all 9 sites over 13 years is 50.17, on the lower range of the “good” category. Beaver Island ranked highest among sites with East River Marsh as second. Sunken Island and Times Beach received the lowest scores with the latter having no amphibians detected. For sites within the Greenway as a whole, both amphibian indicator species richness and total amphibian species richness were “greater than the expected range of values calculated for Great Lakes basin non-AOC marshes based on measured environmental covariates” (Archer and Rankin, 2011). Overall, marshes within the AOC are better suited to support healthy amphibian communities than for marsh nesting birds. See Map 2.4 for site locations and IBI scores.
- ***Percent of natural land cover within 500 m of mapped wetlands:*** Derived from the Lake Erie Strategy, this indicator relates to the impacts of natural land cover loss in coastal wetland areas (Pearsall et al., 2012). Although more research is needed in relation to impacts of land cover changes and wetlands, we used the best information available to characterize alterations in land use as a stressor to wetlands and their natural functions. GIS analysis was used to characterize the amount of natural land cover remaining within the Greenway surrounding mapped wetlands (NWI and DEC combined).

Woodlands

Woodland habitats are important in their ability to protect sensitive headwater areas, provide habitat to native terrestrial and aquatic species, increase stream quality in riparian areas, improve atmospheric conditions, and lessen impacts associated with climate change.

Significant woodland areas that occur within the Greenway include headwater forests located primarily on Grand Island and the Tuscarora Reservation, large patches of woodlands located on Grand Island, and rare woodland communities located within the gorge which are analyzed more closely as a nested feature.

NOAA land covers including “deciduous forest,” “evergreen forest,” and “mixed forest” are used in assessing current forest conditions.

Overall ranking: POOR - Based on <10% forest cover, fragmentation, and population trends of listed species.

Table 2.3 Woodland Viability Ranking

ATTRIBUTE	INDICATOR	POOR	FAIR	GOOD	VERY GOOD	GREENWAY RANK
SIZE	Acreage/% of forest cover	<20%	20-35%	35-60%	>60%	6,847 acres (8% of project area)
CONDITION	Population trends of listed woodland species	<25%	<50%	>50%	>75%	Of 19 listed species, 6 (31%) are known to be stable to increasing- 50% have trends that are unknown
LANDSCAPE CONTEXT	% riparian forest	<56%	57-63%	64-71%	77%	18.7%
"	Presence of core forest tracts (over 250 acres)	Absence		Presence		1 tract (678 acres on Grand Island)

Indicators:

- Acreage of Forest Cover:** The overall amount of forest cover helps to determine the ability of a landscape to support healthy levels of flora and fauna. Current research suggests that the requirement for most forest birds related to long-term persistence in a landscape is around 60% forest cover. Thresholds for viability ranking are derived from Environment Canada's *How Much Habitat is Enough?* (2013).
- Population trends of listed woodland species:** These include: Black-throated Blue Warbler (*Setophaga caerulescens*- s), Cerulean Warbler (*Setophaga cerulean*- d), Cooper's Hawk (*Accipiter cooperii*- i), Golden Eagle (*Aquila chrysaetos*- i), Long-eared Owl (*Asio otus*- u), Louisiana Water Thrush (*Parkesia motacilla*- u), Northern Goshawk (*Accipiter gentilis*- i), Prothonotary Warbler (*Protonotaria citrea*- d), Red-shouldered Hawk (*Buteo lineatus*- d), Red-headed Woodpecker (*Melanerpes erythrocephalus*- d), Scarlet Tanager (*Piranga olivacea*- u), Sharp-shinned Hawk (*Accipiter striatus*- i), Wood Thrush (*Hylocichla mustelina*- d), Eastern Red Bat (*Pantherophis Guttatus*- u), Hoary Bat (*Lasiurus cinereus*- s), Elk Sedge (*Carex garyeri*, u), Smooth Cliff Brake (*Pellaea glabella*- u), Big Shellbark Hickory (*Carya laciniosa*- u), and Shumard Oak (*Quercus shumardii*- u).
- Riparian Forest Cover:** Riparian zones are lands adjacent to rivers and streams. The condition of riparian areas is important for numerous reasons as they provide soil stability, filter pollutants from runoff, and offer important habitat for both aquatic and terrestrial wildlife species. For this analysis riparian forests were defined as areas that contain woodland land covers within a 100 foot buffer on either side of streams within the Greenway. Detailed LIDAR land cover developed through the Strategy was used in this analysis; therefore, only perennial streams where LIDAR data was generated were included. The source of the ranking comes from a study completed for the mid-Atlantic region, but other documents including *How Much Habitat is Enough* support the statement that at least 75% of stream lengths within a watershed should be naturally vegetated (Environment Canada, 2013; Goetz et. al., 2003).
- Presence of Core Forest Tracts (over 250 acres):** The CAP completed for the Canadian side of the Niagara River Corridor recommends 250 acres as a minimum threshold for core forests in

Southern Ontario. Considering projections for more frequent and severe storms associated with climate change, 500 acres is recommended as a more conservative threshold (Jalava et al., 2010). Using 2010 NOAA land cover data, only one forest tract satisfies the minimum recommended threshold of 250 acres or more. The tract is located on Grand Island and totals 678 acres. It should be noted that this criterion is more suitable when applied to less urbanized areas within the upper reaches of a watershed (the entire Niagara River watershed contains 110 tracts of core forest over 500 acres and more than 100 meters from a road). See Map 2.5 for locations of large tracts of woodlands within the Greenway.

Grass/Shrubland

Grasslands can be defined as areas with lower than 35% tree cover and for this analysis include “shrub/scrub” and “grassland/herbaceous” NOAA land covers (Environment Canada, 2013). This habitat type makes up a very small portion of the Greenway, but it is critical both within the region and across much of North America in its ability to support grassland bird species that have been in decline over the past 40 years (Norment, Runge, and Morgan, 2010).

One of the most significant grassland areas remaining within the Greenway is Joseph Davis State Park. Grassland restoration funded by the Greenway Ecological Standing Committee in the park is notable within the region. Areas like the Lewiston Plateau, inactive landfills, and agricultural areas that adhere to specific management techniques and mowing regimes have great potential within the Greenway for grassland habitat restoration.

Overall ranking: POOR - Can be greatly improved if grasslands restoration is designed into remediation strategies for landfills, brownfields, and other re-naturalizing urban-industrial areas, as well as abandoned agricultural lands.

Table 2.4 Grassland Viability Analysis

ATTRIBUTE	INDICATOR	POOR	FAIR	GOOD	VERY GOOD	GREENWAY RANK
SIZE	Acreage/% of grass and/or shrubland	TBD	TBD	TBD	TBD	1,785 acres (2% of project area)
“	Grassland tracts >10 acres	TBD	TBD	TBD	TBD	41 tracts over 10 acres, 58% of total grasslands (1,032 acres out of 1,785)
CONDITION	Population trends of listed grass/shrubland bird species	<25%	<50%	>50%	>75%	Of 11 listed species, 3 (27%) are known to be stable or increasing

Indicators:

- **Acreage of grass/shrubland cover:** We were unable to find sufficient data to support any sort of metric for ranking the amount of grassland cover within the project area. The total area of grassland within a landscape is an important factor in abundance and richness of grassland bird species, yet most studies conducted within the region focus on patch size rather than overall percentage of cover.

- **Grassland tracts > 10 acres:** Grassland tracts greater than 10 acres are considered most functional based on observations of at-risk breeding grassland birds in this region (Norment, Ardizzone, and Hartman, 1999). However, we were unable to locate sufficient data related to the number of patches recommended in a certain area. See Map 2.6 for locations of grassland tracts.
- **Population trends of listed grass/shrubland bird species:** Listed grassland bird species cited within the Greenway include: Bobolink (*Dolichonyx oryzivorus*- d), Dickcissel (*Spiza americana*- u), Eastern Meadowlark (*Sturnella magna*- d), Grasshopper Sparrow (*Ammodramus savannarum*- d), Henslow's Sparrow (*Ammodramus henslowii*-d), Horned Lark (*Eremophila alpestris*- d), Northern Harrier (*Circus cyaneus*- s), Sedge Wren (*Cistothorus platensis*- s), Short-eared Owl (*Asio flammeus*- s), Upland Sandpiper (*Bartramia longicauda*- d), and Vesper Sparrow (*Poocetes gramineus*- d).

Natural Areas

Natural areas consist of combined wetland, woodland, and grassland habitats to look comprehensively at the amount of land cover in a natural state within the Greenway.

Overall ranking: FAIR - Only 28% of the project area has natural cover, although much of that is semi-protected by a density of state and municipal parks, state-regulated wetlands, and Wildlife Management Areas within the Greenway.

Table 2.5 Natural Areas Viability Analysis

ATTRIBUTE	INDICATOR	POOR	FAIR	GOOD	VERY GOOD	GREENWAY RANK
SIZE	% of natural cover	<20	20-45	>45-80	>80	23,157 acres (28% of project area)
CONDITION	Population trends of listed species with large or diverse habitat requirements	<25%	<50%	>50%	>75%	Of 16 listed species, 2 (12%) are known to be stable or increasing
LANDSCAPE CONTEXT	Road density in project area	>2km/km²	1.25-2km/km ²	.5- 1.25 km/km ²	<.5 km/km ²	5.49 km/km ²

Indicators:

- **Percent of natural cover within the project area:** Ranking from Lake Erie Strategy (Pearsall et al., 2012). Map 2.7 shows significant natural areas within the project area.
- **Population trends of listed plant and animal species with large or diverse habitat requirements:** Species include: American Woodcock (*Scolopax minor*- d), Black-billed Cuckoo (*Coccyzus erythrophthalmus*- d), Blue-winged Warbler (*Vermivora pinus*- d), Brown Thrasher (*Toxostoma rufum*- d), Canada Warbler (*Cardellina Canadensis*- d), Common Nighthawk (*Chordeiles minor*- d), Golden-winged Warbler (*Vermivora chrysoptera*- d), Peregrine Falcon (s),

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Prairie Warbler (*Setophaga discolor*- i), Ruffed Grouse (*Bonasa umbellus*- d), Whip-poor-will (*Antrostomus vociferous*- d), Willow Flycatcher (*Empidonax traillii*- d), Yellow-breasted Chat (*Icteria virens*- u), Blue-spotted Salamander (*Ambystoma laterale*- u), Jefferson Salamander (*Ambystoma jeffersonianum*- u), and Lesser Fringed Gentian (*Gentianopsis virgate*- u).

- **Road density in project area:** The purpose of this indicator is to assess the amount of fragmentation of habitat caused by road networks within the project area. Roads cause impacts including disruption of wildlife behavior and movements for both terrestrial and aquatic species, habitat modification, altered drainage patterns, introduction of invasive species, and modification of microclimates (Pearsall et al., 2012). Ranking for this indicator comes from the Lake Ontario Biodiversity Conservation Strategy (Lake Ontario Biodiversity Strategy Working Group, 2009) based on data from the Eastern Ontario Model Forest (EOMF, 2003) and Riitters and Wickham (2003).

Niagara Gorge

The Niagara Gorge is roughly six miles long as measured from First Street in the City of Niagara Falls to Center Street in the Village of Lewiston. It includes steep calcareous cliffs and talus slopes (260-600 feet in height), and an upland rim dominated by state parkland, the Robert Moses Parkway (RMP) and the Niagara Power Project. It is bordered to the east by urban neighborhoods. The gorge and rim area to the west of these neighborhoods--including the RMP and power project--is 702 acres (EDR, 2011).

The deepest (up to 190 feet) and fastest flowing segment of the Niagara River is also part of the Niagara Gorge (not included in above acreage) and will be discussed here for its unique aquatic habitat and species. Surface water features also include Fish Creek, discharging to the river as a flume at Artpark, and Bloody Run, discharging as a small waterfall and seep at Devil's Hole State Park. Many other seeps along the cliff face discharge onto shelves in the Calcareous Cliff Community, creating unique conditions that support NYS-listed plant species.

Overall ranking: FAIR-GOOD - High historic aquatic and terrestrial biodiversity continues to be affected by fragmentation, invasive species, changes to surface and groundwater hydrology, and hydropower demands.

2.6 Gorge Viability Analysis

ATTRIBUTE	INDICATOR	POOR	FAIR	GOOD	VERY GOOD	GREENWAY RANK
AMOUNT	Acreage of natural areas		<50%	>50%		About 350 acres or 50% of study area
"	Acreage protected for long-term conservation		<50%	>50%		100% of the natural area is semi-protected in state parks
CONDITION	Population trends of listed plant species/communities	<25%	<50%	>50%	>75%	Calcareous Cliff and Calcareous Talus Slope Woodlands (NHP); old growth Northern White Cedar. Of 22 listed plant species, 6 (27%) have current records.
"	Population trends of listed animal species	<25%	<50%	>50%	>75%	Of 17 listed populations, 7 (41%) are known to be stable or increasing
"	% of non-native/invasive vegetation	<25%	<50%	>50%	>75%	At least one study estimates non-native plants to represent about 25% of gorge study area
LANDSCAPE CONTEXT	Amount of gorge within 375 m of roads	100%			<20%	100%
"	Percent of gorge free of significant (>6 feet) daily water level fluctuations	0%				0%
"	Are key ecological processes intact?			X		Groundwater seeps remain fairly intact

Indicators:

- Acreage of natural area:** Roughly 350 acres or 50%. Although state parks are a major use of the gorge and rim, including DeVeaux Woods, Whirlpool, Devils's Hole, and Artpark (about 410 acres)—they are not entirely counted as "natural areas" using NOAA land cover definitions. For example, roads, buildings, parking lots, lawns, and other manicured areas are not included. A study by Environmental Design & Research (EDR) entitled *Regional Economic Growth Through Ecological Restoration of the Niagara Gorge Rim* (2011) found that, of the 702-acre gorge study area, 26% is developed, and another 24% is landscaped with lawn and ornamentals.
- Acreage protected for long-term conservation:** Almost 100% of the gorge natural area is located within a state park system. Recent studies on the viability of gorge seeps and wetlands (E & E, 2015), gorge rim habitat connectivity potential (EDR, 2011), and the current status of unique plant communities in the gorge indicate a dire need for long-term conservation management policies and practices (Eckel, 2008; TRC Engineering LLC. and Riveredge Associates, LLC., 2008). The gorge ecosystem remains vulnerable to climate change, energy demands, human disturbance, and erosion (E & E, 2015; Eckel, 2008; Great Lakes Commission, 2011).
- Population trends of listed plants/communities:** There is very high historic botanical biodiversity, but that has decreased significantly since early botanical reports (Eckel, 2004). The

NHP lists two significant natural communities—Calcareous Talus Slope Woodland and Calcareous Cliff Community—and six state-listed plants including Elk Sedge, Slender Blazing Star (*Liatris gracilis*), Sky-blue Aster (*Aster oolentangiensis*), Lesser Fringed Gentian, Ohio Goldenrod (*Oligoneuron ohionse*), and Smooth Cliff Brake. No current records exist for 16 other state-listed plants recorded 30 years ago, suggesting a loss of over 70% state-listed species in 30 years (EDR, 2011; NHP). Northern White Cedars (*Thuja occidentalis*) up to 1,000 years old are found in the gorge along with other >100 year old trees and plant communities, including remnants of oak savannah along the rim in the vicinity of Devil’s Hole.

- **Population trends of listed animal species:** The Niagara River within the gorge is part of an NHP-noted vulnerable “waterfowl winter concentration area;” a NYS DOS Significant Coastal Fish and Wildlife Area including high winter concentrations of gulls and diving ducks; and an internationally-designated Important Bird Area (IBA). The NHP also notes three rare aquatic species in the gorge area: Lake Sturgeon (u), Hickorynut Mussel (u), and Rainbow Mussel (u). Listed bird species documented include: *Peregrine Falcon* (s), *Pied-billed Grebe* (d), *American Bittern* (d), *Sharp-shinned Hawk* (i), *Cooper’s Hawk* (i), *Common Nighthawk* (d), Northern Goshawk (i), Red-shouldered Hawk (d), Red-headed Woodpecker (d), Short-eared Owl (s), Northern Harrier (s), Bald Eagle (i), Horned Lark (d), and Bonaparte’s Gull (u). The first six species (italicized) are also listed in the Breeding Bird Atlas for gorge survey blocks. Only four of the 14 listed bird species are known to have populations that are increasing.
- **Percent of non-native invasive vegetation:** Of the 238 plant species observed by EDR in their 2010 gorge surveys, 105 species (44%) were not native to the region. 21 of these are included on the DEC target list of invasives (EDR, 2011). The NYPA-commissioned *Feasibility Study for the Restoration of Native Terrestrial Plants in the Vicinity of the Niagara Gorge* provided an overall estimate of 75% native and 25% non-native plant communities (TRC Engineering, LLC. and Riveredge Associates, LLC., 2008).
- **Amount of river within 375 meters of a road:** 100% of the gorge segment of the Niagara River is within 375 meters of a road. Negative impacts of roads on rivers include polluted runoff, habitat and forest fragmentation, road kill, noise, and edge disturbance conducive to invasive plant colonization. These threats are well documented (EDR, 2011; DEC, 2005).
- **Percent of gorge free of artificial daily water level fluctuations >6 feet:** 0%. See Map 3.3. NYPA documents 14 fish species, 6 herpetofaunal species, 8 bird species, and 1 mammal species likely affected by daily water level fluctuations that occur in the gorge when more of the river is diverted to US and Canadian power plants (nights and off-season), or back into the river (mornings) (Riveredge Associates, LLC., 2005; Stantec Consulting Services, Inc. et al., 2004). Twice daily fluctuations of 6 – 12 feet occur throughout the gorge. Stranded, flooded, or silted-over fish egg nests are one potential impact. For example, Lake Sturgeon are known to spawn in the gorge but there is little to no evidence of recruitment. The Niagara is one of several Great Lakes watersheds with high “ecological and low-flow vulnerability” rankings relative to future energy demands (Great Lakes Commission, 2011).
- **Are key ecological processes intact?:** A key locally-driven ecological process in the gorge is the discharge of groundwater through certain bedrock layers along the cliff face. Groundwater seeps are a major factor in the botanical diversity of the gorge, and are vulnerable to land uses,

road drainage, and other forms of development along the rim. A 2014 survey of several gorge seeps found groundwater recharge and subsequent discharge processes to be fairly intact, but noted the need for additional research to determine the quality of water and catchment areas (E & E, 2015).

Islands

Included in this feature are those islands and breakwalls whose main habitat feature is their relative isolation from human disturbance (thus not Grand Island). Niagara River islands provide critical shelter, food, and breeding areas to many species of fish and birds. On the US side they are all located in the upper river and include Beaver Island, Buckhorn Island, Goat Island, Luna Island, and Three Sisters Islands components of State Parks, along with Motor and Strawberry Islands. Also included are existing semi-natural habitat areas on the largely developed Unity Island plus two man-made islands: Frog and Grass (or Sunken) Island. Historic islands no longer present include Rattlesnake Island, once one of the river's most significant wetland and migratory bird habitats, Connors Island, Mink Island, and Cayuga Island which is now almost entirely developed. Bird Island was destroyed and rearranged into the Bird Island Pier or breakwall.

Roughly 5.5 miles of Buffalo Harbor breakwalls include the Old Breakwater, South Breakwater, Donnelly's Wall (North Breakwater), and Bird Island Pier. Although they are vulnerable to storms and lake seiches, their habitat values have been enhanced on an annual basis through several NYPA-funded Habitat Improvement Projects (HIPs).

Overall ranking: FAIR-GOOD - Although island habitat acreage has diminished, species use of remaining areas is high indicating potential for improving population trajectories with increased island habitat protection and conservation.

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2.7 Islands Viability Analysis

ATTRIBUTE	INDICATOR	POOR	FAIR	GOOD	VERY GOOD	GREENWAY RANK
AMOUNT	Acreage of island habitat compared to historic	TBD	TBD	TBD	TBD	376 habitat (semi-natural) acres compared to 677 acres historic (56% of historic acres).
"	Amount of semi-protected island habitat	<20%	20-40%	40-70%	>70%	>70%--however, protection levels vary greatly
CONDITION	Population trends of listed plants/communities	<25%	<50%	>50%	>75%	6 species; 4 communities. Trends unknown.
"	Population trends of listed animal species	<25%	<50%	>50%	>75%	Of 22 listed species, 8 (36%) are known to be stable or increasing
"	Population trends of colonial nesting birds	Decreasing	TBD	Stable	Increasing	Steady increase since 1977 except Herring Gull
CONNECTIVITY	Measure of surrounding aquatic habitat	Decreasing	TBD	Stable	Increasing	1,250 acres of surrounding shallow water habitat

Indicators:

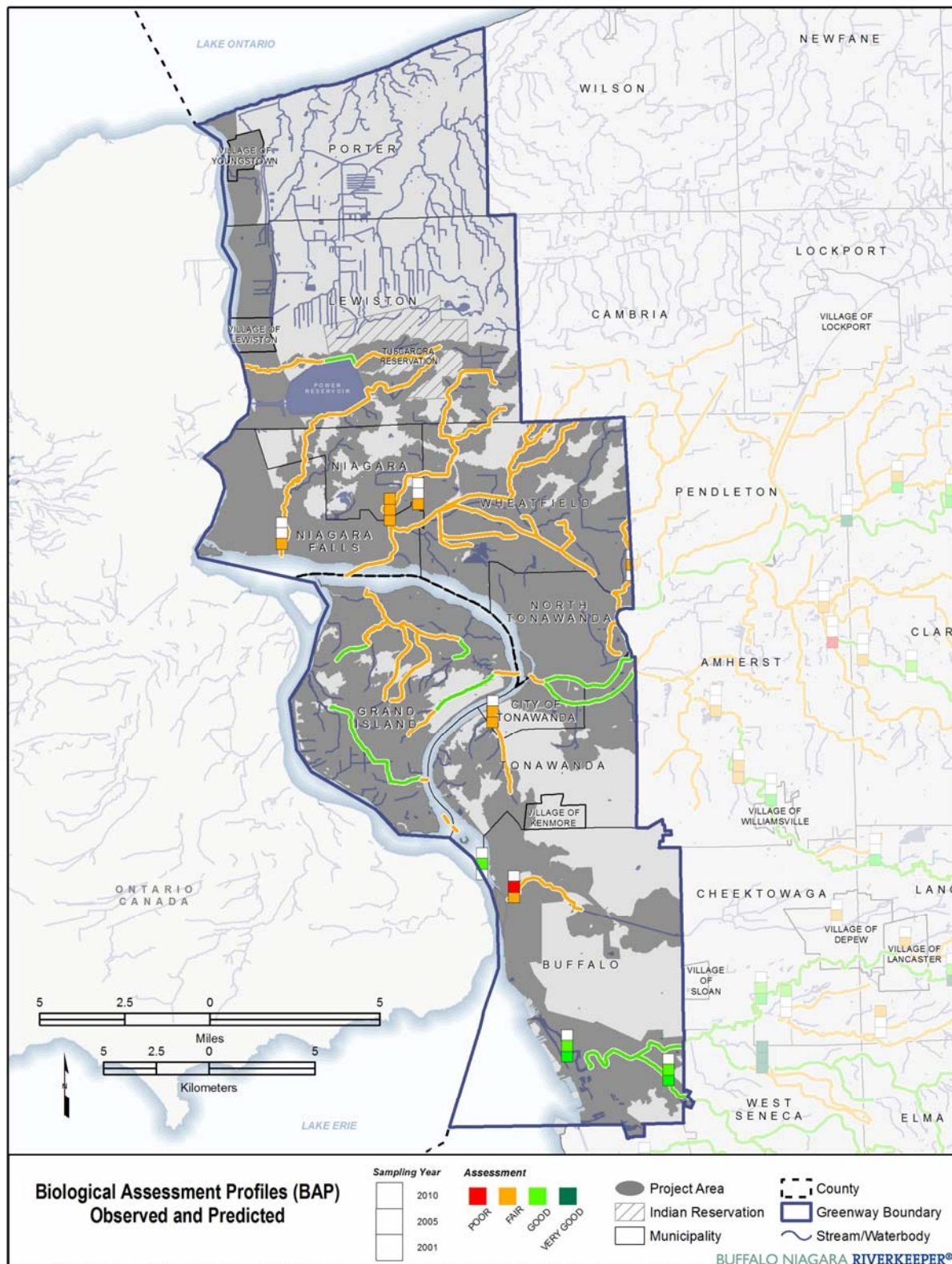
- **Acreage of current island habitat compared to historic.** 376 acres compared to 677 acres or 56% of historic island acreage. See Table 2.9.
- **Amount of semi-protected island habitat:** 100% of the islands are in public ownership and semi-protected as parks, state-regulated wetlands, or Wildlife Management Areas. Some have benefited by NYPA-funded HIPs and may be protected by long-term habitat management plans (such as maintenance of Tern nesting structures on the breakwalls). Nevertheless, we rank this as 70% semi-protected as, in all cases, the level and duration of habitat protection needs to be assessed and strengthened where necessary. For example, the most important island habitats at the south and north ends of Grand Island are vulnerable to disturbance from powerboat anchoring and mooring during sensitive spawning, nesting and fledgling seasons. The ranking for this indicator is derived from the Lake Erie Strategy (Pearsall et al., 2012).
- **Population trends of listed plants and communities:** Of the many NYS-listed (RTE and of concern) plant species historically found on these islands (Goat and Buckhorn primarily), six are found today including Elk Sedge, Big Shellbark Hickory, Shumard Oak, Stiff-leaf Goldenrod (*Oligoneuron rigida*), Southern Blue Flag (*Iris virginica*), and Lesser Fringed Gentian. Four NHP-listed communities—Calcareous Cliff, Deep Emergent Marsh, Silver Maple Ash Swamp, and Calcareous Talus Slope Woodland—are also found on islands within the Niagara River. Trends for all plant species and communities listed above are unknown.
- **Population trends of listed animal species (not including colonial nesting birds):** The following RTE or “of concern” species are all associated with island groups at the north and south end of Grand

Island. Fish: Freshwater Drum (*Aplodinotus grunniens*- u), Iowa Darter (*Etheostoma exile*- s), and Lake Sturgeon (u). Mussels: Eastern Pondmussel (s), Fragile Papershell (u), Hickorynut (u), Kidneyshell (u), Pink Heelsplitter (u), Pocketbook (u), Rainbow (u), Round Pigtoe (u), Threeridge (u), and Wabash Pigtoe (u). Crustacea: Devil Crawfish (s). Birds: King Rail (d), Pied-billed Grebe (d), Cooper's Hawk (i), Peregrine Falcon (s), Least Bittern (d), Northern Harrier (s), Sedge Wren (s), and Bald Eagle (i).

- **Population trends of colonial nesting birds:** Of the following six populations, five appear to have increased over the past 30 years on the river: Great Blue Heron, Great Egret, Black-crowned Night Heron, Ring-billed Gull, and Common Tern. Herring Gull populations have decreased (Hughes et al., 2014; Moore et al., 2013).
- **Measure of surrounding aquatic habitat:** Only about 11% of the upper river is <6 feet deep, and all of that (1,250 acres) surrounds the island groups, tripling their value as aquatic habitat (Stantec Consulting Services, Inc. et al, 2004). These island shallow water areas serve as critical spawning and nursery grounds for Muskellunge, Yellow Perch (*Perca flavescens*), Smallmouth Bass (*Micropterus dolomieu*), along with other young-of-year piscivorous fish and the small-bodied fish they prey upon (Kapuscinski, 2013). They also harbor mussel beds for some of the river's most threatened populations. See Map 2.9 for the extent of aquatic habitat surveyed within the river.

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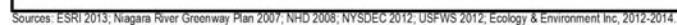
Map 2.1 Biological Assessment Profiles (BAP) Observed and Predicted



Map 2.2 Local Source Areas of Priority Contaminant in Fish and/or Mussel Tissue in the Niagara River Greenway

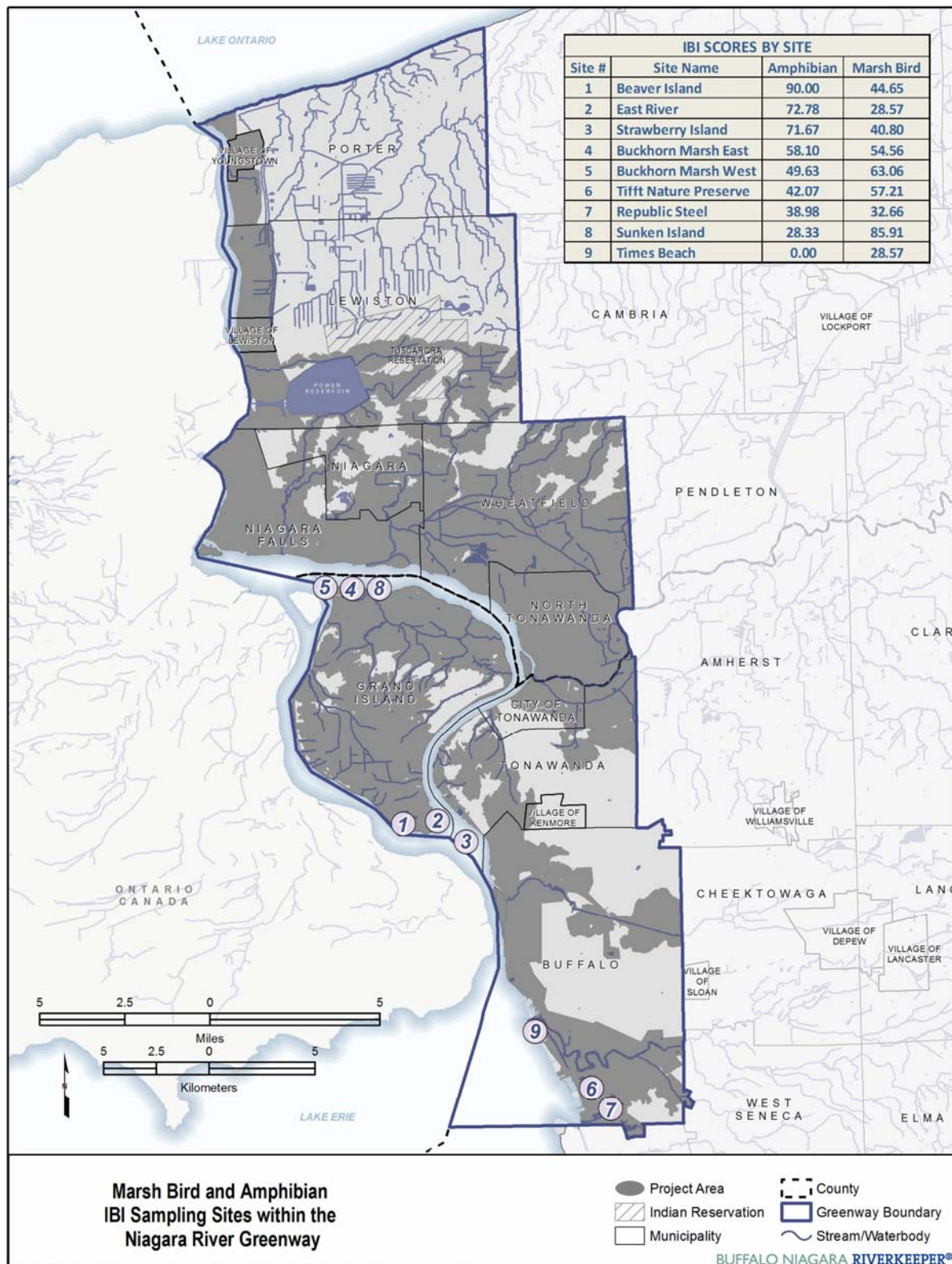


Map 2.3 State and Federal Wetlands within Project Area



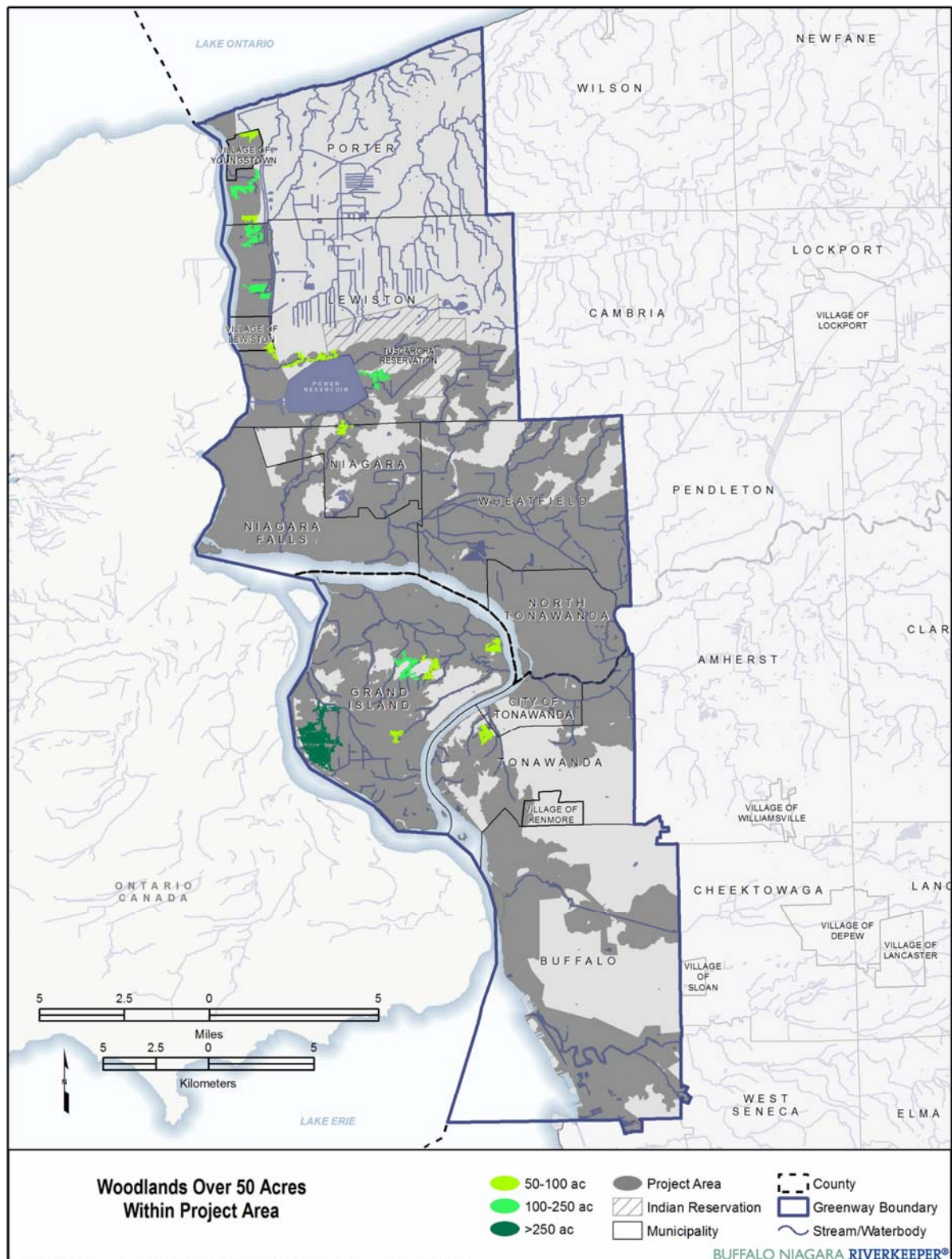
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Map 2.4 Marsh and Amphibian IBI Sampling Sites within the Niagara River Greenway



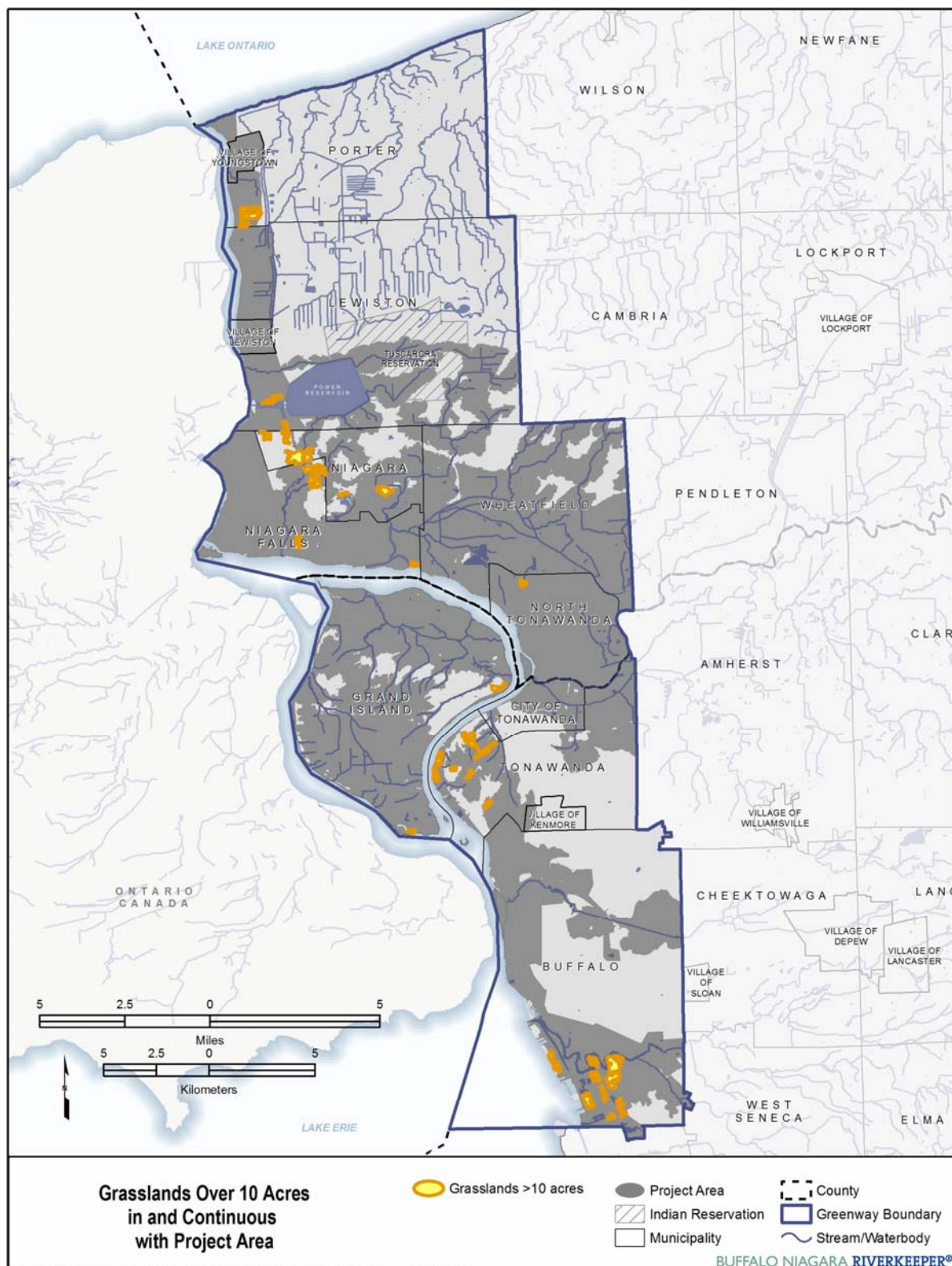
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Map 2.5 Woodlands Over 50 Acres within Project Area



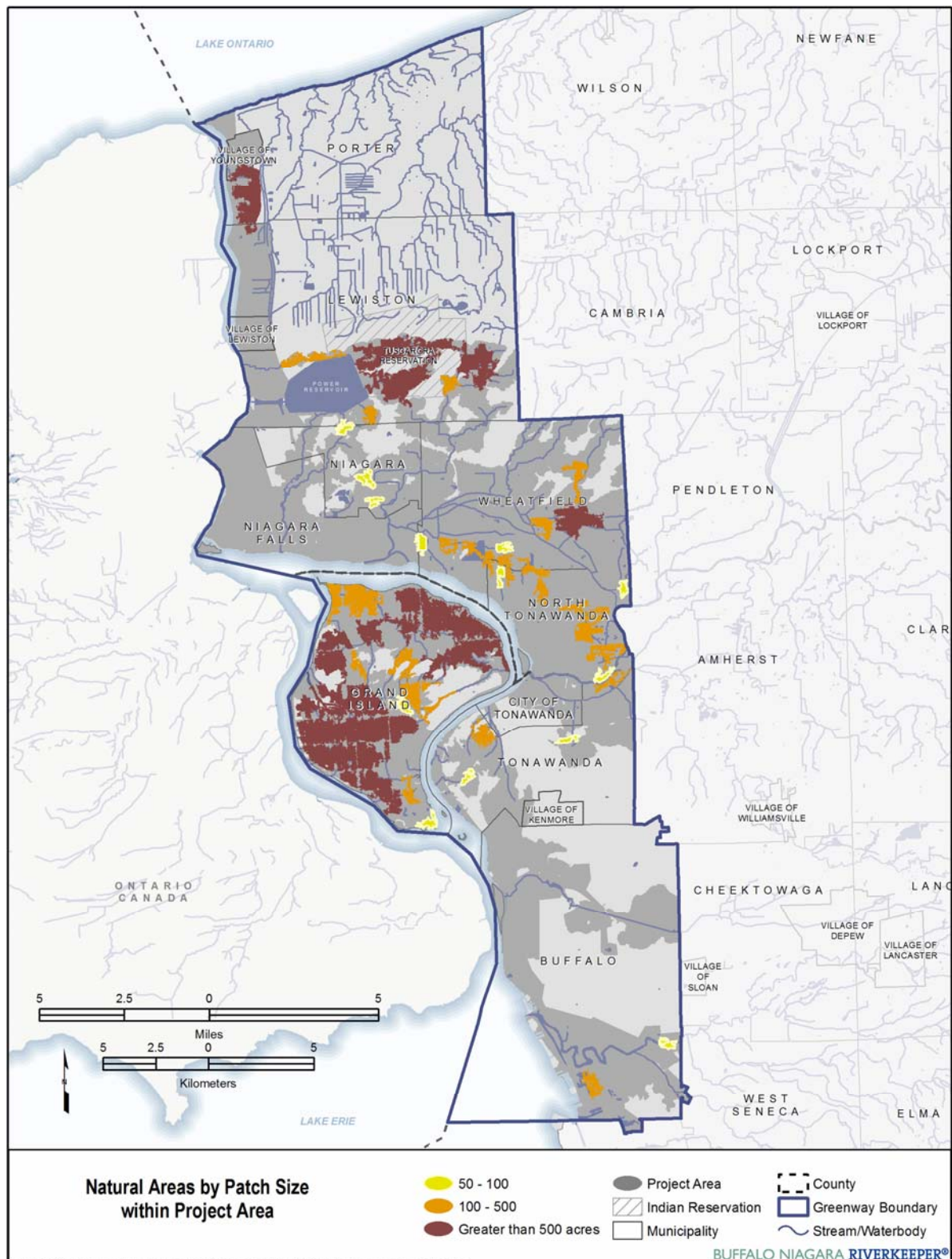
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Map 2.6 Grasslands Over 10 Acres in and Continuous with the Project Area



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Map 2.7 Natural Areas by Patch Size within Project Area



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Map 2.8 Niagara Gorge Study Area (EDR, 2011)



Figure 1.0
Study Area



Sheet 1 of 1

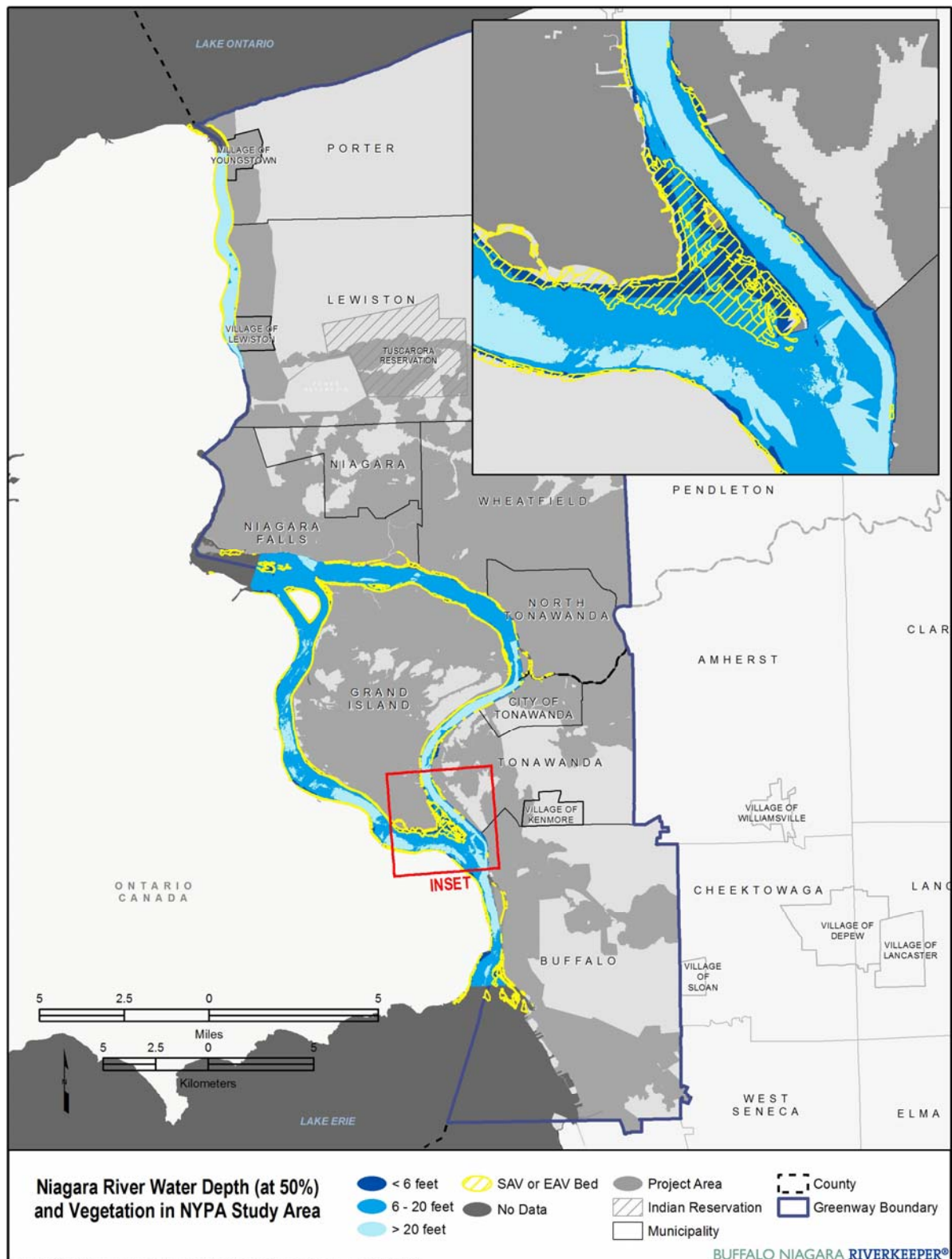
Legend: Study Area

- Interpretive Site
 - Scenic View
 - Study Area
- 0 400 800 1200
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Figure
1.0

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Map 2.9 Niagara River Water Depth (at 50%) and Vegetation in NYPA Study Area



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2.8 Listed Species in the Niagara River Greenway

*Note: Entire list includes those species listed as Species in Greatest Conservation Need within the Lake Erie Basin (DEC, 2010; highlighted in blue) and NHP species cited in the Greenway (highlighted in purple). All citations within the Greenway occurred between 1994-2015.

BIODIVERSITY FEATURE	TAXA	SPECIES NAME	LATIN NAME	STATUS	SOURCE OF STATUS	CITED IN GREENWAY
Aquatic						
	Bird	American Black Duck	Anas rubripes	Unknown	1	D
	Bird	American Golden-plover	Pluvialis dominica	Unknown	1	T
	Bird	Bald Eagle	Haliaeetus leucocephalus	Increasing	1	J
	Bird	Blue-winged Teal	Anas discors	Decreasing	1	D
	Bird	Bonaparte's Gull	Chroicocephalus philadelphia	Unknown	1	M
	Bird	Buff-breasted Sandpiper	Calidris subruficollis	Unknown	1	T
	Bird	Common Loon	Gavia immer	Stable	2	C
	Bird	Common Tern	Sterna hirundo	Stable	2	A
	Bird	Great Egret	Ardea alba	Increasing	1	A
	Bird	Greater Scaup	Aythya marila	Increasing	1	I
	Bird	Greater Yellowlegs	Tringa melanoleuca	Unknown	1	P
	Bird	Horned Grebe	Podiceps auritus	Unknown	1	T
	Bird	Lesser Scaup	Aythya affinis	Stable	1	C
	Bird	Little Gull	Hydrocoloeus minutus	Unknown	1	D
	Bird	Long Tailed Duck	Clangula hyemalis	Unknown	1	T
	Bird	Osprey	Pandion haliaetus	Increasing	3	C
	Bird	Red-throated Loon	Gavia stellata	Unknown	1	T
	Bird	Thayer's Gull	Larus thayeri	Unknown	1	D
	Bird Communities	Gull Colony				O
	Bird Communities	Waterfowl Winter Concentration Area				O
	Crustacea/Meristomata	Devil Crawfish	Cambarus diogenes	Stable	1	O
	Freshwater Fish	Bigeye Chub	Hybopsis amblops	Stable	1	
	Freshwater Fish	Black Redhorse	Moxostoma duquesnei	Stable	1	J
	Freshwater Fish	Brook Trout, Heritage Strains	Salvelinus fontinalis	Stable	1	
	Freshwater Fish	Eastern Sand Darter	Ammocrypta pellucida	Decreasing	1	
	Freshwater Fish	Freshwater Drum	Aplodinotus grunniens			H
	Freshwater Fish	Iowa Darter	Etheostoma exile	Stable	1	D
	Freshwater Fish	Lake Sturgeon	Acipenser fulvescens	Unknown	1	D
	Freshwater Fish	Longear Sunfish	Lepomis megalotis	Unknown	1	
	Freshwater Fish	Mooneye	Hiodon tergisus	Unknown	1	D

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BIODIVERSITY FEATURE	TAXA	SPECIES NAME	LATIN NAME	STATUS	SOURCE OF STATUS	CITED IN GREENWAY	
	Freshwater Fish	Redfin Shiner	Lythrurus umbratilis	Decreasing	1	D	
	Freshwater Fish	Western Pirate Perch	Aphredoderus sayanus	Unknown	1		
	Marine Fish	American Eel	Anguilla rostrata	Unknown	1	Q	
	Herpetofauna	Blanding's Turtle	Emydoidea blandingii	Decreasing	2	R	
	Herpetofauna	Eastern Ribbon Snake	Thamnophis sauritus	Unknown	1	R	
	Herpetofauna	Northern Map Turtle	Graptemys geographica	Unknown	1	R	
	Herpetofauna	Queen Snake	Regina septemvittata	Decreasing	1		
	Herpetofauna	Wood Turtle	Clemmys insculpta	Unknown	1		
	Insect	American Rubyspot	Hetaerina americana	Unknown	1		
	Insect	Blue-tipped Dancer	Argia tibialis	Unknown	1		
	Mammal	River Otter	Lontra canadensis	Unknown	1	S	
	Mollusk	Eastern Pondmussel	Ligumia nasuta	Stable	2	J	
	Mollusk	Elktoe	Alasmidonta marginata	Unknown	1		
	Mollusk	Fragile Papershell	Leptodea fragilis			J	
	Mollusk	Hickorynut	Obovaria olivaria			J	
	Mollusk	Kidneyshell	Ptychobranchus fasciolaris	Unknown	1	J	
	Mollusk	Pink Heelsplitter	Potamilus alatus			J	
	Mollusk	Rainbow	Villosa iris			J	
	Mollusk	Round Pigtoe	Pleurobema sintoxia			J	
	Mollusk	Slippershell Mussel	Alasmidonta viridis	Unknown	1	J	
	Mollusk	Threeridge	Amblema plicata	Unknown	1	J	
	Mollusk	Wabash Pigtoe	Fusconaia flava	Unknown	1	J	
	TOTAL AQUATIC WILDLIFE						42
	TOTAL AQUATIC PLANTS/COMMUNITIES						0
Wetland							
	Bird	American Bittern	Botaurus lentiginosus	Decreasing	1	F	
	Bird	Black-crowned Night Heron	Nycticorax nycticorax	Decreasing	1	A	
	Bird	Black Tern	Chlidonias niger	Decreasing	1	T	
	Bird	Great Blue Heron	Ardea herodias	Increasing	2	A	
	Bird	King Rail	Rallus elegans	Decreasing	1	C	
	Bird	Least Bittern	Ixobrychus exilis	Decreasing	2	A	
	Bird	Pied-billed Grebe	Podilymbus podiceps	Decreasing	1	A	
	Bird	Yellow Rail	Coturnicops noveboracensis	Unknown	1	C	
	Herpetofauna	Common Mudpuppy	Necturus maculosus	Decreasing	1	D	
	Herpetofauna	Four-toed Salamander	Hemidactylium scutatum	Unknown	1		
	Herpetofauna	Fowler's Toad	Bufo fowleri	Unknown	1		

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BIODIVERSITY FEATURE	TAXA	SPECIES NAME	LATIN NAME	STATUS	SOURCE OF STATUS	CITED IN GREENWAY
	Herpetofauna	Snapping Turtle	Chelydra serpentina	Unknown	1	B
	Herpetofauna	Spotted Turtle	Clemmys guttata	Unknown	1	
	Herpetofauna	Western Chorus Frog	Pseudacris triseriata	Decreasing	1	D
	Plant	Four Flowered Loosestrife	Lysimachia quadriflora			J
	Plant	Ohio Goldenrod	Oligoneuron ohionse			J
	Plant	Southern Blue Flag	Iris virginica			J
	Community	Deep Emergent Marsh				J
	Community	Silver Maple Ash Swamp				J
	TOTAL WETLAND WILDLIFE					11
	TOTAL WETLAND PLANTS/COMMUNITIES					5
Woodland						
	Bird	Black-throated Blue Warbler	Setophaga caerulescens	Stable	1	P
	Bird	Cerulean Warbler	Setophaga cerulea	Decreasing	2	C
	Bird	Cooper's Hawk	Accipiter cooperii	Increasing	1	E
	Bird	Golden Eagle	Aquila chrysaetos	Increasing	2	T
	Bird	Long-eared Owl	Asio otus	Unknown	1	E
	Bird	Louisiana Water Thrush	Parkesia motacilla	Unknown	1	T
	Bird	Northern Goshawk	Accipiter gentilis	Increasing	1	E
	Bird	Prothonotary Warbler	Protonotaria citrea	Decreasing	2	C
	Bird	Red Shouldered Hawk	Buteo lineatus	Decreasing	1	C
	Bird	Red-Headed Woodpecker	Melanerpes erythrocephalus	Decreasing	1	J
	Bird	Scarlet Tanager	Piranga olivacea	Unknown	1	N
	Bird	Sharp-shinned Hawk	Accipiter striatus	Increasing	1	E
	Bird	Wood Thrush	Hylocichla mustelina	Decreasing	1	F
	Herpetofauna	Timber Rattlesnake	Crotalus horridus	Decreasing	2	
	Mammal	Eastern Red Bat	Pantherophis Guttatus	Unknown	1	B
	Mammal	Hoary Bat	Lasiurus cinereus	Stable	2	B
	Plant	Elk Sedge	Carex garyeri			J
	Plant	Smooth Cliff Brake	Pellaea glabella			J
	Tree	Big Shellbark Hickory	Carya laciniosa			J
	Tree	Shumard Oak	Quercus shumardii			J
	Community	Calcareous Cliff Community				J
	Community	Calcareous Talus Slope Woodland				J
	Community	Limestone Woodland				J
	TOTAL WOODLAND WILDLIFE					15
	TOTAL WOODLAND PLANTS/COMMUNITIES					7

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BIODIVERSITY FEATURE	TAXA	SPECIES NAME	LATIN NAME	STATUS	SOURCE OF STATUS	CITED IN GREENWAY
Grass/Shrubland						
	Bird	Bobolink	Dolichonyx oryzivorus	Decreasing	1	F
	Bird	Dickcissel	Spiza americana	Unknown	1	P
	Bird	Eastern Meadowlark	Sturnella magna	Decreasing	1	M
	Bird	Grasshopper Sparrow	Ammodramus savannarum	Decreasing	1	J
	Bird	Henslow's Sparrow	Ammodramus henslowii	Decreasing	1	C
	Bird	Horned Lark	Eremophila alpestris	Decreasing	1	F
	Bird	Northern Harrier	Circus cyaneus	Stable	2	M
	Bird	Sedge Wren	Cistothorus platensis	Stable	2	J
	Bird	Short-eared Owl	Asio flammeus	Stable	2	J
	Bird	Upland Sandpiper	Bartramia longicauda	Decreasing	1	J
	Bird	Vesper Sparrow	Pooecetes gramineus	Decreasing	1	N
	Herpetofauna	Smooth Green Snake	Opheodrys vernalis	Unknown	1	
	Plant	Sky-blue Aster	Aster oolentangiensis			J
	Plant	Slender Blazing-star	Liatris gracilis			J
	Plant	Stiff-leaf Goldenrod	Oligoneuron rigida			J
	TOTAL GRASS/SHRUBLAND WILDLIFE					
TOTAL GRASS/SHRUBLAND PLANTS/COMMUNITIES						3
Natural Areas						
	Bird	American Woodcock	Scolopax minor	Decreasing	1	M
	Bird	Black-billed Cuckoo	Coccyzus erythrophthalmus	Decreasing	1	N
	Bird	Blue-winged Warbler	Vermivora pinus	Decreasing	1	N
	Bird	Brown Thrasher	Toxostoma rufum	Decreasing	1	N
	Bird	Canada Warbler	Cardellina canadensis	Decreasing	1	P
	Bird	Common Nighthawk	Chordeiles minor	Decreasing	1	E
	Bird	Golden-winged Warbler	Vermivora chrysoptera	Decreasing	1	J
	Bird	Peregrine Falcon	Falco peregrinus	Stable	1	E
	Bird	Prairie Warbler	Setophaga discolor	Increasing	1	P
	Bird	Ruffed Grouse	Bonasa umbellus	Decreasing	1	N
	Bird	Whip-poor-will	Antrostomus vociferus	Decreasing	1	P
	Bird	Willow Flycatcher	Empidonax traillii	Decreasing	1	A
	Bird	Yellow-breasted Chat	Icteria virens	Unknown	1	C
	Herpetofauna	Blue-spotted Salamander	Ambystoma laterale	Unknown	1	D
	Herpetofauna	Jefferson Salamander	Ambystoma jeffersonianum	Unknown	1	D
	Insect	Checkered White	Pontia protodice	Decreasing	1	
	Insect	Cobblestone Tiger Beetle	Cicindela marginipennis	Unknown	1	

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BIODIVERSITY FEATURE	TAXA	SPECIES NAME	LATIN NAME	STATUS	SOURCE OF STATUS	CITED IN GREENWAY
	Insect	Mottled Duskywing	Erynnis martialis	Decreasing	1	
	Insect	Southern Grizzled Skipper	Pyrgus malvoides	Unknown	1	
	Insect	Tiger Beetle		Unknown	1	
	Plant	Lesser Fringed Gentian	Gentianopsis virgata			J
	TOTAL NATURAL AREAS WILDLIFE					15
	TOTAL NATURAL AREAS PLANTS/COMMUNITIES					1

TOTAL WILDLIFE FOR ALL FEATURES	94
TOTAL PLANTS/COMMUNITIES FOR ALL FEATURES	16

Code	Source of Status
1	NYS DEC. 2005. Comprehensive Wildlife Conservation Strategy (CWCS) Plan - Lake Erie Basin (http://www.dec.ny.gov/docs/wildlife_pdf/lkerietxt.pdf)
2	New York State Natural Heritage Program. 2014. Animal, Plant, and Community Guide from website. (http://acris.nynhp.org/)
3	New York State (Environmental Conservation Law) - List of Endangered, Threatened and Special Concern Fish & Wildlife Species of New York State (http://www.dec.ny.gov/animals/7494.html)
Code	Source of Citation within Greenway
A	Archer R.W. and Rankin W.R. 2011. Bi National Assessments of Marsh Habitat Quality for the Niagara River and Buffalo River Areas of Concern. The National Fish and Wildlife Foundation
B	Applied Ecological Services. 2013. A Wildlife Survey of the Lower Buffalo River AOC, Buffalo NY
C	Bird Studies Canada. 1999. Niagara River Important Bird Area Conservation Plan
D	Conestoga-Rovers and Assoc. 2004. Determine if the Ice Boom has Climatic, Aquatic, Land Management or aesthetic effects
E	EDR. 2011. Regional Economic Growth through Ecological Restoration of the Niagara Gorge Rim
F	Gomez and Sullivan. 2006. Cayuga Creek Watershed Assessment Summary Report
H	Gomez and Sullivan. 2004. Use of Buckhorn Marsh and Grand Island Tributaries by Northern Pike for Spawning and as a Nursery
I	Knapton and Weseloh. 1999. The Niagara River: An Important Bird Area
J	Riveredge Associates. 2004. Assessment of the Potential Effects of Water Level and Fish Fluctuations and Land Management Practices on Rare, Threatened and Endangered Species and Significant Occurrences of Natural Communities at the Niagara River Power Project
K	Riveredge Associates. 2003. Occurrences of Rare, Threatened and Endangered Mussel Species in the Vicinity of the Niagara Power Project
L	Stantec Consulting Services Inc. et al. 2004. Effect of Water Level and Flow Fluctuations on Aquatic and Terrestrial Habitat
M	URS Corporation. 2005. Estimates of Bird Mortality Associated with Transmission Lines
N	NYS Department of Environmental Conservation website. "NYS Breeding Bird Atlas (2000-2005)." Confirmed, probable and possible records. Retrieved on July 23, 2014. (http://www.dec.ny.gov/animals/51030.html) (U.S. Records)
O	NHP
P	eBird data for the Niagara River Corridor IBA. Retrieved on February 1, 2014. (www.ebird.org)
Q	NYS Department of Environmental Conservation website. "Fish Atlas Maps of New York". Retrieved on July 29, 2014. (http://www.dec.ny.gov/animals/84622.html) (U.S. records only)
R	NYS Department of Environmental Conservation website. "Herp Atlas Project". Retrieved on July 23, 2014. (http://www.dec.ny.gov/animals/7140.html) (U.S. records only)
S	DePriest, Tim. Recent NYS DEC Niagara River records. Unpublished. (U.S. Records)
T	DiTommaso, Dean, and David Suggs. B.O.S. Noteworthy Records Database, 1964-2013. "The Prothonotary." vols. 30-79. Buffalo Ornithological Society.

Niagara River Greenway Habitat Conservation Strategy

2.9 Historic vs Current Island Habitat Acreage (and breakwall data)

ISLAND HABITAT	ACREAGE/YEAR				SEMI - PROTECTED	OWNERSHIP/STATUS
	1824 (Tanner)	1870 (Gzowski)	1927	Current		
Strawberry	100			8.4	Y	State park and NYPA HIP
Motor	2.5		7	6	Y	DEC Wildlife Management Area and NYPA HIP
Beaver	29.3		42.6	35.7	Y	State park and NYPA HIP
Tonawanda	69.4		92.9	0	N	Developed
Buckhorn	146.5		243	203	Y	State park and NYPA HIP
Goat	69.5		74.8	50	Y	101.3-acre state park - approx. 50% developed
Grass/Sunken	0		2	4	Y	Created. Now a DEC regulated wetland
Luna	0.8		0.4	0.4	Y	State park
Unity	50		91.3	60	Y	City park on north end of island
Three Sisters North			1	1	Y	State park
Three Sisters Middle			1.4	2.1	Y	State park
Three Sisters South			0.7	0.6	Y	State park
Frog	0			5	Y	Created. NYPA HIP
Bird	50			0	NA	Filled in 1820s
Rattlesnake	47.8			0	NA	Filled in 1920s
Connors	8.3			0	NA	Filled in 1950s
Mink		1		0	NA	Originally associated with Strawberry Island
Cayuga	98.8		187.22	0	N	Developed
TOTAL DIFFERENCE (FROM HISTORIC TO CURRENT): -301 ACRES						

Breakwall Data	
Name	Length (ft)
Bird Island Pier (breakwall)	10,450
Old Breakwater	6,597
South Breakwater	10,206
Donnelly's Wall/North Breakwater	2,210

*Data collected from aerial photos, historic documents, and expert interpretation of historic maps

2.4 Threats

Identification of critical threats is an important step in the CAP process that helps to address the factors that most affect the future viability of biodiversity features. The CAP process generally ranks threats in terms of scope, severity, and irreversibility. Those threats that receive the highest ranks are referred to as critical threats and are factored into conservation strategy priorities.

The preliminary list of threats was developed from local, regional, and Great Lakes studies and from state assessments like the NHP and the CWCS. This list was then fine-tuned through public workshops and meetings with local experts, resulting in the top threats for each biodiversity feature.

The project team added another tier to the ranking process to define top threats responsive to potential conservation actions. This process ranked threats by four factors: whether or not mitigation addressing the threat is available, whether the threat could be mitigated in the short term (5-10 years), whether mitigation is economically feasible, and whether the threat was ranked high at public meetings. Thus, for example, the threat to aquatic habitat of major channelization like the Erie Canal might rank high in terms of scope, severity, and irreversibility, but lower in terms of available mitigation. Furthermore, when channelization is approached in terms of its specific components, such as hardened shorelines, it may point to practical strategies for a major restoration need.

FEATURES THREATS	AQUATIC	WETLANDS	WOODLANDS	GRASS/ SHRUBLANDS	NATURAL AREAS	GORGE	ISLANDS
Barriers to Fish Movement	X						
Erosion and Sedimentation (Lack of Riparian Buffer)	X						
Lack of Protection/Connectivity		X	X	X	X		
Lack of Ecological Management Plans			X				X
Loss of Acreage (development, human disturbance)		X					X
Management Practices on Public Lands				X		X	
Mowing (and landfill regimes) & Farming Practices				X			
Fragmentation (utility, roads, rail)			X		X		
Highway Department Practices (spreading of invasive plants/ditching)		X				X	
Invasive Species	X						
Water Level Fluctuations						X	

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Top ranked threats for ***aquatic habitat*** within the Greenway are barriers to fish movement, erosion and a lack of riparian buffers, and invasive species. Runoff from development increases siltation and pollutant loads- especially where natural vegetated buffers are not present to stabilize banks and filter runoff. Out of all habitat types, aquatic invasives are most numerous and widespread.

For ***wetlands***, a lack of protection and connectivity, loss of acreage, and Highway Department practices are the most critical threats. Roadside management practices that are considered to threaten wetland habitat include soil disturbance, spreading of seeds and propagules, and ditching.

For ***all terrestrial features*** top-ranked threats are a lack of protection and connectivity and fragmentation from roads, utility corridors, and railroad Right-of-Ways (ROWS).

In addition to those mentioned for terrestrial features, ***woodlands*** are also threatened by lacking ecological management plans.

Grasslands and shrublands within the Greenway are affected by management practices on public lands, mowing and farming practices, and a lack of protection and connectivity.

For the ***gorge***, management practices on public lands, Highway Department practices, and water level fluctuations were ranked as the top threats.

A lack of ecological management plans and loss of acreage are the most critical threats affecting ***islands*** found within the Niagara River.