Durham Region

COASTAL WETLANDS

Baseline Conditions and Study Findings
(2002 and 2003)

Lake Ontario water level regulation

Lake Ontario's water level has been regulated since 1960 to accommodate increased demand for shipping and hydroelectric power. Unfortunately, what is good for shipping is not necessarily good for coastal wetlands. Natural water level variability has been diminished, reducing the biological diversity of coastal wetlands that depend on variability to maintain vegetation communities.

Determining the criteria to control regulation of water level and flow in Lake Ontario and the St. Lawrence River is a challenge being addressed through a binational study launched in 2001 by the International Joint Commission (IJC). The five-year study provides a major opportunity to improve the understanding of past water regulation impacts on coastal wetlands. The new knowledge will be used to develop and recommend water-level regulation criteria for the benefit of all interests, including the specific objective of maintaining coastal wetland diversity and health.

For more information on the IJC study: www.losl.org

About this report

This report describes the monitoring activities completed through this project to date. The methods used, in most cases, are screening-level studies that focus on describing the most prevalent elements of the physical and biological aspects of the wetland and watershed. The methods are fully documented in *The Durham Region Coastal Wetland Monitoring Project: Methodology Handbook – Second Approximation* (May 2003). Results from monitoring conducted in the 15 study wetlands in 2002 and 2003 are summarized here from *The Durham Region Coastal Wetland Monitoring Project: Year 2 Technical Report* (March 2004). The results presented here are preliminary findings and represent an initial assessment of the sites. In all cases, the priority was to conduct site assessments during typical environmental conditions (e.g., normal weather) and high biological activity (e.g., breeding season) to assure the overall representation of the site from limited data. Although the sites are ranked using preliminary results, data collected through additional years of monitoring will allow more definitive statements and conclusions to be made regarding the state of these important ecosystems.

Durham Region Coastal Wetlands

Adapted from CLOCA

This report discusses 15 coastal wetlands on the north shore of Lake Ontario in the Regional Municipality of Durham.

Cover Photography: White Water Lily and Oshawa Second Marsh / Canadian Wildlife Service, Pied-billed Grebe / Eric Dresser

Introduction

What are coastal wetlands?

Wetlands are complex and ecologically important ecosystems that are often defined as areas that are seasonally or permanently covered by shallow water, or where the water table is close to or at the surface. The presence of water causes the formation of hydric soils and allows water-tolerant plant species to thrive.

Great Lakes coastal wetlands are a unique wetland type that have formed at the mouths of streams and rivers where they empty into the lakes, and in open or protected bays along the shoreline. Located between the permanent, deep water of the lake and the dry upland areas, coastal wetlands can contain a mix of plant communities. Examples of these communities include treed and thicket swamps, wet grass and sedge meadows, and emergent vegetation stands called marshes which contain plants such as cattails and bulrushes. In addition, coastal wetlands often contain interspersed pockets of open water that support submerged and floating plants such as pondweeds and water lilies.

All wetlands provide environmental functions that are important to both humans and wildlife. These functions may vary among wetlands depending on the size of the wetland, its soils, plant community, and position in the landscape. For example, wetlands found in upper **watersheds** are very important as areas of groundwater recharge, flood retention, and maintenance of base flow in streams.

Coastal wetlands have unique functions that are performed naturally:

- Interception and slowing of watershed run-off before it enters the lake allowing:
  - Settlement and retention of sediments and **contaminants** (such as **heavy metals** and **PCBs**).
  - Reduction of excess **nutrients** as wetland plants absorb nitrogen and phosphorus and use them for growth.
- Provision of habitat for **microbe** and **invertebrate** species, thereby providing the foundation for a complex food web. These food sources, along with the wetland plants, in turn support a wide variety of fish, reptile, amphibian, mammal, and bird species.

These natural wetland functions translate into important societal values:

- Opportunities for recreational activities including canoeing, fishing, hunting, wildlife viewing, and photography.
- Protection of shoreline properties from the potentially destructive forces of erosion.
- Improvement of water quality for the millions of people in Canada and the United States who rely on the Great Lakes for their drinking water.

Who Needs Wetlands?

- *Over two-thirds of all fish species in the Great Lakes depend on coastal wetlands for spawning and nursery habitat.*
- *Each of the 13 species of frogs and toads found in the Great Lakes basin are known to use coastal wetlands during the breeding season.*
- *Over 100 species of waterfowl and other migratory birds use coastal wetlands for food and shelter during migratory stopovers.*
- *Many species at risk of extinction depend on wetlands, such as King Rail, Least Bittern, Spiny Softshell and Spotted Gar.*

Pickerelweed

White Water Lilies

*Words in **bold** are defined in the Glossary of Terms.*

What is the concern about coastal wetlands?

Coastal wetlands are feeling the pressure of land-use intensification. Vast areas of Great Lakes coastal wetlands have been filled in or drained for agriculture, residential and industrial development, and recreational facilities. For those that remain, the loss of natural areas, both adjacent and further up the watershed, decreases water quality and habitat availability within the wetlands. As a result, wetland functions decline and values diminish. For example, wildlife sightings become less frequent, fish production suffers, and birds lose nesting habitat.

Durham Region coastal wetlands are particularly affected by the Great Lakes basin-wide trend of wetland loss and disturbance. This stretch of coastal wetlands begins just east of Toronto and extends 50 kilometres eastward along Lake Ontario's north shore from Pickering to Port Newcastle (see inside front cover).

How Are the Wetlands Ranked?

This report evaluates the physical state and biological condition within the 15 study wetlands using a qualitative scale: poor, fair, good, very good, and excellent. To allow evaluation of the study wetlands in a broad context, additional Lake Ontario coastal wetlands outside of the region were monitored. Coastal wetlands in Durham Region are generally in poorer physical condition, which results in more highly-impacted biological communities. As a result, the physical and biological components of Durham Region sites often received poor, fair, and good rankings – and only in a few cases were they ranked very good or excellent compared to the other Lake Ontario wetlands.

Coordinating regionally-based monitoring – A starting point

Despite significant land-use pressures, Durham Region coastal wetlands are some of the best examples of coastal wetlands on Lake Ontario's north shore and there is widespread interest in protecting and improving their condition. One of the first steps in restoring wetland functions and values is to identify the specific sources and levels of impacts affecting the wetlands. This is a difficult task since the condition of the coastal wetlands is primarily influenced by two very different impacts – rapidly urbanizing upland watersheds and the dynamic water levels of Lake Ontario.

In the past, both the physical state and biological condition of Durham Region coastal wetlands and their watersheds have been monitored to varying degrees, using methods that were unique to the organization responsible. The Durham Region Coastal Wetland Monitoring Project was designed to improve coordination among stakeholders concerned with the state of these wetlands and watersheds and standardize monitoring methods. Using the same methods makes monitoring results comparable among sites. In addition, the approach allows differences in watersheds and variable lake effects across the entire region to be taken into account. As a result, this long-term project will support meaningful landscape-level management decisions regarding wetland conservation and restoration of functions and values.

American Bittern / Walter B. Fechner

Monitoring Activities

Physical Features

Wetland water and sediment quality, and watershed land use were monitored because these physical features are known to affect the condition of biological communities in coastal wetlands.

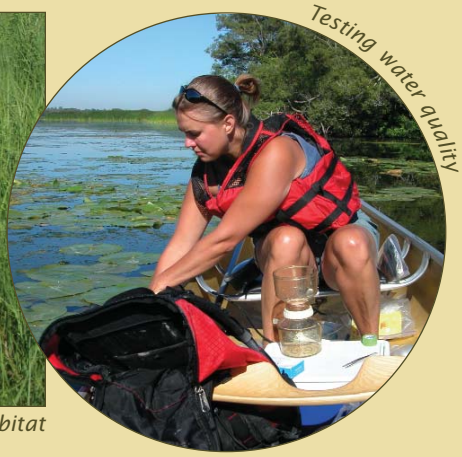
Monitoring Activities	Indicators of High Quality
Water Quality	Low levels of dissolved nutrients such as nitrogen and phosphorus. Low **turbidity** and **conductivity**.
Sediment Quality	Low concentrations of heavy metals, **PAHs**, **pesticides**, and PCBs.
Watershed Land Use	High percent natural cover – mainly forests and inland wetlands. Greater than 10 percent coverage of wetlands and greater than 30 percent forested area are considered preferable levels of natural land cover in the watershed (Environment Canada 2004).

Biological Communities

Monitoring focused on species or groups of species within each biological community that are known to respond to increasing levels of wetland disturbance. Measures such as the abundance, **richness**, and/or **biomass** of these disturbance-sensitive species and groups of species (**indicator species**) were used to provide insight into the condition of the biological communities.

Monitoring Activities	Indicators of a High Quality Community
Submerged Aquatic Vegetation	High richness of **native** and turbidity-intolerant species. High abundance of individuals of these species.
Aquatic Macroinvertebrates	High species richness of mollusks, crustaceans, and insect larvae such as caddisflies, mayflies and dragonflies. High numbers of individuals of these species but low numbers of midge larvae.
Fish	High richness of native species – particularly sunfish species. High abundance of native fish. High biomass of **piscivores** and Yellow Perch, but low biomass of **exotic** fish. In general, these indicators are linked to the ability of the wetland to provide spawning and nursery habitat, food, and cover.
Breeding Amphibians (frogs and toads only)	High species richness and abundance – especially of indicator species – Bullfrog, Northern Leopard Frog, Chorus Frog and Spring Peeper.
Breeding Birds	High richness of **area-sensitive species** (e.g., Least Bittern, Virginia Rail). High abundances of **marsh-nesting obligate species** (e.g., Sora, Marsh Wren), area-sensitive species, and **marsh users** (e.g., rails, bitterns, coots, waterfowl, shorebirds).

Surveying habitat



Testing water quality

Rouge River Marsh

Adjacent to the lower reaches of the Rouge River watershed is the largest urban park in North America – the Rouge Park. Encompassing almost 5,000 hectares of woodland, wetland, and open areas, the park is well used by area residents and out-of-town visitors. It features a network of trails for hiking, areas for picnicking, and offers the only campgrounds within Toronto.

TRCA

The Rouge River Marsh watershed is the largest watershed included in this project. Despite the buffering protection provided to the Rouge River and the wetland by the Rouge Park, there is still evidence of urban impacts on the water quality in the wetland. Turbidity was slightly elevated, dissolved nutrient concentrations were moderate, and contaminant levels in the sediments were low.

Submerged aquatic vegetation was not evaluated at this wetland. General observations and the evaluations of fish and aquatic macroinvertebrate habitat suggest that some parts of the wetland are better suited to supporting submerged aquatic vegetation than others. Submerged vegetation was patchily distributed throughout the wetland. Many of the back bays were thick with submerged plants and floating lilies, while some portions of the open water areas were very sparsely vegetated.

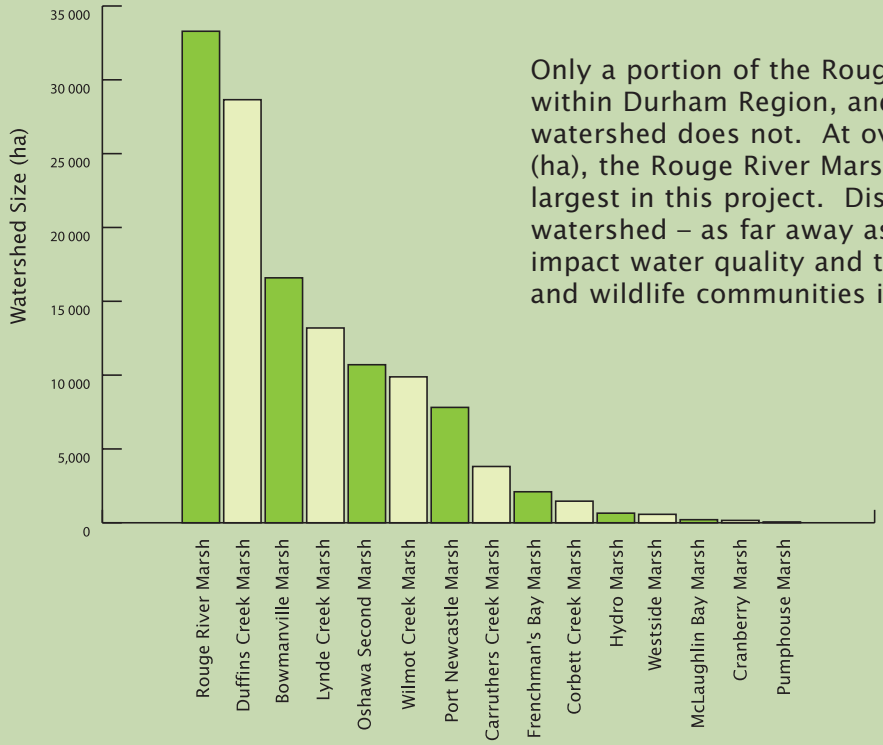
The variability in the quality of available habitat also was reflected in the aquatic macroinvertebrate community. While the wetland supported a diversity of species and high numbers of sensitive mayflies, there were also high numbers of midge larvae – organisms that thrive in more disturbed habitats.

The disturbances that are affecting the aquatic macroinvertebrate community are likely also affecting the presence and abundance of amphibian and bird species within the marsh. Amphibian indicator species were not observed and only fair numbers of the more common American Toad and Green Frog were present. Similarly, the breeding bird community did not appear to contain area-sensitive or marsh-nesting obligate species. However, there were good numbers of other birds, such as Red-winged Blackbirds, that use the marsh for feeding and nesting.

The reduced number of key species observed in other biological communities was also reflected in the fish community. Composed primarily of minnow species and Brown Bullhead, and supporting fair numbers of sunfish species and Yellow Perch, few piscivores were found in the Rouge River Marsh fish.

In spring 2004, the provincial government began transferring an additional 1,432 hectares of land to the Rouge Park.

Fish data collection



Only a portion of the Rouge River Marsh lies within Durham Region, and most of its watershed does not. At over 33 000 hectares (ha), the Rouge River Marsh watershed is the largest in this project. Distant land uses in the watershed – as far away as Aurora – may impact water quality and the condition of fish and wildlife communities in the wetland.

Report Card	
Water Quality	Good
Submerged Aquatic Vegetation	N/A
Aquatic Macroinvertebrates	Good
Amphibians	Poor
Birds	Fair
Fish	Fair – Good

Wetland Statistics	
Location	Cities of Toronto and Pickering
Wetland Type	Drowned River-mouth
Vegetation Types	Marsh 59%, Swamp 41%
Wetland Size (hectares)	56
Watershed Size (hectares)	33 289
Percent Natural Cover in Watershed	24

Frenchman's Bay Marsh

Frenchman's Bay is a shallow, well-sheltered bay that supports a variety of human uses adjacent to the wetland. Marina facilities are available for recreational boating and construction barges, and opportunities for leisure activities such as fishing, canoeing, and sailing are abundant. The 30-metre opening maintained in the barrier beach (Fairport Beach) allows the passage of boat traffic between the bay and Lake Ontario and also creates a permanent **hydrologic** connection between Frenchman's Bay Marsh and the lake.

The marsh's small but heavily residential watershed delivers urban run-off to the bay while the permanent connection to the lake allows cleaner Lake Ontario water to flush into the bay during **seiches**. Despite its small size, the watershed's influence on the marsh's water is considerable and high conductivity and nutrient concentrations were observed. In addition, the bay and its marsh remain quite turbid through sediment re-suspension from a combination of Common Carp disturbance (see sidebar) and wind and wave action on the large open-water section of the wetland.

In the smaller, secluded back bays of the marsh, the water was less turbid and allowed the establishment of patches of submerged pondweeds and floating water lilies. These areas also supported a disturbance-sensitive submerged plant – wild celery. However, even these areas did not support a diverse aquatic macroinvertebrate community. Many sensitive aquatic species (such as dragonfly and caddisfly larvae, and crustaceans including **isopods** and **amphipods**) were absent or present in very low numbers.

Emergent marsh habitat in the bay has been reduced to several patches along the north and west perimeter of the wetland. Fair numbers of common amphibians including Green Frog and American Toad, and low numbers of the indicator species Northern Leopard Frog were found in these cattail-dominated areas.

Despite its small size, the watershed's influence on the marsh's water is considerable.

For breeding birds, the emergent marsh areas do not appear to have sufficient high-quality habitat for area-sensitive species such as American Coot and Black Tern, which have not been seen nesting in the marsh for several years now. However, Marsh Wren, which are marsh-nesting obligates, used the wetland for breeding. Other marsh users, such as Red-winged Blackbird, were seen and heard in the marsh in moderate numbers.

Frenchman's Bay Marsh was one of the few marshes in Durham Region that supported excellent numbers of predators in the fish community – mainly Large and Smallmouth Bass. Although, Yellow Perch, an important species, did not appear to be abundant in the marsh, the diversity of other fish species was very good, including a variety of sunfish species.

Since 1998, the Toronto and Region Conservation Authority has directed the Frenchman's Bay Watershed Restoration Project – an environmental stewardship program working with the City of Pickering, local stakeholders, businesses and community volunteers. To date, restoration activities include both Frenchman's Bay and Hydro marshes and involve providing nesting areas for Common Tern and Osprey, planting aquatic vegetation, Purple Loosestrife removal, and tree plantings on adjacent lands to these wetlands.

Common Carp Impact on Coastal Wetlands

The Common Carp is a freshwater fish first imported from Eurasia in the 1800s as a potential food fish. While feeding on aquatic insects, worms, algae, plants, and seeds, carp suck in and expel water, mud and debris, which causes uprooting of plants, release of nutrients, and re-suspension of sediments. This increases water turbidity, which can reduce aquatic plant growth by limiting light penetration through the water column. Carp have been successfully excluded from some wetlands (e.g., Oshawa Second Marsh) by blocking points of entry with fish control structures designed to allow the passage of most fish, except adult carp, into and out of the wetland. Carp exclusion structures have also been installed in additional Durham Region coastal wetlands including Duffins Creek and Hydro marshes.

Common Carp

Report Card	
Water Quality	Poor
Submerged Aquatic Vegetation	Fair
Aquatic Macroinvertebrates	Poor
Amphibians	Fair
Birds	Poor
Fish	Good

Wetland Statistics	
Location	City of Pickering
Wetland Type	Barrier beach with permanent opening to Lake Ontario
Vegetation Types	Marsh 87%, Swamp 13%
Wetland Size (hectares)	17
Watershed Size (hectares)	1,652
Percent Natural Cover in Watershed	31

Hydro Marsh

Named for its close proximity to the Pickering Nuclear Generating Station, Hydro Marsh is located just east of Frenchman's Bay Marsh. This wetland is exposed to very similar sources and levels of disturbance because the two marshes are hydrologically connected through the southeast corner of Frenchman's Bay. As a result, many of the physical and biological community conditions are alike. Water in Hydro Marsh was very turbid and high in excess nutrients and conductivity. Sediments in the wetland contained some heavy metals that were present in particularly high levels, but levels of PAHs and PCBs were low.

As a result of the elevated turbidity, submerged aquatic plants were not common and the limited assemblage of aquatic macroinvertebrates had low diversity. Sensitive species such as mayfly and caddisfly larvae were rare while midge larvae, indicators of stressed aquatic ecosystems, were very common (see graph).

John Kraft

The fish community also showed signs of stress. Common species such as Brown Bullhead and Fathead Minnow made up the bulk of the fish community while the piscivores that were found in neighbouring Frenchman's Bay were not found in this wetland. There were also low numbers of native species, including important sunfish species and Yellow Perch.

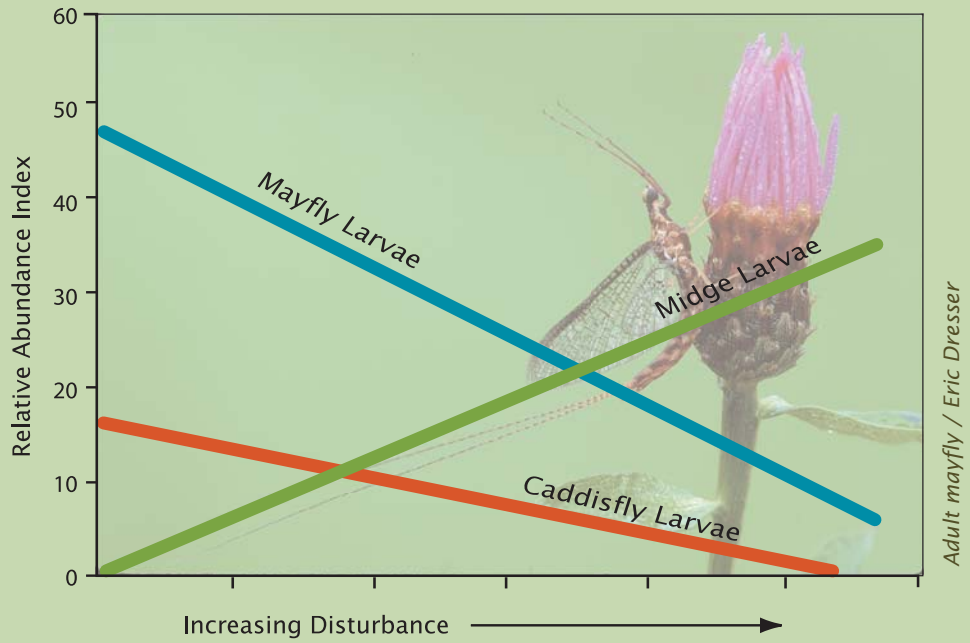
Intense surrounding land use coupled with compromised water quality prevented Hydro Marsh from supporting many amphibian species. Only low numbers of the less-sensitive American Toad were heard calling at the marsh during the breeding season.

The breeding bird community at this wetland was very similar to the Frenchman's Bay Marsh. The emergent marsh areas did not appear to support area-sensitive species, but one marsh-nesting obligate species, Marsh Wren, used the marsh during the breeding season. General marsh users, mainly Red-winged Blackbird, were quite common in the wetland.

Water in the marsh was very turbid and high in excess nutrients.

Trumpeter Swans / TRCA

TRCA



Adult mayfly / Eric Dresser

Research in Lake Ontario coastal wetlands shows that an abundance of different groups of aquatic macroinvertebrates is related to the level of disturbance within the wetland. As coastal wetland watersheds and adjacent lands lose natural cover through urbanization and agriculture, wetlands become more disturbed. As a result, water quality decreases and sensitive aquatic mayfly and caddisfly larvae become less abundant. In contrast, midge larvae, which are more resistant to poor water quality, become relatively more abundant.

Report Card	
Water Quality	Fair
Submerged Aquatic Vegetation	Poor
Aquatic Macroinvertebrates	Poor
Amphibians	Poor
Birds	Poor
Fish	Poor – Fair

Wetland Statistics	
Location	City of Pickering
Wetland Type	Barrier Beach
Vegetation Types	Marsh 93%, Swamp 7%
Wetland Size (hectares)	25
Watershed Size (hectares)	1,071
Percent Natural Cover in Watershed	30

Duffins Creek Marsh

The Duffins Creek Marsh watershed is one of the most comprehensively studied watersheds in Canada. The Toronto and Region Conservation Authority is heavily involved in efforts to manage and restore its biological integrity. The Duffins Creek Marsh watershed is the second largest of the Durham Region coastal wetland watersheds and has a large percentage of land in public ownership. Although the watershed supports a relatively high (37 percent) natural land cover, 54 percent is in agricultural land use. Erosion of soil during cultivation and precipitation events, as well as fertilization of these lands were likely the causes of the very high turbidity and excess nutrient levels in the wetland water. Despite these impacts on water quality, sediments in the wetland remained low in contaminants.

With such high turbidity in the wetland and the resulting decrease in light penetration, submerged aquatic plants were rare. Similarly, the aquatic macroinvertebrate community was characterized by low diversity and low numbers of sensitive species. Even midge species, which are more resistant to wetland disturbance, were only present in low numbers.

The fish community was also affected by the poor water and habitat quality in the marsh – which may further degraded by the presence of Common Carp (see page 7). The diversity of fish species was good with species such as Yellow Perch and Pumpkinseed present, but overall fish abundances were quite low. In addition, the wetland did not support many piscivores – an indication of habitat degradation in the wetland.

While the wetland provides poor conditions for submerged plants, emergent plants such as cattails flourish and dominate the plant community in the marsh. These cattail stands provided cover for amphibian species including low numbers of American Toad and Green Frog. Good numbers of an indicator species, Northern Leopard Frog, were heard calling.

This watershed is one of the most comprehensively studied watersheds in Canada.

Furthermore, the abundant stands of cattails provide habitat for important marsh birds, including the marsh-nesting obligate Swamp Sparrow, though abundances of other marsh users were surprisingly low. Although Sora and Virginia Rail were commonly seen nesting in the marsh in the past, they have not been observed regularly in the past six years. Current efforts by the Toronto and Region Conservation Authority to restore nesting habitats for wetland bird species include construction of Black and Common tern nesting rafts.

Coastal Wetland Restoration in Duffins Creek Marsh

Reduced habitat quality at Duffins Creek Marsh is being addressed through the Duffins Creek Marsh Restoration Plan implemented by the Toronto and Region Conservation Authority. The plan includes wetland restoration and creation, forest restoration and management, meadow management, and the creation of habitat enhancement features for fish and wildlife. Of particular focus is fish habitat restoration, which features the construction of barriers to exclude Common Carp from the wetland, planting of aquatic vegetation, and construction of fish habitat structures in the Corner Creek Marsh basin of the wetland.

Northern Leopard Frog

Report Card	
Water Quality	Poor
Submerged Aquatic Vegetation	Poor
Aquatic Macroinvertebrates	Poor
Amphibians	Fair
Birds	Poor
Fish	Fair

Wetland Statistics	
Location	City of Pickering and Town of Ajax
Wetland Type	Drowned River-mouth
Vegetation Types	Marsh 90%, Swamp 10%
Wetland Size (hectares)	69
Watershed Size (hectares)	28 653
Percent Natural Cover in Watershed	37

Carruthers Creek Marsh

With three-quarters of its area dominated by swamp, the vegetative structure of Carruthers Creek Marsh is unique among Durham Region coastal wetlands. The swamp provides habitat for many woodland species. Urban and agricultural land uses within the moderately-sized watershed have affected the water quality in the wetland. The main tributary, Carruthers Creek, transports relatively uncontaminated sediment loads to the wetland and causes high turbidity and moderately high nutrient concentrations in the water.

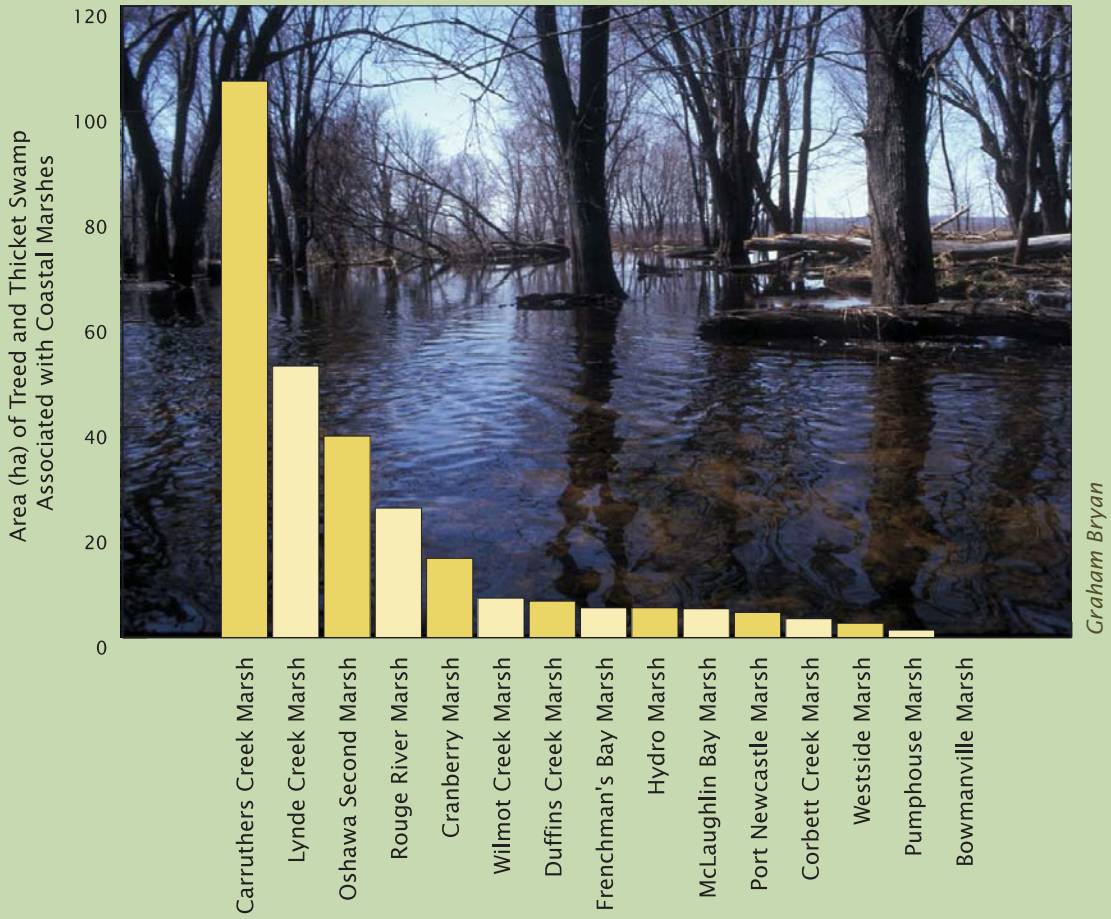
As in most wetlands with high turbidity, the submerged plants in Carruthers Creek Marsh are limited due to the reduced light penetration. Although it lacks an abundance of sensitive species, the aquatic macroinvertebrate community was diverse and disturbance-tolerant macroinvertebrate species were not elevated.

Important species such as sunfish were present; however, the absence of key piscivores and Yellow Perch, combined with the activity of Common Carp, show the signs of increased disturbance within the marsh portions of the wetland.

Although bird and amphibian communities were not sampled in the swamp, these woods are known to support over 65 bird species, including regionally or locally uncommon species such as Veery, American Woodcock, Canada Warbler, and Magnolia Warbler. In addition, the woods are home to an abundance of Wood Frog.

Common Yellowthroat / Walter B. Fechner

The wooded areas surrounding the marsh are known to support over 65 bird species.



Graham Bryan

The Swamp at Carruthers Creek Wetland

During European settlement in what is now the Greater Toronto Area, extensive swathes of land were cleared for agriculture. In many cases, marginal lands were cleared including coastal wetland meadow marshes and treed swamps – and remain under agricultural use today. In general, Durham Region coastal wetlands support small areas of meadow marsh and treed swamp.

A notable exception is the large area of swamp that is part of the Carruthers Creek coastal wetland. Although this area was logged in the past, a long history of public ownership combined with the land's unsuitability for agriculture have contributed to the maintenance of large tracts of wooded swamp. In addition, the community organization, Citizens for Carruthers, has played an essential role in protecting this sensitive ecosystem. The group was formed in 1990 when development plans were unveiled to convert the marsh into a hotel and marina complex. Citizens for Carruthers gathered public support opposing the development. In response, the plans for development were changed and the important ecosystem was saved.

Report Card	
Water Quality	Fair
Submerged Aquatic Vegetation	Poor
Aquatic Macroinvertebrates	Good
Amphibians	N/A
Birds	N/A
Fish	Fair

Wetland Statistics	
Location	Town of Ajax
Wetland Type	Drowned River-mouth
Vegetation Types	Marsh 25%, Swamp 75%
Wetland Size (hectares)	141
Watershed Size (hectares)	3,812
Percent Natural Cover in Watershed	25

Cranberry Marsh

Cranberry Marsh has one of the smallest watersheds of the coastal wetlands in Durham Region. At 47 hectares, the wetland is approximately one-quarter the size of its watershed area. This may not always have been the case. Land records from the early 1800s indicate that Cranberry Marsh received stream inflow from a more extensive upland watershed.

Without the benefit of wetland and watershed awareness that is more common today, the stream connection to the marsh was severed during agricultural development. While future land-use changes in most wetland watersheds will likely negatively impact natural vegetation communities, one positive change for Cranberry Marsh is the anticipated eight percent increase in woodlot and forested area within 1,000 metres of the wetland. This increase in natural area comes from converted cropland, currently owned by the Lynde Shores Alliance and managed by the Central Lake Ontario Conservation Authority, which was recently planted with thousands of White Pine, White Cedar and White Spruce seedlings as well as hundreds of Red Oak, Black Walnut and Bitternut Hickory nuts.

Turbidity in the wetland was low compared with its neighbour, Lynde Creek Marsh, likely due to the much smaller watershed area draining into Cranberry Marsh. However, Cranberry Marsh has notably elevated nutrient levels from local agricultural run-off.

Amphibian indicator species such as Northern Leopard Frog and Spring Peeper were found in low numbers, as were non-indicator species including Green Frog and American Toad. The aquatic macroinvertebrate community supported an abundance of crustaceans and mollusks. Species tolerant of degraded wetland quality such as midges were found in low numbers – a positive indicator of wetland condition. However, only low numbers of desirable sensitive species such as caddisflies and mayflies were recorded.

Common Moorhen / Walter B. Fechner

The re-establishment of emergent vegetation in the marsh through water level management is remarkable.

Cranberry Marsh is a popular wetland for bird watching due to the diversity of species that can be found there each year. Viewing platforms provide numerous opportunities to see the variety and high numbers of marsh users such as Mallard, Blue-winged Teal, and Red-winged Blackbird, and impressive numbers of marsh-nesting obligates, such as Marsh Wren, American Coot, Common Moorhen, and even the secretive Virginia Rail. Since 1990, the Cranberry Marsh Raptor Watch has been staffed by volunteer observers who have recorded the fall migration of thousands of **raptors** along this part of the Lake Ontario shoreline.

Blue-winged Teal / Eric Dresser

CLOCA

In 2001, a water-control structure was installed by Central Lake Ontario Conservation Authority, in partnership with Ducks Unlimited Canada, to manage water levels within the wetland. The goal was to increase biodiversity by establishing approximate hemi-marsh conditions, i.e., a 50:50 ratio of emergent vegetation to open water. As of 2003, the wetland water level has been managed to favour the establishment of emergent vegetation and has seen a corresponding increase in breeding bird community diversity. The isolation from the lake prevents exotic Common Carp from entering the marsh. The future vegetation and wildlife communities in Cranberry Marsh will depend on the continued management of this wetland.

Report Card	
Water Quality	Fair
Submerged Aquatic Vegetation	Fair
Aquatic Macroinvertebrates	Good
Amphibians	Fair
Birds	Very Good
Fish	Not Applicable

Wetland Statistics	
Location	Town of Whitby
Wetland Type	Barrier Beach
Vegetation Types	Marsh 68%, Swamp 32%
Wetland Size (hectares)	47
Watershed Size (hectares)	161
Percent Natural Cover in Watershed	42

Lynde Creek Marsh


American Germander / CLOCA

At 130 hectares in size, Lynde Creek Marsh in the southwest corner of Whitby is the second largest coastal wetland in Durham Region. The Lynde Shores Conservation Area includes Lynde Creek Marsh and the neighbouring Cranberry Marsh (see pages 14-15) and adjacent upland to make up one of the largest contiguous areas of natural waterfront within the Greater Toronto Area. In spring 2004, the Ontario government and the Town of Whitby purchased an additional 59 hectares of land to be added to the conservation area. The newly acquired land includes important upland area immediately west of the marsh. Interpretive walking trails and boardwalks are frequently used by students, families, anglers, and birdwatchers to explore the diverse habitat and wildlife that this wetland offers.

Lynde Creek Marsh is situated at the outlet of a large watershed stretching from the north end of Whitby and totaling over 13 000 hectares in area. With only 14 percent forest cover in the watershed and rapid urbanization occurring both adjacent to the wetland and in the upper watershed, Lynde Creek Marsh is experiencing stresses typical of most urban wetlands. It is expected that residential, transportation, and utility land uses surrounding the wetland will increase by nine percent in the near future.

The vegetation in this wetland includes substantial areas of emergent plants, meadow marsh, and treed swamp. While some vegetation types are more prevalent than others, the condition of the bird community at Lynde Creek Marsh reflects the diversity of vegetation available. Most birds found in the wetland were general marsh users, such as Red-winged Blackbird, while there were fewer marsh-nesting obligates and area-sensitive species.

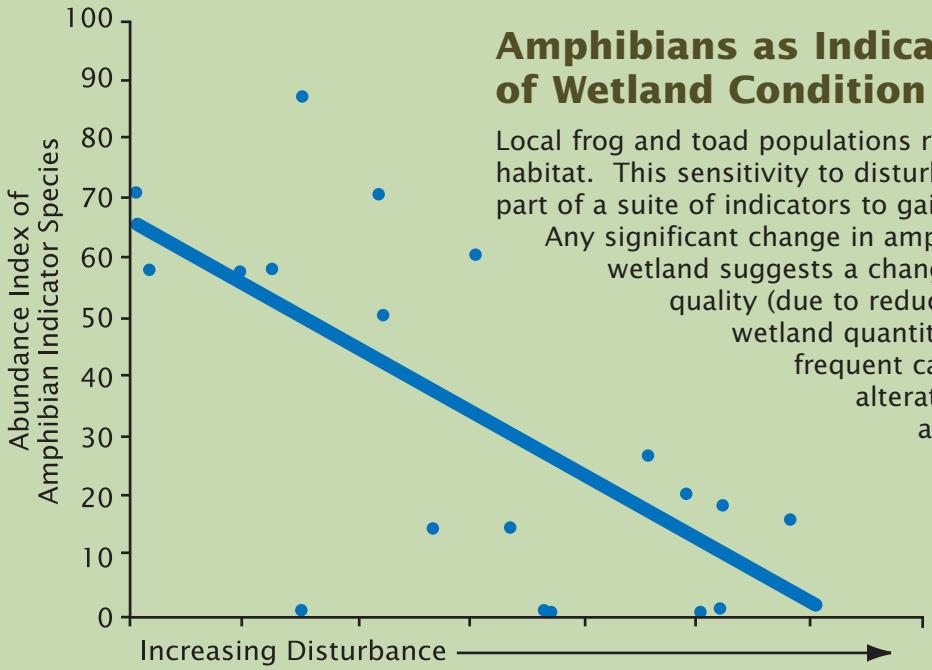
Lynde Creek Marsh's large, heavily urbanized watershed contributes to high turbidity through sediment-laden run-off. As a result, decreased light penetration limits submerged aquatic vegetation growth. Native species and turbidity-intolerant plants were rare. The aquatic macroinvertebrate community showed promise with the presence of important mollusk and crustacean species despite low overall diversity.

The Lynde Shores Conservation Area is one of the largest contiguous areas of natural waterfront within the Greater Toronto Area.

The sediments within Lynde Creek Marsh showed signs of elevated PAH and pesticide residue levels; however, levels of heavy metals were low and, compared to other Lake Ontario coastal wetlands, the sediment quality was quite good.

West Lynde Creek / John Kraft

The native fish community was also affected by the lack of submerged aquatic vegetation cover required for spawning and feeding. The non-native Common Carp is a common resident in Lynde Creek Marsh and contributes to the elevated turbidity in the wetland during its spawning and feeding activities. Yellow Perch were rare. However, the fish community did show some positive signs. Sunfish species were present in good numbers and a piscivore species, Walleye, which is relatively uncommon in coastal wetlands, was present.



Amphibians as Indicators of Wetland Condition

Local frog and toad populations respond quickly to changes in their habitat. This sensitivity to disturbance makes amphibians useful as part of a suite of indicators to gain insight into wetland condition. Any significant change in amphibian presence or abundance in a wetland suggests a change in habitat. Declining wetland quality (due to reduced water clarity) and declining wetland quantity (due to draining or filling) are frequent causes of amphibian habitat alteration. Recent estimates of amphibian populations in Lynde Creek Marsh were low, suggesting degraded wetland condition.

Report Card	
Water Quality	Fair
Submerged Aquatic Vegetation	Fair
Aquatic Macroinvertebrates	Poor
Amphibians	Poor
Birds	Fair – Good
Fish	Fair – Good

Wetland Statistics	
Location	Town of Whitby
Wetland Type	Drowned River-mouth and Barrier Beach
Vegetation Types	Marsh 60%, Swamp 40%
Wetland Size (hectares)	130
Watershed Size (hectares)	13 193
Percent Natural Cover in Watershed	24

Corbett Creek Marsh

Corbett Creek Marsh is a relatively small coastal wetland that has formed at the junction of the east and west branches of Corbett Creek in the Town of Whitby. The watershed of the creek is also relatively small and highly urbanized – with 18 percent natural cover remaining. It is forecast that within one kilometre of the wetland, non-residential development will increase more than 15 percent, replacing shrub thickets, idle fields and croplands.

Urban run-off from the extensive development surrounding the wetland and within the broader watershed has resulted in high nutrient levels and turbidity in the wetland waters. Sediment quality is typical of Durham Region coastal wetlands in highly urbanized watersheds, showing slightly elevated levels of PAHs and chromium.

Turbidity was low in Corbett Creek Marsh compared to other Durham Region coastal wetlands and many species of submerged plants were found among small patches within the marsh. The sparse submerged plant cover supported a diverse aquatic macroinvertebrate community, though sensitive species such as caddisflies and mayflies were not common.

Marked absences were observed in the amphibian community structure. American Toad and Wood Frog are hardier species that were present in low numbers, but sensitive species such as Spring Peeper and Chorus Frog were not recorded at the marsh.

The low numbers of frog and toad species heard calling at Corbett Creek Marsh during the breeding season indicate the poor condition of the amphibian community.

In the same way that frog and toad calls can be used to indicate the condition of amphibian communities, bird calls and sightings during the breeding season can indicate the suitability of the habitat for marsh-nesting birds. Although Corbett Creek Marsh is relatively small, it is large enough to support Virginia Rail, a sensitive and secretive species that requires large areas of high-quality habitat for nesting. The marsh also supports other marsh-nesting obligate species such as Marsh Wren and Swamp Sparrow, in addition to general marsh users such as Great Blue Heron and several species of waterfowl.

During the fall of 2003, Chinook Salmon entered the wetland from the lake and were observed below the beaver dam in West Corbett Creek. However, during fish sampling in the summer, no salmon were found and the fish community did not appear very diverse. Species of smaller fish (e.g., Fathead Minnow), some Yellow Perch and sunfish were observed, but the patchy submerged plant cover did not offer sufficient hiding places for piscivores.

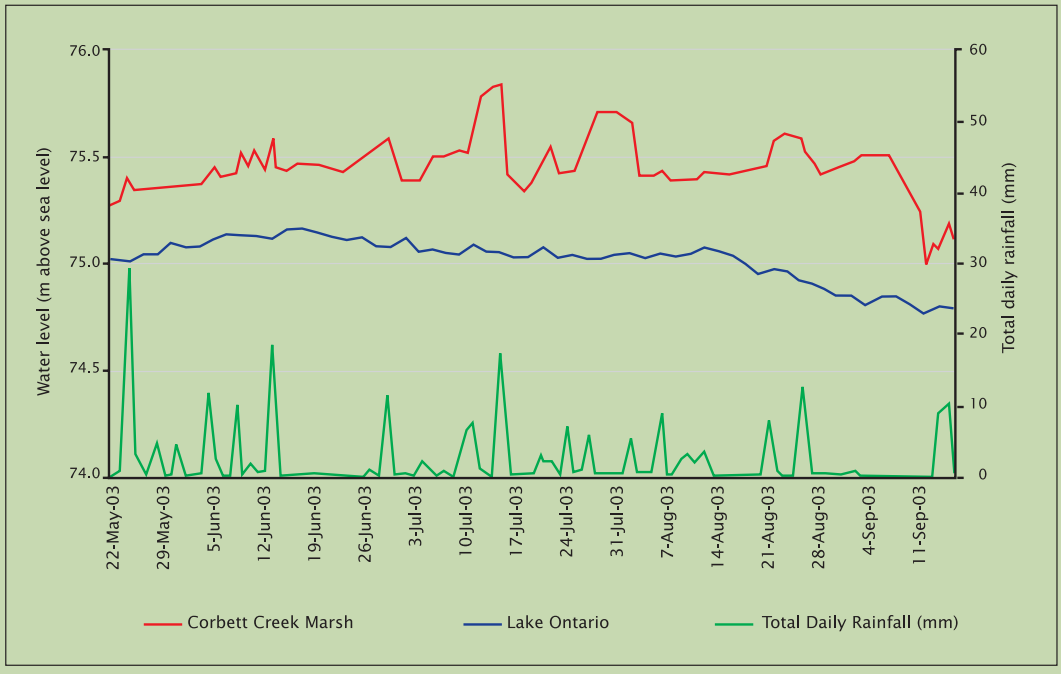
Virginia Rail / Eric Dresser

The marsh is known to support environmentally-sensitive bird species such as Virginia Rail.

Part of this marsh, an adjacent eight-acre meadow, and the 16-acre Thickson's Woods are owned by the Thickson's Woods Land Trust, a non-profit organization dedicated to preserving the marsh and the remnant stand of old-growth mixed forest. This organization, in partnership with the Town of Whitby Parks Department, local service clubs, and industry are working to re-establish naturalized wildlife corridors along both branches of Corbett Creek and the Lake Ontario shoreline.

Barrier Beach Wetlands

Many Great Lakes coastal wetlands are formed behind barrier beaches, with small outlets connecting the wetland to the open lake. Strong waves from the lake can push shoreline sand and cobble across the outlet of the wetland and create a blockage. As the wetland accumulates water from its watershed, the water level in the wetland rises above lake level and increases pressure on the barrier. Starting with seepage or a small trickle, the flow of water accelerates and "blows out" the barrier. As the water flow slows, waves can re-establish the barrier and the process is repeated.



Water levels in barrier beach coastal wetlands (see sidebar), such as Corbett Creek Marsh, can fluctuate greatly throughout the growing season compared to Lake Ontario. These rapid changes in water level can prevent aggressive plant species such as cattails from dominating the marsh. These changes maintain open water pockets within the wetland which are critical for several important wetland bird species, including Virginia Rail, American Coot, Common Moorhen, and Least Bittern.

Report Card	
Water Quality	Fair
Submerged Aquatic Vegetation	Fair
Aquatic Macroinvertebrates	Good
Amphibians	Poor
Birds	Good
Fish	Fair

Wetland Statistics	
Location	Town of Whitby
Wetland Type	Drowned River-mouth with Barrier Beach
Vegetation Types	Marsh 83%, Swamp 17%
Wetland Size (hectares)	21
Watershed Size (hectares)	1,463
Percent Natural Cover in Watershed	18

Pumphouse Marsh

At seven hectares, Pumphouse Marsh is a very small and distinctive coastal wetland. It is the smallest of the coastal wetlands being monitored by the project and is only connected to the lake by seepage through its well-established barrier beach. Land records from the late 1700s suggest that the wetland was once open to Lake Ontario and received stream inflow from a more extensive upland watershed. With urban development, the larger watershed connection to the marsh was lost. What remains is a small 55-hectare watershed, unique in that over 75 percent of its area is covered in residential development. Therefore, the wetland receives almost all of its water from storm sewer outlets.

Notably, this wetland had the worst sediment quality of all Durham Region coastal wetlands. Levels of PAHs were strikingly high, but appear to be limited to the areas in the north end of the wetland where the sewers flow into the marsh. The source of the PAHs is not clear, but most likely comes from automobile oil and grease washed down the sewers during storm events or possibly illegal dumping of used engine oil.

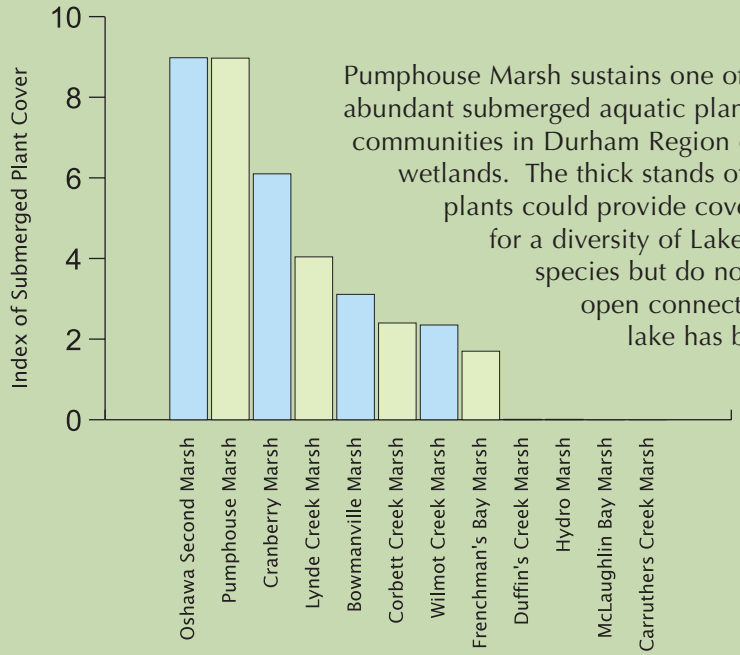
The highly residential nature of the watershed has also had an unexpected positive effect on the wetland. With virtually no erosion in the watershed, the water in the wetland is clear with moderate nutrient concentrations. Unobstructed light penetration has resulted in one of the most abundant and diverse submerged aquatic vegetation community in the Durham Region's coastal wetlands.

The dense submerged vegetation supported an equally diverse aquatic macroinvertebrate community that contained many sensitive mollusks and crustaceans. However, signs of decreased water quality were apparent as more sensitive species such as mayflies and caddisflies were present but not abundant.

The small size and urbanized surroundings of the wetland preclude it from supporting many amphibian species and individuals. Moderate numbers of American Toad and Green Frog have been heard in the wetland. The wetland has also shown an ability to support low numbers of Northern Leopard Frog, a more sensitive species.

A fairly large population of the regionally-rare Swamp Loosestrife (Water Willow), a native relative of the invasive Purple Loosestrife, occurs in Pumphouse Marsh. The seeds of this plant are eaten by waterfowl.

A fairly large population of regionally-rare Swamp Loosestrife (Water Willow) occurs in the marsh.



Pumphouse Marsh sustains one of the most abundant submerged aquatic plant communities in Durham Region coastal wetlands. The thick stands of submerged plants could provide cover and habitat for a diversity of Lake Ontario fish species but do not because the open connection to the lake has been lost.

Submerged aquatic vegetation / CLOCA

Fish Communities in Disconnected Coastal Wetlands

With the establishment of surrounding residential neighbourhoods, the stream inflow to Pumphouse Marsh was lost. As stream water ceased to flow out of the wetland, unabated wave action from Lake Ontario pushed sand and cobble across the mouth of the bay and disconnected it from the lake. Currently, the only hydrologic connection from the wetland to the lake is via seepage through the well-established barrier that now supports mature trees (see aerial photo).

This disconnection from Lake Ontario has had a profound impact on the fish community in Pumphouse Marsh. Piscivore and sunfish species as well as Yellow Perch – all indicators of good fish community condition – are absent from Pumphouse Marsh. The fish community closely resembles that of small and isolated inland wetlands, supporting large populations of primarily minnow species.

Report Card	
Water Quality	Good
Submerged Aquatic Vegetation	Good
Aquatic Macroinvertebrates	Good
Amphibians	Fair
Birds	N/A
Fish	Fair

Wetland Statistics	
Location	City of Oshawa
Wetland Type	Barrier Beach
Vegetation Types	Marsh 80%, Swamp 20%
Wetland Size (hectares)	7
Watershed Size (hectares)	55
Percent Natural Cover in Watershed	23

Oshawa Second Marsh

In the late 1960s, plans were unveiled by the Oshawa Harbour Commission to develop Oshawa Second Marsh into a deep water harbour. At the time, Oshawa Second Marsh was reputed to be the highest-quality coastal wetland on Lake Ontario from the Niagara River to Prince Edward County, so it is no surprise that the plans for the marsh were strongly challenged by conservationists. The debate continued for years and, in the end, the proponents of the harbour creation turned the property over to the City of Oshawa for conservation. Over the past 30 years, the citizens group, Friends of Second Marsh (formerly Second Marsh Defense Association), has continued to play a vital role in the protection and stewardship of this wetland and its watershed.

Despite being saved from harbour development, the quality of the marsh has deteriorated due to watershed stressors. The watershed has become highly urbanized and now consists mostly of residential and agricultural area draining into Harmony and Farewell creeks. Historically, the outflow of these drainage systems emptied directly into Oshawa Second Marsh; however, this has changed in recent years as flow has been diverted directly into Lake Ontario as part of ongoing restoration efforts in the wetland (see sidebar).

Like many Durham Region coastal wetlands, the urbanization of the surrounding land and watershed has resulted in reduced sediment and water quality in Oshawa Second Marsh. Poor sediment quality is mainly due to increased levels of PAHs. Water quality in the marsh is fair due to urban and agricultural run-off entering the wetland and causing increased sediment and nutrient deposition. In the past, these sediment particles in the run-off have increased turbidity. Since creek flow has now been diverted from the wetland, this sediment-laden run-off can no longer enter the wetland, resulting in far less turbid water. The increased water clarity has allowed large stands of submerged aquatic vegetation to re-establish in the wetland.

The developing submerged aquatic plant community simultaneously improves habitat for the fish and aquatic macroinvertebrate communities in the wetland. Although the marsh supported low numbers of piscivores and few sunfish species, there was a high richness of other native fish species in the wetland. In addition, Oshawa Second Marsh was found to support one of the highest densities of Yellow Perch. With improved fish habitat achieved through restoration activities, the future condition of the fish community is expected to continue to improve. The aquatic macroinvertebrate community was diverse and had a high number of individuals, especially crustaceans and mollusks. However, the wetland did not provide suitable habitat for more turbidity-sensitive species such as mayflies and caddisflies.

Common amphibian species such as American Toad and Wood Frog, and the less common Spring Peeper, have each been observed in Oshawa Second Marsh but they do not appear to be abundant. Because of these low numbers and the lack of other sensitive amphibian species, this community received a poor rating.

Oshawa Second Marsh is the largest known spring staging area in North America for the rare Little Gull.

The network of trails through Second Marsh Wildlife Area and the adjacent McLaughlin Bay Wildlife Reserve provides many opportunities for wildlife viewing. Looking over the wetland from the Marshland Trail observation tower in recent years, the good condition of the wetland breeding bird community is evident. Waterfowl, shorebirds, and songbirds are commonly seen. Area-sensitive species such as Virginia Rail nest in good numbers as do marsh-nesting obligates including Swamp Sparrow and Marsh Wren. The marsh is also known to support species at risk such as Least Bittern.

Least Bittern / Walter B. Fechner

Restoration of Oshawa Second Marsh

In many Great Lakes coastal wetlands, the ongoing stresses that cause high turbidity such as the presence of Common Carp and increased sediment loads from the watershed cause the loss of submerged vegetation. Often, these stresses are so severe that vegetation has no opportunity for re-establishment, causing a decrease in habitat quality for many species of wildlife.

Since the early 1990s, organizations interested in restoring Oshawa Second Marsh have been actively employing, modifying, and testing methodologies to eliminate carp, reduce sediment deposition, and re-establish aquatic vegetation. When conventional planting projects and installation of carp barriers proved unsuccessful, a more intensive effort was undertaken to alleviate watershed-related stresses by diverting the main inlet, Farewell Creek, directly to Lake Ontario. The installation of a water-control structure and pump in 2002 allows marsh managers to periodically draw down the water level to encourage the natural seedbank to germinate, and provides stable water levels while the young plants establish. This technique is used selectively throughout the Great Lakes basin. The eventual goal of most of these projects is to re-connect the wetland to the lake once the vegetation is firmly established and able to cope with the stresses once again.

During drawdown, a specially-designed fish passage structure allows fish to exit the wetland into Farewell Creek. Upon re-flooding, many of the damaging mature carp will be excluded from entering the wetland due to their size, while other fish species will be allowed free passage into and out of the wetland.

This most recent phase of Second Marsh restoration has been overseen by Ducks Unlimited Canada on behalf of the City of Oshawa and the other project partners including Environment Canada, Friends of Second Marsh, Central Lake Ontario Conservation Authority, Ontario Power Generation, and Ontario Ministry of Natural Resources.

Report Card	
Water Quality	Poor – Fair
Submerged Aquatic Vegetation	Good
Aquatic Macroinvertebrates	Good
Amphibians	Poor
Birds	Very Good
Fish	Good

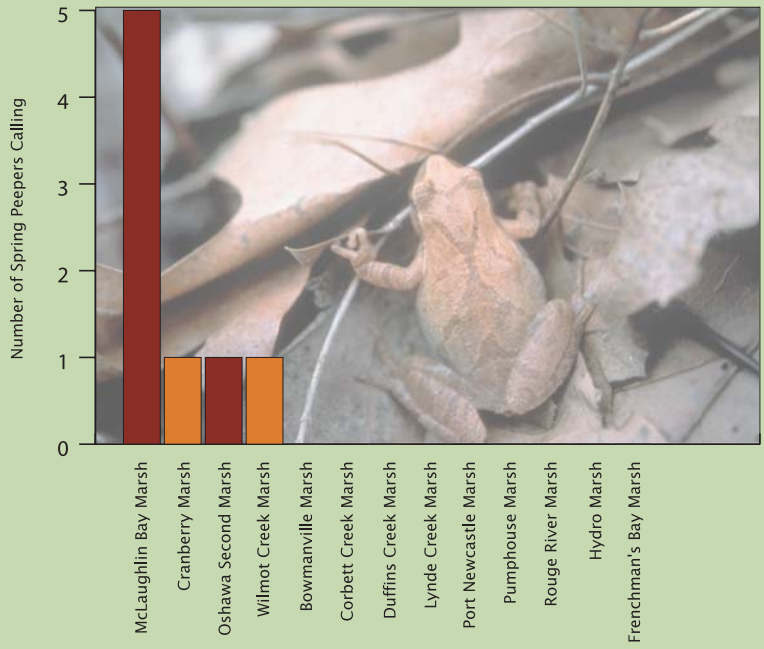
Wetland Statistics	
Location	City of Oshawa
Wetland Type	Barrier Beach
Vegetation Types	Marsh 71%, Swamp 29%
Wetland Size (hectares)	133
Watershed Size (hectares)	10 705
Percent Natural Cover in Watershed	19

McLaughlin Bay Marsh

McLaughlin Bay Marsh is nestled within the 700-metre strip of land between Highway 401 and Lake Ontario adjacent to and east of Oshawa Second Marsh. The wetland consists mostly of shallow open water, with limited emergent vegetation compared to many other Durham Region coastal wetlands. As recently as 1959, this wetland was open to Lake Ontario, but shoreline processes have created a substantial barrier beach across the wetland, closing it off from the lake. The wetland water levels remain perched above Lake Ontario with some seepage from the wetland to the lake through the barrier beach. The bay is associated with the General Motors-owned McLaughlin Bay Wildlife Reserve and Darlington Provincial Park and is subject to light recreational activities such as fishing and canoeing in the summer and skating in the winter.

The marsh's small watershed is primarily in natural cover and abandoned farmland, and includes part of the provincial park. With few sources of urban run-off and agricultural erosion, the wetland water and sediment quality were good and provide the necessary conditions to support some of the highest numbers of disturbance-sensitive aquatic macroinvertebrates – mayflies and caddisflies – in Durham Region coastal wetlands. In addition, the amphibian indicator species Spring Peeper was heard in high numbers (see figure).

The abundance of other less sensitive amphibians, such as Wood Frog and Green Frog, can also be attributed to good water quality.



McLaughlin Bay has some of the highest abundances of disturbance-sensitive Spring Peepers in Durham Region coastal wetlands. This species requires good water quality as well as high quality wetland and surrounding upland habitat for breeding. Although several peepers were heard in McLaughlin Bay, it is common to hear over three times as many individuals calling at less disturbed Lake Ontario coastal wetlands.

Spring Peeper / Eric Dresser

The wetland supports some of the region's highest numbers of disturbance-sensitive Spring Peepers.

Despite favourable water and sediment quality, the waters of McLaughlin Bay Marsh are often turbid due to internal processes. Sediment re-suspension from a combination of wind and wave action on the large open-water section of the wetland and the activities of Common Carp (see sidebar in Frenchman's Bay pages 6-7) are likely the main causes of the limited submerged aquatic plant community. The persistence of these turbid conditions will likely prevent the re-establishment of these plants. The Mute Swan, another invasive species present in high numbers in McLaughlin Bay Marsh, contribute to the loss of submerged aquatic vegetation. At many times during recent summers, over two dozen Mute Swans have been seen on the barrier beach or in the wetland (see sidebar).

Despite sparse submerged vegetation and no connection to Lake Ontario, McLaughlin Bay Marsh still provides enough habitat structure to support a fish community with some diversity of native species. Although sunfish were plentiful, the condition of the fish community was compromised by low Yellow Perch numbers, a lack of piscivores, and the prevalence of Common Carp.

In past centuries, many Europeans prized Mute Swans for their dramatic beauty and grace. When the birds were transported to North America and released into the wild, however, their numbers increased dramatically. They thrive in the Great Lakes region due to an abundance of food and a lack of natural predators. Mute Swans are the largest wild birds in Ontario and can become aggressive towards other birds, humans, or pets that venture into their nesting territory. Adult birds can eat up to 3.5 kilograms of submerged aquatic vegetation daily. This level of consumption can generate significant negative stress for local plant life as well as fish and other birds that require submerged vegetation for food or cover. Depending upon the severity of local problems, control measures such as preventing eggs from hatching, live capture and removal of adult swans may be permitted.

Two native species of swans, Tundra and Trumpeter, have been observed using Durham Region coastal wetlands as stopover points during migration. Mute Swans can be distinguished from the other two species by their orange bill with prominent black knob at its base. Mute Swans also typically hold their necks in an S-shape while the others have a more erect neck posture. Trumpeter swans are generally larger than Tundra Swans and do not have a yellow spot in front of their eye.

Mute Swan | Trumpeter Swan | Tundra Swan

Walter B. Fechner

Report Card	
Water Quality	Good
Submerged Aquatic Vegetation	Poor
Aquatic Macroinvertebrates	Good
Amphibians	Good
Birds	N/A
Fish	Fair – Good

Wetland Statistics	
Location	City of Oshawa and Municipality of Clarington
Wetland Type	Barrier Beach
Vegetation Types	Marsh 87%, Swamp 13%
Wetland Size (hectares)	42
Watershed Size (hectares)	209
Percent Natural Cover in Watershed	70

Westside Marsh

Westside Marsh was once a 45-hectare wetland receiving outflow from Westside Creek that entered the wetland from the west. However, the wetland's northern and western ends will soon be quarried for limestone (for cement production). As a result, Westside Creek will be re-routed around the quarry to enter the marsh from the east. These modifications have reduced the wetland area by almost half of its original extent. In response, the Central Lake Ontario Conservation Authority and the Municipality of Clarington are implementing an environmental management plan for the remaining area of Westside Marsh, Bowmanville Marsh (directly to the east – see pages 28-29), and the upland area between the two wetlands. This management plan will seek to protect and rehabilitate the natural resources remaining in this heavily impacted area of Lake Ontario shoreline.

The Westside Marsh watershed is relatively small and heavily developed. Due to the small size of the watershed, it receives a low volume of urban run-off. As a result, nutrients, conductivity, and turbidity are moderate, and overall water quality is good.

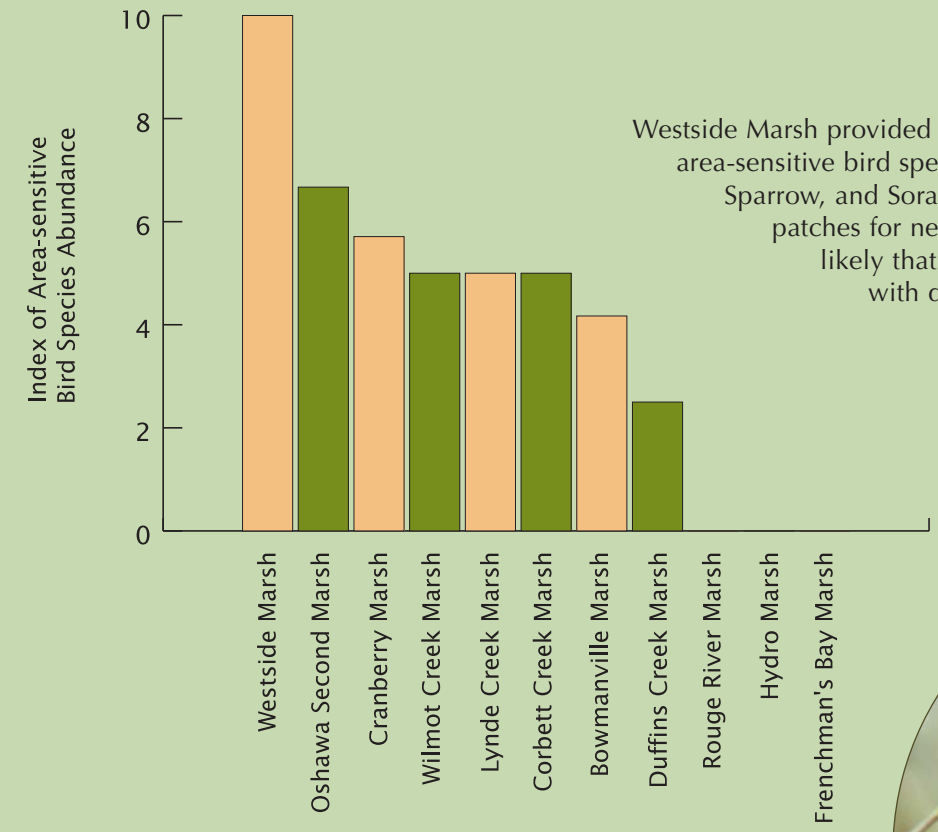
Water quality greatly affects the condition of the submerged vegetation within a coastal wetland. Although submerged vegetation was not sampled at this wetland, previous observations and vegetation surveys note that submerged vegetation cover had been extensive. Past reports indicate that in mid-summer pond lilies were so thick in the wetland that canoeing was made difficult.

Aquatic macroinvertebrates were abundant in the wetland. The diverse community was particularly high in tiny crustaceans called amphipods, which are sensitive to poor water quality.

On-site earth works and marsh reconfiguration have increased the level of disturbance, particularly on the periphery of the wetland. These activities were expected to affect the resident amphibian community and, in fact, only one amphibian species, American Toad, was heard calling in low numbers at the wetland.

Sora / Walter B. Fechner

In past summers, pond lilies were so thick in the wetland that canoeing was made difficult.



Westside Marsh provided nesting and brooding habitat to area-sensitive bird species such as Virginia Rail, Swamp Sparrow, and Sora. The species require larger habitat patches for nesting than other marsh nesters. It is likely that much of this habitat will be lost with quarry expansion.

Red-winged Blackbird / Walter B. Fechner

In contrast, breeding birds are more mobile than amphibians and can easily relocate to less disturbed portions of the wetland. The marsh was well-suited for supporting an abundance of area-sensitive species as evidenced by the particularly high numbers of Virginia Rail that were heard calling throughout the wetland. In addition, Marsh Wren and Sora were recorded from more secluded parts of the site.

Presently, data that describe the current condition of the fish community are lacking. In the past, fish sampling has revealed high numbers of common species such as Brown Bullhead and Golden Shiner. In addition, the marsh appeared to support good numbers of Yellow Perch, a diversity of sunfish species and several Northern Pike.

Report Card	
Water Quality	Good
Submerged Aquatic Vegetation	N/A
Aquatic Macroinvertebrates	Good
Amphibians	Poor
Birds	Excellent
Fish	N/A

Wetland Statistics	
Location	Municipality of Clarington
Wetland Type	Barrier Beach
Vegetation Types	Marsh 94%, Swamp 6%
Wetland Size (hectares)	27
Watershed Size (hectares)	573
Percent Natural Cover in Watershed	29

* Safety concerns associated with the on-site earthworks and construction activities often prevented access; therefore, not all indicators have been monitored.

8 Bowmanville Marsh

One of the most notable features of Bowmanville Marsh, also known as Port Darlington Marsh, is its large watershed. At 16 590 hectares, it is the third-largest watershed of all Durham Region coastal wetlands.

The main tributaries to this wetland, Soper and Bowmanville creeks, deposit sediment into the marsh with low contaminant levels. Water flowing into the wetland had high nutrients and moderate turbidity. The elevated turbidity within the marsh makes it surprising that the submerged aquatic vegetation community included a few stems of Flat-stemmed Pondweed, a species that typically cannot tolerate turbid water. The presence of this sensitive species, in addition to a marked decrease in annual submerged plant abundance over the past two years, suggests that the water quality has only recently begun to decline.

This marsh is unusual in that there is one opening in the southeast corner of the marsh that serves as an inlet and outlet, depending on the direction of water flow (see aerial photo). Lower turbidity levels were generally observed in the more secluded north end of the marsh, where there were extensive patches of water lilies.

A combination of impaired water quality and extensive residential and non-residential development neighboring the marsh has impacted the wildlife that rely on this wetland. Low overall diversity and numbers of sensitive species in both the aquatic macroinvertebrate and amphibian communities have been observed. These communities currently support species that are generally resistant to poor habitat conditions, such as aquatic midge larvae and American Toad.

The naturalization of the agricultural field neighboring the wetland to the west will improve surrounding habitat.

Collecting fish by electrofishing / CLOCA

White Water Lilies / CLOCA

Planned increases in urban development on the east side of the wetland suggest that declining conditions are likely to persist. In contrast, the naturalization of the agricultural field neighbouring the wetland to the west will improve surrounding habitat and may alleviate some of the human-disturbance stressors experienced by Bowmanville Marsh.

The vast majority of this marsh is covered in cattails – plants that generally provide good nesting habitat to marsh-nesting obligate species. However, lower than expected numbers of birds using this wetland during the breeding season suggest that other habitat conditions appear to be limiting the numbers of these species. Even though the marsh does not support good numbers of disturbance-sensitive birds, the wetland is alive with generalist marsh users such as Great Blue Heron, Mallard, and a large population of Red-winged Blackbird.

As in many of Durham Region's coastal wetlands, the fish community in Bowmanville Marsh is showing signs of stress likely due to deteriorating water quality and submerged plant community condition. Evidence of this stress is indicated by the lack of piscivores observed in the fish community assemblage. Despite this shortcoming, the wetland does support a good diversity and abundance of Golden Shiner and other important fish species such as Yellow Perch and sunfish.

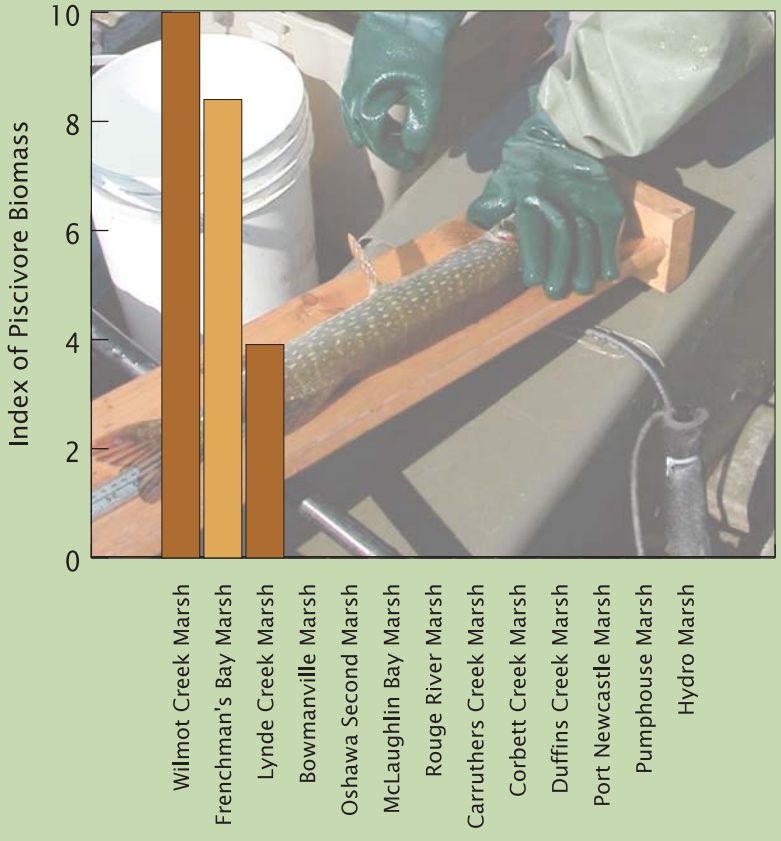
Report Card	
Water Quality	Fair
Submerged Aquatic Vegetation	Fair
Aquatic Macroinvertebrates	Poor
Amphibians	Poor
Birds	Fair
Fish	Fair – Good

Wetland Statistics	
Location	Municipality of Clarington
Wetland Type	Drowned River-mouth
Vegetation Types	Marsh 100%
Wetland Size (hectares)	29
Watershed Size (hectares)	16 590
Percent Natural Cover in Watershed	30

Wilmot Creek Marsh

Wilmot Creek is best known for its cold-water fishery comprised of Rainbow, Brown, and Brook trout as well as Chinook and Coho salmon. The clear, cold-water creek is able to support these fish species because it is relatively free of human barriers (weirs and dams) and provides natural stream-bank vegetation throughout much of its course through the watershed. Wilmot Creek Marsh receives its water from this watershed and from the smaller Foster Creek watershed.

With many natural buffers around the watercourse, the watershed is only 12 percent urbanized. These creeks and their tributaries drain the watershed and the water that enters the wetland is not as clear as the upper reaches of Wilmot Creek. On its way, the stream water accumulates moderate amounts of excess nutrients and other contaminants often associated with agricultural run-off. As well, analysis of sediment deposited in the wetland has revealed some pesticide residue; however, overall sediment quality is good.



Measuring Northern Pike

In coastal wetland fish communities, piscivores (fish that eat other fish) are important in the food web as top predators. They are also indicators of fish community condition. Disturbed coastal wetlands, like many in Durham Region, show little or no sign of these species – and are in fair or poor condition. Wilmot Creek Marsh supports one of the best fish communities in the Region's coastal wetlands and has high numbers of piscivore species, mainly Northern Pike and Largemouth Bass.

Largemouth Bass

The marsh waters sustain one of the best coastal wetland fish communities in Durham Region.

Wilmot Creek / John Kraft

Unlike the upper creeks, turbidity within the wetland can be quite high and results in a patchy submerged plant community. The submerged plants were absent in many open-water parts of the wetland but thick in the secluded back bays that are not exposed to turbid water.

The open-water areas on the margins of large cattail stands that dominate the wetland supported one of the best aquatic macroinvertebrate communities among Durham Region coastal wetlands. The Wilmot Creek Marsh aquatic macroinvertebrate community was particularly abundant in two varieties of sensitive crustaceans, isopods and amphipods.

Although other biological communities are well-represented here compared to most other Durham Region coastal wetlands, only low numbers of American Toad and Green Frog were heard calling. One indicator species, Spring Peeper, was present but in low numbers. Results suggest that while the marsh offers fair amphibian habitat, it is being affected by human disturbance.

Wilmot Creek Marsh was also abundant in birds that are general marsh users (e.g., Red-winged Blackbird). In addition, good numbers of area-sensitive species such as Virginia Rail and Swamp Sparrow were present in the marsh and the marsh-nesting obligate, American Coot, was common.

As expected, the salmon and trout species that make Wilmot Creek renowned as a cold-water fishery are not generally found in the warmer wetland waters. However, the marsh waters themselves sustain one of the best coastal wetland fish communities in Durham Region. Dominated by warm-water species, the fish community was characterized by populations of Yellow Perch and many sunfish species. In addition, this is one of the few coastal wetlands in the region that had an abundance of predatory Northern Pike and Largemouth Bass. In Lake Ontario coastal wetlands, these species occupy the upper levels of the aquatic food web and are indicators of a high-quality fish community.

Report Card	
Water Quality	Fair
Submerged Aquatic Vegetation	Fair
Aquatic Macroinvertebrates	Good
Amphibians	Fair
Birds	Very Good
Fish	Good – Very Good

Wetland Statistics	
Location	Municipality of Clarington
Wetland Type	Drowned River-mouth and Barrier Beach
Vegetation Types	Marsh 71%, Swamp 29%
Wetland Size (hectares)	26
Watershed Size (hectares)	9,882
Percent Natural Cover in Watershed	35

Port Newcastle Marsh

Port Newcastle Marsh is the easternmost coastal wetland in Durham Region. At just over eight hectares, this wetland is the second smallest in the project. The wetland is flanked by residential development and a marina has replaced its southern portion. Although much of the land surrounding the wetland is developed, over 40 percent of the watershed has natural land cover.

Graham Creek feeds into the wetland, supplying water that carries some excess nutrients but is quite clear and able to support a highly diverse community of aquatic macroinvertebrates. Many crustaceans and mollusks were common in the wetland waters. Of particular interest were the high numbers of sensitive insect larvae, including caddisflies, mayflies, and dragonflies. Sediments are generally of good quality overall, despite slightly elevated pesticide residue.

The disturbance-sensitive Northern Leopard Frog occurred here in the highest numbers recorded in this project. Other amphibian species that used the wetland in good numbers included American Toad and Green Frog.

Port Newcastle Marsh has a limited capacity to support breeding bird species because of its small size. Nonetheless the area-sensitive Swamp Sparrow was present. In addition, the wetland appeared to support common marsh users such as Red-winged Blackbird and the not-so-common Great Egret.

Caddisfly retreats

National Water Research Institute

Caddiflies – Aquatic Architects

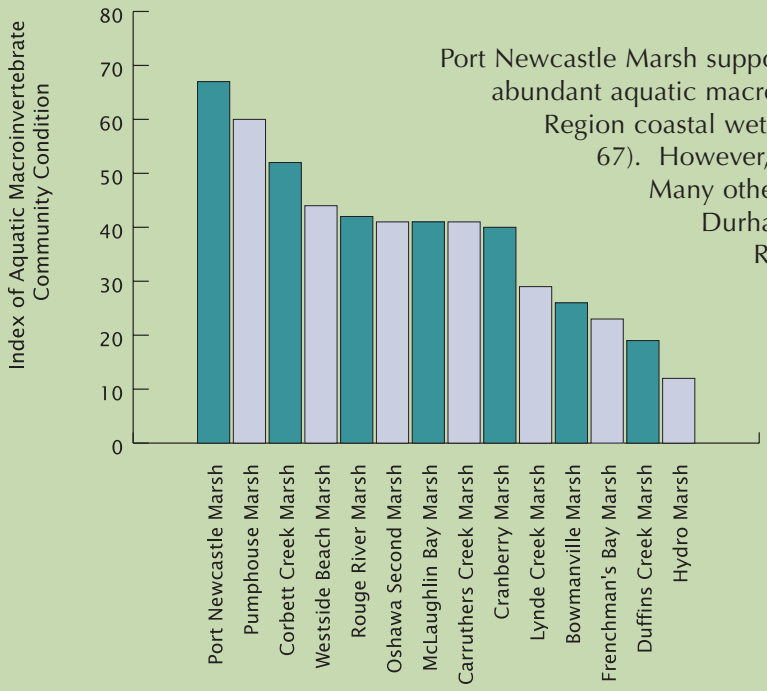
Caddisflies are a large group of insects that contains many different species. The larvae of caddisflies develop in equally diverse habitats including lakes, streams, marshes, temporary pools, springs, and seepage areas. These species are noteworthy for their sensitivity to environmental stresses; however, their most unique feature is their ability to construct protective retreats.

Most species of caddisfly make their retreats using strands of silk, much like the silk strand of a spider web, which is secreted from a gland on their lower lip. The encasements vary in construction, shape, and portability. Some retreats are made purely of spun silk threads while others use bound pieces of small pebbles, sand, plant material or mollusk shells. These protective shelters can be in the shape of tubes, bugles, turtle shells, boxes or even fans. Some retreats are fastened to the ground while others are portable and protect the larva wherever it travels in its underwater environment. After the larvae develop into adult caddisflies, they are free flying and abandon their protective abodes.

Of particular interest were the high numbers of sensitive insect larvae, including caddisflies, mayflies, and dragonflies.

With macroinvertebrate, bird, and amphibian communities in good condition, one would expect the fish community to be in good condition. Unfortunately, this does not appear to be the case. The fish community at the Port Newcastle Marsh resembled other impacted fish communities in Durham Region coastal wetlands, illustrated by the deficiency of piscivores. In addition, the wetland appeared to support only a few native fish species and low numbers of important species such as Yellow Perch.

Great Egret / Walter B. Fechner



Port Newcastle Marsh supports one of the most diverse and abundant aquatic macroinvertebrate communities in Durham Region coastal wetlands (index of community condition = 67). However, there is always room for improvement. Many other Lake Ontario coastal wetlands outside Durham Region (e.g., Hay Bay and Robinson's Cove marshes) have an index of community condition in the 80s.

Dragonfly larva exoskeleton

Report Card	
Water Quality	Fair
Submerged Aquatic Vegetation	N/A
Aquatic Macroinvertebrates	Good
Amphibians	Good
Birds	Fair – Good
Fish	Fair

Wetland Statistics	
Location	Municipality of Clarington
Wetland Type	Drowned River-mouth
Vegetation Types	Marsh 43%, Swamp 57%
Wetland Size (hectares)	8
Watershed Size (hectares)	7,814
Percent Natural Cover in Watershed	44

White Water Lily

Gray Treefrog / Greg Grabas

Glossary of Terms

Term	Definition – as used in the context of this project
Amphipod	A small (less than 1 cm) shrimp-like crustacean.
Area-sensitive species	Breeding bird species that require a minimum area of suitable marsh habitat for nesting. These minimum areas are generally larger than areas required by other marsh nesters. Area-sensitive nesters examined in this project were: Black Tern, American Bittern, Virginia Rail, Sora, Swamp Sparrow, Pied-billed Grebe, and Least Bittern.
Biomass	The total mass of living matter in a particular biological community; often used as a measure of productivity.
Conductivity	The ability of a material to transmit heat, electricity or sound. In the context of water quality, this is a measure of the total amount of dissolved ions (often salts) in the water. Conductivity increases as urban run-off with high ionic content (e.g., road salt) enters the water body.
Contaminant	Any physical, chemical, biological, or radiological substance that is found at a concentration capable of producing adverse effects in air, water, soil, or biological communities.
Exotic	Organisms (plant or animal) introduced to a habitat where they are non-native. They are often severe agents of habitat alteration and degradation and are a major cause of loss in biological diversity. Often referred to as introduced, alien, non-native, or non-indigenous species, they include Purple Loosestrife, Common Carp, and Mute Swans.
Heavy metals	A series of metallic elements with high molecular weights that are generally toxic in low concentrations to plant and animal life. Such metals are often residual in the environment and can accumulate in biological tissues. This project examined levels of arsenic, cadmium, chromium, copper, lead, zinc, and mercury in wetland sediments.
Hydrologic	Pertaining to the direction and path of water flow through the upland and wetland environments.
Indicator species	Species of plants or animals whose prevalence can provide information on ecological change and give early warning signals regarding ecosystem processes due to their sensitive reactions to them. In this project, species that are sensitive to human disturbance and whose presence and/or abundance may indicate habitat quality were monitored.
Invertebrate	Any animal without a backbone including snails and other mollusks, insects, worms, crayfish, etc.
Isopod	A small (less than 1 cm) crustacean recognized by having seven pairs of legs.
Marsh users	Birds that often use marshes for feeding, breeding activities, and cover, but may also use upland or open water (lake) habitat for these activities. These birds include: Red-winged Blackbirds, gulls, waterfowl, rails, and coots.

Term	Definition – as used in the context of this project
Marsh-nesting obligate species	Breeding bird species that nest exclusively in wetlands. These birds include: Common Moorhen, American Coot, and Marsh Wren.
Microbe	Bacteria and other small organisms that cannot be seen with the naked eye.
Native	Organisms (plant or animal) that occur naturally in an area or habitat and therefore have not been introduced as a result of human activity.
Nutrient	Any substance that is taken in by organisms and promotes growth. In this project, dissolved nitrogen and phosphorus compounds were considered.
PAH	Polycyclic aromatic hydrocarbon. A group of over 100 chemicals that are formed during the incomplete burning of coal, oil, and gas, garbage, or other organic substances such as tobacco or charbroiled meat. Some PAHs are manufactured and are found in substances such as coal tar, creosote, and roofing tar. A few are used in medicines or to make dyes, plastics, and pesticides. In wildlife, PAHs are known to reduce lifespan and reproductive ability and cause tumours.
PCB	Polychlorinated biphenyl. A group of human-made compounds with industrial uses. In the environment, these compounds are highly toxic to living organisms and bioaccumulate in tissues.
Pesticides	Chemicals used to kill pests, including certain plants, animals, and fungi that interfere with human interests. Some of these chemicals, such as DDT, persist in the environment and can cause adverse effects on organisms that were not the intended target.
Piscivores	Species with diets composed predominantly of fish. In Lake Ontario coastal wetlands, the most common piscivorous fish are Northern Pike, Largemouth Bass, and Bowfin.
Raptor	A bird of prey such as an eagle or hawk.
Richness	The total number of species as part of a group in a particular area. For example, bird community species richness is the number of different bird species that make up the bird community.
Seiche	Local rises and falls in water levels due to atmospheric pressure and wind.
Turbidity	The degree of cloudiness of water due to suspended particles (e.g., clay, silt) or organic matter (e.g., algae, zooplankton).
Watershed	The specific land area that contributes surface run-off to a river system, body of water or, in this context, a coastal wetland.

Blue Flag / Eric Dresser

Great Blue Heron / Walter B. Fechner

Next Steps

This document reports on data collected through 2002 and 2003 that provide a baseline assessment of the physical and biological characteristics of Durham Region coastal wetlands and their watersheds. The results represent preliminary findings and will become more definitive with additional years of monitoring.

The assessments made in this project are presented using additional (non-Durham Region) coastal wetlands for comparison. In general, these additional wetlands (and their watersheds) are exposed to less intense human impacts than Durham Region sites. As such, they are in better physical condition and, for the most part, support better biological communities.

Within Durham Region, more easterly sites were usually exposed to less disturbance than sites closer to Toronto. In general, the condition of biological communities decreased with increasing disturbance. Some of the biological communities in Durham Region coastal wetlands were in very good or excellent condition compared to other Lake Ontario sites. Examples of these are fish at Wilmot Creek and breeding birds at Cranberry, Oshawa Second, Westside, and Wilmot Creek marshes.

Initial indications of trouble spots in biological communities can allow full biological assessments to be carried out. With this knowledge, restoration activities can be focused on reducing sources of stress based on priority (e.g., poor water quality, non-natural surrounding land use) and improving habitat (e.g., re-establishing submerged plant communities). Methods developed for this project can then be used to monitor the effectiveness and success of the restoration activities.

Central Lake Ontario Conservation

Environment Canada Environnement Canada

ONTARIO POWER GENERATION
Darlington Nuclear

TORONTO AND REGION Conservation
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DURHAM REGION

GANARASKA REGION CONSERVATION AUTHORITY

Acknowledgements

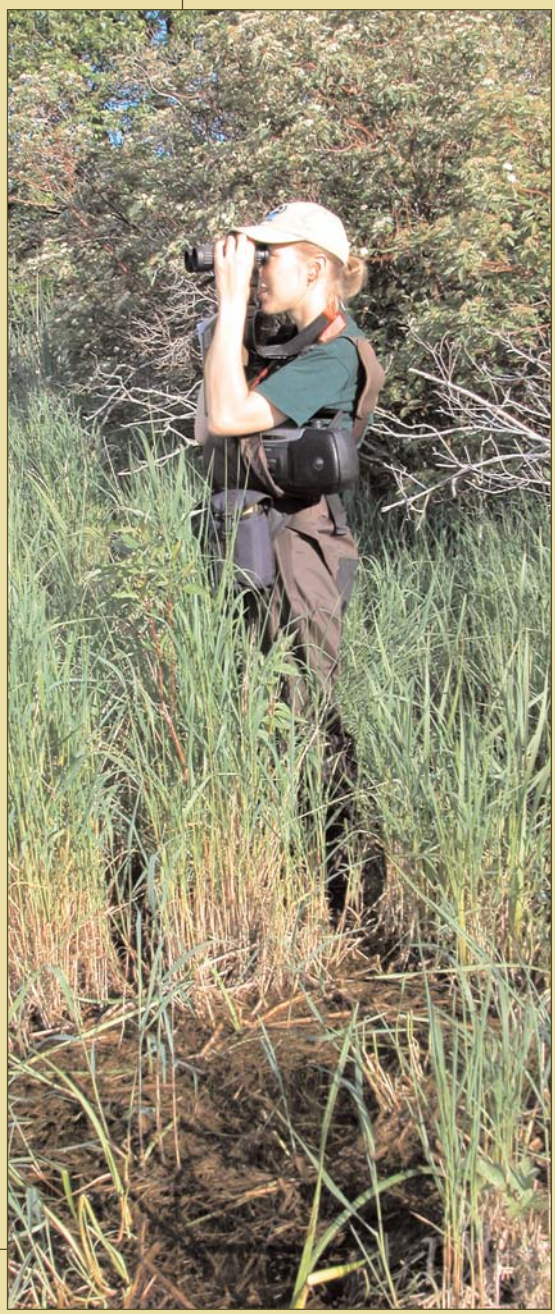
This report was written by Greg Grabas with contributions from Lesley Dunn and Maggie Galloway.

Editorial reviews were provided by Joel Ingram, Nancy Patterson, Julie Suzanne Pollock, and Donna Stewart. Additional comments were provided by Marc Desjardins, Jennifer Haslett, Bob Hester, Ian Kelsey, Gord MacPherson, Jill McColl, Mark Peacock, Satu Pernanen, Ralph Toninger, and Ken Towle.

The following partners have contributed to the data collection, analysis, and review of project results:

- Environment Canada, Ontario Region – Canadian Wildlife Service (CWS)
- Central Lake Ontario Conservation Authority (CLOCA)
- Toronto and Region Conservation Authority (TRCA)
- Ganaraska Region Conservation Authority (GRCA)
- Environment Canada, Ontario Region – Ecosystem Health Division (EHD)
- Bird Studies Canada
- Ontario Power Generation
- Fisheries and Oceans Canada
- Ontario Ministry of Natural Resources (OMNR)
- University of Toronto
- Ontario Streams
- Trent University
- Ducks Unlimited Canada

Financial support from Environment Canada, Ontario Region – Canadian Wildlife Service, Environment Canada, Ontario Region – Great Lakes Sustainability Fund, Ontario Power Generation, and the Regional Municipality of Durham is gratefully acknowledged.



Published by Authority of the Minister of the Environment

ISBN 0-662-36768-5
Cat No. En164-3/2003E

This report was printed on recycled paper with vegetable-based inks.

Copies are available from:
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Aussi disponible en français sous le titre :
Zones humides côtières de la région de Durham : Conditions de base et conclusions d'une étude (2002 et 2003)

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