Report On Little Cataraqui Creek Wetland, West Side, Front Road To Bath Road

Cover Photo by David J. White.

Kingston Field Naturalists

Kingston, Ontario

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ABOUT THE AUTHORS

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ACKNOWLEDGEMENTS

This report was funded by Kingston Field Naturalists (KFN) and the generous donation of time and expertise by many people. Lists of individuals within a group are usually in alphabetical order. Sincere appreciation is extended to everyone in this list and anyone else who contributed and was overlooked.

Individual KFN members contributed to this report in several ways. An advisory team, Carolyn Bonta, Sharon Critchley, Adèle Crowder, Robert Stewart and Ron Weir, provided support, advice and proof reading for the report. Each of these members also authored a section of the report. Carolyn Bonta and Ron Weir carried out field surveys for their respective report sections. Other KFN members who conducted field work and/or wrote a section of the report are David Bree, Susan Grigg and Bruce Ripley. The late Tom Marsh searched out papers on wetland buffers. Gary Ure contributed data on mammals. Gail Gault pulled the report together as final copy editor.

David J. White, a private consultant who is an expert botanist, was contracted by KFN for the vegetation portion of the report. He accommodated our requirements with good grace and a spirit of co-operation.

Mary Alice Snetsinger, Ecological Services, generously donated her expertise on fish for a section of the report.

Erling Armson of Ducks Unlimited contributed information and reports.

Staff of six agencies made important contributions to this report in various ways. The agencies are listed in alphabetical order.

Robert Gerritsen of Cataraqui Region Conservation Authority (CRCA) provided digitized mapping for the use of KFN's contracted consultant. He also provided other maps used in this report and a scientific permit to access CRCA lands within the study area. Tom Beaubiah, CRCA, and Rob McRae, CRCA, provided maps and gave us reports and information from CRCA files.

Shirley Bailey and Philip Healey, City of Kingston, Planning Division, provided orthographic print maps.

Akrum Matuk, Correctional Service of Canada, Regional Office, and Chris Stafford, Frontenac Institution, established a protocol and gave permission for access to the Frontenac Institution farm for field survey work. Ed Posthumus, Frontenac Institution, contributed data on mammals.

Maggie Galloway and Greg Grabas, Canadian Wildlife Service, Environment Canada, provided reports and other data.

Ross Cholmondeley, Ontario Ministry of Natural Resources, loaned air photo maps to our contracted consultant and provided copies of reports.

Corina Brdar, Ontario Parks, provided documents necessary for the administrative aspect of the report.

I served as coordinator for this report, maintaining contact with the advisory team, the contracted consultant and all the contributors to the report.

Sharon Critchley
Conservation Chair
Kingston Field Naturalists
November, 2004

SUMMARY

The Little Cataraqui Creek coastal marsh is a Provincially Significant Wetland in the City of Kingston. Near the creek mouth, the wetland is currently bounded on the west side by federally-owned agricultural land. Should this land be sold in the future, the Official Plan for the former Kingston Township proposes that Centennial Drive, a major roadway, be extended across the property and over part of the wetland. The Kingston Field Naturalists are concerned about potential negative impacts of an additional road (*e.g.*, decreased water quality, increased road mortality of wildlife, loss of habitat connectivity, diminished nest success for breeding waterfowl) on the health and habitat of the Little Cataraqui Creek.

The Study Area for this report is the west side of the Little Cataraqui Creek wetland, between Front Road and Bath Roads. This report begins by describing the physical and chemical background of the wetland and its adjacent upland. A discussion of land use history, from pre-settlement times to current activities, shows that human impacts on the wetland have been both negative (*e.g.*, development, deforestation) and positive (*e.g.*, wetland enhancement and conservation).

Inventories of biota within the Study Area through the 2004 field season were conducted and supplemented with reports from the literature. Nine vegetation zones were identified, including open water, marsh, and swamp wetland components. The Study Area was found to contain 292 species of plants, from 72 families. Thirteen species of mammal (three of which are wetland-dependent) were present on and near the Study Area. Sixty-four species of birds were found to nest on the Study Area, and an additional 35 species are migrants. At least nineteen fish species have been recorded in the Little Cataraqui Creek, and 15 herptile (reptile and amphibian) species, 12 of which are wetland-dependent, were present in and around the Study Area. Little Cataraqui Creek was recently (2003/04) found to have a relatively good diversity of aquatic macroinvertebrates in its lower reaches. Thirteen species of odonates (dragonflies and damselflies) were present on the Study Area in 2004. A flight season butterfly survey of the Study Area identified nine species, one of which is a wetland obligate.

Three locally rare native plant species were identified on the Study Area. Five of Ontario's Species at Risk–Least Bittern (Threatened), Black Tern (Special Concern), Short-eared Owl (Special Concern), Northern Map Turtle (Special Concern) and Monarch (Threatened)– were also observed. One species of dragonfly, the Black Saddlebags, is a rare southern migrant and possible breeder on the Study Area.

A comprehensive review of planning policies and legislation, as they relate to Provincially Significant Wetlands and their adjacent lands, and a discussion of Great Lakes coastal wetlands follow. Finally there is a literature review on wetland buffers, which relates buffer width to the organisms which need protection. For waterfowl, a 300 m buffer is recommended. This report will further contribute to our understanding of the significance of the Little Cataraqui Creek wetland's function and value on the landscape.

1.0 INTRODUCTION

Adèle Crowder

The purpose of the Kingston Field Naturalists in compiling this report is to document and describe the ecosystem of the Study Area in 2004. The Study Area, on the west bank of Little Cataraqui Creek, is both a Provincially Significant Wetland, as designated by the Ontario Ministry of Natural Resources, and a relatively undisturbed Great Lakes coastal wetland. In 1996 the Official Plan of Kingston Township identified a proposed road linking Bath and Front Roads, immediately west of Little Cataraqui Creek, in land administered by the Correctional Service of Canada in Frontenac Institution. We are concerned by the negative impact of such a road and of developments such as housing on this land and the adjacent wetland.

The Little Cataraqui Creek watershed is shown in **Figure 1-1** which also includes parts of Collins Creek and Great Cataraqui River watersheds, all of which flow generally NE to SW. Little Cataraqui Creek has several tributary streams, the largest being the West Branch that flows SW to NE between Days Road and Bath Road. Despite being urban for approximately one third of its length, the Little Cataraqui valley contains a Provincially Significant Wetland complex of three units: wetlands are shaded in **Figure 1-1.** Evaluations of the valley wetlands were made for the Ontario Ministry of Natural Resources by Brownell in 2004 and Boxall in 1992; the Study Area was last evaluated on its own by Mosquin Bioinformation in 1985.

Figure 1-2 shows the boundaries of the Study Area delimited by two main roads, Bath Road to the north, and Front Road to the south where the creek flows into Lake Ontario. The outlet is confined under the Front Road bridge. The open creek forms the east boundary and fields of Frontenac Institution the west. To the east of the creek lies more wetland, with fewer tributaries than the Study Area and more wooded areas. A small parcel of open field and wetland in the southeast corner of the Study Area, contiguous with the more northern part of the marsh, belongs to Cataraqui Region Conservation Authority (CRCA) and is shown in **Figure 1-3**. Two small woodland areas shown on **Figures 1-2** and **1-3** were included in the Study Area because they are "islands" of natural or semi-natural vegetation in the farmland, and were known to contain ponds.

The focus of sections of the report shifts from small portions of the study area, such as a tributary creek or a small woodland, to the entire wetland complex, to the whole valley, or to Lake Ontario.

There are three parts to the report: geographical and historical background, biological inventory (biota) and planning considerations. The report is based on field work,[1] literature searches and interviews and begins with a summary of the geographical background of the study area. Descriptions of solid geology, surficial deposits, soils and sediments are followed by notes on hydrology and its historical changes. These include lake-wide phenomena such as water-level control. Protection from lake storm-surges, and severe riverine floods have resulted in large cattail stands. Two sections on land history, past and recent, describe deforestation and agricultural use within the Study Area as urbanization and industrial use increased throughout the valley. The recent historical section reviews efforts at restoration and rehabilitation.

The second part of the report recounts what we know about the biota of the stream, the wetland and adjacent upland habitats in 2004; records from several years are included for some organisms. Each author describes methods and results and discusses possible effects of development. Sections are on vegetation and flora, mammals, fish, herptiles, aquatic

[1] Copies of field notes have been filed with Cataraqui Regional Conservation Authority and the Ontario Ministry of Natural Resources.

invertebrates, odonata and lepidoptera. There are obvious gaps in knowledge, such as a lack of information on algae in this eutrophic system, and about many groups of invertebrates. No data on productivity or nutrient cycling are included. The presence of Species At Risk in Ontario is noted in the sections on birds, herptiles and butterflies.

The third part of the report contains a full discussion of municipal, provincial and national legislation and policies under which the Study Area falls. Because of the threat of a possible road (to be built partly within the Provincially Significant Wetland, Figure 5.1-1.) we have included a discussion of good policy for adjacent land. A section on buffers discusses this possible use of adjacent land and recommended buffer widths for different groups of organisms, based largely on numbers of roadkills within Ontario.

A section on Great Lakes coastal wetlands, of which the Study Area is one, describes their international importance and governance. The Little Cataraqui Creek was one of the least disturbed of twenty-eight Lake Ontario wetlands analysed and compared this year, ranking in the top three; data from this research are used in sections on sediments, water chemistry and aquatic invertebrates.

Because the report has several authors, emphasis varies in different sections, for example the presence of stoneworts (*Chara* spp.) is noted in submerged shallow aquatic ecosites under vegetation and then its stands are more fully discussed as habitat for small fish. Different sections reinforce each other–carp are in the species list of fish, turbidity values are given under Water Quality, and the linkage between carp, turbidity and submergent diversity is in the Vegetation and Flora section.

A common theme in sections on animals is their use of more than one type of habitat. Some fish migrate from the wetland in and out of Lake Ontario, some insects use water and land during different phases of their lives and may need specific types of terrain, such as meadow or woodland. Some bird species have very specialized nesting habitats, either in the marsh or upland, and some which breed near the water need upland terrain for their young. The herptiles also require wet and dry habitats; some use the small woodlands while other species migrate across the fields. Large mammals such as deer include the Study Area in much bigger home ranges. The size and varied nature of these needs make the information on suitable buffer widths extremely relevant to continued survival of all these groups in the Study Area. The Study Area is part of a continuum, across the creek to the wetland on the east bank, across fields to the wetland on the West Branch, north up the valley to the rest of the wetland complex and to rural areas, and south to the lake.

The superb bird community–it contains breeding ospreys and thousands of migrants–is related to the presence of Corrections Canada. Prisons not only keep people in, they exclude them. Frontenac Institution excludes them from the mosaic of habitats described in this report. Since the 1930s, hunters, trappers, hikers, cross-country skiers, crowds of birders alerted by web sites, ATV drivers and snowmobilers have all been kept out. The dark haven of the marsh is lit by headlights only near Front Road and Bath Road. The staff of the Correctional Service have, in addition, recently been actively concerned in wetland protection.

Figure 1-1: Location of Little Cataraqui Creek and associated wetlands in Kingston. ***Source: Prepared by Cataraqui Region Conservation Authority, 2004.***

Figure 1-2: Study area for report. *Source: Ontario Base Map from Cataraqui Region Conservation Authority, Ministry of Natural Resources Sheet 10 18 3750 48950, 1992. Scale: 1:10,000*

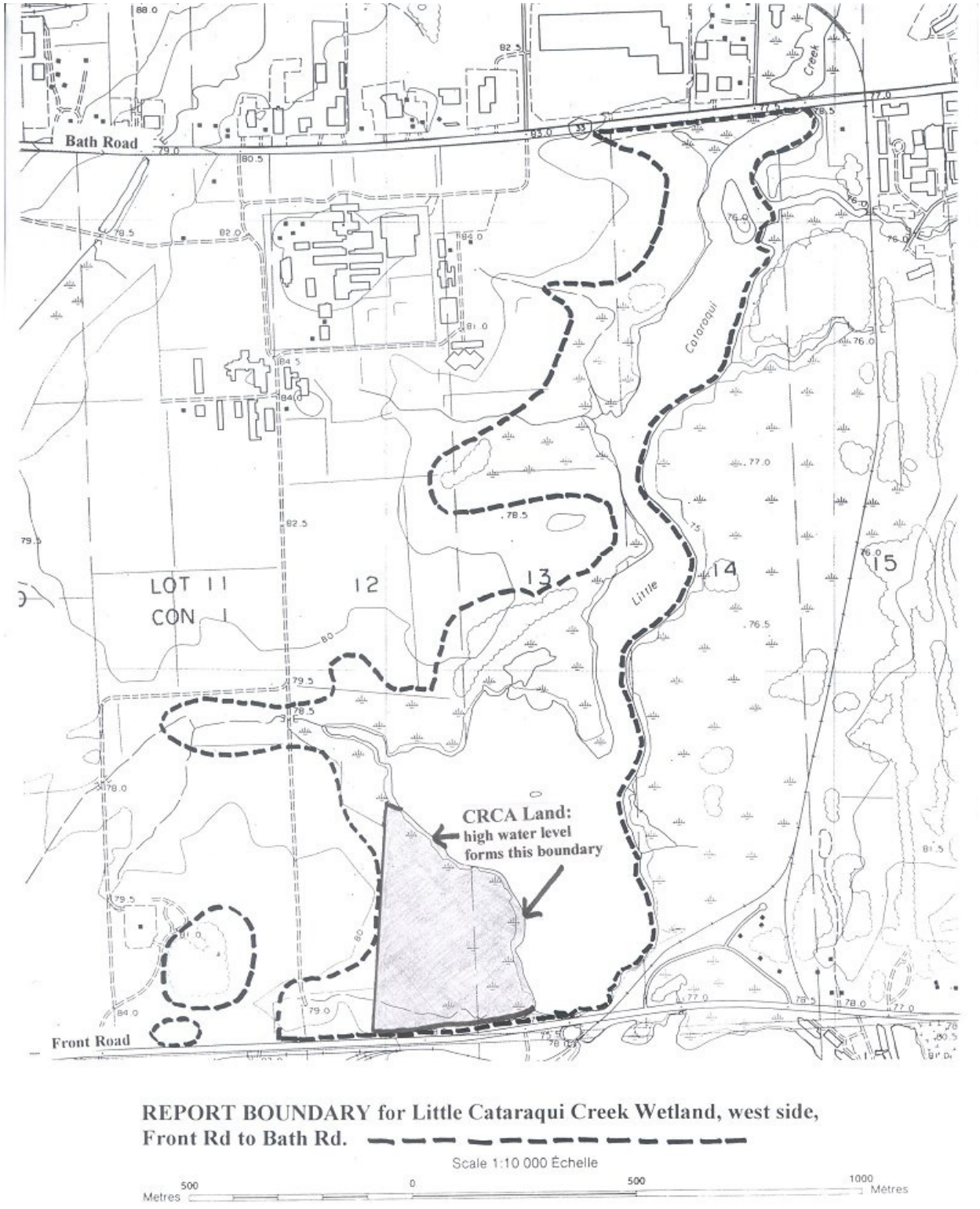


Figure 1-3: Study area for report showing Cataraqui Region Conservation Authority land. *Source: Ontario Base Map from Cataraqui Region Conservation Authority, Ministry of Natural Resources Sheet 10 18 3750 48950, 1992. Scale: 1:10,000*

2.0 PHYSICAL AND CHEMICAL BACKGROUND

Adèle Crowder

ACKNOWLEDGEMENTS

Thanks are due to the members of the KFN committee working on the area, and particularly to Sharon Critchley for obtaining information. I should also like to thank P. Chantraine, M. Galloway, R. Gilbert , G. Grabas, S. Knechtel, A. Matuk, V. Remenda, V. Schmolka, R. Snetsinger, J. Van Oostrom , W. Vreeken and D. White for helpful discussions and for data. My understanding of local coastal marshes is based on working in them with many colleagues including M. Bristow, W. Dushenko, J. Greig, and A. McLaughlin.

2.1 GEOLOGY

The study area is underlain by Ordovician limestone. The rock is a Gull River type (Ontario Geological Survey ERLIS data sets and Map P 2611) which is relatively porous. The formation has frequently been quarried locally. A small quarry was worked at the south of the Frontenac Institution farm near Front Road.

Outcrops are abundant in the Little Cataraqui valley, including flat surfaces where overburden has been removed, and cliffs or small scarps. Cliffs and scarps were mapped by Vreeken(1994 A); in the study area his map (**Figure 2-1**) shows five scarps running parallel with the creek's west bank. In this part of the valley scarps do not sharply define its sides as they do further upstream.

2.2 SURFICIAL DEPOSITS

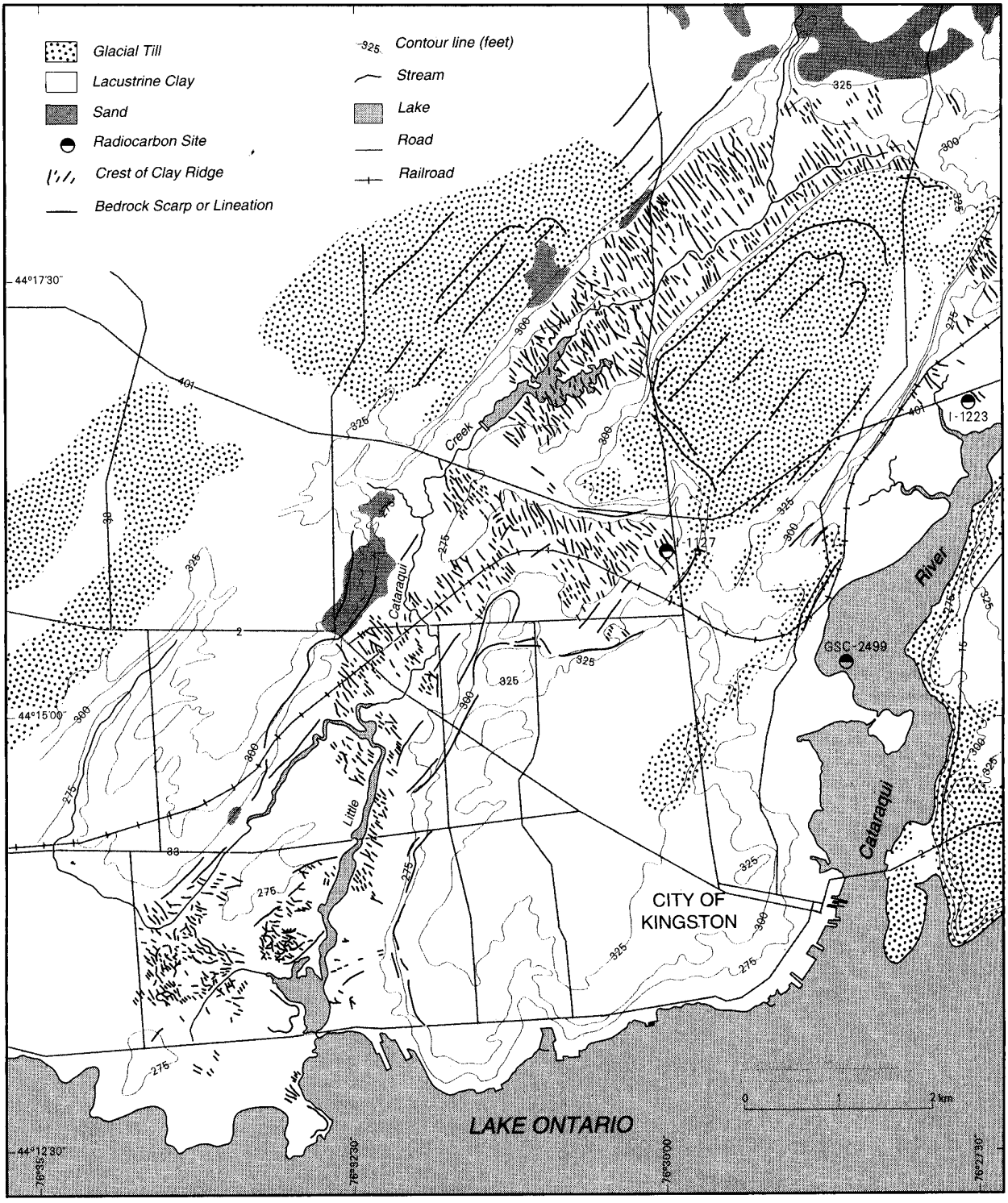
The valley contains glaciolacustrine clays with inclusions of sands and gravels of varied depths. As ice retreated north-eastwards up the valley it is generally assumed that rapid streams deposited sands along both its sides; some of the sand deposits have been quarried near the creek mouth on its east side.

Vreeken (1994 A) described the landforms as follows: "The bottomland is marked by prominent regular clay ridges". Throughout the valley the ridges mostly follow a trend perpendicular to its general direction, and are aligned NW to SE, but some bifurcate and some are curved. Ridges are up to 3 m high and 300 m long. Their glaciolacustrine clays commonly have inclusions of sand and gravels. Ridges in the upper part of the valley are more prominent than at the creek mouth and many of the hollows between them have seasonal or perennial ponds, often with surrounding fringes of wetland. **Figure 2-1**, from Vreeken (1994A), shows the ridge pattern in the study area and on both sides of the West Branch. The wet hollows between ridges show very clearly on infrared images e.g. those taken in 1990 (**Figure 2-2**).

The formation of the parallel ridges during deglaciation was discussed by Vreeken (1994 A). The generally accepted theory is that an icesheet may have pressed into soft sediments as a post-glacial lake drained.

The stratigraphy of surficial deposits is known from boreholes. On the east side of the creek DBA Engineering made 14 pits with a backhoe in 2003; in areas free from fill the profile consisted of topsoil overlying silty clay or silty sand. Clay was described as grey, soft or stiff, and sand was described variously as having trace organics or cobbles and was brown in places. In one test pit, sand was observed to be flowing at the bottom at a depth of 3.5 m. (DBA Engineering 2003).

Six boreholes were made parallel to the Dupont railway spur line south of the study area in 1998. The limestone was found at a depth of 3 to 5 m, sloping to the south and east. Deposits covering bedrock were described as rock fill with clay, and organics such as peat, wood and cattails. "It appears that these sites has been infilled over the former alluvial lake bed [sic]" (INSPEC-SOL 1998).



Distribution of clay ridges in the Little Cataraqui Creek valley near Kingston, Ontario (W.J. Vreeken, unpub. data, 1992).

Figure 2-1: Ridges and scarps from Vreeken, 1994 *"Reproduced with the permission of the Minister of Public Works and Government Services Canada, 2004 and Courtesy of Natural Resources Canada, Geological Survey of Canada."*

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2.3 SOILS AND SEDIMENTS

Soil in the study area includes Napanee and Lansdowne clays and organic deposits (**Figure 2-3**, Gillespie *et al.* 1966). The County Soil Capability map (Gillespie *et al.* 1966) shows a wide swath of organic soil in the valleys of the main branch and west branches of the creek. It is described as "fine textured", overlying till or lacustrine sediment. This area mapped as organic soil is more extensive than the floodplain area mapped by OMNR and Environment Canada in 1987 and very similar to White's swamp and marsh zones in this report.

Peat was found in a boring made immediately south of the Bath Road bridge (Vreeken 1994B) and is the obvious top layer in much of the cattail marsh.

Sediment was briefly described by Ollson and Reimer (2000) at their sampling points CAT 12, 3 m south of Bath Road on the east bank, and CAT 13 north of the Front Road bridge, 2 m from its east wing wall. At the Bath Road the description was "very light decayed matter mixed with very little sediment", and at Front Road "mud with some organic matter". The sampling date was November 1999. This report contains excellent photographs of the sampling sites.

Percent loss on ignition and bulk density were estimated from several vegetation zones in the marsh by Environment Canada (2004). Bulk density ranged from 0.13 to 0.87 $gm.cm^{-3}$ and loss on ignition from 12.7 to 54.5%. These values are typical of soils from clayey meadows and from peat under emergents.

Other Lake Ontario riverine wetlands are characterized by extremely patchy deposits of peat, gyttja, clay, silt, sand and gravel so that the Little Cataraqui marsh sediments fit a regional pattern (Johnson 1972; Greig 1989; Dushenko 1990; Crowder *et al.* 1996). The Little Cataraqui valley, however, appears to lack deposits of marl, which is common in local marshes (Vreeken 1981). The Great Cataraqui Marsh, in eastern Kingston, has been intensively studied and its sedimentary record shows evidence of periods when it has been an emergent marsh accumulating peat and periods when is was an open-water lagoon accumulating gyttja; its rapid changes of state were probably due to past climatic fluctuations (Dalrymple and Carey 1990; Crowder *et al*. 1996). It is reasonable to assume that the Little Cataraqui valley has undergone similar changes.

2.4 HYDROLOGY

The Little Cataraqui is a riverine coastal Great Lakes marsh. Its level as far up as Counter Street is controlled by the level of Lake Ontario (S. Knechtel, pers. comm. 2004). Lake Ontario is controlled by (1) seiches and storms, with an amplitude of centimetres or decimetres, lasting a few days (2) seasonal changes generally varying by about 0.5 m in six months (3) differences up to 1 m resulting from the annual balance of precipitation and evaporation, and (4) long-term oscillations of 0.5-1 m with periods of the order of 200 to 300 years, presumably due to climatic changes (Crowder *et al*.1996). See **Figure 2-4**.

"Fractal analysis of the historical record of mean annual water levels in Lake Ontario indicates that water levels vary continuously at all temporal scales, so that it is inappropriate to speak of discrete periods or cycles. Lake Ontario wetlands are described as 'pulse stabilized' rather than cyclic." (Crowder *et al*. 1996). Predictions on the effects of global warming vary from a rise in lake level of 1.5 m to a drop of the same magnitude. The current regulation of Lake Ontario is designed to keep lake levels within a range of 1.2 m but they actually have a range of approximately 2 m (IJC Levels Reference Study Board 1993). **Figure 2-4** shows historic lake levels.

The creek flow is considered insignificant in controlling long-term levels of water in the marsh, but obviously affects short-term fluctuations. Runoff from summer rain created a measured flow of 610cfs at the outlet in the 1970s (Crysler and Lathem 1976). The peak from snowfall was less, at 400cfs. The main flow was in the East Branch (369 cfs).

Figure 2-2: Ridges and ponds on a 1990 infrared image. *Source: Cataraqui Region Conservation Authority, 1990 infrared air photographs from Centre for Remote Sensing*

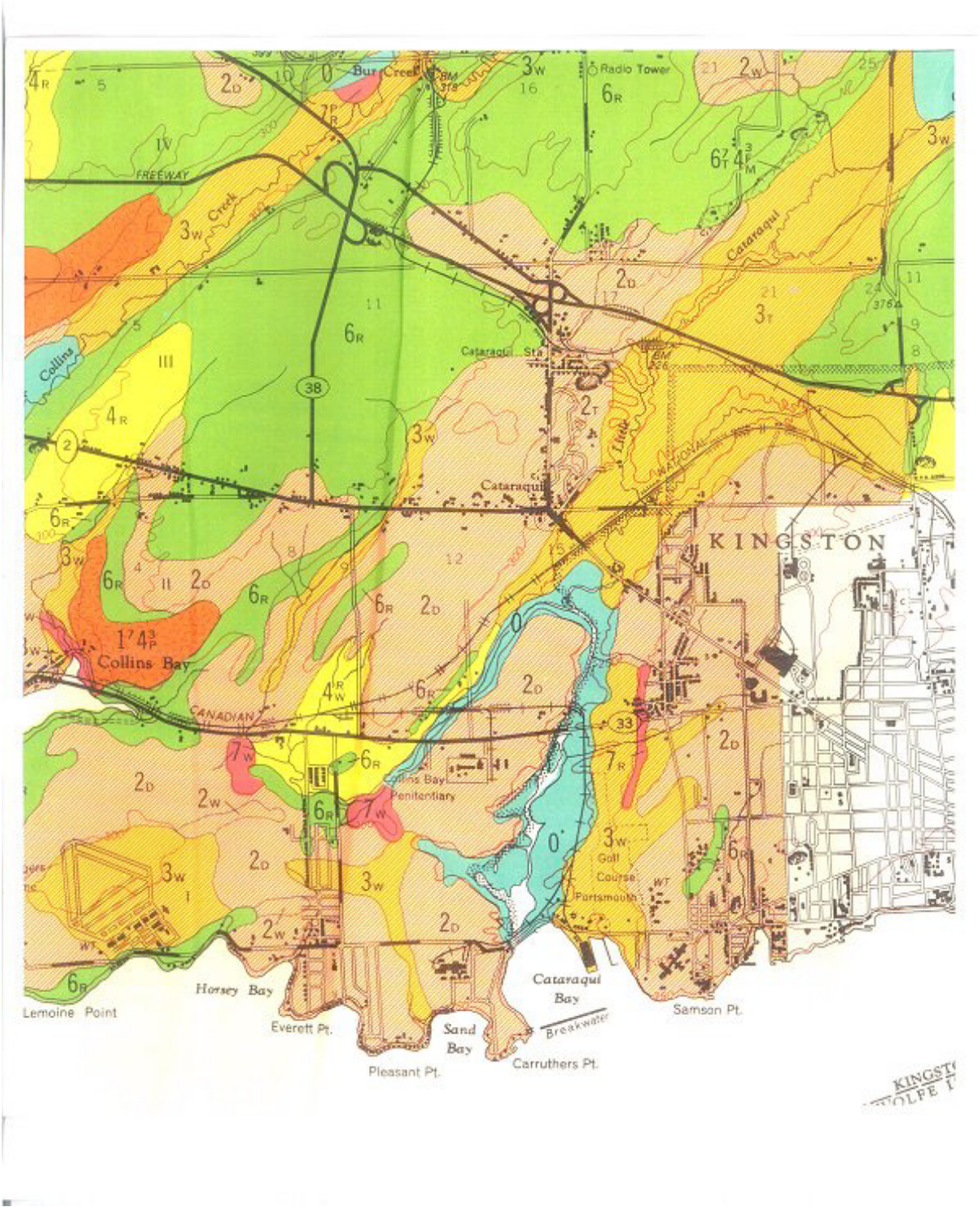

Figure 2-3: Soil capability map showing organic soil on both sides of the Little Cataraqui valley, from Gillespie, 1966. Shading shows "organic soil" (0) along the Little Cataraqui Creek; Numerals 1-7 refer to potential agricultural use, with 1 being optimal.

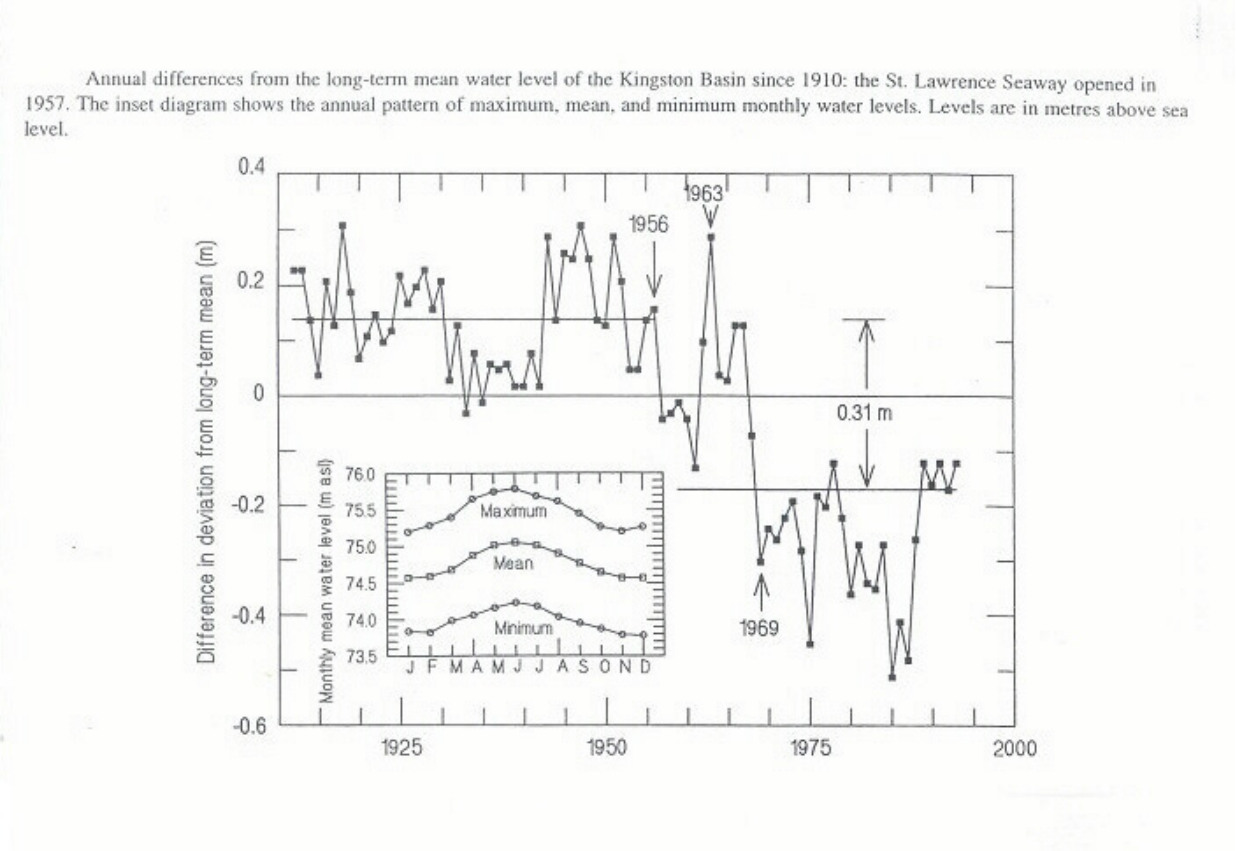

Figure 2-4. Lake Ontario water levels; annual cycle and differences from the long-term mean, from Crowder *et al.* 1996. Reproduced with permission of the authors.

The influence of the watershed on the creek is apparent during flooding. Extensive flooding occurred in the 1950s and 1960s, for example, during Hurricane Hazel in October 1954 (CRC Report 1968). A report by James MacLaren Ltd specified the potential for flood control of a reservoir which was later constructed in the Cataraqui Region Conservation Authority headquarters area, and also discussed the possibility of a weir on King Street which was not approved. Subsequently, in 1982, a stormwater pond was made to control runoff into the West Branch at the Cataraqui Town Centre (Anderson *et al.* 1996). Although flooding has been greatly reduced, occasional rapid storm events occur, and one such was recorded by a crew at the stormwater pond in the 1990s.

The study area, the west bank between Bath and Front Roads, receives runoff from six small creeks, the longest of which is approximately 800 m. These creeks are clearly shown on **Figure 2-5**, from OMNR Natural Resource Values Information System Map, 2003. Drainage to the East and West Branches is separated by only approximately 200 m; this distance can be noted on Figure 2-1 between the clusters of ridges.

Drought is a hazard in eastern Ontario, but the influence of Lake Ontario maintains ground water levels in the study area. The closest work on seasonal water levels in a Great Lakes marsh has been on Wolfe Island (Dalrymple and Price 1994). The authors found that during part of summer the cattail upper zones depended on rainfall, and presumably a similar seasonal pattern occurs in the Little Cataraqui valley.

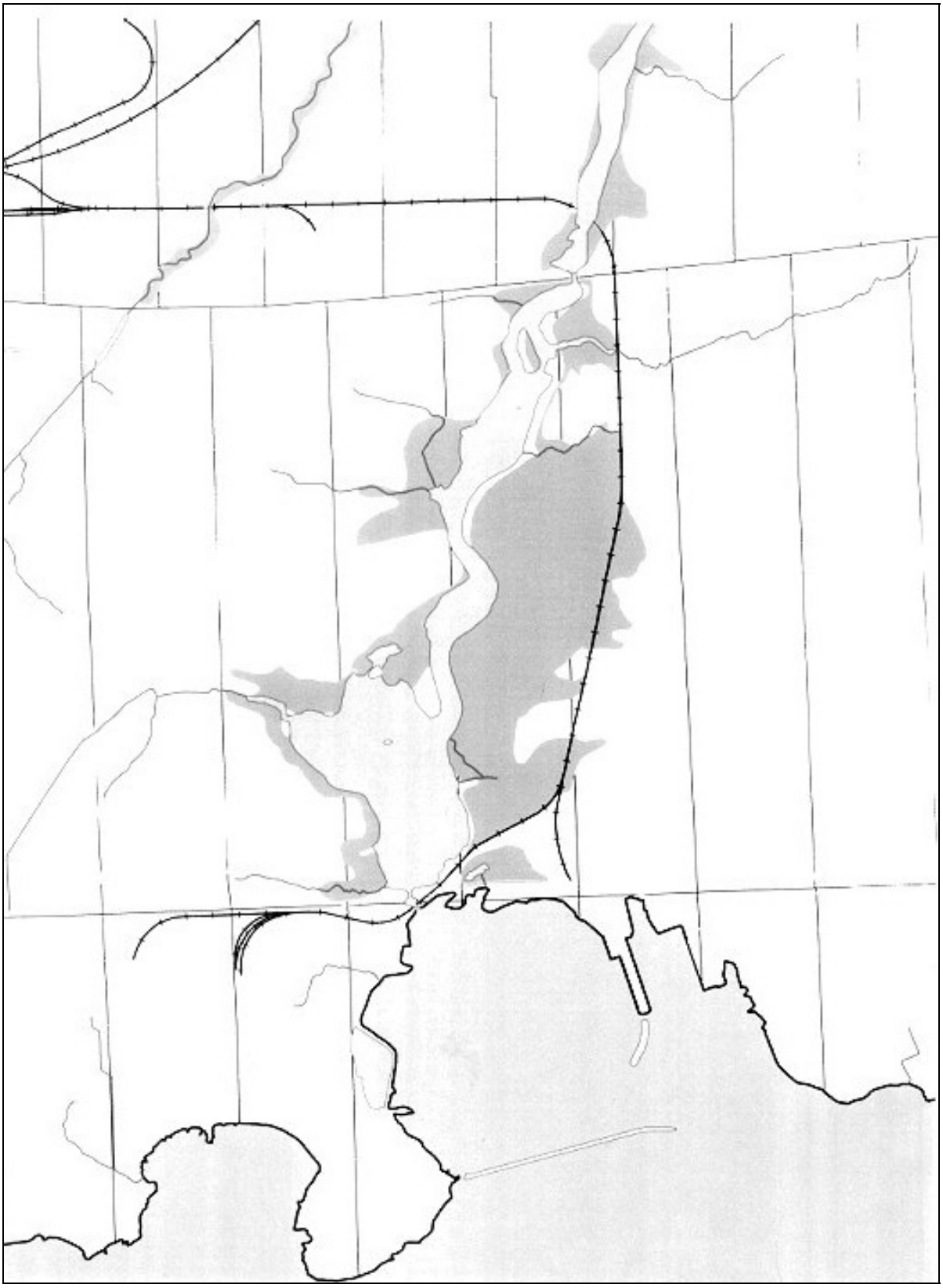

Figure 2-5. Tributary streams, OMNR Natural Resource Values Information System Map, 2003

2.5 HISTORICAL CHANGES IN HYDROLOGY

Great Lakes riverine marshes historically were pulse stabilized, with large fluctuations in water levels, subject to storm surges and strong wave action at times. High plant diversity is considered to have depended on such changes, and their loss can result in the growth of large stands of emergents, such as cattails, with low species richness (Wilcox 1993). However, while some organisms thrive in a dynamic situation, others such as wild rice benefit from stable wetlands (Planck 1993).

The Little Cataraqui river mouth has been greatly changed. A berm was built across the bay, presumably to protect shipping. The river mouth was bridged by road and rail, and in the 1960s the road bridge was doubled in width. The effect of these changes has been to diminish fetch; McLaughlin (1993) found that coastal marshes in the Bay of Quinte which had low fetch values had organic sediment as their most common substrate whereas inorganic sediment was deposited on more exposed shores. In the case of the Little Cataraqui valley, muds or muck have been deposited on the west bank as a result of the loss of storm surges. The mouth now has fine sediment (Snetsinger, pers. comm.).

Extensive growth of cattails had occurred as early as 1953, when part of the channel was closed by floating mats (**Figure 2-6**). The increase in area of cattail mats could have been due to eutrophication in addition to the bottling up of the creek mouth. On the whole, air photographs show little change in the extent of marsh in the study area, although north of the Bath Road open water occupied a larger area in the 1950s.

2.6 WATER CHEMISTRY

Water quality at the mouth of the creek was examined in 2003 as part of a comparative study of Lake Ontario marshes in the Durham region and further east (Grabas 2003; Environment Canada and Central Ontario Conservation Authority 2004). The report gives details of methodology. The following summary values are from the report:

- pH ranged from 7.35 to 7.81, a value typical of Lake Ontario water.
- Alkalinity similarly was typical at 100-175 mg L^{-1}.
- Total conductivity (a useful measure of all the solutes in the water) was 0.39-1.088 mS cm^{-1} with a mean of 0.522. This compares with means of 1.09 for Parrott's Bay and 0.238 for Hay Bay South.
- Turbidity was measured in Nepho-lometric Turbidity Units (NTUs); this is a useful measure when Secchi Disc values are limited by the depth of water. This occurs in the Little Cataraqui where the SD values of less than 1 m coincided with the bottom. Mean NTU was 8.4-48.1. A value exceeding 30 NTU is considered excessive as insufficient light then reaches the bottom for growth of good macrophyte beds, which are valuable fish habitat.

Both sediment particles and algae cause turbidity. The Little Cataraqui sediments are resuspended by carp (D.J. White, pers comm.). Algal content, represented by chlorophyll a, was highly variable, but the mean value of 9.1 μg L^{-1} was comparable to that at Parrott's Bay and sites on Wolfe Island, and less than such sites as Oshawa Second Marsh, Bowmanville or Frenchman's Creek.

2.7 SEDIMENT CHEMISTRY

A current study led by Dr. V. Remenda is investigating carbon cycling in the marsh. Changes in CO_2 and CH_4 emission rates and in biogeochemical production pathways are being measured, largely in relation to climatic change (Bishop *et al*. 2004).

Concentrations of the following elements in stream sediments were estimated at Bath Road

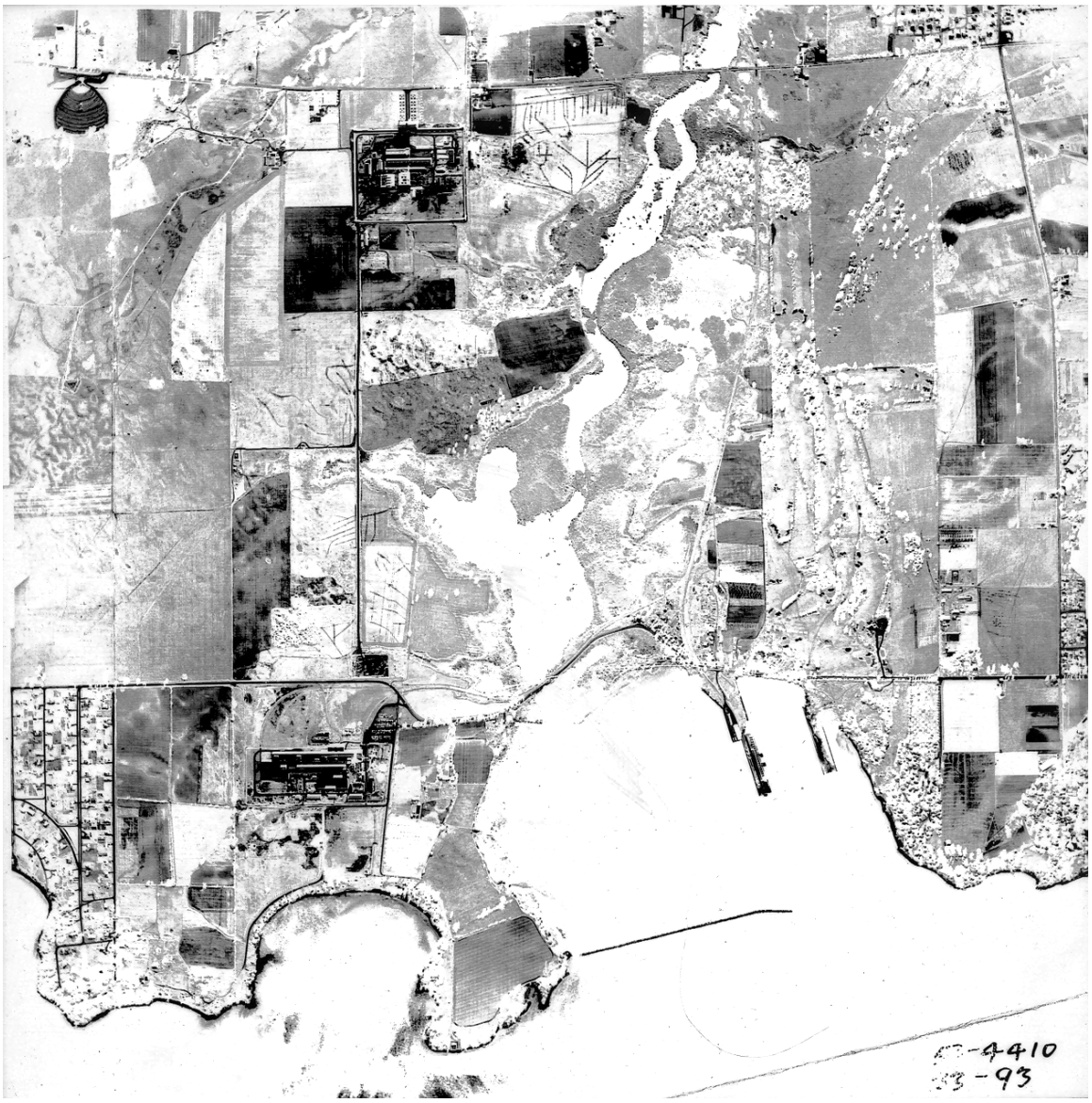

Figure 2-6. 1953 Aerial photograph showing a former distribution of cattail marsh blocking the channel.

(CAT 12) and Front Road (CAT 13) by Ollson and Reimer in November 1999:Al, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Pb, Mg, Mn, Mo, Ni, Sr, V and Zn. At both sites the Fe concentration exceeded guidelines for protection of aquatic life, with concentrations of 0.83 and 0.73 mgL^{-1} respectively. At both sites Mn concentrations were also high.

Because the metals were not speciated it is not easy to estimate whether they are likely to affect aquatic biota. It seems more likely that Na and Cl concentrations, which were not measured by Ollson and Reimer, have an impact on plants and invertebrates. High salt concentrations have been found in local streams, especially during spring runoff and near roads (Dushenko *et al*. 1989; Dushenko 1990; Crowder and Mc-Laughlin 1993).

Organic contaminants analysed by Ollson and Reimer were Aroclor1254, Aroclor 1260, total PCBs and percent oil and grease. Sites CAT 12 and 13 exceeded the interim sediment quality guideline and the provincial lowest effect level for aquatic organisms for PCB-Aroclor1254 (ranging from 0.1 to 0.2 ppm). The authors concluded that these sites in our study area, and another near the railway station, deserve further study.

2.8 REFERENCES

Anderson, B.C, W.E Watt, J. Marsalek and A. Crowder. 1996. Integrated urban stormwater quality: field investigation at a best management facility. Can. Water Res. J. 21:165-182.

Bishop,F., D. Lin and J. McIlveen. 2004. *Evaluation of Wetland Gas Emissions.* Department of Geology, Queen's University, Kingston.

CRC. 1968. *Cataraqui Region Conservation Report.*

Crowder, A. and A. McLaughlin. 1991. Salt in water and sediments in spring 1989. Bay of Quinte RAP Monitoring Report #3:855-86. Ontario Ministry of Environment.

Crowder, A.A., J. P. Smol, R. Dalrymple, A. Gilbert , A. Mathers and J. Price. 1996. Rates of natural and anthropogenic change in shoreline habitats in the Kingston Basin, Lake Ontario. Can. J. Fish. Aquat. Sci. 53:121-135.

Crysler and Lathem. 1976. *Little Cataraqui Creek East Branch Floodplain Mapping.* Cataraqui Region Conservation Authority, Kingston.

Dalrymple, R.W. and J.S.Carey. 1990. Water-level fluctuations in Lake Ontario over the last 4000 years as recorded in the Cataraqui River lagoon, Kingston, Ontario. Can. J. of Earth Sci. 27 :1330-1338.

Dalrymple, R.W. and J. S. Price. 1994. Evolution and hydrology of wetlands in the Cataraqui Lagoon, Kingston. In (ed. R. Gilbert) *A Field Guide to the Glacial and Postglacial Landscape of Southeastern Ontario and part of Quebec*. Geological Survey of Canada Bulletin 453:50-54.

Dhillon Burleigh and Associates (DBA Engineering) 2003. *Geotechnical Investigation, Trailhead Place, Kingston, Ontario.* Project 52257-0011. Kingston, Ontario.

Dushenko, W., A. Crowder and J. Greig. 1989. Shoreline distribution of contaminants and submerged macrophytes in the Bay of Quinte. In (ed. M. Bardecki and N. Patterson) *Wetlands, Momentum or Inertia*. 377-384. Federation of Ontario Naturalists, Don Mills.

Dushenko, W.T. 1990. Physical and chemical factors affecting nearshore aquatic vegetation in the Bay of Quinte. Ph.D. thesis. Queen's University, Kingston.

Environment Canada and Central Ontario Conservation Authority. 2004. *Durham Region Coastal Wetland Monitoring*. Year 2 Technical Report. Downsview.

Gillespie, J.E., R. E. Wicklund and B.C. Matthews. 1966. *The Soils of Frontenac County*. Report #39, Ontario Soil Survey Ontario Department of Agriculture, Toronto.

Greig, J. 1989. Distribution of selected elements in substrates, plants and snails from marshes in the Bay of Quinte, Ontario. M.Sc. thesis. Queen's University, Kingston.

I.J.C. Levels. 1993. International Joint Commission Levels Reference Study Board. Windsor.

INSPEC-SOL. 1998. *Preliminary Report On Proposed Rail Bridge Rehabilitation*. Front Street and Little Cataraqui Creek. Report for Dupont Engineering, Kingston.

Johnson, L. M. 1972. A geochemical study of Deadman Bay near Kingston, eastern Ontario. M.Sc. thesis. Queen's University, Kingston.

MacLaren, James. See CRC 1968.

McLaughlin, A. 1993. Submergent wetland distribution in the Bay of Quinte, a link to abiotic factors and emergent wetland distribution. M.Sc. Thesis, Queen's University, Kingston, Ontario

Ollson, C. and K. Reimer. 2000. *Sediment And Water Quality Study Of Little Cataraqui Creek, Kingston, Ontario*. Royal Military College. RMC-CCE-ES-00-10 Kingston.

Planck, J.T. 1993. Historic wetland changes in the Great Lakes. Great Lakes Wetlands 4:33-7.

Vreeken, W.J. 1981. Distribution and chronology of freshwater marls between Kingston and Belleville, Ontario. Can. J. Earth Sci. 18: 1228-1239.

Vreeken,W.J. 1994A. Ridged glaciolacustrine clay terrain near Kingston, Frontenac County. In (ed. R. Gilbert) *A Field Guide to the Glacial and Postglacial Landscape of Southeastern Ontario and part of Quebec*. Geological Survey of Canada Bulletin 453 :23-26.

Vreeken, W. J. 1994B. Holocene lacustrine marl and peat sediments at Dry Lake, Hastings Co. In (ed. R. Gilbert) *A Field Guide to the Glacial and Postglacial Landscape of Southeastern Ontario and part of Quebec*. Geological Survey of Canada Bulletin 453: 36-40.

W. Wilcox, D.A. 1993. Effects of water level regulation on wetlands of the Great Lakes. Great Lakes Wetlands 4:1-2.

3.0 LAND HISTORY

3.1 LAND HISTORY: PAST

Sharon Critchley

ACKNOWLEDGEMENTS

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3.1.1 HISTORY

This land history will focus on the impacts of human habitation on the natural environment: first, on Eastern Ontario, then, on the Kingston area.

The retreat of ice associated with the last ice age occurred about 11,000 years ago. Human habitation of Eastern Ontario dates back approximately 9,000 years, when small groups depended on plants and large animals for food, clothing and creation of shelters (Cataraqui Archeological Research Foundation, 2004; Wright 1995). Agriculture in Eastern Ontario began around 1000 years ago and was well developed by the time of European contact, circa 1600. Land was cultivated; trees were killed by a bark-stripping process; brush was removed and burned for fertilizer (Ray 1996). Crops of corn, beans and squash complemented a diet of animals, fish and wild berries. Some villages required trees for the construction of palisades. Prior to European contact in the 1600s, the population of the Eastern Great Lakes and St. Lawrence Valley was under 150,000. (Ray 1996).

A report on Cataraqui Marsh on Great Cataraqui River (Blancher 1984) includes information from Cataraqui Archeological Research Foundation on 4 prehistoric sites dating from 500 to 1300 along the Great Cataraqui River. No registered archeological sites were reported by SNC-Lavelin (1999) on the Correctional Service of Canada lands in the study area.

In the 1700s, the Mississauga Ojibwa eventually controlled much of southern Ontario. In Eastern Ontario, this was achieved by agreement with the Iroquois. After the American Revolution, Major John Ross was moved from Oswego to re-establish Cataraqui, formerly Fort Frontenac, now downtown Kingston (Osborne and Swainson 1988). Intending to settle people loyal to the British Crown in this area, he signed the Crawford Purchase, October 1783, with the Mississauga. This treaty covered an area extending to 30 miles inland between Gananoque and the Trent River.

On 27 October 1783, John Collins, Deputy Surveyor, reported on the survey of Kingston Township, which extended west from the settlement of Cataraqui (present-day Kingston) to Collins Bay, north about 9 miles, then east to the Great Cataraqui River and south to the settlement of Cataraqui (Patterson 1985). The Little Cataraqui River [sic], emptying into Lake Ontario, was centrally located in Kingston Township with two tributary branches. It was reported navigable to the northern surveyed reach of the township and capable of supporting saw mills. Trees mentioned in the survey report were maple, bass, hickory, ash, elm, pine and white oak, some with a diameter of 2.5 to 3 feet. The surveyed land was divided into 200-acre lots, and later divided again into 100-acre lots and smaller parcels by 1878 (Meacham & Co. 1878). During the first year of Loyalist settlement in Kingston Township, the clearing of 86.5 acres for agriculture was reported (Patterson 1985). Thus began the systematic removal of forest cover and the cultivation of the soil to grow crops and pasture livestock.

Development along Little Cataraqui Creek included the building of roads, bridges and mills. By 1793, a carriage road along the Second Concession (Highway 33 or Bath Road) linked Kingston to Collins Bay and Bath (Patterson 1985). In 1811, there were plans for a bridge

over the Little Cataraqui River. Highway 2 or the Kingston Road was completed in 1817 with a branch through Waterloo (present day Cataraqui) Village and Napanee. W. Lemoine was one of the petitioners to council in 1842 for the construction of a bridge across Little Cataraqui Creek at the present day Front Road. By 1846 sawmills existed on many local watercourses including one on Little Cataraqui Creek. One of the first commercial grist mills was Purdy's Saw and Grist Mill on Little Cataraqui Creek east of Waterloo Village. Around the early 1900s, Little Cataraqui Creek was no longer navigable to the mill because it was infilling with "marsh and cattails" (Patterson 1985).

The Kingston Field Naturalists study area includes the wetlands and associated vegetation on the eastern edge of the Frontenac Institution farm as well as a remaining woodlot on these lands. The study area area also includes lands now owned by Cataraqui Region Conservation Authority and the open water of Little Cataraqui Creek.

The lands currently owned by the Government of Canada and occupied by Correctional Service of Canada (CSC), south of Bath Rd. were purchased in 1930, 1931 and 1958, primarily from individuals and families and comprised parts of 5 lots (SNC-Lavelin 1999). Land ownership in the area had been patented between 1798 and 1812 and it remained a rural agricultural area until the construction of Collins Bay Institution, where the inmates operated a farm on the property. Various agricultural facilities were erected from the 1940s to 1960 when a separate minimum security facility was established called the Collins Bay Farm Annex (Johnson 2002; CSC website). In 1975-6, the farm operation was renamed Frontenac Institution (CSC website). In 2004 the farming operation covers about 240 hectares and includes dairy cows, laying hens and field crops required for the livestock operations. Solid manure is composted on site (C. Stafford, pers.comm.).

In 1940, Canadian Industries Ltd. purchased land adjacent to the outlet of Little Cataraqui Creek from individuals and families (SNC-Lavelin 1999). By court order this company location became Dupont Company of Canada in 1954 (Patterson 1985). A small piece of the original property is located on the north side of Front Road adjacent to Little Cataraqui Creek. In 1966, a plan of subdivision was registered for an access road and six lots on this land (CRCA files; Gerald Dyer pers. comm.). However, in 1991, Dupont Co. donated the land to the Cataraqui Region Conservation Authority, stipulating that the lands shall be used as "conservation land . . . for the objects of the conservation, restoration, development and management of natural resources" (CRCA files: land registration document).

Little Cataraqui Creek and its associated wetlands have been subject to various proposals for draining, filling and channelizing according to newspaper reports. In 1960, a study looked at the costs of "reclaiming" (i.e. filling and chanelling) Little Cataraqui Creek north and south of Princess Street (Kingston Field Naturalists, Archives). In 1964, there was a proposal to "study ways to channel little Cataraqui Creek, to drain properly the flow of its entire basin, prevent the creation of swamps or other undesirable conditions and that as much adjacent land as possible be made available for residential recreational and institutional purposes" (KFN Archives). Neither of these plans succeeded as proposed, but filling and channelization have been done on sections of Little Cataraqui Creek wetland. A brief tour of various crossings of Little Cataraqui Creek wetland close to the KFN report area reveals fill placed to re-align or build road crossings (Front Rd., King St., Bath Rd.), to accommodate commercial development (Bath Rd, south side, east of creek), to build rail access (Little Cataraqui Creek wetland, east side, Front Rd. to Bath Rd). Currently, the Official Plan of the former Kingston Township, which remains in effect, has a proposed extension of Centennial Drive which would enter the Correctional Service of Canada lands on Bath Rd. and proceed south to Front Rd. traversing the wetland. Chemical contamination, the intrusion of alien species and the construction of a breakwater/berm and docks in Cataraqui Bay are other factors affecting the study area.

3.1.2 REFERENCES

Blancher, P.J. 1984. *Natural Resource Description and Management Considerations, Cataraqui Marsh-Rideau Canal.* Parks Canada, Ottawa, Ontario

Cataraqui Archeological Research Foundation. 2004. Website: **http://www.carf.info**

CSC website: **http://www.csc-scc.gc.ca/text/facilit/institutprofiles/frontenac_e.shtml**

Dyer, Gerald, Director of Research, Dupont Canada in 1980s, personal communication

Johnson, Dana. 2002. *Twenty-five buildings, Collins Bay Institution, 455 Bath Road, Kingston, Ontario.* Federal Heritage Buildings Review Office. Ottawa, Ontario.

Kingston Field Naturalists. Archives. Queen's Archives. A. Arch 5008.11 Box 3 of 4, File No. 50.

Meacham, J.H. & Company. 1878. *Illustrated Historical Atlas of the Counties of Frontenac, Lennox and Addington, Ontario.* Re-published 1972 Mika Silk Screening, Belleville, Ontario

Osborne, Brian S. and Donald Swainson. 1988. *Kingston: Building on the Past.* Butternut Press Westport, Ontario.

Patterson, Neil A. (ed.) 1985. *History of the Township of Kingston.* Brown & Martin Ltd., Kingston, Ontario

Ray, Arthur, J. 1996. *I Have Lived Here Since the World Began.* Lester Publishing Ltd. and Key Porter Books, Toronto, Ontario.

SNC-Lavelin Engineers & Constructors Inc. 1999. *Baseline Environmental Data, Frontenac Institution.* Public Works and Government Services Canada, Environment–Ontario Region.

Stafford, C.L., Assistant Warden, Frontenac Institution, correspondence.

Wright, J.V. 1995. *A History of the Native People of Canada. Volume I (10,000-1,000 B.C.)* Canadian Museum of Civilization. Hull, Quebec.

3.2 LAND HISTORY: RECENT

Carolyn Bonta

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3.2.1 LITTLE CATARAQUI CREEK MARSH AND THE KINGSTON WETLANDS WORKING GROUP

In 1995, the Kingston Wetlands Working Group (KWWG) was formed among local organizations and agencies cooperatively promoting wetland education and restoration in the Kingston bioregion. Members of the group include: Canadian Forces Base–Kingston, Cataraqui Region Conservation Authority, Correctional Service of Canada, City of Kingston, Ducks Unlimited, Environment Canada, Frontenac Stewardship Council, Kingston Field Naturalists, Loyalist Township, Ontario Ministry of Natural Resources, and Parks Canada–Rideau Canal. The KWWG's mission is "*Protecting and restoring wetland ecosystems in the Kingston area through public education, good stewardship, and cooperative action*" (2003-05 KWWG Strategic Plan). The Little Cataraqui Creek Marsh wetland has been a priority area for KWWG work.

A *Little Cataraqui Creek Wetland Restoration and Monitoring Manual* was prepared for Environment Canada and the KWWG in 1997 (Snetsinger), and made several recommendations for restoring this Provincially Significant Wetland to a healthier state. Many recommendations for restoration activities in and near the Study Area, defined as the west side of the Little Cataraqui Creek Marsh between Front and Bath Roads, have since been implemented.

In 1999, the KWWG initiated the Frontenac Restoration Project on lands near the Study Area. This project restored and enhanced a historic wetland that was once part of Little Cataraqui Creek Marsh's west branch, on the Correctional Service of Canada (CSC)'s Frontenac Institution farm property. This historic wetland was situated near the current junction of Bath and Days Roads (southeast corner), and its restoration was recommended in the *Restoration and Monitoring Manual* (Snetsinger 1997). As part of the Frontenac Project, Ducks Unlimited maintains high water levels in five ponds covering 9.7 acres; 7.3 acres of additional wetland habitat is also present at the site. Cattle access to these wetlands has been restricted, and a flushing bar is used during haying to help protect nesting waterfowl.

The Little Cat Restoration Project expanded the scope of the Frontenac Restoration Project to cover a wider area of the Little Cataraqui Creek Marsh. Running from 1999 to 2003, this ambitious project was funded primarily by Environment Canada's *EcoAction* program and by in-kind support from KWWG partners. Landowner education and water quality improvement were the main focus of the Little Cat Restoration Project. This project concentrated extensively on establishing buffers of native vegetation (as per the *Restoration and Monitoring Manual* recommendations [Snetsinger 1997]) along east and west branches of the Little Cataraqui Creek, on both public and private lands. In its first two years, the project had a goal of planting 4,000 shrubs and 30 trees and stabilizing 1,000-1,200 m of creek bank along the creek's west branch; this goal was exceeded by the planting of more than 1,300 m of creekbank. In the second phase of the project, 4,424 native trees and shrubs were planted, covering an area of 0.72 acres and including 965 m of riparian woody vegetation.

3.2.2 WETLAND ENHANCEMENT AND OTHER PROJECTS ON THE STUDY AREA

Wetland enhancement projects have also taken place directly on the Study Area. In 1997, an

Osprey *(Pandion haliaetus*) nest platform was erected by the KWWG (with the Ontario Ministry of Natural Resources as the lead) on the Cataraqui Region Conservation Authority's land near the mouth of the creek. Osprey, have actively used this platform since 2002, and are believed to have successfully fledged young in 2003 and 2004 (R. Weir, pers. obs.). In 1999, 12 Wood Duck nest boxes were installed by Ducks Unlimited along the eastern edge of the cattails throughout the lower reaches of the Little Cataraqui Creek, between Front Road and Princess Street. These boxes are used by Wood Ducks, *Aix sponsa* (R. Weir, pers. comm.) and other common cavity nesting birds. Eight of these boxes remain (none of which are within the Study Area), and are maintained by the Kingston Field Naturalists youth.

The *Restoration and Monitoring Manual* (Snetsinger 1997) also made specific recommendations for CSC's Frontenac Institution farm lands on the Study Area, including 30 m wide buffer plantings along the main wetland, particularly at the north end of the property. This was attempted in the KWWG's Little Cat Restoration Project, but the buffer has repeatedly been mowed, and only a few large-stock trees remain. Excavation of the wetland extension near the southeast corner of the property was also recommended, but has not occurred. A final recommendation for wetland restoration on the Study Area was channel cutting in the cattails, and the Cataraqui Region Conservation Authority is currently in the process of arranging this work for 2005.

3.2.3 WETLAND CONSERVATION ON THE STUDY AREA

Within the Study Area, there is one parcel of public land dedicated to conservation, which is owned by the Cataraqui Region Conservation Authority. This parcel, known internally as the "Dupont Land" in recognition of the donor (see **Section 3.1.** "Land History–Past"), protects wetland and meadow habitats near the mouth of the Little Cataraqui Creek.

The remainder of the wetland on the Study Area is under a renewable, 10-year Memorandum of Agreement between the CSC and Environment Canada. The current Agreement came into effect on 15 April 2000, with the purpose of allowing for the "*wise use and management of the federal portion of the valuable wetland complex on the Little Cataraqui Creek"* (Memorandum of Agreement, April 2000). The Frontenac Institution agrees to conserve the wetlands, while the Environmental Conservation Branch, Ontario Region of Environment Canada acts as wetland conservation advisor. Further wetland habitat enhancement will be considered, should the opportunity arise (Memorandum of Agreement, April 2000).

3.2.4 REFERENCES

Kingston Wetlands Working Group. 2003. *Kingston Wetlands Working Group Strategic Plan 2003-05.*

Kingston Wetlands Working Group. 1999. *Factsheet:* Frontenac Restoration Project.

Memorandum of Agreement Between the Correctional Service of Canada and Environment Canada. RE: CSC–Frontenac Institution, Kingston, Ontario. Conservation of Wetlands, Little Cataraqui Creek. April 15, 2000.

Snetsinger, R. 1997. *Little Cataraqui Creek Wetland. Restoration and Monitoring Manual. Prepared for Environment Canada and the Kingston Wetlands Working Group*. 72 p.

4.0 BIOTA

4.1 VEGETATION AND FLORA

David J. White

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First, I would like to thank Sharon Critchley, Conservation Chair, Kingston Field Naturalists, who supervised the study and attended to a multitude of administrative details. Maggie Galloway, Canadian Wildlife Service, Downsview, provided maps and data based on detailed studies of the Little Cataraqui Creek wetland. Robert Gerritsen of the Cataraqui Region Conservation Authority formatted the digital topographic data on which the large-scale map is based. Adèle Crowder, Queen's University provided background information. Ross Chomondeley, Ontario Ministry of Natural Resources, Kingston, loaned air photos of the area. Carolyn Bonta, also with the Ontario Ministry of Natural Resources, Kingston, provided the new wetland boundary points shown on the large-scale map. Akrum Matuk, Correctional Service of Canada, and Chris Stafford, Frontenac Institution, arranged access to the grounds of the minimum security facility on which much of the study took place.

This report benefited from review of an earlier draft by Carolyn Bonta, Sharon Critchley, Adèle Crowder, Ron Weir, and Robert Stewart—all members of the Kingston Field Naturalists advisory team for the project. Without the help offered by the above-noted people, this study would not have been possible.

4.1.1 INTRODUCTION

The Study Area occurs within the City of Kingston along the west side of the Little Cataraqui Creek Wetland between Bath Road to the north and Front Road to the south (**Figure 1-2**). The Study Area includes upland forest and thicket along the west side of the wetland as well as the wetland communities of the creek as far east as the western edge of emergent marsh vegetation on the east side of the creek. Two somewhat isolated areas near the southwest corner of the wetland just north of Front Road are also included within the Study Area which covers a total of 103.48 ha. The Study Area boundary as shown on the vegetation map **Figure 4.1.1** was expanded in several areas to include all the wetland communities and is thus somewhat different from that shown in **Figure 1-2** and **Figure 1-3**. The Study Area is part of the Little Cataraqui Marsh Complex—a Provincially Significant Wetland (Boxall 1992).

4.1.1.1 Study Objectives

Specifically, this portion of the study was undertaken to meet the following objectives:

- To conduct detailed field investigations in the Study Area to document the flora and vegetation.
- To map and describe the vegetation communities of the Study Area.
- To produce a checklist of the vascular flora of the Study Area.
- To analyse significant species for their local, regional, and provincial context.
- To consider the possible impact of a future road on the vegetation in the Study Area.

4.1.1.2 Study Methodology

The project is based on field work in 2004 in the Study Area, study of previous reports on the wetland, map and air photo interpretation, and contact with knowledgeable people. The study was undertaken in four phases.

Phase One: Pre-field Study

Published and unpublished literature, and topographic maps were reviewed to identify potential areas of significance. The recent wetland map (Environment Canada-Canadian Wildlife Service, 2004) and the 1:10,000 scale air photos were examined and interpreted to identify important areas within the Study Area and to prepare a draft vegetation map. This review provided the basis to plan the field study. Adèle Crowder of Queen's University searched the plant database of *Plants of the Kingston Region* (Crowder *et al.* 1997) for plant records from the Study Area.

Phase Two: Field Study

The field survey took place on 16 June, 11 July, and 12 August of 2004. Seven to eight hours each day were spent in field observation. The field survey consisted of visiting as much of all vegetation types as possible within the Study Area. A handheld Global Positioning System (GPS) unit was used to record significant species and features, and to aid with locating vegetation boundaries. Two of the three field days were spent accessing the site on foot; the third visit (11 July) was spent primarily on the water looking at the wetland communities using a kayak. The two days on foot covered all upland areas of the Study Area each time; however, the actual route taken on each visit was different through most of the zones.

Notes were taken on vegetation classification, the impact of recent disturbances, and special features etc. Running lists were kept of plant species and their abundance in each area. Voucher specimens were collected where necessary to confirm difficult determinations or to document a significant species.

Phase Three: Data Analysis

Information from the literature review, field data, map, and air photo interpretation was integrated to form the basis for the report. Plant specimens collected during the field survey were identified and processed to be donated to the herbarium of Queen's University as vouchers of the study. Published and unpublished literature was consulted to determine the significance of species and vegetation found in the study.

A final interpretation of the air photos was combined with the initial interpretation, field data, and general notes on the vegetation and special features to produce the 1:6,000 scale vegetation map.

Phase Four: Report Preparation

The text of the report was written on an IBM-PC compatible computer using WordPerfect 9 word-processing software and converted to Microsoft Word 97 format. The maps were prepared using ArcView GIS 3.2a. A CD of the computer files of this report has been submitted under separate cover.

4.1.1.3 Study Limitations

- The field study took place during early- to mid-summer. Some spring ephemerals—that mature and decline very early in the season—may have been missed. Plants that mature late in the fall, like some Asters (*Aster* spp.), may also have been overlooked.

- In order to cover the entire Study Area, there was little extra time to thoroughly examine particular locations and few specific areas were surveyed more than once during the field season. Nonetheless, all portions of the Study Area were surveyed at least at a reconnaissance level.

4.1.2 LIFE SCIENCES

4.1.2.1 Vegetation And Flora

The Study Area occurs in central Kingston adjacent to the large farming operation of the minimum security Frontenac Institution. Past and ongoing disturbance from the grounds maintenance and farming operations taking place on the adjacent lands have likely added to the poor water quality that would be expected

from an urban creek. These disturbances have created conditions more suitable for alien flora than native plants. A large Carp population causes continuing disturbance to aquatic communities by extensive uprooting of vegetation. Thus, the flora of the Study Area contains a large number of introduced species and few significant native plants.

In this report, upland and wetland vegetation classification follows the Ecological Land Classification (ELC) system (Lee *et al.*, 1998). The community classification in this report is taken to the level of "Ecosite" but not to the final community level of vegetation "Type" as listed in Lee *et al.,* (1998). Since Lee *et al.*,, (1998) provides a first approximation of the vegetation diversity within Ecoregions 6 and 7, the list of vegetation types is incomplete for most ecosites. Many community associations seen during the field work for this project are simply not listed in Lee *et al.,* (1998). When there are two or more examples of a particular ecosite in the Study Area that differ in dominant species, the examples are put in subcategories ("a", "b", etc.) and described and mapped separately. For wetland communities, the classification used in the *Ontario Wetland Evaluation System* (OMNR 1993) is also given.

The extent of all vegetation types is shown on the large-scale vegetation map. Listed with each vegetation description below is the area covered in hectares and the percentage of that type based on the total area of the Study Area—103.48 ha. These area figures are calculated by the mapping software ArcView GIS that was used for the large-scale map. The area figures for the vegetation types are listed to one-hundredth of a hectare and one-tenth of a percent to show the area covered by some of the more minor vegetation types. This apparent level of accuracy is misleading since many individual areas in the Study Area were too small to delineate at the mapping scale of 1:6,000 and so were included in the most appropriate adjacent community.

One must keep in mind that vegetation occurs as a continuum and not as discrete vegetation 'types'. Many of the sites investigated in this study were somewhat intermediate in nature; however, for the purposes of mapping they were placed in the most appropriate category. As noted above, the vegetation in the Study Area is quite disturbed due to past human activity, poor water quality in the wetland, and the presence of alien flora and fauna. These disrupted communities do not easily fit within the ELC framework.

In early September of 2004, Carolyn Bonta of the Ontario Ministry of Natural Resources mapped the wetland boundary within the Study Area using a handheld GPS unit to record points along the boundary. The points were then fine tuned to smooth the boundary line. The series of points was sent to the author and was added to the large-scale vegetation map. Due to the wetland boundary occurring within a transitional vegetation community (such as Meadow Marsh), due to the inherent inaccuracy of handheld GPS receivers (± 10 m), and due to differences in observer interpretation, the wetland boundary shown on the 1:6,000 scale vegetation map does not exactly coincide with vegetation zone boundaries.

The order of the vegetation types described below follows the order in Lee *et al.,* (1998). Site factors, distribution within the Study Area, and characteristic species are included with each vegetation type. Most trees are listed in this report simply by their common names as they are well known and generally agreed upon. The scientific name is included in parentheses in a few cases where there might be uncertainty. Other plants are always listed with both common and scientific names to avoid any confusion.

Also listed with each vegetation type are the locally significant species found in that type. Refer to **Section 4.1.3.0**, "Significant flora and Vegetation" for definitions of the different levels of significance or rarity.

4.1.2.1.1 Dry-fresh White Pine-Maple-Oak Mixed Forest Ecosite (FOM2): dry to moderately fresh soils. Dominant trees are White Pine, Red Oak, White Ash, Manitoba Maple, and Red Maple. The canopy is tall and semi-open. There is a moderate understorey of

saplings, *Rhamnus cathartica* (Common Buckthorn), and *Prunus virginiana* (Choke Cherry). The ground flora is quite sparse with *Rubus idaeus* ssp. *melanolasius* (Red Raspberry) and young *Prunus virginiana* (Choke Cherry). The mapped zone in the southwest corner of the Study Area covers 0.46 ha or 0.4%.

No significant species were found in the above vegetation type.

4.1.2.1.2 Dry-fresh Oak Deciduous Forest Ecosite (FOD1): dry to moderately fresh soils. The soil in most areas has a well-developed humus layer. There are three areas of this ecosite in the Study Area. **FOD1a** occurs in the north portion along the west side of the wetland. The open canopy is dominated by Red Oak. There is some planted Red Pine and White Spruce around the edges. There is a moderate understorey of *Cornus foemina* ssp. *racemosa* (Red-panicle Dogwood) and *Rhamnus cathartica* (Common Buckthorn). The ground flora is variable in density with the most common species being *Aster macrophyllus* (Large-leaved Aster), *Circaea lutetiana* ssp. *canadensis* (Enchanter's Nightshade), *Impatiens capensis* (Touch-me-not), *Waldsteinia fragarioides* (Barren-strawberry), and *Rubus idaeus* ssp. *melanolasius* (Red Raspberry). **FOD1b** occurs in two areas: in the central part of the Study Area along the west side of the wetland, and in the southwest part of the Study Area in the isolated woodland. The semi-open canopy is dominated by Red Oak, Sugar Maple, Bur Oak, Basswood, Red Maple, Black Cherry, White Ash, White Birch, and Hybrid Soft Maple (*Acer Xfreemanii*). There is a moderate understorey of *Viburnum lentago* (Nannyberry), *Cornus foemina* ssp. *racemosa* (Red-panicle Dogwood), *Prunus virginiana* (Choke Cherry), and *Rhamnus cathartica* (Common Buckthorn). The ground flora is fairly diverse but rather weedy and is dominated by *Aster macrophyllus* (Large-leaved Aster), *Impatiens capensis* (Touch-me-not), *Rubus idaeus* ssp. *melanolasius* (Red Raspberry), *Alliaria petiolata* (Garlic Mustard), *Rubus pubescens* (Dwarf Raspberry), *Parthenocissus inserta* (Virginia Creeper), and *Circaea lutetiana* ssp. *canadensis* (Enchanter's Nightshade). In the isolated woods in the southwest corner of the Study Area, past logging has left a very open canopy in places and the ground is quite moist adjacent to the two small wetland ponds that occur within the woods. The mapped zones cover 3.76 ha or 3.6%.

Locally Significant Plants:
Carex cristatella (Crested Sedge)
Uvularia sessilifolia (Sessile-leaved Bellwort)

4.1.2.1.3 Deciduous Plantation (CUP1): a fencerow in the southern part of the Study Area is planted with Cottonwood (or a hybrid involving Cottonwood as one of the parents). The soil is moist and there is a dense understorey (mostly along the edges) of *Cornus foemina* ssp. *racemosa* (Red-panicle Dogwood) and *Rhamnus cathartica* (Common Buckthorn). There is no ground flora except for a few weeds encroaching from the adjacent fields. The mapped zone covers 0.19 ha or 0.2%.

No significant species were found in the above vegetation type.

4.1.2.1.4 Mineral Cultural Meadow Ecosite (CUM1): several areas of lawn, pasture, hayfield and cropland occur along the edges of the wetland within the Study Area. **CUM1a** is active hay field dominated by *Medicago sativa* (Alfalfa), *Bromus inermis* (Awnless Brome Grass), *Elymus repens* (Quack Grass), and *Phleum pratense* (Timothy). **CUM1b** is lawn dominated by *Poa pratensis* (Kentucky Blue Grass) and *Trifolium repens* (White Clover). **CUM1c** is former pasture that is dominated by *Poa pratensis* (Kentucky Blue Grass), Bromus inermis (Awnless Brome Grass), *Vicia cracca* (Vetch), *Solidago canadensis* (Canada Goldenrod), *Asclepias syriaca* (Common Milkweed), and *Phleum pratense* (Timothy). There is some shrub regeneration, mainly of *Cornus foemina ssp. racemosa* (Red-panicle Dogwood). **CUM1d** is corn field. The mapped zones cover 18.22 ha or 17.6%.

Locally Significant Plant:
Carex pallescens (Pale Sedge)

4.1.2.1.5 Willow Mineral Deciduous Swamp Ecosite (SWD4): There are two examples of this community in the Study Area. **SWD4a** occurs along the west side of the central portion of the Study Area. The ground is moist to wet. The semi-open to closed canopy is dominated by Crack Willow (*Salix fragilis*) with a few Manitoba Maple. There is a limited understorey of saplings, *Viburnum lentago* (Nannyberry), *Vitis riparia* (Wild Grape), and *Cornus foemina* ssp. *racemosa* (Red-panicle Dogwood). The ground flora is moderate and is dominated by *Impatiens capensis* (Touch-me-not), *Parthenocissus inserta* (Virginia Creeper), and *Glyceria maxima* (Great Manna Grass). **SWD4b** occurs near the west end of the south-most west-facing "finger" in the Study Area. The ground is wet with some standing water. The semi-open to closed canopy is dominated by Crack Willow (*Salix fragilis*). There is a very limited understorey of a few saplings. The ground flora is dominated by a dense stand of *Glyceria maxima* (Great Manna Grass). Both of these communities would be classed as Deciduous Swamp in the *Wetland Evaluation System* (OMNR 1993). The mapped zones cover 0.99 ha or 1.0%.

No significant species were found in the above vegetation type.

4.1.2.1.6 Organic Meadow Marsh Ecosite (MAM3): This community occurs in spring-flooded meadows that become drier in summer where the soil is moist but without standing water. Meadow marsh occurs as a variable-width transition between the dry upland fields and the Cattail marsh of the wetland. The community is dominated by a diversity of herbaceous species such as *Phalaris arundinacea* (Reed Canary Grass), *Calamagrostis canadensis* (Canada Bluejoint), *Carex aquatilis* (Aquatic Sedge), *Onoclea sensibilis* (Sensitive Fern), *Impatiens capensis* (Touch-me-not), and *Glyceria maxima* (Great Manna Grass). There is a patchy regeneration of shrubs, such as *Cornus foemina* ssp. *racemosa* (Red-panicle Dogwood), *Spiraea alba* (Meadowsweet), *Viburnum lentago* (Nannyberry), and *Crataegus* spp. (Hawthorns). In places on the uphill or field side, this community grades into a narrow band of Mineral Meadow Marsh Ecosite **(MAM2)** and Cultural Thicket Ecosite **(CUT1)** that are too small to show at the mapping scale of 1:6,000. The dominant shrubs in this upland thicket edge are *Cornus foemina* ssp. *racemosa* (Red-panicle Dogwood), *Viburnum lentago* (Nannyberry), and *Crataegus* spp. (Hawthorns). This community is classed as Meadow Marsh in the *Wetland Evaluation System* (OMNR 1993). The mapped zones cover 13.74 ha and 13.3%.

No significant species were found in the above vegetation type.

4.1.2.1.7 Organic Shallow Marsh Ecosite (MAS3): This community occurs along most of the length of the creek next to the shallow water zone. It is also found in two small ponds within the isolated woods at the southwest corner of the Study Area. Shallow marsh vegetation develops where the substrate is inundated with shallow water most of the season. **MAS3a** is dominated mainly by robust emergent herbaceous species, such as *Typha latifolia* (Cattail), *Typha Xglauca* (Hybrid Cattail), and *Phalaris arundinacea* (Reed Canary Grass). *Lemna minor* (Duckweed) is also common. Frequently there is a narrow strip of *Butomus umbellatus* (Flowering-rush) adjacent to the shallow water zone. **MAS3b** occurs in three locations: just north of the central portion of the Study Area adjacent to an area of MAS3a, just south of the central portion of the Study Area in the long west-facing "finger", and in a small pond in the isolated woodland in the southwest corner of the Study Area. They are all dominated by almost pure stands of *Glyceria maxima* (Great Manna Grass) with some *Typha Xglauca* (Hybrid Cattail). The northmost area of this vegetation type has a fringe of *Spiraea alba* (Meadowsweet) while the southmost area has a fringe of *Ilex verticillata* (Winterberry). **MAS3c** also occurs in a small woodland pond in the isolated woods in the southwest corner of the Study Area and is dominated by a mix of narrow-leaved and broad-leaved emergent species. The dominant plants are *Glyceria striata* (Fowl Manna Grass), *Leersia oryzoides* (Rice Cut Grass), *Cicuta bulbifera* (Bulb-bearing Water-hemlock), *Alisma plantago-*

aquatica (Water-plantain), *Impatiens capensis* (Touch-me-not), *Bidens cernuus* (Nodding Beggarticks), and *Solanum dulcamara* (Climbing Nightshade). The floating-leaved plants *Hydrocharis morsus-ranae* (European Frog's-bit) and *Lemna minor* (Duckweed) are also common. These communities would be classed as Emergent Marsh in the Wetland Evaluation System (OMNR 1993). The mapped zones cover 21.80 ha or 21.1%.

No significant species were found in the above vegetation type.

4.1.2.1.8 Submerged Shallow Aquatic Ecosite (SAS1): This community is common in the central portion of the creek with water depth about one to two metres. The substrate is mostly silt with some very fine peat. In the central portions of the creek, silt predominates; along the edges, fine peat predominates. There is a considerable range of associations. **SAS1a** is dominated by plant species that remain entirely underneath the surface, such as the alga *Chara* sp. (Stonewort), *Potamogeton pectinatus* (Comb-like Pondweed), and *Potamogeton pusillus* (Small Pondweed). There are frequent small patches within this zone that are largely unvegetated. **SAS1b** is also dominated by plant species that remain entirely underneath the surface, such as *Najas flexilis* (Naiad), *Potamogeton crispus* (Curly Pondweed), *Potamogeton pectinatus* (Comb-like Pondweed), *Potamogeton pusillus* (Small Pondweed), and *Elodea canadensis* (Canada Water-weed). This zone also includes the floating-leaved species *Nuphar variegata* (Bullhead-lily) and *Nymphaea odorata* ssp. *tuberosa* (Tuberous Water-lily) that are of scattered occurrence. These communities would be classed as Open Water Marsh in the *Wetland Evaluation System* (OMNR 1993). The mapped zones cover 13.05 ha or 12.6%.

No significant species were found in the above vegetation type.

4.1.2.1.9 Mixed Shallow Aquatic Ecosite (SAM1): This community is the most common association in the creek with water depth about one metre. The substrate is a mixture of silt and very fine peat. In the central portions of the creek, silt predominates; along the edges, fine peat predominates. There is a considerable range of associations, but all are dominated by a mix of plant species that remain entirely underneath the surface, such as *Potamogeton pectinatus* (Comb-like Pondweed), *Najas flexilis* (Naiad), and *Potamogeton pusillus* (Small Pondweed); as well as the floating-leaved *Nymphaea odorata* ssp. *tuberosa* (Tuberous Water-lily). This community would be classed as Open Water Marsh in the Wetland Evaluation System (OMNR 1993). The mapped zones cover 30.50 ha or 29.5%.

No significant species were found in the above vegetation type.

4.1.2.1.10 Floating-leaved Shallow Aquatic Ecosite (SAF1): This community occurs in the mouth and lower stretches of the small tributary creek in the south portion of the Study Area and is dominated by aquatic plants that allow their leaves to float on the water surface. Water depth is less than one metre. This area is dominated by dense *Nymphaea odorata* ssp. *tuberosa* (Tuberous Water-lily). There is also *Potamogeton pectinatus* (Comb-like Pondweed) and *Myriophyllum spicatum* (Eurasian Water-milfoil). The shallow edges are dominated by a narrow fringe of *Sparganium emersum* ssp. *emersum* (Stemless Bur-reed) and *Sparganium eurycarpum* (Broad-fruited Bur-reed). This community would be classed as Open Water or Shallow Marsh in the *Wetland Evaluation System* (OMNR 1993). The mapped zone covers 0.77 ha or 0.7%.

No significant species were found in the above vegetation type.

4.1.3 SIGNIFICANT FLORA AND VEGETATION

The flora identified from the Study Area during the course of the field visits could represent a range of significance levels: none, local, regional, provincial, and national. Only plants that are native to this area are considered to have possible significance—aliens, *i.e.*, introduced species or 'weeds', have no life science significance even if they are rare and hence they are not discussed in this section of the report.

The determination of significance is based on the available literature.

Provincial significance is based on the *Natural Heritage Resources of Ontario: Rare Vascular Plants* (Oldham 1999). According to Oldham (1999), no species found during field work for this study are rare in Ontario.

Regional significance is based on draft 2.0 of the *Vascular Plants of Eastern Ontario* (Cuddy, 1991). Eastern Ontario in Cuddy (1991) is defined as the former Eastern Administrative Region of the Ministry of Natural Resources. According to Cuddy (1991), no species found during field work for this study are regionally rare.

4.1.3.1 Locally Significant Plants

Local significance is based on a species listing of "Rare" in Plants of the Kingston Region (Crowder *et al.*, 1997). The following three native plants, found during field work for this study, are considered locally rare (Crowder *et al.*, 1997). Locations are shown on the large-scale map.

Carex cristatella (Crested Sedge)—found once in moist open woods in the southwest corner of the Study Area.
Carex pallescens (Pale Sedge)—found at two locations in unused pasture near the south side of the Study Area.
Uvularia sessilifolia (Sessile-leaved Bellwort)—a large colony was found in moist open woods in the southwest corner of the Study Area.

4.1.3.2 Significant Vegetation

Vegetation is the plant community or association occurring on a site. Significant vegetation may consist of associations of rare plants and hence be rare due to the rarity of the component species, or an association may be a rare combination of otherwise common species. Thus, a vegetation community may have a different status from its component species. Vegetation may also be considered significant on the basis of its condition and ecological integrity.

Provincially rare vegetation is listed in Bakowsky (1996). None of the communities found in the Study Area are considered rare in Bakowsky (1996). There are no references for the regional or local significance of vegetation so the determination of regional or local significance is based on the Consultant's field experience. The vegetation types in the Study Area are all common elsewhere in eastern Ontario and thus are deemed to have neither regional nor local life science significance. Due to past and ongoing disturbance to the Study Area, none of the communities can be considered significant on the basis of their condition or ecological integrity.

4.1.4 PIKE BREEDING HABITAT

The lower reaches of the small creek that drains east from the long west-facing finger of wetland in the southern third of the Study Area occurs in a broad flood plain with shallow water and dense vegetation. This is likely suitable habitat for spawning pike (Scott & Crossman 1973). Shallow water in protected bays and small inlets elsewhere along the west edge of the Study Area could also be suitable pike breeding habitat.

4.1.5 POTENTIAL ROAD IMPACT

The Official Plan of the former Kingston Township shows a planned road (Proposed Centennial Drive Extension) going north from Front Road through and along the west side of the Study Area. Such a road could have significant negative impacts on the Little Cataraqui Creek Wetland.

There would be an increase in road salt and vehicle emissions that would reach and contaminate the wetland. The longest of the west-pointing wetland fingers would be bisected by the road causing habitat fragmentation, and loss of wetland area and function. There would be increased erosion, sedimentation, and turbidity.

The result would be that some native plant species now present in small numbers might be eliminated by the additional stress and disturbance. These latter factors would favour and benefit alien plants—possibly to the further detriment of existing native species.

The proposed road alignment crosses the meadow supporting two populations of the locally rare *Carex pallescens* (Pale Sedge) which could be eliminated by the construction of the road.

4.1.6 REFERENCES

Bakowsky, W.D. 1996. *Natural Heritage Resources of Ontario: Vegetation Communities of Southern Ontario.* Ontario Natural Heritage Information Centre, Ministry of Natural Resources, Peterborough.

Boxall, J. 1992. *Wetland Evaluation of Little Cataraqui Marsh Complex.* Ontario Ministry of Natural Resources, Kingston. Unpublished wetland data record. 50 p.

Crowder, A., K.E.J. Topping, and J.C. Topping. 1997. *Plants of the Kingston Region: 1996*. Queen's University, Kingston. 133 p.

Cuddy, D.G. 1991. *Vascular plants of Eastern Ontario. Draft 2.0.* Ontario Ministry of Natural Resources, Eastern Region, Kemptville. 80 p.

Environment Canada-Canadian Wildlife Service. 2004. *International Joint Commission Lake Ontario Water Level Review Study*. Unpublished raw data.

Gillett, J.M. and D.J. White. 1978. *Checklist of vascular plants of the Ottawa-Hull Region, Canada.* National Museum of Natural Sciences. 155 p.

Lee, H., W. Bakowsky, J. Riley, J. Bowles, M. Puddister, P. Uhlig, and S. McMurray. 1998. *Ecological land classification for Southern Ontario: first approximation and its application.* Ontario Ministry of Natural Resources, Sault Ste. Marie. SCSS Field Guide FG-02.

Newmaster, S.G., A. Lehela, P.W.C. Uhlig, S. McMurray, M.J. Oldham. 1998. *Ontario Plant List.* Ontario Ministry of Natural Resources, Ontario Forest Research Institute, Sault Ste. Marie, Ontario. Forest Research Information Paper No. 123. 550 p.

Oldham, M.J. 1999. *Natural heritage resources of Ontario: rare vascular plants*. Natural Heritage Information Centre. 3rd edition. 56 p.

OMNR. 1993. *Ontario Wetlands Evaluation system: Southern Manual.* Wildlife Policy Branch Toronto.

Scott, W.B. and E.J. Crossman. 1973 . *Freshwater Fishes of Canada.* Bulletin 184. Environment Canada. Fisheries Research Board of Canada, Ottawa. 966 p.

Voss, E.G. 1972, 1985, 1996. *Michigan Flora. Parts 1 (Gymnosperms and Monocots), 2 (Dicots: Saururaceae-Cornaceae), and 3 (Dicots: Pyrolaceae-Compositae).* Cranbrook Institute of Science Bulletins 55, 59, and 61, and University of Michigan Herbarium. Part 1: 488 p., Part 2: 724 p., Part 3: 622 p.

APPENDIX 1: CHECKLIST OF VASCULAR PLANTS

The following list gives the 292 taxa of vascular plants that were identified during detailed inventories of the west side of the Little Cataraqui Creek Wetland between Bath Road and Front Road.

The plant families are arranged in a traditional taxonomic order such as that used by Crowder *et al.* (1997) or Voss (1972, 1985, 1996). Within the families, the genera and species are arranged alphabetically. The scientific names and family groupings follow those in Newmaster *et al.* (1998). Voss (1972, 1985, 1996) was considered the final authority in cases of apparent spelling errors of scientific names or citation errors of authors in Newmaster *et al.* (1998). Synonyms are given where necessary to simplify locating the plant in other checklists and floras—such as the Plants of the Kingston Region (Crowder *et al.*, 1997). The common names mainly follow Gillett & White (1978) with some entries based on Newmaster *et al.* (1998) or Crowder *et al.* (1997).

A species may be preceded by a pound sign "#" which denotes a native plant that is regarded as locally significant (rare in the Kingston area) in Crowder *et al.* (1997). Refer to **Section 4.1.3.1** for additional information on locally significant species.

When a species name is preceded by an asterisk "*", it denotes a non-native or introduced species. If the asterisk is in parentheses, it indicates a plant whose native/non-native status in the region is uncertain.

J. Deslauriers collected a number of plants at the Frontenac Institution in 1996. These specimens were identified by Adèle Crowder of Queen's University in 2003 and a list sent to the author. It is not certain that all were collected within the present Study Area. Four of the species found by Deslauriers were not recorded by DJW and these species are noted as such in the checklist. ***Carex normalis*** Mack. (Normal Sedge) is listed as one of the collections; however, since this species only occurs in the Carolinian Zone of southern Ontario (M. Oldham, pers. com., 1998), the specimen is probably misidentified.

	EQUISETACEAE	HORSETAIL FAMILY
	Equisetum arvense L.	Field Horsetail
	Equisetum sylvaticum L.	Wood Horsetail
	DRYOPTERIDACEAE	WOODFERN FAMILY
	Athyrium filix-femina (L.) Roth	Lady Fern
	Onoclea sensibilis L.	Sensitive Fern
	PINACEAE	PINE FAMILY
	Picea glauca (Moench) Voss	White Spruce
	Pinus resinosa Ait.	Red Pine
	Pinus strobus L.	White Pine
*	***Pinus sylvestris*** L.	Scotch Pine
	CUPRESSACEAE	CYPRESS FAMILY
	Juniperus virginiana L.	Red Cedar
	TYPHACEAE	CATTAIL FAMILY
	Typha Xglauca Godr.	Hybrid Cattail
	Typha latifolia L.	Cattail
	SPARGANIACEAE	BUR-REED FAMILY
	Sparganium emersum Rehm. ssp ***emersum***	Stemless Bur-reed
	Sparganium eurycarpum Engelm.	Broad-fruited Bur-reed
	POTAMOGETONACEAE	PONDWEED FAMILY
*	***Potamogeton crispus*** L.	Curly Pondweed
	Potamogeton pectinatus L.	Comb-like Pondweed
	Potamogeton pusillus L.	Small Pondweed
	NAJADACEAE	NAIAD FAMILY
	Najas flexilis (Willd.) Rostk. & Schmidt	Naiad
	ALISMATACEAE	WATER-PLANTAIN FAMILY
	Alisma plantago-aquatica L.	Water-plantain
	Sagittaria latifolia Willd.	Broad-leaved Arrowhead
	Sagittaria rigida Pursh	Stiff-leaved Arrowhead
	BUTOMACEAE	FLOWERING-RUSH FAMILY
*	***Butomus umbellatus*** L.	Flowering-rush
	HYDROCHARITACEAE	FROG'S-BIT FAMILY
	Elodea canadensis Rich.	Canada Water-weed
*	***Hydrocharis morsus-ranae*** L.	European Frog's-bit
	Vallisneria americana Michx.	American Eel-grass
	GRAMINEAE	GRASS FAMILY
*	***Agrostis gigantea*** Roth	Redtop
	Agrostis stolonifera L.	Creeping Bent Grass
	Alopecurus aequalis Sobol	Short-awn Foxtail
*	***Bromus inermis*** Leyss.	Awnless Brome Grass

* ***Bromus tectorum*** L. ..... Downy Chess..... (J. Deslauriers, 1996)
Calamagrostis canadensis (Michx.) Beauv. ..... Canada Bluejoint
* ***Dactylis glomerata*** L. ..... Orchard Grass
* ***Echinochloa crusgalli*** (L.) Beauv. ..... Barnyard Grass
* ***Elymus repens*** (L.) Gould. ..... Quack Grass
* ***Festuca rubra*** L. ..... Red Fescue
* ***Glyceria maxima*** (Hartm.) Holmb. ..... Great Manna Grass
Glyceria striata (Lam.) Hitchc. ..... Fowl Manna Grass
Hordeum jubatum L. ..... Fox-tail Barley
Leersia oryzoides (L.) Sw. ..... Rice Cut Grass
* ***Lolium pratense*** (Huds.) Darbys. ..... Meadow Fescue
Panicum capillare L. ..... Old Witch Grass
(*) ***Phalaris arundinacea*** L. ..... Reed Canary Grass
* ***Phleum pratense*** L. ..... Timothy
Phragmites australis (Cav.) Trin. ..... Common Reed Grass
* ***Poa annua*** L. ..... Annual Meadow Grass
* ***Poa nemoralis*** L. ..... Wood Meadow Grass
Poa palustris L. ..... Swamp Meadow Grass
* ***Poa pratensis*** L. ..... Kentucky Blue Grass
* ***Puccinellia distans*** (Jacq.) Parl. ..... Alkali Grass
* ***Setaria viridis*** (L.) Beauv. ..... Green Foxtail

CYPERACEAE — SEDGE FAMILY
Carex aquatilis Wahl. ..... Aquatic Sedge
Carex crinita Lam. ..... Fringed Sedge
\# ***Carex cristatella*** Britt. ..... Crested Sedge
Carex gracillima Schwein. ..... Filiform Sedge
Carex lacustris Willd. ..... Lake Sedge
\# ***Carex pallescens*** L. ..... Pale Sedge
Carex pseudo-cyperus L. ..... Cyperus-like Sedge
Carex rosea Schkuhr ..... Stellate Sedge
Carex scoparia Schkuhr ..... Broom Sedge
* ***Carex spicata*** Huds. ..... Sedge
Carex stipata Willd. ..... Awl-fruited Sedge
Carex tenera Dew. ..... Slender Sedge
Carex tribuloides Wahl. ..... Blunt-broom Sedge
Carex vulpinoidea Michx. ..... Fox Sedge
Eleocharis obtusa (Willd.) Schultes ..... Blunt Spike-rush
Scirpus atrovirens Willd. ..... Blackish Bulrush
Scirpus cyperinus (L.) Kunth ..... Wool-grass
Scirpus fluviatilis (Torr.) Gray ..... River Bulrush ..... (J. Deslauriers, 1996)
Scirpus validus L. ..... Strong Bulrush

LEMNACEAE — DUCKWEED FAMILY
Lemna minor L. ..... Duckweed

PONTEDERIACEAE — PICKEREL-WEED FAMILY
Zosterella dubia (Jacq.) Small ..... Water Stargrass

JUNCACEAE — RUSH FAMILY
Juncus bufonius L. ..... Toad Rush

Juncus dudleyi Wieg. ..... Dudley's Rush
Juncus effusus L. ..... Common Rush
Juncus tenuis Willd. ..... Path Rush

LILIACEAE — LILY FAMILY
* ***Hemerocallis fulva*** L. ..... Day-lily
\# ***Uvularia sessilifolia*** L. ..... Sessile-leaved Bellwort

IRIDACEAE — IRIS FAMILY
* ***Iris pseudacorus*** L. ..... Yellow Flag
Iris versicolor L. ..... Wild Iris

ORCHIDACEAE — ORCHID FAMILY
* ***Epipactis helleborine*** (L.) Crantz. ..... Helleborine

SALICACEAE — WILLOW FAMILY
Populus deltoides Bartram ..... Cottonwood
* ***Populus nigra*** L. ..... Lombardy Poplar
Populus tremuloides Michx. ..... Trembling Aspen
Salix discolor Muhl. ..... Pussy Willow
* ***Salix fragilis*** L. ..... Crack Willow
Salix petiolaris Sm. ..... Slender Willow

BETULACEAE — BIRCH FAMILY
Betula papyrifera Marsh ..... White Birch
Carpinus caroliniana Walt. ..... Blue-beech
Ostrya virginiana (Mill.) K. Koch ..... Ironwood, Hop Hornbeam

FAGACEAE — BEECH FAMILY
Quercus macrocarpa Michx. ..... Bur Oak
Quercus rubra L. (***Q. borealis*** Michx. f.) ..... Red Oak

ULMACEAE — ELM FAMILY
Ulmus americana L. ..... American Elm

URTICACEAE — NETTLE FAMILY
Pilea pumila (L.) Gray ..... Clearweed
Urtica dioica L. ssp. ***gracilis*** (Ait.) Selander ..... Stinging Nettle

POLYGONACEAE — BUCKWHEAT FAMILY
* ***Polygonum achoreum*** Blake ..... Leathery Knotweed
Polygonum amphibium L. ..... Water Smartweed
* ***Polygonum aviculare*** L. ..... Knotweed
* ***Polygonum convolvulus*** L. ..... Black Bindweed
* ***Polygonum hydropiper*** L. ..... Water-pepper
Polygonum lapathifolium L. ..... Dock-leaved Knotweed
* ***Polygonum persicaria*** L. ..... Lady's-thumb
Polygonum sagittatum L. ..... Tear-thumb
* ***Rumex crispus*** L. ..... Curled Dock
Rumex verticillatus L. ..... Water Dock

	CHENOPODIACEAE	GOOSEFOOT FAMILY
*	***Atriplex heterosperma*** Bunge	Russian Atriplex
*	***Atriplex prostrata*** Bouch.	Orach
*	***Chenopodium album*** L.	Lamb's Quarters
*	***Chenopodium glaucum*** L.	Oak-leaved Goosefoot
	AMARANTHACEAE	AMARANTH FAMILY
*	***Amaranthus retroflexus*** L.	Pigweed
	PORTULACACEAE	PURSLANE FAMILY
*	***Portulaca oleracea*** L.	Purslane
	CARYOPHYLLACEAE	PINK FAMILY
*	***Cerastium fontanum*** Baumg.	Mouse-ear Chickweed
	Moehringia lateriflora (L.) Fenzl	Grove Sandwort
*	***Saponaria officinalis*** L.	Bouncing Bet
*	***Silene latifolia*** Poir. (***S. pratensis*** (Rafn.)	White Campion
*	***Stellaria graminea*** L.	Lesser Stitchwort
	CERATOPHYLLACEAE	HORNWORT FAMILY
	Ceratophyllum demersum L.	Coontail
	NYMPHAEACEAE	WATER-LILY FAMILY
	Nuphar variegata Dur.	Bullhead-lily
	Nymphaea odorata Ait. ssp. ***tuberosa*** Paine	Tuberous Water-lily
	RANUNCULACEAE	CROWFOOT FAMILY
	Anemone canadensis L.	Canada Anemone
*	***Ranunculus acris*** L.	Buttercup
	Ranunculus sceleratus L.	Cursed Crowfoot
	BERBERIDACEAE	BARBERRY FAMILY
	Podophyllum peltatum L.	May Apple
	CRUCIFERAE	MUSTARD FAMILY
*	***Alliaria petiolata*** (Bieb.) Cav. & Gr. (***A. officinalis*** Andrz.)	Garlic Mustard
*	***Barbarea vulgaris*** R. Br.	Winter Cress
*	***Capsella bursa-pastoris*** (L.) Medic.	Shepherd's-purse
*	***Descurainia pinnata*** (Walt.) Britt.	Green Tansy-mustard
*	***Erysimum cheiranthoides*** L.	Wormseed Mustard
*	***Erysimum hieraciifolium*** L.	Tall Wormseed Mustard
*	***Hesperis matronalis*** L.	Dame's Rocket
*	***Lepidium densiflorum*** Schrad.	Peppergrass
	Rorippa palustris (L.) Besser ssp. ***hispida*** (Desv.) Jonsell	Hairy Yellow Cress
*	***Rorippa sylvestris*** (L.) Besser	Creeping Yellow Cress
*	***Sinapis arvensis*** L.	Charlock
*	***Sisymbrium altissimum*** L.	Tumble Mustard
*	***Sisymbrium officinale*** (L.) Scop.	Hedge Mustard (J. Deslauriers, 1996)
*	***Thlaspi arvense*** L.	Field Penny-cress

	SAXIFRAGACEAE	SAXIFRAGE FAMILY
	Penthorum sedoides L.	Ditch-stonecrop
	GROSSULARIACEAE	GOOSEBERRY FAMILY
	Ribes americanum Mill.	Wild Black Currant
	ROSACEAE	ROSE FAMILY
	Agrimonia gryposepala Wallr.	Hooked Agrimony
	Amelanchier laevis Wieg.	Smooth Serviceberry
	Crataegus chrysocarpa Ashe	Golden-fruited Hawthorn
	Crataegus punctata Jacq.	Punctate Hawthorn
	Fragaria virginiana Mill.	Wild Strawberry
	Geum aleppicum Jacq.	Yellow Avens
	Geum canadense Jacq.	White Avens
*	***Potentilla argentea*** L.	Silvery Cinquefoil
*	***Potentilla inclinata*** Vill. (***P. intermedia*** auct.)	Downy Cinquefoil
*	***Potentilla norvegica*** L.	Rough Cinquefoil
*	***Potentilla recta*** L.	Rough-fruited Cinquefoil
	Potentilla simplex Michx.	Common Cinquefoil
	Prunus nigra Ait.	Canada Plum
	Prunus serotina Ehrh.	Black Cherry
	Prunus virginiana L.	Choke Cherry
	Rosa blanda Ait.	Wild Rose
	Rubus allegheniensis Porter	Blackberry
	Rubus idaeus L. ssp. ***melanolasius*** (Dieck) Focke	Red Raspberry
	Rubus pubescens Raf.	Dwarf Raspberry
*	***Sorbaria sorbifolia*** (L.) A. Br.	False Spiraea
	Spiraea alba DuRoi	Meadowsweet
	Waldsteinia fragarioides (Michx.) Tratt.	Barren-strawberry
	LEGUMINOSAE	BEAN FAMILY
	Amphicarpaea bracteata (L.) Fern.	Hog-peanut
*	***Coronilla varia*** L.	Crown-vetch
	Lathyrus palustris L.	Marsh Wild Pea
*	***Lotus corniculatus*** L.	Bird’s-foot Trefoil
*	***Medicago lupulina*** Lindl.	Black Medic
*	***Medicago sativa*** L.	Alfalfa
*	***Melilotus alba*** Medic.	White Sweet-clover
*	***Melilotus officinalis*** (L.) Pall.	Yellow Sweet-clover
*	***Trifolium hybridum*** L. ssp. ***elegans*** (Savi) Asch. & Graebn.	Alsike Clover
*	***Trifolium pratense*** L.	Red Clover
*	***Trifolium repens*** L.	White Clover
*	***Vicia cracca*** L.	Vetch
*	***Vicia tetrasperma*** (L.) Schreb.	Four-seeded Vetch
*	***Vicia villosa*** Roth.	Hairy Vetch (J. Deslauriers, 1996)
	OXALIDACEAE	WOOD-SORREL FAMILY
*	***Oxalis fontana*** Bunge (***O. europaea*** Jord.)	Yellow Wood-sorrel

	ANACARDIACEAE	CASHEW FAMILY
	Rhus typhina L.	Staghorn Sumac
	Toxicodendron rydbergii (Rydb.) Greene	Poison Ivy
	AQUIFOLIACEAE	HOLLY FAMILY
	Ilex verticillata (L.) Gray	Winterberry
	CELASTRACEAE	STAFF-TREE FAMILY
	Celastrus scandens L.	Bittersweet
	ACERACEAE	MAPLE FAMILY
*	***Acer negundo*** L.	Manitoba Maple
	Acer rubrum L.	Red Maple
	Acer saccharum Marsh. ssp. ***saccharum***	Sugar Maple
	Acer Xfreemanii Murr.	Hybrid Soft Maple
	BALSAMINACEAE	TOUCH-ME-NOT FAMILY
	Impatiens capensis Meerb.	Touch-me-not
	RHAMNACEAE	BUCKTHORN FAMILY
*	***Rhamnus cathartica*** L.	Common Buckthorn
	VITACEAE	GRAPE FAMILY
	Parthenocissus inserta (Kerner) Fritsch	Virginia Creeper
	Vitis riparia Michx.	Wild Grape
	TILIACEAE	LINDEN FAMILY
	Tilia americana L.	Basswood
	MALVACEAE	MALLOW FAMILY
*	***Abutilon theophrasti*** Medic.	Velvet-leaf
*	***Malva neglecta*** Wallr.	Common Mallow
	GUTTIFERAE	ST. JOHN'S-WORT FAMILY
*	***Hypericum perforatum*** L.	Common St. John's-wort
	Hypericum punctatum Lam.	Spotted St. John's-wort
	VIOLACEAE	VIOLET FAMILY
	Viola sororia Willd.	Common Blue Violet
	LYTHRACEAE	LOOSESTRIFE FAMILY
	Decodon verticillatus (L.) Ell.	Water-willow
*	***Lythrum salicaria*** L.	Purple Loosestrife
	ONAGRACEAE	EVENING-PRIMROSE FAMILY
	Circaea lutetiana L. ssp. ***canadensis*** (L.) Asch. & Magnus.	Enchanter's Nightshade
	Epilobium ciliatum Raf.	Northern Willow-herb
*	***Epilobium hirsutum*** L.	Hairy Willow-herb
	Oenothera biennis L.	Evening-primrose

	HALORAGACEAE	WATER-MILFOIL FAMILY
*	***Myriophyllum spicatum*** L.	Eurasian Water-milfoil
	UMBELLIFERAE	PARSLEY FAMILY
	Cicuta bulbifera L.	Bulb-bearing Water-hemlock
	Cicuta maculata L.	Water-hemlock
*	***Daucus carota*** L.	Queen Anne's-lace
*	***Pastinaca sativa*** L.	Wild Parsnip
	CORNACEAE	DOGWOOD FAMILY
	Cornus amomum Mill. ssp. ***obliqua*** (Raf.) J.S. Wilson	Silky Dogwood
	Cornus foemina Mill. ssp. ***racemosa*** (Lam.) J.S. Wilson	Red-panicle Dogwood
	Cornus rugosa Lam.	Round-leaved Dogwood
	Cornus stolonifera Michx.	Red Osier
	PRIMULACEAE	PRIMROSE FAMILY
	Lysimachia ciliata L.	Fringed Loosestrife
	Lysimachia terrestris (L.) BSP.	Swamp-candles
	Lysimachia thyrsiflora L.	Tufted Loosestrife
	OLEACEAE	OLIVE FAMILY
	Fraxinus americana L.	White Ash
	Fraxinus pennsylvanica Marsh.	Red Ash
*	***Syringa vulgaris*** L.	Lilac
	APOCYNACEAE	DOGBANE FAMILY
	Apocynum cannabinum L.	Indian Hemp
	ASCLEPIADACEAE	MILKWEED FAMILY
	Asclepias incarnata L.	Swamp Milkweed
	Asclepias syriaca L.	Common Milkweed
	CONVOLVULACEAE	MORNING-GLORY FAMILY
	Calystegia sepium (L.) R. Br.	Hedge Bindweed
*	***Convolvulus arvensis*** L.	Field Bindweed
*	***Ipomoea purpurea*** (L.) Roth	Common Morning-glory
	HYDROPHYLLACEAE	WATERLEAF FAMILY
	Hydrophyllum virginianum L.	Waterleaf
	BORAGINACEAE	BORAGE FAMILY
*	***Lithospermum officinale*** L.	Gromwell
	VERBENACEAE	VERVAIN FAMILY
	Verbena hastata L.	Blue Vervain
	LABIATAE	MINT FAMILY
*	***Galeopsis tetrahit*** L.	Hemp-nettle
*	***Glechoma hederacea*** L.	Gill-over-the-ground .. (J. Deslauriers, 1996)
*	***Leonurus cardiaca*** L.	Motherwort
	Lycopus americanus Muhl.	Cut-leaved Water-horehound

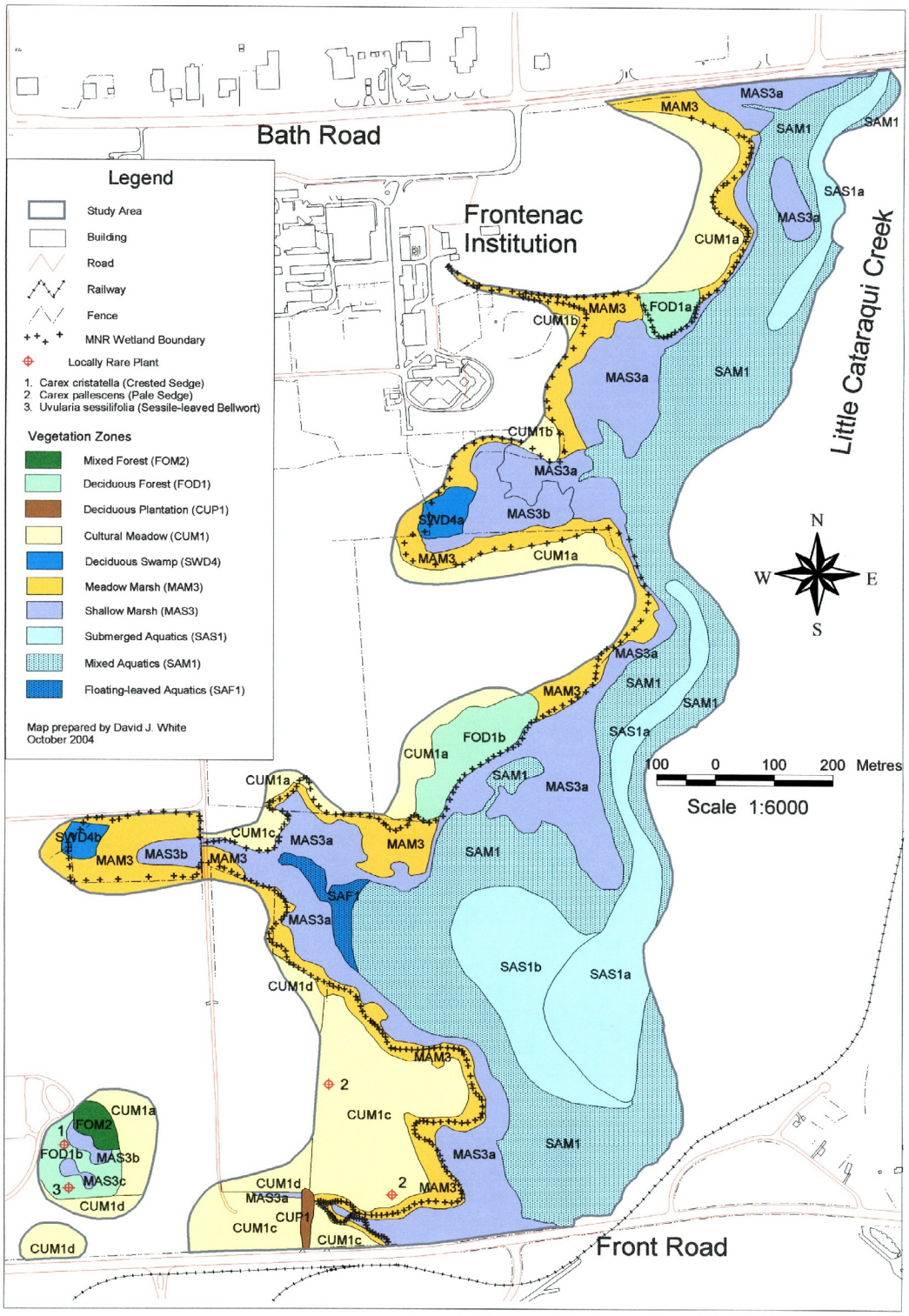
	Lycopus uniflorus Michx.	Northern Water-horehound
	Mentha arvensis L.	Wild Mint
*	***Nepeta cataria*** L.	Catnip
*	***Prunella vulgaris*** L.	Heal-all
	Scutellaria galericulata L.	Marsh Skullcap
	Scutellaria lateriflora L.	Mad Dog Skullcap
*	***Stachys palustris*** L.	Marsh Hedge-nettle
	SOLANACEAE	NIGHTSHADE FAMILY
*	***Solanum dulcamara*** L.	Climbing Nightshade
	SCROPHULARIACEAE	FIGWORT FAMILY
*	***Linaria vulgaris*** Mill	Butter-and-eggs
	Scrophularia lanceolata Pursh	Figwort
*	***Verbascum thapsus*** L.	Mullein
*	***Veronica officinalis*** L.	Common Speedwell
*	***Veronica peregrina*** L. ssp. ***peregrina***	Purslane Speedwell
	Veronica scutellata L.	Marsh Speedwell
*	***Veronica serpyllifolia*** L. ssp. ***serpyllifolia***	Thyme-leaved Speedwell
	LENTIBULARIACEAE	BLADDERWORT FAMILY
	Utricularia vulgaris L.	Common Bladderwort
	PLANTAGINACEAE	PLANTAIN FAMILY
*	***Plantago lanceolata*** L.	English Plantain
*	***Plantago major*** L.	Common Plantain
	RUBIACEAE	MADDER FAMILY
	Galium obtusum Bigel.	Wild Madder
	Galium palustre L.	Marsh Bedstraw
	CAPRIFOLIACEAE	HONEYSUCKLE FAMILY
*	***Lonicera tatarica*** L.	Tartarian Honeysuckle
	Sambucus canadensis L.	Elderberry
	Sambucus racemosa L. ssp. ***pubens*** (Michx.) House	Red-berried Elder
	Viburnum lentago L.	Nannyberry
*	***Viburnum opulus*** L.	European Highbush-cranberry[2]
	Viburnum rafinesquianum Schultes	Rafinesque's Arrowwood
	CAMPANULACEAE	HAREBELL FAMILY
*	***Campanula rapunculoides*** L.	Creeping Bellflower
	Lobelia inflata L.	Indian Tobacco
	COMPOSITAE	COMPOSITE FAMILY
(*)	***Achillea millefolium*** L.	Yarrow
	Ambrosia artemisiifolia L.	Ragweed
	Ambrosia trifida L.	Giant Ragweed

[2] ***Viburnum opulus*** (European Highbush-cranberry) is not listed in the Plants of the Kingston Region (Crowder *et. al.*, 1997); however, this is included within the native ***Viburnum trilobum*** (Highbush-cranberry) (A. Crowder, pers. com., 2004).

* ***Anthemis cotula*** L. ..... Stinking Chamomile
* ***Arctium minus*** Bernh. ..... Burdock
Aster ericoides L. ..... Heath Aster
Aster lanceolatus Willd. (***A. simplex*** Willd.) ..... Panicled Aster
Aster lateriflorus (L.) Britt. ..... Calico Aster
Aster macrophyllus L. ..... Large-leaved Aster
Aster novae-angliae L. ..... New England Aster
Bidens cernuus L. ..... Nodding Beggarticks
Bidens frondosus L. ..... Large-leaved Beggarticks
* ***Carduus acanthoides*** L. ..... Plumeless-thistle
* ***Centaurea jacea*** L. ..... Brown Knapweed
* ***Chrysanthemum leucanthemum*** L. ..... Ox-eye Daisy
* ***Cichorium intybus*** L. ..... Chicory
* ***Cirsium arvense*** (L.) Scop. ..... Canada Thistle
* ***Cirsium vulgare*** (Savi) Ten. ..... Bull Thistle
* ***Conyza canadensis*** (L.) Cronq. ..... Horseweed
Erigeron annuus (L.) Pers. ..... Daisy Fleabane
Erigeron strigosus Muhl. ..... Strigose Fleabane
Eupatorium maculatum L. ..... Joe-Pye-Weed
Eupatorium perfoliatum L. ..... Boneset
Euthamia graminifolia (L.) Nutt. ..... Narrow-leaved Goldenrod
* ***Gnaphalium uliginosum*** L. ..... Low Cudweed
* ***Helianthus annuus*** L. ..... Common Sunflower
* ***Hieracium caespitosum*** Dumort. ..... Field Hawkweed
* ***Inula helenium*** L. ..... Elecampane
Lactuca canadensis L. ..... Wild Lettuce
* ***Lactuca serriola*** L. (***L. scariola*** L.) ..... Prickly Lettuce
* ***Leontodon autumnalis*** L. ..... Fall Dandelion[3]
* ***Matricaria discoidea*** DC. ..... Pineapple-weed
Prenanthes altissima L. ..... Tall White-lettuce
Solidago canadensis L. ..... Canada Goldenrod
Solidago juncea Ait. ..... Early Goldenrod
* ***Sonchus arvensis*** L. ..... Sow-thistle
* ***Sonchus asper*** (L.) Hill ..... Spiny Sow-thistle
* ***Taraxacum officinale*** Weber ..... Dandelion

[3] ***Leontodon autumnalis*** L. (Fall Dandelion) is not listed in the Plants of the Kingston Region (Crowder *et. al.*, 1997); however, this was an oversight as the species is known elsewhere in the area (A. Crowder, pers. com., 2004).

Figure 4.1.1: Features and Vegetation Zones



This map was re-formatted from the original tabloid size, therefore the scale is incorrect.

4.2 MAMMALS

Compiled by Sharon Critchley

4.2.1 INTRODUCTION

Mammals were reported from 6 sources for the Study Area (**Figure1-2**) in this report. Mammals were considered to be associated with the Study Area if they were observed within a distance normally included in their habitat.

4.2.2 METHOD

- Carolyn Bonta recorded mammal sightings while surveying for herptiles for this report.
- Ron D. Weir noted mammals observed while conducting field surveys for birds.
- Gary Ure carried out trap and release in two areas using Havahart cage-style traps in four different sizes set to capture mammals ranging from mice to raccoon. Traps were baited with cat food and peanut butter. On 12 July 2004 1100 h., four traps were set in the long grass and under shrubs adjacent to the north south internal farm road which crosses the southwest tributary. Two traps were set at the edge of long grass and shrubs outside the northern section of the Study Area, close to a walking area. On 13 July 2004, all traps were checked and trapped animals released.
- Ed Posthumus, Farm Manager for Frontenac Institution, conducted a survey of people working on the farm and reported sightings within the Study Area from June to September 2004.
- Barry Robertson and Sharon Critchley, members of Kingston Field Naturalists, reported mammal sightings made from Front Rd.

4.2.3 SPECIES LIST

Table 4.2-1 Mammal species in/near the study area

Species are listed in taxonomic order; common and scientific names follow Banfield (1974).

Common Name	Scientific Name	Notes	Surveyor			F. I. Farm	Other	
			CB	RW	GU		BR	SC
Bat	*spp.?*	unable to confirm species	*	*				
Eastern Cottontail	*Sylvilagus floridanus*	in shrub/treed areas	*	*		*		
Woodchuck (Groundhog)	*Marmota monax*	throughout uplands; trapped; roadkill	*	*	*			*
Grey Squirrel	*Sciurus carolinensis*	isolated woodlot	*					
American Beaver	*Castor canadensis*	evidence of chewing	*					
Deer Mouse	*Peromyscus leucopus*	trapped; evidence of scat			*			
Muskrat	*Ondatra zibethicus*	1 live in marsh; 2 dead, south side Bath Rd. bridge		*				
Coyote	*Canis latrans*	2 adults observed together		*		*		
Red Fox	*Vulpes vulpes*	south end of Study Area		*				
Raccoon	*Procyon lotor*	dead, south side Bath Rd., adjacent to Study area		*				
American Mink	*Mustela vison*	carcass, 300 m from Study Area	*					
Striped Skunk	*Mephitis mephitis*	roadkill, N. shoulder Front Rd. bridge		*			*	
White-tailed Deer	*Odocoileus virginianus*	maximum observed together: 5 bucks, 2 does	*	*		*		*

CB = C. Bonta; GU = G. Ure; F.I. Farm = Frontenac Institution farm; BR = Barry Robertson; SC = S. Critchley, RW = Ron D. Weir

4.2.4 DISCUSSION

The Correctional Service of Canada property has a White-tailed Deer population of about 12 and a Coyote population of 4 to 5, reported by the participants in the survey at the Frontenac Institution farm.

The mammals confirmed for the Study Area during 2004 are the expected species. In a list of mammals commonly seen in the past on Frontenac Institute farm and adjacent properties in Kingston, G. Ure reported only two additional species not observed in 2004, American Red Squirrel (*Tamiasciurus hudsonicus*) and Eastern Chipmunk (*Tamias striatus*).

The Study Area would be only a part of the home ranges for large mammals, such as White-tailed Deer, Coyote and Red Fox. These large mammals have home ranges that are at least several hundred acres in size and encompass a variety of habitats.

4.2.5 CONCLUSION

The number of species recorded in 2004 likely under-represents actual mammalian diversity on the Study Area. Nocturnal surveys, bat netting and additional small mammal trapping for common species, such as Meadow Vole (*Microtus pennsylvanicus*), would provide a more accurate sample of local mammals.

4.2.6 REFERENCES

Banfield, A.W.F. 1974. *The Mammals of Canada.* National Museums of Canada, Ottawa.

4.3 BIRDS

Ron D. Weir

ACKNOWLEDGEMENTS

Thanks are due to Carolyn Bonta, Shirley Paul, Gerald Paul, Shirley Tregenza, for help with the field surveys. The Kingston Field Naturalists are also acknowledged for allowing access to their extensive files of records and surveys of the Study Area. The author is also grateful to Erwin Batalla, Kenneth Edwards, Michael Evans, Paul Mackenzie, Arthur Rowe, and Robert Stewart, for helpful discussions.

4.3.1 FIELD INVESTIGATIONS

Annual Surveys 1970 to 2004

Regular surveys of the Study Area, over the 35 years since 1970, have been conducted annually. They have been done by R.D. Weir and by other members of the Kingston Field Naturalists. These surveys have consisted of counts taken regularly from mid-April to early December by which time the waters of the Little Cataraqui Creek are frozen. During spring and summer (April to August), weekly or bi-weekly counts by sight and sound have been carried out. During the autumn migration (September to December), visual tallies are done bi-weekly. During the period 1981-1985, special attention was directed at the extensive marshland on both sides of the Little Cataraqui Creek as part of the first *Ontario Breeding Birds Atlas*. (Cadman *et al*. 1987; Weir 1989).

Annual Surveys 2001 to 2004

The second Ontario Breeding Bird Atlas was launched in 2001 for the period 2001–2005. As such, the study area was again the focus of special attention with intense surveys of the marsh and adjacent contiguous land. For this report, data from four years of the study 2001 to 2004 are incorporated into the tables that are included below. Total visits devoted to the birds by year were 27 during 2004, 19 during 2003, 26 during 2002, and 15 during 2001. The summary of the visits by year with relevant other information is shown in **Table 4.3-1**.

The access points for the surveys of the study area were several. On the east bank of the creek, several trails lead to the edge of the cattails directly opposite the west bank from which the birds singing on territory on the west side are monitored. These access points are located at the north end, mid-way north - south, south mid-way and at the south end. Some of these access points allow a closer access to the west bank than the approach from the land side of the west bank, where much of the cattails are on extremely soft terrain. On the west side of the creek, the access points were at the north end outside the property of the Frontenac Institution, all along the accessible points from within the property of the Frontenac Institution as far out towards the creek as the soft wet terrain allowed, and at the south end along the property of the Cataraqui Region Conservation Authority.

In addition, tallies from the water have been done by boat launched at the south end of the property off the Front Road.

4.3.2 THE INVENTORY OF BIRDS

The avifaunal inventory for the designated Study Area has been assembled with their seasonal status noted. The arrangement and order are from the American Ornithological Union (A.O.U. 1998) and Supplements (2000, 2002, 2003, 2004). A total of 110 species has been documented for the Study Area during the period 2001-2004. Listed in **Table 4.3-2** are the 64 species confirmed as having nested (shown as **) in the Study Area during 2001-2004 together with 10 other species that over-summer (non-breeding) and one species that over-winters there. Shown in **Tables 4.3-3** and **4.3-4** respectively are the 14 species of waterfowl and 21 species of shorebirds (waders) that use the waters and shoreline of the study area in migration to stage and feed.

4.3.2.1 The 64 Nesting Species

The convention to establish the level of breeding follows that used in the first and second Breeding Bird Atlas (Cadman 1987). The highest level of breeding is confirmed (CO) based on a nest with eggs or young, fledged young unable to leave the site, parents carrying food for young or carrying a fecal sac, adults entering or leaving a nest site, a used nest, distraction display or injury feigning by the adult. The next level of breeding is probable (PR) based on nest building, agitated behaviour or anxiety calls of the adult, visiting a probable nest site, courtship display between a male and female, territorial singing males, or a mated pair. The lowest level of breeding is the possible category and this category is excluded from consideration of any nesting species in the study area. Nesting for this report includes only birds in the COnfirmed or PRobable category.

Eleven species of waterfowl nest regularly. Their nests are normally placed on the drier areas of the emergent vegetation or in the vegetation at the edge of and on the upland side of the cattails. Some species place their nests farther from the water than other species. For all these waterfowl, the hatched young are taken by the hen into open leads of water among the emergent vegetation in order to feed and hide. As the young grow, they are brought more often into the open water of the Little Cataraqui Creek and as well onto the drier upland areas to the west of the emergent vegetation.

Four species of bittern and herons nest regularly within the Study Area, namely American Bittern (*Botaurus lentigenosis),* Least Bittern (*Ixobrychus exilis)* **[Threatened species]**, Green Heron (*Butorides striatus),* and Black-crowned Night-Heron (*Nycticorax nycticorax).* The nests of the American Bittern are placed either at the base of emergent vegetation or camouflaged among the vegetation on the drier ground on the upland side of the emergent vegetation. The Least Bittern places its nest at the base of emergent vegetation most often within the wet cattail stands, but sometimes in the drier areas. However, the Green Heron and Black-crowned Night-Heron use dense groves of bushes and small trees as the site of their nests and these sites lie at either the edge of the emergent vegetation, where there is standing water, or on the drier ground upland from the emergent vegetation.

Six species of raptors nest within the Study Area made up by four species of hawks and two species of owls. The Osprey (*Pandion haliaetus)* uses the man-made platform at the southern end of the marsh and the adult birds take fish from the creek to feed their young. The Northern Harrier (*Circus cyaneus)* nests on the drier ground at the edge of the vegetation, sometimes along the edge of a grove of trees or bushes. The adults hunt regularly for food over the marsh and adjacent drier areas. The Short-eared Owl (*Asio flammeus)* **[Special Concern]** is also a ground nester at the edge of the emergent vegetation and is more prone to using the southern sections of the Study Area where there is more suitable nesting habitat.

The Black Tern (*Chlidonias niger)* **[Special Concern]** nests amid the emergent vegetation wherever the marsh is more open. Especially favoured are the tops of muskrat houses. The adult Black Terns hunt regularly for small fish in the Creek.

The large area where the cattails grow serves as the nesting section for significant numbers of rails (Virginia Rail *Rallus limicola*, Sora *Parzana carolina*), Common Moorhen (*Gallinula chloropus*) American Coot (*Fulica Americana)* and Marsh Wren (*Cistothorus palustris).* Most of the other 35 species, including the Sedge Wren, use the dense emergent vegetation growing out from the wet edges of the marsh as their nest sites. Their young are hidden among the grasses and bushes that also serve to provide their food source.

4.3.2.2 The Migrant Species

Southward migration during autumn is a more leisurely passage compared with the northward flight. Most individual migrants linger in special ‘oases’ such as the Study Area in order to stage and feed as a necessary part of their long arduous journey farther south.

Migrant species, which appear only as passage birds in the Study Area, are listed in **Tables 4.3-3** and **4.3-4.** Some migrant species are also the species that nest in the Study Area and the numbers of the local nesters are greatly augmented during the period of autumn migration. Migrant waterfowl stage and feed in the waters of the Creek, while the herons feed along the shoreline and the songbirds (from Alder Flycatcher to those at the end of **Table 4.3-2**) stage and feed among the cattails and the adjacent vegetation. Of special note are the thousands of autumn migrant Tree Swallows and Barn Swallows that sleep on the cattails during hours of darkness and feed on the swarms of insects over the Study Area by day.

The migrant waterfowl species listed in **Table 4.3-3** are diving ducks that swim below the water surface to capture either fish or food from the bottom of the Creek. While they use the water portion of the whole Study Area, they are most concentrated at the southern end where thousands can be easily viewed by looking north from the Front Road near the bridge. Their presence is an indicator of the health of the waters of the Creek to produce the food they need.

The migrant waders listed in **Table 4.3-4** feed in shallow waters and along the muddy shoreline of the Creek. Their numbers increase through autumn as the water level falls and more shoreline becomes exposed. Like the migrant waterfowl, they are easily seen from the southern end of the Study Area by looking north from the Front Road near the bridge.

Table 4.3-1 Days and times of the field visits to study area for investigation of the birds

Year 2004			
DATE	*TIME*	*SURVEYOR(S)*	*NOTES*
09 Apr 04	0815-0835	CB	CRCA & SW corner
17 Apr 04	0330-0400	RDW	Owls, bitterns, rails, herons: mapping
15 Apr 04	1430-1730	CB	Herptiles, birds: west side
28 May 04	0630-1030	GP, SP	Singing bird mapping
08 Jun 04	0530-0700	RDW	Singing bird mapping
11 Jun 04	0500-0600	RDW	Singing bird mapping
13 Jun 04	1000-1100	CB	Herptiles, birds: canoe
15 Jun 04	0500-0700	RDW	Nest search: west side
15 Jun 04	1000-1015	CB	Herptiles, birds: north side
21 Jun 04	0500-0700	RDW	Singing bird mapping
24 Jun 04	0520-0610	CB	Herptiles, birds: south side
24 Jun 04	0600-1000	GP, SP	Singing bird mapping
24 Jun 04	2045-2200	CB	Herptiles, birds: canoe
25 Jun 04	0700-1000	GP, SP	Singing bird mapping
07 Jul 04	1830-1930	RDW	CRCA & SW corner
14 Jul 04	1830-1930	RDW	CRCA & SW corner
21 Jul 04	1830-1930	RDW	Broods: waterfowl, rails
28 Jul 04	1830-1930	RDW	Broods: waterfowl, rails
04 Aug 04	1830-1930	RDW	Broods: waterfowl, rails
07 Aug 04	0900-1000	CB	Herptiles, birds: west side
11 Aug 04	1830-1930	RDW	Broods: waterfowl, rails
14 Aug 04	0800-0810	CB	Herptiles, birds
17 Aug 04	1830-1930	RDW	Broods: waterfowl, rails
02 Sep 04	1300-1500	CB	Land mapping from west side
03 Sep 04	1300-1500	CB	Land mapping from west side
04 Sep 04	0930-0945	CB	Herptiles, birds
11 Sep 04	0915-0930	CB	Herptiles, birds

Table 4.3-1 (continued) Days and times of the field visits to study area for investigation of the birds

Year 2003 DATE	TIME	SURVEYOR(S)	NOTES
26 Apr 03	0730-0830	GP, SP	Singing bird mapping
01 May 03	0700-0815	GP, SP	Singing bird mapping
13 May 03	1730-1830	RDW	Singing bird mapping
17 May 03	2100-0100	RDW	Owls, bitterns, herons, rails: mapping
20 May 03	1730-1830	RDW	Singing bird mapping
29 May 03	1730-1830	RDW	Singing bird mapping
31 May 03	0745-0930	GP, SP	Singing bird mapping
05 Jun 03	0430-0730	GP, SP	Owls, bitterns, rails, herons: mapping
12 Jun 03	0700-0900	RDW	Breeding bird mapping
12 Jun 03	1730-1830	RDW	Breeding bird mapping
17 Jun 03	1730-1830	RDW	Broods: waterfowl, rails
21 Jun 03	0745-0945	GP, SP	Breeding bird mapping
24 Jun 03	1730-1830	RDW	Broods: waterfowl, rails
06 Jul 03	1010-1040	GP, SP	Breeding bird mapping
19 Jul 03	1200-1400	RDW	Broods: waterfowl, rails
25 Jul 03	0640-0810	GP, SP	Breeding bird mapping
18 Oct 03	0830-0930	ST	Migrant counts: south side
01 Nov 03	1530-1730	RDW	Migrant counts: south side
02 Nov 03	0900-1000	ST	Migrant counts: south side
Year 2002 DATE	TIME	SURVEYOR(S)	NOTES
04 May 02	0700-0830	GP, SP	Singing bird mapping
05 May 02	0800-1000	GP, SP	Singing bird mapping
06 May 02	0700-0830	GP, SP	Singing bird mapping
09 May 02	0700-0730	GP, SP	Singing bird mapping
10 May 02	0630-0715	GP, SP	Singing bird mapping
22 May 02	1830-2300	GP, SP	Owls, bitterns, herons, rails: mapping
03 Jun 02	0900-1200	GP, SP	Singing bird mapping
08 Jun 02	0700-0930	GP, SP	Singing bird mapping
12 Jun 02	1730-1830	RDW	Singing bird mapping
15 Jun 02	0700-1830	GP, SP	Breeding bird mapping
17 Jun 02	1730-1830	RDW	Breeding bird mapping
19 Jun 02	1730-1830	RDW	Breeding bird mapping
22 Jun 02	0730-0830	GP, SP	Breeding bird mapping
26 Jun 02	1730-1830	RDW	Breeding bird mapping
28 Jun 02	0730-0830	GP, SP	Breeding bird mapping
06 Jul 02	1100-1200	GP, SP	Breeding bird mapping
08 Jul 02	1730-1830	RDW	Breeding bird mapping
10 Jul 02	1730-1830	RDW	Breeding bird mapping
15 Jul 02	1730-1830	RDW	Breeding bird mapping
16 Jul 02	0745-0830	GP, SP	Breeding bird mapping
17 Jul 02	1730-1830	RDW	Broods: waterfowl, rails
04 Aug 02	1730-1830	RDW	Broods: waterfowl, rails
05 Aug 02	1730-1830	RDW	Broods: waterfowl, rails
16 Oct 02	0830-1000	ST	Migrant counts: south side
02 Nov 02	1530-1730	RDW	Migrant counts: south side
03 Nov 02	0900-1000	ST	Migrant counts: south side

Table 4.3-1 (continued) Days and times of the field visits to study area for investigation of the birds

Year 2001			
DATE	*TIME*	*SURVEYOR(S)*	*NOTES*
16 May 01	2000-2330	RDW	Owls, bitterns, rails: mapping
25 May 01	0600-1020	GP, SP	Singing bird mapping
01 Jun 01	0830-1100	GP, SP	Singing bird mapping
05 Jun 01	1100-1200	GP, SP	Singing bird mapping
06 Jun 01	2100-0200	RDW	Owls, bitterns, herons, rails: mapping
09 Jun 01	0730-0930	GP, SP	Singing bird mapping
10 Jun 01	0630-0830	GP, SP, RDW	Singing bird mapping
15 Jun 01	0730-0930	GP, SP	Singing bird mapping
19 Jun 01	0830-0930	GP, SP	Breeding bird mapping
23 Jun 01	0600-1030	GP, SP	Breeding bird mapping
07 Jul 01	0630-0800	GP, SP	Breeding bird mapping
10 Jul 01	0730-0900	GP, SP	Breeding bird mapping
10 Oct 01	0900-1030	ST	Migrant counts: south side
03 Nov 01	1530-1730	RDW	Migrant counts: south side
04 Nov 01	0900-1000	ST	Migrant counts: south side

- Surveyors: CB = C. Bonta, GP = G. Paul, SP = S. Paul, ST = S. Tregenza, RDW = R.D. Weir

4.3.3 BIRD SPECIES NESTING WITHIN THE STUDY AREA ON THE SPECIES AT RISK LISTS

For a complete discussion of the legislation and policies affecting the Study Area, refer to **Section 5.1 "**Policy and Planning" in this report. The *Species at Risk Act* (SARA), (**www.sararegistry.gc.ca),** proclaimed into law June 2003, is a federal government act to prevent wildlife species from becoming extinct and to secure the necessary actions for their recovery. It provides for the legal protection of wildlife species of plants and animals and the conservation of their biological diversity. This represents the first time that the Federal Parliament has the legislative power to guide the assessment, listing and recovery of any species at risk. The national Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assigned one of five status designations to species, namely *Extinct, Extirpated, Endangered, Threatened and Special Concern*. The Act provides protection for listed *Threatened* species as well as *Endangered* species and their critical habitat.

Ontario put into law in 1996 its Endangered Species Act. Within this province, the Committee on the Status of Species at Risk in Ontario (COSSARO) assesses the status of risk and integrates its programme with that of COSEWIC, **(www.mnr.gov.on.ca),** under the Federal SARA. Under the Planning Act of Ontario, the Provincial Policy Statement provides direction for municipal land-use planners on how to ensure that species at risk habitats are protected when lands zoning is assigned for Official Plans and when lands are developed. Other laws that apply in Ontario to protect species at risk include the *Environmental Assessment Act*, **(www.e-laws.gov.on.ca)**.

In November 2001 as a result of the destruction of marsh habitat, the status of the Least Bittern (see Table 4.3-2) was moved up from *Species of Special Concern* to *Threatened*. The Black Tern and Short-eared Owl are categorised as *Special Concern*. Currently two other species, *viz.* the Northern Harrier and Sedge Wren, are under careful review as studies continue regarding their population dynamics and nesting successes.

Of these five species noted in **Section 4.3.3**, four species were confirmed as nesting in each of the years 2004, 2003, 2002, 2001, namely Northern Harrier, Least Bittern, Black Tern, and Sedge Wren. The Short-eared Owl was confirmed

Table 4.3-2 Avifaunal inventory and seasonal status: Little Cataraqui Creek designated study area for avifaunal inventory nesters ** and others

The numbers shown are for individual birds unless indicated otherwise

		Spring	Summer	Autumn
Common Loon	*Gavia immer*	1 or 2	1 or 2	2 - 4
Pied -Billed Grebe **	*Podilymbus podiceps*	2-4 pairs	2-4 pairs	5 - 15
Double-crested Cormorant	*Phalacrocorax auritus*	5 - 10	5 - 10	5 - 10
American Bittern **	*Botaursus lentiginosus*	2-4 pairs	2-4 pairs	-
Least Bittern **	*Ixobrychus exilis*	1-2 pairs	1-2 pairs	-
Great Blue Heron	*Ardea herodias*	2 - 5	2 - 5	5 - 10
Green Heron **	*Butorides striatus*	1-2 pairs	1-2 pairs	-
Black-crowned Night-Heron **	*Nycticorax nycticorax*	2 - 15	1-2 pairs	2 - 15
Canada Goose **	*Branta canadensis*	50-200	1-4 pairs	1000-5000
Mute Swan	*Cygnus olor*	1- 2	1- 2	1 - 2
Wood Duck **	*Aix sponsa*	1-3 pairs	1-3 pairs	5 - 30
Gadwall **	*Anas strepera*	1-3 pairs	1-3 pairs	10 - 40
American Wigeon **	*Anas americana*	1-2 pairs	1-2 pairs	20-100
Black Duck **	*Anas rubripes*	1-2 pairs	1-2 pairs	20-100
Mallard **	*Anas platyrhynchos*	2-6 pairs	2-6 pairs	50-500
Blue-winged Teal **	*Anas discors*	2-4 pairs	2-4 pairs	5 - 20
Northern Shoveler **	*Anas clypeata*	1-2 pairs	1-2 pairs	5 - 25
Northern Pintail **	*Anas acuta*	1-2 pairs	1-2 pairs	5 - 25
Green-winged Teal **	*Anas crecca*	2-4 pairs	2-4 pairs	10-100
Osprey **	*Pandion haliaetus*	1 pair	1 pair	1 - 3
Northern Harrier **	*Circus cyaneus*	1-2 pairs	1-2 pairs	2 - 5
Red-tailed Hawk **	*Buteo jamaicensis*	1 pair	1 pair	2 - 4
Rough-legged Hawk	*Buteo lagopus*	-	-	1 - 5
American Kestrel **	*Falco sparverius*	1-2 pairs	1-2 pairs	2 - 4
Virginia Rail **	*Rallus limicola*	3-6 pairs	3-6 pairs	4 - 8
Sora **	*Parzana carolina*	3-6 pairs	3-6 pairs	4 - 8
American Coot **	*Fulica americana*	1-2 pairs	1-2 pairs	25 - 100
Common Moorhen **	*Gallinula chloropus*	2-4 pairs	2-4 pairs	4 - 8
Killdeer **	*Charadrius vociferus*	2-4 pairs	2-4 pairs	4 - 8
Spotted Sandpiper **	*Actitis macularia*	1-2 pairs	1-2 pairs	2 - 6
Upland Sandpiper **	*Bartramia longicauda*	1-2 pairs	1-2 pairs	-
Wilson's Snipe **	*Gallinago gallinago*	2-4 pairs	2-4 pairs	4 - 20
American Woodcock **	*Scolopax minor*	1-2 pairs	1-2 pairs	4 - 10
Bonaparte's Gull	*Larus philadelphia*	2 - 5	-	5 - 30
Ring-billed Gull	*Larus delawarensis*	100-250	100-250	100-8000
Herring Gull	*Larus argentatus*	5 -500	5 -10	10 - 500
Great Black-backed Gull	*Larus marinus*	2 - 20	1 - 2	2 - 20
Caspian Tern	*Sterna caspia*	2 - 5	2 - 5	2 - 5
Black Tern **	*Chlidonias niger*	2 - 5	2 - 5	-
Mourning Dove **	*Zenaida macroura*	2-10	2 - 3 pairs	10 - 50
Great Horned Owl **	*Bubo virginianus*	1 pair	1 pair	1 pair
Short-eared Owl **	*Asio flammeus*	1 pair	1 pair	1 pair
Belted Kingfisher	*Ceryle alcyon*	1 pair	1 pair	2 - 5
Downy Woodpecker **	*Picoides pubescens*	2 - 5	1 pair	2 - 5

Table 4.3-2 (continued) avifaunal inventory and seasonal status: Little Cataraqui Creek designated study area for avifaunal inventory nesters ** and others

		Spring	Summer	Autumn
Northern Flicker **	*Colaptes auratus*	2 - 5	1 pair	2 – 5
Alder Flycatcher **	*Empidonax alnorum*	1-2 pairs	1-2 pairs	-
Willow Flycatcher **	*Empidonax traillii*	5-10 pairs	5-10 pairs	-
Eastern Phoebe **	*Sayornis phoebe*	1-2 pairs	1-2 pairs	5 - 10
Eastern Kingbird **	*Tyrannus tyrannus*	2-4 pairs	2-4 pairs	-
Warbling Vireo **	*Vireo gilvus*	2-4 pairs	2-4 pairs	-
Red-eyed Vireo **	*Vireo olivaceus*	2-4 pairs	2-4 pairs	-
American Crow **	*Corvus brachyrynchos*	2-4 pairs	2-4 pairs	20-200
Tree Swallow **	*Tachycineta bicolor*	2-4 pairs	2-4 pairs	50-5000
Barn Swallow **	*Hirundo rustica*	2-10 pairs	2-10 pairs	20-2000
White-breasted Nuthatch **	*Sitta carolinensis*	1-2 pairs	1-2 pairs	2 - 6
House Wren **	*Troglodytes aedon*	2-4 pairs	2-4 pairs	2-10
Marsh Wren **	*Cistothorus palustris*	25-75 pairs	25-75 pairs	10-100
Sedge Wren **	*Cistothorus platensis*	2-4 pairs	2-4 pairs	-
American Robin **	*Turdus migratorius*	30-300	5-25 pairs	30-300
Gray Catbird **	*Dumetella carolinensis*	2-4 pairs	2-4 pairs	2-10
Cedar Waxwing **	*Bombycilla cedrorum*	2-4 pairs	2-4 pairs	10-100
Yellow Warbler **	*Dendroica petechia*	15-50 pairs	15-50 pairs	-
Chestnut-sided Warbler **	*D. pensylvanicus*	2-10 pairs	2-10 pairs	10-100
Common Yellowthroat **	*Geothlypis trichas*	5-50 pairs	5-50 pairs	10-100
Chipping Sparrow **	*Spizella passerina*	2-10 pairs	2-10 pairs	10-100
Savannah Sparrow **	*Passerculus sandwichensis*	5-50 pairs	5-50 pairs	10-100
Song Sparrow **	*Melospiza melodia*	5-50 pairs	5-50 pairs	10-500
Swamp Sparrow **	*Melospiza georgiana*	25-100 pairs	25-100 pairs	10-500
Bobolink **	*Dolichonyx orizivorus*	5-50 pairs	5-50 pairs	-
Red-winged Blackbird **	*Agelaius phoeniceus*	30-300 pairs	30-300 pairs	to 20000
Eastern Meadowlark **	*Sturnella magna*	2-10 pairs	2-10 pairs	5 - 50
Common Grackle **	*Quiscalus quiscula*	5-50 pairs	5-50 pairs	to 5000
Brown-headed Cowbird **	*Molothrus ater*	2-10 pairs	2-10 pairs	10-500
House Finch **	*Carpodacus mexicanus*	2-10 pairs	2-10 pairs	5 - 50
American Goldfinch **	*Carduelis tristis*	2-10 pairs	2-10 pairs	10-500

nesting only in 2001. This species is highly dependent on the supply of rodents, which undergo periodic cycles of abundance and scarcity.

4.3.4 POTENTIAL IMPACT OF ROAD DEVELOPMENT

The continued richness of the Study Area for breeding and migrant bird species has been due in large part to its isolation from human encroachment. The lands of the Frontenac Institution are not accessible by the public and road traffic is not an issue. This is also true for most of the Conservation lands situated on the east side of the Creek, although the section at the northeast corner nearest the Bath Road has been seriously degraded by the presence of the apartments with human disturbance and deleterious runoff from the roadways. Studies by R.D. Weir have shown that since about 1980, many of the marsh species have been displaced well away from this northeast corner to other sections of the marsh.

Table 4.3-3 Avifaunal inventory and seasonal status: Little Cataraqui Creek designated study area for migrant waterfowl

		Spring	Summer	Autumn *
Tundra Swan	*Cygnus columbianus*	-	-	5-20
Canvasback	*Aytha valisineria*	-	-	5-15
Redhead	*Aytha americana*	-	-	25-200
Ring-necked Duck	*Aytha collaris*	-	-	25-300
Greater Scaup	*Aytha marila*	-	-	250-3000
Lesser Scaup	*Aytha affinis*	-	-	250-1500
White-winged Scoter	*Melanitta fusca*	-	-	1-5
Long-tailed Duck	*Clangula hyemalis*	-	-	1-5
Bufflehead	*Bucephala albeola*	-	-	10-150
Common Goldeneye	*Bucephala clangula*	-	-	10-150
Hooded Merganser	*Lophodytes cucullatus*	-	-	5-25
Common Merganser	*Mergus merganser*	-	-	10-100
Red-breasted Merganser	*Mergus serrator*	-	-	1-10
Ruddy Duck	*Oxyura jamaicensis*	1 pair	1 pair	2-5

Table 4.3-4 Avifaunal inventory and seasonal status: Little Cataraqui Creek designated study area for migrant shorebirds

		Late Summer *	Autumn *
Black-bellied Plover	*Pluvialis squatarola*	-	5-20
Semiplamated Plover	*Charadrius semipalmatus*	-	5-40
Greater Yellowlegs	*Tringa melanoleuca*	2-5	5-15
Lesser Yellowlegs	*Tringa flavipes*	5-10	10-30
Solitary Sandpiper	*Tringa solitaria*	1-5	1-5
Willet	*Catoptrophorus semipalmatus*	1-2	1-2
Hudsonian Godwit	*Limosa haemastica*	-	2-15
Ruddy Turnstone	*Arenaria interpres*	-	2-5
Sanderling	*Calidris alba*	-	10-50
Semipalmated Sandpiper	*Calidris pusilla*	-	10-50
Least Sandpiper	*Calidris minutilla*	5-10	10-50
White-rumped Sandpiper	*Calidris fuscicollis*	-	2-5
Baird's Sandpiper	*Calidris bairdii*	-	2-5
Pectoral Sandpiper	*Calidris melantos*	-	5-15
Purple Sandpiper	*Calidris maritima*	-	2-5
Dunlin	*Calidris alpina*	-	10-150
Stilt Sandpiper	*Calidris himantopus*	1-2	2-5
Short-billed Dowitcher	*Limnodromus griseus*	1-2	2-10
Long-billed Dowitcher	*Limnodromus scolopaceus*	-	2-5
Wilson's Phalarope	*Phalaropus tricolor*	1-2	2-5
Red-necked Phalarope	*Phalaropus lobatus*	-	1-2

***** Actual number of individual birds

Construction of the southern extension of Centennial Drive on the east side of the Study Area within several hundred meters of the emergent vegetation would almost certainly result in a significant degrading of productivity of the marsh and adjacent areas for nesting birds (Findlay and Houlahan 1997). During the study period 2001 to 2004, road kill was found to be a definite cause of mortality for adults and their fledgling young along the roads defining the northern boundary (Bath Road) and southern boundary (Front Road). The construction of a new road along the western boundary would lead to more road kill of adult birds as well as kill inexperienced young birds. The increased mortality of the adult birds would reduce the numbers of breeding pairs required to sustain the population in the marsh. The presence of the road would inevitably lead to human access and encroachment into the marsh as well as probable development along the road with the associated loss of habitat and runoff carrying pollutants into the marsh. The prudent and responsible course of action would be to prohibit all types of development in the Study Area within at least 300 m west of the current boundary along the lands in cultivation and the marsh vegetation (Norman 1996) and to declare these lands protected.

4.3.5 REFERENCES

A.O.U Check-list of North American Birds, 7th edition, 1998. 829 p. American Ornithological Union, Washington, D.C.

42nd Supplement to the A.O.U. Check list. 2000. The Auk 117: 847-858.

43rd Supplement to the A.O.U. Check list. 2002. The Auk 119: 897-906.

44th Supplement to the A.O.U. Check list. 2003. The Auk 120: 923-932.

45th Supplement to the A.O.U. Check list. 2004. The Auk 121: 985-995.

Cadman, M.D., P.F.J.Eagles and F.M. Helleiner. 1987. *Atlas of the Breeding Birds of Ontario.* 616 p. University of Waterloo Press.

Findlay, C.S. and J. Houlahan. 1997. Anthropogenic correlates of species richness in southeastern Ontario wetlands. Cons. Biol. 11:1000-1009.

Norman, A.J. 1996. The use of vegetative buffer strips to protect wetlands in Southern Ontario, pp 273-278. In: B.G. Warner, E.A. McBean, G. Mulamoottil [Eds] *Wetlands: Environmental Gradients, Boundaries and Buffers: Proceedings of an International Symposium, 22-23 Apr 1994*. Lewis Publishers, 320 p.

Weir, R.D. 1989 *Birds of the Kingston Region*. Quarry Press, Kingston. 608 p.

4.4 FISH

Mary Alice Snetsinger,
Ecological Services

4.4.1 INTRODUCTION

In support of the Kingston Field Naturalists' report on Little Cataraqui Creek wetland between Bath and Front Roads, Ecological Services volunteered to undertake some netting in the creek system to give an indication of the fish species using the habitat. The site was visited in early September, and netting by seine and dip nets was carried out.

4.4.2 METHODS

Mary Alice Snetsinger and John Critchley visited the site on 7 September 2004. After signing in with Frontenac Institution authorities, sampling sites were identified along the west shore of Little Cataraqui Creek, just south of Bath Road (**Figure 4.4-1**). For effective sampling by seine net, a moderately 'clean' shoreline was required, or one that had little or no emergent vegetation, and light or sparse submerged vegetation cover. Three potential sites were located, designated Sites 1, 2, and 3.

The fish communities were sampled with a seine net, which was pulled through small areas of nearshore littoral zone. The area sampled was dependent on the density of aquatic vegetation, and was not standardized.

The fish caught in the seine net were identified, before being returned to the creek. No specimens were preserved. Species were identified, and a count was made of the individuals caught.

The shoreline approximately mid-way between Bath and Front Roads was also examined with the intention of sampling. It was determined, however, that dense beds of *Chara* were present along those shoreline areas that had appropriate areas of shoreline (i.e., areas that lacked dense growths of *Typha*). Sampling with the seine net was not possible. Dip netting was attempted at this site.

4.4.3 RESULTS

At the time of sampling, aquatic vegetation in the channel of Little Cataraqui Creek was very dense. This type of vegetation growth hampers sampling for fish, and none of the seine nets samples had large numbers of fish.

For Site 1, three different areas were sampled. The results are presented in **Table 4.4-1**. The results from Site 1-C reflect the result of heavy vegetation combined with moderately strong winds, and no fish were caught on this haul. The fish habitat assessment form is included in **Table 4.4-2**.

At Site 2, the seine haul netted no fish. This was due to a dense growth of *Chara*, which resulted in the net rolling and no fish being caught.

Table 4.4-1 Fish species observed at Site 1 on Little Cataraqui Creek on 7 September 2004.
None of the fish observed are considered to be species at risk, and none are being tracked by the Ministry of Natural Resources (status taken from the Natural Heritage Information Centre web site: **http://www.mnr.gov.on.ca**). The number of fish observed at each site is recorded.

Common Name	Scientific Name	Site 1-A	Site 1-B	Site 1-C
Pumpkinseed	*Lepomis gibbosus*	11	5	0
Blue Gill	*Lepomis macrochirus*	4	0	0
Central Mudminnow	*Umbra limi*	1	0	0
Brown Bullhead	*Ameiurus nebulosus*	0	1	0
Largemouth Bass	*Micropterus salmoides*	0	1	0

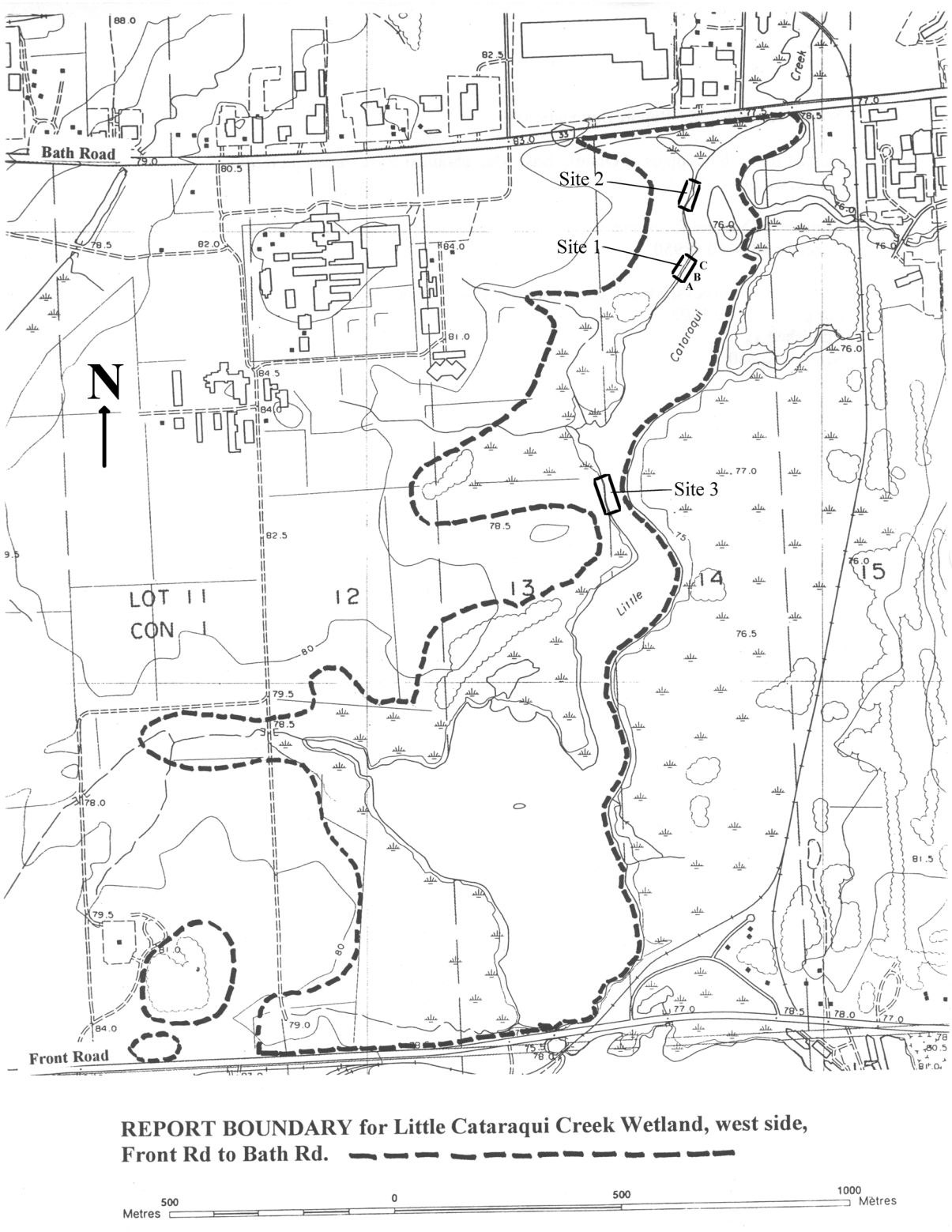


Figure 4.4-1 Sampling sites for fish habitat assessment in the Little Cataraqui Creek study area on the Frontenac Institution lands. The sites were sampled on 7 September 2004.

Table 4.4-2 Fish habitat site inspection from Ecological Services site inspection of Little Cataraqui Creek on 7 September 2004.

PROJECT IDENTIFICATION
Project Description
Kingston Field Naturalists study of Little Cataraqui Creek wetland between Bath and Front Roads. Site inspection of west side of creek on Frontenac Institution (Correctional Service of Canada) lands.

Site Inspection Date
September 7, 2004
Time: 10:50
File No.
Proponent File No.

Name of Waterbody	Township:	Lot. No.	Concession No.
Little Cataraqui Creek	City of Kingston	Part Lots13 & 14	Concession I

Proponent
Kingston Field Naturalists

Project Contractor
Not applicable.

SITE ASSESSMENT
Aquatic Resources
Water Conditions
Is this a wetland habitat?
Yes × No ☐ Unknown ☐
Distance from shore to 1 m depth: 2-3 m

Cover/Structure in Water [none (no), little (li) moderate (mo), heavy (he)
Large Rock no
Other (specify) Vegetation (see below)
Logs or Stumps no
Localized concentration in 25% of area:

Bottom Type (Express as a %, totaling 100%)

Rock
Boulder
Rubble
Gravel
Sand
Silt
Muck ~50%
Marl
Detritus ~50%
Other (specify)

If silt or muck, please give depth to hard bottom.
10 to 15 cm, but quite variable.

Aquatic Vegetation (Express as a % totaling 100%)

Submergent 50%
Floating ~ 10%
Emergent 40%
None

Plant Names (if known) (indicate dominant species with an *)

Typha angustifolia *
Butomus umbellatus
Nymphaea odorata *
*Ceratophyllum demersum**
Elodea canadensis
Polygonum amphibium
Chara *

Fish Observations: or None Observed ☐

	Pumpkinseed	Bluegill	Central Mudminnow
Life Stage			
Adult	x	x	x
Sub Adult			
Fry			
Egg			
Numbers	(see text report)		
Adult			
Sub Adult			
Fry			
Egg			
Activity	Not known, likely feeding.		
Spawning			
Feeding			
Nest Guarding			
Nesting			
No. of Nests			

Other species observed or comments:
Vegetation very dense, hampering sampling effort.

Table 4.4-2 (continued)
Upland Resources

Adjacent Land Use/Terrain Characteristics

Undeveloped				Developed	
Upland Hardwood	☐	Scrub Marsh	☐	Cottage Lot	☐
Upland Coniferous	☐	Open Marsh	☐	Agriculture	☐
Swamp Hardwood	☐	Other (specify) _____		Urban	☐
Swamp Coniferous	☐			Industrial	☐
				Other (specify) Agricultural (alfalfa)	

Past Shoreline Disturbance (within 10 m)
(e.g., dredging, shoreline structures)
Little evidence of past shoreline disturbance along most of shoreline. Some evidence observed at other shoreline sites examined during the day.

Installation: New ☐ Replacement ☐ Disposition of old cable: _____ N/A ×

CONTACTS (Any person(s) contacted in connection with the site assessment.)
Tom Beaubiah, Cataraqui Region Conservation Authority Phone: (613) 546-4228, extension 240.
Ross Cholmondeley, Ministry of Natural Resources, Kingston Office. Phone: (613) 531-5719

REMARKS (E.g., type of equipment to be used and location of use.)
See report.

GENERAL COMMENTS

CERTIFICATION

To the best of my knowledge this site inspection record is accurate.
Site photos attached: ☐

Mary Alice Snetsinger, Ecological Services — Prepared by:
September 8, 2004 — Date

September 8, 2004
Date

Signature

Table 4.4-2 (continued)
Definition of terms used.

Substrate Types

Rock (bedrock): All exposed rock with no overburden.

Boulder:	All rock over 25 cm (10 in.) in diameter.
Rubble:	Rock material between 8 cm (3 in.) and 25 cm (10 in.) in diameter.
Gravel:	Rock material between 0.2 cm (1/8 in.) and 8 cm (3 in.) in diameter.
Sand:	Material of crystalline rock origin less than 0.3 cm (1/9 in.) in diameter.
Silt:	An organic material of various origins but finer than sand.
Clay:	A material of inorganic origin with a greasy feel and no apparent structure.
Marl:	A calcareous material composed principally of carbonates derived from the photosynthetic activity of algae and mollusk shells. It is primarily white in color.
Muck:	A soft material largely of organic origin without sand or gravel Intermingled, but composed of silt and clay with considerable amounts of organic material.
Detritus:	An organic material in which large pieces such as sticks, leaves, remnants of decayed aquatic plants, etc. form at least 85% of the total mass of the soil.

Aquatic Vegetation

Emergent:	Plants which may be temporarily or permanently flooded at the base, but are nearly always exposed at the upper portion. Examples are cattails, wild rice, grasses, sedges, rushes, pickerel weed and arrowhead.
Floating:	Herbaceous plants with leaves or entire plant floating at the water surface. Examples are water lilies, pondweeds, water smartweed, and duckweeds.
Submergent:	Vegetation cover that is entirely submerged and rooted and anchored to the bottom. Examples include pondweeds, coontail, water milfoil and wild celery.

Wetland Types

Swamps: Wooded wetlands where standing to gently flowing water occurs seasonally or persists for long periods. Soft maple, elm, black ash, willow, dogwood and alder are typical species.

Marshes: Wetlands dominated by reed-like plants and grasses. Vegetation is patchy and is interspersed with channel and open water. Water levels fluctuate and annual plants - such as cattails, rushes, arrowheads and water lilies predominate.

Bogs: Peat-covered areas or peat-filled depressions with a high and stable water table and a surface carpet of mosses, primarily sphagnum. Distinguishing features include:

- closed or very restricted drainage
- low oxygen concentrations
- acidic water
- low rates of decomposition

Typical plants are sphagnum moss, leatherleaf, sundew and pitcher plant.

Fens: They are wetlands which are rich in nutrients and contain low levels of acidity. Sedges are the predominant plants and the shrub cover is similar to bogs. The trees in fens, however, are usually tamarack.

As noted in the Introduction, Site 3 was characterized by a dense growth of Chara, and sampling with the seine net was not attempted. Instead, several dips were made with the dip nets, but the depth of the water and density of the vegetation made these attempts fruitless. No fish were caught at Site 3.

During our attempt to sample Site 3, we were accompanied by one of the inmates of the Frontenac Institution, who regularly fishes at this site, and has done so over several years. He reported catching the following species:

Common Carp (*Cyprinus carpio*)
Northern Pike *(Esox lucius)*
Yellow Perch (*Perca flavescens*)
Smallmouth Bass *(Micropterus dolomieu)*
Brown Bullhead (*Ameiurus nebulosus*)
Longnose Gar *(Lepisosteus osseus)*
Bowfin (*Amia calva*)

Further, it is noted that Common Carp were also reported in the Little Cataraqui Creek by David White, who observed them during field work for the Kingston Field Naturalists (White 2004).

4.4.4 DISCUSSION

The fishes observed (Table 4.4.1) are typical of the location and the warmwater, eutrophic ecosystem type in which they were observed. No species at risk were observed. It is notable, however, that many species that would be expected to occur were not found (particularly Cyprinids, or minnows). Many other species are known to occur in this system. Keast (1968) reported Brown Bullheads, Rock Bass *(Ambloplites rupestris)*, Pumpkinseeds, Black Crappie (*Poxomis nigromaculatus*) and Yellow Perch. Snetsinger (1992) reported Blacknose Shiners (*Notropis heterolepis*), Banded Killifish (*Fundulus diaphanus*), Pumpkinseeds, Golden Shiners (*Notemigonus crysoleucas*), Brown Bullheads, Rock Bass, Tadpole Madtoms (*Noturus gyrinus*), Fathead Minnows (*Pimephales promelas*), White Suckers (*Catostomus commersoni*), Central Mudminnows, and Northern Pike. Species distribution information published by Scott and Crossman (1973) and Mandrak and Crossman (1992) suggest that many other species may be present. The direct connection to Lake Ontario means that a wide array of fish species has an opportunity to access Little Cataraqui Creek, particularly the southern portions such as that of the current study area.

The limited results obtained are almost certainly an artifact of sampling. Sampling was hampered by the dense growth of aquatic vegetation (typical of this eutrophic system at this time of the year) and a moderately strong wind. For a more complete picture of the fish community, sampling should occur both over a greater number of sites, and over a longer period of time (spring to fall). As well, additional sampling methods might expand the number of species observed.

In general, the fish habitat observed was good fish habitat. The dense aquatic vegetation provides good cover and supports high numbers of benthic organisms that form an important part of the resource base. Fisheries and Oceans Canada (1998) considers all fish habitat to be important, but recognizes that habitats vary in the degree to which they contribute to fisheries production. To assess the level of protection appropriate, they categorize habitat as Critical, Important or Marginal. This habitat should be considered to be 'Important' habitat for several reasons:

- this area is used by fish for feeding and growth;
- the habitat offers potential breeding habitat for some common fish species that may occur;
- the fish species known to be using this habitat are habitat generalists; and
- the habitat is not rare or specialized, and would not be considered to be critical.

It should also be assumed that the fish community is characterized by more fish species than were observed in 2004. The sampling gear used for this study was selected to capture small fishes (about which less is typically known), so the lack of large-bodied "game" fish is not

unexpected. However, it is expected that numerous other small-bodied fish are present in the creek, particularly Blacknose Shiners and Banded Killifish. These two species with two others, accounted for 89 to 98% (with some seasonal variation) of the fish caught inshore by Snetsinger (1992). As these two species school, however, they are often caught in large numbers or not at all; more extensive sampling would likely expand the number of species observed in this section of the creek.

4.4.5 REFERENCES

Fisheries and Oceans Canada. 1998. *Habitat conservation and protection guidelines.* 2nd edition. Habitat Management, Habitat Management and Environmental Sciences. 19 p.

Keast, Allen. 1968. Feeding of some Great Lake fishes at low temperatures. J. Fish. Res. Bd. Canada 25(6): 1199-1218.

Mandrak, N. and E.J. Crossman. 1992. *A checklist of Ontario Freshwater Fishes.* Royal Ontario Museum, Toronto, Ontario. 176 p.

Natural Heritage Information Centre web site: **http://www.mnr.gov.on.ca**
This web site is maintained by the Ontario Ministry of Natural Resources, and was used to assess current rarity rankings at the provincial and national levels.

Scott, W.B. and E. J. Crossman. 1973. *Freshwater Fishes of Canada.* Bulletin 184. Fisheries Research Board of Canada, Ottawa. 966 p.

Snetsinger, Mary Alice. 1992. Resource division in a pond impoundment fish community with comparisons to other small water body systems. Thesis submitted to the Dept. of Biology in conformity with the requirements for the degree of Masters of Science. Queen's University, Kingston, Ontario. 92 p.

White, David. 2004. E-memorandum to Sharon Critchley, reporting observation of numerous carp on 11 July 2004.

4.5 HERPTILES
Carolyn Bonta

The herptile section of this report is dedicated to
Tom Marsh, who died 1 November 2004.

ACKNOWLEDGEMENTS

I am indebted to the late T. Marsh for his suggestions regarding the methodology, and for providing me with additional herptile literature. I am also grateful to J. Critchley, D. Hunter, M. Johnson, and B. Saunders for their assistance with field work. Many thanks to R. Weir for the Map Turtle observation. I would also like to acknowledge the helpful comments provided by S. Critchley, A. Crowder, D. Hunter, and T. Marsh in their review of the draft report.

4.5.1 INTRODUCTION

Reptiles and amphibians, collectively known as herptiles, have a life cycle that often requires both aquatic and terrestrial habitats. In addition, their cold-bloodedness creates a dependency on their environment for body temperature regulation. As a result, many reptiles and amphibians are highly dependent on a mosaic of diverse habitat types. Permanent and ephemeral water, moist woods, wet meadows, sunny basking areas and sandy/gravelly nest sites are examples of habitats used by herptiles. Interconnecting corridors among these habitats are crucial to their value for herpetofauna.

Amphibians are important as indicators of ecosystem disturbance. Their permeable skin and unshelled eggs make them highly sensitive to temperature and moisture changes, pollution and pesticides, ultraviolet radiation, and disease outbreaks (summarized in Helferty 2002). The presence or absence of amphibians in a wetland is often used as a measure of the health of that ecosystem.

The purpose of this investigation was to inventory herpetofauna along the west side of the Little Cataraqui Creek, between Front and Bath Roads, and to identify their habitats. Evidence of roadkill was also documented, so that potential impacts of existing roads on herptile movement could be assessed, and future negative impacts of additional roads (i.e., the proposed Centennial Drive extension) could be forecast.

4.5.2 METHODS

Study Area
Herptile habitat in and around the Study Area for this report consists of an open water channel of the Little Cataraqui Creek, bordered by cattail-dominated emergent marsh. Adjacent to the cattails is a thin, approximately 15-metre-wide, zone of meadow marsh. The upland habitat is a mix of agricultural cropland and old field. There are three small woodland parcels adjacent to the wetland, and a third woodland pocket isolated from Little Cataraqui Creek Wetland. Small ponds are present within this isolated woodlot, and these remained late into the summer of 2004.

Survey Protocol
In early March, potential herptile habitat was identified using orthographic aerial photos, and the west shore of Little Cataraqui Creek was visited by canoe.

Field investigation took place between 9 April and 3 September 2004; a summary of field visits is provided in **Table 4.5-1**. Search effort included listening for calling individuals, turning over rocks, logs and debris, and scanning basking areas. Numbers of individuals heard or seen (including roadkill), and their locations, were documented. Frog call counts were described as per the *Marsh Monitoring Program* protocol, which measures the intensity and number of individuals calling using the Call Level Code and Abundance Count (*The Marsh Monitoring Program* 2003). Herptiles were examined for physical deformities and other abnormalities.

All herptile observations were submitted to the Ontario Ministry of Natural Resources' Ontario Herpetofaunal Atlas (Oldham and Weller 2000).

4.5.3 RESULTS

Nine species of herptile have been found within the Study Area: one species of salamander, four of frogs, three of turtles, and one snake (see **Table 4.5-2**). Only one of these, the Northern Map Turtle (*Graptemys geographica)* is considered to be a Species at Risk in Ontario.

Five Blue-spotted Salamanders (*Ambystoma laterale)*[4], were found under moist debris within the isolated woodlot on CSC property. Western Chorus Frogs (*Pseudacris triseriata)*—maximum call count 3—and Wood Frogs (*Rana sylvatica)*—maximum call count 1-4—were heard calling from the ponds in the isolated woodlot in April. One Eastern Gartersnake (*Thamnophis sirtalis sirtalis*) was found basking on an old stone foundation on CSC property in the spring.

Green Frogs (*Rana clamitans)* were seen and heard (maximum call count 1-4) throughout the cattails along the wetland edge and 7 adult Midland Painted Turtles (*Chrysemys picta marginata)* were observed basking and swimming within the Little Cataraqui Creek through the summer months. Northern Map Turtles have been previously observed basking within the open bay of the Creek, at the south end of the Study Area (R.D. Weir pers. comm.), but were not observed in 2004. A single Common Snapping Turtle (*Chelydra serpentina)* was found along the gravel shoulder of Bath Road, at the northern boundary of the study area, in mid-June. Northern Leopard Frogs (*Rana pipiens*) were common among the cattails and within the adjacent upland area in late summer.

No physical defects or other abnormalities were observed on any of the herptiles found within the study area. An early morning roadside survey along Front Road in June noted two roadkilled Midland Painted Turtles and one roadkilled Common Snapping Turtle. A depredated turtle nest was found immediately outside the study area, on the gravel embankment adjacent to the east shore of the wetland on the south side of Front Road. In late August and through September, roadkilled Northern Leopard Frogs were common along Front and Bath Roads. In mid-September, five hatchling Common Snapping Turtles were found roadkilled on Front Road; these appeared to have originated from a nest on the Study Area, located on the gravel embankment next to the bridge.

4.5.4 DISCUSSION

All herptiles observed on the Study Area were expected within the appropriate habitat(s) on site, and three anticipated species were not found. Five additional species are possible on the Study Area, but were not observed in the 2004 survey.

Herptiles Observed on the Study Area

Wood Frogs and Chorus Frogs rely on temporary spring water with emergent vegetation for breeding habitat. While the former is an inhabitant of woodlands, the latter prefers open fields but is also commonly found in shrubby, sparsely wooded areas. The small, fishless ponds in the Study Area's isolated woodlot provide breeding habitat for Wood Frogs and Chorus Frogs.

Northern Leopard Frogs require semi-permanent water and Green Frogs require permanent water to complete their life cycles, because their tadpoles take from three months (for Leopard Frogs) to 1-2 years (for Green Frogs) to mature to the frog stage. These species are very adaptable, and are common in lakes, ponds, marshes, rivers, and floodplains. In summer, juveniles and adults tend to migrate widely, Green Frogs remaining close to water, while Northern Leopard Frogs disperse into nearby wet meadows and fields. The extensive wetland

[4] Where the southern range of the Blue-spotted Salamander overlaps with the northern range of the similar-looking Jefferson Salamander (*Ambystoma jeffersonianum)* the two species are known to interbreed, producing a triploid (three-chromosome) hybrid known as *A. jeffersonianum x laterale*. Although positive field identification of these salamanders is impossible, because the Study Area falls within the known range of the Blue-spotted Salamander and outside the known range of the Jefferson Salamander, the specimens found in this study were considered to be Blue-spotted Salamanders.

habitat of the Little Cataraqui Creek and its tributaries, as well as the adjacent riparian buffer and nearby hayfields, is Green and Northern Leopard Frog habitat.

Blue-spotted Salamanders prefer wet habitats, such as marshes, flooded ditches, and ponds in poorly drained areas. On the Study Area, they were present under rocks and logs in and around woodland depressions. All specimens were found in the isolated woodlot; none were found in any of the wooded areas adjacent to the wetland, despite the presence of swamps and other ephemeral ponds.

Of all of Ontario's turtles, Snapping and Painted Turtles inhabit a wide range of aquatic habitats– from lakes and wetlands to sewage lagoons– including shallow, soft-bottomed, marshy waterways such as the Little Cataraqui Creek. In June, females nest in loose dirt and/or gravel in exposed, sunny areas. Suitable turtle nesting habitat within and adjacent to the study area is found along the gravel shoulders of Front and Bath Roads and the active CNR railway track, as well as along the dirt roadways that intersect the Frontenac Institution farmland. The presence of a turtle nest near Front Road confirms the use of these habitats as breeding sites.

Gartersnakes are common and widespread in a diversity of habitats, including fields, open forests, and shorelines, and were therefore expected to be present within the Study Area.

Northern Map Turtles inhabit clear, deep waterbodies, such as lakes and rivers. The open bay at the south end of the study area connects to Elevator Bay on Lake Ontario, an even more suitable area of habitat where Map Turtles are also often seen (T. Marsh pers. comm.).

With the exception of Northern Map Turtles, all species observed on the Study Area have been previously observed in the Little Cataraqui Creek system (Snetsinger 1997 for Blue-spotted Salamanders, Green Frogs, and Chorus Frogs; Oldham and Weller 2000 for all species).

Southeastern Ontario Herptiles Not Observed on the Study Area

The American Toad (*Bufo americanus)* was expected to occur in the study area, but was not found during the survey. This thick-skinned, terrestrial amphibian breeds in shallow bodies of water, but otherwise prefers wooded upland environments with abundant leaf litter and loose soils. The American Toad is highly adaptable, and commonly found in urban areas, including Kingston (Oldham and Weller 2000). For this reason, I expected to find American Toads within the woodlots or along the wetland margin on the Study Area, and therefore attribute its absence to insufficient search effort. A visit to the isolated woodlot's ephemeral ponds in late May would likely find American Toad tadpoles on the Study Area.

A Northern Watersnake (*Nerodia sipedon)* has been previously observed on the Rideau Trail immediately east of the Study Area (T. Marsh pers. comm.). In 2004, on the east side of Little Cataraqui Creek wetland, Spring Peepers (*Pseudacris crucifer*) were heard calling in April from a shrubby area south of Bath Road, and Gray Treefrogs (*Hyla versicolor*) were heard calling regularly through May and June in a shrubby field colonized by small stands of Poplar, *Populus* sp., north of Bath Road. Any species that use habitat on the east bank of the Little Cataraqui Creek probably also use suitable habitat on the west bank.

Wetland Evaluations completed for the Little Cataraqui Creek Marsh in 1985 (Mosquin and Wilson) and for the Little Cataraqui Creek Wetland Complex (which combines the marsh with two wetland areas to the north) in 1992 (Boxall) noted the presence of Snapping Turtles and Bullfrogs (*Rana catesbeiana*) within the evaluated wetland. Bullfrogs inhabit deep, permanent waterbodies such as lakes and bays. A single individual was observed in a residential area near the east side of the Little Cataraqui Creek wetland, north of Bath Road, on a rainy fall evening. Therefore, it is likely that Bullfrogs are present in the Study Area. Field work done along the Little Cataraqui Creek system in 1997 also observed Bullfrogs, as well as Spring Peepers, Gray Treefrogs, and Eastern

Red-backed Salamanders (*Plethodon cinerus*). [Snetsinger 1997].

The Eastern Red-backed Salamander is the only salamander that does not require standing water to complete its life cycle, and is thus not wetland-dependent. However, it does require moist, wooded habitats, and may be present within the isolated woodlot or swamp forest on the Study Area.

The permanent, vegetation-lined waters of the Little Cataraqui Creek, and their direct connection with the deeper waters of Elevator Bay, appear to be suitable habitat for the Mudpuppy (*Necturus maculosus)* [T. Marsh pers. comm.]. This secretive, nocturnal amphibian was not observed on the Study Area, however, nor are there any existing records of this species in the Little Cataraqui Creek system.

The *Ontario Herpetofaunal Atlas* (Oldham and Weller 2000) notes a Dekay's Brownsnake (*Storeria dekayi)* in the Little Cataraqui Creek area north of Bath Road, basking along the railway bed. This urban-adapted snake is not wetland-dependent; however, the dry woodlands and meadows it inhabits are present on the CSC famlands adjacent to the Little Cataraqui Creek, so it could also be present on the Study Area.

Habitat Connectivity and Buffer Use by Herptiles

The most commonly recommended vegetated buffer width for wetlands is 30 m. In one study, streamside buffers at least 30 m wide provided sufficient habitat for herptiles (Dickson 1988, as cited in Norman 1996), although other features of the buffer, such as a closed tree canopy, shaded understorey, and abundant leaf litter, likely enhanced habitat quality. Some taxonomic groups, such as the lungless salamanders, depend on moist habitats and generally do not venture into the upland.

Based on a review of buffer width literature, Norman (1996) recommends a minimum wetland buffer of 50 m, but that the most appropriate width be determined and continually amended based on new scientific information and the results of ongoing monitoring. With regards to species present on the Study Area, terrestrial migration distance was found to average 137 m for Green Frogs in Ontario (Oldham 1967) and 90.4 m for Painted Turtles in Quebec (Christens and Bider 1986). Semlitsch and Bodie (2003) reviewed literature on the use of terrestrial habitats by wetland-associated herptiles, and found that amphibians ranged 159 to 290 m and reptiles 127 to 289 m from the wetland edge to forage, breed, and overwinter.

Nearby forest habitat has also been found to be almost as important for herptiles as wetland. A model by Findlay and Houlahan (1997) found that a 20% loss in forest cover within 2 km of a Southwestern Ontario wetland would be expected to have a negative impact on herptile species richness similar to a 50% loss in wetland area. Positive effects of forest cover on amphibians were found to extend out to 3 km from the wetland edge in Southeastern Ontario (Houlahan and Findlay 2003). Further still, the effects of increased land use intensity up to 4 km from a wetland have been found to influence amphibian species richness, but the authors acknowledged that a wetland buffer of this size would be impractical (Houlahan and Findlay 2003). Because herptiles require more than one habitat to complete their life cycle, maintaining wetland and woodland communities and safe interconnecting natural corridors between them is a more practical means of managing healthy herptile populations (Mazanti 2003, Houlahan and Findlay 2003).

Effects of Roads on Herptile Movement

Human impact on Little Cataraqui Creek wetland in and adjacent to the Study Area includes agriculture, buildings, filling, dredging, channelization, dumping, a railway corridor, and two major roadways traversing the wetland. A third major road, a southern extension of Centennial Drive across the Study Area, is proposed in the *Official Plan of the Township of Kingston* (Kingston Township revised 1997; soon to be amalgamated with the City of Kingston).

Roads have been shown to have a strong negative impact on herptile populations. Roads increase mortality of migrating, nesting and

basking individuals, discourage dispersal, and reduce genetic diversity, among other things. On the Study Area, roadkill was found to be a definite cause of mortality for nesting and hatching turtles and for migrating frogs. The addition of a third major roadway would exacerbate the problem. Houlahan and Findlay (2003) found that amphibian species richness (i.e. diversity) decreased with increasing road density, beginning with two-lane, paved roadways with a centre line, within 100 m of a wetland's edge. Herptile species richness for wetlands within 2 km of a paved road was found to decrease by 19% for each 2 m/ha increase in paved road density (Findlay and Houlahan 1997). Amphibian mortality was further found to increase with increasing traffic volume (Houlahan and Findlay 2003; Fahrig *et. al.* 1995).

The presence of culverts under roads has been found to positively affect herptile road crossing. Yanes *et. al.* (1995) found that lizards, snakes, and amphibians in Central Spain readily accepted culverts as movement corridors. Anuran crossing was especially high following rainfall, and culverts with native herbaceous cover adjacent to the opening, and natural ground substrate, were preferred (Yanes *et. al.* 1995).

Prior to construction of the proposed Centennial Drive extension, a comprehensive traffic assessment should be completed to identify current risks to herptile survival and to anticipate potential negative effects of a third major arterial road.

Other Threats to Herptiles on the Study Area

Despite the abundance of suitable habitat for Green and Northern Leopard Frogs, the number of individuals seen and heard on the Study Area was lower than anticipated. In addition to potential negative effects of roads and pollution, predation by the omnivorous, non-native Carp (*Cyprinus sp.*) is an additional threat to tadpoles and other small aquatic life, including soft-shelled turtle hatchlings. Carp are believed to have entered Lake Ontario sometime in the late 1800s or early 1900s, and by the 1950s were widely distributed throughout southern Ontario (summarized in Scott and Crossman 1998). No information is available for when Carp first entered the Little Cataraqui Creek mouth, but their current abundance in the Study Area has likely disrupted the balance of native herptiles in the wetland.

No young Painted Turtles were observed on the Study Area. This same observation has been made in previous years (Pers. obs. 2002, 2003) for the wetland area immediately north of Bath Road. Although the absence of juvenile turtles could very likely have been due to their relatively secretive nature, several other factors could also affect recruitment of young Painted Turtles to the Study Area. In addition to road mortality of egg-bearing females and hatchlings and depredation of hatchlings by Carp, both discussed above, nest depredation by mammalian predators could also be a concern. Raccoon (*Procyon lotor*), Striped Skunk (*Mephitis mephitis*), Mink (*Mustela vison*), and Red Fox (*Vulpes vulpes*), all known to be present on and near the Study Area (see **Section 4.2 "**Mammals"), prey on turtle eggs and hatchlings, and are known to target roadsides and narrow riparian corridors when foraging.

Physical Deformities in Herptiles

Herptile habitat on the Study Area is affected by petrochemicals, motor oils and fluids, road salt, and other contaminants that decrease water quality and have the potential to impact parasite-host dynamics. For this reason, physical deformities in herptiles were investigated, but none were found.

4.5.5 CONCLUSION

The results of this study suggest that the west side of the Little Cataraqui Creek Wetland, between Bath Road and Front Road currently contains an average diversity of herpetofauna. The greatest threat to amphibians, reptiles and their habitat on and near the Study Area is urban encroachment. A proposed extension of Centennial Drive across the lands west of the wetland would have a direct negative impact on local herptiles through increased road mortality and habitat fragmentation between the main wetland and nearby herptile habitat (i.e., the isolated woodlot and Ducks Unlimited's

Frontenac Project). Other potential threats include: microhabitat dessication, salt and automotive fluid runoff, and increased predation.

Should the federal government decide to sell the Frontenac Institution farmlands in the future, the establishment and maintenance of native plant buffers along the wetland and around the isolated woodland would play an important role in protecting herptiles from encroaching development. With proper planning, and due consideration to natural environments and their habitats, healthy herptile populations can be kept viable in urban areas.

4.5.6 REFERENCES

Boxall, J. 1992. Southern Ontario Wetland Data Record and Evaluation–Little Cataraqui Marsh Complex. July 20-22 & August 10, 1992. Consultant. manuscript. 43 pp + 3 pp.

Christens, E. and J.R. Bider. 1986. Reproductive ecology of the Painted Turtle *(Chrysemys picta marginata)* in southwestern Quebec. Can. J. of Zool. 64: 914-920.

Fahrig, L., J.H. Pedlar, S.E. Pope, P.D. Taylor, and J.F. Wegner. 1995 Effect of road traffic on amphibian density. Biol. Cons. 73:177-182.

Findlay, C.S. and J. Houlahan. 1997. Anthropogenic correlates of species richness in southeastern Ontario wetlands. Cons. Biol., 11(4): 1000-1009.

Helferty, N.J. 2002. *Natural Heritage Planning for Amphibians and their Habitats–With reference to populations on the south slope of the Oak Ridges Moraine.* Prepared by Natural Heritage Consulting for Save the Rouge Valley System Inc. and the City of Toronto. Supplementary Report for Oak Ridges Moraine Richmond Hill Ontario Municipal Board Hearing. 71 p.
www.city.toronto.on.ca/moraine/pdf /amphibian_natural_history_ombfinal.pdf

Houlahan, J.E. and C.S. Findlay. 2003. The effects of adjacent land use on wetland amphibian species richness and community composition. Can. J. Fish. Aquat. Sci. 60: 1078-1094.

Mazanti, L. 2003. Managing Wildlife Groups–Reptiles and Amphibians. In: *Wetland Restoration, Enhancement, and Management.* US Department of Agriculture, Natural Resources Conservation Service, Wetland Science Institute. 345 p.
www.msa.ars.usda.gov/ms/oxford/nsl/projects /restoration/wre8m.pdf

Mosquin, T. and J. Wilson. 1985. *Little Cataraqui Marsh Wetland Data Record.* Wetland evaluation completed for the Ministry of Natural Resources. Napanee.

Norman, A.J. 1996. The use of vegetated buffer strips to protect wetlands in southern Ontario. In: Mulamoottil, G., Warner, B.G., and McBean, E.A. (Eds.), *Wetlands: Environmental Gradients, Boundaries and Buffers. Proceedings of an International Symposium, April 22-23, 1994*. Lewis Publishers. 320 p.

Oldham, M.J. and W.F. Weller. 2000. *Ontario Herpetofaunal Atlas.* Natural Heritage Information Centre, Ontario Ministry of Natural Resources.
www.mnr.gov.on.ca/MNR/nhic/herps/ohs.html

Oldham, R.S. 1967. Orienting mechanisms of the green frog, *Rana clamitans.* Ecology, 48: 477-491.

Scott, W.B. and E.J. Crossman. 1998. *Freshwater Fishes of Canada.* Galt House Publications, Oakville. 966 p.

Semlitsch R.D. and J.R. Bodie. 2003. Biological criteria for buffer zones around wetlands and riparian habitats for amphibians and reptiles. Cons. Biol., 17(5): 1219-1228.

The Marsh Monitoring Program – Training Kit and Instructions for Surveying Marsh Birds, Amphibians and Their Habitats. 2003 Edition. March 2003. Published by Bird Studies Canada in cooperation with Environment Canada and the U.S. Environmental Protection Agency. 40 p.

Snetsinger, R. 1997. *Little Cataraqui Creek Wetland: Restoration and Monitoring Manual. Prepared for Environment Canada and the Kingston Wetlands Working Group*. 72 p.

Township of Kingston. 1996. *Official Plan of the Township of Kingston.*

Yanes, M., Velasco, J.M. and F. Suarez. 1995. Permeability of roads and railways to vertebrates: the importance of culverts. Biol. Cons., 71: 217-222

Table 4.5-1 Field visit summary for the 2004 herptile survey.

DATE	TIME	OBSERVERS*	WEATHER	VISIT PURPOSE; AREA SEARCHED
26 March	1800–1835 h	CHB, MAJ	Clear	Site reconnaissance and listened for early-calling frogs; walked CRCA property
28 March	1500–1630 h	CHB, MAJ	Clear, sunny, light wind	Site reconnaissance; paddled open water along Little Cataraqui Creek west side, between Bath and Front Roads, and back.
31 March	1820–1920 h	CHB, DH	Cloudy, light wind	Listened for early-calling frogs and searched for breeding salamanders; walked CRCA property
9 April	2000–2040 h	CHB, MAJ	9°C, 38% RH, wind 18 km/hr	Listened for early-calling frogs and searched for salamanders; walked CRCA property
11 April	Day	CHB, MAJ	High ~ 8 °C	Searched for salamanders and snakes; walked CRCA property
12 April	Evening	CHB, MAJ	Clear with some clouds	Listened for early-calling frogs and searched for salamanders; walked CRCA property
15 April	1400–1720 h	CHB	Sunny	Herptile survey; walked CSC farmland, with emphasis on woodlands, riparian areas, old stone foundation
13 June	1000–1100 h	CHB, BS	17-18 °C, 75% RH, wind 16 km/hr	Searched for aquatic herptiles; paddled Little Cataraqui Creek west side, between Bath and Front Roads, and back
15 June	1000 h	CHB	Sunny	Adult Snapping Turtle found crossing Bath Road toward Study Area
24 June	0520–0610 h	CHB	Cloudy, 15 °C, 86% RH, wind S 15 km/hr	Roadkill and turtle nesting search; walked roadside along Front Road and walked CRCA property

Table 4.5-1 (continued).

DATE	TIME	OBSERVERS*	WEATHER	VISIT PURPOSE; AREA SEARCHED
	2045–2200 h	CHB, JC	Cloudy, 20 °C, 59% RH, wind NW 22 km/hr w/ gusts to 35 km/hr; thunderstorms brewing	Listened for frogs; paddled Little Cataraqui Creek west side between Front and Bath Roads, and back
7 August	0900–1105 h	CHB	Sunny	Herptile survey; walked CSC farmland, with empahsis on woodlands, riparian areas, old stone foundation
14 August	1950 h	CHB	Scattered clouds	Passed along Front Road by foot
2 September	1300–1600 h	CHB	Sunny	Mapped wetland boundary on CRCA lands
3 September	0920–1500 h	CHB, HK	Sunny	Mapped wetland boundary on CSC property
4 September	0930 h	CHB	Cloudy, light showers	Passed along Front Road by foot
11 September	0915 h	CHB	Sunny	Passed along Front Road by foot

* Observers were: CHB = Carolyn Bonta, JC = John Critchley, DH = Dora Hunter, MAJ = Michael Johnson, HK = Hillary Knack, and BS = Brenda Saunders.

Table 4.5-2. Amphibians and Reptiles observed on and near the study area.

COMMON NAME	SCIENTIFIC NAME	LOCATION(S)	ON / OFF STUDY AREA	REFERENCE[1]	PROVINCIAL STATUS[2]
AMPHIBIANS					
Blue-spotted Salamander	*Ambystoma laterale*	Under rocks and woody debris in isolated woodlot, CSC land; Cataraqui Bay CA	ON	1, 4, 5	S4
Red-backed Salamander	*Notopthalmus viridescens viridescens*	Little Cataraqui system	?	4	S5
Spring Peeper	*Pseudacris crucifer*	Calling from shrub swamp near east side of Little Cataraqui Creek, south of Bath Road	OFF	2 (CHB), 4, 5	S5
Grey Treefrog	*Hyla versicolor*	Calling from meadow near east side of Little Cataraqui Creek, north of Bath Road	OFF	2 (CHB), 4, 5	S5
Western (Striped) Chorus Frog	*Pseudacris triseriata*	Calling from ponds in isolated woodlot and near stone foundation, CSC land.	ON	1, 5	S5, NAR
Wood Frog	*Rana sylvatica*	Calling from ponds in isolated woodlot, CSC land.	ON	1	S5
Northern Leopard Frog	*Rana pipiens*	Abundant in wet meadow, CSC land.	ON	1, 4	S5
Green Frog	*Rana clamitans*	Calling from cattails, Little Cataraqui Creek.	ON	1, 4, 5	S5
Bullfrog	*Rana catesbeiana*	In residential area near east side of Little Cataraqui Creek, north of Bath Road	OFF	2 (CHB), 3, 4	S4

Table 4.5-2 (continued)

COMMON NAME	SCIENTIFIC NAME	LOCATION(S)	ON / OFF STUDY AREA	REFERENCE[1]	PROVINCIAL STATUS[2]
REPTILES					
Snapping Turtle	*Chelydra serpentina*	Nesting along Bath and Front Roads.	ON	1, 2, 3, 5	S5
Midland Painted Turtle	*Chrysemys picta marginata*	Basking among cattails in Little Cataraqui Creek.	ON	1, 2, 5	S5
Northern Map Turtle	*Graptemys geographica*	Basking in Elevator Bay and among cattails in southernmost bay of Little Cataraqui Creek.	ON	1	S3, SC
Gartersnake	*Thamnophis sirtalis sirtalis*	Basking on old stone foundation, CSC land.	ON	1, 3	S5
Northern Watersnake	*Nerodia sipedon sipedon*	Along Rideau Trail, east side of Little Cataraqui Creek, between Front and Bath Roads	OFF	2	S5, NAR
Dekay's Brownsnake	*Storeria dekayi*	Little Cataraqui Creek, north of Bath Road; one individual basking on railway tracks	OFF	5	S5, NAR

[1] Reference abbreviations are as follows: 1 = Field work for this Study, 2 = Casual observations (CHB = C. Bonta, TM = Tom Marsh, RDW = R. Weir; no names given if seen by all listed observers), 3 = Wetland Evaluation reports for Little Cataraqui Creek, 4 = *Little Cataraqui Creek Wetland Restoration and Monitoring Manual*; 5 = Ontario Herpetofaunal Atlas (within the Little Cataraqui Creek System)

[2] Provincial status taken from the Natural Heritage Information Centre, 2004. Global status for all species is G5. NAR = Not at Risk, SC = Special Concern

4.6 INVERTEBRATES

4.6.1 AQUATIC MACROINVERTEBRATES
Compiled by Adèle Crowder

Acknowledgements
G. Grabas, M. Galloway and R. Cholmondeley kindly provided data.

To totally describe an ecosystem is impossible, so indicators are selected which are relatively easy to determine and which will respond to environmental change. The international search for indicators of the condition of coastal marshes is discussed in this report under Great Lakes Wetlands. One of the indicators generally selected is the community of macroinvertebrates because polluted sites rapidly lose mayflies, dragonflies etc.

Macroinvertebreate communities have recently been sampled in the Little Cataraqui Creek as part of a stream assessment (Ritchie, 2003) and also as part of an assessment of selected Great Lakes marshes between Durham County and Wolfe Island (Environment Canada and Central Ontario Conservation Authority 2004). Ritchie's stream assessment, however, did not cover any of the area south of the Bath Road, our study area, because it was not accessible to users of chest waders.

The most useful section of the stream survey is that listing macroinvertebrate families found immediately north of Bath Road. The largest number of individuals comprised worms (oligochaetes and nematodes), followed by blood worms (chiromid larvae such as midges), and scuds (amphipods). Isopods (aquatic sowbugs) and water mites were abundant, and snails and flatworms occasional.

An unpublished list from the Durham Region survey is appended as **Table 4.6.1-1**. At each wetland three replicate subsamples of approximately 150 aquatic macroinvertebrates were collected by sweep-netting through the water column in the cattail-dominated emergent community. Macroinvertebrates were identified to the lowest taxonomic group possible. The Durham Region study includes references and discussion of sampling and analytical methods. **Table 4.6.1-1** includes molluscs, crustaceans, and snails. Chironomid larvae (midges) were the most numerous individuals in one sample; fly and midge (Diptera and Chironomid) larvae are generally not affected by disturbance and can survive in polluted sites. Less tolerant of difficult conditions, such as low oxygen concentrations, mayfly (Ephemoptera), caddisfly (Trichoptera), and dragonfly (Odonata) larvae were also found.

For the sampling effort involved, data from the stream and from the marsh show a fairly high diversity of invertebrates, typical of what can be expected in a creek with a muddy bottom and in shores with cattail marshes. Durham Region's comparative study ranked invertebrate communities from 28 sites as an expression of disturbance and of these the Little Cataraqui Creek ranked third in quality. Hay Bay and the Wolfe Island marshes also ranked highly, with poor rankings in sites such as Bowmanville Marsh and Frenchman's Bay.

REFERENCES

Environment Canada and Central Ontario Conservation Authority. 2004. *Durham Region Coastal Wetland Monitoring Project: Year 2 Technical Report.* Downsview.

Ritchie, J. 2003. *Little Cataraqui, Butternut and Abbey Dawn Creeks. Stream Assessments 2003*. Ontario Ministry of Natural Resources. Kingston.

Table 4.6.1-1 Invertebrates found at mouth of Little Cataraqui Creek from data used for Environment Canada and Central Ontario Conservation Authority (2004). Reproduced with the permission of the authors.

Invertebrate Community						
Little Cataraqui Creek						
24-Jul-03						
				sample		
Class	Order	Family	Genus/Species	1	2	3
Bivalvia	Veneroida	Sphaeriidae	Musculium		1	
			Pisidium	1		
Crustacea	Amphipoda	Gammaridae	Gammarus pseudolimnaeus	74	74	30
		Hyalellidae	Hyalella azteca			9
	Isopoda	Asellidae	Caecidotea	4	11	4
Gastropoda	Limnophila	Lymnaeidae	Fossaria exigua	2		
			Pseudosuccinea columella			1
		Physidae	Physella gyrina	7	5	2
		Planorbidae	Gyraulus	5	6	10
			Heliosoma anceps	7	2	
	Mesogastropoda	Bithynidae	Bithynia tentaculata	1		
		Hydrobiidae	Amnicola limosa	6		
		Valvatidae	Valvata sincera			1
Insecta	Coleoptera	Hydrophilidae	Paracymus		1	
	Diptera	Ceratopogonidae	Bezzia		3	
		Chironomidae	Chironomini	2	11	1
			Orthocladinae		2	
			Tanypodinae			1
		Stratiomyidae	Odontomyia			1
	Ephemeroptera	Baetidae	Callibaetis		2	9
		Caenidae	Caenis	4	1	3
	Hemiptera	Corixidae	Palmacorixa			5
		Nepidae	Ranatra	4		
		Pleidae	Neoplea striola			2
	Odonata	Aeshinidae	Anax junius			1
		Coenagrionidae	Enallagma	4	2	2
			Ishnura verticalis	8	2	1
	Trichoptera	Hydroptilidae	Hydroptila		2	
		Leptoceridae	Oecetis	3		
			Triaenodes	2	2	1

4.6.2 ODONATA (DAMSELFLIES AND DRAGONFLIES)

David Bree

Summary

The Little Cataraqui Creek Wetland-west side was investigated for Odonata (Dragonflies and Damselfly) on two site visits in 2004. Species diversity was found to be low due to a combination of limited field time, limiting weather conditions during field work (high wind), and a lack of diversity of aquatic habitats in the study site. Thirteen species of Odonates, all common in the Kingston region, were observed. There exists the very real probability of additional common species being present at this site, and the possibility of some less common deep water species being present in the creek itself.

The Odonate species present represent a typical marsh assemblage. In addition to aquatic habitats Odonates require upland foraging habitats. The non-urbanized lands found on both sides of the creek provide these upland habitats. The creek and non-urbanized lands could also provide a corridor for migrating darners and other species in the fall.

The construction of a roadway through the area would negatively effect the population and diversity of Odonate species through the reduction of foraging habitat, increased mortality caused by insect-vehicle collisions, and a reduction of water quality through salt and oily run-off from the roadway.

4.6.2.1 Introduction

Field investigations of Odonate species diversity and abundance found in the Little Cataraqui Creek Wetland-west side was carried out on 14 June and 12 July 2004 as part of a larger site study being conducted by the Kingston Field Naturalists. The study site in question is part of a proposed road extension within the former Township of Kingston's official plan. A base-line database of habitats and species present within this study area is being accumulated in order to assess the environmental impact of such a roadway.

Odonates require two distinct habitats for their survival. An aquatic habitat where the eggs are laid and the larva grow and an upland habitat where young adults and females spent most of the time resting and foraging. Both aspects of odonate requirements were considered in this survey.

The aquatic habitat is most important in determining odonate distribution. The larva of many species require very specific aquatic conditions, with water quality, pH, oxygen content, type of substrate and the presence or absence of aquatic predators being some of the limiting factors (Corbet, 1999 p.124-205). Other species are generalists and their larva will survive in any bit of standing water. Not surprisingly an area that provides a greater diversity of aquatic habitats also provides, the potential at least, for a greater diversity of odonate species.

While not as limiting, upland habitats are also essential for the support of odonate species. The size and type of upland habitat required varies for different species. Damselfly species may only require an upland fringe extending a few metres away from the water while larger dragonfly species may forage up to 1600 m away, before returning to their local breeding territory (Corbet, 1999 p. 394). Conversely large migrant dragonflies can breed in isolated and temporary ponds and after emergence fly completely away from the area never to return. Upland areas used are usually some aspect of a natural open area, be it a meadow or opening in the forest, though more disturbed open areas are also utilised by some species. Some of the rarer species require wooded uplands to forage in and are rarely found away from the breeding areas, presumably foraging in the canopy.

Habitats found in the study area have been described and mapped by White (this publication) and his designations and map units have been used below. Wetland habitats examined for odonates include a large cattail emergent zone (**MAS3a**) and a localized floating-leaved aquatics zone (**SAF1**). Small

wetlands dominated by emergent graminiods (**MAS3b&c**) also exist near the southern woodlot but these were dry when this site was visited in July. Upland habitats examined include meadow marsh (**MAM3**), cultural meadow (**CUM1**), some of which are active agricultural fields, and small stands of deciduous (**FOD1b**) and mixed (**FOM2**) forests.

4.6.2.2 Methodology

Surveying was carried out by visually searching for adults while walking the study site. Some effort was made to include all water edges in the survey but that was found to be impossible due to the difficulty of getting to the open water through the thick cattails that dominate most of the wetlands of the study area. Water edges examined were the southern inlet and the inmate fishing area in the middle of the study area.

Adults found were identified by sight, or for those species that required closer scrutiny for positive identification, they were captured with a "butterfly-type" net and examined in the hand using a 10x lens. The water edges reached were also examined for dragonfly exuviae (larval skins left behind during emergence) which could be collected for later identification.

Absolute numbers of species seen were only recorded up to 10 individuals. Above this number subjective designations of "common" or "abundant" were used. The latter was used if it was estimated that more than 50 individuals were seen throughout the day.

One hour was spent on 14 June walking around the Cataraqui Region Conservation Authority section of the study site. Three hours were spent on 12 July walking the Frontenac Institution farm property from the southern woodlot north to the building complex. The north section of the property was not examined, but from air photo, map and distant visual inspection, it was anticipated not to be significantly different from the area surveyed.

4.6.2.3. Results

Odonate species observed and an indication of their abundance is presented in Table 4.6.2-1. Though both visit days were sunny, neither day was optimal; high winds kept odonate flying to a minimum. Only two species (Eastern Forktail, and Boreal Bluets) could be found on 14 June and these were sheltering in the lee of isolated shrubs. The Forktails and the additional species listed were seen on 12 July. Further species are almost certainly present and future surveys would probably benefit by investigating the shoreline by boat.

No exuviae were located anywhere during the two site visits. A macroinvertebrate sampling programme just up-stream of this study site found larva of *Anax junius*, *Ishnura verticalis* and *Enallagma sp*. which is consistent with the species of adults seen flying in the study site (Environment Canada and Central Ontario Conservation Authority 2004).

Cattail marsh is one of the more limiting wetland habitats for odonates and within the cattails themselves only Sedge Sprites were seen. These small damselflies tend to forage in areas away from other odonates to avoid predation.

The Dot-tailed Whiteface was the common species found in the limited amount of floating-leaved habitat investigated. One Green Darner was seen patrolling the edge of the open water at the fishing platform.

All other species seen were foraging in upland habitats. The most productive habitat for odonates was meadow marsh, present in a limited extent between the cattail marsh and the cultural meadows. These areas were large enough to provide foraging habitat to damselflies and some of the smaller dragonfly species and the greatest numbers of odonates were of these types, with Bluets, Forktails, and Meadowhawks dominant.

Table 4.6.2-1 Odonata observed at the Little Cataraqui Creek Wetland, west side, June-July 2004

Common Name	Scientific Name	Numbers seen	Ontario Conservation Ranking
Common Spreadwing	*Lestes disjunctus*	1 male	S5
Emerald Spreadwing	*Lestes dryas*	1 male	S5
Boreal Bluet	*Enallagma boreal*	3 males	S5
Marsh Bluet	*Enallagma ebrium*	common	S5
Eastern Forktail	*Ischnura verticalis*	common	S5
Sedge Sprite	*Nehalennia irene*	abundant	S5
Green Darner	*Anax junius*	1	S5
Prince Baskettail	*Epitheca princeps*	1	S5
Dot-tailed Whiteface	*Leucorrhinia intacta*	common	S5
Widow Skimmer	*Libellula luctuosa*	3	S5
Twelve-spotted Skimmer	*Libellula pulchella*	1	S5
White-faced Meadowhawk	*Sympetrum obtrusum*	common	S5
Black Saddlebags	*Tramea lacerata*	1	SZB
* from (Oldham, Sutherland and Holder, 2000). S5 species are commonly found in the province and no special management is considered necessary for their conservation. SZB indicates a species that is too migratory, with only limited breeding in Ontario, to be given a practical conservation rank here.			

4.6.2.4 Discussion

All species seen were typical of still water marsh habitats, and some (Eastern Forktail, Dot-tailed Whiteface, and Widow Skimmer) are known for their tolerance of low quality eutrophic waters.

The only uncommon species seen was a Black Saddlebags, foraging along the landward side of the cattails. This is a southern migrant that is commonly seen along the Lake Ontario shoreline but has rarely been documented to breed in the province. In eastern Ontario breeding records are known from Prince Edward County (Bree, personal observation, 2002) and Ottawa (D. Bert pers com. 2003). The potential is good that this rare Ontario breeder also breeds in the Kingston area.

Some larger, uncommon species (Cruisers, Darners and Clubtails) breed in deeper moving water, and the Little Cataraqui Creek may provide suitable habitat for some of these. These species are rarely encountered as adults, even when they are present and they are best documented by finding the exuviae left behind when they emerge. The conditions at the study site required a boat for a proper search of the water's edge for any exuviae present.

The seasonal wetlands (**MAS3b&c**) near the south woodlot may also support some species of odonates, including some uncommon species that specialize in using ephemeral, fishless water bodies. Further study would be required to determine the odonate productivity of these marshes.

The creek and non-urbanized areas along its edge are also potentially an important corridor for migrating dragonflies in the fall. Large swarms of Green Darners, with smaller numbers of Black Saddlebags, *Pantala sp*. and *Aeshna sp*., numbering into the 1000s have been documented elsewhere along the Lake Ontario Shoreline (Catling and Brownell 1998; Bree 2001). These swarms back up along the shoreline waiting for favourable weather conditions to cross or go around the lake. While these swarms have not been recorded in the Kingston area literature, they doubtless occur. The study area provides one of the few natural

corridors through an increasingly urbanized shoreline in the Kingston area that these swarms could utilize.

4.6.2.4.1 Road Construction Implication

The construction of a road through the area would negatively impact the odonate population. Such a road would reduce the upland foraging areas needed by all species of odonates and would result in the deaths of many adults as they tried crossing the road to find foraging areas. While the species found are to some extent tolerant of poorer water quality it can be assumed that road run-off would further reduce water quality that would reduce larval populations through direct poisoning as well as reducing prey species. The road would also further reduce the narrow corridor through urban Kingston to the lakeshore that could be used by migrating species of Odonata.

4.6.2.5 Conclusion

The Little Cataraqui Creek, west side study area showed average to low diversity of Odonata species for the habitat available. Those species present are common species associated with marsh environments, though the presence of additional species is almost certain. Further surveys covering different times of the year and investigating the water's edge by boat would no doubt increase our knowledge of the odonate fauna present at this site. Road construction in the area would certainly negatively impact odonate species present.

4.6.2.6 References

Bert, D. 2003. Landscape Ecology Laboratory, Ottawa–Carleton Institute of Biology, Carleton University–comments made on the Odonate-l list server.

Bree, D. 2001. Further Notes on the Odonata of Sandbanks Provincial Park. pp. 24-26. In Catling, P.M., C.D. Jones, and P. Pratt. (eds.) 2001. *Ontario Odonata Volume 2 (Including Observations for the Year 2000).* Toronto Entomologists' Association, Toronto, Ontario.

Catling, P.M. and V.R. Brownell. 1998. Migratory concentrations of dragonflies on the north shore of Lake Ontario, and northward extension of migratory species. Argia 10 (4): 19-22.

Corbet, P.S. 1999. *Dragonflies, Behaviour and Ecology of the Odonata.* Cornell University Press, Ithaca, New York. 829p.

Environment Canada and Central Ontario Conservation Authority. 2004. *Durham Region Coastal Wetland Monitoring Project: Year 2 Technical Report.* Downsview, Ont.

Oldham, M.J., D.A. Sutherland, and M.L. Holder. 2000. Conservation Status for Ontario Odonata. pp. 1-7. In Catling, P.M., C.D. Jones, and P. Pratt. (eds.) 2000. *Ontario Odonata Volume 1 (Including Observations for the Year 1999).* Toronto Entomologists' Association, Toronto, Ont.

4.6.3 LEPIDOPTERA (BUTTERFLIES)
Bruce Ripley

4.6.3.1 Introduction

On 12 July 2004 and 27 September 2004 a survey of butterflies in the region adjacent to the west side of the Little Cataraqui Creek between Front Road and Bath Road was conducted. On 12 July, the weather was sunny with a few clouds and the temperature was hot, ranging between 25 to 30 degrees Celsius, which is ideal for butterflies. On 27 September, the weather was sunny with a light wind and the temperature was 20 degrees Celsius. This detailed report includes butterflies during a flight season when the number of species for the year is highest.

4.6.3.2 Method

On 12 July, two hours were spent on the Frontenac Institution Farm part of the site between 10:00 a.m. and 12:00 p.m. which is the best time for locating butterflies. On 27 September, one hour was spent on the Cataraqui Region Conservation Authority lands part of the site. Other contributions to the report are from Carolyn Bonta from 02 September 2004. The area covered included most of the area adjacent to the wetland. A small section along the north half, mostly farm field, was not covered. Identification was made by sight records and collecting.

4.6.3.3 Species List

Taxonomic order and nomenclature follow Layberry *et al.* (1998)

Provincial Ranking of Status of butterflies was taken from Holmes *et al*. (1991)

- **S4** – Apparently secure and essentially ineradicable under present conditions.
- **S5** – Demonstrably secure and essentially ineradicable under present conditions.
- **SN** – Regularly occurring, usually migratory and typically non-breeding species for which no significant or effective habitat conservation measures can be taken; i.e., lepidoptera which regularly migrate to where they reproduce, but then completely die out every year with no return migration. Species in this category are so widely and unreliably distributed during migration that no small set of sites could be set aside with the hope of significantly furthering their conservation. Adapted from a report made to the Ontario Heritage Foundation by the Nature Conservancy of Canada.
- **T** – Threatened (Ontario Ministry of Natural Resources) Any native species that is at risk of becoming endangered in Ontario

Table 4.6.3-1 - Species accounts

Common Name	Scientific Name	Numbers Observed	Status
European Skipper	*Thymelicus lineola*	10	S5
Canadian Tiger Swallowtail	*Papilio canadensis*	1	S5
Cabbage White	*Pieris rapae*	22	S5
Clouded Sulphur	*Colias philodice*	33	S5
Summer Azure	*Celastrina neglecta*	1	S5
Painted Lady	*Vanessa cardui*	2	SN
Red Admiral	*Vanessa atalanta*	1	S5
Eyed Brown	*Satyrodes eurydice*	6	S5
Monarch*	*Danaus plexippus*	3	T

*Reported by C.Bonta

4.6.3.4 Status Of Host Plants

The status of host plants in the Kingston area is taken from (Crowder A. *et al.*) 1997, Plants of the Kingston Region:1996. However, some of the host plants listed may not be present in the study area. Host plants for butterflies is taken from The Ontario Butterfly Atlas: 1991 (Holmes A. *et al*. 1991).

Table 4.6.3-2 Host plant species

Butterfly	Host Plant	Status of Host Plant
European Skipper	Timothy	Very Abundant*
	Red Top	Abundant*
	Other Grasses	
Canadian Tiger Swallowtail	White Birch	Abundant
	Poplar (sp.)	Abundant
	Cherry(sp.)	Common to Abundant
	Ash (sp.)	Abundant
	Maple (sp.)	Abundant
Cabbage White	Mustard Family (especially domestic varieties)	Abundant*
Clouded Sulphur	White Clover	Abundant*
	Alfalfa	Abundant*
	Vetch (sp.)	Abundant*
Summer Azure	Blueberry	Abundant
	Meadowsweet	Abundant
	Trefoil (sp.)	Occasional to Abundant (some*)
	Sumac (sp.)	Abundant
Painted Lady	Thistles (sp.)	Abundant*
	Knapweed (sp.)	Abundant*
	Burdock (sp.)	Abundant*
	Nettles (sp.)	Abundant (some*)
Red Admiral	Nettles (sp.)	Abundant (some*)
Eyed Brown	Sedges (sp.)	Abundant
Monarch	Common Milkweed	Abundant

* - Introduced Plants
(sp.) – particular species not identified

4.6.3.5 Discussion

The species discussed in this report are all common in the Kingston area and there is probably little difference with the information provided from Holmes A. *et al.* (1991), *The Ontario Butterfly Atlas.*

With the exception of Monarch, none of the species reported is endangered, threatened or of special concern provincially. Monarch is now a Threatened species on the Species at Risk in Ontario list (Ontario Ministry of Natural Resources). The two non-native species (Cabbage White, European Skipper) are the two most common butterflies in southern Ontario during their flight seasons. The Painted Lady is a breeding migrant with two broods and is a visitor to most parts of the province where it can be very common some years yet not present in other years. All species found, except for the Eyed Brown and the Summer Azure, use open areas like most of the Frontenac Institution property. The Summer Azure was located near the wood lot at the south end of the survey area. The Eyed Brown was the only species that requires open wet sedge areas. The number of species overall and species numbers are low compared to other habitats in the Kingston area. The weather for the 2004 season has been relatively wet with cooler temperatures which has had an effect on all populations of butterflies in the Kingston region.

The fall blooms of New England Aster (*Aster novae-angliae*) and Canada Goldenrod (*Solidago canadensis*) on the Cataraqui Region Conservation Authority lands, provide nectar sources for migrating Monarchs. Several patches of Common Milkweed (*Asclepias syriaca*) can provide a food source for Monarch larvae.

Eastern Monarch populations in 2004 have been low across North America. In many cases, population numbers can rebound after a poor year. However, in central Mexico two severe storms in January, along with illegal logging has had an effect (Davis 2004). This combined with other factors such as global warming could be detrimental to Monarch populations.

Although this survey was conducted during a flight season with the highest number of species, a complete list of butterflies of the area would have to include numerous visits starting in April and ending in late October. However, it doesn't appear that any species in the Kingston area, with a different flight season and which could be a species at risk, with the exception of Monarch as noted above, would be found with the habitat present in this region.

Development would be likely to diminish numbers of butterflies, through loss of habitat or possible collision with motor vehicles.

4.6.3.6 Summary

The study area has an average diversity for this type of habitat and the sampling effort involved.

4.6.3.7 References

Layberry R., P. Hall, J. Lafontaine.1998. *The Butterflies of Canada: 1998.* University of Toronto Press, Toronto, Ont.

Holmes, A., R. Tasker, Q. Hess and A. Hanks.1991. *The Ontario Butterfly Atlas: 1991*. Toronto Entomologists' Association, Canada.

Ontario Ministry of Natural Resources. **www.ontarioparks.com/english/sar.html**

Davis, D. 2004. Monarch News. In Ontario Insects: 2004, Vol.10, No.1. Toronto Entomologists Association, Toronto, Ontario.

Crowder, A., K. Topping, J. Topping. 1997. *Plants of the Kingston Region: 1996.* Department of Biology, Queen's University, Kingston Ontario.

5.0 PLANNING CONSIDERATIONS

5.1 POLICY AND PLANNING

Susan E.Grigg

5.1.1 INTRODUCTION

The Official Plan of the Township of Kingston (1996) identifies a proposed extension of Centennial Drive south between Bath Road and Front Road west of Little Cataraqui Creek. Determination of a preferred route for the proposed road extension would be subject to federal, provincial and municipal legislation and policy. The former Kingston Township Official Plan identifies provincially significant values within which development cannot occur, and adjacent lands where prior environmental assessment would be required before development could occur. The Municipality of the City of Kingston, which resulted from the 1998 amalgamation of the City of Kingston and the Townships of Kingston and Pittsburgh, is currently engaged in a process to prepare a new Official Plan for the amalgamated municipalities that would replace the existing official plans. As part of this process, the City is preparing several subsidiary plans, such as the Urban Growth Strategy, Transportation Master Plan and a Natural Heritage Plan. Although the proposed road extension is included in the Official Plan for the former Kingston Township, it is not illustrated in the Transportation Master Plan for the City for the next 25 years (Dillon Consulting, 2004).

For an extension of Centennial Road south from Bath Road to Front Road to occur in the future under a new Official Plan, it is likely that the project would need to be identified and enabled in the new Official Plan. During formulation of such a plan, the Municipality is required to have regard for protection of provincially significant values identified in the Provincial Policy Statement under the *Planning Act*. The project area includes such values as significant wetland and fish habitat. The City has approval authority for the Official Plan; review by provincial ministries would be coordinated by the Ministry of Municipal Affairs. The project would require screening under the Municipal Class Environmental Assessment (EA) under Ontario's *Environmental Assessment Act* to determine the category of project, but would appear most likely to meet a Schedule C process under this Class EA. In addition to assessment through the Schedule C process under the Municipal Class EA, the project would appear to trigger assessment under the *Canadian Environmental Assessment Act*. Tenure of the lands adjacent to the creek also appears to be a factor that would require further study, as some of these lands are under restrictive covenants that would be prohibitive to this type of land use.

Regardless of the form of assessment, the potential environmental effects of the project should be considered along with other like projects within the watershed of Little Cataraqui Creek, and not just at the location of the project in question. Assessment should also consider potential effects on the wetland complex from increased urban development that may be associated with a road extension. This approach would allow consideration of the overall diversity and interconnectivity of natural features and areas within the Little Cataraqui Creek watershed and wetland complex, recognizing that some of these features extend beyond the project area. This approach would be consistent with the Natural Heritage System approach explained in the *Natural Heritage Reference Manual for Policy 2.3* of the Provincial Policy Statement prepared by the Ministry of Natural Resources (MNR, 1999). This is also consistent with recommendations from other studies of the report area (Queen's University, 2002).

Key municipal, provincial and federal legislation and policy that are relevant to the proposed road extension are outlined below.

5.1.2 MUNICIPAL LEGISLATION AND POLICY

5.1.2.1 Official Plan of the former Kingston Township

The City of Kingston currently uses the policies of three Official Plans to guide physical development of the municipality. These plans are for the three former municipalities: City of Kingston, Kingston Township and Pittsburgh Township. The City is in the process of developing a single updated and integrated Official Plan. As part of the process for a new Official Plan, the City is preparing subsidiary plans, including a Transportation Master Plan, Urban Growth Strategy, Cycling and Pathways Study, and a Natural Heritage Plan. The current Official Plans will remain in effect until approval of a new comprehensive plan for the amalgamated City.

The study area is located within the former Kingston Township. The proposal for a two lane arterial road between Front Road and Highway 33 (Bath Road) west of Little Cataraqui Creek (Centennial Drive Extension) is noted within section 5, Infrastructure Policy, of the Official Plan for the former Kingston Township and illustrated on Schedule "A" (**Figure 5.1-1**). The plan acknowledges that an assessment of this proposed road will be required in accordance with the *Environmental Assessment Act*. It also states that "While it is the intention of the Township to locate the southern termination point of this proposed road as shown on Schedule "A", the ultimate location of this termination point will be decided in the context of the aforementioned Environmental Assessment." (Township of Kingston, 1996).

Schedule "A" Map 1 of the Official Plan illustrates the road crossing through lands designated as: Environmental Protection Area (Wetlands), Institutional, and Major Recreational Open Space. Environmental Protection Area (Wetland) policies in the official plan are designed to protect and conserve land and the natural environment. Section 3-5.3(c) of the Official Plan allows for new private and or public utilities (e.g. roads). It also states that development may be allowed on adjacent lands following completion of environmental assessment. This is in keeping with direction in the Provincial Policy Statement (**Section 5.1.3.1** below).

The Official Plan of the Township of Kingston (1996) contains many provisions for the protection of natural heritage features within the former Township which should be considered as part of the environmental assessment of the road extension:

- The Vision in the Strategic Community Plan states: "Kingston Township is a community where people come first, living in a healthy, barrier-free environment characterized by neighbourhoods and districts having a sense of belonging and identity and governed by the values set out below...". One of these values listed is Natural Environment: "In the on-going evaluation of the Municipality, the natural environment and all resource lands, including agricultural lands, are to be respected, protected, preserved and improved by every reasonable means."
- Under section 2, General Policies, provisions for sustaining land through protection of natural and cultural environment are outlined. "It is intended that community resources and assets be conserved and carefully managed and that the need to preserve these assets (including resource lands) be carefully weighed against the need to use such assets for other purposes."
- Under section 2.2, Natural Environment, the plan "encourages the conservation, protection and sound management of natural environmental assets and resources, including, but not limited to: significant wetlands; significant flood plains; areas of significant aquatic and/or wildlife habitat; areas of natural and scientific interest (ANSI); significant forest areas; shorelines; and, other environmentally sensitive areas."

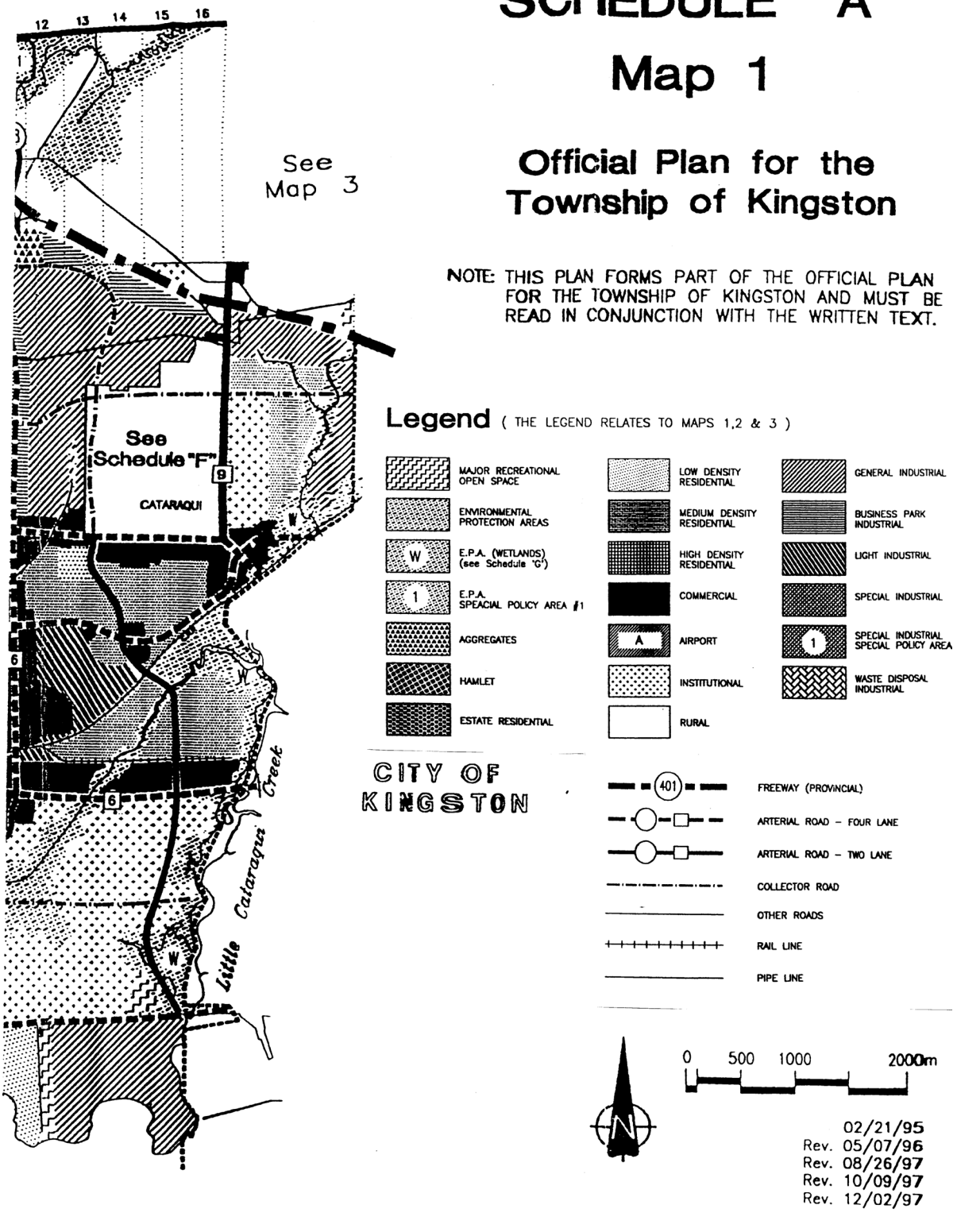


Figure 5.1-1: Composite excerpt from Official Plan for the (former) Township of Kingston (Courtesy City of Kingston)

5.1.2.1.1 Kingston Transportation Master Plan

This document outlines strategic direction for the development of transportation networks, programs and priorities for the City of Kingston for a 25-year period. Figure 9 of the plan, Recommended Transportation Network Improvements (Year 2026), illustrates a Centennial Drive road connection from Taylor Kidd Boulevard to Bath Road, but does not include an extension of this road from Bath Road south to Front Road as is identified in the former Kingston Township Official Plan **(Figure 5.1-2)** (**www.cityofkingston.ca**).

5.1.2.2 Municipal Class Environmental Assessment

The Municipal Class Environmental Assessment (2000) for Ontario is a planning process approved under Ontario's *Environmental Assessment Act (EA Act)* for a class of municipal undertakings. Infrastructure projects undertaken by municipalities, including roads, are subject to the requirements of the Municipal Class EA. Projects are classified into one of three classes: Schedule A, B or C. Schedule C projects include the preparation of an Environmental Study Report (ESR) that evaluates feasible alternative ways of solving an identified problem, including the "null" or do nothing alternative. Schedule C projects include three mandatory points of consultation in the form of published notices (i.e. media advertisements), and the ESR is subject to review by the public and affected agencies.

In 2001, an environmental assessment for the proposed extension of Centennial Drive between Taylor Kidd Boulevard and Bath Road was completed, following the process for a Schedule C project under the Municipal Class EA. A proposed extension of Centennial Drive to Front Road would also require EA under the Municipal Class EA, and would likely fall within Schedule C, requiring completion of an ESR. Projects that fall within Schedule C include construction of a new road with estimated costs over $1.5 million.

The ESR would evaluate alternative solutions to meeting the road and traffic problems and the demand for a new road. It would assess potential effects on: agriculture; residential/ commercial/institutional uses; terrestrial vegetation and wildlife; heritage resources; outdoor recreation; aesthetics; communities; noise; surface drainage; ground water; soils geology; topography/landforms; climatic features; fish, aquatic wildlife and vegetation. Key considerations when screening potential effects include whether the project would affect watercourses, fisheries, and significant natural heritage features. Significant natural and cultural heritage features should be avoided where possible, or where not, effects should be minimized and every effort made to mitigate effects. The use of prime agricultural lands shall also be minimized, "unless such lands have been designated for development by Official Plan or by some other approval which has undergone Review Agency review." (Municipal Engineers Association, 2000).

Individuals, interest groups and review agencies may make a request for a Part II Order in writing to the Minister of the Environment if they feel their concerns have not adequately been addressed through the Municipal Class EA process (**Section 5.1.3.2**). This is in effect requesting that the project comply with Part II of the EA Act which involves an individual EA (also known as a bump-up request). The Minister of Environment determines whether or not to approve such a request. If such a request is made, implementation of the project would be delayed pending a decision by the Minister of Environment.

5.1.3 PROVINCIAL LEGISLATION AND POLICY

Ontario's municipal land use planning process is currently under review, including the Ontario *Planning Act* (2000) and the accompanying Provincial Policy Statement. One overriding aspect of the proposed changes is to require that planning authorities, such as the City of Kingston, "be consistent with" the policy statements under the *Planning Act*, rather than the current "have regard for" wording in the legislation. The provincial statutes described below can be found at the following weblink:
http://www.e-laws.gov.on.ca/.

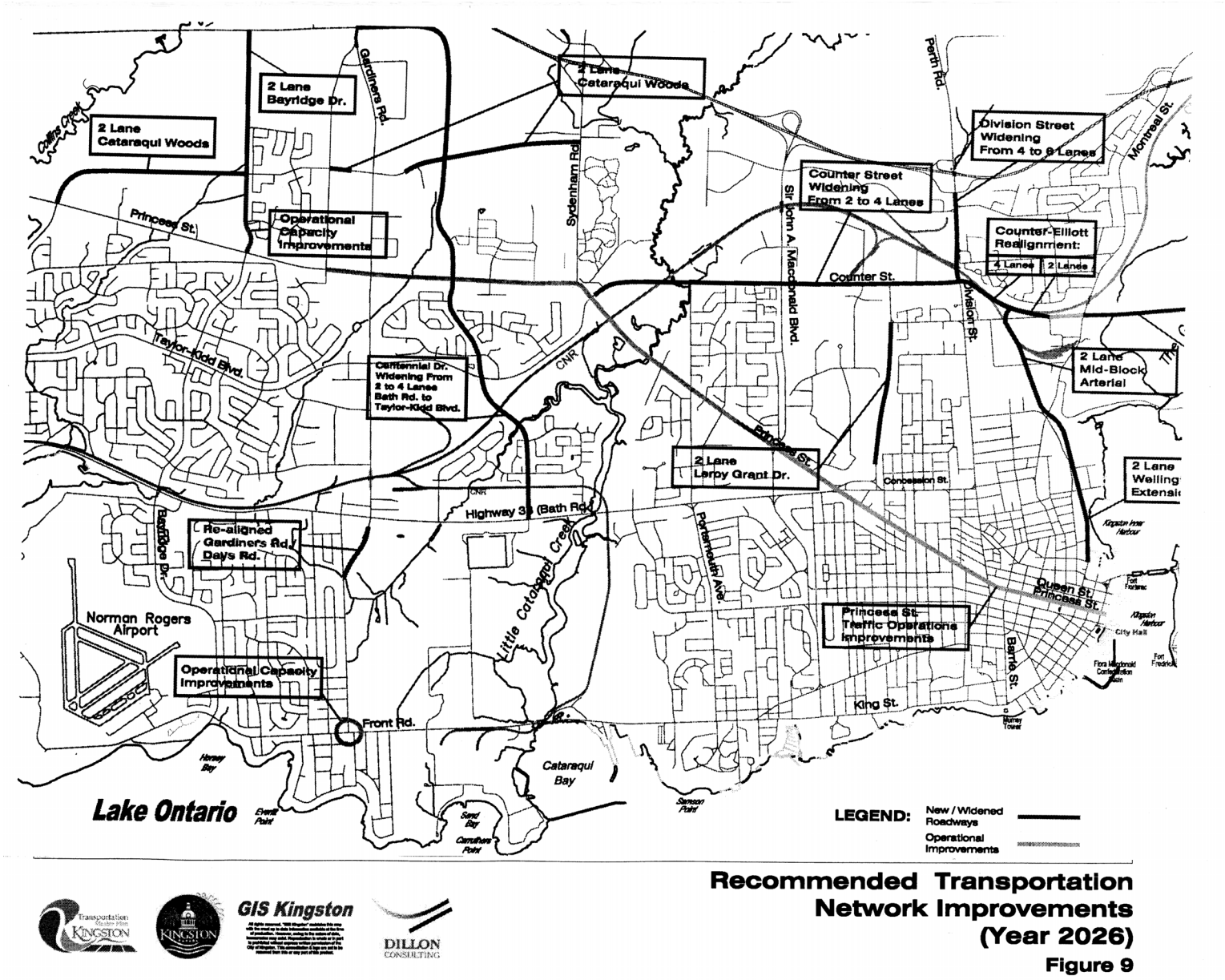


Figure 5.1-2: Taken from Transportation Master Plan (Courtesy City of Kingston)

5.1.3.1 Provincial Policy Statement

The Ministry of Municipal Affairs and Housing (MMAH) Provincial Policy Statement (PPS) under the *Planning Act* provides policy direction for key provincial interests related to land use planning. As outlined below, several sections of the PPS apply to the proposed road extension.

In section 1.3.2, Transportation, the PPS directs that "Transportation systems will be provided which are safe, environmentally sensitive, and energy efficient." (MMAH 1997)

Section 2.3, Natural Heritage, specifies prohibitions for development and site alteration. Development and site alteration "will not be permitted in: significant wetlands south and east of the Canadian Shield…" (i.e. identified as provincially significant by the Ministry of Natural Resources) and "significant portions of the habitat of endangered and threatened species." The definition of development "…does not include activities that create or maintain infrastructure authorized under an environmental assessment process..", and so dependent on the results of the environmental assessment the development prohibitions may not apply to the proposal. Site alteration means "activities, such as fill, grading and excavation, that would change the landform and natural vegetative characteristics of a site." (MMAH, 1997). The Little Cataraqui Creek Wetland is classed by the Ministry of Natural Resources as provincially significant, and therefore the site alteration prohibitions should apply within the wetland boundary.

The policies state that "Development and site alteration may be permitted" in the following areas that apply to this site, if it has been demonstrated that there will be no negative impacts on the natural features or the ecological functions for which the area is identified: fish habitat, significant woodlands south and east of the Canadian Shield, significant valleylands south and east of the Canadian Shield, significant wildlife habitat. For the above, "significant" refers to features or areas that are "ecologically important in terms of features, functions, representation or amount, and contributing to the quality and diversity of an identifiable geographic area or natural heritage system." (MMAH 1997). At this time the City has not identified significant woodlands through an Official Plan. The policies also state that the diversity of natural features in an area, and the natural connections between them should be maintained, and improved where possible.

Development and site alteration may be permitted on adjacent lands to the above areas if it has been demonstrated that there will be no negative impacts on the natural features or on the ecological functions for which the area is identified (MMAH 1997). The Natural Heritage Reference Manual for Policy 2.3 of the Provincial Policy Statement (MNR 1999) prepared by the Ministry of Natural Resources (MNR) recommends an adjacent lands distance of 120 m of individual significant wetlands, and 50 m of significant habitat of endangered or threatened species. Protection of endangered and threatened species is also provided for in provincial and federal legislation as outlined below.

Section 2.4 of the PPS, Water Quality and Quantity, may also apply: "The quality and quantity of ground water and surface water and the function of sensitive ground water recharge/discharge areas, aquifers and headwaters will be protected or enhanced." (MMAH 1997).

5.1.3.2 Environmental Assessment Act

Municipalities are subject to the requirements of the *Environmental Assessment Act* (EA Act). Environmental assessment obligations may be met through a Class EA, exemption orders or individual EA (i.e. Municipal Class EA). The Minister of Environment is responsible for ensuring that EA Act requirements are met. As noted in **Section 5.1.2.2**, individuals may appeal to the Minister if they feel their concerns regarding a project subject to the EA Act have not been adequately addressed.

5.1.3.3 Species at Risk Legislation (Endangered Species Act, Fish and Wildlife Conservation Act)

The Ministry of Natural Resources (MNR) is the lead provincial agency responsible for species at risk management in Ontario. The MNR recommends species to be added to or removed from the recently approved Species at Risk in Ontario list: (**http://www.mnr.gov.on.ca/mnr/Ebr/saro/SARO_26April2004.pdf**). Ontario species are assigned status designations based on complementary evaluations carried out by the provincial Committee on the Status of Species at Risk in Ontario (COSSARO) and the national Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (**Section 5.1.4.2**). Species at risk status designations are: extirpated, endangered, endangered-regulated (COSSARO), threatened, and special concern (MNR, 2004). Endangered-regulated species and their habitat have legislative protection in this province through regulation under Ontario's *Endangered Species Act* (1971). This Act is administered and enforced by the Ministry of Natural Resources. Some species at risk are listed as specially protected under the province's *Fish and Wildlife Conservation Act* (e.g., specially protected mammals, amphibians, reptiles, invertebrates, and birds as listed in schedules under the Act), also administered and enforced by the MNR. There is also federal legislation that provides protection for species at risk (**Section 5.1.4**).

5.1.3.4 Conservation Authorities Act

In 1991, Dupont Canada Inc. transferred ownership of lands within the study area to the Cataraqui Conservation Authority (Lots 11, 12 and 13, Broken Front Concession, Township of Kingston). Included under "restrictive covenants" of the transfer was a restriction that the land conveyed "be used as conservation land as defined in *Conservation Land Act*, S.O. 1988 c. 41 and shall be used for the objects of the conservation, restoration, development and management of natural resources as defined in the *Conservation Authorities Act*, R.S.O. c. 85, s. 20 as amended and in the event that the said lands are no longer designated conservation land or used for the objects hereinbefore set forth, the Transferee shall reconvey the lands to the Transferor for the sum of one ($1.00) dollar." Under the *Conservation Lands Act*, conservation land is defined as "includes wetland, areas of natural and scientific interest, land within the Niagara Escarpment Planning Area, conservation authority land and such other land owned by non-profit organizations that through their management contribute to provincial conservation and heritage program objectives." Allowing use of these lands for an arterial road does not appear in keeping with the restrictive covenants, and would appear to trigger a reconveyance.

The southern section of the proposed road, as illustrated in Schedule "A" of the *Official Plan of the Township of Kingston*, would be within the floodplain of Little Cataraqui Creek. The creek has an associated Designated Flood Risk Area as illustrated in **Figure 5.1-3**, determined through hydrologic analysis. Any proposed works within this area would require approval from the Cataraqui Region Conservation Authority under the Fill, Construction and Alteration to Waterways Regulations under the *Conservation Authorities Act*. Applications are reviewed by a Board of Directors, and there is no legislative requirement for consultation.

5.1.3.5 Other Provincial Directions That May Apply

Dependent on the route location, several other pieces of legislation and policies may apply to the proposed project. Some of these are identified below.

- Environmental Guidelines for Access Roads and Water Crossings (MNR)
- Ontario Water Resources Act (MNR)

5.1.4 FEDERAL LEGISLATION

The proposed road extension may be subject to federal legislation, some of which are described below. This legislation can be found at the following weblink**: http://laws.justice.gc.ca/**

5.1.4.1 Canadian Environmental Assessment Act

Extension of Centennial Road through the report boundary would appear to meet at least three "triggers" under the *Canadian Environmental Assessment Act* (CEA Act). A trigger occurs when a federal department is the proponent of a project, provides funds or lands to facilitate a project, or exercises a regulatory duty in relation to a project. For each trigger, the responsible federal authority would confirm the application of the CEA Act and determine the scope of assessment that would need to be conducted. Under the CEA Act, federal departments are required to conduct an environmental assessment for projects for which they provide lands to facilitate the project, such as the farm lands adjacent to the west side of the creek south of Bath Road within Frontenac Institution and managed by the Correctional Service of Canada. Federal departments are also required to conduct an environmental assessment for a project where they exercise a regulatory duty in relation to a project, such as Fisheries and Oceans Canada and provisions under the *Fisheries Act* that protect fish or fish habitat. The following triggers would appear to apply to the project:

- is on federal land (i.e. affects projects crossing federal lands)–CEAA ss. 5 (1)(c). Correctional Service of Canada is the responsible authority (e.g. Frontenac Institution farm lands).
- likely to affect fish or fish habitat, affect the quantity or quality of water available for fish or result in the harmful alteration, disruption or destruction (HADD) of fish habitat–Fisheries Act-Fisheries and Oceans Canada–Habitat Management and Enhancement (authorization is required to harmfully alter fish habitat, e.g. in the construction of stream crossings).
- involves the federal government in the acquisition, administration or disposal of real property for which a licence for any use or occupation of real property is required–Federal Real Property Regulations, paragraph 4(2)a (apply to projects which propose to use or occupy federal real property).

5.1.4.2 Federal Species at Risk Act

The *Species at Risk Act* (SARA), proclaimed into law in June of 2003, is federal government legislation with the goal of preventing wildlife species from becoming extinct in Canada and securing necessary actions for species recovery. It provides for the legal protection of listed endangered and threatened species of plants and animals (i.e. "listed" means a species on the List of Wildlife Species at Risk set out in Schedule 1 of the Act) and the conservation of their biological diversity through protection of their critical habitat. The national Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assigns one of five status designations to native species, namely *Extinct*, *Extirpated*, *Endangered*, *Threatened* and *Special Concern*. SARA is administered by Environment Canada in collaboration with Parks Canada and Fisheries and Oceans Canada. There are four categories of prohibitions under this Act that apply to prevent destruction of species or their critical habitat. SARA applies to migratory birds (i.e. listed in the *Migratory Birds Convention Act*) and aquatic species anywhere, and all listed species and their critical habitat on federal lands. The definition of "aquatic species" is a wildlife species that is a fish, as defined in section 2 of the *Fisheries Act* and outlined below, or a marine plant, as defined in section 47 of that Act. This legislation also includes a "safety net" that applies if the Minister decides that provincial legislation is not sufficient to protect a species at risk (**http://laws.justice.gc.ca/en/s-15.3/102837.html**). As well, the federal *Fisheries Act*, described below, provides protection to all fish habitat and the federal *Migratory Birds Convention Act* provides protection to most species of migratory birds.

Figure 5.1.3:Excerpt from Public Information Flood Risk Map, 1987 (Courtesy CRCA)

5.1.4.3 Fisheries Act

The Cataraqui Region Conservation Authority (CRCA) has a stage 2 agreement with Fisheries and Oceans Canada under Section 35(2) of the *Fisheries Act*. Under this agreement, the CRCA screens projects for harmful alteration, disruption or destruction (HADD) to fish habitat. The definition of "fish" under this legislation includes: parts of fish; shellfish, crustaceans, marine animals and any parts of shellfish, crustaceans or marine animals; and the eggs, sperm, spawn, larvae, spat and juvenile stages of fish, shellfish, crustaceans and marine animals.

5.1.5 REFERENCES

Dillon Consulting. 2004. *Kingston Transportation Master Plan. Final Report.* July 2004. Submitted to the City of Kingston
. **http://www.cityofkingston.ca/**

Ministry of Municipal Affairs and Housing. 1997. *Provincial Policy Statement.* Queen's Printer for Ontario.

Ministry of Natural Resources. 1999. *Natural Heritage Reference Manual for Policy 2.3 of the Provincial Policy Statement. June 1999.*

Ministry of Natural Resources. 2004. *Species at Risk in Ontario list.* **http://www.mnr.gov.on.ca/mnr/Ebr/saro/SARO_26April2004.pdf**

Municipal Engineers Association. 2000. *Municipal Class Environmental Assessment. June 2000.*

Queen's University. 2002. *Green Space Planning for the Little Cataraqui Creek Watershed: From Fragmentation to Connectivity. A report to the Cataraqui Region Conservation Authority.* School of Urban and Regional Planning, Queen's University.

Township of Kingston. 1996. *Official Plan of the Township of Kingston.*

http://laws.justice.gc.ca/ (Consolidated Federal Statutes and Regulations)

http://www.e-laws.gov.on.ca/ (Consolidated Provincial Statutes and Regulations)

5.2 LITTLE CATARAQUI CREEK MARSH, A GREAT LAKES WETLAND

Adèle Crowder

5.2.1 DEFINITION

Lake Ontario wetlands include submerged and emergent offshore plant beds, plant beds on sandy shores with sand bars offshore, lagoons behind barrier beaches, and riverine or bay marshes. (Kusler and Smardon 1990) The Little Cataraqui Creek marsh is a riverine marsh, and the portion from the mouth to Princess Street is estuarine, influenced by both lake and river water.

5.2.2 HISTORY AND GOVERNANCE

Great Lakes wetlands have been converted to agricultural land, used as industrial or dumpsites, as transport corridors, and more recently as housing sites. By the 1960s, however, their ecological functions were becoming recognised, particularly as controls on water levels, as immobilization sites for toxins and nutrients, and as habitats for fish and waterfowl. As a result, conservation of coastal marshes became part of planning protocols in Ontario and the U.S. lake states. The initial Ontario evaluation system for wetlands did not give Great Lake wetlands a high score (Ontario Ministry of Natural Resources, 1993), but this was remedied by an addition to the scoring system introduced in 1994. The proposed Ontario Provincial Policy Statement, 2004, currently under discussion, states that significant coastal wetlands within the Great Lakes-St. Lawrence river system should be protected (Ontario Ministry of Municipal Affairs and Housing website).

Because the waters of Lake Ontario and the fish and wildlife that use them are a binational concern, the International Joint Commission formulated a Great Lakes Water Quality Agreement "to restore and maintain the chemical, physical and biological integrity of the Great Lakes basin ecosystem". Since 1998, to implement the Great Lakes Water Quality Agreement, a management plan for Lake Ontario has been in place (Lakewide Management Plan for Lake Ontario, LaMP), organized by the United States Environmental Protection Agency (USEPA), Environment Canada (working out of Burlington), New York State Department of Environmental Conservation and the Ontario Ministry of Environment. The goals of the four agencies include the following: (1) "the perpetuation of a healthy, diverse, and self-sustaining wildlife community that utilizes the lake for habitat and/or food shall be ensured by attaining and sustaining the waters, coastal wetlands, and upland habitats of the Lake Ontario basin in sufficient quality and quantity" and (2) "Lake Ontario offshore and nearshore zones and surrounding tributary, wetland and upland habitats shall be of sufficient quality and quantity to support ecosystem objectives for the health, productivity, and distribution of plant and animals in and adjacent to Lake Ontario."

The management plan includes improving areas which have become badly degraded. Locally in eastern Ontario, such sites include the Bay of Quinte, where "a fisheries habitat management plan is being developed to protect existing high-quality habitats from future development and restore degraded habitats". (LaMP Update, 2004). A binational habitat strategy for the LaMP is expected in future years.

Our study area therefore is not only of interest municipally and provincially but to the four Canadian and U.S. agencies managing Lake Ontario.

5.2.3 MONITORING

Recently the USEPA set up a Great Lakes Coastal Wetlands Consortium to develop and implement a monitoring framework for coastal wetlands. Questions about the condition of coastal wetlands—is a particular wetland static, degrading, improving?—have led to conferences held every two years on the State of the Lakes Ecosystem (SOLEC). An intense binational effort has defined possible indicators of change,

including ecosystem components such as water quality, and diversity and numbers of wildfowl, macroinvertebrates, and fish (Nature Conservancy 1997).

5.2.3.1 Monitoring in Ontario

As part of this international monitoring effort Environment Canada and allied agencies investigated 28 marshes on Lake Ontario, ranging from disturbed, polluted and silted marshes at Bowmanville and Oshawa east to relatively pristine shore marshes on Wolfe Island (Environment Canada and Central Lake Ontario Conservation Authority 2004). We are fortunate that the agencies included the mouth of Little Cataraqui Creek as one of their 28 selected sites; their 2004 report has been used in preparing some of our sections such as those on macroinvertebrates and water quality. The report "evaluated data collected during 2002 and 2003 and proposes a multi-metric approach for simplifying comparisons among biotic communities and across years of the study. Metrics are biological attributes that are known to respond in specific and predictable ways to change in wetland condition. Individual metrics can then be combined to create an Index of Biotic Integrity (IBI) for biological monitoring. Additional data from other coastal wetlands within Lake Ontario were used to provide a lake-wide context for comparison and to support broader conclusions." (Environment Canada and Central Lake Ontario Conservation Authority, 2004). The IBI was shown to be positively correlated to disturbance.

When scores of the IBI were compared, with higher scores indicating better conditions, Little Cataraqui Creek Marsh ranked sixth out of 28 (after Bayfield Bay, Robinson's Cove, Hay Bay South, Button Bay and Hay Bay North). At the bottom of the ranking were sites such as Bowmanville Marsh and Frenchman's Bay. Oshawa Second Marsh was ranked fourteenth. For relative disturbance the Little Cataraqui Creek Marsh was ranked seventh, with Parrott's Bay being top of the list, followed by Presqu'ile and Big Sandy Bay on Wolfe Island.

The importance of this research for our study site is that the Little Cataraqui Creek Marsh currently ranks high in the hierarchy of coastal marshes on the north shore of Lake Ontario. Although it has been impacted by farming, industry, transport corridors and building, its chemical and biotic condition is still relatively good. It is therefore imperative that it should now be maintained against further degradation which would result from development such as road building or housing. Once a marsh has been disturbed its restoration (considered vital for the Lake Ontario ecosystem) becomes very expensive. Examples of the costs of restoration are not far to seek, in the Bay of Quinte and in the even more degraded and therefore more expensive sites at Coote's Paradise near Burlington and Oshawa Second Marsh.

5.2.4 REFERENCES

Environment Canada and Central Lake Ontario Conservation Authority. March 2004. *Durham Region Coastal Wetland Monitoring Project: Year 2 Technical Report.* Downsview.

Environment Canada, USEPA, Ontario Ministry of the Environment, and New York State Department of Environmental Conservation. May 1998. *Lakewide Management Plan for Lake Ontario. Stage 1; Problem Definition*. Downsview.

Ontario Ministry of Natural Resources. 1993. *Ontario Wetland Evaluation System, Southern Manual*. Toronto

Ontario Ministry of Municipal Affairs and Housing website: **www.mah.gov.on.ca**

LaMP Update. 2004. Environment Canada. Burlington.

Nature Conservancy. 1997. *Great Lakes Wetlands Biomonitoring Project.* Working Draft. Toronto.

5.3 WETLAND BUFFERS

Robert B. Stewart

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Thanks to Erling Armson of Ducks Unlimited and to the late Tom Marsh for providing me with the background material that launched me into this project.

5.3.1 INTRODUCTION

A general recognition of the value of wetland ecosystems in trapping agricultural and toxic chemicals, protecting water resources and providing habitat for many species of mammals, birds, reptiles, amphibians and fish as well as a variety of aquatic and wetland margin plants has resulted in an Ontario Wetland Policy (1992) establishing an adjacent lands policy of 120 m from the edge of provincially significant wetlands. The policy states "The diversity of natural features in an area and the natural connections between them should be maintained...". The policy allows for incursions into this protected space ONLY if it "... has been demonstrated that there will be no negative impacts on the natural features ...". While the term "adjacent lands" is that used by the Ontario Ministry of Natural Resources (OMNR), "buffer" is the term most frequently encountered in the scientific literature and while the two are not synonymous, adjacent lands would include but not necessarily define the size of the buffer zone.

5.3.2 REVIEW OF THE LITERATURE

The loss of wetlands in Ontario, south of the Canadian shield, was calculated by Snell (1989) to be sixty-one percent of that which existed at the time of settlement. While the greatest loss of wetlands occurred in southwestern Ontario, this process of wetland loss continues. Snell (1989) showed that from 1967 to 1982 the loss of wetland in south Frontenac County increased to seventy percent.

Hummel (1981) pointed out the importance of wetlands to wildlife. He listed forty-two species of birds that are totally dependent on southern Ontario wetlands and a further twenty-six that are partially dependent. Eighteen species of fish are listed that are most common to Ontario wetlands and sixteen species of mammals that utilize wetlands for feeding and/or breeding. Twenty species of reptiles and amphibians are noted as found in southern Ontario wetlands. The importance of a buffer zone supporting these wildlife species must be emphasized.

A number of reports dealing with the effect of buffer width from the edge of water inland on the well-being of a variety of vertebrate species have advocated widths from generally 30 to 300 m.

The recommended width of buffer zones to preserve wetland biodiversity has varied dependent on the particular study. Semlitsch and Bodie (2003) studied 19 frog, 13 salamander, 5 snake and 28 turtle species and recommended a buffer width up to 290 meters for amphibians and 289 m for reptiles. Fahrig *et al*. (1995) concluded that road traffic in the vicinity of wetlands has a negative impact on the survival of amphibians. This study, carried out near Ottawa, Ontario, has some relevance for the amphibian species likely to occur in our area. They point out that the number of passenger vehicles in Canada has doubled from 6.4 million in 1969 to 12.8 million in 1989 suggesting that the effect of automobile traffic on wetland amphibians is more likely to increase than decrease. Houlahan and Findlay (2003) concluded, following a study of 74 Ontario wetlands that a buffer zone of 3000 to 4000 m is important for maximum richness of species and diversity. While the authors note the impracticality of such a buffer width, it does point to the potential inadequacy of a narrow buffer width. A study by Findlay and Houlahan (1997) on the effects of roads and forest cover on the species richness of birds, mammals, herptiles and plants in 30 southeastern Ontario wetlands concluded that either increased traffic or decreased forest negatively impacted on

species numbers up to a distance of 2 km from the wetland.

While the inclusion of the forest component in their study (Findlay and Houlahan 1997) reduces its relevance for the Little Cataraqui Creek wetland, as it now exists, it does emphasize the negative impact that some human activities can have on wildlife at a distance from where the habitat modification or disturbance took place. Improvement of the biological quality of the buffer strip will be essential if adjacent lands are sold for development. Planting of tree, shrub and grass species while improving wildlife habitat, can affect microclimate by providing shade over wet areas and increase the sequestering of undesirable chemicals from water run-off from adjacent lands (Eastern Canada Soil and Water Conservation Centre 1995). Planting of sedges at the wetland edge can also help remove heavy metals before they reach the water (Anderson *et al.* 1996).

Norman (1996) points out reduced wetland habitat resulting from changes in land use place greater emphasis and importance on those remaining as we become more aware of the importance of wetlands to a number of environmental issues. Where waterfowl utilize a wetland for nesting, Norman recommends a buffer setback of 300 m. Norman (1996) also points out that the water-covered portion of these wetland complexes serve as spawning grounds, nursery habitat and living areas for many important fresh water species.

The importance of wetland buffers has been recognized in other jurisdictions. In 1997 the United States Department of Agriculture (USDA) launched the National Conservation Buffer Initiative with a target of creating two million miles and up to seven million acres of conservation buffers by 2002. By 2000, 172,000 mi. [about 378000 km] and 619,000 ac. [about 290000 ha] of buffer had been established (Davis 2000).

5.3.3 CONCLUSION

The importance of wetlands to Ontarians should not be underestimated. In September 1981, then Minister of Natural Resources, Alan W. Pope released a discussion paper: “Toward a Wetland Policy for Ontario”. Five hundred and nineteen of the 520 letters received (99.8%) indicated that wetlands must be protected and preserved. Four hundred and twenty-eight of these letters were from individuals (OMNR 1982). The importance of a buffer width sufficient to protect the ecological integrity of this wetland complex is vitally important to the members of the local community who share a concern for wetlands and the wildlife populations dependent on them. A particular concern is the extension of Centennial Drive from Bath road to Front road which would separate two ecologically related wetlands; the Cataraqui Region Conservation Authority (CRCA) and Ducks Unlimited (DU) reconstructed wetland on the west of the Frontenac Institution farm property and the CRCA property donated by then Dupont Canada bordering the Little Cataraqui Creek and the Frontenac Institution farm bordering the Creek to the north. Motor vehicle traffic along such a road will exact a heavy toll on migrating amphibians and herptiles at particular times of the year. Run-off from the road with all of the contaminants collected from tire wear, oil and salt etc. are a threat to the wetland and the integrity of the buffer zone. These concerns emphasize the necessity of a buffer of sufficient width and diversity of plant species to protect the wildlife species considered in this report.

5.3.4 REFERENCES

Anderson, B.C., A.A. Crowder, W.E. Watt, and J. Marsalek, 1996. Integrated management of urban storm water quality and quantity. Can. Water Res. J. 21: 165-182.

Davis, S. 2000. *Incentive Programs in Riparian Zone Workshop 2000 : Using Buffers to Improve Ontario Waterways. A Symposium held at the Canada Centre for Inland Waters, May 17, 2000.*

Eastern Canada Soil and Water Conservation Centre. 1995. *Buffer Strips and Water Quality: A Review of the Literature.* Eastern Canada Soil and Water Conservation Centre,. 1010 ch. de l’Eglise, Grand Falls, N.B.

Fahrig,L., J.H. Pedlar, S.E. Pope, P.D.Taylor, and J.F. Wegner, 1995. Effects of Road Traffic on Amphibian Density. Biol. Cons. 73: 177-182.

Findlay, C.S. and J. Houlahan, 1997. Anthropogenic Correlates of Species Richness in Southeastern Ontario Wetlands. Cons. Biol. 11: 1000-1009.

Houlahan, J. and C.S.Findlay, 2003. The Effects of Adjacent Land Use on Wetland Amphibian Species Richness and Community Composition. Can. J. Fish. Aquat. Sci. 60: 1078-1094.

Hummel, M. 1981. "Wetland Wildlife Values" pp 27-32. In *Ontario Wetlands Conference Proceedings.* Federation of Ontario Naturalists and Department of Applied Geography, Ryerson Polytechnical Institute. Toronto, Ont.

Norman, A.J. 1996. The Use of Vegetative Buffer Strips to Protect Wetlands in Southern Ontario. pp.263-268. In Warner, B.G., McBean, E.A. and Mulamoottil.G.,. (Eds) *Wetlands: Environmental Gradients, Boundaries and Buffers: Proceedings of an International Symposium, April 22-23. 1994.* Lewis Publishers.

OMMA and OMNR. 1992. *Wetlands. A Statement of Ontario Government Policy.* Ontario Ministry of Municipal Affairs and Ontario Ministry of Natural Resources. Toronto, Ont.

OMNR. 1982. *Towards a Wetland Policy for Ontario. A Summary of Responses to the Wetland Discussion Paper.* Queen's Park. Toronto. Ont.

Semlitsch, R.D. and J.R. Bodie, 2003. Biological Criteria for Buffer Zones Around Wetlands and Riparian Habitats for Amphibians and Reptiles. Cons. Biol. 17: 1219-1228.

Snell, E.A. 1989.Recent Wetland Loss Trends in Southern Ontario. pp 183-197. In *Wetlands: Inertia or Momentum. Proceedings Of a Conference held in Toronto, Ontario 1988.* Bardecki, M.J. and N. Patterson, eds. Federation of Ontario Naturalists