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**CITY OF MISSISSAUGA**

# NATURAL AREAS SURVEY

# REPORT
**(Volume 1 of 3)**

1996 September

*prepared for:*
Planning and Building Department
City of Mississauga

*prepared by*:
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## ACKNOWLEDGEMENTS

Helen Powers, who was the day to day contact and project manager for the City of Mississauga through most of the project, responded quickly and efficiently to our many requests and provided helpful and constructive review of many ideas and drafts of progress reports and preliminary submissions. The steering committee (page 3) also provided constructive criticism of the suggestions we placed before them and many of their comments are reflected in the final product.

Michael Oldham and Wasyl Bakowsky (Natural Heritage Information Centre, MNR Peterborough) provided much advice on the status of flora and fauna, the application of the Ontario version of the Floristic Quality Index and provided the historic records of reptiles and amphibians for the City. Ken Tuninga (MNR Maple District) provided a thorough and helpful review of the wetland evaluations and assisted in the interpretation of significant species reports. Our close friend, Dr. Gerould Wilhelm (Conservation Design Forum, Inc., Naperville, Illinois) provided significant help in the use and interpretation of the Floristic Quality Index, which he co-authored, and assisted in the deliberations of the role of fire in native communities in Mississauga. Dr. Bill Crins kindly confirmed plant identifications.

To these people, and others whom we contacted by telephone for advice and clarification on various issues and whose names have not been mentioned, we owe thanks.

## STUDY TEAM

Geomatics International Inc.

| | |
|---|---|
| Mirek J. Sharp | project manager, principal researcher, fieldwork, management recommendations and main report author |
| Derek Baranowski | coordination of digital mapping |
| Robert Delorme | review and analysis of physical features, report author |
| Tim Janes | fieldwork |
| Helen Kubiw | background review and analysis, fieldwork |
| Mary Ann Johnson | fieldwork, data base creation, analysis of results, report author |
| Chris Manderson | fieldwork |
| Melissa McCue | data entry for floristic analyses |
| Julia Switzer | creation of digital mapping |
| Mark Taylor | fieldwork with respect to fauna |
| Chris Zoladeski | fieldwork |

Keir Consultants

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| Susan Keir | planning analysis and recommendations, report author |
| Paul Lowes | design and analysis public survey |
| Bonny Lee | analysis and writing of public survey |

The Landplan Collaborative Ltd.

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| Brian Roth | management recommendations, report author |

Project Advisors

| | |
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| Jocelyn Webber | advice and assistance with floral records and status |
| Kevin Reid (Beak Consultants) | fisheries advice |

# EXECUTIVE SUMMARY

This report provides a review of the remnant natural features in the City of Mississauga, reports on public opinion regarding the importance of natural features, discusses typical impacts on natural areas in urban environments, and provides recommendations to protect and manage the remnant natural features of the City in the long term. It is supplemented by a number of other products (*e.g.*, digital mapping, descriptions and mapping of the remnant natural areas) that can assist in the planning and management of Mississauga's environment.

A survey of public opinion indicated that the residents of Mississauga care about the natural areas in the City and recognize the positive influence they have on the quality of life. Most importantly from a management perspective, they believe natural areas should be protected first for their ecological function and secondly for recreation.

The proposed natural area system includes 144 areas for protection. Of these, 141 were natural areas and 3 were residential woodlands. In addition, the system includes linkages and special management areas (see Figure 2, page 51). The natural areas total approximately 2077 ha (5130 a.), which represents 7.10% of the land base of the City. Of this, approximately 1620 ha (4001 a.) are associated with valley lands (5.6% of the City's land base), 340 ha (840 a.) are tableland (1.1% of the City's land base), and 104 ha (257 a.) are wetlands and associated features (0.36% of the City's land base). These figures highlight the importance of protecting the remaining tableland and wetlands if these habitats are to be represented in the City's natural area system.

The physical and biological features of the City were described including: climate, geology, landforms, shorelines, soils, water features, vegetation and wildlife. Natural areas were described and evaluated including: determination of boundaries, mapping of plant communities, inventory of flora, recording of wildlife observations, evaluation of condition and documentation of obvious impacts and management needs. This information was summarized and provided to the City under separate cover as hardcopy and in electronic data bases. Each of the natural areas, linkages and special management areas were digitally mapped and provided in a format consistent with the City's new Geographic Information System, as well as in hard copy format.

A comprehensive set of strategies and recommendations are provided which will facilitate the implementation of the natural areas system. The guiding principle of the strategies is that: *the maintenance of the long term ecological integrity of the remnant natural areas (including Significant Natural Sites, Natural Sites and Natural Green Space) will have primacy over all other considerations, to the extent that is feasible*. The intent of the strategies is to provide management guidance to City staff that will restore and sustain the long term ecological integrity of the natural areas. It is recommended that the natural areas system be implemented through a systems approach that emphasizes the interdependence of remnant areas. Strategies and recommendations address: stewardship, public education, access, resource management, appropriate activities, development in natural areas, adjacent land uses, linkages, organizational requirements, and official plan approaches.

# 1.0 INTRODUCTION

The conservation of natural features has become an accepted component of land use planning in Ontario. In the more developed, southern portions of the province, incorporation of significant environmental areas into local planning documents first became commonplace in the 1970's. At that time, remnant areas were viewed as "islands of green" around which development could be undertaken. However, there was gradual realization that just setting areas aside does not provide sufficient protection to maintain the natural features in the long term. The influence of adjacent development results in impacts that gradually and incrementally degrade the remnant natural areas. Also, studies in conservation biology indicate that isolated populations of plants and animals will not remain healthy over long periods of time and are prone to local extinction.

From this increased understanding developed a refined approach to environmental planning that recognized the interaction between areas. There is an obvious need to maintain connections between remnant natural patches and consider the influences of adjacent development on ecosystem processes. In areas of southern Ontario that are already highly developed, the opportunity for maintaining ecologically functional connections has often been lost. Nonetheless, the remaining opportunities need to be recognized and incorporated into environmental planning documents. Also, as the impacts of adjacent development become more noticeable, there is increasing need to implement site specific management in areas where retention of natural values is a main goal, especially for isolated natural areas.

Environmental planning in the City of Mississauga has been undertaken primarily on the basis of inventory and analysis completed in the late 1970's. The advances in conservation biology since then and the changes within the City itself dictate the need for an update to the City's environmental programme. In addition, there is an increased public awareness of environmental issues and an expectation that the natural environment will be accommodated within planning policies. New environmental policies in the recent City Plan (City of Mississauga 1996) are an interim measure which will be refined based on the findings of this current study.

This report documents the main findings of a 2-year study to update the inventory of natural features in the City of Mississauga and provide recommendations for their long term protection. The Goal and Objectives of the study provided in the Terms of Reference are as follows:

***Project Goal:***

*To create and maintain a data base, strategies and guidelines to further the preservation, enhancement, and restoration of Mississauga's natural forms, functions and linkages with development applications, capital works projects and acquisition plans. From both a detailed analysis level of individual forms, functions and linkages, and from the strategic level with a broad perspective, the study will provide the basis for future decisions concerning Mississauga's natural environment.*

***Project Objectives:***

1. *Update the current inventory of natural forms, functions and linkages.*

2. *Assess the condition, sensitivity, opportunities and constraints of these areas.*

3. *Determine appropriate strategies and guidelines for preservation, enhancement and restoration of natural forms, functions and linkages.*

## 1.1 Study Process

The project can be broken into 4 distinct phases as outlined below:

i) Review of Background Information:
This section reviewed all the available reports and data bases that described the physical and biotic features of the City. The intent was to identify those areas which had been well documented with respect to natural features and those which required further study.

ii) Survey of Public Opinion on Environmental Issues
This survey was undertaken to identify general public attitudes to the environment and to ascertain the level of support that existed for protection of remnant natural features. Public perception of appropriate uses and management was also sought. The results of this section of the study were documented in a separate report.

iii) Inventory of Remnant Features
In this task, remnant natural features were visited to obtain inventory information and undertake an initial evaluation of each area with respect to its condition. Field visits were prioritized based on the extent of existing information as determined from the background review.

iv) Identification of Protection and Management Needs
The information obtained from the background review and the inventory was entered into several data bases which provide a complete listing of the flora and fauna of each remnant natural feature in the City. Using this and the evaluation results, each site was characterized and strategies and recommendations for their long term conservation and protection were developed.

The study commenced in the fall of 1994. This enabled completion of the review of background information, the survey of public attitudes, and the preparation for fieldwork in 1995. The spring, summer and early fall of 1995 were devoted to undertaking the inventory and preliminary evaluation of remnant natural features in the City. The winter of 1995 through to early summer 1996 was spent summarizing and analysing the information collected, constructing electronic data bases, mapping remnant areas and developing management and protection guidelines.

## 1.2 Consulting Team and Steering Committee

The study was undertaken by a consulting team headed by environmental consultants (Geomatics International Inc.) and including planners (Keir Consultants Inc.) and landscape architects (The Landplan Collaborative Ltd.). In addition, there were advisors to the project who gave input on technical matters: local botanical data (Jocelyn Weber) and fisheries (Beak Consultants Ltd.). The study team worked with staff from the City's Planning and Building Department throughout the project to obtain feedback on direction and preliminary findings and for assistance with logistical matters (*e.g.*, landowner contact). The consulting team presented preliminary findings at various stages of the project to a 12 member steering committee composed of representatives of City departments and local agencies with interest in the project. This included:

Bill Waite City of Mississauga Planning and Building Department;
Helen Powers City of Mississauga Planning and Building Department;
Lesley Pavan (replacement for Helen Powers)
Anne Farrell City of Mississauga Community Services Department;
Grant Walton City of Mississauga Community Services Department;
Peter Lyons (replacement for Grant Walton)
Al Sousa City of Mississauga Transportation and Works Department, Environmental Engineering;
Erica Edwards City of Mississauga Corporate Service Department;
Steve Roberts Region of Peel, Planning;
Dena Lewis Metropolitan Toronto and Region Conservation Authority (MTRCA);
Susan Jorgenson Credit Valley Conservation (CVC);
Brenda Axon Halton Region Conservation Authority (HRCA);
Doris Krahn Ontario Ministry of Natural Resources (MNR);
Elizabeth Stanley Ontario Ministry of Environment and Energy (MOEE);
Eugene Macchione (replacement for Elizabeth Stanley).

## 1.3 Role of this Document in a Natural Areas Programme

The current study is just one step within the planning process required to maintain remnant natural features in the City of Mississauga in the long term. Three hierarchical levels of documentation are perceived as necessary to protect and maintain these areas. At the top is the City's Strategic Plan, and the City Plan which flows from it, which provide overall guidance. The City Plan gives direction for the protection and management of remnant natural areas, and articulates the policies that support a Natural areas programme. Recommendations in section 6 of this report should be incorporated into the City Plan to strengthen its role in this regard.

This current study constitutes the middle layer in the hierarchy. It flows from the City Plan policies and identifies natural areas, provides a description and preliminary evaluation of each natural area, identifies the types of impacts and disturbance that are present in the City's natural areas, and provides guidance on management and protection measures that can be employed to maintain natural areas in the long term. However, it will not give site specific direction on the management requirements for each site.

The third layer of information needed will take the form of site specific conservation plans. These are required for each natural area and should be completed in the future. They should identify specific problems at each site (*e.g.*, there is soil erosion on the slope in the northeast corner and a large patch of garlic mustard along the west boundary *etc.*) and outline the specific actions that each site requires (*e.g.*, replant the tableland above the erosion area to mitigate surface runoff, replant the slope with the following species [list of species provided], remove the garlic mustard). The conservation plans should be written with a stewardship programme in mind such that specific directions can be given to volunteers to undertake management (*e.g.*, organizing a work crew to remove garlic mustard). Details on the contents of these reports are provided in Section 7.4.1.

## 1.4 Organization of the Report

This report is divided into 9 main sections as shown in the Table of Contents. Following the Introduction, a historical perspective on natural area protection is provided (section 2), and the methods and approach used to undertake the study are summarized (section 3). Section 4 provides a general description of the City in terms of its natural environment (landform, climate, soils, plants, animals, *etc.*), and provides an overview of the built environment with reference to stormwater management and the City's open space network. The results of the public survey are summarized in section 5. The following section (section 6) describes the natural areas system proposed for the City of Mississauga and includes discussion of the overall findings of the study. It also provides a map illustrating the location of the natural areas and discusses them in the context of an interrelated system. The last main section of the report (section 7) provides the strategies and recommendations for the long term protection of the natural areas system. Conclusions are provided in section 8, and list of references (section 9) conclude the report. Detailed descriptions of each of the natural areas in the system were provided to the City under separate cover and do not constitute part of this final report.

Several other products supplied to the City of Mississauga at the completion of this project include:

- summary descriptions of each area with accompanying 8½"x 11" maps;
- a set of 1:6125 "working" maps of the natural areas for in-house use;
- digital data base of all floral and faunal records for the City;
- copy of the Floristic Index and manual used for evaluating floristic quality of areas;
- a report on potentially contaminated sites with accompanying map;
- a final report on the public survey;
- a matrix summarizing the background review;
- evaluations of four wetlands in the City prepared using MNR Evaluation methods;
- digital files of all mapping layers;
- digital files of all text products.

# 2.0 HISTORICAL PERSPECTIVE

## 2.1 A Brief History of Development

The City of Mississauga was once a predominantly forested landscape. Illustrations of pre-European settlement conditions, such as the 1794 painting of the mouth of the Credit by Lady Simcoe, show slope and tableland forests dominated by towering white pines and with a relatively closed canopy of deciduous trees (probably maple and beech). We also know that the original occupants of southern Ontario periodically burned areas to maintain open understorey conditions in the forest. These burns also produced occasional openings in the woodlands. Remnant prairie and savannah (open forest) landscapes in southern Ontario (*e.g.*, south of Cambridge, on the shore of Lake Simcoe, near Holland Landing, in the High Park area of Toronto and on the south shores of Rice Lake) attest to the wide and scattered distribution of these diverse habitats. These open woods and prairie elements occurred in Mississauga in the areas around Lorne Park, Port Credit, Clarkson, often associated with the dry sands of the old Lake Iroquois shoreline, as well as along the Credit River. Interspersed with the upland habitats, and associated with the several watercourses that drain toward Lake Ontario, were wetlands, some of which were forested (swamps), and others open in character (marshes). One of the most distinctive natural features of the original landscape was the extensive drainage system, dominated by the Credit River, that extended from well north of the current City limits to the shore of Lake Ontario.

It is the landscape described above that was met by the early European settlers of the Mississauga area. The first major alteration of the Mississauga wilderness was the construction of Dundas Street in 1796. This was primarily a military road and the first permanent residency of the area by a European, credited to Major Thomas Ingersol who ran an inn at the mouth of the Credit River (then accessible only by water), did not occur until 1805. Settlement proceeded slowly starting from the early 1800's, and was predominantly agricultural. Numerous small hamlets materialized throughout the century to service the agricultural communities, many of which remain today in name: Dixie, Streetsville, Cooksville, and Clarkson. By the end of the century, Toronto Township, as it was then named, was divided into concessions and was serviced by roads, railways and telegraph lines. The lumber industry, which had thrived during the clearing of the land, peaked in 1850, but by 1870 little was exported and most lumber was for local use. The landscape was now primarily agrarian; a farm landscape dotted with villages and with a scattering of industry along the lakefront.

Thus, although modern development pressures are generally thought of as being the principal cause of the demise of natural features, the major impacts were initiated 200 years ago, and can be attributed to the clearing of land for settlement and agriculture. However, compared to the present, there was probably still much forested tableland at the turn of the century. The agricultural landscape remained relatively stable until around 1950. At that time, the increasing population and prosperity, and widespread ownership of automobiles enabled a commuting lifestyle in which individuals could work in Toronto and reside in the outlying rural areas. This lead to a general urbanizing trend that has resulted in the present day suburban landscape in Mississauga.

In 1974 the former Towns of Mississauga, Port Credit, Streetsville and a portion of the Town of Oakville were administratively united to form the City of Mississauga. In 1979, the future identity of the new City was strongly influenced by the establishment of the City Centre at the corner of Hurontario Street and Burnamthorpe Road. The City Centre, which began as a shopping centre, now contains the Civic Centre, Central Library and the Living Arts Centre. At present, all but a few planning districts have been subdivided, although a few active farms still remain within the City. The development over the last 200 years has defined the remaining natural sites in the City. Although there are a few cleared but undeveloped sites that offer the

potential for restoration, for the most part, the remnant natural areas identified in this report represent the only examples of the former, pre-settlement landscape.

## 2.2 Need for Protection of Natural Areas

The development of the City of Mississauga precipitated the need for a mechanism to protect remnant natural habitat. This became increasingly urgent as land values rose and pressure to develop the remaining natural areas, especially those on the tablelands, increased. In the 1970s, a comprehensive inventory of the City's natural features was undertaken to facilitate the identification and protection of important natural features. This consisted primarily of a woodlot analysis (City of Mississauga 1976a) which documented the major woody species, provided notes on tree size, stocking (tree density), crown cover and evaluated each site with respect to plant diversity, wildlife habitat and aesthetics. A total of 270 woodlots were thus described and evaluated. The woodlot evaluation, surface water features and "areas of special significance" were used to identify "environmental planning areas" (City of Mississauga 1976b). These environmental planning areas were subsequently divided into one of three categories which reflects "varying degrees of natural value": Environmental Protection Areas (EPA), Environmental Policy Area A and Environmental Policy Area B.

A Planning Report (City of Mississauga 1976b) indicates the intent to retain and maintain all EPAs in their natural state. The EPAs were primarily the valley systems associated with the Credit River, Etobicoke Creek and Fletcher's Creek, as well as woodlots with high composite ratings, areas with high ecological sensitivity and organic soil. Policy Areas "A" included watercourses and woodlots with moderate ratings. The Planning Report notes that, "*serious consideration should be given to retain such areas as visually attractive and socially beneficial design components within the urban environment*". Environmental Policy Areas "B" were composed of woodlots with low ratings and aquifer discharge areas. The Planning Report indicates that, "*Development is not discouraged in these areas, but development plans should recognize inherent environmental opportunities and constraints*".

The basic structure consisting of the three levels of significance formed the basis for the protection of environmental features in the City until January 1996, when the most recent City Plan was approved. The policies that provided the actual guidance for the protection of EPAs, and "A" and "B" policy areas were refined and updated over the 20 year period, but the fundamental framework that EPAs should be protected, that Policy Areas "A" should be incorporated into urban designs with as little loss of canopy cover as possible, and that Policy Areas "B" receive a low priority for protection, remained unchanged. As discussed in section 2.3.3, the three tier structure is still evident in the current District Plans.

## 2.3 Existing Planning Framework

### 2.3.1 Provincial Policy

In the overall hierarchy of policy strategies in the Province, there are several layers of policy to which the local policies must either conform or have regard. At the highest level are the provincial policies and Bill 20, as recently adopted, providing direction on Natural Heritage and Natural Hazards, policy sections 2.3 and 3, respectively.

As articulated in the implementation/interpretation section of the 1996 Provincial Policy Statements, "*nothing in this policy statement is intended to prevent planning authorities from going beyond the minimum standards established in specific policies, in developing official plan policies and when making decisions on planning matters, unless doing so would conflict with any other policy*." Studies such as this Natural Areas Survey enable municipalities to go beyond the minimum standards set out in provincial policy.

Provincial policy states that natural heritage features and areas will be protected from incompatible development and development may only be permitted if it can be demonstrated that there will be no negative impacts on the natural features or the ecological functions for which the area is identified. The provincial policies also state that development and site alteration may be permitted on lands adjacent to significant natural features 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.

Provincial policies dealing with Natural Hazards are primarily in response to public health and safety issues as opposed to natural heritage protection, although many of these hazard areas or features are also ecologically significant. The provincial policies generally direct development to areas outside of hazardous lands adjacent to river and stream systems which are subject to flooding or erosion hazards. Some development may be permitted in hazardous lands provided specific performance criteria are met, excluding institutional uses or essential emergency services or the disposal, manufacture, treatment or storage of hazardous substances.

The province acknowledges that Official Plans are the most important vehicle for the implementation of its Policy Statement. All applicable provincial policies must be integrated into the Official Plan and reflected in the application of appropriate land use designations and policies.

### 2.3.2 Regional Official Plan

The Region of Peel Official Plan (Region of Peel 1996), defines a regional Greenlands System of Core Areas, Natural Areas and Corridors, and Potential Natural Areas and Corridors. The elements of the Greenlands System include: wetlands, woodlands, Environmentally Sensitive or Significant Areas (ESAs), Areas of Natural and Scientific Interest (ANSIs), habitats of vulnerable, threatened and endangered species (VTE), ravine, valley and stream corridors, shorelines, natural corridors and wildlife habitats. Only the Core Areas ( including provincially significant wetlands, woodlands greater than 30 ha (74 a.), old growth forests, ESAs, Life Science Areas of Natural and Scientific Interest, VTE, major ravine, valley and stream corridors as defined by the Region and the area municipalities in consultation with the conservation authorities and the Ministry of Natural Resources and any other features and functional areas interpreted as Core Areas of the Greenlands System in Peel by the individual area municipality) are depicted schematically in the Regional Plan. However, if any other natural areas are identified, they are also to be protected and shown in the municipal Official Plans.

The Regional Plan requires municipalities to include objectives and policies in their Official Plans for the interpretation, protection, enhancement, proper management and stewardship of areas within the Greenlands System and generally prohibits development in these areas. Area municipalities must require environmental impact studies for development and site alterations adjacent to Core Areas of the Greenlands System. Area municipalities must also comply with the criteria for interpretation of Natural Areas and Corridors and Potential Natural Areas and Corridors in addition to whatever else the municipality may include in its Greenland System for these areas. The Regional Plan also states that development should not alter or disrupt fish habitat.

The Regional Plan requires municipalities to generally prohibit development within the one hundred year erosion limit, consistent with provincial policy. They must also identify the flood plain lands in the appropriate planning documents and formulate objectives and policies in their Official Plans. Area municipalities are also required to include in their Official Plans objectives and policies for the management of stormwater quality and quantity.

### 2.3.3 Mississauga Official Plan (City Plan)

Currently, the Official Plan (City of Mississauga 1996) has a schedule of Environmental Planning Areas that are not designations but overlays to the land use categories. Many of these Environmental Planning Areas restrict land uses because of particular environmental concerns. The restriction of use relates specifically to a particular feature (*e.g.*, valley lands and watercourse corridors ) or may depend on the outcome of particular studies to be undertaken. For instance, development proposals within or adjacent to Environmental Planning Areas, as stated in City Plan, must submit an environmental impact study. Environmental Planning Areas are not treated as a 'system' within the current framework of City Plan but are rather a collection of various environmental features and areas that do not necessarily have any interrelationships with one another, but which may restrict development activity.

All of the City's Environmental Planning Areas in City Plan have been further categorized relative to their environmental significance and ecological sensitivity within each District Plan (Secondary Plan) to include:

- Environmental Protection Areas
- Environmental Policy Area "A"
- Environmental Policy Area "B".

The highest level of protection is afforded to Environmental Protection Areas which primarily includes valley lands and watercourses. District Plans state that development applications which include lands in Environmental Protection Areas or adjacent to such areas must demonstrate, through an environmental assessment report, that the proposal will be compatible with the preservation and maintenance of natural conditions. Most Environmental Protection Areas are also designated Greenbelt in the District Plans. The Greenbelt designation applies to watercourse valley corridors and generally precludes development because of the natural hazards, hydrologic functions and natural features associated with these areas.

Environmental Policy Areas A and B are somewhat more permissive with regard to their development potential and requirement for environmental assessment studies. Further, many of these lands are designated to some other use within approved or adopted District Plans. The Environmental Policy Areas A are often designated

as Special Park or other types of parks within the Open Space hierarchy, although those along watercourses may revert to the Greenbelt designation.

Most Environmental Policy Areas B as depicted in District Plans are incorporated into a number of possible development designations (Residential, Industrial, Commercial) or Open Space designations. The intent with Policy Areas B was to incorporate these natural features into the development.

The introductory sections of the 1976 planning report (City of Mississauga 1976b) speak to a "systems" approach to environmental planning: *"... environmental components must not be perceived as random accumulations of unrelated landscape features; the natural environment constitutes an interrelated system of dynamic processes. ... this is the systems approach to environmental planning ..."* (City of Mississauga 1976b, page 5). However, this approach is not reflected in the actual policies. Only EPAs are protected for their natural values, Policy Area A having value as being "*visually attractive*" and "*socially beneficial*", and Policy Areas B having unspecified "*inherent environmental opportunities and constraints*". There is a lack of connectiveness in the way in which remnant natural areas are treated in the protection framework. As a result, many Policy Area B sites were developed, and the Policy Area A sites that were retained were generally not managed specifically for their natural values, and often degraded through overuse. It would appear that the ecological distinctions among Environmental Protection Areas and Policy Areas A and B was based more in the ability to acquire the lands than in their ecological sensitivity. Historically, given the hierarchical framework, the City has tended to acquire more A than B areas. It was this history that led to recognition of the need for an updated inventory and new mechanism for protecting natural areas that reflected a systems approach if remaining natural areas were to be retained in the long term.

Both valley lands and tablelands should be important components of an environmental protection framework even though not all lands may be publicly acquired. The A and B policy area system appears to be a framework which treats natural features as separate entities rather than as an integrated system of interrelated or potentially interrelated features. The recently adopted environmental policies in City Plan, developed under Bill 163, moved away from the hierarchy of environmental features and made reference to individual features without placing them in a hierarchy. These policies were intended to be reviewed once the findings of the current Natural Areas Survey was complete. Staff are currently in the process of updating the Official Plan and incorporating the relevant portions of the individual District Plans within the primary document.

## 2.4 Rationale for Protection of Natural Areas

The pre-settlement landscape of the Mississauga area was unique. There was no other area that exactly mimicked the combination of post glacial events, soils, precipitation and topography, and the thousands of years of interaction with native people. These phenomena gave rise to the mosaic of native vegetation that persisted there and the wildlife which it supported. The remnants of the early landscape are important as representative examples of this part of Ontario and the natural heritage of the present day City. That early landscape dictated the way in which the area was developed, the crops that it would support and the location of the early development centres. It provides the roots for the City and deserves to be protected as a reminder of the past.

The importance of having natural spaces for human well being is becoming increasingly accepted. Edward Wilson (1984) developed a thesis that humankind has an innate kinship with other living beings and that as a part of the living environment we are intimately bonded to natural systems. Some authors (Rifkin 1991 and Turner 1983) maintain that the reason we can so easily degrade the natural environment is that we have lost, at least partially, the close relationship with the landscape that we once had. Both those authors feel that the re-establishment of the connection is essential for our long term health and in order to place a high priority on protecting the environment. Maintaining natural areas within a suburban framework facilitates periodic contact with the environment and, through community involvement in management and protection, can re-establish some connection with the landscape.

In addition to human well being in a spiritual sense, the natural environment is our life support system, without which we will perish. Clean air and clean water are essential ingredients for our persistence on the planet, and the maintenance of healthy environments is necessary for supporting the plants and animals which constitute our food. It is important that the ecological processes of natural features be maintained to minimize the impacts of suburban environments. Vegetation fixes atmospheric carbon, produces oxygen, contributes to the water cycle (through evapotranspiration) and stabilizes soil. Natural decomposition cycles produce soil, wetlands filter sediment and remove enriching nutrients. Natural areas cannot mitigate all impacts, nor will they alone provide the requirements for a healthy environment. However, with sound planning and engineering, they can be used to minimize impacts and contribute to environmental health.

Lastly, humans, as stewards of the planet, have a responsibility to preserve natural life forms to the greatest extent possible: to maximize biodiversity. Although Mississauga will never maintain the biodiversity of large wilderness areas, its southern location, and unique soils and climate support many species and biotic communities that are near the northern limits of their range. Such species and community assemblages must be protected within the more populated southern part of Ontario of which Mississauga is a part.

These three reasons; spiritual well being, environmental health and maintenance of biodiversity, constitute the rationale for protecting the remaining natural areas in the City in the long term. However, these have to be viewed in the current context of the City. Most of the City is developed and the natural landscape is fractured. Most of the tableland natural areas are small and isolated. This limits their ability to be self supporting, to maintain natural ecological processes and to support a diverse array of flora and fauna. Thus the limitations of what can be achieved by a natural areas programme in the City of Mississauga need to be recognized.

## 2.5 The Need for Management

The nature of the present day natural landscape justifies the need for on-going management of natural areas. In the context of this study this does not mean management for the extraction of resources, but management to allow natural processes to occur and to maximize biodiversity. Management in this sense may mean controlling access, limiting the types of permissible activities, removing problem species that have become weeds through human introduction, and restoring areas through planting. A set of goals and objectives to guide the management of natural areas is provided in section 6.1.

The need to manage does not arise out of hubris and the notion that we can improve on nature. It is a response to the fact that the environment in urban areas is subject to stresses that have been imposed since European settlement and which the native flora and fauna are not adapted to coping with. These stresses include, for example: introduction of competitive non-native plants and animals, excessive use resulting in trampling and soil compaction and changes in surface and groundwater regimes. These are discussed more completely in section 6.4. Owing to these stresses there is a need to manage the natural environment through, for example, trail construction, reintroduction of native species, removal of non-native species and a host of other activities in order to mitigate these stresses. Protection and management strategies are provided in section 7.0.

Also, although human intervention may seem intrusive and at odds with the concept of a natural area, it must be remembered that the Mississauga area was occupied and managed for thousands of years prior to the arrival of European settlers. Native peoples used fire to create productive wildlife habitat and to clear areas for agriculture. They also selectively harvested timber for shelter, cooking and warmth. The amount of wood needed to sustain a village of several hundred people through Canadian winters should not be trivialized. However, this history of land use does not provide license for continued harvesting, obviously there was far more habitat to provide sustained yields 200 years ago than exist today. Some of the habitats that persisted in pre-settlement Mississauga, notably the savannahs and prairies, require periodic management to persist. Such management should be viewed as reinstatement of natural processes that restores the land. It should become community event as it was 200 years ago, one that reaffirms human connection with the land.

# 3.0 METHODS

This section of the report provides a brief overview of the methods used for this project. Details of the various techniques and evaluation criteria used are provided in Appendix 1.

At the outset of the study, a detailed review of existing planning reports and studies was undertaken (see Appendix 2 for a complete list of reports reviewed). Information from the review was used to help identify candidate natural areas and to determine the extent of information known about the City's remnant natural spaces. The approach used for the identification of candidate areas was to initially include all areas that had some remnant natural value(s). All EPA, Policy Area "A" and Policy Area "B" areas were identified from District Plans and included as candidates. Additional candidate areas were identified through aerial photograph examination and the review of existing reports. A total of 170 candidate natural areas were identified. A decision was made early in the study to organize candidate natural areas by Planning Districts since these form the basis for planning within the City. Within each Planning District, candidate natural areas were assigned a number. For example, candidate natural areas in Churchill Meadows were named CM1 through CM12. These labels were retained throughout the study.

During the review of background studies, information on each candidate natural area was tabulated in large matrices, one each for physical, biotic and human-related features. Information was classified into one of three categories: accurate and thorough, useful but additional information required; or inadequate. Many candidate natural areas had no information recorded for them at all.

Following the background review, a reconnaissance tour of all candidate natural areas was undertaken to evaluate which areas warranted inclusion in the study. It was found that some candidate areas had been completely removed for development and that others had insufficient natural value to retain in the study (*e.g.*, the candidate consisted of a few scattered trees with a mowed lawn beneath). Some new candidate natural areas were added during the reconnaissance. A total of 144 areas which were identified for summer field work. Candidate natural areas which were excluded are provided in Appendix 3. A public open house was held at the conclusion of this stage of the project to inform the public of the Natural Areas Survey and solicit input prior to the field season.

Concurrent with the background review, a survey of public opinion on the study was undertaken. The purpose of the survey was to determine public attitudes to natural areas in the City with respect to general knowledge of natural areas, appropriate uses, the value placed on areas, reaction to alternative management scenarios and willingness to participate in stewardship programmes.

Throughout the summer of 1995 each of the 144 candidate natural areas were visited. The number and duration of visits were determined by the extent and quality of existing information and the need for repeat visits as determined during the first inspection. Information on the physical and biotic characteristics of each site, disturbance, evidence of natural processes and obvious management needs were recorded. Preliminary boundaries were determined from 1:6000 aerial photographs prior to field visits and, refined in the field. Emphasis was placed on visiting and describing the tableland natural areas rather than the valley lands. This was in response to the recognition that in the past there has generally been more study in the valley lands, and that there are protection mechanisms in place for most of the valley systems. Thus valley systems were sampled in several places and the descriptions from those areas extrapolated to valley land sites not visited.

Owing to the relatively short visits to each site (typically 3 hours), few data were collected on fauna. Complete

fauna for each site would require special techniques (*e.g.*, trapping, netting) which could not be accommodated in the study. The data for reptiles and amphibians was greatly enhanced through the purchase of a data base of current and historical records for the City. Some areas had many animals recorded for them because they had been carefully studied in the past.

In the fall of 1995 several comprehensive electronic data bases were set up to facilitate the recording and maintenance of inventory data on each site. The data bases also provided the significance of species and the source of information. They were set up to allow for on-going inventory and thus provide a powerful tool for management, protection and environmental assessment in the future. Analysis of sites with respect to their role in a system of natural areas was undertaken by examining their geographical relationship to one another, evaluating the quality of the flora, identifying significant earth and life science features, looking for management and restoration opportunities on adjacent sites and identifying opportunities for linking sites together. It was decided to include all candidate natural areas in the final natural areas system, thus the candidate status was dropped for all sites and they were referred to thereafter as "natural areas". All sites were mapped and digitized for input into the City's Geographic Information System (GIS). Each site was described in a "Natural Areas Fact Sheet", which will be provided to the City as a separate product along with mapping for each site.

Strategies for the protection and management of the proposed natural areas were developed through discussion with other municipalities, review of other natural area management plans, discussion with knowledgeable people and examination of provincial policies regarding the protection of natural features. A brief survey of municipal approaches to natural area protection and management was undertaken and is provided in Appendix 21.

# 4.0 OVERVIEW OF THE CITY OF MISSISSAUGA

The purpose of this section of the report is to provide a general description of the natural environment and some components of the built features of the City. This provides a background context for the natural areas system that is described in section (section 6.0).

## 4.1 Natural Environment

### 4.1.1 Climate

The climate in and around the City of Mississauga provides a humid, warm to hot summer. The presence of Lake Ontario provides one of the major climatic controls affecting this region as it significantly moderates the temperature regimes of adjacent land areas. The lake acts as a large reservoir for the storage and subsequent exchange of heat energy with the atmosphere (Philips and McCulloch 1972). During the autumn and winter months the surface water is generally warmer than the air temperature due to the transfer of heat upwards from warmer deeper waters. In contrast, spring months find surface waters near-freezing due to the influence of cold sub-surface waters. Average daily mean temperatures in the City for the period 1937 to 1990 (Table 1) indicate that July is the hottest month [20.5°C (69°F)] followed closely by August [19.5°C (67°F)] and then June [17.4°C (63°F)], while January and February are the coldest [-6.7°C (20°F) and -6.1°C (43°F) respectively]. There is generally a 9 to 12°C (14 to 23°F) difference between average daily maximum and minimum temperatures. April, May and June tend to have the largest variance between highs and lows, and the winter months tend to have the least variation in temperature.

Total precipitation values indicate that the wettest months are July [76.6 mm (3 in)], August [84.2 mm (3.3 in)] and September [74.2 mm (2.9 in)]. January [45.6 mm (1.8 in)] and February [45.5 mm (1.8 in)] account for the lowest total monthly precipitation (Environment Canada 1993). Rainfall accounts for the majority of the accumulated precipitation from March through December.

Those areas of the City of Mississauga along the Lake Ontario shoreline can expect to be frost-free from around May 10$^{th}$ to around October 15$^{th}$. The northern part of the City experiences slightly less of the moderating effects of the lake and can expect frost on average as late as May 15$^{th}$ and as early as October 5$^{th}$ (Brown et al. 1968).

The major winds that influence the climate of the City of Mississauga usually originate from the west. Northwesterly winds are the norm with westerly and minor southwesterlies during the fall and winter months. The presence of Lake Ontario produces localized breezes that tend to blow off the lake during warm days of the summer months and off the land during the colder winter months. Approximately half of all summer days have light on-shore winds that have a slight cooling effect on the air temperature over land (Phillips and McCulloch 1972).

**Table 1: Canadian climate normals 1937 to 1990 Toronto Pearson International Airport (after Environment Canada. 1993)**

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Daily Maximum Temperature** | | | | | | | | | | | | |
| **(°C)** | -2.5 | -1.6 | 3.7 | 11.5 | 18.4 | 23.6 | 26.8 | 25.5 | 20.9 | 14.1 | 7.2 | 0.4 |
| **(°F)** | 27.5 | 29.1 | 38.7 | 52.7 | 65.1 | 74.5 | 80.2 | 77.9 | 69.6 | 57.4 | 44.9 | 32.7 |
| **Daily Minimum Temperature** | | | | | | | | | | | | |
| **(°C)** | -11.1 | -10.6 | -5.3 | 0.6 | 6.1 | 11.1 | 14.2 | 13.4 | 9.4 | 3.6 | -0.8 | -7.4 |
| **(°F)** | 12.0 | 12.9 | 22.5 | 33.1 | 42.9 | 51.9 | 57.6 | 56.1 | 48.9 | 38.5 | 30.6 | 18.7 |
| **Daily Mean Temperature** | | | | | | | | | | | | |
| **(°C)** | -6.7 | -6.1 | -0.8 | 6.0 | 12.3 | 17.4 | 20.5 | 19.5 | 15.2 | 8.9 | 3.2 | -3.5 |
| **(°F)** | 19.9 | 21.0 | 30.6 | 42.8 | 54.1 | 63.3 | 68.9 | 67.1 | 59.4 | 48.0 | 37.8 | 25.7 |
| **Rainfall** | | | | | | | | | | | | |
| **(mm)** | 18.5 | 20.8 | 35.1 | 56.0 | 65.8 | 68.9 | 76.6 | 84.2 | 74.2 | 62.0 | 64.3 | 38.3 |
| **(in)** | 0.73 | 0.82 | 1.38 | 2.20 | 2.59 | 2.71 | 3.02 | 3.32 | 2.92 | 2.44 | 2.53 | 1.51 |
| **Snowfall** | | | | | | | | | | | | |
| **(cm)** | 32.3 | 25.9 | 19.9 | 7.3 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 1.1 | 6.4 | 31.1 |
| **(in)** | 12.7 | 10.2 | 7.8 | 2.87 | 0.04 | 0.0 | 0.0 | 0.0 | 0.0 | 0.43 | 2.52 | 12.2 |
| **Total Precipitation** | | | | | | | | | | | | |
| **(mm)** | 45.6 | 45.5 | 65.9 | 64.0 | 66.0 | 68.9 | 76.6 | 84.2 | 74.2 | 63.0 | 70.3 | 65.5 |
| **(in)** | 1.8 | 1.8 | 2.6 | 2.5 | 2.6 | 2.7 | 3.0 | 3.3 | 2.9 | 2.5 | 2.8 | 2.6 |
| **Wind Speed** | | | | | | | | | | | | |
| **(km/h)** | 19 | 17 | 17 | 17 | 15 | 13 | 12 | 11 | 12 | 13 | 16 | 16 |
| **(mi/h)** | 11.8 | 10.6 | 10.6 | 10.6 | 9.3 | 8.1 | 7.5 | 6.8 | 7.5 | 8.1 | 9.9 | 9.9 |
| **Most Frequent Direction** | SW | W | NW | NW | NW | NW | NW | NW | W | W | W | W |

### 4.1.2 Geology

The City of Mississauga is underlain by bedrock formed during the Palaeozoic Era. The Queenston Formation and the underlying Georgian Bay Formation were both formed during the Ordovician Period (400 to 425 million years ago) when this area was covered by a shallow warm sea.

The Georgian Bay Formation has been classified as Upper Ordovician in age. It consists of blue-grey and green-grey shales with interbedded sandstone, green-grey siltstone and grey argillaceous (very fine grained) limestone (Bond et. al. 1976). The harder interbedded units occur with increasing frequency towards the top of the unit. The limestones and siltstones also contain abundant fossils. The shales of the Georgian Bay Formation are exposed in numerous places along the walls of the Credit River valley and it's tributaries.

The contact with the overlying Queenston Formation is gradational and is exposed within the City along the steep-sided valleys of the Credit River. The Queenston Formation is a very distinctive red-shale, characteristic of much of the area below the Niagara Escarpment. It is Upper Ordovician in age and has been described as thick bands of dark red, iron rich (hematitic), fissile, calcareous shale, interbedded with very fine grained, homogeneous, grey to green layers of limestone. The Queenston Formation is exposed along creek valleys in the Streetsville area, to the north along Fletchers Creek and as part of a shale plain just north of the Queen Elizabeth Way along the western border of the City.

### 4.1.3 Surficial Geology and Physiography

The City of Mississauga has been developed in a landscape highly influenced by both lake processes and glacial activities. The physiography of the area is dominated by till plains and the sand deposits of former Lake Iroquois (Chapman and Putnam 1984).

The glacial material within the City is primarily comprised of the clayey to silty Halton Till, deposited approximately 13 000 years ago during events of the Wisconsin glaciation. The majority of the till sheet within the City of Mississauga (south of Highway No. 401 and east of Streetsville) has been described as a drumlinized till plain (Chapman and Putnam 1984). This is reflected in the undulating topography throughout the area. In contrast, the area north of Highway 401 and west of Streetsville has been smoothed by erosional ice action during the last glacial events of the Wisconsin glaciation, producing an area referred to physiographically as a "bevelled" till plain (Chapman and Putnam 1984).

Minor exposures of older till sheets have been identified along the shore of Lake Ontario in the vicinity of Port Credit and west of the mouth of Etobicoke Creek. These deposits generally contain a higher silt content than the Halton Till and have been attributed to mid-Wisconsin glacial actions (Sharpe 1980).

As the glacial ice melted away, meltwaters became ponded in localized depressions. This produced numerous small lakes throughout the region that drained towards Lake Ontario and were collectively referred to as the Peel Ponds (Sharpe 1980). Three such deposits have been identified within the City of Mississauga: between Cawthra and Tomken roads north of Highway 5, along Dixie Road north of Bloor Street, and west of Etobicoke Creek just north of Burnhamthorpe Road. These consist of sands, originally deposited in shallow water.

Lake Iroquois formed in the present Lake Ontario basin following the retreat of the Wisconsin glacier between 12 500 and 12 000 years ago. The Lake Iroquois shoreline is a prominent physiographic feature found across the lower third of the study area. It generally parallels the present shoreline of Lake Ontario, forming a distinct

ridge. This ridge marks a well defined change in physiography from the hummocky clay and silt-rich glacial materials located further inland to relatively flat lying, sandy lake deposits extending to the shore of Lake Ontario.

The Iroquois shoreline has historically been a source of accessible aggregate for use in localized construction. Several high quality gravel deposits existed at one time ( Dixie Road north of Highway 5, Highway 5 at Etobicoke Creek, and between Mississauga Road and the Queen Elizabeth Way just east of Erin Mills Parkway), of which most have now been removed. These gravels were originally formed as barrier bars and spits along the former shoreline, not unlike those that presently form the Toronto Islands (Sharpe 1980).

The Lake Iroquois sand plain stretches between present day Lake Ontario and the Lake Iroquois shoreline, running from the Niagara River to the Trent River. The large areas of well drained sand have a gentle slope towards Lake Ontario. The gentle grade and preferred drainage, along with the close proximity to Lake Ontario, have resulted in the use of this area for prime development, both agricultural and, more recently, urban.

During the past 10 000 years the local landform has remained relatively stable. The only major naturally modifying processes are those of surface run-off and river actions. The Credit River and Etobicoke Creek have eroded the deepest valleys through the landscape, however, numerous other smaller tributaries have also contributed to the present day landform.

### 4.1.4 Shoreline Physiography

The identification of areas undergoing erosion or accretion, along with existing shore types, can lead to potentially different land use recommendations or management strategies. In 1992, the International Joint Commission undertook a study designed to map and classify the shorelines of the Great Lakes along the Canadian side (Geomatics and Davidson-Arnott 1992). The shoreline reaches (or segments) identified within the IJC study have been applied to the 26.5 km (16.5 mi) of Lake Ontario frontage for the City of Mississauga (see Figure 2, page 53), and the corresponding classifications are discussed below.

The shoreline classification system is composed of three separate zone classifications. The first deals with the geomorphology of the subaerial (exposed) portion of the shoreline; the second categorizes those areas with shore protection structures; and the third zone identifies the composition of the regions closest to shore but essentially underwater.

**Geomorphic Shoreline Classification**

The exposed shoreline within the City of Mississauga can be grouped into 4 geomorphic classes. The geomorphic features accounting for the largest proportion of the waterfront [16.7 km (10.4 mi) or 62.9%], are low bluffs less than 15 metres in height, with intermittent or no beach. The generally discontinuous beaches along the shoreline average less than 10 metres in width. The low bluff classes extend from the western border east almost to the mouth of Cooksville Creek (reaches 1-3,5,6,8, see Figure 2, page 53) with two small gaps. The first gap is at Rattray Marsh and second is for the Marina at the mouth of the Credit River.

The second most prevalent geomorphic shoreline classification is ‘artificial’ [8.1 km (5 mi) or 30.4%]. This refers to reaches where the natural shoreline no longer exists due to the presence of large man-made structures or developments. The three occurrences of this class are found at the Marina at the mouth of the Credit River (reach 7), and in reaches 9 and 10, marking the water treatment plant, refinery and sewage treatment facilities

at the eastern end of the City's lakefront.

The last two classifications, sandy-beach dunes and baymouth/barrier beach, account for less than 10% of the total area. Sandy-beach dunes exist for 1.3 km (0.8 mi) (5%) and have been mapped in reach 11, located at the extreme eastern end of the shoreline from the sewage treatment lagoon to the eastern border. The baymouth/barrier beach class is found for only 0.4 km (0.25 mi) (1.7%) and marks the location of Rattray Marsh (reach 4), at the mouth of Sheridan Creek.

**Protection Classification**

In general, the Mississauga shoreline is heavily protected against erosion as identified in reaches 1, 3, 7, 8, 9 and 10. These areas account for approximately 18.9 km (11.7 mi) (71.3%) of the shoreline, and include the reinforced shorelines of large industrial areas. Seven kilometres (27%) of the study area have moderate to minor protection against shoreline erosion (reaches 2, 5, 6 and 11) covering mainly the residential built up areas. A small section of shoreline (reach 4-Rattray Marsh), totalling approximately 0.4 km (0.25 mi) (1.7%), has no artificial shoreline protection features.

**Subaqueous/Near-shore Classification**

The subaqueous near-shore zone is predominantly composed of bedrock (90.8%). There is a small stretch of shoreline identified as reach 6, approximately 2.4 km (1.5 mi) (9.2%) in length, where the near-shore zone is composed of clay.

### 4.1.5 Soils

Soil development directly reflects the available parent material in a region. A soil catena represents a series of soils all developed in similar parent material but having slightly different textural components or different drainage classes. The soils developed within the City of Mississauga are represented by seven different catenas with 17 separate soil series.

The soils within the study area belong to two basic soils groups: Luvisolic soils and Gleysolic soils. The luvisols represent the larger group of soils, formed in areas rich in clay, being well to imperfectly drained. These soils are described as having a dark grayish brown surface horizon (Ah or Ap) with a relatively high abundance of organic matter, underlain by a light brown horizon (Ae). The underlying dark coloured B horizons contain high levels of clay sized materials.

Gleysols represent soils formed in poorly drained areas. Their surface horizons (Ah) are thick and have very high levels of organic material. These overlie grey or greyish brown horizons marked by gleying or mottling. Both of these conditions indicate a reducing environment due to water saturation of the soil profile for extended periods of time. Gleying appears as a bluish-grey hue while mottling represents marked discolouration of the soil materials.

Since the original classification of the soils within the City of Mississauga (Hoffman and Richards 1953), the classification of surface materials, drainage patterns and the soil classification system itself have changed. In much of southern Ontario, what once was referred to as a member of the Podzolic Great Group is now part of the Luvisolic great group. The area around Pearson International Airport in Malton was previously identified as lacustrine (lake deposited) clays overlying clay tills. This has since been updated to reflect the current thinking that the entire area is covered by the Halton till with varying clay content. The actual soil

classification for Peel Region has never been similarly updated. The following descriptions represent the original classifications by Hoffman and Richards modified by the current knowledge base.

The soils of the Oneida catena represent the largest areal coverage of any catena within the City of Mississauga. The three soils series (Oneida clay loam - well drained: Chinguacousy clay loam - imperfectly drained; and Jeddo clay loam - poorly drained) correspond to the majority of the area covered by the Halton till. The well drained and imperfectly drained series are typical grey-brown luvisols while the poorly drained Jeddo clay loams are generally humic gleysols.

The Cashel catena was identified as soils developed on clay rich deposits of the Halton till in the Malton area. The topography in this area is level providing slow surface drainage. The soil series represent the grey-brown luvisols (Cashel clay-well drained and Peel clay-imperfectly drained) and a humic gleysol (Malton clay-poor drainage).

The Brockport (Brockport clay loam, Cooksville clay loam and Mississauga clay loam) and Lockport (Trafalgar clay) catenas both represent soils developed in thin glacial material over bedrock. The difference in these soils is that the Brockport soils are developed over the grey limestones of the Georgian Bay Formation, while the Lockport soils developed over the red shales of the Queenston formation. All of the series within these two catenas are classed as grey-brown luvisols with the exception of the Mississauga clay loams which are poorly drained and are classed as humic gleysols.

The Fox Catena of soils correspond to the sand deposits of the Iroquois sand plain. The Fox sand and the Fox sandy loam represent the soils that are well drained while the Brady sandy loams have imperfect drainage. The Brady sandy loams show evidence of gleying which sets them apart from the Fox sandy loams.

The soils of the Caledon catena (Caledon loam and the Gilford loam) correspond to the gravelly deposits associated with the Iroquois shoreline in the east end of the City. These represent well drained and poorly drained sites respectively and are classed as a grey brown luvisol and an orthic humic gleysol.

The Bookton catena, identified as the Bookton sandy loam and the Berrien sandy loam, correspond to the sandy deposit of the Peel ponds. The Berrien series is at the imperfectly drained end of the catena, while the Bookton is well drained; both are typical grey-brown luvisols.

### 4.1.6 Surface Water

Water flow is from north to south with Lake Ontario representing the final destination of all surface waters. Portions of 35 subwatersheds are included within the City limits. Most of the surface water ways have been modified over time through development and expansion of urban areas. Engineered water-ways, modified either through controlled banks (armorstone, gabion baskets, concrete spillways, *etc.*) or buried watercourses, are found in numerous places throughout the City.

The Credit River flows through the western half of the City entering Lake Ontario at Port Credit, while Etobicoke Creek marks the eastern boundary in the southern half of the City. These represent the two major watersheds within the City. The Credit River has approximately eleven tributaries feeding it within Mississauga while Etobicoke Creek has only one.

The subwatersheds within the City (Gore & Storrie Ltd. and RE Winter & Associates Ltd. 1994) range in size from large (Credit, Etobicoke, Cooksville) areas running approximately north-south through the City, to

numerous smaller subwatersheds covering limited areas of either small tributaries (Chappell Creek, Carolyn, Loyalist) of the larger waterways, or as relatively small watersheds along the shore of Lake Ontario (Sheridan, Clearview, Moore, Cawthra, Serson, Lakeside). The Credit subwatershed represents the outfall to Lake Ontario from several contributing subwatersheds (e.g., Wolfedale, Sawmill, Mary Fix), along with the Credit River itself.

The established watercourses within the City are geologically still relatively young as reflected in their erosive characteristics. Erosion along the rivers and streams tends to be vertical, producing steep-sided valley walls. These are most evident along the Credit River and Etobicoke Creek.

As much of the areas within the City is covered with the clay rich and relatively impermeable Halton till, surface runoff is relatively rapid. Historically, this produced a network of ephemeral watercourses feeding the major systems, although many of them now flow through stormwater sewers. Little base flow now exists within most of these runoff-event based watercourses.

### 4.1.7 Hydrogeology

The City of Mississauga is underlain by two relatively impervious shale deposits which have been identified as barriers to significant groundwater recharge, discharge or accumulation. As a result, there are no significant bedrock aquifers within the City. Any minor aquifers present within the bedrock exist mainly within the upper weathered surface layer. In addition, the overlying clay rich Halton till, has poor infiltration characteristics, and has also been identified as a constraint on groundwater recharge.

The sandy deposits of the Iroquois sand plain have a better capacity to infiltrate precipitation. However, these sand deposits are generally thin and are underlain by either shale or clay rich till materials, limiting deep groundwater recharge. The sand plain does, however, provide base flow for a variety of watercourses that lie entirely within these deposits. During extended dry periods these local watercourses tend to run dry as the watertable within the sand deposits drops. Urbanization and development on the sand plain has also affected the ability of the sand plain to store water. As surface water is diverted through engineered watercourses and areas are paved over, infiltration rates drop and the recharge of the localized aquifers diminishes.

### 4.1.8 Vegetation and Flora

The City of Mississauga lies mainly within the Niagara Section of the Deciduous Forest Region as mapped by Rowe (1972). However, the northern area of the City coincides with the transition to the Huron-Ontario Section of the Great Lakes - St. Lawrence Forest Region. In Canada, the Deciduous Forest Region (often described as the Carolinian Zone), occurs only in southwestern Ontario, extending in a narrow strip along the northern shores of Lakes Erie and Ontario. It contains southern forest types and is widespread in the northeastern USA. This forest region is characterized by broad-leaved trees, such as sugar maple, American beech, and white oak, as well as a general lack of conifers. A number of plant species have the northern limits of their range within this region, including sassafras, swamp white oak, several of the hickories and black oak. The Great Lakes - St. Lawrence Forest Region extends from the Mississauga area north to New Liskard and represents a transition zone between the southern deciduous forests and the predominantly conifer forests of the boreal zone to the north. It is characterized by a wide range of plant species including: white and red pine, eastern hemlock, yellow birch, sugar maple, red maple, red oak and basswood. Both of these forest regions are well settled, and extensive forest tracts no longer exist. Within the City of Mississauga both of these forest regions and their associated flora are represented within remnant natural areas.

The largest influence on the flora of the City has been the clearing of the forests for agriculture and the subsequent urbanization. The original survey records for Peel County, which date between 1806 and 1822, suggest that almost the entire County was forested. Some of the larger, relatively undisturbed forests existing today are representative of these pre-settlement forests. Other influences on the flora of the City have been: the early removal of large [typically 3.5 m (11.5) ft in diameter] white pines and oaks for ship masts, the elimination of tamarack from the river valleys in the 1890s by larch saw-fly (Webber 1984) and the elimination of large elms in the 1950s by the Dutch Elm Disease.

**Vegetation Communities**

Forty-eight vegetation communities occupying a total area of 2328.23 ha (5751 a.) have been described for the City (see Table 2) based on the classifications of Bakowsky (1995) and Kavanaugh and McKay-Kuja (1992). These communities were delineated in Mississauga through field work and air photo interpretation. Each community was uniquely labelled with an upper case letter which appears in brackets in the following discussion. The vegetation communities of each natural area are described in detail in the Natural Area Fact sheets provided to the City. The vegetation communities can be divided into seven broad categories: valley lands, woodlands, successional areas, wetlands, prairie, beach and anthropogenic (created by human use). In addition, there were three tableland communities which were not visited owing to access difficulties and which could not be determined from aerial photographs. These are labelled as unknown.

Some anthropogenic communities were included within natural areas owing to their location. For instance, golf courses are not considered natural areas *per se*, but those that occur in valley lands were included as part of the overall feature. This also applies to manicured parks that occur in valley lands.

Within the City certain combinations of environmental factors have produced two vegetation communities which are considered rare or uncommon within Ontario. These communities are: the tallgrass prairie remnants located within or close to the former settlement of the Mississauga Indians (now part of the Mississauga Golf Club), and the wetland community, willow-buttonbush shrub thicket (X) found within the Creditview wetland.

Within the valley lands category there are nine vegetation communities comprising 1301.8 ha (3216 a.), or 56% of the total area of all vegetation communities. Five of these communities are among the most widespread in the City: wooded slope (A) with 347.4 ha (858 a.), flood plain (B) with 458.4 ha (1132 a.), golf course (G) with 101.2 ha (250 a.), wooded non-native (J) with 93.4 ha (231 a.), and open with open slopes (K) with 229.0 ha (566 a.). The community wooded native (L) is used for a few valley land sites that were not surveyed during the field season due to access problems or lack of time.

**Table 2: The Vegetation Communities Mapped for the City of Mississauga**

Their areas and their proportion of the total area [communities are based on classifications of Bakowsky (1995) and Kavanaugh and McKay-Kuja (1992)]

| Community Code | Vegetation Community Name | # Occurrences | Area | | Proportion of Vegetation Area (%) | Proportion of City Area (%) |
|---|---|---|---|---|---|---|
| | | | (ha) | (acres) | | |
| A | wooded slope | 19 | 347.36 | 857.98 | 14.92 | 1.19 |
| B | flood plain | 22 | 458.42 | 1132.30 | 19.69 | 1.57 |
| C | old field | 26 | 88.45 | 218.47 | 3.80 | 0.30 |
| D | hedgerow | 5 | 7.68 | 18.97 | 0.33 | 0.03 |
| E | early successional forest | 9 | 21.68 | 53.55 | 0.93 | 0.07 |
| F | manicured | 11 | 72.41 | 178.85 | 3.11 | 0.25 |
| G | golf course | 4 | 101.18 | 249.91 | 4.35 | 0.35 |
| H | urban lake | 2 | 7.26 | 17.93 | 0.31 | 0.02 |
| I | wooded residential | 3 | 251.59 | 621.43 | 10.81 | 0.86 |
| J | wooded non-native valley lands | 18 | 93.43 | 230.77 | 4.01 | 0.32 |
| K | open with open slopes valley lands | 31 | 229.02 | 565.68 | 9.84 | 0.78 |
| L | wooded native valley lands | 5 | 39.77 | 98.23 | 1.71 | 0.14 |
| M | open with wooded slopes valley lands | 2 | 5.26 | 12.99 | 0.23 | 0.02 |
| N | open with manicured slopes valley lands | 2 | 22.16 | 54.74 | 0.95 | 0.08 |
| O | manicured with wooded slopes valley lands | 1 | 5.17 | 12.77 | 0.22 | 0.02 |
| P | hawthorn thicket | 4 | 14.54 | 35.91 | 0.62 | 0.05 |
| R | beach | 3 | 2.36 | 5.83 | 0.10 | 0.01 |
| S | tall grass prairie | 1 | 0.06 | 0.15 | 0.00 | 0.00 |
| T | plantation | 11 | 21.58 | 53.30 | 0.93 | 0.07 |
| U | unknown | 5 | 35.65 | 88.06 | 1.53 | 0.12 |
| V | cattail marsh | 13 | 27.73 | 68.49 | 1.19 | 0.09 |
| W | open water marsh | 6 | 22.70 | 56.07 | 0.98 | 0.08 |
| X | willow buttonbush swamp thicket | 1 | 2.77 | 6.84 | 0.12 | 0.01 |
| Y | wet meadow | 1 | 3.43 | 8.47 | 0.15 | 0.01 |
| Z | willow-ash forest | 2 | 0.55 | 1.36 | 0.02 | 0.00 |

**Table 2:** continued .....

| Community Code | Vegetation Community Name | # Occurrences | Area | | Proportion of Vegetation Area (%) | Proportion of City Area (%) |
|---|---|---|---|---|---|---|
| | | | (ha) | (acres) | | |
| AA | silver maple forest | 5 | 18.59 | 45.92 | 0.80 | 0.06 |
| BB | red ash-American elm forest | 14 | 35.32 | 87.24 | 1.52 | 0.12 |
| CC | sugar maple forest | 7 | 14.79 | 36.53 | 0.64 | 0.05 |
| DD | sugar maple-American beech forest | 15 | 108.35 | 267.62 | 4.65 | 0.37 |
| EE | sugar maple-white ash forest | 9 | 63.06 | 155.76 | 2.71 | 0.22 |
| FF | sugar maple-red oak forest | 10 | 42.48 | 104.93 | 1.82 | 0.15 |
| GG | sugar maple-Eastern hemlock forest | 1 | 16.03 | 39.59 | 0.69 | 0.05 |
| II | sugar maple-black cherry forest | 1 | 1.93 | 4.77 | 0.08 | 0.01 |
| KK | sugar maple-American beech-red oak forest | 5 | 29.46 | 72.77 | 1.27 | 0.10 |
| LL | sugar maple-American beech-eastern hemlock forest | 1 | 4.44 | 10.97 | 0.19 | 0.02 |
| MM | white pine-Eastern hemlock-sugar maple forest | 1 | 6.77 | 16.72 | 0.29 | 0.02 |
| NN | eastern hemlock forest | 3 | 4.09 | 10.10 | 0.18 | 0.01 |
| OO | red maple-red oak forest | 5 | 30.24 | 74.69 | 1.30 | 0.10 |
| PP | American beech forest | 1 | 2.56 | 6.32 | 0.11 | 0.01 |
| QQ | bur oak-American beech forest | 1 | 2.24 | 5.53 | 0.10 | 0.01 |
| RR | oak-ash forest | 8 | 28.61 | 70.67 | 1.23 | 0.10 |
| SS | oak-hickory forest | 5 | 24.20 | 59.77 | 1.04 | 0.08 |
| TT | ash-hickory forest | 3 | 6.94 | 17.14 | 0.30 | 0.02 |
| UU | black walnut grove | 1 | 0.17 | 0.42 | 0.01 | 0.00 |
| VV | black cherry-eastern hemlock-white ash forest | 1 | 2.02 | 4.99 | 0.09 | 0.01 |
| WW | bur oak-black walnut forest | 1 | 0.90 | 2.22 | 0.04 | 0.00 |
| XX | birch forest | 1 | 0.46 | 1.14 | 0.02 | 0.00 |
| YY | poplar forest | 1 | 2.37 | 5.85 | 0.10 | 0.01 |

The woodland category has nineteen vegetation communities, all of which occur outside of creek valleys, although intermittent streams may be present within them. This category comprises 424.4 ha (1047 a.), 18% of the total area of vegetation communities. Sugar maple-American beech forest (DD), with 108.4 ha (268 a.), is one of the most widespread communities within the City. Fourteen woodland communities are considered uncommon within the City, each either comprising less than 1% of the total vegetation community area or containing an uncommon working group, as defined by Krahn *et al.* (1995). Communities such as sugar maple forest (CC), eastern hemlock forest (NN), and oak-hickory forest (SS) would have been more extensive in the past within the City but are now uncommon. Some communities such as bur oak-American beech forest (QQ), and black cherry-eastern hemlock-white ash forest (VV) are probably the result of selective removal of sugar maple trees. On the other hand, some small communities such as bur oak-black walnut forest (WW), and sugar maple-black cherry forest (II), are most likely the result of fragmentation of larger forests, or hydrological changes created by development. For example, within the bur oak-black walnut woodland were many decaying eastern white cedar and yellow birches suggesting that this site was once quite wet.

The successional category has six communities comprising 135.2 ha (334 a.), 6% of the total area of vegetation communities. One, old field (C), is considered among the most widespread in the City with 88.4 ha (218 a.). The remainder of these communities are considered uncommon within the City, each comprising less than 1% of the total vegetation community area.

The wetland category has six vegetation communities comprising 75.8 ha (187 a.), 3% of the total vegetation community area. All of these communities are considered uncommon within the City, with each containing 1% or less of the total vegetation community area. Four sites contain the largest portion of the wetland area, with the rest existing in small pockets adjacent to, or within woodlands.

The anthropogenic category contains five vegetation communities comprising 353.0 ha (872 a.), 15% of the total vegetation community area within the City. The Residential Woodland community (I) is among one of the largest in the City with 251.6 ha (621 a.). This community describes the older areas of the City in Clarkson-Lorne Park, Mineola, and Cooksville where a remnant, but continuous, tree canopy is present within residential areas. The urban lake community includes Lakes Aquitaine and Wabukayne, both located in Meadowvale.

The most prevalent communities within the City are those in the valley land category. All of these communities occur within the floodplains and slopes. The relatively small amount of area represented by the woodland, wetland, and successional vegetation communities, all of which are on the tablelands, suggests that they are not as well represented in the City and that there should be a high priority placed on protecting them from development.

**Flora**

The flora of the City used for this report relied heavily on The Vascular Plant Flora of Peel County, Ontario (Webber 1984). However, the plant names used follow Oldham *et al.* (1995) and Morton and Venn (1990) to reflect recent changes in naming. Criteria and/or sources for significance status are provided in Appendix 4. Historical records are included in the data base to indicate the species that were noted in the past but have not been documented for a specific area since 1970 or before. Field work and review of consultants studies revealed 51 new species for Mississauga, only 21 of which are native (see Appendix 5), the remainder being introduced from elsewhere. Five native plant species considered to be extirpated within the City prior to the 1995 field season, were subsequently documented. These species are: the hawthorn (*Crataegus calpodendron*) at site ETO3 (see Figure 2, page 53), broad-leaved spring-beauty (*Claytonia caroliniana*) at sites ETO4 and MV2, fragrant water-lily (*Nymphaea odorata*) at site MB8/ME8, wild blue phlox (*Phlox divaricata*) at LS3, and Clinton's woodfern (*Dryopteris clintoniana*) at sites CL9, HO7, and CL24. Some plant records from

existing reports and studies are considered unlikely occurrences and may have been misidentified. These questionable species records are provided in Appendix 6 and require confirmation before they are added to the data base.

One thousand one hundred and one plant (1,101) species have been documented to date for the City of Mississauga (see Appendix 9 for a complete list). Of the total number of species, 431 (39%) are introduced (garden escapes, plantings, or aggressive agricultural weeds), and 670 (61%) are native. This is a relatively high proportion of non-native plants when compared to the provincial flora, which is approximately 27.4% non-native (Kaiser 1983). However, the average proportion of non-native species for the areas surveyed was 28.4%, with a range of 4% to 60%. Of the native species, 435 (65%) are considered rare to uncommon within the City and 235 (35%) are considered common. This is probably a reflection of the relatively small area of the landscape which supports native vegetation. Seventy-one species previously known from the City have been extirpated, of which 50 are native and 21 non-native. Nineteen provincially rare plant species have been historically documented as occurring in the City (see Appendix 7). However, six of these are thought to be extirpated (locally extinct). A number of new sites for regionally rare species were located, thus changing the status of some species (Appendix 8).

The proportion of non-native plants may be higher at present for many sites, since a lot of the flora information used here was collected in the 1970's and 1980's, ten to twenty years ago. A much more intensive survey of individual areas is required to determine current floral composition. Three sites designated as wetland (EC1), and Environmentally Significant Area (EC1, CL30, CL31) and an ANSI (CL30, CL31) need to be re-evaluated to determine if their designations are still defensible in light of new inventory and analysis undertaken during this study.

**Floristic Quality Assessment**

The Floristic Quality Assessment system allows for an objective numerical evaluation of an area based on the quality of its flora. It can be used to compare two or more areas or compare an area at two different points in time. It is extremely useful for measuring the success of management and restoration programmes. However, it is important to realize that it is just one tool for assessing sites, and should be used in conjunction with other site characteristics and evaluation criteria. The results of these assessments need to be interpreted by someone with skills in plant ecology. A copy of the software and accompanying manual for undertaking the evaluation has been provided to City staff.

The premise upon which the evaluation method is based derives from the fundamental character of a region's flora, in particular the faithfulness a plant displays to a specific habitat. Some plants are very demanding in the quality of habitat in which they will persist and are thus restricted to those habitats. Other species are not as demanding and occur in a variety of habitats. Each native species in the flora is assigned a numerical value from 1 to 10. This is referred to as the “coefficient of conservatism”. Species ranked as 10 are the most demanding and thus the ones most representative of high quality habitat. The numbers have been assigned for Ontario by a group of experts on the provincial flora (Oldham *et al*. 1995). In order to evaluate a site, a species list is compiled, and the coefficients of all native plants are summed and divided by the total number of native species to yield a mean coefficient for the site. A Floristic Quality Index (FQI) can then be calculated by multiplying the mean coefficient by the square root of the total number of native species. Natural areas can then be compared using their mean coefficient and/or the FQI.
During an inventory of plants in a given area, the mean coefficient of conservatism tends to stabilize quite quickly as new plants are recorded and included in the total for the site. The mean coefficient thus serves as a reliable indicator of natural area quality even when only reconnaissance inventories are available. However, the FQI is more influenced by species richness, therefore areas that have complete inventories tend to have

higher FQIs. Although the FQI is generally sensitive to the species richness (number of species) at a site, it does not seem to be necessarily correlated to the size of a site.

Areas with very incomplete inventories (*i.e.* fewer than 30 native species recorded), or ones where just rare plants were surveyed, may provide biased results. The Floristic Quality Assessment was not used for such areas. However, heavily disturbed areas where an inventory of 30 or fewer native species represents a relatively complete inventory, were assessed. One hundred and seven (107) of the 145 natural areas were evaluated using the Floristic Quality Assessment. The mean coefficients and FQIs were divided into three groups as follows. For mean coefficients: high > 4.0, medium = 3.3 to 3.99, low < 3.3; for FQIs: high > 40, medium = 30 to 39.99, and low < 30.

Table 4 (page 55) provides a list showing the mean coefficient and FQI for all sites. The mean coefficients range from 1.20 to 4.82. The majority of the natural areas within the City fall in the medium range of mean coefficients (3.3 to 3.9). The FQIs range from 2.68 to 80.10. The majority of sites fall in the low range for the FQI's (<30.00). Sites with high FQIs include CL9 (Rattray Marsh), EC13 (Creditview Wetland), EM4 (Sawmill Valley Trail), and CRR6 (Credit River), all of which have been extensively studied in the past.

The majority of sites having a medium or high mean coefficient, but a low FQI, probably reflects the diminishing quality of natural areas within the City. This happens where a few non-native species displace native vegetation resulting in lower overall species richness (and thus in lower FQIs), but the medium to high mean coefficient is retained by small patches of high quality native plants persisting in some marginal habitat. When these remnant patches disappear then the mean coefficient will decrease. The high number of sites with a medium mean coefficient indicates that remnant conservative (*i.e.* high quality native) species are still present in many locations. This is important as it indicates these sites have the potential to recover and should therefore be a priority for management. The remnant conservative species within the City's natural areas could serve as the nucleus for restoration efforts.

### 4.1.9 Fauna

Most animals are far more sensitive to human presence than plants and thus the fauna of a suburban area is usually much more degraded than its flora. The effects of general environmental degradation of the air, water, and soil; the proximity of humans, as well as the significant loss or fragmentation of habitats associated with human settlement are the primary reasons for the extirpation of fauna. Prior to European settlement, species such as black bear and wolf, now only associated with relatively wild areas, were common in Mississauga. Although most fauna species have been affected negatively by these changes, several species have adapted to human presence and even benefit from human activities. These include species such as: gray squirrel, racoon, opossum, skunk, red fox, American robin, American crow and blue jay.

Approximately half of the fauna species known to occur in the province have been documented in the past from the City of Mississauga. There have been 16 native reptile, 15 native amphibian, 225 native bird and 30 native mammal species, documented for the City to date. These species are listed in Appendices 10, 11 and 12. The original mammal and bird communities in the City are not well documented and were not determined. Four of the reptiles, two amphibians, one bird and three mammal species have not been recorded since before 1970 and are probably extirpated, and there may have been other extirpations since. There are certainly additional bird species which formerly bred in Mississauga, but these have not been documented.

Significant fauna species documented for the City are listed in Appendix 13. For rarity status definitions see Appendix 4. Historical records are included in the data base to indicate the species that used to occur at

various sites. Historical records are those older than 1970. There are 44 provincially significant bird species documented for the City, the majority (51%) of which are either migrants, wintering, or accidental (*i.e.* do not breed in the City). There is no documentation of any provincially significant bird species recently nesting within the City. There is no documentation of any significant mammal species. One provincially significant amphibian species, the Jefferson salamander, has recently been documented and may still occur in the City. Four other significant reptile species have been documented for the City, all of which are considered historical records. There is also an historical record of redside dace, considered vulnerable in the province, for Fletcher's Creek. Redside dace is currently present in Fletcher's Creek north of the City.

Fisheries information for the watercourses within the City can be found in Table 3. For definitions of the habitat classification refer to Appendix 14. There are seven subwatersheds that are not considered to support fisheries because the watercourses once present have been completely sewered and diverted to other watercourses. These subwatersheds are: Avonhead Creek, Port Credit, Cumberland Creek, Moore Creek, Lakeside, Lake Ontario Outfall, and Cawthra Creek. The MNR designation for each of the watercourses is an overall designation for the entire creek. Very little accurate, published information was available to allow individual reaches within watercourses to be designated, except at river mouths. Type 1 designations are high quality fisheries habitat, for instance spawning or nursery habitat, or the presence of a vulnerable, threatened or endangered (VTE) species. The Department of Fisheries and Oceans will not accept compensation for the loss of such habitats. Type 2 habitats are usually abundant and do not limit the productive capacity of fish species. Type 3 habitats have a low capacity for fish production and do not have reasonable potential for enhancement or restoration. No watercourse within the City was designated overall as Type 3, however, sections of various watercourses probably fall into this category. The fisheries information was compiled from existing reports including: Credit Valley Conservation Authority information, Ontario Ministry of Natural Resources information, Gore & Storrie (1994), Beak Consultants Limited et al. (1992), Proctor & Redfern Limited (1992), and RE White & Associates (1991).

The fauna information for natural areas within the City is extremely limited. Extensive surveys of the fauna within the City's natural areas needs to be conducted. The lack of recent records for reptiles and the predominance of urban adapted wildlife suggests that there has been a degradation of wildlife habitat within the City over the past twenty years.

## Table 3: Areas of Current and Potential Fish Habitat

(for explanation of habitat classification see Appendix 4, MNR designations are explained in section 4.19 of text.

| WATERCOURSE | HABITAT CLASSIFICATION | MNR DESIGNATION | INDICATOR SPECIES | SIGNIFICANT AREA OR SPECIES | COMMENTS |
|---|---|---|---|---|---|
| Lake Ontario shoreline | coastal | TYPE 1 and 2 | Atlantic salmon<br>lake trout<br>white sucker | seasonal spawning from J.C. Saddington Park to Marie Curtis Park | • MNR stocking of chinook salmon, coho salmon, rainbow trout, brown trout |
| Credit River | migratory coldwater | TYPE 1 | Atlantic salmon<br>rainbow trout<br>Pacific salmon | MNR fish sanctuary between QEW and Dundas St.<br><br>MNR fish sanctuary between Burnhamthorpe Road and Streetsville Memorial Park | • MNR maintains migration barrier at Streetsville to protect resident coldwater habitat further upstream<br>• there is little evidence of successful hatching of fry<br>• seasonal fish spawning at river mouth |
| | coolwater | | smallmouth bass | | |
| Carolyn Creek | migratory coldwater | TYPE 1 (only at confluence with Credit) | Pacific salmon<br>rainbow trout | | • fish migration barrier, shallow, relatively turbid, intermittent upstream<br>• very degraded, needs rehabilitation in middle and upper reaches<br>• potential coldwater stream<br>• utilization by spawning adult salmonids<br>• sedimentation and erosion from construction |
| | coolwater | TYPE 2 | | | |
| Fletcher's Creek | migratory coldwater | TYPE 1 (to McLaughlin Rd.) | Pacific salmon | historical records of redside dace within the City | • potential production zone for coldwater species (rainbow trout)<br>• degraded water quality in lower reaches |
| | coolwater | TYPE 2 | largemouth bass | | |
| Levi Creek | migratory coldwater | TYPE 1 (only at confluence with Credit) | Pacific salmon | | • potential coldwater stream<br>• utilized by juvenile salmon and spawning adults (rainbow trout)<br>• degraded water quality<br>• fish migration barrier |
| | coolwater | TYPE 2 | | | |
| Loyalist Creek | migratory coldwater | TYPE 1 (only at confluence with Credit) | Pacific salmon<br>rainbow trout | | • degraded, primarily warm water, little turbidity<br>• extensive sewer network<br>• north portion diverted to Sawmill Creek<br>• little in-stream cover other than rocks |
| | warmwater | TYPE 2 | longnose dace | | |
| Mullet Creek | migratory coldwater | TYPE 1 (only at confluence with Credit) | Pacific salmon<br>rainbow trout | | • migration barrier, high turbidity<br>• potential coldwater stream<br>• potential spawning by coldwater species (rainbow trout)<br>• utilization by juvenile and adult salmonids |
| | coolwater | TYPE 2 | smallmouth bass | | |

**Table 3:** continued .....

| WATERCOURSE | HABITAT CLASSIFICATION | MNR DESIGNATION | INDICATOR SPECIES | SIGNIFICANT AREA OR SPECIES | COMMENTS |
|---|---|---|---|---|---|
| Lake Aquitaine | ponds | TYPE 2 | smallmouth bass | | • low oxygen content<br>• sediment deposition high<br>• algae blooms |
| Lake Wabukayne | ponds | TYPE 2 | | | • algae blooms |
| Sawmill Creek | migratory coldwater | TYPE 1 (only at confluence with Credit) | salmon<br>rainbow trout<br>brown trout | | • major obstructions to fish movement<br>• may provide thermal refuge to main credit<br>• potential coldwater stream<br>• no fish captured winter of 1991/92<br>• at confluence with the Credit supports migrating salmonids, however 6 m (20 ft) drop structure prevents migration into Sawmill Creek<br>• impaired water quality, insufficient baseflow |
| | coolwater (east and main branches) | TYPE 2 | | | |
| Etobicoke Creek | migratory coldwater | TYPE 1 | brown trout<br>rainbow trout | | • rehabilitation potential<br>• primarily fair quality (poor quality at mouth)<br>• little forest cover present<br>• seasonal fish spawning at river mouth<br>• relatively high summer water temperatures |
| | coolwater | TYPE 2 | longnose dace | | |
| Little Etobicoke Creek | warmwater | TYPE 2 | longnose dace | | • extensive channelization in upper reaches<br>• enclosure of headwater streams, shallow<br>• fair water quality |
| Sheridan Creek | warmwater | TYPE 2 | | | • sedimentation, high fluctuating flows, introduction of nutrients and toxic substances<br>• almost completely channelized |
| Rattray Marsh | pond | TYPE 1 | smallmouth bass | | • white sucker, longnose sucker, carp, brown bullhead spawning |
| Turtle Creek | warmwater | TYPE 2 | | | • little information available<br>• possibly Type 1 due to the presence of a wetland near the Lake |
| Applewood Creek | warmwater | TYPE 1 (at mouth) | | seasonal spawning at mouth (Marie Curtis Park) | • little information available |
| | | TYPE 2 | | | |
| Birchwood Creek | warmwater | TYPE 2 | | | • several sections enclosed<br>• leachate plume from north Sheridan landfill south to Delaney Drive and Elite Road<br>• high estimated maximum summer water temperatures |

**Table 3:** continued .....

| WATERCOURSE | HABITAT CLASSIFICATION | MNR DESIGNATION | INDICATOR SPECIES | SIGNIFICANT AREA OR SPECIES | COMMENTS |
|---|---|---|---|---|---|
| Clearview Creek | no fisheries information available | | | | |
| Cooksville Creek | warmwater | TYPE 2 | longnose dace | | • relatively shallow, turbid water<br>• extensively channelized |
| Joshua Creek | warmwater | TYPE 2 | creek chub<br>blacknose dace | | • sections channelized upstream<br>• rehabilitation potential |
| Kenollie Creek | warmwater | TYPE 2 | | | • little information available<br>• little in-stream cover and banks partly open<br>• good water quality |
| Lornewood Creek | coolwater | TYPE 2 | | | • gravel, shale cobble substrate and pool/riffle ratio 3:1<br>• enclosed downstream of Lakeshore Rd. & north of Indian Rd.<br>• sensitive warmwater with potential as coldwater |
| Mary Fix Creek | warmwater | TYPE 2 | | | • channelization and enclosure north of Burnhamthorpe Rd.<br>• diversion to Wolfedale Creek, intermittent flow in north |
| Mimico Creek | warmwater | TYPE 2 | | | • moderate to heavily impacted<br>• some rehabilitation potential<br>• extensive channelization |
| Serson Creek | warmwater | TYPE 2 | | | • upper portion sewered |
| Sixteen Mile Creek | limited fisheries potential | TYPE 2 | | | • low baseflow and high turbidity<br>• large section channelized |
| Stavebank Creek | warmwater | TYPE 2 | | | • little information available |
| Tecumseh Creek | warmwater | TYPE 2 | longnose dace | | • sewered in upper reaches<br>• enclosed in lower reaches |
| Wolfedale Creek | warmwater | TYPE 1 (only at confluence with Credit )<br>TYPE 2 | | | • extensive channelization south of Hwy 403<br>• fair to good water quality |

## 4.2 Open Space Network

Open space provides opportunities for recreation. It constitutes the land base required for facilities, organized sports, and spontaneous activities. It can also serve to preserve natural features such as valley land, wetlands, floodplains, and forested areas, and preclude development of hazardous areas. Open space contributes to urban form by providing variety and contrast in land use. It creates spaces among residential, commercial, and industrial land uses; provides flexibility by accommodating a variety of activities and land use changes; and provides continuity through pathways and linkages among neighbourhoods.

Open Space includes lands owned or managed through lease agreement by the City for recreational and public use. The location of lands identified as Open Space in the City are shown in Figure 1. The following summarizes the existing municipal open space framework in place in the City.

***Greenbelt***

Greenbelt consists of valley and flood plain lands that are not suited for urban development. These lands are reserved primarily for flood and erosion management, conservation of hazard lands, and preservation of natural conditions; a secondary benefit is the provision of opportunities for passive, spontaneous recreation in a natural setting.

***Parkland***

**City Parkland**

City parkland accommodates social, cultural, athletic, and educational recreation activities of City residents. City parkland consists of three park types:

1. waterfront parks

    - include parkland along the Lake Ontario shoreline and are used primarily for water-related, passive, and family activities.

2. sports parks

    - should accommodate a major sports complex including facilities for training and competition such as an outdoor stadium or 50 m (164 ft) pool;

    - should contain major sports fields (ball, soccer, football) for employee and adult league and tournament play.

3. special-use parks

    - should provide for specific uses and/or facilities such as golf course, a public garden, a demonstration farm;

    - should be established for the preservation of environmentally significant and ecologically sensitive areas such as high quality woodlands and large, passive-use parks that serve the entire City (*e.g.* major City park).

# MISSISSAUGA
# NATURAL AREAS SURVEY

## FIGURE 1
## CITY OF MISSISSAUGA OPEN SPACE

- Neighbourhood Parkland
- Community Parkland
- City Parkland
- Greenbelt
- Greenbelt (Not Accessible)
- Schools

0 500 1000 1500 2000
metres

NOTE:
OPEN SPACE INFORMATION PROVIDED BY
COMMUNITY SERVICES DEPARTMENT

MISSISSAUGA
Planning and Building

1996 September

**Community Parkland**

Community parkland provides opportunities for leisure activities within the recreation community. Community parks are of two types:

1. multiple-use parks

    - form the focus of community recreation activities.

2. special-use parks

    - are areas of community significance, containing special features or functions such as woodlands and single purpose facilities.

**Neighbourhood Parkland**

Neighbourhood parkland serves recreational needs within the immediate neighbourhood and represents the smallest park type. Neighbourhood parks serve as a focus for neighbourhood activities, providing opportunities for both passive and active recreation.

The City's Open Space has a potentially significant role to play in the natural areas system. Many of the areas proposed as natural areas or linkages are currently designated as open space in the City Plan, mostly as Greenbelt, but some within the various park classifications. Some of the other parks that are adjacent to proposed natural areas may serve as transition areas between highly urbanized land uses and proposed natural areas, or may function as linkages. In some cases, however, high use parks may contribute to negative impacts within proposed natural areas by focusing use within them with resultant trampling, soil compaction, development of *ad hoc* trails, *etc.* Recommendations regarding the role of existing open space in the natural areas programme is addressed in section 7.0.

## 4.3 Stormwater Facilities

Although specifically designed to accommodate urban stormwater run-off, there are several components of the City's stormwater system which contribute, or have the potential to contribute to the proposed system of natural areas. All the watercourses in the City are used to varying extents for conveying stormwater to Lake Ontario. The impact of this often varies with the size of the watercourse. Thus the Credit River and Etobicoke Creek valleys, owing to their size, still retain sufficient riparian vegetation within the flood plain and valley slopes to allow many ecological functions to occur. However, portions of many smaller watercourses have been engineered to accommodate the increased flows associated with storm events and thus do not retain as much ecological function. Some of these minor creeks have been partially enclosed in pipes and can no longer be identified as landscape features. Despite this, most smaller watercourses are still recognizable features on the landscape and could perform linkage functions within the City.

Several of the minor watercourses are mainly or wholly within natural areas. These include: Clearview Creek, Turtle Creek, Birchwood Creek, Lornewood Creek, Kenollie Creek, Cooksville Creek, Mimico Creek, Fletcher's Creek, Levi Creek, Joshua's Creek (Mississauga portion), Mullet Creek, Sawmill Creek, Chappel Creek and Little Etobicoke Creek. Many of these contain channelized portions which should be evaluated to determine the extent to which they can be restored or naturalized to improve their value as natural areas.

A number of watercourses have one or more natural areas along their length, but with major channelized or disturbed sections between. These watercourses should be examined to determine the extent to which the intervening areas can be restored or naturalized to improve their natural values and enhance their linkage function. These watercourses include: Sheridan Creek, Tecumseh Creek, Wolfdale Creek, Mary Fix Creek, Applewood Creek, Levi's Creek, Sixteen Mile Creek (to provide linkage to adjacent municipality), Loyalist Creek, and Carolyn Creek. There are also a number of unnamed tributaries, primarily associated with Etobicoke Creek, which also have the potential to provide linkage to and between natural areas.

There are several watercourses which have essentially disappeared owing to development including: Cawthra Creek, Cumberland Creek, Moore Creek and Lakeside Creek. There are also two creeks which have no natural features associated with them, or which are substantially piped and should have only a low priority for restoration or naturalization. These include Avonhead Creek and Serson Creek.

## 4.4 Potentially Contaminated Sites

As part of this study, potentially contaminated sites were reviewed to resolve apparent discrepancies between the regional and provincial identification of these sites in the City. The report addressing this component of the study is provided to the City under separate cover. The sites of potential contamination were mapped, however, in nearly all cases, the locational data available to us was extremely vague. In light of this, the general location of potentially contaminated sites was mapped using large circles that show only the general location of the site, not the boundaries of the site or the possible impact zone associated with it.

# 5.0 NATURAL AREAS QUESTIONNAIRE

The main objectives of the questionnaire were to inform residents about natural area issues, determine residents' perceptions and attitudes toward natural areas, and determine needs for public education on natural areas and the role of public stewardship.

The City mailed out questionnaire forms to community groups, environmental organizations, and through posted notices and media announcements, invited individual residents of Mississauga to participate. The process yielded 166 completed questionnaires along with numerous briefs, letters and comments collected during the Mississauga Natural Areas Survey Public Open House of March 28th, 1995. Respondents included residents as young as 17 and as old as 89 years of age, representing all areas within Mississauga, and having lived in the City for an average of slightly more than 18 years.

The Natural Areas Questionnaire addressed five key subject areas:

- the public's general awareness and knowledge of natural areas;
- people's perceptions of the value of natural areas;
- people's use and interaction with these natural areas;
- priorities for their active management; and
- willingness of the public to participate in the stewardship of natural areas.

## 5.1 Awareness of Natural Areas in Mississauga

The questionnaire results reveal a high level of public awareness about the natural areas present in Mississauga. Almost all respondents were able to name and locate one or more natural areas and overall identified more than 70 such areas, including wetlands, woodlands, creeks and rivers, areas along the Lake Ontario Waterfront and conservation areas. The most well-known areas are Rattray Marsh, the Credit River, and parks and ravines including Erindale Park and Cawthra Park. Respondents most often identified the natural areas they actually use or visit, but also demonstrated an awareness of natural areas they did not directly use or visit. Along with a high level of awareness of Mississauga's natural areas there is a strong consensus that there is presently "too little" land preserved as natural areas in the City.

## 5.2 People's Perceptions of Natural Areas

The questionnaire results show that the public places significant value on protecting natural areas in order to preserve them for their ecological function (recharging groundwater, reducing flooding, providing plant and animal habitat), and as desirable recreational community resources. Respondents generally agree that uses of natural areas should be restricted primarily to those which minimize damage and disruption and are compatible with the concept of "natural environments" as peaceful places where one can be close to nature. As examples, many respondents feel that such activities as the operation of motorized vehicles (*e.g.* snowmobiles, power boats and ATVs); biking; hunting and fishing; walking dogs off the leash, teenage partying, tree cutting and construction of paved paths and formal gardens should not be permitted in natural areas.

Based on the percentage of government expenditures respondents would target toward various competing service areas, they place higher priority on protection of natural areas than on creation and operation of parks and recreation facilities and programs, public transit and other public service areas. Protection of natural areas ranked fourth in spending priority only behind schools and libraries, emergency services, and public works.

## 5.3 People's Use and Interaction with Natural Areas

Identifying how people use and interact with natural areas provides an indication of their importance and role in people's lives. Residents presently use the natural areas in Mississauga most often for walks/nature walks and bird watching. The more active uses of trail cycling, children's playing and dog walking (on a leash) which are significantly less popular, and potentially more detrimental to natural areas. The majority of respondents (57%) use the natural areas quite frequently (at least once a week).

## 5.4 Priorities for Active Management

The survey results suggest a public consensus on the importance of protecting the integrity and ecosystem function of many of the natural areas in Mississauga, in particular Credit River valley areas, Rattray Marsh, and including remnant woodlands and many of the small, local natural areas within the City's neighbourhoods. The majority of respondents favour limiting permitted activities and/or limiting public access where necessary to protect these priority areas.

Respondents generally favour the replanting of native flora, eliminating grass cutting and the idea of park naturalization, but are reluctant to support more aggressive measures such as the removal of non-native species, which may be necessary. Many respondents perceive such measures as acts which destroy rather than protect the natural areas; this indicates a need to better inform Mississauga residents of the benefits and rationale for these aggressive measures before they are implemented.

## 5.5 Participation in the Protection and Management of Natural Areas

All residents of Mississauga have a stake in the protection and management of its natural areas. Recognizing this, an overwhelming majority of questionnaire respondents (88%) indicate a willingness to participate directly in efforts to enhance, preserve and restore the remaining natural areas in Mississauga. In numerous cases, people are already doing so by participating in special organized clean-up campaigns (*e.g.*, the annual Rattray Marsh Clean-up); belonging to organizations which promote the protection of natural areas in Mississauga (*e.g.*, Credit River Angler Association); or through individual efforts such as picking up litter that one may come across during nature walks.

The importance people seem to place on protecting the remaining natural areas in Mississauga, their interest in natural areas, and their willingness to get involved favour the feasibility of a volunteer, community-based stewardship program as part of an overall strategy for future protection and management of the natural areas in the City.

## 5.6 Implications for Natural Areas Protection, Management and Stewardship

The data obtained on people's awareness, perceptions, attitudes and values related to natural areas suggest a number of implications for natural areas protection, management and stewardship which should be considered in the development of strategies and guidelines to preserve, enhance and restore Mississauga's natural areas in the future.

***Preservation of natural areas for natural ecosystem integrity and enjoyment of residents***

Residents believe it is most important to preserve natural areas for their ecological functions, but also place high value on maintaining the natural areas for recreation and leisure activities. For these to be compatible goals, it will be necessary to prohibit or limit activities which are detrimental to natural areas and/or restrict the number of users permitted. The potential need to provide alternative locations or facilities for these activities in order to discourage their continued practice in vulnerable natural areas should also be considered.

***Contentious active management measures***

Active management of some natural areas may be required to preserve, enhance and restore natural areas. Public support for aggressive measures such as physical removal, or the use of herbicides to control non-native plants varies. Where such intervention is required, public education and consideration of alternatives should be undertaken before aggressive management measures opposed by residents are implemented.

***Education on the value of natural areas***

Education is important for enhancing public awareness of natural areas and improving residents' understanding of how their actions and activities can negatively impact the natural areas in Mississauga. The questionnaire results suggest education may need to be provided on:

- the value and function of natural areas;
- the value of active management of Mississauga's natural areas;

- how certain activities undertaken in natural areas can be damaging; and

- how chemical fertilizer and herbicide use on residential properties and other seemingly innocuous activities of individual residents can potentially harm natural areas.

***Stewardship***

Many respondents are interested and willing to participate in the management and protection of natural areas in their neighbourhood. The voluntary efforts and commitment of such residents can provide the foundation for a public stewardship program. Trust and cooperation between the City and residents who volunteer to participate will also be important and should be promoted, to assure residents that they do have a meaningful role to play in decisions about natural areas management issues.

***Strategies should reflect the public's attitudes and values***

Strategies and guidelines to preserve, enhance and restore the City's natural areas in the future should take into account the public's perceptions, attitudes and values related to natural areas. The strategies and guidelines should promote and capitalize on residents' willing, active involvement in the preservation and restoration of natural areas. The strategies should also recognize that the City cannot please everyone. The residents of the City have a diverse cultural and educational background and as such, the attitudes and values with respect to natural areas may be varied.

# 6.0 THE NATURAL AREAS SYSTEM

"Natural area" is a fairly subjective phrase that can be applied to a variety of sites. Its application relies heavily on the landscape context in which it is being used. In northern Ontario, a site which has been selectively logged may not be considered a natural area since there are other, unlogged sites. However, every remnant site in southern Ontario has been logged to some extent in the past so the same concept of natural area does not apply. Within a highly urbanized environment such as the City of Mississauga, all areas which still maintain the basic structure of a natural system can be considered natural areas as, relatively speaking, they are providing ecological functions such as groundwater recharge, surface water storage or conveyance, carbon fixing, oxygen production, soil stabilization, soil production, wildlife habitat, *etc.* In addition, they provide a recreation alternative that many residents find important and which can otherwise only be attained by travelling considerable distance outside the City. Natural areas within Mississauga are often quite degraded when compared to the wildness of remote areas, but this should not diminish their legitimacy as urban natural areas. It is with this general notion of "natural area" that the areas in this study were identified and described.

## 6.1 Goal and Objectives of the Natural Areas System

Goals and objectives are a critical component of any programme. Goals serve to provide overall direction and indicate the ideal end point that the programme strives to attain. Objectives should represent achievable milestones, and the degree to which they are achieved can be used to evaluate the overall success of the programme.

Proposed goal for Mississauga's Natural Area Programme:

*To protect, for the long term, remnant natural areas in the City of Mississauga that are representative of the indigenous ecosystems and landscapes that once characterized the area. The maintenance and restoration of ecological integrity of natural areas shall be paramount in this regard.*

Proposed objectives for Mississauga's Natural Areas:

1. *maintain and, where possible and feasible, restore natural ecological processes (such as natural regeneration, decomposition, nutrient cycling, and groundwater recharge and discharge) in remnant natural areas and the surrounding lands which affect them;*

2. *maximize biological diversity in the City through the protection and maintenance of native flora and fauna and the ecological interactions between them and the environment;*

3. *protect identified natural areas in the City from further fragmentation by development, road construction and utility routing;*

4. *maintain, restore, or create functional ecological linkages between remnant natural areas;*

5. *minimize impacts on identified natural areas through designation of compatible adjacent land uses;*

6. *develop and initiate a stewardship programme that will actively involve the public in the management and protection of natural areas;*
7. *minimize harmful disturbance to identified natural areas through:*

*i) controlling and limiting access in areas sensitive to human use;*

*ii) limiting the type of recreational activities that are permitted in natural areas;*

*iii) reviewing and refining City trail plans and standards to respect the sensitive nature of natural areas and as a means to control certain activities;*

*8. develop and implement natural area management in areas requiring mitigation of existing or historic impacts including:*

*i) development of management plans for specific natural areas;*

*ii) removing and controlling non-native plant species where required;*

*iii) restoring indigenous vegetation where appropriate;*

*iv) removing litter and dumped materials from natural areas; and*

*v) rehabilitating and controlling, using non-engineered solutions, areas where erosion has occurred, with the emphasis on eliminating the cause of the problem, rather than treating symptoms;*

*9. periodically update the inventory of natural areas and maintain a current electronic data base of the flora and fauna of all natural areas;*

*10. develop and implement a public education programme to increase general awareness of the value of natural areas and the protection and management required to preserve them.*

## 6.2 Classification Scheme

The development of a classification of natural areas is one useful component of a strategy for their long term protection. Not all areas will have equal value as natural areas. Some very high quality areas should probably receive more attention than areas that are degraded or are lacking special features. Thus a classification which discriminates among areas on the basis of "degree of naturalness" could be used as a basis for management, establishing appropriate uses, protection measures, priority for acquisition, *etc.*

Notwithstanding the fact that some areas are of higher quality than others, a fundamental premise of this study is that all remnant natural areas are part of a system, within which the health and connection of areas should be maintained to the highest possible degree. Thus, all the proposed natural areas contribute to the system, and the total or partial loss of any one of them diminishes the entire system.

Although measures of disturbance or degree of degradation are often included as criteria for designating natural areas, they are not explicitly used here. However, disturbance history is integrated to some degree into the classification, since criteria such as presence of Vulnerable, Threatened, and Endangered (VTE) species or high Floristic Quality Index (see page 28 for explanation of Floristic Quality Index) are a reflection of past use. Disturbance criteria were not explicitly included owing to the fact that careful management (including restoration) and protection measures can mitigate disturbances such as trampling, soil compaction and non-native species. The retention of all areas that have the basic structure of a remnant natural system, notwithstanding current condition, is important to allow restoration in the future.

The criteria used to classify natural areas are provided below. Areas need to fulfil just one criteria in any class to be designated in that class. There are three classes of natural areas: Significant Natural Site, Natural Site and Natural Green Space. In addition, there are three other classes which contribute to the natural areas system: Special Management Areas (SMA's), Residential Woodland and Linkages. The six classes are described below.

***Natural Areas:***

### 1. Significant Natural Sites

These are the areas which are outstanding from a natural areas perspective, in the context of the City of Mississauga. Significant Natural Sites include:

- ANSI's, ESA's and other areas designated for outstanding ecological features;
- areas with a Floristic Index of $\geq$40;
- areas with a mean floristic coefficient $\geq$4.5;
- woodlands $\geq$10 ha (25 a.);
- areas that support provincially significant or vulnerable, threatened or endangered (VTE) species;
- woodlands with the potential to provide interior conditions [*i.e.* no dimension of the woodland is <700 m (2300 ft)];

- woodlands that support old growth trees (≥100 years old);
- wetlands ≥2 ha (5 a.) (regardless of rank); and
- the Credit River and Etobicoke Creek river valleys.

**2. Natural Sites**

These are areas that represent good examples of remnant features that once characterized the City of Mississauga. Natural Sites include:

- woodlands ≥2 ha (5 a.), but <10 ha (25 a.) (woodland being defined as forests which support appropriate understorey as well as woody canopy species);
- forests composed of uncommon (in the context of Mississauga) canopy species;
- forests that represent uncommon vegetation associations in the City;
- areas that support regionally rare or significant plant species;
- areas with a Floristic Quality Index (FQI) 25-39.99;
- areas with a mean floristic coefficient of 3.5 to 4.49; and
- areas that include natural (*i.e.* not engineered) landscape features [*i.e.* valley lands, watercourses, unusual (in the context of Mississauga) landform features].

**3. Natural Green Space**

The term "Natural Green Space" is used in preference to the generic term "Green Space". Green Space often refers to areas that are primarily recreational, and which are usually dominated by mowed grass, whereas Natural Green Space refers to areas which have some remnant "naturalness". This class will include areas which perform ecological functions but do not satisfy any of the criteria for the previous two natural area classes. Natural Green Space includes:

- watercourses that have some riparian vegetation other than mowed grass, even if they are predominantly engineered (*i.e.* have been straightened, or channelized);
- wooded areas that are <2 ha (5 a.) and do not fulfil any of the criteria for Natural Site or Significant Natural Site; and
- Lakes Aquitaine and Wabukayne.

***Other Contributing Areas:***

**1. Special Management Areas**

These are areas adjacent or close to existing natural areas, and which have potential for restoration, or which

should be planned or managed specially. They are primarily identified to alert planners to the possibility of directing compatible land uses to lands adjacent to natural areas.

**2. Residential Woodland**

These are older residential areas, generally with large lots, and are almost completely in private ownership. They support trees with a mature, fairly continuous canopy, but the native understorey is generally absent or degraded, usually through maintenance of residential lawns and landscaping. However, these areas still serve some functions such as: providing habitat for tolerant canopy birds, both in migration and for breeding; fixing atmospheric carbon; and facilitating groundwater recharge owing to the high proportion of permeable ground cover. With approaches that involve landscaping with native species, the ecological function of these areas could be greatly increased.

**3. Linkages**

These are areas which serve to link two or more of any of the previous 5 classes within the City, or to natural areas outside of the City boundaries. It is recognized that many pedestrian walkways, whose primary function is recreational, often have grassed or vegetated margins that may provide a linkage function for some wildlife species. However, since the emphasis of this project is on ecological features, these areas were not included here. The potential for the restoration or naturalization of walkways that are within the City's open space system should be examined in the future. It is noted that many of the City's ecological linkages have been designated as Significant Natural Sites or Natural Sites owing to their overall significance beyond their linkage function (*e.g.*, Credit River valley and Etobicoke Creek valley).

Linkages could include:

- stormwater management facilities including ponds and watercourses;
- designated open space;
- rights-of-way; and
- greenspace along major arterial roads providing there is an adequate barrier between the linkage and the roadway

It is also recognized that Lake Ontario itself constitutes an important ecological link between the major drainages within the City. Some species of aquatic plants and animals may disperse among the various watersheds in Mississauga via the Lake. Since Lake Ontario is outside the boundaries of the City, it is not included as a linkage within the natural areas system. However, sound environmental planning along the shoreline that could enhance the linkage role of the Lake within the context of the City is important.

The degree to which contributing areas can be managed as natural areas varies, since some of them are privately owned. For instance, practically all the area within the Woodland Residential category is private. Any protection or management associated with areas in this category must be done in cooperation with landowners through a landowner contact programme.

### 6.3 Presentation of the Natural Areas Framework

Figure 2 shows the location of natural areas, Special Management Areas, Residential Woodlands and Linkages, and Table 4 summarizes some of their basic characteristics. Owing to the scale of mapping, Significant Natural Sites, Natural Sites and Natural Green Space are not discriminated on this map, but are all labelled "natural area". The classification of these areas can be determined from Table 4. In addition, the location of "minor natural features" is illustrated.

## Figure 2: Legend For Natural Area System for the City of Mississauga

(Note: There are 141 natural areas and 3 Residential Woodlands identified on Figure 2, however 149 areas are listed below because 5 span two planning districts and are thus listed twice)

SOUTHDOWN
1. SD1
2. SD4
3. SD5 (Meadowwood)

CLARKSON-LORNE PARK
4. CL52 (Meadowwood)
5. CL1 (Meadowwood)
6. CL9 (Rattray Marsh)
7. CL8
8. CL15
9. CL16 (Jack Darling Park)
10. CL17 (Lorne Park Estates)
11. CL13
12. CL43
13. CL42
14. CL21 (Birch Glen)
15. CL39 (Whiteoaks)
16. CL22
17. CL30 (Lorne Park Prairie)
18. CL31 (Lornewood Creek Trail)
19. CL24 (Tecumseh)
20. CL26
24. CRR9 (Credit River Flats)

PORT CREDIT
21. PC1 (Rhododendron Gardens)
22. PC2 (Port Credit Memorial)
23. PC3

MINEOLA
24. CRR9 (Credit River Flats)
25. MI4
26. MI1

LAKEVIEW
27. LV3 (Adamson Estate)
28. LV4 (Helen Molasy Memorial)
29. LV5
30. LV2
31. LV1 (Marie Curtis)
32. ETO8
33. LV14 (Lakeview Golf Course)
34. LV6
35. LV7 (Cawthra Woods)
36. ETO7

SHERIDAN PARK
37. SP1
38. SP3

SHERIDAN
39. SH6
40. CRR7
41. CRR8

ERINDALE
40. CRR7
41. CRR8
42. ER6
43. CRR6

COOKSVILLE
44. CV1 (Iroquois Flats)
45. CV2
46. CV12 (Richard Jones)
47. CV10
48. CV8 (Camilla)

DIXIE
36. ETO7
49. ETO6
50. AW1 (Willowcreek)

WESTERN BUSINESS PARK
51. WB1 (Erin Mills Twin Arena)

ERIN MILLS
52. EM30 (Tom Chater Memorial)
53. EM6 (King's Masting)
54. EM2 (South Common)
55. EM10
56. EM14
57. EM4
58. EM5 (Glen Erin Trail)
43. CRR6
59. EM21 (Richard F.C. Mortensen)

CREDITVIEW
60. CR1

FAIRVIEW
61. FV1
62. FV3

CITY CENTRE
63. CC1 (Bishopstoke Walk)

MISSISSAUGA VALLEY
64. MY1 (Mississauga Valley)
65. MY3 (Stonebrook)

APPLEWOOD
50. AW1 (Willowcreek)
66. AW4 (Applewood Hills)
67. AW3 (Applewood Hills)
68. ETO5
49. ETO6

RATHWOOD
69. ETO4
70. RW5 (Applewood Hills)
71. RW6 (Applewood Hills)
72. RW4 (Rathwood District)
73. RW1
74. RW2 (Woodington Green)

CHURCHILL MEADOWS
75. CM7
76. CM9
77. CM11
78. CM12
79. CM17
80. CM13

CENTRAL ERIN MILLS
81. CE7 (Sugar Maple Woods)
82. CE9 (Quenippenon Meadows)
83. CE10 (Erin Wood)
84. CE5
85. CE1 (Woodland Chase Trail)
86. CE12 (Bonnie Brae)
87. CRR5
88. CRR4

STREETSVILLE
89. SV12 (Bonnie Brae)
90. SV10
88. CRR4
91. SV1 (Turney Woods)
92. CRR3
93. CRR2

EAST CREDIT
87. CRR5
88. CRR4
92. CRR3
93. CRR2
94. EC22
95. EC10
96. EC13
97. EC1

HURONTARIO
98. HO1
99. HO2
100. HO3 (Staghorn Woods)
101. HO6
102. HO7
103. HO9 (Britannia Woods)

NORTHEAST
104. NE4
105. NE3
106. NE2
107. NE1
108. NE6

NORTHEAST
109. NE5
110. NE7
69. ETO4
111. ETO3
112. NE8
113. NE10
114. NE11
115. NE12
116. ETO2
117. ETO1
118. NE9 (Wildwood)

LISGAR
119. LS1 (Lisgar Meadow Brook)
120. LS2
121. LS3 (Trelawny Woods)

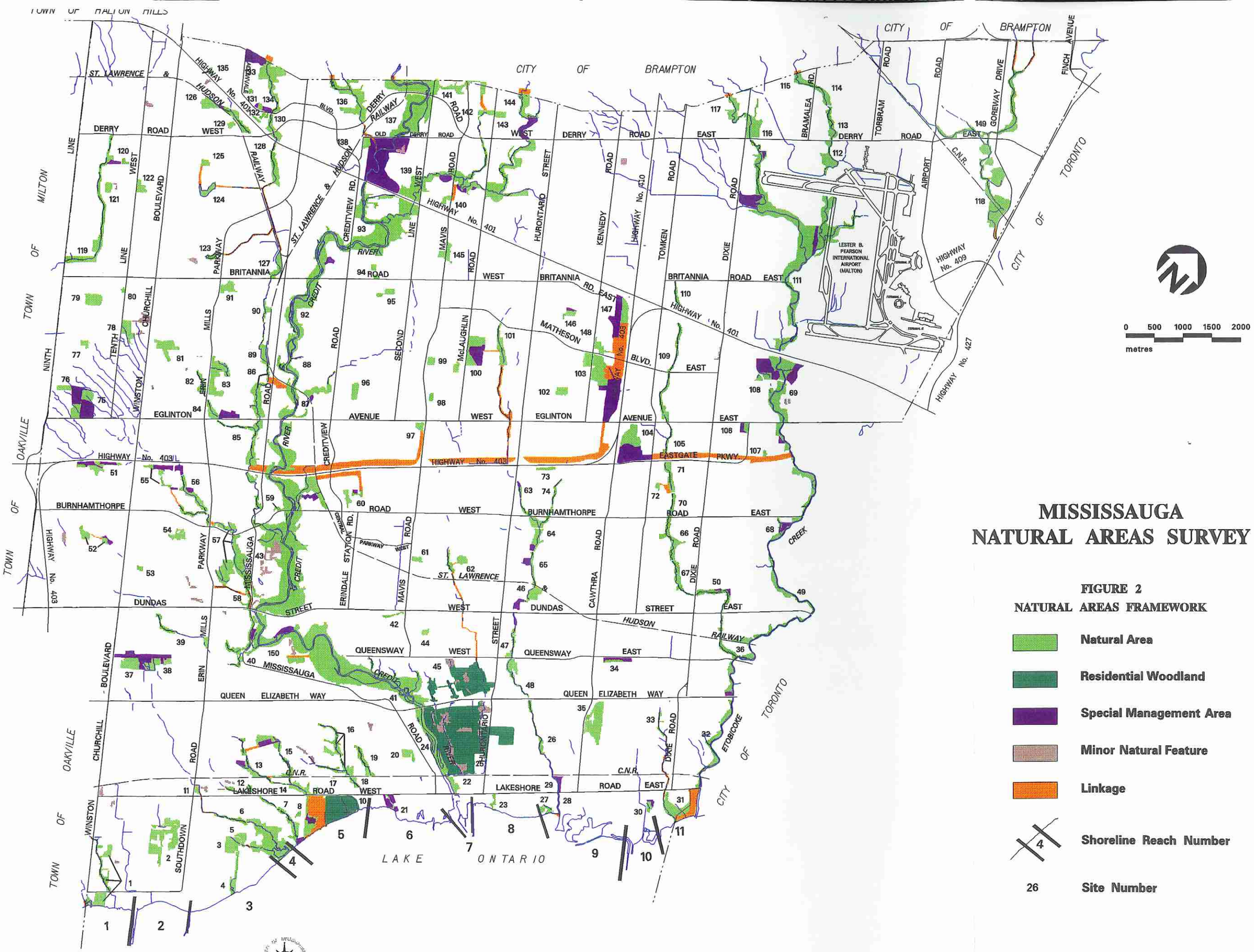
MEADOWVALE
122. ME10 (Eden Woods)
123. ME12 (Lake Wabukayne)
124. ME11 (Lake Aquitaine)
125. ME9 (Maplewood)
126. ME8 (Windrush Woods)

MEADOWVALE BUSINESS PARK
127. MB9
128. MB7 (Mullet Creek)
129. MB8
130. MB3
131. MB5
132. MB4
133. MB6 (Totoredaca)
134. MB2
135. MB1

MEADOWVALE VILLAGE
136. MV19
137. CRR1 (Meadowvale Conservation Area)
138. MV18
139. MV2
140. MV3
141. MV12
142. MV14
143. MV11
144. MV15
93. CRR2

GATEWAY
145. GT1
146. GT3
147. GT2
148. GT4 (Brittania Woods)

MALTON
149. MAI




# MISSISSAUGA NATURAL AREAS SURVEY

**FIGURE 2**
**NATURAL AREAS FRAMEWORK**

- Natural Area
- Residential Woodland
- Special Management Area
- Minor Natural Feature
- Linkage
- 4 — Shoreline Reach Number
- 26 — Site Number

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**Table 4: Summary of Natural Area Features, Their Significant Features and Condition**

Classification abbreviations are as follows: SNS = Significant Natural Site, NS = Natural Site, NGS = Natural Green Space, and RW = Residential Woodland. Native FQI and native mean C are defined in Section 4.18. Defintions for provincially significant species (prov. sig. species) and regionally significant species (reg. sig. species) are in Appendix 4. Condition is explained in Appendix 1, abbreviations are as follows: E=excellent, G=good, F=fair, P=poor, and n/a=not available.

| Site Number | Site Code | Classification | Designation | Area | | Flora | | | | | | | Fauna | | | | Condition |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | (ha) | (acres) | total | # non-native (proportion) | native FQI | native mean C | # vegetation communities | prov. sig. species | reg. sig. species | # birds | # mammals | # herptiles | prov. sig. species | |
| 1 | SD1 | NS | | 19.50 | 48.17 | 94 | 25 (26.6%) | 30.22 | 3.64 | 5 | | 4 | 13 | 4 | 2 | | F |
| 2 | SD4 | NS | | 26.58 | 65.65 | 65 | 16 (24.6%) | 26.14 | 3.73 | 1 | | 2 | | | | | n/a |
| 4 | CL52 | NGS | | 6.67 | 16.47 | 34 | 18 (52.9%) | 12.75 | 3.19 | 1 | | | 10 | 1 | | | P |
| 5/3 | CL1/SD5 | SNS | | 13.74 | 33.94 | 38 | 4 (10.5%) | 28.13 | 4.82 | 2 | | 2 | 2 | | | | G |
| 6 | CL9 | SNS | ESA,ANSI, wetland | 46.89 | 115.82 | 491 | 156 (31.4%) | 80.10 | 4.38 | 13 | 2 | 125 | 200 | 23 | 22 | 1 | G |
| 7 | CL8 | SNS | wetland | 11.28 | 27.86 | 48 | 9 (18.8%) | 19.86 | 3.18 | 7 | | 2 | 13 | 10 | 1 | | G |
| 8 | CL15 | NS | | 0.83 | 2.05 | 44 | 9 (18.2%) | 24.51 | 4.14 | 1 | | 3 | 2 | 2 | | | F |
| 9 | CL16 | NS | | 8.52 | 21.04 | 119 | 33 (26.9%) | 37.63 | 4.06 | 5 | | 11 | 37 | 16 | | | F-P |
| 10 | CL17 | RW | | 33.28 | 82.20 | 71 | 13 (18.6%) | | | 1 | | 17 | | | 4 | | n/a |
| 11 | CL13 | NGS | | 1.50 | 3.71 | 40 | 23 (55.0%) | 8.25 | 1.94 | 2 | | | 2 | | | | P |
| 12 | CL43 | NS | | 4.16 | 10.28 | 68 | 11 (16.2%) | 29.27 | 3.88 | 2 | | 5 | 5 | 1 | | | F |
| 13 | CL42 | NS | | 8.87 | 21.91 | 103 | 28 (27.2%) | 35.80 | 4.13 | 3 | | 9 | 4 | 1 | | | F-P |
| 14 | CL21 | SNS | ESA,ANSI, wetland | 9.36 | 23.12 | 97 | 22 (21.6%) | 38.91 | 4.49 | 3 | | 18 | 2 | | 1 | | F |
| 15 | CL39 | SNS | | 12.98 | 32.06 | 245 | 69 (28.0%) | 54.51 | 4.13 | 2 | | 41 | 6 | 2 | 8 | | F |
| 16 | CL22 | SNS | ESA,ANSI | 17.85 | 44.09 | 131 | 45 (34.4%) | 37.74 | 4.07 | 1 | 2 | 13 | 2 | 1 | 6 | | G |
| 17 | CL30 | SNS | ESA,ANSI | 0.06 | 0.15 | 24 | 8 (33.3%) | | | 1 | 2 | 11 | | | | | P |
| 18 | CL31 | SNS | ESA,ANSI | 2.78 | 6.87 | 50 | 26 (50.0%) | | | 1 | | 2 | 1 | | | | P |
| 19 | CL24 | SNS | | 7.80 | 19.27 | 213 | 51 (23.0%) | 58.06 | 4.56 | 3 | | 31 | 6 | 1 | | | G |
| 20 | CL26 | NS | | 4.34 | 10.72 | 157 | 58 (35.7%) | 31.66 | 3.18 | 2 | | 15 | 5 | 2 | | | F |
| 21 | PC1 | NS | | 1.09 | 2.69 | 75 | 31 (41.3%) | 23.82 | 2.11 | 1 | | 7 | 68 | 1 | | | P |
| 22 | PC2 | NGS | | 4.37 | 10.79 | | | | | 1 | | | | | | | P |
| 23 | PC3 | NS | | 1.73 | 4.27 | 11 | | | | 1 | | | | | | | n/a |
| 24 | CRR9 | SNS | ESA,ANSI, wetland | 25.63 | 63.31 | 37 | 14 (37.8%) | 17.10 | 3.57 | 3 | | 12 | 10 | 1 | 13 | | F |
| 25 | MI4 | RW | | 165.14 | 407.90 | 97 | 27 (24.7%) | 36.65 | 4.32 | 1 | | 5 | | | 3 | | F |
| 26 | MI1 | NS | | 6.31 | 15.59 | 9 | 5 (44.4%) | | | 1 | | | | | | | F |
| 27 | LV3 | NS | | 3.54 | 8.74 | 80 | 34 (40.0%) | 24.33 | 3.59 | 3 | | | 18 | 2 | | | F |
| 28 | LV4 | NGS | | 0.95 | 2.35 | | | | | 1 | | | | | | | P |
| 29 | LV5 | NGS | | 1.09 | 2.69 | | | | | 1 | | | | | | | P |
| 30 | LV2 | NS | | 2.09 | 5.16 | 26 | 11 (38.5%) | 11.62 | 3.00 | 1 | | | 3 | | | | P |
| 31 | LV1 | SNS | | 14.03 | 34.65 | 82 | 34 (40.2%) | 23.09 | 3.33 | 4 | 1 | | 8 | | | | F |
| 32 | ETO8 | SNS | | 16.67 | 41.17 | 85 | 34 (37.6%) | 26.05 | 3.65 | 3 | | 3 | 2 | 4 | 1 | | F |
| 33 | LV14 | NGS | | 1.95 | 4.82 | 35 | 17 (45.7%) | 13.67 | 3.22 | 1 | | | | | | | P |

**Table 4:** continued .....

| Site Number | Site Code | Classification | Designation | Area | | Flora | | | | | | | Fauna | | | | Condition |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | (ha) | (acres) | total | # non-native (proportion) | native FQI | native mean C | # vegetation communities | prov. sig. species | reg. sig. species | # birds | # mammals | # herptiles | prov. sig. species | |
| 34 | LV6 | NS | | 2.02 | 4.99 | 61 | 19 (29.5%) | 24.38 | 3.76 | 1 | | 3 | | | | | F |
| 35 | LV7 | SNS | ESA,ANSI | 21.56 | 53.25 | 292 | 101 (33.9%) | 57.67 | 4.17 | 2 | | 46 | 65 | 6 | 3 | 1 | G |
| 36 | ETO7 | SNS | ESA | 27.18 | 67.13 | 84 | 35 (39.3%) | 21.29 | 3.04 | 2 | | 2 | 11 | 2 | 12 | 2 | F |
| 37 | SP1 | NS | | 10.12 | 25.00 | 107 | 27 (24.3%) | 33.99 | 3.80 | 1 | | 11 | 4 | 1 | | | F |
| 38 | SP3 | SNS | ANSI | 9.64 | 23.81 | 133 | 30 (21.8%) | 41.09 | 4.05 | 1 | | 11 | 5 | 2 | 1 | | G |
| 39 | SH6 | NS | | 6.85 | 16.92 | 69 | 32 (46.4%) | 21.37 | 3.51 | 2 | | 1 | 4 | | | | P |
| 40 | CRR7 | SNS | ESA,ANSI | 88.96 | 219.73 | 61 | 10 (13.1%) | 33.89 | 4.75 | 3 | 1 | 8 | | | 9 | | G |
| 41 | CRR8 | SNS | ESA,ANSI | 110.62 | 273.23 | 43 | 3 (7.0%) | | | 4 | 2 | 31 | 8 | 1 | 4 | | G |
| 42 | ER6 | SNS | | 1.56 | 3.85 | 36 | 13 (36.1%) | 16.26 | 3.39 | 1 | 1 | | 1 | | | | P |
| 43 | CRR6 | SNS | ESA,ANSI | 213.66 | 527.74 | 269 | 88 (32.3%) | 63.63 | 4.73 | 4 | 4 | 65 | 87 | 8 | 17 | 1 | G |
| 44 | CV1 | NS | | 1.48 | 3.66 | 29 | 9 (31.0%) | 13.86 | 3.10 | 1 | | | 5 | 1 | | | F |
| 45 | CV2 | RW | | 53.17 | 131.33 | 142 | 43 (29.6%) | 41.71 | 4.19 | 1 | 1 | 12 | 6 | 1 | | | F |
| 46 | CV12 | SNS | | 6.99 | 17.27 | 199 | 89 (44.2%) | 37.19 | 3.55 | 3 | 1 | 13 | 2 | 1 | | | F |
| 47 | CV10 | NS | | 4.59 | 11.34 | 20 | 9 (40.0%) | 8.74 | 2.64 | 2 | | | 2 | | | | P |
| 48 | CV8 | NS | | 7.87 | 19.44 | 39 | 18 (43.6%) | 13.53 | 2.95 | 4 | | 1 | 1 | | | | P |
| 49 | ETO6 | SNS | | 11.39 | 28.13 | | | | | 3 | | | | | | | P |
| 50 | AW1 | SNS | | 7.98 | 19.71 | 51 | 18 (35.0%) | 18.45 | 3.21 | 3 | 1 | 1 | 5 | 1 | | | P |
| 51 | WB1 | NS | | 7.12 | 17.59 | 53 | 9 (17.0%) | 25.93 | 3.91 | 3 | | | 4 | | 1 | | F |
| 52 | EM30 | NS | | 5.56 | 13.73 | 52 | 5 (9.6%) | 29.61 | 4.32 | 2 | | 6 | 9 | 8 | | | G |
| 53 | EM6 | NS | | 1.07 | 2.64 | 53 | 11 (20.8%) | 25.00 | 3.86 | 1 | | 1 | 6 | 1 | | | F |
| 54 | EM2 | SNS | | 4.90 | 12.10 | 63 | 12 (19.0%) | 28.85 | 4.04 | 1 | 1 | | 8 | 1 | | | F |
| 55 | EM10 | NS | | 3.99 | 9.86 | 43 | 9 (18.6%) | 21.78 | 3.74 | 2 | | | 4 | 2 | | | F |
| 56 | EM14 | NS | | 9.61 | 23.74 | 49 | 22 (42.9%) | 15.40 | 2.96 | 2 | | | 4 | | | | P |
| 57 | EM4 | SNS | ESA,ANSI | 46.82 | 115.65 | 225 | 61 (26.7%) | 55.05 | 4.30 | 8 | 2 | 28 | 67 | 4 | 6 | | G-F |
| 58 | EM5 | NS | | 1.88 | 4.64 | 49 | 9 (32.7%) | 22.27 | 3.94 | 1 | | | 4 | | | | F |
| 59 | EM21 | NS | | 1.13 | 2.79 | 42 | 8 (16.7%) | 21.27 | 3.65 | 1 | | | 2 | 1 | | | F |
| 60 | CR1 | SNS | ESA,ANSI | 4.90 | 12.10 | 47 | 3 (4.3%) | 29.55 | 4.45 | 2 | | 6 | 2 | 1 | | | F |
| 61 | FV1 | NS | | 2.23 | 5.51 | 38 | 7 (18.4%) | 18.50 | 3.32 | 1 | | | | | | | F |
| 62 | FV3 | NS | | 7.00 | 17.29 | 50 | 15 (22.0%) | 25.63 | 3.86 | 3 | | | 15 | 2 | | | F |
| 63/64 | CC1/MY1 | NS | | 15.33 | 37.87 | 129 | 43 (32.6%) | 35.58 | 3.84 | 2 | | 5 | 8 | 1 | 5 | | F |
| 65 | MY3 | NGS | | 3.71 | 9.16 | 26 | 18 (69.2%) | 6.01 | 2.13 | 1 | | | | | | | P |
| 66 | AW4 | NGS | | 11.71 | 28.92 | | | | | 1 | | | | | | | P |
| 67 | AW3 | NGS | | 7.92 | 19.56 | 33 | 21 (60.6%) | | | 2 | | | 4 | 1 | | | P |
| 68 | ETO5 | SNS | | 9.12 | 22.53 | | | | | 2 | | | | | | | P |
| 69 | ETO4 | SNS | ESA | 58.09 | 143.48 | 128 | 35 (26.6%) | 42.31 | 4.39 | 3 | | 14 | 23 | 2 | 9 | | F |
| 70 | RW5 | NGS | | 3.51 | 8.67 | | | | | 1 | | | | | | | P |
| 71 | RW6 | NGS | | 7.31 | 18.06 | | | | | 1 | | | | | | | P |
| 72 | RW4 | NS | | 1.08 | 2.67 | 33 | 7 (18.2%) | 22.36 | 4.38 | 1 | | | 3 | | | | F |
| 73 | RW1 | SNS | | 2.11 | 5.21 | 69 | 12 (17.4%) | 34.04 | 4.51 | 1 | | 3 | | 1 | | | F |

**Table 4:** continued .....

| Site Number | Site Code | Classification | Designation | Area | | Flora | | | | | | | Fauna | | | | Condition |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | (ha) | (acres) | total | # non-native (proportion) | native FQI | native mean C | # vegetation communities | prov. sig. species | reg. sig. species | # birds | # mammals | # herptiles | prov. sig. species | |
| 74 | RW2 | NGS | | 3.50 | 8.65 | | | | | 1 | | | | | | | P |
| 75 | CM7 | SNS | | 11.38 | 28.11 | 88 | 18 (20.5%) | 34.78 | 4.16 | 3 | | 5 | 15 | 1 | 5 | | E |
| 76 | CM9 | NS | | 3.37 | 8.32 | 62 | 12 (17.7%) | 27.58 | 3.90 | 2 | | 3 | 8 | 2 | | | G |
| 77 | CM11 | NS | | 2.24 | 5.53 | 22 | 1 (4.5%) | 18.33 | 4.00 | 1 | | | 1 | | | | G |
| 78 | CM12 | NS | | 8.22 | 20.30 | 54 | 8 (14.8%) | 27.42 | 4.04 | 2 | | 2 | 11 | 2 | 5 | | G |
| 79 | CM17 | NS | | 8.39 | 20.72 | 25 | 4 (16.0%) | 16.80 | 3.67 | 1 | | | 5 | | | | F |
| 80 | CM13 | NGS | | 0.77 | 1.90 | 37 | 14 (35.1%) | 16.26 | 3.39 | 1 | | | 1 | 1 | | | P |
| 81 | CE7 | SNS | | 10.08 | 24.90 | 88 | 28 (31.8%) | 30.47 | 3.93 | 2 | | 4 | 2 | 1 | 7 | | G |
| 82 | CE9 | NS | | 4.83 | 11.93 | 58 | 14 (24.1%) | 26.99 | 4.07 | 3 | | 2 | 2 | 1 | | | F |
| 83 | CE10 | SNS | | 18.20 | 44.95 | 73 | 13 (17.8%) | 33.82 | 4.37 | 3 | | 6 | 8 | | 2 | | G |
| 84 | CE5 | NGS | | 5.47 | 13.51 | 13 | 8 (61.5%) | 2.68 | 1.20 | 1 | | | | | | | P |
| 85 | CE1 | NGS | | 16.94 | 41.84 | 50 | 24 (46.0%) | | | 2 | | | 3 | | | | P |
| 86/89 | CE12/SV12 | SNS | | 17.61 | 43.50 | 52 | 19 (34.6%) | 17.76 | 3.09 | 2 | 1 | | 4 | 1 | | | F |
| 87 | CRR5 | SNS | | 21.22 | 52.41 | 64 | 27 (42.2%) | 21.37 | 3.51 | 2 | 1 | | 5 | | 5 | | F |
| 88 | CRR4 | SNS | ESA,ANSI | 24.69 | 60.98 | 11 | 2 (5.5%) | | | 3 | | 1 | | | 7 | | G |
| 90 | SV10 | NGS | | 3.93 | 9.71 | 28 | 13 (42.9%) | 9.55 | 2.47 | 1 | | | 1 | 1 | | | P |
| 91 | SV1 | SNS | | 5.62 | 13.88 | 67 | 16 (23.9%) | 29.55 | 4.14 | 2 | 1 | 3 | | | | | F |
| 92 | CRR3 | SNS | | 68.94 | 170.28 | 34 | 5 (11.8%) | | | 4 | | 3 | 1 | | 9 | | F |
| 93 | CRR2 | SNS | ESA,ANSI | 91.30 | 225.51 | 89 | 30 (32.6%) | 32.94 | 4.29 | 8 | | 3 | 13 | | 10 | | G |
| 94 | EC22 | NS | | 2.59 | 6.40 | 39 | 4 (10.3%) | 24.00 | 4.06 | 1 | | 4 | 1 | 1 | | | F |
| 95 | EC10 | NS | | 3.35 | 8.27 | 41 | 9 (22.0%) | 19.98 | 3.53 | 2 | | 1 | 2 | | | | F |
| 96 | EC13 | SNS | wetland | 4.61 | 11.39 | 162 | 29 (16.7%) | 50.73 | 4.40 | 4 | | 58 | 89 | 6 | 11 | | E |
| 97 | EC1 | SNS | ESA,ANSI, wetland | 2.63 | 6.50 | 10 | 4 (40.0%) | 4.90 | 2.00 | 1 | | 1 | 13 | | 3 | | P |
| 98 | HO1 | NS | | 1.20 | 2.96 | 20 | 5 (25.0%) | 16.27 | 4.20 | 1 | | | 2 | 1 | | | F |
| 99 | HO2 | NS | | 2.50 | 6.18 | 24 | 3 (12.5%) | 18.77 | 4.10 | 2 | | | 3 | | | | F |
| 100 | HO3 | NS | | 14.41 | 35.59 | 49 | 9 (18.4%) | 25.61 | 4.06 | 3 | | | 11 | 2 | | | F |
| 101 | HO6 | NGS | | 9.57 | 23.64 | | | | | 1 | | | | | | | P |
| 102 | HO7 | NS | | 4.09 | 10.10 | 54 | 10 (16.7%) | 26.53 | 4.00 | 3 | | 4 | | | | | F |
| 103 | HO9 | SNS | see 148 | | | | | | | | | | | | | | |
| 104 | NE4 | NS | | 13.43 | 33.17 | 95 | 22 (23.0%) | 33.04 | 3.79 | 5 | | 8 | 5 | | | | E |
| 105 | NE3 | NGS | | 2.59 | 6.40 | 29 | 11 (34.5%) | | | 2 | | | | | | | P |
| 106 | NE2 | NS | | 1.85 | 4.57 | 55 | 11 (18.2%) | 28.49 | 4.30 | 1 | | 4 | 5 | | | | F |
| 107 | NE1 | NGS | | 0.95 | 2.35 | 54 | 26 (48.1%) | 14.93 | 2.82 | 1 | | | 3 | | | | F |
| 108 | NE6 | NS | | 4.34 | 10.72 | 40 | 10 (25.0%) | 20.27 | 3.70 | 2 | | | | | | | G |
| 109 | NE5 | NGS | | 13.29 | 32.83 | | | | | 1 | | | | | | | P |
| 110 | NE7 | NGS | | 2.76 | 6.82 | | | | | 1 | | | | | | | P |
| 111 | ETO3 | SNS | | 134.93 | 333.28 | 405 | 169 (41.2%) | 57.09 | 3.72 | 4 | 2 | 60 | 7 | 5 | 5 | | F |
| 112 | NE8 | NGS | | 11.05 | 27.29 | | | | | 1 | | | | | | | P |

**Table 4:** continued .....

| Site Number | Site Code | Classification | Designation | Area | | Flora | | | | | | | Fauna | | | | Condition |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | (ha) | (acres) | total | # non-native (proportion) | native FQI | native mean C | # vegetation communities | prov. sig. species | reg. sig. species | # birds | # mammals | # herptiles | prov. sig. species | |
| 113 | NE10 | NGS | | 7.82 | 19.32 | | | | | 1 | | | | | | | P |
| 114 | NE11 | NGS | | 6.07 | 14.99 | | | | | 1 | | | | | | | P |
| 115 | NE12 | NGS | | 6.49 | 16.03 | | | | | 1 | | | | | | | P |
| 116 | ETO2 | SNS | | 13.01 | 32.13 | | | | | 1 | | | | | | | P |
| 117 | ETO1 | SNS | | 10.40 | 25.69 | | | | | 2 | | | | | | | F |
| 118 | NE9 | NS | | 45.21 | 111.67 | 46 | 24 (50.0%) | | | 4 | | 1 | 5 | | | | F |
| 119 | LS1 | SNS | wetland | 28.92 | 71.43 | 63 | 14 (20.6%) | 27.14 | 3.88 | 3 | | 6 | 4 | | | | G-P |
| 120 | LS2 | NS | | 1.26 | 3.11 | 45 | 14 (31.1%) | 22.09 | 3.97 | 1 | | | 2 | | | | F |
| 121 | LS3 | NS | | 3.00 | 7.41 | 66 | 23 (33.3%) | 23.94 | 3.65 | 2 | | 2 | 1 | 1 | 2 | | F |
| 122 | ME10 | SNS | | 4.18 | 10.32 | 55 | 15 (27.3%) | 24.67 | 3.90 | 1 | 1 | 2 | 4 | | | | F |
| 123 | ME12 | NGS | | 2.90 | 7.16 | 49 | 28 (57.1%) | 12.00 | 2.62 | 1 | | | 7 | 2 | 7 | | P |
| 124 | ME11 | NGS | | 4.36 | 10.77 | 41 | 21 (51.2%) | 11.40 | 2.55 | 1 | | | 5 | 2 | 4 | | P |
| 125 | ME9 | NS | | 2.39 | 5.90 | 44 | 11 (25.0%) | 25.59 | 4.45 | 1 | | 2 | 2 | 1 | | | F |
| 127 | MB9 | NS | | 6.60 | 16.30 | | | | | 1 | | 2 | | | | | P |
| 128 | MB7 | NGS | | 10.45 | 25.81 | | | | | 1 | | | | | | | P |
| 129/126 | MB8/ME8 | SNS | | 15.98 | 39.47 | 87 | 13 (26.4%) | 30.25 | 3.78 | 2 | 1 | 4 | 3 | 3 | 4 | | F |
| 130 | MB3 | NGS | | 7.11 | 17.56 | | | | | 1 | | | | | | | P |
| 131 | MB5 | NS | | 0.90 | 2.22 | 41 | 4 (9.8%) | 23.67 | 3.89 | 1 | | | | | | | P |
| 132 | MB4 | NS | | 1.93 | 4.77 | 40 | 11 (27.5%) | 19.31 | 3.59 | 1 | | | | | | | P |
| 133 | MB6 | SNS | | 23.70 | 58.54 | 84 | 15 (16.7%) | 30.70 | 3.70 | 2 | | 6 | 1 | 1 | 2 | | G |
| 134 | MB2 | NS | | 1.34 | 3.31 | 41 | 6 (14.6%) | 23.66 | 4.00 | 1 | | 1 | 1 | | | | P |
| 135 | MB1 | NS | | 0.94 | 2.32 | 34 | 6 (17.6%) | 22.87 | 4.32 | 1 | | | | | | | F |
| 136 | MV19 | SNS | | 26.30 | 64.96 | 196 | 50 (25.0%) | 50.48 | 4.18 | 3 | | 31 | 13 | 6 | 3 | | E |
| 137 | CRR1 | SNS | ESA,ANSI | 71.40 | 176.36 | 41 | 12 (26.8%) | | | 5 | 1 | 2 | 2 | 2 | 1 | | F |
| 138 | MV18 | NS | | 3.14 | 7.76 | 19 | 1 (5.3%) | | | 2 | | 1 | 2 | | | | F |
| 139 | MV2 | SNS | ESA,ANSI | 80.18 | 198.04 | 200 | 60 (29.5%) | 46.99 | 3.97 | 4 | 1 | 20 | 58 | 10 | 2 | | G-F |
| 140 | MV3 | NS | | 2.67 | 6.59 | 47 | 13 (27.7%) | 21.61 | 3.71 | 1 | | | | | | | F |
| 141 | MV12 | SNS | | 13.28 | 32.80 | 103 | 32 (30.1%) | 33.94 | 4.03 | 3 | | 6 | 5 | 3 | | | F |
| 142 | MV14 | NGS | | 4.55 | 11.24 | | | | | 1 | | | | | | | P |
| 143 | MV11 | NS | | 2.90 | 7.16 | 24 | 4 (16.7%) | 17.44 | 3.90 | 1 | | | 1 | | | | F |
| 144 | MV15 | NS | | 10.70 | 26.43 | 53 | 25 (45.3%) | 14.74 | 2.79 | 2 | | 1 | 7 | 1 | | | P |
| 145 | GT1 | NS | | 5.77 | 14.25 | 33 | 8 (24.2%) | 17.00 | 3.40 | 1 | | | | | | | F |
| 146 | GT2 | NS | | 7.20 | 17.78 | 41 | 6 (7.0%) | 22.12 | 3.79 | 3 | | 3 | 2 | 1 | | | G |
| 147 | GT3 | NS | | 2.67 | 6.59 | 43 | 12 (25.6%) | 19.04 | 3.42 | 2 | | 1 | 1 | | | | F |
| 148/103 | GT4/HO9 | SNS | ESA,ANSI | 27.06 | 66.84 | 201 | 55 (26.4%) | 50.40 | 4.17 | 2 | | 22 | 9 | 1 | | 1 | E-P |
| 149 | MA1 | NGS | | 25.79 | 63.70 | | | | | 1 | | | | | | | P |

These are sites that were not included in the Natural Areas Survey, but have some natural attributes which are of interest to the City. They are not discussed in this report. The map also shows the location of shoreline reaches that correspond to the shoreline description given in section 4.1.4.

Information on the proposed natural areas can be accessed in two ways. If the location of the area is known, it can be identified on Figure 2 and then looked up in Table 4. If the proposed natural area has a commonly known name (*e.g.*, Cawthra Woods, Rattray Marsh, Tecumseh Park, *etc.*), it is provided in the legend for Figure 2. Alternatively, if the proposed natural areas of a particular Planning District are required, they can be determined from the legend to Figure 2, which is organized by Planning District.

A total of 141 proposed natural areas were identified in this study. Table 5 shows the number of proposed natural areas in each of the three classes (Significant Natural Site, Natural Site, and Natural Green Space), as well as the total area of each class, and the proportion of each class in relation to the total area in the natural area system and in relation to the entire City. It is significant that only 7.10% of the entire City is proposed as natural area. In addition to these natural areas, there are 55 Special Management Areas, 3 Residential Woodlands and 40 Linkages proposed. Residential Woodland areas total 252 ha (a.).

**Table 5: Summary of Natural Area Classes for the City of Mississauga**

| Classification | Number of Sites | Total Area (ha) | Total Area (acres) | Proportion of Natural Areas System | Proportion of the City |
|---|---|---|---|---|---|
| Significant Natural Site (SNS) | 51 | 1530.17 | 3779.52 | 74% | 5.23% |
| Natural Site (NS) | 59 | 349.92 | 864.30 | 17% | 1.2% |
| Natural Green Space (GS) | 31 | 197.05 | 486.71 | 9% | 0.67% |
| TOTAL | 141 | 2077.14 | 5130.53 | 100% | 7.10% |

The proposed natural areas are not evenly distributed in the City. Table 6 shows the number and area of natural areas associated with the three major landform types in the City. Most of the natural areas (73 areas or 70% of the natural areas system) are associated with valley systems. Although there are a similar number of areas located on the tablelands (60), they are small in size when compared with the valley land areas (mean size 5.5 ha (13.6 a.) compared to 22 ha (54.3 a.) for valley land features). In addition, tableland natural areas (which are mainly wooded) tend to be discrete and no longer connected to other remnant natural features (see Figure 2). Valley lands are better connected by virtue of the linearity of the landform which historically has been better protected from development. From a City-wide perspective, only 1.1% of the landbase is represented in tableland natural areas. The relatively small size and fragmented nature of the tableland areas highlights the need to place a high priority on protecting those which remain.

**Table 6: Summary of Natural Areas by Major Landform Type**

| Landform Type | No. of Sites | Size (ha) | Size (acres) | Mean Size (ha) | Mean Size (acres) | Proportion of Natural Area System | Proportion of entire City |
|---|---|---|---|---|---|---|---|
| valley lands and associated tablelands | 73 | 1626.3 | 4016.96 | 22.28 | 55.03 | 78.3% | 5.6% |
| tableland | 60 | 339.89 | 839.53 | 5.66 | 13.98 | 16.4% | 1.16% |
| wetlands and associated valley land | 6 | 103.69 | 256.11 | 17.28 | 256.11 | 5.0% | 0.36% |
| Total | 139* | 2069.88* | 5112.6* | - | - | 99.7%* | 7.1% |

* Note: two small areas did not readily fall into these three categories and were omitted from this analysis so figures differ slightly from those provided elsewhere in the report.

As can be seen from Table 4, the proposed natural areas vary greatly with respect to their diversity. In many cases, this may be attributed to differences in the amount of field investigation that has been conducted in them. The vegetation types were determined using a consistent method as part of this report and from this perspective, sites can be fairly compared. However, while sites such as Rattray Marsh and Creditview wetland have many species reported from them, which probably represents their true species richness, others such as NE6 and ME10, have not been adequately studied and the species richness reported here should be regarded as a preliminary list, useful mainly for characterizing the area. As stated earlier, the Floristic Quality Index and mean coefficient are quite robust, even when based on preliminary surveys, thus they generally allow a good comparison of the quality of different areas.

Connectivity with natural areas outside of the City is exclusively along valley lands. The only connections to the west with Halton Region are via the Joshua Creek valley, Clearview Creek valley and Sixteen Mile Creek valley. Joshua Creek and Sixteen Mile Creek connect with recognized Environmentally Sensitive Areas identified in Halton's and the Town of Oakville's Official Plans. To the north, Mullet Creek, Credit River, Levi's Creek, Fletcher's Creek, Etobicoke Creek (east and west branches) and Mimico Creek provide connections to the City of Brampton. Only two of these, Credit River and Etobicoke Creek, link up with recognized environmental areas (Huttonville Valley ESA and Heart Lake Woodlands respectively). There are also several forests recognized for their natural values located along the Credit River, Etobicoke Creek, Levi's Creek and Fletcher's Creek (AgPlan 1992b) Most of the eastern boundary of Mississauga is located along Etobicoke Creek. There is one small ESA located on the Etobicoke side of the boundary that is within Etobicoke Creek, and the valley itself has environmental constraints associated with it, but is not explicitly recognized in the Etobicoke Official Plan for its natural or ecological values. To some degree, Lake Ontario to the south provides connectivity with areas all around Lake Ontario. However, from an ecological perspective, this is meaningful mainly for aquatic species which can utilize both lacustrine and riverine systems such as salmon and some turtles. Other species such as frogs, aquatic snakes, as well as aquatic vegetation can also disperse among shoreline wetlands and rivers via Lake Ontario, but probably on an infrequent basis.

The natural areas within the City of Mississauga are generally in fair condition. A number of larger sites

throughout the City are still in good condition, with a diverse flora and fauna. A wide range of vegetation communities are represented within the City's natural areas including woodlands, wetlands, and prairie. The most common disturbances observed within natural areas were: the creation of *ad hoc* trails, the use of mountain bikes, garbage, encroachment, and vandalism. The *ad hoc* trails and the mountain bikes both caused soil compaction and trampling of the vegetation. Garbage ranged from household litter (*e.g.*, grass clippings, litter) to large scale dumping (*e.g.*, tires, metal barrels, batteries, electronic appliances, abandoned automobiles). Encroachment occurs where residences abut a natural area and include: manicuring, sheds, cutting trees, and draining swimming pool water. Vandalism included physical damage to vegetation, setting fire to snags, and stripping bark off of trees.

Many natural areas still support diverse assemblages of native plants. Even in those areas which are dominated by non-native weeds, there are usually pockets of native plants. These remnant patches are crucial if restoration of natural areas is ever initiated. Most areas contained some invasive non-native plants, the most common being: garlic mustard (*Alliaria petiolata*), common buckthorn (*Rhamnus cathartica*), purple loosestrife (*Lythrum salicaria*), Manitoba maple (*A. negundo*), Tartarian honeysuckle (*Lonicera tatarica*), multiflora rose (*Rosa multiflora*) and Norway maple (*A. platanoides*).

## 6.4 The Effects of Urbanization on Natural Areas

Development, whether it be agricultural or urban, introduces stresses to remnant natural systems. The impact of the actual displacement of natural landscapes is obvious, but the impacts resulting from the proximity of development are more subtle. The impacts of adjacent development are critical to understand and manage if the remaining natural areas are to be protected over the long term. What is important for management is the recognition that most adverse environmental impacts originate with changes to underlying ecological processes. If environmental conditions change, then so will the species that grow there. The visible problems: non-native species, eroded soils, *etc.*, are in part only indicators of degraded ecosystems. The real impacts are the changes to ecological process.

### Non-native species

One stress is the introduction of a few aggressive agricultural and horticultural plants which are capable of displacing our native trees, shrubs and wildflowers, and reducing biodiversity. These increasingly widespread introduced plants are mainly of European origin and are adapted to the types of disturbances that accompanied European settlement. These disturbances take different forms. Some, like water control structures, stabilize natural environmental fluctuations such as the dampening of water level fluctuations in Lake Ontario which has favoured the establishment of purple loosestrife in shoreline marshes. Others disturbances increase natural environmental fluctuations such as increasing the intensity and frequency of flood events in riparian ecosystems, changing the conditions that the native flood plain species are adapted to, and producing disturbance regimes that favour non-native crack and hybrid willows, Manitoba maple, garlic mustard and Japanese knotweed. The general degradation of woodlands (discussed below) leads to a loss of rich soils which favours the dominance of non-native species such as garlic mustard and European buckthorn. One typical characteristic of sites with introduced plant problems is that favourable conditions tend to be created for relatively few non-native species, which subsequently dominate the vegetation. Thus we see woodlands and floodplains carpeted with Japanese knotweed and garlic mustard, and wetlands with monocultures of purple loosestrife. The key to controlling these aggressive species is the re-establishment of natural conditions, but this must nearly always be supplemented by management aimed specifically at elimination of the weedy species.

### Domestic animals

The introduction of domestic pets, especially cats, from residential developments adjacent to natural areas are a major stress on native wildlife. These pets, do not have to compete for resources with other species (because they have guarantee of safe havens and adequate food supplies) and, combined with the lack of natural predators, enjoy an advantage over native wildlife. They heavily predate ground and low nesting birds, as well as small mammals (mice, shrews, voles), reptiles (mainly snakes) and amphibians (mainly frogs), with significant repercussions on natural populations of animals throughout the food chain.

### Elimination of predators

Elimination of top level predators which previously occurred in southern Ontario (*e.g.*, extirpated mammals such as wolf and fisher), and the fragmentation of the landscape by agriculture and human settlement has also altered the population dynamics of native species. Animals such as squirrels, racoons, red fox, and more recently, opossum and coyote, have benefited greatly by landscape-level changes. The numbers of these "middle level" predators has increased substantially in urban areas owing to their ability to adapt, even thrive, on human presence, and in the absence of their natural predators. Such species are heavy predators of all bird species, especially ground nesting species. Deer, which were far less common in the pre-settlement landscape,

thrive in the mixed agricultural/urban setting, where their numbers have reached levels that result in serious damage to native vegetation through grazing.

**Effects of fragmentation**

Forest fragmentation has resulted in the predominance of animal species that thrive in "edge habitat". The edges of forests have characteristics that are different from the interior and the completely open adjacent habitats. These include differences in light penetration, moisture (soil and air), temperature, precipitation and vegetation structure. Forest birds which nest in the edge zones are more susceptible to nest parasitism from species such as brown-headed cowbirds, and nest predation from domestic pets, bluejays and American crows. The "edge effects" can penetrate 300 m (984 ft) or more from the woodland edge, thus woodlands may need to be over 600 m (1970 ft) wide to provide interior forest conditions. Based on this, an approximate guideline for the size of woodland required to support even a small area with interior conditions is 30 ha (74 a.) [assuming a circular woodland with a radius of 300 m (984 ft)]. Thus throughout southern Ontario, but especially in the more densely populated areas like Mississauga, interior forest species are rare or completely absent owing to the lack of sufficiently large areas to support interior conditions.

**Degradation of woodland habitat**

The proximity of woodlands to urban areas results in heavy human use with direct effects of trampling and mountain biking. These impacts not only cause specific damage to ground vegetation, but also initiate a cascade of effects that may eventually lead to degradation of large areas. Excessive trampling and biking compacts the soil and disrupts the surface duff layer (the uppermost layer of soil and decaying plant material). The compaction and loss of duff reduces the ability of the soil to retain moisture, disrupts the seed bed required for regeneration of some species, and accelerates surface water run-off. All these changes also degrade the soil environment required for persistence of soil fauna and fungi. These are essential components of the decomposition cycle and without them soil formation and nutrient cycles are impaired or lost. These changes affect wildlife as well. The loss of soil fauna removes a major food source for some bird and small mammal species, which in turn results in prey reduction for higher level predators (hawks, owls, fox, weasels, *etc.*). In addition, appropriate habitat for migratory species that forage on the ground is lacking so there is reduced habitat to rest and replenish reserves *en route* to northern nesting grounds. These impacts are self perpetuating: as soil fauna goes, soil is not worked up and aerated so it becomes more compacted, ground cover becomes sparser and surface erosion accelerates thus further degrading habitat for soil fauna, *etc.*

The end result is a woodland floor with a high proportion of compacted, erosion prone, bare earth with exposed root systems and a loss of wildlife habitat. The only plant species which can persist in these conditions are those which evolved to exploit the disturbed conditions of agricultural regimes, primarily European weeds. Further, although the tree canopy may persist for many years, as individual trees die there are no regenerating native trees to replace them and eventually the whole forest system will fail.

**Impacts from buried services and sod lawns**

The water regime in natural areas adjacent to urban development will also change. Services such as sewers and communication lines are buried in granular material a metre or more deep. These subterranean seams of porous material can intercept groundwater and act as tile drains, typically lowering the surrounding watertable. In addition, roads, buildings and the sod-forming grasses which are installed throughout urban areas restrict the infiltration of water into the soil, creating excess run-off. Also, because the shallow root systems of sod-forming grasses do not penetrate the soil, but form a dense, shallow carpet, carbon deposition and the exchange of nutrients with the deeper layers of the soil is reduced. Native grassland systems are generally not sod-

forming and allow water penetration and carbon fixing to occur. These changes in soil moisture restrict the ability of native trees and shrubs to absorb the nutrients and water required for their normal growth. In addition, the excess run-off from urban areas quickly flows to stormwater systems and into the creeks and rivers where natural flooding regimes become altered and siltation is increased.

**Surface drainage systems**

Urban development also tends to eliminate most of the small natural watercourses that collected and conveyed precipitation in small amounts before it discharged into the larger creeks and rivers. Following development only the intermediate and large watercourses remain (*e.g.*, Carolyn Creek, Cooksville Creek, Mary Fix Creek, Etobicoke Creek, *etc.*). Water is quickly piped to these watercourses with the aforementioned impacts. This type of change can be clearly seen in Figure 2 by comparing the undeveloped area in the northwest corner of Eglinton Avenue and Winston Churchill Boulevard (Churchill Meadows) with adjacent areas. This surface drainage pattern, which meters water to Sawmill Creek, is completely absent in built up areas where it is replaced with storm drain systems.

**Summary**

The impacts discussed in this section are not insurmountable. It is unreasonable to try and restore pristine conditions to urban areas, but initiatives can be implemented to maintain, enhance or restore fundamental natural processes. Protection alone is insufficient to accomplish this. In an urban environment, where natural processes are impaired, natural resources will require some management, whether it be controlling human access and activities, removing non-native plants, restoring soil environments. The extent of this management should diminish as natural process is reinstated. Also, there may be places where natural processes may return unaided once the initial impact is removed. The decision on whether, and what kind of management is required needs to be addressed in site specific management plans.

# 7.0 IMPLEMENTATION STRATEGIES AND RECOMMENDATIONS

In order to adequately maintain and improve the environment within the City, there needs to be a significant commitment to providing the resources required for on-going protection and management of remnant natural features. This covers a wide range of needs including policy direction in the City Plan, adequate staff skills, a current and reliable information base, an educated and involved public, as well as the identification and appropriate designation of the features themselves. Commitment to this wide range of needs is especially acute in highly urbanized environments like Mississauga where remnant natural areas outside of valley lands need more adequate protection. In addition, the long term maintenance and improvement of the ecological integrity of remnant areas will also require a commitment to on-going ecological management.

It must be noted that the natural areas identified in the course of this study occur on both public and private lands. While the City has considerable influence over its own lands, protection and management of other public lands and private lands must be done in concert with the respective land owners. Thus the following recommendations cannot be applied consistently to all of the natural areas. Nonetheless, the spirit of the following recommendations should be upheld to the degree possible throughout the City.

There is one fundamental principle that underlies all of the strategies and recommendations discussed in this section: the maintenance of the long term ecological integrity of the remnant natural areas (including Significant Natural Sites, Natural Sites and Natural Green Space) will have primacy over all other considerations, to the extent that is feasible. This means that wherever there is a choice between two or more activities, proposed developments, management options or other course of action; the one which best maintains the ecological integrity of the natural area in question should be given preference. This may not be possible in all situations. Essential public works, developments or other actions which clearly provide a better and higher use of the land for the greater public good should prevail. However, with only 7.0% of Mississauga's land base identified as natural area, much of which is in need of management and/or restoration, the rationale for any course of action that would further diminish the natural areas of the City must be sound.

## 7.1 Stewardship

A key to successful implementation of a natural areas programme will be the active involvement of the public. Several municipalities have shown that community groups can be used to undertake a large proportion of the tasks required for natural area protection including: inventory, policing, resource management (weed and exotic plant removal, litter pickup, restoration, planting, *etc.*), and monitoring. This constitutes a large volume of work which probably could not otherwise be accomplished with the existing resources within the City. Involvement of the community will increase community pride, and the investment of time and personal commitment will result in support for allocation of resources for natural area acquisition and protection from development. The involvement of the community also restores a connection between people and the landscape in which they reside, adding to community identity and respect for the natural systems which ultimately sustain us.

The stewardship programme proposed here has two principal components. One component addresses the need for a landowner contact programme to initiate and establish an on-going partnership with private owners of natural areas. The second component involves the development and initiation of a City-wide network of volunteers to assist with the protection and management of natural areas, primarily on public land. However, it should be noted that with the cooperation of private landowners, management by volunteer stewards could also occur on private lands under the guidance of the City and the private landowner. It should be noted that the

Conservation Authorities have considerable experience in coordinating volunteer groups and assisting with stewardship initiatives, and City efforts should be co-ordinated with the Conservation Authorities programmes.

### 7.1.1 Landowner Contact Programme

There are a number of system components which partially or wholly consist of private lands. The most obvious of these are the three areas classified as Residential Woodland. The ability of the City to protect and guide the stewardship of these lands is limited. In areas where development is not limited by policy and associated policies the City must endeavour to establish working relationships with landowners in order to encourage them to manage their lands in a manner which respects valued natural features. There have been a number of landowner contact programmes initiated in Ontario in the last few years, the administrators of which should be contacted for advice. A few examples are: 1) the Wetland Habitat Agreement Landowner Contact Programme, contact: Larry O'Grady, Cambridge MNR office; 2) Carolinian Canada Landowner Contact Programme, contact Stu Hilts or Peter Mitchell, University of Guelph (519 824-4120) and 3) Landowner Notification for the Niagara Escarpment Ecological Survey, contact: Bruce King, southern region MNR office, Aurora. The following recommendations are provided with respect to landowner contact.

- Identify a staff member with the specific mandate to establish and initiate a landowner contact programme.
- Contact administrators of existing landowner contact programmes for advice.
- Establish goals and objectives for the landowner contact programme.
- Identify the landowners, including names, addresses and phone numbers, of all the identified natural areas.
- Prepare information packages, including the goals and objectives of the landowner contact programme, descriptions of the natural area, management concerns, and offer suggestions as to how the City could assist landowners in beneficial management of their land.
- Seek to conduct informal face-to-face meetings with landowners, preferably at the natural area site to discuss possible cooperation.
- Maintain flexibility with respect to management options to provide the opportunity for trust building and gaining a mutual understanding of intent.

### 7.1.2 Stewardship Programme

To be genuinely community based, leadership and responsibility needs to include local individuals and groups. A structure needs to be developed and refined that allows for local participation and input to decision-making within a framework that provides for consistency across the City and adherence to the goals and objectives of the natural areas programme. The experience of at least some other municipalities is that the development of volunteer-based programmes has been spontaneous and, to a large extent, been a grassroots movement. Thus a framework has to be developed that will accommodate the ability to respond to unexpected requests from volunteer groups, but structured enough that management needs are identified, priorities are recognized and direction can be given when opportunities do arise. In addition, the development of an organized, volunteer-based stewardship programme will not develop overnight. It will likely be an adaptive, iterative process in

which the City and volunteer groups work out each others needs and establish their respective responsibilities.

For instance, a volunteer group may recognize the need to undertake planting in a local natural area where overuse has resulted in large areas of bare soil. They should be able to come to the City and identify the problem and their desire to correct it. The City should be able to respond with advice on preparation of the soil, planting materials and some organizational help to implement work days and undertake follow-up maintenance during the establishment phase. In some cases the group may have specific ideas on what they want planted and the City must be able to review their proposal with regard for the goals and objectives of the natural area programme, or if available, a specific Conservation Plan for the area in question (see section 7.4.1), and respond with refinements and suggestions. In some cases the City may have to undertake some public education to convey why certain proposals are unacceptable (for instance if they include non-native plant species). In other cases, if the group is very knowledgeable, the City may take guidance from the proposal.

There are already volunteer projects that are being undertaken in the City (*e.g.*, planting along the Credit River and activities at Rattray Marsh). Some other volunteer initiatives have been reactionary in response to unwanted proposals (*e.g.*, development of Creditview Wetland, forest management in Cawthra Woods). These illustrate the desire of residents to be part of the decision-making process and involved in natural area management. What is needed is a structure that will direct energy toward common goals in a positive manner. A stewardship programme can form the framework that will involve volunteers and provide direction.

In municipalities where there are volunteer programmes, staff generally indicate that they are accomplishing far more natural area management with the assistance of volunteer groups. At a recent planting event organized by the Little River Enhancement Group in the City of Windsor, who work in cooperation with City staff on management and restoration in the Little River watershed, a relatively small work group fortuitously brought extra tools to a weekend restoration project which was adjacent to a trail. Regular trail users inquired about the activity and were invited to pick up a shovel and contribute. Twenty new individuals were recruited by the end of the day, all of whom now have personal time and energy invested in a public resource. This will significantly contribute to the future care and maintenance of the area through which the trail runs. In addition it promotes cooperation between the municipality and its constituents. Since neither party can effectively achieve long term protection and management of natural resources alone, the development of a positive relationship between municipal staff and volunteer groups is essential for the mandates of both groups. The relationship should be one of the municipality showing leadership and the community the responsibility for stewardship of its natural resources.

Ideally, in the long term, effort should be directed toward a model in which there are volunteer experts throughout the City who can take on some of the responsibility of management within a City-wide natural areas programme. This framework could take the form of a hierarchy composed of an advisory group, a level of "chief stewards" that work within each of the planning districts, and a corps of volunteers that are prepared to actively participate in the management of natural areas. There are many experts resident in the City who can assist in the protection and management of natural areas, but the City must provide an effective mechanism within which they can work. The development of such a well structured framework will take many years to develop. A similar model exists in the Chicago region. There, in 1983, the Illinois Chapter of the Nature Conservancy organized a Volunteer Stewardship Network. By 1991, there were "*... 171 volunteer stewards working at 172 preserves* [comparable to the 141 natural areas identified in this study], *organized into 22 geographic regions* [analogous to Mississauga's planning districts] *and coordinated by 72 volunteer regional leaders. Nearly 5,000 volunteers work at these preserves under direction from stewards, who act in cooperation with the public agencies which own the land*." (Loeser-Small 1992).

In Chicago, there had been volunteer initiatives similar to those now taking place in Mississauga many years prior to the initiation of the Volunteer Stewardship Network. The Network, however, organized and directed the efforts of the volunteers and provided knowledgeable leadership through qualified (but still volunteer) stewards (see Appendix 15 for a description of the model and responsibilities of stewards in the Volunteer Stewardship Network). A similar structure must eventually be developed in Mississauga if the approximately 140 natural areas are to be protected, restored and managed into the future.

The following recommendations are provided to initiate the development of a stewardship programme in Mississauga:

- Develop an administrative framework which can support a volunteer stewardship programme. This will require at least one staff contact person dedicated to this task as well as support staff and a budget. The City contact person should be highly accessible to the stewards.

- Seek to identify candidate stewards within the City. Stewards should:

  i) be members of the local community;

  ii) preferably have knowledge of the sites within their respective areas;

  iii) wherever possible, be recommended by existing local community groups (*e.g.*, the friends of ..., ratepayers groups, *etc.*); and

  iv) preferably have knowledge of natural areas management, gained either through formal education, experience or both.

- Recognize the knowledge and experience of existing community groups who are focused already on environmental issues and pursue mutually agreeable means of including them in the stewardship structure by providing logistical support and possibly follow-up maintenance.

- Pursue partnerships, and seek advice and assistance with other resource management agencies such as the CVC, MTRCA, HRCA and MNR in the development of a stewardship programme.

- Organize workshops, workdays, field trips, education sessions to involve the public and through these sessions seek to identify volunteers to provide on-going assistance with management tasks. Such sessions may be organized with the assistance or participation of existing organizations that represent the conservation community such as the Society for Ecological Restoration (Ontario Chapter), Federation of Ontario Naturalists and the Canadian Wildflower Society. Work days should be organized around the City to draw out volunteers and act as "seed events" for groups that can eventually grow and take responsibility for natural areas in their local communities.

- Appoint a Natural Areas Advisory Committee to provide volunteer advice to staff on the status and management needs of local natural areas. The existing Urban Forest Management Advisory Committee may be able to assume this role with a change in their mandate. The committee should:

  i) have wide geographical representation from the City;

  ii) include one council member to assist the committee;

iii) include one member of the Planning and Building or Community Services Departments to act as a liaison and resource person and to assist the committee in performing, and focusing on their mandate;

iv) report to council (or an appropriate subcommittee of council) through the Planning and Building or Community Services Departments; and

v) have an explicit mandate to assist the City in the achievement of the goals and objectives of the natural areas programme

### 7.1.3 Education/Training of Stewards

The City needs to address the training of stewards to ensure they are knowledgeable of up-to-date concepts and techniques for natural areas management and restoration. To this end, the following recommendations are provided.

- Investigate the feasibility of establishing training programmes at local community colleges and/or universities aimed at providing 1) the necessary academic understanding to undertake the management of natural resources, and 2) hands-on techniques and methods for natural area management. The City should consider subsidizing the cost of such courses for members in a City stewardship network. The training programmes should be structured to:

  i) provide several levels of certification that represent standards of proficiency in natural area stewardship and which correspond to the knowledge and understanding required for the various levels of responsibility within a stewardship network;

  ii) include "entry level" instruction for laypeople with no previous knowledge of natural systems; and

  iii) include an overview course(s) for planners, developers and others who work within the community that will provide an understanding of the rationale behind protection and management measures for natural areas.

- Develop a Steward's Handbook to guide stewards in their tasks. This could be modelled after the *Steward's Handbook* developed by The Nature Conservancy for the Volunteer Stewardship Network (Loeser-Small 1992).

## 7.2 Public Education

Natural areas are not always recognized for their ecological value. They are often perceived as parkland or in some cases as abandoned property awaiting some form of redevelopment. Unless fenced and/or posted as private property, there is a perception that these areas are open for free, unrestricted use. While outright acts of vandalism, dumping of garbage and "camp" fires are viewed as harmful activities, other actions are misunderstood as beneficial or to have no serious impact on natural areas. Examples of such activities include unauthorized trail development, dumping of lawn and garden wastes, removal of native trees and wildflowers, planting of non-native ornamental trees, shrubs and ground covers to "enhance" natural areas, or the removal of dead wood to "clean up" natural areas.

The impact of such activities is not immediate. The loss of indigenous forest or wetland species may take many years. This process may go unnoticed given that many indigenous plants do not have showy, ornamental features and that non-native exotic species quickly fill in the gaps. The environment for the most part remains green; the plants themselves appearing healthy. Except in the case of severely degraded ecosystems, the very basic form of forest, wetland or meadow remains intact. Most people do not commonly recognize changes in flora and fauna species type and diversity, soil composition and water quality. However, changes may severely impair the ecological functions which are required for healthy natural areas.

The strategy for public education should be to establish a comprehensive program that increases awareness of natural areas, provides information about natural systems, flora, fauna and processes, enlightens users to sensitivities of and appropriate activities in natural areas, advises and informs of management, restoration and stewardship initiatives and practices, and provides information regarding the support network for Mississauga's natural areas system (City staff, volunteer organizations, stewardship program). The public education program should provide information for both the overall natural areas system and specific sites. Public education is a critical component of any urban natural areas programme. In New York City, a $1.5 million, five year programme was initiated just to undertake community outreach and public education as part of the restoration programme in a major (250 acre) urban park (Prospect Park). The Director of Landscape Management for Prospect Park, Ed Toth, noted, "*As much effort is going into public education and community outreach as into the management plan itself*." Given that people are the primary source of impacts, this allocation of resources is often justified. Similarly, Tony Emmerich, from New York's Urban Forest and Education Program observed, "*Out of a five year natural areas restoration budget of $6.4 million, we spend $1.4 million on public education*."

### 7.2.1 Identity

One mechanism to help protect natural areas is to identify them as unique and separate from other parks and open spaces. Native forest, wetland and grassland ecosystems each possess a set of ecological characteristics specifically defined by the interconnected network of flora, fauna, soils, hydrology, hydrogeology, topography and climate. Each individual natural area is unique, each has its own sense of place. It is this unique signature which provides users and area residents a feeling of relation and identification with a particular natural area. The following is recommended:

- develop a City-wide graphic map locating all natural areas by classification for public availability;

- develop descriptive, colour brochures for specific sites that can be used for demonstrating the ecological characteristics of natural areas. Information on the site's historic landscape character, cultural past, health and restoration initiatives, and opportunities for public involvement may be included. Telling the story of a specific site can effectively generate community interest and support; and

- provide opportunities for local neighbourhoods, schools and/or community groups to name each natural area. If a natural area occurs within a named park, it should be provided with its own name. As an example, the forest in Martin L. Dobkin Memorial Park could be named the Martin L. Dobkin Memorial Natural Site.

### 7.2.2 General Information

The public education programme can employ a variety of media techniques. The following is recommended for dissemination of general information.

- A series of pamphlets, brochures, maps and guidebooks could be developed and made available to residents of Mississauga. The series should be designed using a family of colours, graphic styles, format and typefaces to be recognizable as part of the natural areas education programme.

- Develop a natural areas newsletter or provide regular notices on the Community Page of local newspapers to advertise volunteer opportunities, stewardship programs, general information.

- Encourage, support (sponsor) or provide interpretive programs (walking tours, school trips, seminars at professional conferences, talks at interest group meetings) focused on Mississauga's natural areas or natural area programs.

- Restoration and maintenance projects, Conservation Plans and new acquisitions should all be subject to public notice and comment. Such initiatives should include public meetings or open houses. The public can be involved in all aspects of natural area management including identifying problems, prioritizing tasks and projects, and implementing Conservation Plans.

- When creating a natural area, whether through acquisition or identification by name, hold a "grand opening" or similar event for the local community. This may be of most value in recognizing the result of volunteer efforts following significant restoration projects.

- Develop co-operative education programs with local school boards to educate students at all grade levels about natural areas.

- Develop a library of relevant articles, books and periodicals for use by City staff and the public.

### 7.2.3 Signage

A comprehensive signage system is required for each natural area. Signs are the most literal means of identifying natural areas and outlining information as to their value, use and history. Signage for all natural areas needs to be standardized in form and design to reinforce natural area identity as unique from other parks and open space. The following is recommended for signage.

- Interpretive signage includes educational information regarding natural features, sensitivities, ecological function, plant communities, habitats, natural history and restoration programs. These also include name signs for each natural area. These signs should be located at entrances and along property boundaries, adjacent sidewalks and roadways.

- Directional signage includes trail markings, orientation to adjacent streets, landmarks and/or facilities. These should be located along trails. Maps of trail systems may be useful, especially for larger areas.

- Regulation signage includes by-laws, rules of etiquette for users, permitted uses, hours of operation. These signs should be located at entrances and possibly along trails at key nodes where direction and notification is required. Trail closures, soil enhancements, planting projects or slope stabilization requiring temporary fencing should be signed explaining what is being done.

- The size, materials and choice of colours for signage should be sympathetic to a natural environment setting while being easy to see and understand.

- The design and specific location of signs must be approved by the City of Mississauga in the event that community groups coordinate management of an area or signage as part of a development agreement.

### 7.3 Access

Some natural areas are currently designated as components of Mississauga's parks and open space system. Whether woodland or sports field, all parks and open spaces are perceived as public land available for unlimited human use. Sports fields and active recreation areas are designed for free access and heavy usage. However, natural areas quickly show signs of stress when exposed to such use. Trampling of ground flora, compaction of root zones, erosion of soils and disturbance of wildlife are consequences of uncontrolled access.

There is a specific set of criteria used to design urban parks and sports fields. For example, the choice and layout of plant material is such that large numbers of users have easy and clear access into and throughout parks. Parks are defined by their function. The function of a park focuses on the provision of opportunities for human activity whether recreational, educational, aesthetic or cultural. The physical form of parks may vary but their common purpose is for human use. Natural areas can, in most cases, also provide important human use functions. The physical and psychological benefits from contact with nature, and respite from the city, has been a long standing rationale for the preservation of natural areas in the city. Nature provides a contrast and change from the urban built environment. It is this very dichotomy of form and function that threatens natural areas. Human use and access within natural areas must be consistent with the preservation of natural values, or use will destroy the very features that make natural areas attractive. Thus access must respond to the capacity for each area to sustain use. This may result in parts or entire areas being temporarily or even permanently restricted from use by the general public.

Methods to control and influence human access into, movement through, and use within natural areas should be implemented. Methods include designating points of entry, implementing well-marked trail systems and limiting access where required. In addition, access may be controlled by ensuring that land uses adjacent to natural areas are appropriate, as discussed in section 7.7.

#### 7.3.1 Trails

The implementation of well-marked, authorized trails decreases the risk of damage or disturbance while facilitating human interaction with the natural environment. Trail planning, design and construction are dependent on natural area sensitivity. Also, without a well marked formal trail system, it is impossible to impose and enforce regulations that restrict free access throughout a particular site. The following is recommended for trails.

- Review, and update as required, the 1991 Bicycle and Pedestrian Route Study to incorporate design guidelines and specifications for trails in public natural areas. Consideration should be given to the following.

    i) Trail width to be appropriate to anticipated volume of pedestrian traffic.

    ii) Assess the appropriateness of bicycle traffic in natural areas, recognizing that mountain bike use is a primary cause of impacts in wooded natural areas in the City.

    iii) Trail materials to be appropriate to the site's ecological sensitivity, topography and hydrology.

    iv) Trails that are marked with well-defined edges to discourage trail widenings and the creation of unauthorized trails. Trail markers should be of an appropriate height, dimension and spacing to easily identify the trail's location and direction in all seasons.

v) The ease and efficiency of maintenance.

vi) Special construction (drainage structures, boardwalks).

- Restrict access through all natural areas to authorized trails.

- Address trail design as a component of area Conservation Plans for each public natural area (see section 7.4.1 for Conservation Plan discussion). Trail design studies should consider site analysis issues such as the following.

  i) Areas of special ecological sensitivity, (steep slopes, areas prone to erosion, locations of rare plants, etc.) should be identified and avoided.

  ii) Trail system layout should provide for the exploration and appreciation of the natural environment without compromising natural forms or functions. The trail system should be designed to give the impression that all parts of a given natural area have been explored by the trail system. An interesting trail system providing choice and challenge will fulfil user needs. There will appear to be no places of mystery or areas left unexplored. This will remove some of the incentive for off-trail use. The size, shape and sensitivity of each natural area will directly affect the degree to which this can be accomplished.

  iii) Trail system layout should consider public safety issues of open site lines, clarity of access, path delineations, and barrier free access. The degree to which any or all of these considerations are implemented is dependant on each individual site. If such considerations significantly impact the form or function of the natural area, means of limiting access into the natural area may need to be employed (see below).

  iv) Trail systems should be designed to minimize intrusive elements, thus where larger areas may warrant washroom facilities, drinking fountains, etc., they should be located at the entrance points, outside of the natural area itself. Where natural areas are adjacent to parks, such facilities should be located in the park space.

  v) Lighting should not be installed in natural areas, if areas are not considered safe for night access they should be restricted in their hours of operation.

  vi) An assessment of existing trails needs to be conducted. In some instances, existing foot paths may be assessed as appropriate locations for authorized trails. Established by regular users, these trails often follow natural paths of movement and are familiar. Where a number of unauthorized trails all lead to the same destination, determine which one(s) shall be delineated and improved, and progressively close the others.

  vii) An assessment of adjacent land uses and trail systems needs to be conducted. The type of adjacent land use and layout of trails, sidewalks and roadways (existing or proposed) have potential impacts on natural areas. The site planning of each natural area within its contextual precinct should be examined as part of the trail design. This may also influence Conservation Plans. Specifically this involves a study of human movement patterns. For example, the woodland in Dr. Martin L. Dobkin Memorial Park is surrounded by a large residential area and a school. The pedestrian flow linking

the two land uses runs through the woodland. To alleviate the stress on the woodland, the primary pedestrian trail may more appropriately be re-routed around the woodland. With carefully located barrier fencing and plantings, a secondary looped trail system would enable access into the woodland without creating a thoroughfare.

### 7.3.2 Points of Entry

Coincident with trail design is the designation of well-marked access points into public natural areas. The natural area is given identity, significance and distinctness when marked by physical entrances. The following recommendations address points of entry.

- Entrances to natural areas may be marked by "gateways" to signify the point where a path crosses the boundary between natural areas and adjacent land uses. The physical form may be structure, planting or simply signage. It must signify the end of one kind of land use or activity and the beginning of another.

- The gateway functions as a visual target, leading users to designated trails. When clearly marked, there should be no confusion as to where to access the natural area.

- Entry points may be further enhanced by including signage, garbage receptacles, drinking fountains; amenities which are not generally appropriate within the natural area itself.

### 7.3.3 Limiting Access

The most direct means to controlling access is through the introduction of physical barriers. The Community Services Department has recently undertaken an analysis of the need for fencing certain types of parks to restrict access. The resulting policies on fencing should be considered for application to all natural areas.

- Fencing natural area boundaries may be necessary to stop existing unauthorized access or prevent an anticipated problem. The requirement, extent and choice of materials will be in response to adjacent land use and outlined in specific Conservation Plans. Consideration should be given to the particular message a specific type of barrier conveys. A page wire farm fence, a four foot high black vinyl chain link fence, a six foot high standard chain link fence, bollards placed six feet on centre each convey a different message regarding access and each may be appropriate in different situations.

- The City of Mississauga should allow for the ability to:

  i) temporarily prohibit access into part or all of a natural area until a site specific Conservation Plan is prepared outlining carrying capacity;

  ii) limit access by setting restricted hours of operation;

  iii) prohibit access permanently if deemed necessary; and

  iv) restrict bicycle and equestrian access.

## 7.4 Resource Management

There are many people who perceive management as unnecessary intervention that detracts from the naturalness of an area. The associated strategy is generally a "hands-off" approach where the vegetation is left to run its own course. There are several difficulties with this approach.

First, the vegetation of this part of Ontario has always been subject to human management. Following the withdrawal of the last glaciation, native people moved into southern Ontario and managed the land for their own survival. They cut wood for shelter, warmth and cooking, cleared and burned land to enhance game production and improve visibility, and encouraged the growth of food-producing trees, shrubs and herbs. The vegetation of this part of Ontario has always been managed by humans and has developed, even evolved, in response to management.

Secondly, the recent activities of humans following European settlement has produced a suite of environmental conditions that the native vegetation is not adapted to. We have introduced aggressive plants from other continents, altered hydrologic regimes, lowered watertables, drained wetlands, introduced excessive nutrients to the soil and water, sprayed herbicides onto the land, suppressed natural fire and introduced a host of other activities.

Plants are adapted to certain environmental conditions. The native vegetation of Mississauga persisted in response to a certain set of conditions, some of which resulted from native land management practices. Since those conditions have changed, it is unreasonable to expect the same native vegetation to persist unaided.

The role of vegetation management (given the intent to produce "natural vegetation") is to reintroduce, to the extent possible, the suite of conditions that supported the native vegetation communities. Without reintroducing those conditions, the native vegetation can not be sustained, thus the need for management. However, this does not justify a license for unbridled management and human intervention. Management should be implemented only where necessary and justified, and should be minimized to the extent possible.

### 7.4.1 Conservation Plans

In order to protect and maintain Mississauga's natural areas in the long term, there is a need for Conservation Plans that are site specific. These plans should incorporate the recommendations provided in this study (e.g, removal of aggressive non-native plants, replanting denuded areas, mitigating erosion problems, *etc.*). They should be written with the notion of implementation by volunteers and should thus be non-technical in nature. They need not be comprehensive with respect to articulating all there is to know about each site. They should be brief (10-15 pages) and focus on the problems at each site and the management actions that are required, including follow-up monitoring. The following recommendations address the development of these Conservation Plans.

- Develop Conservation Plans to guide the management of each natural area in the City. Clearly, owing to the large number of natural areas in the City, sites need to be prioritized for such studies. Eventually, the responsibility for these plans should be assumed by stewards. Plans should include:

  i) specific objectives for site management;

  ii) a summary of the site gleaned from the Natural Areas Survey data base;
  iii) a sketch map of the site to identify the location of significant features and areas of management

concern, this map can be produced from the digitized map files provided with this project;

iv) specific impacts which are degrading the natural features of the site;

v) significant features of the site which need to be safeguarded;

vi) a list of specific actions needed to protect and enhance the site in the long term;

vii) expertise needed to undertake management (*i.e.* volunteers, specialists, consultants, *etc.*);

viii) depending on the level of degradation, identify the need for specialized studies (*e.g.*, rare plant recovery plans, fire history study);

ix) undertake an analysis of appropriate trails, as discussed in section 7.3;

x) where appropriate, guidelines for edge management as discussed in section 7.7.2;

xi) plans must respond to schedules and requirements for maintenance currently undertaken by City parks staff (e.g., tree inspection, litter removal, etc.);

xii) a schedule for undertaking management actions; and

xiii) monitoring requirements.

- Conservation Plans should follow a standard format which provides main headings and points to be covered so they are consistent in their style and organization (thus making it easy for managers to find information on any site) and will facilitate their writing following a "cookbook" type of procedure.

- An approval mechanism for site management involving the Advisory Committee and staff should be developed. This mechanism should also include an opportunity for public review and comment.

- The management history of each site should be maintained to keep track of what management was undertaken, by whom, when, and with some evaluation of the results. Basic record keeping in the form of notes and photographs is effective given the typical constraints of time and budget.

- A file should be opened on each natural area in which a complete record of management activities is kept.

### 7.4.2 Non-native Plant Control

The impact of introduced, non-native plants was discussed in section 6.4. The following recommendations address the control of non-native flora.

- Undertake to remove plants that are not native to Mississauga from natural areas, with a priority given to:

  i) species that are invasive and threaten native ecosystems (*e.g.*, common buckthorn, garlic mustard, purple loosestrife, Norway maple, dog strangling vine, *etc.*), and

ii) areas that are highly valued because they contain significant features and/or and are in otherwise good condition.

- Undertake an Exotic Plant Management Plan for the City which will:

  i) identify exotic species present in the City;

  ii) prioritize exotic species for removal programmes based on their ecological threat to native ecosystems (i.e. rate of invasiveness, ability to displace native flora);

  iii) identify the distribution of such species in the City;

  iv) identify the need for control of exotic species through by-laws prohibiting the planting of invasive exotic species;

  v) investigate known methods for the control of species with a high priority for removal; and

  vi) investigate control through restoration of indigenous ecological processes (*e.g.*, flooding, fire, *etc.*) in appropriate places that will provide a competitive edge for native species.

- Eliminate invasive species from City planting programmes (*e.g.*, Norway maple).

### 7.4.3 Forest Management

The following recommendations apply to forest management.

- Ensure that forest management practices are ecologically based and rationalized on the need to mitigate impacts, not to manipulate canopy composition or satisfy aesthetic concerns.

- Integrate forestry management with site Conservation Plans developed to conserve the natural features of City natural areas in accordance with the goal and objectives of the natural areas programme.

- Do not export woody material from natural areas, even if cut for safety reasons. Macro woody debris should be left to decompose on-site

- Standing deadwood and snags should be left in place to provide wildlife habitat, unless they are proximate to trails and pose a safety hazard.

### 7.4.4 Restoration

Restoration explicitly means the management of a site back to a historical condition. Clewell (1994) notes that, *" ... Ecological Restoration is any intervention that guides the return of a converted ecosystem to its presumed or relatively original state."* It is generally accepted in the conservation community that the goal of restoration should be the return to ecological conditions that persisted in presettlement times, this being the most easily recognized point in time where the landscape was not subject to non-indigenous management regimes. However, other goals could be defined with an appropriate rationale. One important component of

restoration is that it involves more than just planting vegetation, it addresses the need to re-establish ecological process. As pointed out in section 6.4, it is the loss of ecological process that constitutes the real impacts to the environment. For this reason, restoration should become the central approach to improving the condition of the City's remnant natural areas, linkages and special management areas. Site restoration should involve the public to the greatest degree possible for reasons discussed under stewardship (section 7.1).

- Produce a generic approach for developing restoration projects in the City (see Appendix 20 for an example);

- Include the need for restoration in the analysis of sites and preparation of site Conservation Plans including:

  i) the establishment of appropriate restoration goals;

  ii) identification of how the public can be actively involved through the stewardship programme;

  iii) identification of communities that need restoring;

  iv) development of a work programme for restoration that places primacy on restoration of process before restoration of structure (planting);

  v) identification of various techniques for restoration at particular sites;

  vi) provision of an approximate timeframe for implementation;

  vii) indication of how the restoration will be monitored and procedures for refining restoration prescriptions as a result of monitoring.

- Develop a formal protocol for planting in natural areas that includes consideration of the following:

  i) only species that are native to the City of Mississauga should be considered for planting;

  ii) preferably, planting stock should be grown from indigenous genetic material to protect the genetic variability inherent in Mississauga's vegetation;

  iii) investigate the feasibility of growing stock in City nurseries or collaborating with local nurseries to ensure a supply of suitable species is available;

  iv) planting plans should be based on plant community structures (composition, distribution and density) that are appropriate to the site being planted (*e.g.*, well drained, mesic upland sites should be planted with maple beech woods as a probable end product, dry well-drained sites may contain oaks and hickory, or be restored to savannah or prairie type habitats);

  v) planting plans should include a strategy for reaching the desired objectives of the natural area being planted. This may include consideration of nurse crops, managed succession and staged planting over long time periods; and

  vi) planting plans should be reviewed and commented on by an environmental advisory committee and

receive final approval from the City.

- Consider giving priority to the restoration of plant communities that are most poorly represented in Mississauga owing to historical impacts (see Table 2 for a summary of remaining plant communities).

### 7.4.5 Wildlife

The quality of wildlife habitat is related to the quality of vegetation and, for many species, the absence of human activities. Given the urban context of the study area, the management of habitat for species intolerant of human activities is not feasible. However, some species, in particular birds and insects, may well benefit from habitat improvement. Fish species can also benefit from directed watercourse management. The creation of an active sport fishery in the Credit River has been an on-going initiative of the MNR and Credit Valley Conservation.

In some cases, consideration may have to be given to the control of nuisance wildlife in natural areas. For instance, new plantings are routinely destroyed by deer browse, and thus deer may need to be controlled at restoration/rehabilitation sites. Domestic pets also constitute a major impact to native fauna. This is addressed in section 7.7.4. Lastly, some non-native species of pets, such as red-eared sliders (the common pet turtle) are frequently released into native habitats with varying impacts on the native fauna. The following recommendations address wildlife concerns.

- Include consideration of wildlife improvement incentives in the development of site specific Conservation Plans (section 7.4.1) and the management of linkages as discussed in section 7.8.

- Consider the need for wildlife control as part of management efforts.

- Discourage the practice of releasing non-native species to the wild through public education programmes.

### 7.4.6 Litter Removal

Litter in natural areas consists of garbage and refuse casually left by users and that which is carried in by wind or watercourse. Other litter problems involve deliberate dumping of debris, construction or organic materials (see section 7.7.3 addressing encroachment). The common practice of dumping yard waste in natural areas, especially by residents living adjacent to them, should be addressed in a the public education programme (see Section 7.7.3 *re:* required signage). The following are recommendations addressing litter control.

- Determine a frequency of regular inspections for each natural area. This should be part of each Conservation Plan and could be undertaken by community groups. Frequency will be dependant on the amount of use.

- Provide signage indicating regulations and fines regarding littering.

- Provide adequate waste receptacles at access points.

- The clean up of casual litter may be undertaken by stewardship initiatives pending time of year related to sensitivity of soils and/or plant communities.

- Larger scale dumping of foreign materials within natural areas requires on-site assessment to determine equipment and labour requirements and appropriate scheduling to remedy the problem.

### 7.4.7 Erosion Control

Erosion occurs as both a natural process and in response to intrusive external stresses. The Credit River valley itself is an erosional feature that developed in response to natural phenomena. The following recommendations set a framework for addressing erosion areas.

- Discriminate between areas that are eroding naturally and those which are a result of human impacts. The former should be left to proceed wherever feasible, but the latter should be investigated and rectified.

- Where erosion problems are widespread, especially if in valley systems, investigation of the cause should include tablelands and stormwater systems as poor planning of either can result in downstream impacts such as erosion.

- Identify areas where erosion has occurred and identify appropriate restoration initiatives within the context of site Conservation Plans.

- In the development of erosion control measures, give primacy to the management of the causes of erosion rather than solely treating the impacted area in isolation. This is particularly relevant where sheet erosion is occurring owing to over use or inappropriate grading on adjacent areas.

- Minimize the use of intrusive materials (concrete rip-rap, gabion baskets, *etc.*) in the control of erosion, give preference to bioengineering solutions that are consistent with the natural values of areas being managed.

### 7.4.8 Prescribed Burning

That the native people of North America burned prairies, savannahs, wetlands and woodlands on an annual basis is undisputed. There are hundreds of early accounts of deliberate burning by native people (see Pyne 1988). In Ontario, native-set fires maintaining prairie/savannah habitats have been documented as far east as Rice Lake (Catling et al. 1992). These fires were not just disturbances that the vegetation recovered from, they were an integral part of the ecology of many plant communities. Native cultures had been managing vegetation with fire for thousands of years and many of the plant communities which the first explorers and settlers saw and described as wilderness, was not only adapted but dependant on human fire management.

There are some plant communities within the City that require burning to be healthy. These include the remnant prairie patches that are scattered in the southwest part of the City. In addition, there are undoubtably several of the drier woodland systems which would have been regularly burned by the native Mississaugians, often on an annual basis. Approximately 350 plant species that occur in the City (32% of the Mississauga flora) are known to occur in fire-adapted communities elsewhere, and are indicated in Appendix 9. Some of these species may require fire to persist indefinitely at a site, others may not require fire, but can persist in fire dependant ecosystems, and may benefit from it.

Burning creates conditions that favour native, fire-adapted plant species and discourages introduced weedy plants that are currently displacing our native flora, and which evolved in a European, agrarian culture where fire was suppressed. Thus reintroduction of ground fires helps control non-native plants and increases biodiversity. It also creates highly aesthetic open-canopied woodlands with lush displays of wildflowers that are appealing to the public. If the goal of natural area preservation is maintenance of native vegetation

communities, then fire must be a part of the management regime.

There has been increasing recognition of the role of fire in vegetation management in southern Ontario. Prescribed burning is a part of vegetation management at Pinery Provincial Park, Turkey Point Provincial Park, and Ojibwa Nature Reserve. The first burn at Point Pelee National Park is scheduled for the fall of 1996 and the Dufferin County forest was burned in 1994. Fire has been recognized as an essential component for restoration of oak woodlands in High Park, Toronto (Varga 1989) and the Regional Municipality of Waterloo conducted a prescribed burn experiment in one of their agreement forests in 1995. Advice and assistance can be sought from these agencies and from the MNR prescribed burn unit (contact provided below). The following recommendations provide guidance for investigating the possible role of fire in Mississauga's natural areas.

- Undertake a feasibility study to determine the suitability of burning and identify sites which are candidates for a fire management programme. This study should include:

  i) examination of areas to see where fire adapted species predominate;

  ii) investigation of fire history through tree core analysis, fire scars, *etc.*;

  iii) consultation with elders of the Mississauga tribe to determine if there is any memory or history that has been passed on about the burning ritual and protocol practised by the natives that resided there;

  iv) Contact and consult parks and agencies that have undertaken or are developing prescribed burn programmes including: the Pinery Provincial Park (Terry Crabe (519) 243-2220), Turkey Point Provincial Park (Mike Postma (519) 426-3239), Ojibwa Nature Reserve (Paul Pratt (519) 966-5852), Point Pelee National Park (Dan Reive (519) 322-2365), City of Toronto Parks and Recreation Department (Murray Boyce (416) 392-0584), Regional Municipality of Waterloo (Chris Gosselin, 519-575-4501) and MNR fire unit (Jack Chapman - Senior Fire Officer (519) 426-7650).

  v) an implementation framework for a prescribed burn programme;

  vi) a mechanism to actively involve the public in the programme; and

  vii) recommendations for a public consultation process.

- If it is determined that prescribed burns should be included in the site Conservation Plans for some natural areas, a substantial public education initiative should be undertaken, as the benefits and role of fire in maintaining natural conditions is not generally recognized by the public.

### 7.4.9 Further Inventory

Several sites have not been completely inventoried for plant species, and very few have been adequately surveyed for animals. An on-going inventory programme should be initiated to complete these gaps following the guidance provided below.

- Establish a protocol for inventorying natural areas. This should include substantial public involvement and will require data screening and data base entry protocol as discussed in section 7.4.11.

- Prioritize the need for inventory updates from the Natural Area Fact Sheets (supplied under separate cover to the City of Mississauga Planning and Building Department) and from the summary in Table 4.
- As inventories become more complete, update site files including recalculation of Floristic Quality Assessments. This information should be made available within the City so decisions regarding planning on adjacent land, acquisition, initiatives in other departments (*e.g.*, Transportation and Works Department, Environmental Engineering), *etc.* can be based on the most current information.

### 7.4.10 Monitoring

Ongoing monitoring is an essential component of any resource management programme. Without monitoring it is not possible to identify areas that are degrading, document problems that require management attention, or evaluate the progress of management initiatives. Monitoring also serves an education function by continually familiarizing resource managers with natural areas and thus increasing their knowledge of them. The following recommendations address monitoring.

- Develop a general monitoring protocol for natural areas that includes:

  i) a standard field sheet for recording information;

  ii) identification of new resource management problems (new trails, dumping, soil erosion, plant mortality, *etc.*);

  iii) changes in the use or development status of adjacent lands;

- Adopt the Floristic Quality Assessment method as a standard tool for measuring the success of management initiatives undertaken to improve ecological integrity and native species diversity (see section 4.1.8 for description of method). This will entail:

  i) setting up transects with fixed monitoring points at regular intervals;

  ii) using a 1 m² quadrat, record all species in the quadrat;

  iii) calculate the Floristic Quality Index (FQI) and mean coefficient for each quadrat;

  iv) compare the quadrat FQIs and mean coefficients to those for the entire area (sites which are degraded and in which high quality flora is infrequent and scattered will have large differences between quadrat values and overall values, as quality vegetation becomes more widespread, the difference between quadrat values and overall values will decrease);

  v) repeating the assessment at regular time intervals (possibly every two to five years) to identify changes.

- Develop monitoring protocols as part of specific management initiatives to enable assessment of success (*e.g.*, projects such as exotic plant removal or erosion management should include a specific monitoring component).

### 7.4.11 Database Management

A comprehensive data base that records the flora and fauna of each natural area is provided with this study. It also provides the source of the data, status of species, location, *etc.* The data base not only provides a record of the composition of each area, but also facilitates the calculation of the Floristic Index used in the evaluation of each area. Recalculation of the Index over time (possibly 10 to 15 year periods) will provide a quantitative measure of management success, thus the maintenance of the data base is important.

A considerable amount of information is collected by laypeople and local experts out of personal interest, university level courses, consulting projects, naturalist projects and other mechanisms. Protocols must be developed for adding such data to the City's data base in such a way that the quality and rigour of the data base is maintained. The following recommendations are provided to promote this.

- Assign a staff person to manage the data base on an on-going basis.

- Develop a protocol to track the history of the data base with respect to the source of information that is added and when it was updated.

- Identify local experts who are willing to volunteer or act on retainer to scrutinize the data collected from a variety of sources and screen it for accuracy and reliability. Use of appropriate nomenclature should also be reviewed. Considerations should include:

    i) the experience and knowledge of the individuals who collected the data (note that with respect to consulting companies, this evaluation should be based on the actual person who collected the data, not the reputation of the firm in general);

    ii) the source of the data (review of historical notes, herbarium or zoological collection, word of mouth or verification of collected specimen or photograph, *etc.*);

    iii) circumstances associated with unusual reports (appropriate habitat, time day, season); and

    iv) locational information that would facilitate verification (at least for plants, which do not move).

- Require, as part of Environmental Impact Studies associated with the development approval process, floral and faunal inventories to be submitted in an electronic data base that can be added to existing area data bases using a "compare and add" procedure, but only following expert scrutiny as noted above.

- Encourage the use of nomenclature used in the data base to minimize problems associated with taxonomic arguments.

- Prepare and make available a standard list of requirements for reporting observations. This should be kept simple to encourage use by naturalists who do not wish to undertake extensive description and fill out lengthy forms. The list should include descriptions of habitat and, most importantly, accurate locational data. Collection of voucher specimens should not be encouraged. Such collections, if justified, should be made by a qualified botanist or ecologist who can evaluate the need for a voucher and the potential impact to a population.

## 7.5 Appropriate Activities

Table 7 identifies activities appropriate for the three natural area classifications and linkages. Residential Woodland and Special Management Areas were omitted from the table. The former is composed almost entirely of privately owned residential properties for which there will never be substantial public ownership, thus the potential activities in the table are either irrelevant (canoeing, sports fields) or are practised legitimately by homeowners (barbequing, exercising pets). Special Management Areas were considered too diverse currently and in the future with respect to natural character and potential uses to be evaluated in the table.

The general approach reflected in Table 7 is to restrict activities which could result in negative impacts to the natural values of each area. In some cases aesthetics were also considered. It was felt that there was ample opportunity for the pursuit of the inappropriate activities in other publicly owned open space in the City. In keeping with the general approach outlined in the introduction to section 7.0, it was felt that maintaining the natural values of the proposed natural areas should take precedence over providing recreational opportunities, thus only activities that were considered totally unintrusive were recommended.

**Table 7: Permitted Activities Within Natural Areas and Linkages in the City of Mississauga**

| Activities | Significant Natural Site | Natural Site | Natural Green Space | Linkages |
|---|---|---|---|---|
| arboretums | N | N | Y | n/a |
| campgrounds | N | N | N | n/a |
| canoeing | Y | Y | Y | Y |
| commercial activity (food vendors, equipment rental, *etc.*) [access will limit vendor to small wheeled vehicles with no perceptible impacts] | Y[1] | Y | Y | Y |
| encroachment by adjacent landowners | N | N | N | N |
| exercising pets (off leash) | N | N | N | N |
| exercising pets (on leash) | Y | Y | Y | Y |
| feeding animals | N | N | N | N |
| campfires, barbeques, *etc.* | N | N | N | N |
| fort/tree house building | N | N | N | N |
| golfcourses | N | N | N | N |
| horseback riding | N | N | N | N |
| in-line skating (roller blading) [this will be limited by surface and can thus be controlled with trail type] | Y | Y | Y | Y |
| nature appreciation | Y | Y | Y | Y |
| off-trail hiking | N | N | N | N |
| on-trail hiking | Y | Y | Y | Y |
| off-trail cycling | N | N | N | N |
| on-trail cycling [if kept on trails would be low impact, but bike access will encourage off trail use and thus is considered incompatible in sign. natural areas] | N | Y | Y | Y |

**Table 7:** continued .....

| Activities | Significant Natural Site | Natural Site | Natural Green Space | Linkages |
|---|---|---|---|---|
| operation of motorized vehicles[4] | N | N | N | N |
| picnicking (except near cultural features, *e.g.*, at Cawthra, Adamson Estates) | N | N | N | Y |
| playgrounds | N | N | N | N |
| removal/damage of vegetation (picking flowers, vandalism, tree cutting)[5] | N | N | N | N[2] |
| downhill skiing/tobogganing | N | N | N | N |
| cross-country skiing (on established walking trails only) | Y | Y | Y | Y |
| sport fields (soccer, baseball, tennis courts, *etc.*) | N | N | N | N |
| teenage partying | N | N | N | N |
| large social gatherings (fairs, festivals, *etc.*) | N | N | N | N |
| hunting | N | N | N | N |
| commercial forest management (any instance where native trees are being exported off site)[6] | N | N | N | N |
| education/interpretation buildings | N | N | N | N |
| garden plots | N | N | N | N |
| swimming | Y | Y | Y | Y |
| boating | N[3] | N | N | N |
| interpretive programmes (including signage, *etc.*) | Y | Y | Y | Y |

1. Food vendors with permits, but no rental equipment (paddle boats, canoes, *etc.*)
2. Except within rights-of-way with overhead utilities where tree height must be restricted
3. With the exception of the lower Credit River
4. With the exception of motorized vehicles for handicapped persons (*i.e.* motorized wheelchairs) where trail surface permits
5. This excludes necessary vegetation maintenance such as to maintain clearances beneath Hydro lines and telephone lines.
6. Exceptions may be made for continuation of established cultural practices (e.g., "sugarbush" management).

## 7.6 Development In Natural Areas

The primary impact on the natural environment in Mississauga has been the displacement and subsequent fragmentation of the landscape through agricultural conversion and land development. The remnant natural areas are relatively small, and few can be connected in such a way to allow ecological processes to function at a landscape level. Fundamental to the preservation of the remnant natural features in the City of Mississauga is the prevention of further displacement and fragmentation through development and the associated supporting infrastructure.

The City Plan should seek to reflect the following recommendations. Specific Official Plan policy approaches are provided in section 7.10.

- Where feasible, no new building development, roadways or linear utilities (gas lines, hydro corridors) should be allowed within Significant Natural Sites, Natural Sites, Natural Green Space or Linkages, recognizing the possible need to locate essential services in (*e.g.*, water treatment facilities) or over (*e.g.*, roadways) natural areas. All development proposed in or adjacent to natural areas should be subject to Environmental Impact Studies or Environmental Assessments and allowed only if impacts of development are acceptable.

- Development and re-development proposals in Residential Woodlands should seek to preserve the existing tree canopy as much as possible.

- Wherever possible, Special Management Areas should be restored to natural systems with the eventual aim of reclassifying them as Natural Greenspace or Natural Sites. Failing this, development proposals should have regard for the proximity of natural areas adjacent to Special Management Areas with respect to the type of development which is allowed and other factors such as density, open space connections *etc.* (see section 7.7 Adjacent Land Uses).

## 7.7 Adjacent Land Uses

The environmental, social and economic benefits of natural areas support the need for their integration into the urban fabric of the City of Mississauga. Adjacent land uses have the ability to directly or potentially impact natural areas and thus, where there are still opportunities, should be directed to those uses which are most compatible with the maintenance of natural values.

Impacts from adjacent use can result from both the actual development or by activities associated with the land use. Examples of impacts associated with development activities include: buried facilities (cables, storm drainage systems, *etc.*) which are contained within granular mediums that intercept and draw down near-surface watertables, thus altering local hydrogeology; the dense root mats of sodded lawns which restrict the downward percolation of precipitation; and grade changes resulting from development which alter surface and ground water regimes, potentially impacting natural systems; *etc.* All of these impacts can be avoided or rectified to varying degrees by careful and thoughtful design. Impacts resulting from adjacent land use include: the introduction of domestic pets which predate on native fauna; encroachment into natural areas; over use which leads to trampling; soil erosion, *etc.*; and activities associated with active sports parks, schools and residential areas that frequently spill over into natural areas. Impacts associated with urban development are discussed more completely in section 6.4.

Means to protect natural areas from impacts resulting from development and after use must be implemented. Preferably, this should be accomplished through impact avoidance: *i.e.* directing development to land adjacent to natural areas that results in the least impact. Residual impacts may be mitigated through site design and innovative installation (*e.g.*, backfill service trenches with impervious materials to prevent them acting as french drains, landscape with native plant communities that are non-sod forming, minimize alteration of grade changes, undertake water balance analyses to ensure that the hydrology of areas, especially wetlands are unaltered, *etc.*).

### 7.7.1 Type of Development

As noted above, some land uses are less susceptible to creating negative impacts to natural areas than others. Typical land uses are divided into compatible and incompatible groups below, recognizing that with appropriate mitigation and in certain circumstances, these generalizations may not apply. Generally, land uses that do not themselves generate impacts (*e.g.*, noise, fumes, light, water discharge *etc.*), have the potential for alternative landscape treatments (*i.e.* have large open areas associated with them), and result in low densities of human use are more compatible than areas that create direct impacts, leave little impermeable cover or create high density human use.

- Partial list of potentially compatible land uses
  - other natural areas
  - campus-type research facilities
  - institutional: hospitals, universities
  - passive parkland
  - estate lot residential
  - industrial (assuming safe environmental practices)

- Partial list of potentially incompatible land uses
  - commercial

- residential
- institutional: schools
- active recreation parks

With respect to corporate type campuses, it is noteworthy that a number of high profile corporate offices in the USA (*e.g.*, AT&T, IBM) are installing low maintenance native ecosystems around their major office complexes to reduce development and maintenance costs, and enhance the ecological function of their properties.

### 7.7.2 Buffers and Edge Management

Buffers are a commonly used mechanism for separating natural areas from incompatible adjacent land uses. Although various buffer widths have been proposed in studies [10 m (33 ft), 15 m (49 ft), 30 m (98 ft)], the designation of buffers must relate to an identifiable ecological need in order to be defensible. Thus the MNR's 30 m (98 ft) buffer from coldwater streams can be justified on the basis that it ameliorates surface water runoff and provides opportunity for the maintenance of riparian vegetation that keeps water temperatures down, attenuates siltation, and provides a source of in-stream detritus. However, a recommendation that, for example, designates a 15 m (49 ft) buffer around all upland woods, without consideration of the condition of woodland edge, adjacent land use, local topography *etc.* is arbitrary and not defensible in every case. With respect to woodland edges, the protection of fine root systems, maintenance of native ground covers over root systems (sod is relatively impervious and if placed over root systems will deprive them of water) and maintenance of existing surface runoff regimes is important. With wetland areas, water budgets need to be calculated to determine pre-development surface and groundwater contributions that can be used to set standards for post-development stormwater designs. The following recommendations address buffers.

- Develop Edge Management Plans that address site-specific ecological functions of natural areas. These may be developed as a component of site specific Conservation Plans (see section 7.4.1) for areas where there are still options for managing the edge of natural areas. Edge Management Plans should also be a requirement for submission of draft plans of development or redevelopment, and reviewed as part of development proposals. A variety of edge issues may need to be addressed including:

  i) health and status of existing intact edges, newly opened edges;

  ii) strata: condition of canopy, subcanopy, shrub layer and herb layer;

  iii) species composition of edge;

  iv) role of the edge in maintaining interior conditions (*e.g.*, shading, wind protection, visual barrier) ;

  v) existing adjacent land use (a successional field will have had a different impact on the edge than an agricultural field);

  vi) protection measures during construction of adjacent land uses;

  vii) the role of the edge in defining the natural area and contributing to its community identity;
  viii) the need for fencing and access points; and

  ix) the need to control grading and off-site drainage as to eliminate impacts on the adjacent natural area.

- A protocol for applying buffers should be developed that requires proponents to identify the potential ecological impacts resulting from proposed land uses and then rationalize buffer widths that will mitigate, to the extent possible, those impacts. This analysis should be as part of the EIS requirements associated with the development application process.

- The function and sensitivity of the natural area will determine whether access within a buffer should be controlled, uncontrolled or prohibited.

- Concurrent with examining site planning issues related to trail design (section 7.3.1), buffer recommendations to control and influence human use and movement should be considered.

### 7.7.3 Encroachment

The issue of encroachment is generally related to the activities of land owners directly adjacent to natural areas. Such activities involve trespassing onto City property and conducting activities not authorized by the City of Mississauga. These include the removal of trees, shrubs and herbaceous material, the clearing of dead wood, the dumping of debris, planting in natural areas, the storage of equipment, supplies or vehicles, or the construction of structures within natural areas. Surveys in other municipalities have revealed that most residents participating in these activities are not aware of the resulting negative impacts. The City's Community Services Department has recently undertaken a study of encroachment and is developing policy and strategy to address this concern. Encroachment issues should be addressed in the public education program. Specific problems should be resolved on an individual basis. The following recommendations relate to controlling encroachment.

- Conduct regular inspections to identify encroachment/dumping problems and document infringements. This would become part of site specific Conservation Plans and could be undertaken by community groups.

- Ensure that natural area property boundaries are clearly marked and properly surveyed.

- Educate homeowners regarding the problems resulting from encroachment through information sheets, site visits, telephone calls.

- Install fencing in areas with a high degree of sensitivity or in areas where chronic encroachment has been a problem, following the guidelines provided by the recent survey undertaken by the Community Services Department.

- Enforce by-laws which prohibit encroachment, dumping of refuse or lawn wastes, storage of equipment or property, altering vegetation or soils in any way.

### 7.7.4 Domestic Pets

Domestic cats and dogs pose serious threats to wildlife in natural areas through direct predation of native fauna (see section 6.4). The following should be given consideration to minimize impacts from pets.

- Enforce/implement dog and cat leash by-laws.

- Prohibit dog and cat access into natural areas unless leashed by the owner.

- Include information regarding the impact from pets in public education materials, school programmes. *etc.* Knowledgeable people should be contacted for such information including Michael Cadman (Canadian Wildlife Service, 519 826-2094).

- Consider securing natural area boundaries adjacent to residential properties with a 2.0 metre high chain link fence. Chain link fabric should extend to the ground at the bottom and above the top rail. The top rail should be round, eliminating a surface which cats can grasp or traverse. The fencing will at least exclude dogs.

### 7.7.5 Planting

Planting is discussed under both Resource Management (sections 7.4.2 and 7.4.4) and Effects of Urbanization (section 6.4). Further recommendations are provided below.

- Prohibit the planting of invasive, non-native plant species in and adjacent to natural areas. This should be addressed in the Exotic Plant Species Management Plan. Although it is not possible to prohibit the use of such plant materials on private land, the potential impacts of their use can be addressed in the public education program.

- Invasive, exotic species such as: Norway maple, tree of heaven, lilac, multiflora rose and periwinkle should not be planted on public lands.

## 7.8 Linkages

Linkage between natural areas is important for facilitating the movement of wildlife and people. Linkage opportunities are very limited in urbanized environments such as Mississauga and are generally defined by the existing development patterns. Urban adapted wildlife can utilize areas not generally recognized as corridors, and many species (*e.g.*, racoons, skunks, squirrels) can move through residential areas without the need for designated corridors. Deer have been known to travel west along the undeveloped strip adjacent to the south side of Highway 403 and forage in the undeveloped area just west of City Hall. Designed wildlife linkages would not normally be located to cross roads, especially wide arterial roads. However, wildlife do cross these roads in urban situations and given the lack of alternatives, linkages must cross such roads or not be identified at all.

The following recommendations address the linkage component of the natural areas system.

- Recognize the linkages identified on the mapping accompanying this report as an integral component of the natural area system.

- Where feasible, develop Conservation Plans for linkages that will enhance their role as wildlife corridors including but not limited to: planting of screening vegetation, fencing against incompatible adjacent uses (roads), and control of off-road vehicles (ATVs, trail bikes, *etc.*).

- Investigate the use of open space (walkways and other links between parks natural areas) as potential linkages for wildlife.

- Consult with animal control agencies to assess the feasibility of determining if the recognition of linkages that cross roads lead to unacceptably high mortality rates or constitute road hazards. If so, appropriate actions including creation of alternate paths ( including underpasses) or the possible obstruction of wildlife movement pathways should be considered where there are no other available options.

## 7.9 Organizational Requirements

### 7.9.1 Internal Staff Requirements

The management of a system of natural areas will impose an additional work load on City staff and will require skills that may not currently be present. It is especially important that if the public is to support and assist with the natural areas system through the recommended stewardship and landowner contact initiatives, that at least one member of City staff be highly accessible to the public. Also the updating of inventory, application of the floristic quality assessment, monitoring of flora and fauna require specialized skills that should reside within the department that takes responsibility for the ongoing maintenance of natural areas. The following recommendations are provided.

- Hire on as permanent staff a conservation ecologist with skills in natural area management to refine, implement and administer the natural areas programme including data base management, coordination of the stewardship programme and on-going management and monitoring of natural areas.

- Commit to the on-going training of planning and parks maintenance staff in the management of natural areas through workshops, specialized training courses, attendance and participation in conferences and other venues that will maintain a state-of-the-art knowledge of approaches and techniques in natural areas management within the City staff.

- Commit sufficient fiscal and human resources to maintain up-to-date data bases and mapping of natural area features within the City for use by planners and others in order to facilitate informed planning and decision making with respect to the City's natural features.

### 7.9.2 Internal Auditing of System

There are a number of components to the natural areas programme that have been outlined in this report. All of the proposed initiatives are seen to contribute to a system that will ensure the long term protection of the remnant natural areas in the City. Each of the components including: the stewardship programme, public education, access initiatives, resource management, and development control should be periodically examined to ensure that they are being effective and contribute to the goal and objectives of the natural areas system articulated in section 6.1. The following recommendation is provided to achieve this.

- Establish a protocol for internal auditing of all components that contribute to the natural areas system to ensure they are contributing to the goal and objectives of the system.

## 7.10 Official Plan Strategy Approaches

Implementation strategies include the use of a number of land use planning and other mechanisms including the preparation and undertaking of site specific Conservation Plans, various stewardship initiatives, and policy and plan formulation. Some of these strategies have been addressed in the preceding sections. This section will outline some of the techniques afforded through the Official Plan (City Plan) and planning strategies that could strengthen the role of City Plan with respect to natural area protection and management.

While the current Official Plan environmental policies were intended to follow an ecosystem approach to planning, it was recognized that more work had to be done on implementing this approach if the City was to be successful at protecting and enhancing its natural areas and systems. It is recommended that the environmental planning policy framework for Mississauga continue to be based on an ecosystem approach which minimizes disruption of natural resources while ensuring the long term health of the natural, social and economic systems, and makes provision for natural area restoration and enhancement. In developing environmental policies, staff should be cognizant that only 7% of the City is included in natural area categories and that these require a strong level of protection.

There are several approaches to the implementation of natural heritage features in City Plan. First, would be the approach of designating natural areas as a land use with policies and permitted uses. This clearly indicates what areas are set aside in Mississauga's policy document for environmental protection, enhancement and restoration, and clearly depicts these areas as a cohesive system. The natural areas identified in the study could be designated on a Land Use schedule and include policies for their use and protection. The three different classifications (Significant Natural Site, Natural Site and Natural Green Space) may warrant different designations and policies if various levels of protection and permitted uses are envisaged. Some of the features and areas that currently exist in other designations (*e.g.*, greenbelt or parks) would be re-designated "Natural Site" in the Official Plan (City Plan) or District Plans.

Some individual features or areas that make up the natural areas systems may be recognized at a provincial level (*e.g.* ESA's, ANSI's, fish habitat, *etc.*). These areas may, therefore, have specific policies within the City Plan, and evaluation criteria to determine under what circumstances studies may be required. Areas identified as Special Management Areas, Residential Woodland and Linkages would not lend themselves to a natural area designation. Areas in these classes may require some special recognition in the City Plan to address their management, protection or restoration, within their respective land use designations at the District Plan level.

A second approach, similar to the Region's Official Plan, that would promote the protection of a natural heritage system in Mississauga would be the incorporation of the natural areas classifications, and possibly even the open space areas where appropriate, within a Greenlands System. This approach has been taken by other municipalities such as Halton Region, York Region, the Town of Georgina and currently, the Town of East Gwillimbury. The Greenlands System could be organized under different land use designations such as parkland, private open space, natural areas and the waterfront, or other appropriate designations. The Greenlands approach would not discriminate between the three classes of natural area (Significant Natural Site, Natural Site and Natural Greenspace), but would treat them equally within one system. The natural area designation in a Greenlands System, as suggested above in the first approach, could also incorporate policies on the various types of natural features within it. The municipal Greenlands System or Natural Areas System could be a schedule in City Plan and the individual designations (*e.g.*, parkland, natural areas, *etc.*) depicted in the more detailed land use schedules of the District Plans.

The advantage of this latter approach is the opportunity to recognize that the open space and natural areas combined could create a municipal system of Greenlands. It emphasizes the interrelationship of areas and

promotes an ecosystem approach. Currently, many of the City's natural areas and features are incorporated into the parks and open space hierarchy as shown on the Land Use schedules in the District Plans. However, where the open space network contains or abuts Environmental Protection Areas (EPA's), the policies for the EPA'S apply. The current Plan also acknowledges that the recreational potential of natural areas should be restricted in order to protect these areas and that formalized passive recreational use may be acceptable.

It is recognized that the primary purpose of the natural areas is for ecological processes, while the primary purpose for open space is recreational. However, there may be a number of common goals, objectives and policies for both open space and natural areas that address naturalization of the former and passive recreational use of the latter. It may not be practical nor desirable to include all of the elements of open space hierarchy in a Greenlands System. Perhaps only those areas where natural features are now included within the open space system would be incorporated into a proposed Greenlands or Natural Areas System.

A third approach to the Official Plan would be to maintain a system of land use designations separate from the natural areas classification system by way of a separate overlay similar to the Environmental Planning Areas schedule in the current City Plan. The recommended natural area categories (*i.e.* natural areas and possibly the three categories of Special Management Areas, Residential Woodland and Linkages ) could be described as a Natural Areas System on a schedule which replaces the Environmental Planning Areas and includes different policies and levels of protection for the various categories.

The weakness of the overlay approach is that once a number of different land use designations apply at the District Plan level, the management and protection of natural areas as an integrated system looses some effect. The current Environmental Planning Areas do not lend themselves to the promotion and protection of Mississauga's natural features and areas as an integrated natural heritage system. Further, the environmental policies appear to become somewhat redundant once the land use designations at the District Plan level have been applied, unless the feature has been specifically addressed in the policies for that designation.

There is also the potential problem of having two sets of potentially conflicting policies (land use policies and environmental policies) apply to one piece of land. Clearly there needs to be a precedent of what policies apply in what circumstances as is the case with the current City Plan policies. There does not appear to be a consistent rationale or basis for the designation of Environmental Planning Areas to Open Space or Greenbelt at the District Plan level other than perhaps the securement options that were available at the time of negotiation.

### 7.10.1 Recommendations

The designation of all classified natural areas within the City Plan may not be practical given the process that would be required to re-designate all of the City’s natural areas from their current land use designations (at the District Plan level) and given the limited means at the City’s disposal to acquire and manage many of these areas. Although designation does not necessarily imply public ownership, lands currently designated for development that presently include identified natural features may be subject to negotiations with individual property owners during the development approvals process, and some may remain in private ownership. In addition, the creation of a hierarchy of natural areas designations which reflects the natural area classification system could create a process that undermines the systems approach to the protection and enhancement of the natural areas as a whole.

Given the above considerations, it is recommended that the Natural Areas Survey be incorporated into the City Plan through the implementation of either a Greenlands or Natural Areas System with more detailed land use

designations specified in the District Plan schedule. This approach is one which is not unfamiliar to Mississauga, as it incorporates some of the elements of the existing overlay approach (EPA's) and would also implement the regional greenlands system approach. However, this approach will still require rationalization at the District level to ensure a consistent application of land use designations that address the protection, enhancement or restoration of natural areas and features while maintaining the systems approach to environmental planning. It is recommended that the natural area classifications not be treated separately in the City Plan, but, rather they be incorporated into a comprehensive system of Natural Areas and treated uniformly in a policy sense.

The following framework should form the basis of goals, objectives and policy formulation for incorporation into City Plan.

**Basis for City Plan Goals and Objectives**

- statement of primary purpose of the natural areas system: to protect and maintain significant natural heritage features and areas
- a goal to create an ecosystem approach to planning
- a goal for Mississauga to become proactive in terms of its approach to the management and protection of its natural areas and features
- objectives related to the City's targets for restoration, enhancement, education, and stewardship
- goals and objectives of the natural areas system (see section 6.1)

**Provincial and Regional Policy Considerations for City Plan**

To date, the provincial policies on natural heritage have not been accompanied by implementation guidelines which may assist the municipality in determining approaches that "have regard to" provincial policy. However, the approach to the City's natural area system recommended in this study goes beyond the minimum standards established in provincial policies. All of the features and areas described in the provincial and regional policies (*e.g.*, significant wetlands, significant woodlands, significant valley lands, significant wildlife habitat significant portions of the habitat of endangered and threatened species, fish habitat, areas of natural and scientific interest) are incorporated within the proposed natural areas system. The criteria for determining "significance" in the local municipal context has been established through the Natural Areas Survey and resulted in the incorporation of specific features and areas into the proposed natural area system. This approach achieves, at a minimum, the same objectives as established in both the regional and provincial policy documents.

If specific implementation guidelines are produced by the province in the future, they should be reviewed by the City to determine what additional evaluation criteria or considerations, if any, should be incorporated into City Plan for purposes of implementing provincial interests. The following recommendations provide direction for incorporating the natural areas system into the official plan.

- Incorporate into the Mississauga Official Plan, the appropriate policies reflecting Federal, Provincial and

Regional legislation, policies and guidelines related to the protection of natural areas within a local greenland system.

- Incorporate appropriate policies for protected features and systems within the natural areas system (*i.e.* significant wildlife habitat, fish habitat, areas of endangered and threatened species, significant woodlands, ANSI's, ESA's and wetlands and valley and watercourse corridors and Lake Ontario Waterfront). Many of the current policies of the Environmental Planning Areas section of the Official Plan would be appropriate to incorporate into the new Official Plan policies for the proposed natural areas system.

- Incorporate natural areas (including Significant Natural Sites, Natural Sites and Natural Greenspace), Linkages and Special Management Areas into a natural areas system or Greenlands System within the Primary Plan (City Plan) and then into appropriate and consistent land use designations in the District Plan Land Use Schedules that would identify and protect areas that perform important ecological functions, contain significant attributes and contribute to ecosystem linkages.

- Establish or facilitate partnerships among public and private sector organizations and individuals that may assist in the implementation of a natural areas system.

- Inclusion of lands within the natural area system does not imply that the lands will be purchased by the City or any other public agency, nor does it mean that the public has a right to use or access private lands within the natural area system.

- Applicants for development adjacent to all natural areas should be required to complete and submit an Edge Management Plan that analyses the ecological function of the existing edge, demonstrates how the proposed application avoids impact to the existing edge, and recommends future restoration and management of the edge that would strengthen the ecological function of the adjacent natural area.

- It is recommended that City Plan recognize the importance of restoration and rehabilitation as a component of an ecosystem planning approach.

- Where feasible the City, in cooperation with the appropriate government agencies and community groups, should identify opportunities to naturalize channelized watercourses and explore methods to restore the natural characteristics of degraded watercourse channels where they are within, or an extension of, natural areas.

- All City, conservation authority and regionally owned lands, including municipal parks, should maintain a naturalized riparian corridor of appropriate native plant communities along watercourses and the shoreline of Lake Ontario where they are within the natural areas system.

- The City should minimize the use of pesticides, herbicides and fertilizer on its own lands within the natural areas system, and private landowners should also be encouraged to minimize chemical dependant land management practices in natural areas under private ownership.

- Within municipally owned natural areas, the City should encourage natural regeneration through removal of non-native species, restriction of human activities as appropriate or other efforts deemed necessary as discussed in section 7.0

**Development and Use in and Adjacent to Natural Areas**

The following provides recommendations for development and use in and adjacent to natural areas.

- No new development should be permitted in natural areas except for essential public works subject to appropriate Environmental Assessments (EA).

- Permitted land uses in natural areas should be limited to existing uses and possibly limited expansions to those uses with supporting Environmental Impact Studies (EIS) or EA's as required.

- Other permitted uses in natural areas should be limited to conservation lands, essential public works subject to EA's, natural area management, passive recreational uses compatible with the features or areas, nature interpretation or education centres, existing uses and accessory buildings.

- New development should not be permitted adjacent to natural areas if the development could have significant impact on the integrity of the feature or the ecological functions for which the natural area was identified as determined through EIS's (new guidelines for the current provincial policies have not been provided to date, however, municipal Official Plans should recognize these implementation guidelines as applicable when they become available).

- New development adjacent to natural features and areas within the natural areas system should identify opportunities for maintaining, restoring and enhancing aquatic and terrestrial linkages between remnant natural features.

- New watercourse crossings should be avoided where possible and should only be permitted subject to the completion of a satisfactory environmental assessment study and securement of required permits from Conservation Authorities.

- No new development, filling or alteration should be permitted within wetlands.

**Stewardship**

The City should identify the importance of stewardship in its revised City Plan and encourage private landowners to participate through cooperation with the City and other appropriate public agencies.

The City should also consider including the following recommended stewardship policy approaches in City Plan:

- The City should encourage stewardship of privately owned natural areas through public understanding and participation in appropriate government programs, as they may be offered from time to time.

- The City should encourage private landowners to reduce the use of pesticides, herbicides and fertilizers, especially those adjacent to proposed natural areas.

- The City should encourage private landowners to plant only indigenous plant species, especially on lands adjoining natural areas system.

- The City, in conjunction with the appropriate public agencies, should encourage and advise private landowners in conserving and rehabilitating wetland areas.

- The City should work with the appropriate government agencies to promote public awareness of the importance of Lake Ontario and its ecological role and to identify possible stewardship initiatives which can be undertaken by residents and local community groups that will benefit the natural functions and processes along the shoreline.

- A public education process should be undertaken cooperatively with the appropriate government agencies to increase public awareness of the impacts of habitat loss, introduction of non-native plants and animals, domestic pets, and other urban impacts on natural areas.

- The City should explore opportunities for local stewardship of publicly owned natural areas and features by neighbouring residents and associations as discussed in section 7.0. Opportunities for local initiatives include: active management, monitoring, record keeping, field work, public contact and education.

- The City should establish and facilitate partnerships among public and private sector organizations and individuals that may assist in the implementation of a natural areas system.

**Other Implementation Approaches**

The implementation section of the Official Plan should establish the methods to implement an ecosystem planning approach during the planning for new development and redevelopment. The primary implementing tools for realizing the proposed natural areas system should include such things as land securement, stewardship initiatives, development charges, bonusing, environmental inventories, environmental impact statements, zoning and site plan control.

***Securement***

Securement of natural areas through acquisition offers a means for the City and other appropriate government agencies to ensure that lands of greatest priority are protected through public ownership. It also provides the greatest long term control and thus potentially the best way to ensure long term ecological integrity is maintained. Although this approach is highly effective it may not always be appropriate nor practical as a primary means of protection given the large number of natural areas, current budgetary constraints and other considerations such as management and liability issues. Some natural areas may best be left in private ownership and owners provided with stewardship assistance through municipal, regional and provincial initiatives. In these instances, it may be appropriate to provide a level of protection for various natural features through such mechanisms as conservation easements and trusts or private stewardship agreements. Landowners should be advised of any potential tax incentives associated with various stewardship initiatives.

The City should identify and prioritize lands for acquisition based on development pressures and the importance of natural areas. Natural areas should be acquired through the development approvals process, land trusts, development agreements and other means at its disposal. To assist in public acquisition of tableland natural features the City may consider the use of bonusing provisions. The City should also investigate the opportunities to utilize provisions under the *Development Charges Act* to acquire and improve lands in the natural areas system.

***Environmental Impact Studies (EIS)***

Lands subject to development proposals in and adjacent to natural areas should require the submission of an Environmental Impact Study (EIS) prior to consideration for development. The distance requirements for studies may be determined when the new provincial guidelines for implementation of the provincial policies are available.

An EIS should, at a minimum, address the following:

i) a complete description of the biophysical features and functions of the site;

ii) boundaries, delineation of features (in consultation with the City and other review agencies) and the linkages to other natural areas;

iii) an assessment of the expected impacts of development on the functions, attributes and linkages for which the area was identified;

iv) the extent of development which can be accommodated on adjacent land without negative impact to the natural area;

vi) strategies for avoidance of impacts through alternate uses, location of proposed development, setbacks, *etc.*;

vi) recommendation for remediation of net impacts;

vii) opportunities for restoration;

viii) specific boundaries and buffers required to protect the natural area; and

ix) a monitoring plan to measure the potential impacts on the natural area.

All of the information provided by applicant(s) or their consultant(s) should be added to the current files and base information established for each of the individual natural areas identified in this study, consistent with the protocols described in section 7.4.11.

***Zoning***

Section 34 (1) of the *Planning Act* permits the zoning of land to restrict development within areas defined as significant wildlife habitat, wetland, woodland, ravine, valley, area of natural and scientific interest, shoreline of lake, river or stream, or a significant natural corridor, feature or area. The City may choose to use this tool in implementing its Official Plan.

***Site Plan Control***

In order to achieve the environmental objectives for natural heritage areas and features, all development adjacent to the natural areas system should be subject to site plan control. Site plan control can be established in the Official Plan for the purpose of determining the location and maintenance of buffers and type of vegetation cover on a development site; access and egress into adjacent natural areas, fencing, controlling the alteration of elevation or contour of the land; and for determining the specific location of buildings and

structures in relation to setbacks or buffers. Erosion control measures should be ensured through all phases of construction and conditions may be established prior to or during site plan control. A construction management plan should be required to show how construction will minimize erosion and sedimentation and any impacts on adjoining natural heritage features.

Landscaping plans may be required at the site plan, subdivision or rezoning stages of development. They should ensure that the development proposals maintain and preserve the existing native vegetation wherever practical. Landscaping plans should allow for replanting with native species only, particularly where the site abuts a natural feature or area.

# 8.0 CONCLUSION

This report provides a review of the remnant natural features in the City of Mississauga, reports on public opinion regarding the importance of natural features, discusses typical impacts in the urban environment, and provides recommendations to manage and maintain the remnant natural features of the City in the long term. It is supplemented by a number of other products that can assist in the planning and management of Mississauga's environment (see page 5).

It is unreasonable to expect Mississauga to ever support pristine examples of its historic natural features. It is a primarily urban landscape and will remain that way in the foreseeable future. However, the uniqueness of the original landscape, the need to maintain functioning natural ecosystems for human well being, and the desire to provide environments composed of natural features for human enjoyment, is sufficient rationale for the protection and maintenance of the remaining natural areas in the City.

Of prime importance is the need to foster a stewardship programme that will enable the maintenance of the remaining natural features and provide the opportunity for engendering a more healthy relationship between humans and the environment which supports them. The effects of such a relationship will benefit the environment well beyond the limits of the City. This relationship is necessary for the well being of our culture and to protect the life support systems that ultimately support us.

It is incumbent upon the City staff and elected representatives of the citizens of the City to ensure that the environment of the City of Mississauga remains healthy and that sufficient area is protected from development. The general perception, as indicated by the public survey, is that insufficient area is being set aside in a natural state. The fact that 93% of the City is no longer considered to be in a natural state supports this perception. There is opportunity to increase the natural area in the City through protection and restoration of sites that are not irreversibly developed. This report provides the groundwork to enable protection and maintenance of the remaining natural environment through planning and management, and identifies areas that could be returned to a more natural condition. The protection and long term stewardship of Mississauga's remnant natural areas will require courage and commitment by staff and council, but is both possible and desirable.

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**Table 2:** continued .....

| Community Code | Vegetation Community Name | # Occurrences | Area (ha) | Area (acres) | Proportion of Vegetation Area (%) | Proportion of City Area (%) |
|---|---|---|---|---|---|---|
| A | wooded slope | 19 | 347.36 | 857.98 | 14.92 | 1.19 |
| B | flood plain | 22 | 458.42 | 1132.30 | 19.69 | 1.57 |
| C | old field | 26 | 88.45 | 218.47 | 3.80 | 0.30 |
| D | hedgerow | 5 | 7.68 | 18.97 | 0.33 | 0.03 |
| E | early successional forest | 9 | 21.68 | 53.55 | 0.93 | 0.07 |
| F | manicured | 11 | 72.41 | 178.85 | 3.11 | 0.25 |
| G | golf course | 4 | 101.18 | 249.91 | 4.35 | 0.35 |
| H | urban lake | 2 | 7.26 | 17.93 | 0.31 | 0.02 |
| I | wooded residential | 3 | 251.59 | 621.43 | 10.81 | 0.86 |
| J | wooded non-native valley lands | 18 | 93.43 | 230.77 | 4.01 | 0.32 |
| K | open with open slopes valley lands | 31 | 229.02 | 565.68 | 9.84 | 0.78 |
| L | wooded native valley lands | 5 | 39.77 | 98.23 | 1.71 | 0.14 |
| M | open with wooded slopes valley lands | 2 | 5.26 | 12.99 | 0.23 | 0.02 |
| N | open with manicured slopes valley lands | 2 | 22.16 | 54.74 | 0.95 | 0.08 |
| O | manicured with wooded slopes valley lands | 1 | 5.17 | 12.77 | 0.22 | 0.02 |
| P | hawthorn thicket | 4 | 14.54 | 35.91 | 0.62 | 0.05 |
| R | beach | 3 | 2.36 | 5.83 | 0.10 | 0.01 |
| S | tall grass prairie | 1 | 0.06 | 0.15 | 0.00 | 0.00 |
| T | plantation | 11 | 21.58 | 53.30 | 0.93 | 0.07 |
| U | unknown | 5 | 35.65 | 88.06 | 1.53 | 0.12 |
| V | cattail marsh | 13 | 27.73 | 68.49 | 1.19 | 0.09 |
| W | open water marsh | 6 | 22.70 | 56.07 | 0.98 | 0.08 |
| X | willow buttonbush swamp thicket | 1 | 2.77 | 6.84 | 0.12 | 0.01 |
| Y | wet meadow | 1 | 3.43 | 8.47 | 0.15 | 0.01 |
| Z | willow-ash forest | 2 | 0.55 | 1.36 | 0.02 | 0.00 |

**Table 2:** continued .....

| Community Code | Vegetation Community Name | # Occurrences | Area (ha) | Area (acres) | Proportion of Vegetation Area (%) | Proportion of City Area (%) |
|---|---|---|---|---|---|---|
| AA | silver maple forest | 5 | 18.59 | 45.92 | 0.80 | 0.06 |
| BB | red ash-American elm forest | 14 | 35.32 | 87.24 | 1.52 | 0.12 |
| CC | sugar maple forest | 7 | 14.79 | 36.53 | 0.64 | 0.05 |
| DD | sugar maple-American beech forest | 15 | 108.35 | 267.62 | 4.65 | 0.37 |
| EE | sugar maple-white ash forest | 9 | 63.06 | 155.76 | 2.71 | 0.22 |
| FF | sugar maple-red oak forest | 10 | 42.48 | 104.93 | 1.82 | 0.15 |
| GG | sugar maple-Eastern hemlock forest | 1 | 16.03 | 39.59 | 0.69 | 0.05 |
| II | sugar maple-black cherry forest | 1 | 1.93 | 4.77 | 0.08 | 0.01 |
| KK | sugar maple-American beech-red oak forest | 5 | 29.46 | 72.77 | 1.27 | 0.10 |
| LL | sugar maple-American beech-eastern hemlock forest | 1 | 4.44 | 10.97 | 0.19 | 0.02 |
| MM | white pine-Eastern hemlock-sugar maple forest | 1 | 6.77 | 16.72 | 0.29 | 0.02 |
| NN | eastern hemlock forest | 3 | 4.09 | 10.10 | 0.18 | 0.01 |
| OO | red maple-red oak forest | 5 | 30.24 | 74.69 | 1.30 | 0.10 |
| PP | American beech forest | 1 | 2.56 | 6.32 | 0.11 | 0.01 |
| QQ | bur oak-American beech forest | 1 | 2.24 | 5.53 | 0.10 | 0.01 |
| RR | oak-ash forest | 8 | 28.61 | 70.67 | 1.23 | 0.10 |
| SS | oak-hickory forest | 5 | 24.20 | 59.77 | 1.04 | 0.08 |
| TT | ash-hickory forest | 3 | 6.94 | 17.14 | 0.30 | 0.02 |
| UU | black walnut grove | 1 | 0.17 | 0.42 | 0.01 | 0.00 |
| VV | black cherry-eastern hemlock-white ash forest | 1 | 2.02 | 4.99 | 0.09 | 0.01 |
| WW | bur oak-black walnut forest | 1 | 0.90 | 2.22 | 0.04 | 0.00 |
| XX | birch forest | 1 | 0.46 | 1.14 | 0.02 | 0.00 |
| YY | poplar forest | 1 | 2.37 | 5.85 | 0.10 | 0.01 |

**Table 3:** continued .....

| WATERCOURSE | HABITAT CLASSIFICATION | MNR DESIGNATION | INDICATOR SPECIES | SIGNIFICANT AREA OR SPECIES | COMMENTS |
|---|---|---|---|---|---|
| Lake Ontario shoreline | coastal | TYPE 1 and 2 | Atlantic salmon<br>lake trout<br>white sucker | seasonal spawning from J.C. Saddington Park to Marie Curtis Park | • MNR stocking of chinook salmon, coho salmon, rainbow trout, brown trout |
| Credit River | migratory coldwater | TYPE 1 | Atlantic salmon<br>rainbow trout<br>Pacific salmon | MNR fish sanctuary between QEW and Dundas St.<br><br>MNR fish sanctuary between Burnhamthorpe Road and Streetsville Memorial Park | • MNR maintains migration barrier at Streetsville to protect resident coldwater habitat further upstream<br>• there is little evidence of successful hatching of fry<br>• seasonal fish spawning at river mouth |
| | coolwater | | smallmouth bass | | |
| Carolyn Creek | migratory coldwater | TYPE 1 (only at confluence with Credit) | Pacific salmon<br>rainbow trout | | • fish migration barrier, shallow, relatively turbid, intermittent upstream<br>• very degraded, needs rehabilitation in middle and upper reaches<br>• potential coldwater stream<br>• utilization by spawning adult salmonids<br>• sedimentation and erosion from construction |
| | coolwater | TYPE 2 | | | |
| Fletcher's Creek | migratory coldwater | TYPE 1 (to McLaughlin Rd.) | Pacific salmon | historical records of redside dace within the City | • potential production zone for coldwater species (rainbow trout)<br>• degraded water quality in lower reaches |
| | coolwater | TYPE 2 | largemouth bass | | |
| Levi Creek | migratory coldwater | TYPE 1 (only at confluence with Credit) | Pacific salmon | | • potential coldwater stream<br>• utilized by juvenile salmon and spawning adults (rainbow trout)<br>• degraded water quality<br>• fish migration barrier |
| | coolwater | TYPE 2 | | | |
| Loyalist Creek | migratory coldwater | TYPE 1 (only at confluence with Credit) | Pacific salmon<br>rainbow trout | | • degraded, primarily warm water, little turbidity<br>• extensive sewer network<br>• north portion diverted to Sawmill Creek<br>• little in-stream cover other than rocks |
| | warmwater | TYPE 2 | longnose dace | | |
| Mullet Creek | migratory coldwater | TYPE 1 (only at confluence with Credit) | Pacific salmon<br>rainbow trout | | • migration barrier, high turbidity<br>• potential coldwater stream<br>• potential spawning by coldwater species (rainbow trout)<br>• utilization by juvenile and adult salmonids |
| | coolwater | TYPE 2 | smallmouth bass | | |

**Table 3:** continued .....

| WATERCOURSE | HABITAT CLASSIFICATION | MNR DESIGNATION | INDICATOR SPECIES | SIGNIFICANT AREA OR SPECIES | COMMENTS |
|---|---|---|---|---|---|
| Lake Aquitaine | ponds | TYPE 2 | smallmouth bass | | • low oxygen content<br>• sediment deposition high<br>• algae blooms |
| Lake Wabukayne | ponds | TYPE 2 | | | • algae blooms |
| Sawmill Creek | migratory coldwater | TYPE 1 (only at confluence with Credit) | salmon<br>rainbow trout<br>brown trout | | • major obstructions to fish movement<br>• may provide thermal refuge to main credit<br>• potential coldwater stream<br>• no fish captured winter of 1991/92<br>• at confluence with the Credit supports migrating salmonids, however 6 m (20 ft) drop structure prevents migration into Sawmill Creek<br>• impaired water quality, insufficient baseflow |
| | coolwater (east and main branches) | TYPE 2 | | | |
| Etobicoke Creek | migratory coldwater | TYPE 1 | brown trout<br>rainbow trout | | • rehabilitation potential<br>• primarily fair quality (poor quality at mouth)<br>• little forest cover present<br>• seasonal fish spawning at river mouth<br>• relatively high summer water temperatures |
| | coolwater | TYPE 2 | longnose dace | | |
| Little Etobicoke Creek | warmwater | TYPE 2 | longnose dace | | • extensive channelization in upper reaches<br>• enclosure of headwater streams, shallow<br>• fair water quality |
| Sheridan Creek | warmwater | TYPE 2 | | | • sedimentation, high fluctuating flows, introduction of nutrients and toxic substances<br>• almost completely channelized |
| Rattray Marsh | pond | TYPE 1 | smallmouth bass | | • white sucker, longnose sucker, carp, brown bullhead spawning |
| Turtle Creek | warmwater | TYPE 2 | | | • little information available<br>• possibly Type 1 due to the presence of a wetland near the Lake |
| Applewood Creek | warmwater | TYPE 1 (at mouth) | | seasonal spawning at mouth (Marie Curtis Park) | • little information available |
| | | TYPE 2 | | | |
| | | | | | |

**Table 3:** continued .....

| WATERCOURSE | HABITAT CLASSIFICATION | MNR DESIGNATION | INDICATOR SPECIES | SIGNIFICANT AREA OR SPECIES | COMMENTS |
|---|---|---|---|---|---|
| Birchwood Creek | warmwater | TYPE 2 | | | • several sections enclosed<br>• leachate plume from north Sheridan landfill south to Delaney Drive and Elite Road<br>• high estimated maximum summer water temperatures |
| Clearview Creek | no fisheries information available | | | | |
| Cooksville Creek | warmwater | TYPE 2 | longnose dace | | • relatively shallow, turbid water<br>• extensively channelized |
| Joshua Creek | warmwater | TYPE 2 | creek chub<br>blacknose dace | | • sections channelized upstream<br>• rehabilitation potential |
| Kenollie Creek | warmwater | TYPE 2 | | | • little information available<br>• little in-stream cover and banks partly open<br>• good water quality |
| Lornewood Creek | coolwater | TYPE 2 | | | • gravel, shale cobble substrate and pool/riffle ratio 3:1<br>• enclosed downstream of Lakeshore Rd. & north of Indian Rd.<br>• sensitive warmwater with potential as coldwater |
| Mary Fix Creek | warmwater | TYPE 2 | | | • channelization and enclosure north of Burnhamthorpe Rd.<br>• diversion to Wolfedale Creek, intermittent flow in north |
| Mimico Creek | warmwater | TYPE 2 | | | • moderate to heavily impacted<br>• some rehabilitation potential<br>• extensive channelization |
| Serson Creek | warmwater | TYPE 2 | | | • upper portion sewered |
| Sixteen Mile Creek | limited fisheries potential | TYPE 2 | | | • low baseflow and high turbidity<br>• large section channelized |
| Stavebank Creek | warmwater | TYPE 2 | | | • little information available |
| Tecumseh Creek | warmwater | TYPE 2 | longnose dace | | • sewered in upper reaches<br>• enclosed in lower reaches |
| Wolfedale Creek | warmwater | TYPE 1 (only at | | | • extensive channelization south of Hwy 403 |

**Table 3:** continued .....

| WATERCOURSE | HABITAT CLASSIFICATION | MNR DESIGNATION | INDICATOR SPECIES | SIGNIFICANT AREA OR SPECIES | COMMENTS |
|---|---|---|---|---|---|
| | | confluence with Credit ) | | | • fair to good water quality |
| | | TYPE 2 | | | |

**Table 4:** continued .....

| Site Number | Site Code | Classification | Designation | Area | | Flora | | | | | | | Fauna | | | | Condition |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | (ha) | (acres) | total | # non-native (proportion) | native FQI | native mean C | # vegetation communities | prov. sig. species | reg. sig. species | # birds | # mammals | # herptiles | prov. sig. species | |
| 1 | SD1 | NS | | 19.50 | 48.17 | 94 | 25 (26.6%) | 30.22 | 3.64 | 5 | | 4 | 13 | 4 | 2 | | F |
| 2 | SD4 | NS | | 26.58 | 65.65 | 65 | 16 (24.6%) | 26.14 | 3.73 | 1 | | 2 | | | | | n/a |
| 4 | CL52 | NGS | | 6.67 | 16.47 | 34 | 18 (52.9%) | 12.75 | 3.19 | 1 | | | 10 | 1 | | | P |
| 5/3 | CL1/SD5 | SNS | | 13.74 | 33.94 | 38 | 4 (10.5%) | 28.13 | 4.82 | 2 | | 2 | 2 | | | | G |
| 6 | CL9 | SNS | ESA,ANSI, wetland | 46.89 | 115.82 | 491 | 156 (31.4%) | 80.10 | 4.38 | 13 | 2 | 125 | 200 | 23 | 22 | 1 | G |
| 7 | CL8 | SNS | wetland | 11.28 | 27.86 | 48 | 9 (18.8%) | 19.86 | 3.18 | 7 | | 2 | 13 | 10 | 1 | | G |
| 8 | CL15 | NS | | 0.83 | 2.05 | 44 | 9 (18.2%) | 24.51 | 4.14 | 1 | | 3 | 2 | 2 | | | F |
| 9 | CL16 | NS | | 8.52 | 21.04 | 119 | 33 (26.9%) | 37.63 | 4.06 | 5 | | 11 | 37 | 16 | | | F-P |
| 10 | CL17 | RW | | 33.28 | 82.20 | 71 | 13 (18.6%) | | | 1 | | 17 | | | 4 | | n/a |
| 11 | CL13 | NGS | | 1.50 | 3.71 | 40 | 23 (55.0%) | 8.25 | 1.94 | 2 | | | 2 | | | | P |
| 12 | CL43 | NS | | 4.16 | 10.28 | 68 | 11 (16.2%) | 29.27 | 3.88 | 2 | | 5 | 5 | 1 | | | F |
| 13 | CL42 | NS | | 8.87 | 21.91 | 103 | 28 (27.2%) | 35.80 | 4.13 | 3 | | 9 | 4 | 1 | | | F-P |
| 14 | CL21 | SNS | ESA,ANSI, wetland | 9.36 | 23.12 | 97 | 22 (21.6%) | 38.91 | 4.49 | 3 | | 18 | 2 | | 1 | | F |
| 15 | CL39 | SNS | | 12.98 | 32.06 | 245 | 69 (28.0%) | 54.51 | 4.13 | 2 | | 41 | 6 | 2 | 8 | | F |
| 16 | CL22 | SNS | ESA,ANSI | 17.85 | 44.09 | 131 | 45 (34.4%) | 37.74 | 4.07 | 1 | 2 | 13 | 2 | 1 | 6 | | G |
| 17 | CL30 | SNS | ESA,ANSI | 0.06 | 0.15 | 24 | 8 (33.3%) | | | 1 | 2 | 11 | | | | | P |
| 18 | CL31 | SNS | ESA,ANSI | 2.78 | 6.87 | 50 | 26 (50.0%) | | | 1 | | 2 | 1 | | | | P |
| 19 | CL24 | SNS | | 7.80 | 19.27 | 213 | 51 (23.0%) | 58.06 | 4.56 | 3 | | 31 | 6 | 1 | | | G |
| 20 | CL26 | NS | | 4.34 | 10.72 | 157 | 58 (35.7%) | 31.66 | 3.18 | 2 | | 15 | 5 | 2 | | | F |
| 21 | PC1 | NS | | 1.09 | 2.69 | 75 | 31 (41.3%) | 23.82 | 2.11 | 1 | | 7 | 68 | 1 | | | P |
| 22 | PC2 | NGS | | 4.37 | 10.79 | | | | | 1 | | | | | | | P |
| 23 | PC3 | NS | | 1.73 | 4.27 | 11 | | | | 1 | | | | | | | n/a |
| 24 | CRR9 | SNS | ESA,ANSI, wetland | 25.63 | 63.31 | 37 | 14 (37.8%) | 17.10 | 3.57 | 3 | | 12 | 10 | 1 | 13 | | F |
| 25 | MI4 | RW | | 165.14 | 407.90 | 97 | 27 (24.7%) | 36.65 | 4.32 | 1 | | 5 | | | 3 | | F |
| 26 | MI1 | NS | | 6.31 | 15.59 | 9 | 5 (44.4%) | | | 1 | | | | | | | F |
| 27 | LV3 | NS | | 3.54 | 8.74 | 80 | 34 (40.0%) | 24.33 | 3.59 | 3 | | | 18 | 2 | | | F |
| 28 | LV4 | NGS | | 0.95 | 2.35 | | | | | 1 | | | | | | | P |
| 29 | LV5 | NGS | | 1.09 | 2.69 | | | | | 1 | | | | | | | P |
| 30 | LV2 | NS | | 2.09 | 5.16 | 26 | 11 (38.5%) | 11.62 | 3.00 | 1 | | | 3 | | | | P |
| 31 | LV1 | SNS | | 14.03 | 34.65 | 82 | 34 (40.2%) | 23.09 | 3.33 | 4 | 1 | | 8 | | | | F |
| 32 | ETO8 | SNS | | 16.67 | 41.17 | 85 | 34 (37.6%) | 26.05 | 3.65 | 3 | | 3 | 2 | 4 | 1 | | F |
| 33 | LV14 | NGS | | 1.95 | 4.82 | 35 | 17 (45.7%) | 13.67 | 3.22 | 1 | | | | | | | P |
| 34 | LV6 | NS | | 2.02 | 4.99 | 61 | 19 (29.5%) | 24.38 | 3.76 | 1 | | 3 | | | | | F |

**Table 4:** continued .....

| Site Number | Site Code | Classification | Designation | Area | | Flora | | | | | | | Fauna | | | | Condition |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | (ha) | (acres) | total | # non-native (proportion) | native FQI | native mean C | # vegetation communities | prov. sig. species | reg. sig. species | # birds | # mammals | # herptiles | prov. sig. species | |
| 35 | LV7 | SNS | ESA,ANSI | 21.56 | 53.25 | 292 | 101 (33.9%) | 57.67 | 4.17 | 2 | | 46 | 65 | 6 | 3 | 1 | G |
| 36 | ETO7 | SNS | ESA | 27.18 | 67.13 | 84 | 35 (39.3%) | 21.29 | 3.04 | 2 | | 2 | 11 | 2 | 12 | 2 | F |
| 37 | SP1 | NS | | 10.12 | 25.00 | 107 | 27 (24.3%) | 33.99 | 3.80 | 1 | | 11 | 4 | 1 | | | F |
| 38 | SP3 | SNS | ANSI | 9.64 | 23.81 | 133 | 30 (21.8%) | 41.09 | 4.05 | 1 | | 11 | 5 | 2 | 1 | | G |
| 39 | SH6 | NS | | 6.85 | 16.92 | 69 | 32 (46.4%) | 21.37 | 3.51 | 2 | | 1 | 4 | | | | P |
| 40 | CRR7 | SNS | ESA,ANSI | 88.96 | 219.73 | 61 | 10 (13.1%) | 33.89 | 4.75 | 3 | 1 | 8 | | | 9 | | G |
| 41 | CRR8 | SNS | ESA,ANSI | 110.62 | 273.23 | 43 | 3 (7.0%) | | | 4 | 2 | 31 | 8 | 1 | 4 | | G |
| 42 | ER6 | SNS | | 1.56 | 3.85 | 36 | 13 (36.1%) | 16.26 | 3.39 | 1 | 1 | | 1 | | | | P |
| 43 | CRR6 | SNS | ESA,ANSI | 213.66 | 527.74 | 269 | 88 (32.3%) | 63.63 | 4.73 | 4 | 4 | 65 | 87 | 8 | 17 | 1 | G |
| 44 | CV1 | NS | | 1.48 | 3.66 | 29 | 9 (31.0%) | 13.86 | 3.10 | 1 | | | 5 | 1 | | | F |
| 45 | CV2 | RW | | 53.17 | 131.33 | 142 | 43 (29.6%) | 41.71 | 4.19 | 1 | 1 | 12 | 6 | 1 | | | F |
| 46 | CV12 | SNS | | 6.99 | 17.27 | 199 | 89 (44.2%) | 37.19 | 3.55 | 3 | 1 | 13 | 2 | 1 | | | F |
| 47 | CV10 | NS | | 4.59 | 11.34 | 20 | 9 (40.0%) | 8.74 | 2.64 | 2 | | | 2 | | | | P |
| 48 | CV8 | NS | | 7.87 | 19.44 | 39 | 18 (43.6%) | 13.53 | 2.95 | 4 | | 1 | 1 | | | | P |
| 49 | ETO6 | SNS | | 11.39 | 28.13 | | | | | 3 | | | | | | | P |
| 50 | AW1 | SNS | | 7.98 | 19.71 | 51 | 18 (35.0%) | 18.45 | 3.21 | 3 | 1 | 1 | 5 | 1 | | | P |
| 51 | WB1 | NS | | 7.12 | 17.59 | 53 | 9 (17.0%) | 25.93 | 3.91 | 3 | | | 4 | | 1 | | F |
| 52 | EM30 | NS | | 5.56 | 13.73 | 52 | 5 (9.6%) | 29.61 | 4.32 | 2 | | 6 | 9 | 8 | | | G |
| 53 | EM6 | NS | | 1.07 | 2.64 | 53 | 11 (20.8%) | 25.00 | 3.86 | 1 | | 1 | 6 | 1 | | | F |
| 54 | EM2 | SNS | | 4.90 | 12.10 | 63 | 12 (19.0%) | 28.85 | 4.04 | 1 | 1 | | 8 | 1 | | | F |
| 55 | EM10 | NS | | 3.99 | 9.86 | 43 | 9 (18.6%) | 21.78 | 3.74 | 2 | | | 4 | 2 | | | F |
| 56 | EM14 | NS | | 9.61 | 23.74 | 49 | 22 (42.9%) | 15.40 | 2.96 | 2 | | | 4 | | | | P |
| 57 | EM4 | SNS | ESA,ANSI | 46.82 | 115.65 | 225 | 61 (26.7%) | 55.05 | 4.30 | 8 | 2 | 28 | 67 | 4 | 6 | | G-F |
| 58 | EM5 | NS | | 1.88 | 4.64 | 49 | 9 (32.7%) | 22.27 | 3.94 | 1 | | | 4 | | | | F |
| 59 | EM21 | NS | | 1.13 | 2.79 | 42 | 8 (16.7%) | 21.27 | 3.65 | 1 | | | 2 | 1 | | | F |
| 60 | CR1 | SNS | ESA,ANSI | 4.90 | 12.10 | 47 | 3 (4.3%) | 29.55 | 4.45 | 2 | | 6 | 2 | 1 | | | F |
| 61 | FV1 | NS | | 2.23 | 5.51 | 38 | 7 (18.4%) | 18.50 | 3.32 | 1 | | | | | | | F |
| 62 | FV3 | NS | | 7.00 | 17.29 | 50 | 15 (22.0%) | 25.63 | 3.86 | 3 | | | 15 | 2 | | | F |
| 63/64 | CC1/MY1 | NS | | 15.33 | 37.87 | 129 | 43 (32.6%) | 35.58 | 3.84 | 2 | | 5 | 8 | 1 | 5 | | F |
| 65 | MY3 | NGS | | 3.71 | 9.16 | 26 | 18 (69.2%) | 6.01 | 2.13 | 1 | | | | | | | P |
| 66 | AW4 | NGS | | 11.71 | 28.92 | | | | | 1 | | | | | | | P |
| 67 | AW3 | NGS | | 7.92 | 19.56 | 33 | 21 (60.6%) | | | 2 | | | 4 | 1 | | | P |
| 68 | ETO5 | SNS | | 9.12 | 22.53 | | | | | 2 | | | | | | | P |
| 69 | ETO4 | SNS | ESA | 58.09 | 143.48 | 128 | 35 (26.6%) | 42.31 | 4.39 | 3 | | 14 | 23 | 2 | 9 | | F |
| 70 | RW5 | NGS | | 3.51 | 8.67 | | | | | 1 | | | | | | | P |

**Table 4:** continued .....

| Site Number | Site Code | Classification | Designation | Area | | Flora | | | | | | | Fauna | | | | Condition |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | (ha) | (acres) | total | # non-native (proportion) | native FQI | native mean C | # vegetation communities | prov. sig. species | reg. sig. species | # birds | # mammals | # herptiles | prov. sig. species | |
| 71 | RW6 | NGS | | 7.31 | 18.06 | | | | | 1 | | | | | | | P |
| 72 | RW4 | NS | | 1.08 | 2.67 | 33 | 7 (18.2%) | 22.36 | 4.38 | 1 | | | 3 | | | | F |
| 73 | RW1 | SNS | | 2.11 | 5.21 | 69 | 12 (17.4%) | 34.04 | 4.51 | 1 | | 3 | | 1 | | | F |
| 74 | RW2 | NGS | | 3.50 | 8.65 | | | | | 1 | | | | | | | P |
| 75 | CM7 | SNS | | 11.38 | 28.11 | 88 | 18 (20.5%) | 34.78 | 4.16 | 3 | | 5 | 15 | 1 | 5 | | E |
| 76 | CM9 | NS | | 3.37 | 8.32 | 62 | 12 (17.7%) | 27.58 | 3.90 | 2 | | 3 | 8 | 2 | | | G |
| 77 | CM11 | NS | | 2.24 | 5.53 | 22 | 1 (4.5%) | 18.33 | 4.00 | 1 | | | 1 | | | | G |
| 78 | CM12 | NS | | 8.22 | 20.30 | 54 | 8 (14.8%) | 27.42 | 4.04 | 2 | | 2 | 11 | 2 | 5 | | G |
| 79 | CM17 | NS | | 8.39 | 20.72 | 25 | 4 (16.0%) | 16.80 | 3.67 | 1 | | | 5 | | | | F |
| 80 | CM13 | NGS | | 0.77 | 1.90 | 37 | 14 (35.1%) | 16.26 | 3.39 | 1 | | | 1 | 1 | | | P |
| 81 | CE7 | SNS | | 10.08 | 24.90 | 88 | 28 (31.8%) | 30.47 | 3.93 | 2 | | 4 | 2 | 1 | 7 | | G |
| 82 | CE9 | NS | | 4.83 | 11.93 | 58 | 14 (24.1%) | 26.99 | 4.07 | 3 | | 2 | 2 | 1 | | | F |
| 83 | CE10 | SNS | | 18.20 | 44.95 | 73 | 13 (17.8%) | 33.82 | 4.37 | 3 | | 6 | 8 | | 2 | | G |
| 84 | CE5 | NGS | | 5.47 | 13.51 | 13 | 8 (61.5%) | 2.68 | 1.20 | 1 | | | | | | | P |
| 85 | CE1 | NGS | | 16.94 | 41.84 | 50 | 24 (46.0%) | | | 2 | | | 3 | | | | P |
| 86/89 | CE12/SV12 | SNS | | 17.61 | 43.50 | 52 | 19 (34.6%) | 17.76 | 3.09 | 2 | 1 | | 4 | 1 | | | F |
| 87 | CRR5 | SNS | | 21.22 | 52.41 | 64 | 27 (42.2%) | 21.37 | 3.51 | 2 | 1 | | 5 | | 5 | | F |
| 88 | CRR4 | SNS | ESA,ANSI | 24.69 | 60.98 | 11 | 2 (5.5%) | | | 3 | | 1 | | | 7 | | G |
| 90 | SV10 | NGS | | 3.93 | 9.71 | 28 | 13 (42.9%) | 9.55 | 2.47 | 1 | | | 1 | 1 | | | P |
| 91 | SV1 | SNS | | 5.62 | 13.88 | 67 | 16 (23.9%) | 29.55 | 4.14 | 2 | 1 | 3 | | | | | F |
| 92 | CRR3 | SNS | | 68.94 | 170.28 | 34 | 5 (11.8%) | | | 4 | | 3 | 1 | | 9 | | F |
| 93 | CRR2 | SNS | ESA,ANSI | 91.30 | 225.51 | 89 | 30 (32.6%) | 32.94 | 4.29 | 8 | | 3 | 13 | | 10 | | G |
| 94 | EC22 | NS | | 2.59 | 6.40 | 39 | 4 (10.3%) | 24.00 | 4.06 | 1 | | 4 | 1 | 1 | | | F |
| 95 | EC10 | NS | | 3.35 | 8.27 | 41 | 9 (22.0%) | 19.98 | 3.53 | 2 | | 1 | 2 | | | | F |
| 96 | EC13 | SNS | wetland | 4.61 | 11.39 | 162 | 29 (16.7%) | 50.73 | 4.40 | 4 | | 58 | 89 | 6 | 11 | | E |
| 97 | EC1 | SNS | ESA,ANSI, wetland | 2.63 | 6.50 | 10 | 4 (40.0%) | 4.90 | 2.00 | 1 | | 1 | 13 | | 3 | | P |
| 98 | HO1 | NS | | 1.20 | 2.96 | 20 | 5 (25.0%) | 16.27 | 4.20 | 1 | | | 2 | 1 | | | F |
| 99 | HO2 | NS | | 2.50 | 6.18 | 24 | 3 (12.5%) | 18.77 | 4.10 | 2 | | | 3 | | | | F |
| 100 | HO3 | NS | | 14.41 | 35.59 | 49 | 9 (18.4%) | 25.61 | 4.06 | 3 | | | 11 | 2 | | | F |
| 101 | HO6 | NGS | | 9.57 | 23.64 | | | | | 1 | | | | | | | P |
| 102 | HO7 | NS | | 4.09 | 10.10 | 54 | 10 (16.7%) | 26.53 | 4.00 | 3 | | 4 | | | | | F |
| 103 | HO9 | SNS | see 148 | | | | | | | | | | | | | | |
| 104 | NE4 | NS | | 13.43 | 33.17 | 95 | 22 (23.0%) | 33.04 | 3.79 | 5 | | 8 | 5 | | | | E |
| 105 | NE3 | NGS | | 2.59 | 6.40 | 29 | 11 (34.5%) | | | 2 | | | | | | | P |
| 106 | NE2 | NS | | 1.85 | 4.57 | 55 | 11 (18.2%) | 28.49 | 4.30 | 1 | | 4 | 5 | | | | F |

**Table 4:** continued .....

| Site Number | Site Code | Classification | Designation | Area | | Flora | | | | | | | Fauna | | | | Condition |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | (ha) | (acres) | total | # non-native (proportion) | native FQI | native mean C | # vegetation communities | prov. sig. species | reg. sig. species | # birds | # mammals | # herptiles | prov. sig. species | |
| 107 | NE1 | NGS | | 0.95 | 2.35 | 54 | 26 (48.1%) | 14.93 | 2.82 | 1 | | | 3 | | | | F |
| 108 | NE6 | NS | | 4.34 | 10.72 | 40 | 10 (25.0%) | 20.27 | 3.70 | 2 | | | | | | | G |
| 109 | NE5 | NGS | | 13.29 | 32.83 | | | | | 1 | | | | | | | P |
| 110 | NE7 | NGS | | 2.76 | 6.82 | | | | | 1 | | | | | | | P |
| 111 | ETO3 | SNS | | 134.93 | 333.28 | 405 | 169 (41.2%) | 57.09 | 3.72 | 4 | 2 | 60 | 7 | 5 | 5 | | F |
| 112 | NE8 | NGS | | 11.05 | 27.29 | | | | | 1 | | | | | | | P |
| 113 | NE10 | NGS | | 7.82 | 19.32 | | | | | 1 | | | | | | | P |
| 114 | NE11 | NGS | | 6.07 | 14.99 | | | | | 1 | | | | | | | P |
| 115 | NE12 | NGS | | 6.49 | 16.03 | | | | | 1 | | | | | | | P |
| 116 | ETO2 | SNS | | 13.01 | 32.13 | | | | | 1 | | | | | | | P |
| 117 | ETO1 | SNS | | 10.40 | 25.69 | | | | | 2 | | | | | | | F |
| 118 | NE9 | NS | | 45.21 | 111.67 | 46 | 24 (50.0%) | | | 4 | | 1 | 5 | | | | F |
| 119 | LS1 | SNS | wetland | 28.92 | 71.43 | 63 | 14 (20.6%) | 27.14 | 3.88 | 3 | | 6 | 4 | | | | G-P |
| 120 | LS2 | NS | | 1.26 | 3.11 | 45 | 14 (31.1%) | 22.09 | 3.97 | 1 | | | 2 | | | | F |
| 121 | LS3 | NS | | 3.00 | 7.41 | 66 | 23 (33.3%) | 23.94 | 3.65 | 2 | | 2 | 1 | 1 | 2 | | F |
| 122 | ME10 | SNS | | 4.18 | 10.32 | 55 | 15 (27.3%) | 24.67 | 3.90 | 1 | 1 | 2 | 4 | | | | F |
| 123 | ME12 | NGS | | 2.90 | 7.16 | 49 | 28 (57.1%) | 12.00 | 2.62 | 1 | | | 7 | 2 | 7 | | P |
| 124 | ME11 | NGS | | 4.36 | 10.77 | 41 | 21 (51.2%) | 11.40 | 2.55 | 1 | | | 5 | 2 | 4 | | P |
| 125 | ME9 | NS | | 2.39 | 5.90 | 44 | 11 (25.0%) | 25.59 | 4.45 | 1 | | 2 | 2 | 1 | | | F |
| 127 | MB9 | NS | | 6.60 | 16.30 | | | | | 1 | | 2 | | | | | P |
| 128 | MB7 | NGS | | 10.45 | 25.81 | | | | | 1 | | | | | | | P |
| 129/126 | MB8/ME8 | SNS | | 15.98 | 39.47 | 87 | 13 (26.4%) | 30.25 | 3.78 | 2 | 1 | 4 | 3 | 3 | 4 | | F |
| 130 | MB3 | NGS | | 7.11 | 17.56 | | | | | 1 | | | | | | | P |
| 131 | MB5 | NS | | 0.90 | 2.22 | 41 | 4 (9.8%) | 23.67 | 3.89 | 1 | | | | | | | P |
| 132 | MB4 | NS | | 1.93 | 4.77 | 40 | 11 (27.5%) | 19.31 | 3.59 | 1 | | | | | | | P |
| 133 | MB6 | SNS | | 23.70 | 58.54 | 84 | 15 (16.7%) | 30.70 | 3.70 | 2 | | 6 | 1 | 1 | 2 | | G |
| 134 | MB2 | NS | | 1.34 | 3.31 | 41 | 6 (14.6%) | 23.66 | 4.00 | 1 | | 1 | 1 | | | | P |
| 135 | MB1 | NS | | 0.94 | 2.32 | 34 | 6 (17.6%) | 22.87 | 4.32 | 1 | | | | | | | F |
| 136 | MV19 | SNS | | 26.30 | 64.96 | 196 | 50 (25.0%) | 50.48 | 4.18 | 3 | | 31 | 13 | 6 | 3 | | E |
| 137 | CRR1 | SNS | ESA,ANSI | 71.40 | 176.36 | 41 | 12 (26.8%) | | | 5 | 1 | 2 | 2 | 2 | 1 | | F |
| 138 | MV18 | NS | | 3.14 | 7.76 | 19 | 1 (5.3%) | | | 2 | | 1 | 2 | | | | F |
| 139 | MV2 | SNS | ESA,ANSI | 80.18 | 198.04 | 200 | 60 (29.5%) | 46.99 | 3.97 | 4 | 1 | 20 | 58 | 10 | 2 | | G-F |
| 140 | MV3 | NS | | 2.67 | 6.59 | 47 | 13 (27.7%) | 21.61 | 3.71 | 1 | | | | | | | F |
| 141 | MV12 | SNS | | 13.28 | 32.80 | 103 | 32 (30.1%) | 33.94 | 4.03 | 3 | | 6 | 5 | 3 | | | F |
| 142 | MV14 | NGS | | 4.55 | 11.24 | | | | | 1 | | | | | | | P |

**Table 4:** continued .....

| Site Number | Site Code | Classification | Designation | Area | | Flora | | | | | | | Fauna | | | | Condition |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | (ha) | (acres) | total | # non-native (proportion) | native FQI | native mean C | # vegetation communities | prov. sig. species | reg. sig. species | # birds | # mammals | # herptiles | prov. sig. species | |
| 143 | MV11 | NS | | 2.90 | 7.16 | 24 | 4 (16.7%) | 17.44 | 3.90 | 1 | | | 1 | | | | F |
| 144 | MV15 | NS | | 10.70 | 26.43 | 53 | 25 (45.3%) | 14.74 | 2.79 | 2 | | 1 | 7 | 1 | | | P |
| 145 | GT1 | NS | | 5.77 | 14.25 | 33 | 8 (24.2%) | 17.00 | 3.40 | 1 | | | | | | | F |
| 146 | GT2 | NS | | 7.20 | 17.78 | 41 | 6 (7.0%) | 22.12 | 3.79 | 3 | | 3 | 2 | 1 | | | G |
| 147 | GT3 | NS | | 2.67 | 6.59 | 43 | 12 (25.6%) | 19.04 | 3.42 | 2 | | 1 | 1 | | | | F |
| 148/103 | GT4/HO9 | SNS | ESA,ANSI | 27.06 | 66.84 | 201 | 55 (26.4%) | 50.40 | 4.17 | 2 | | 22 | 9 | 1 | | 1 | E-P |
| 149 | MA1 | NGS | | 25.79 | 63.70 | | | | | 1 | | | | | | | P |

**Table 7:** continued .....

| Activities | Significant Natural Site | Natural Site | Natural Green Space | Linkages |
|---|---|---|---|---|
| arboretums | N | N | Y | n/a |
| campgrounds | N | N | N | n/a |
| canoeing | Y | Y | Y | Y |
| commercial activity (food vendors, equipment rental, *etc.*) [access will limit vendor to small wheeled vehicles with no perceptible impacts] | Y[i] | Y | Y | Y |
| encroachment by adjacent landowners | N | N | N | N |
| exercising pets (off leash) | N | N | N | N |
| exercising pets (on leash) | Y | Y | Y | Y |
| feeding animals | N | N | N | N |
| campfires, barbeques, *etc.* | N | N | N | N |
| fort/tree house building | N | N | N | N |
| golfcourses | N | N | N | N |
| horseback riding | N | N | N | N |
| in-line skating (roller blading) [this will be limited by surface and can thus be controlled with trail type] | Y | Y | Y | Y |
| nature appreciation | Y | Y | Y | Y |
| off-trail hiking | N | N | N | N |
| on-trail hiking | Y | Y | Y | Y |
| off-trail cycling | N | N | N | N |
| on-trail cycling [if kept on trails would be low impact, but bike access will | | | | |

**Table 7:** continued .....

| Activities | Significant Natural Site | Natural Site | Natural Green Space | Linkages |
|---|---|---|---|---|
| encourage off trail use and thus is considered incompatible in sign. natural areas] | N | Y | Y | Y |
| operation of motorized vehicles[4] | N | N | N | N |
| picnicking (except near cultural features, *e.g.*, at Cawthra, Adamson Estates) | N | N | N | Y |
| playgrounds | N | N | N | N |
| removal/damage of vegetation (picking flowers, vandalism, tree cutting)[5] | N | N | N | N[2] |
| downhill skiing/tobogganing | N | N | N | N |
| cross-country skiing (on established walking trails only) | Y | Y | Y | Y |
| sport fields (soccer, baseball, tennis courts, *etc.*) | N | N | N | N |
| teenage partying | N | N | N | N |
| large social gatherings (fairs, festivals, *etc.*) | N | N | N | N |
| hunting | N | N | N | N |
| commercial forest management (any instance where native trees are being exported off site)[6] | N | N | N | N |
| education/interpretation buildings | N | N | N | N |
| garden plots | N | N | N | N |
| swimming | Y | Y | Y | Y |
| boating | N[3] | N | N | N |
| interpretive programmes (including signage, *etc.*) | Y | Y | Y | Y |

1. Food vendors with permits, but no rental equipment (paddle boats, canoes, *etc.*)

**Table 7:** continued .....

2. Except within rights-of-way with overhead utilities where tree height must be restricted
3. With the exception of the lower Credit River
4. With the exception of motorized vehicles for handicapped persons (*i.e.* motorized wheelchairs) where trail surface permits
5. This excludes necessary vegetation maintenance such as to maintain clearances beneath Hydro lines and telephone lines.
6. Exceptions may be made for continuation of established cultural practices (e.g., "sugarbush" management).