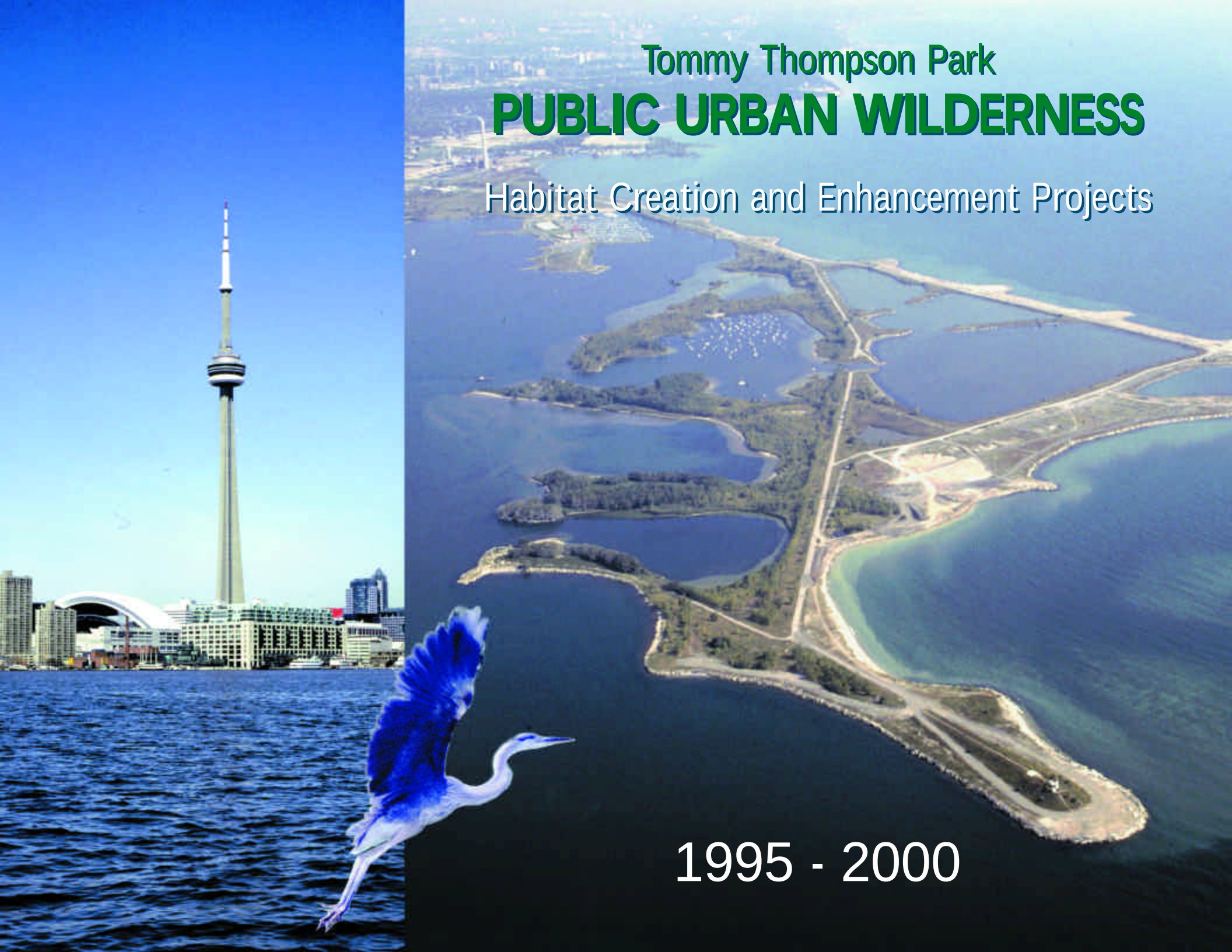


Tommy Thompson Park

PUBLIC URBAN WILDERNESS

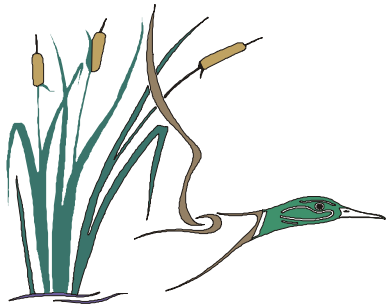
Habitat Creation and Enhancement Projects

1995 - 2000

Tommy Thompson Park

PUBLIC URBAN WILDERNESS

Habitat Creation and Enhancement Projects
1995-2000



Conservation TORONTO AND REGION

TORONTO

Environment Canada Environnement Canada
GREAT LAKES 2000 CLEANUP FUND
FONDS D'ASSAINISSEMENT DES GRANDS LACS 2000

ONTARIO Great Lakes RENEWAL FOUNDATION

Tommy Thompson Park
Public Urban Wilderness
Habitat Creation and Enhancement Projects
1995-2000

Printed on Recycled Paper
Printed March 2000

Contributors: Tamara Chipperfield, TRCA; Scott Jarvie, TRCA; Judson Venier, TRCA.
Editing: Angela Agard, TRCA; Tamara Chipperfield, TRCA; Gladys Locke, GL2000 CUF.
Photography: Hans Blokpoel, C.W.S.; Tamara Chipperfield, TRCA; Rose Hasner, TRCA;
Verna Higgins, U. of T.; Peter Kupovics; Scott Jarvie, TRCA; Cathy Snape.
Design: Ronald Domerchie, TRCA.

We greatly appreciate the contributions and support provided to these projects from the following:
• Great Lakes 2000 Cleanup Fund • Great Lake Renewal Foundation • City of Toronto
• Canada Trust - Friends of the Environment Foundation • Toronto Port Authority • Friends of the Spit
• Aquatic Park Sailing Club • Viacom Canada • Canadian Wildlife Service • The Local Community

Table of Contents

1 INTRODUCTION

The purpose of this document is to summarize the habitat creation, enhancement and restoration which has been implemented at Tommy Thompson Park (TTP) by the Toronto and Region Conservation Authority (TRCA). The framework for the habitat work at TTP has been designed through an extensive Master Planning Process conducted by the TRCA (TTP Master Plan and Environmental Assessment (EA); MTRCA, 1989 and TTP Master Plan and EA; MTRCA 1992) for the Tommy Thompson Park Area. The Master Planning Process involved an ecological approach to park development which focused on preserving and creating a unique urban wilderness, and consisted of consultations, workshops and public meetings. The process began in 1983 and entailed a five-phase approach:

> ***Conservation Design*** is defined as the purposeful act of planning and designing for a variety of wildlife habitats to assist in restoring rare, endangered or significant plant and animal species.

Phase I - Setting of goals/zone identification/review of background data (completed 1985)
Phase II - Evaluation of development components/identification of restraints (completed 1986)
Phase III - Examination of concept alternatives/selection of preferred concept plan (completed 1987)
Phase IV - Preparation of a Master Plan (completed 1989; revised 1992)
Phase V - Environmental Assessment Act approval (received 1995).

The main objectives of the Master Plan are to:

- Preserve significant species;
- Protect environmentally significant areas;
- Enhance aquatic and terrestrial habitat; and
- Enhance public recreational opportunities.

Although the Master Plan called for early capital work, much of the funding available for implementation was allotted for habitat projects, mainly through the Great Lakes 2000 Cleanup Fund and the Toronto and Region Remedial Action Plan. As a result, the phasing of the implementation stage could not follow the time line set in the Master Plan. The actual goals and targets of the habitat projects, however, have remained as outlined in the Plan.

Four major habitat projects have been implemented since approval of the Environmental Assessment. Each of these initiatives is described to provide a picture of the broad range of habitat work currently underway at TTP. They are presented also to emphasize the creative and innovative philosophy of conservation design (see text box), which is based on natural succession or ecological approaches to habitat creation, augmented by minimal human intervention and management (Kehm 1989; MTRCA 1989; 1992).

1.1 CONTEXT

In 1959, the Toronto Harbour Commissioners (now known as the Toronto Port Authority (TPA) began construction of a spit of land at the base of Leslie Street in the City of Toronto, to expand port facilities in anticipation of increased shipping activity on the Great Lakes. From 1959 until present day, a combination of lakefilling and dredging activities created the current configuration of TTP. Construction followed a three phased design with the formation of the Eastern Headland first, followed by the peninsulas on the north side of the spine in 1973-74 and the Endikement, which was initiated in 1979. Tommy Thompson Park extends 5 kilometres into Lake Ontario and has a total land base of approximately 160 hectares and a water surface area of 100 hectares composed of embayments and the disposal cells.

The three disposal cells, contained between the endikement and the main spine (headland), have been designed as a Confined Disposal Facility for the disposal of dredged material. The smaller of the three cells (Cell 1 - 8.2 hectares and Cell 2 - 9.3 hectares) have both been filled to capacity and no longer receive dredgeate. Cell 3, the largest at 32.1 hectares, is still actively used for dredgeate disposal.

Part of the construction process involved a large scale hydraulic dredging operation to deepen the Outer Harbour for the expected port navigational requirements. Approximately 6,466,120 m3 of sand was removed from the lake bottom and transferred to what are now the western peninsulas associated with TTP. This material when placed in its present locations comprises approximately 65.9 ha of the TTP landbase, and over the years has naturalized into what has now been designated as Environmentally Significant Areas (see insert) (ESA Study MTRCA 1982;1993). Protected between the peninsulas are a series of four embayments that have been found to function as thermal refugia for a variety of fish species.

The additional port facilities were never needed and, in 1973, the TRCA was given the responsibility by the Ontario Provincial Cabinet to:

- be the Province's agent with regard to the proposed Aquatic Park (now TTP);
- prepare a master plan; and
- in 1977, develop an Interim Management Program for both biological and human interest activities.

The TRCA currently owns 247 hectares of the land and water included in TTP. Those areas still under construction are owned by the Ontario Ministry of Natural Resources (OMNR) and are leased to the THC (now the Toronto Port Authority). The OMNR indicated the intent to transfer a further 224 hectares of land and water to the TRCA upon the completion of lakefilling activities.

Environmentally Significant Areas Study:
The purpose of the Environmentally Significant Areas Study (ESA) was to identify areas of environmental significance and to suggest direction for their recognition and management. In order for a site to be classified as an ESA it must meet at least one of the nine criteria for designation. TTP was designated an ESA because it met 4 criteria for designation:

- It is the only breeding habitat for double-crested cormorants and herring gulls in the TRCA region. It is also a significant stopover area for migrating birds, with over 290 species being observed to date.
- TTP provides habitat for nationally and provincially rare plant and avian species.
- The Park contains aquatic and terrestrial communities as well as biological communities which are exceptional and of high quality within the TRCA Region and Ontario.
- The dune, shoreline meadow, and cottonwood forest habitats of TTP are of limited representation and geographically restricted within the Region.

Much of the land area of TTP has, through natural successional processes, been colonized by a variety of plant and animal communities since the Spit's construction. Overall, the park represents the largest area of existing natural habitat on the central Toronto waterfront, and provides one of the best opportunities to undertake habitat creation and enhancement using techniques and principles that are consistent with the TTP Master Plan, and that are in keeping with the unique characteristics of the park.

One of the main advantages to initiating habitat projects at TTP is that the entire spit of land, with its accompanying embayments, was created by humans and initially contained a poor suite of habitats. Through habitat creation projects, functional and critical habitats for a large variety of species can be created where none existed before. Thus a totally new area can become available for indigenous plants and animals to live, located in the centre of the largest city in Canada.

Species rarely seen in Toronto since early in the 20th century will now have a suitable place to live, thus providing opportunities for the public to view and learn about them in their natural environment without travelling far from home. At TTP, people will be able to see large northern pike spawning, coyotes searching for prey, beavers and muskrats swimming beneath the Toronto skyline, frogs and turtles basking in the sun, and large numbers of migratory birds stopping over in created habitats on their way north or south.

1.2 SIGNIFICANCE TO TORONTO AND REGION AREA OF CONCERN

Although these Habitat Enhancement Programs have taken place in the Toronto and Region Area of Concern (AOC), the technology demonstrated at Tommy Thompson Park is easily transferable to other AOC's. Networking between "Resource Managers" of Remedial Action Plan (RAP) areas has been ongoing for some time now and will continue in the future, as it proves beneficial to compare experiences and concerns.

In addition, the TTP habitat creation and enhancement projects assist in the remediation of the Toronto Waterfront, as outlined by Toronto and Region RAP. Specifically, these projects address the following goals and restoration targets outlined in the Metro RAP document "Clean Waters, Clear Choices" (1994):

GOAL 2b: Rehabilitation of fish and wildlife habitat
Specific Target: Waterfront "Sheltered bays are rehabilitated to encourage re-establishment of aquatic plants suitable for Northern Pike, Smallmouth Bass, and Largemouth Bass spawning, nursery and feeding habitat"

GOAL 2c: Protection and rehabilitation of wetlands
Specific Target: Restored beneficial uses by providing high wetland production characteristics and provide significant habitat benefit

GOAL 2h: Ecosystem observation
Specific Target: Provision of viewing areas for residents and visitors to study or observe functioning, healthy ecosystems

and

ACTION 21: Protect and Restore Fish and Wildlife Habitat
The primary goal of the Metro Toronto RAP is one of ecosystem health. Toronto's waterfront and watersheds should be a diverse, healthy, integrated ecosystem, managed using an ecosystem approach to restore beneficial uses of aquatic resources. The protection, enhancement and rehabilitation of fish and wildlife habitat have been identified as objectives of the Metro Toronto RAP as a means of achieving the overall objective of ecosystem health. On the waterfront, the greatest potential for the restoration of lost and degraded habitat for native species has been identified as the embayments and lands associated with waterfront parks (Strus et.al., 1993).

1.3 PROJECT DESIGN

In 1995, following a 10-year planning and public review process, the Master Plan and Environmental Assessment for TTP was approved. This plan outlines many opportunities within the park for habitat regeneration, recreation, outdoor education, and park facilities. It also outlines several environmental management techniques to be used throughout the implementation process.

The collective goal of the TTP habitat creation/enhancement projects is to create, enhance and rehabilitate terrestrial and aquatic habitats through a multi-year implementation program. The overall guiding principle in the habitat creation projects is the philosophy that "diversity of habitat promotes a diversity of wildlife communities." The function of this philosophy is that habitat diversity will provide a variety of conditions for the resident fish and wildlife, including important nurturing areas for immature and juvenile individuals; reduced predation through improved shelter; high primary production; and significant foraging areas. Emphasis is placed on creating and enhancing "critical habitats" by providing features and conditions that are required by wildlife species during their reproductive, rearing, overwintering, staging and migrating activities. Examples of these components include: the creation of seasonally flooded and protected pools for amphibian reproduction; mudflat areas for migrating shorebirds; flat open areas for nesting colonial waterbirds; shallow, vegetated channels for northern pike spawning; and, sheltered thickets and den sites for over-wintering reptiles, birds and mammals.

> The loss of natural areas in Ontario is a serious problem, however, the loss of habitat that is important to various life stages of wildlife is even more of a concern. Loss of habitat that is used by wildlife for reproduction, rearing of young, overwintering, staging and migrating activities can have serious impacts on wildlife populations. The creation and restoration of critical habitat features is of particular importance at Tommy Thompson Park.

In order to accomplish the above collective goals, a number of objectives must be met. The objectives for the Tommy Thompson Park Habitat projects are to:

1. Create functional fish and wildlife habitat through structural habitat diversity.
   - Create fish and wildlife reproductive habitat by providing a diversity of shore and substrate types, structural habitat, vegetated shorelines and seasonally inundated shorelines.
   - Promote the growth of emergent wetland plants and aquatic macrophytes to provide a diversity of habitats.
   - Establish fish and wildlife habitat structures for specific species and critical habitat for various life stages.

2. Establish a variety of native wetland plants and promote the development of successional plant communities.
   - Inoculate the area with a variety of native aquatic submergent and emergent and terrestrial plant species by planting seed, cuttings, propagules, soil cores and transplants to encourage the development of natural successional communities.
   - Create distinct vegetative nodes including shrub, wet meadow, strand, emergent, littoral and limnetic zones.

1.4 HABITAT PROJECT SITES

The philosophy and objectives presented above were used in the planning and implementation of several aquatic and terrestrial habitat projects in TTP. Each of these projects was designed to create critical habitat for a variety of organisms where habitat was previously unavailable, or to augument and enhance habitats that have previously evolved at TTP. Through the use of innovative design techniques, critical, functional and variable habitats were created, planted with vegetation, and allowed to flourish and reproduce naturally. The following is a brief description of each of these initiatives.

Above: Terrestrial habitat creation project.
Left: Embayment B habitat creation and enhancement project.

1. Embayment B Habitat Creation and Enhancement Project

The Embayment B Habitat Creation and Enhancement Project was the focus of the initial habitat restoration efforts at TTP and involved the establishment of a variety of habitat features along the shoreline and within the open water sections of the embayment. Wetland vegetation has been, and will continue to be, established along the shoreline in major planting nodes. Critical habitat in the form of reproductive, juvenile/nursery, resting/loafing, and overwintering areas has been created for resident fish and wildlife species. Structural fish habitat has been created in the form of shoals, brush bundles, and log cribs strategically located within the embayment. The goal of this habitat project was to enhance the aquatic habitat within Embayment B and create a diverse shoreline and enhanced fish and wildlife community.

2. Terrestrial Habitat Creation and Enhancement Project

The Terrestrial Habitat Creation/Enhancement Project encompasses approximately 8 hectares of the TTP land base which was formerly under construction by the TPA. These lands exhibit varying degrees of natural regeneration from bare soil or rubble cover, to meadow/shrub communities depending on the type of surficial soil composition and the elapsed time since actual filling and grading. In some cases unique habitat features, such as seasonally flooded pools, mudflats, and meadow communities, have evolved on the existing landscape. However, much of the area required rehabilitation. Through a variety of techniques including landform alterations, drainage design, soil conditioning and plantings, critical habitat features have been created for both target and non-target species. Through these techniques the goals of the project, which were to create, enhance, and rehabilitate recently disturbed areas to provide diverse terrestrial and aquatic habitats and increase the biodiversity and ecological integrity of TTP, have been fulfilled.

Embayment C habitat enhancement project

Access Corridor Node.

3. Embayment C Habitat Enhancement Project

The project site is located in the southwestern portion of Embayment C. Before the project began the area was shallow, with little structural diversity and little aquatic vegetation. The adjacent shoreline was and is still well vegetated. The purpose of this project was to enhance the fish and wildlife habitat in Embayment C through modification of the shoreline structure, riparian and wetland vegetation plantings and addition of structural aquatic habitats (rocks, rubble, gravel, stumps, brush bundles, log cribs). As a result of these efforts the main goal of the project, to create a structurally and biologically diverse shoreline and wetland habitat within Embayment C in order to increase the abundance and sustainability of native wildlife populations through the provision of specific habitat components, will be met.

4. Natural Resource Area Habitat Enhancement Project

Phase III of the Master Planning Process designated sections of TTP into several categories of environmental protection or management. The largest of these is the Natural Resource Area which has a broad range of community types. Three separate initiatives have been implemented in the Natural Resource Area to date. The collective goal of these initiatives is to create diverse and ecologically stable natural resources through the use of conservation design principles and the implementation of specific habitat components.

The Access Corridor Node project area is located on the west side of the neck, or spine, of the Spit. The purpose of this initiative is to provide linkages between critical habitat areas and provide improved access to these areas from the base of TTP. These linkages can be achieved through the creation of habitat nodes and corridors designed to maximize the diversity of habitats provided. In this area, an ephemeral wetland and wet meadow was created through site grading and plantings.

Northern pike spawning channels were created in Embayment C just north of the channel cut through to Cell 3 as part of the Natural Resource Area Habitat Enhancement Project. The purpose of this initiative was to create spawning habitat for northern pike. This was accomplished by cutting shallow channels into the shoreline which will be planted with aquatic vegetation in the future.

The third initiative is the enhancement of the aquatic habitat within "Triangle Pond" and the surrounding terrestrial area. The goal of this initiative is to enhance and diversify the terrestrial and aquatic habitats of Triangle Pond through conservation design and the implementation of specific habitat components. The existing pond needed to be drained and capped to cover contaminated sediments. The structure of the pond was then altered and a

Northern Pike captured in Embayment B, pike spawning channel.

more shallow and diverse waterbody was created. The goal of the initiative was fulfilled through the use of site grading, alterations to the bathymetry of the pond, expansion of its surface area, diversification of substrates, provision of woody material and boulders for perching and basking, removal of invasive vegetation, wetland plantings and the establishment of linkages between the Triangle Pond terrestrial habitat and other areas.

1.5 CONSERVATION DESIGN

Natural succession is the key concept behind the philosophy of conservation design. All habitat projects within TTP have utilized this philosophy in their implementation. The project areas were designed to facilitate the growth and natural development of indigenous plant and animal communities. Plantings and seedings were done to inoculate an area with vegetation adapted to that specific environment and allowed to grow, reproduce and spread naturally. In this way early successional plant communities can mature and be replaced by late successional species, and the habitat can mature on its own.

Wildlife communities are allowed to naturally colonize the newly created habitats from population sources outside of the target area. In many cases, these populations exist already within TTP and migration to the new habitats is fairly rapid. In other cases, sources are located outside of the park and, consequently, these populations may take longer to colonize.

The habitat areas are designed to be sustainable in the long-term. Thus, successional processes are allowed to occur which will serve to increase diversity as new species colonize. Minimal human intervention is needed to maintain these areas and is avoided as much as possible.

1.6 COMMUNITY OUTREACH

Information related to the habitat creation and enhancement initiatives at Tommy Thompson Park was provided to the public through a number of venues between 1996 and 2000.

Stakeholders in the Park were invited to a workshop in the winter of 1996 to discuss ideas for future habitat restoration and enhancement projects. Members of the Friends of the Spit, Toronto Ornithological Club, University of Toronto Department of Landscape Architecture, University of Toronto Botany Conservation Group, and the City of Toronto Parks and Recreation were in attendance at the meeting. Several ideas for future projects were discussed at length at the workshop. Each organization in attendence provided ideas and suggestions that were incorporated into the design process for each of the habitat projects at the Park.

Following the stakeholders meeting, the TRCA held a Conservation Seminar in April 1997 to inform the public about the habitat restoration and enhancement work in Embayment B and to report back on the future habitat work discussed at the stakeholders meeting a few months prior.

Aquatic Plants Program at Tommy Thompson Park.

Planting activities were held in the springs of 1997-1999 for elementary grade school classes. Several local schools provided softstem bulrushes propagated under the Aquatic Plants Program (see insert), with approximately 70 students participating annually. Although the planting activities focused on one habitat project annually, these activities provided the opportunity to highlight all of the habitat initiatives at the Park. The Aquatic Plants Program will be undertaken again in future years at Tommy Thompson Park.

Aquatic Plants Program

In 1995, the Aquatic Plants Program was established for Col. Samuel Smith Park. The purpose of this program is to provide local students with "hands on" environmental science by assisting in developing a natural habitat area within their community. Students are provided with kits that will allow them to grow soft stem bulrush plants in their classroom. At the end of the school year, the students are encouraged to visit the park, and plant their soft stem bulrushes. This program was introduced to TTP in 1996 and will continue during the 1999/2000 season.

Tommy Thompson Park and the ongoing habitat restoration and enhancement was one of the features included in a TRCA display at the Spring Fishing and Outdoors Show held at the Toronto International Centre on February 12-14, 1999. A map identifying the various habitat projects was displayed and staff were on hand to answer questions regarding the methods and techniques used.

In 1999 the TRCA undertook several "pilot" eco-tours in the GTA area. One of the tours that was tested was a "Near City Kayaking/Wilderness Experience." The focus of the tour was Tommy Thompson Park and the significant natural features associated with this site. It also included an information and "hands on" session related to the ongoing habitat creation and enhancement at this site. These tours provided another valuable opportunity to highlight the various partnerships in place and the techniques used at the Park.

Members of the public have also been involved in the habitat enhancement and creation projects by assisting with monitoring. Community members have undertaken point count surveys of all the habitat projects in 1999 and the early part of 2000. The public can also report incidental wildlife observations through the Tommy Thompson Park Wildlife Hotline.

2 FACTORS INFLUENCING THE DESIGN PROCESS

Several factors and associated criteria must be considered when designing effective habitat creation and enhancement projects. Not only must environmental factors be addressed, but also physical, hydrological and social factors as well. When these factors are taken into account, a broader range of benefits can result from the implementation of habitat projects (North Shore of Lake Superior Remedial Action Plans 1998).

The TTP Master Plan focuses not only on the improved environmental conditions which can result from habitat initiatives, but also the benefits influenced by social criteria, such as recreational, interpretive and educational opportunities. The goals and objectives of other programs also have an effect on the design and implementation of habitat projects. Such programs influencing TTP projects include: Toronto and Region RAP, The Municipal Official Plan for Urban Structure, The Central Waterfront Plan, and The Integrated Shoreline Management Plan (ISMP).

2.1 ENVIRONMENTAL FACTORS

1. Preservation of Significant Species

All of the habitat projects implemented at TTP have, as one of their objectives, the protection and preservation of significant species. Consideration must be given to the effectiveness of the design in meeting this objective and not adversely effecting the populations of these wildlife through new habitat availability for non-target species. These species could potentially out-compete significant species and lead to their decline.

2. Dynamic Properties of Natural Areas

The core principle in conservation design is natural succession. The dynamic nature of biological systems needs to be considered when implementing any habitat project. Plant species introduced into newly created habitat should be left to develop naturally to maintain the integrity, not only of the natural area, but of the principles behind the design. Indigenous populations of plants and animals should be able to colonize the areas and replace or out-compete each other with minimal management interference.

3. Sediment Quality

Since all of the projects at TTP have been implemented on lakefilled land or water areas, the quality of sediments must be considered during the planning process. Poor sediment quality can have a detrimental effect on wildlife communities through poor forage bases in the lower trophic levels, bioaccumulation of contaminants and toxicity effects on various life stages. Sediments should be tested prior to the implementation of projects and remediation activities completed before the work is initiated.

4. Water Quality

Poor water quality, like poor sediment quality, can lead to similar detrimental effects on wildlife communities. Any habitat efforts designed to improve the aquatic community can be rendered ineffective due to problems with water quality. Testing should be conducted before initiation and techniques to combat poor water quality should be incorporated into the project design if test results reveal a problem.

5. Vegetation

Plants form the basis of good habitat, both aquatic and terrestrial, since they are the primary producers and are at the bottom of the food web. Therefore, choosing the appropriate species is a critical factor when creating functional habitat. Plant species should be chosen based on a number of criteria such as edibility, as providers of shade and shelter and stabilization of landscapes and shorelines. Only native species indigenous to the target area should be selected for planting and allowed to grow and spread naturally. Also, to guarantee survival and a healthy plant community, vegetation should be chosen which is appropriate to the conditions at the site, such as soil type, moisture and quality, exposure to the sun and weather conditions and compatibility with adjacent plant communities (North Shore of Lake Superior Remedial Action Plans 1998).

6. Habitat Linkages

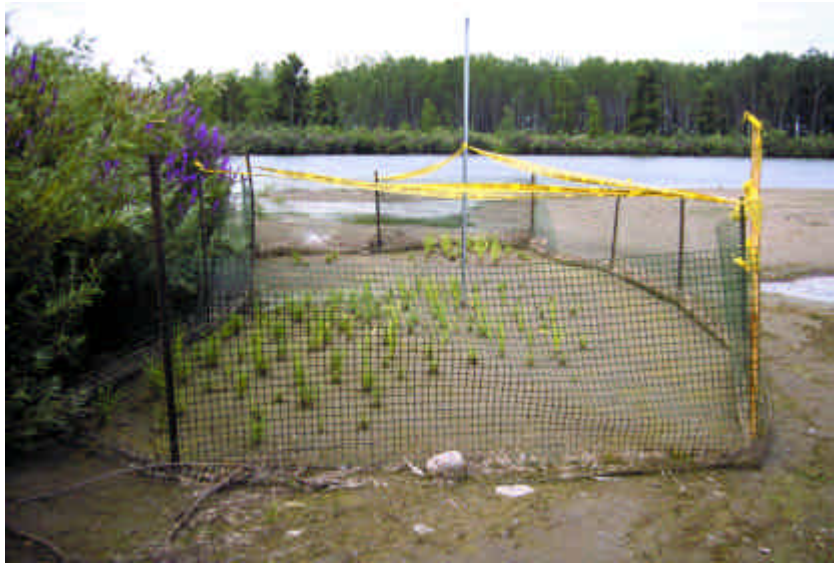
A created habitat is only as good as the species it attracts. If the species cannot physically get there to colonize, then the created or enhanced habitat has only succeeded in partially meeting its objectives. The establishment of habitat linkages or corridors must be considered when habitat projects are in the design process. The diversity and accessibility of an area can be greatly increased if this factor is incorporated into habitat projects.

7. Construction Disturbance

Consideration must be given to the disturbance of construction activities and their impacts on the existing system when planning a habitat initiative (North Shore of Lake Superior Remedial Action Plans 1998). Impacts from equipment access, actual construction activities, noise and sedimentation must be minimized. Of important consideration, especially at TTP, is the interference with migration and nesting activities of both migratory and resident wildlife. Construction activities should be implemented during a time of year so as to avoid disturbing wildlife during these times.

8. Wildlife Management

"Although the objective of habitat enhancement initiatives is to benefit fish and wildlife communities, the management of wildlife and fish may be necessary to ensure the successful establishment of aquatic and terrestrial vegetation, an essential component of many habitat enhancement initiatives" (North Shore of Lake Superior Remedial Action Plans 1998). Planted vegetation must be protected against damage caused by herbivores. Techniques such as rodent guards and snow fencing should be considered for the prevention of herbivory. Also, the control of non-native, invasive plant species may be necessary to ensure the survival of planted vegetation.



2.2 PHYSICAL FACTORS

1. Landform

The shape of the land has major influences on the formation of micro-habitats by diversifying sun, weather and wind exposure, soil moisture and drainage. These features can then provide sheltered micro-habitats away from weather and solar extremes. Differences in soil moisture and sun exposure can control the type of plant community growing in an area. Well drained areas will support communities adapted to dry conditions and wet areas can support wet meadow or wetland communities. By applying variation of landform in a habitat project, a much larger diversity of species can be supported and sustained in the long-term.

2. Bathymetry

As with the topography of terrestrial environments, variation of the bathymetry of an aquatic site adds to its habitat diversity. Thermal refugia for aquatic species can be made available in deeper water, shallow areas can support emergent plant species or spawning habitats for fishes, sharp drop-offs can be supplemented with structural habitat to create foraging areas for predators and the water temperature over large areas can be become variable. All of these features will increase the diversity of fish and wildlife able to utilize and survive in the created or enhanced habitat.

3. Physiography

Another factor to consider when planning and designing terrestrial habitat projects is physiography. Soil nutrient content and soil type are important for governing the types of plant communities which can grow in an area. Variation in nutrient content and soil types can add to the diversity of a site by providing conditions suitable for a wider range of plant species, which in turn can attract a larger variety of wildlife.

2.3 HYDROLOGIC FACTORS

1. Water Levels

The fluctuations of the water levels in aquatic habitat projects is a major factor to consider when designing initiatives. For coastal projects, lake levels must be investigated and mean low water should be chosen for projects where flooded areas are required. In this way, only in the lowest years will these areas

not meet their objectives. In addition, high water years must also be considered and planned for so that emergent or terrestrial vegetation is not destroyed. In most cases, the function of these types of habitats depends on good planning with regard to fluctuating water levels. For seasonally flooded wetland areas, landform design must maximize run-off in order to provide enough water to meet project objectives.

2. Erosion Protection

In coastal projects, erosion control measures must be considered to avoid the destruction of created habitat. Many newly planted wetland vegetation species can easily be washed away during high wave events such as storms. Proper barriers to open coast effects should be designed and constructed to ensure the longevity of the habitat.

2.4 SOCIAL FACTORS

1. Recreational Opportunities

Tommy Thompson Park receives many visitors throughout the year and, therefore, habitat creation and enhancement projects should also provide for some sort of passive or active type of human activity. Provision of areas for bird and wildlife observation, hiking/walking trails, boating/canoeing/kayaking and fishing should all be considered when designing habitat projects. Restrictions on activities should also be considered to certain areas during sensitive periods for target species, such as nesting/spawning seasons.

2. Educational Opportunities

The dissemination of knowledge to the public regarding the techniques used to create habitat, their benefits and information about the specific habitat requirements of certain species should be incorporated into any habitat plan. The provision of facilities for education and interpretation regarding habitat projects can also add to the overall "wild" experience that visitors receive when attending these areas. The use of interpretive signs can also be useful in informing the public about the specific habitat project that they are viewing.

3. Accessibility

Human accessibility should also be considered when designing habitat projects. Trails and paths can be constructed to give the public free access to view habitat projects in their finished state. Resting areas for wildlife viewing or interpretation can be provided in higher areas to provide wide vantage points. Sensitive areas can be blocked off for the part of the year when wildlife is particularly vulnerable to disturbances.

4. Community Involvement

Getting the public and other organizations concerned with an area at an early stage in the design process can be beneficial to the project in the long-term. Support for initiatives is needed for funding and the overall success of the initiative. Other benefits include reduced implementation and labour costs "as well as increased awareness of the importance and fragility of ecological resources" (North Shore of Lake Superior Remedial Action Plans 1998).

3

HABITAT PROJECTS - DEMONSTRATING THE EFFECTIVENESS OF CONSERVATION DESIGN

This section of the report provides a detailed description of each of the four major habitat projects implemented at TTP and an evaluation of their progress in meeting their various objectives. The benefits of each is presented within the context of TTP and the Toronto and Region AOC. Although the same philosophy of conservation design was employed in all projects, the objectives of each differed depending upon the type of project and the specific area in which it was implemented. Thus, techniques for each project varied along with these objectives and their different target species.

3.1 EMBAYMENT B HABITAT CREATION AND ENHANCEMENT PROJECT

Project Description and Introduction

Following the approval of the TTP Master Plan and Environmental Assessment in 1995, initial habitat creation and restoration efforts were focused on Embayment B. Baseline aquatic monitoring activities within the embayment were undertaken during the summer and fall of 1995 to provide insight into the organisms utilizing the area and the quality of the sediments. These activities included:

- fish community monitoring through electrofishing;
- benthic invertebrate community analysis;
- intensive sediment sampling for quality analysis and identification of physical properties;
- sediment bioassays using midge larvae, burrowing mayfly nymphs and fathead minnows; and
- invertebrate tissue analysis.

Woody shoreline structure - Embayment B.

The results of the sediment monitoring in Embayment B indicated that the overall quality of the sediments within the project location were good.

In the fall of 1995, a vegetation survey (contracted to Gavin C. Miller, Ecological Restoration) was conducted along the shoreline of the embayment to identify any significant plant species and communities. Also, the existing bathymetry of Embayment B was surveyed through a series of depth soundings, and then was plotted (mapped) and used in the production of concept drawings and calculations of fill volume requirements.

A collaborative meeting between the TRCA (then the MTRCA) and representatives from local interest groups (Friends of the Spit and the University of Toronto Botany Conservation Group) was held in the fall of 1995 to discuss the design considerations and habitat features of the Embayment B project. A consensus was met concerning the inclusion and location of the specific habitat features designed for use in the project area. In addition, support was garnered relating to assistance with volunteer implementation activities, public awareness and the promotion of the Aquatic Plants Program through local schools. A meeting with the Toronto Port Authority was also undertaken to determine the availability of fill material, discuss the use of heavy equipment and address the logistics of bringing fill material to the project location. Based on the meeting, it was determined that fill could be made available through the existing lakefilling operations at TTP and arrangements were made regarding the contracting of grading and fill moving activities.

Project Design

Habitat designs were developed to ensure that the components of the Embayment B project fulfilled the goals and objectives for the Park's habitat projects. Planting plans were prepared which specified the location and extent of the various habitat components. The design was planned so that the function of each component would be enhanced by its proximity to other components. The habitat diversity needed to fulfill the objectives provides:

- important nursery areas for immature and juvenile individuals;
- reduction of predation through improvements in shelter;
- provision of high primary production;
- shelter from harsh (physical) conditions; and
- significant foraging areas

to the resident fish and wildlife communities.

In order to obtain the great degree of functional habitat diversity stated in the objectives, the following habitat components have been incorporated into the project design:

Barrier Beach: One of the major structural modifications to the embayment involved the creation of an artificial barrier across the back end of the bay. This barrier provides protection from wind and wave action as well as thermal protection from the inundation of cold water from Lake Ontario. This protection is beneficial to the fish habitat within the embayment and for the establishment of emergent vegetation.

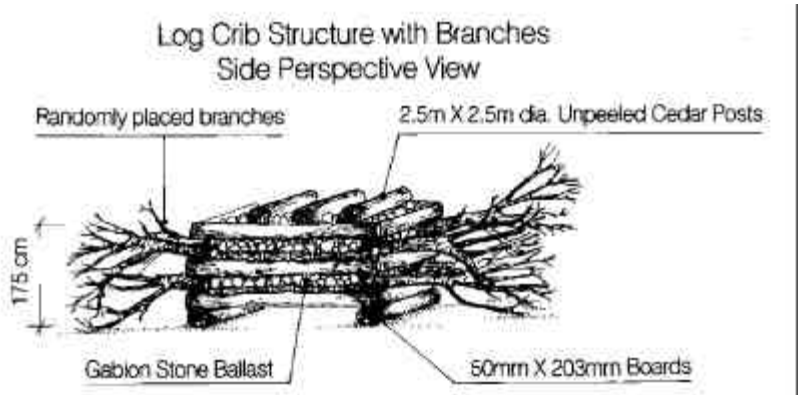
Vegetation Nodes: A variety of emergent, submergent and terrestrial wetland vegetation was established in key nodes within Embayment B. The site was inoculated with plant material through the use of seeds, cuttings, propagules, soil cores and transplants in order to encourage further establishment of the vegetated areas through natural succession.

Pike spawning channel.

Amphibian Ponds: Two small amphibian ponds were constructed at either end of the artificial barrier beach. The ponds were isolated from the lake and were provided with aquatic emergent vegetation and woody debris for shelter and basking opportunities. These ponds have been designed to provide breeding and hibernating locations for turtles, frogs and toads.

Pike Spawning Habitat: A series of channels were excavated into the existing shoreline and were connected to the protected portion of the embayment. The depth of the channels was designed to support emergent narrow leaf aquatic vegetation which, in turn, provides the preferred spawning habitat for northern pike.

Woody Structures: Woody material in the form of brush bundles, dead trees and stumps were utilized in both shallow and deep areas to provide structural habitat for warm water fish species. Those structures placed in shallow water are partially emergent and provide basking areas for turtles and protection for wave-exposed, vegetated shorelines.



Log Cribs: Additional structural fish habitat was provided in the form of submerged log cribs within the protected portion of the embayment. These cribs were filled with rubble and augmented with brush in order to provide shelter for a variety of warmwater fish species including largemouth bass and yellow perch.

Shoals/Reefs: Structural habitat was established by providing a diversity of substrate types and conditions. Aggregate material (rock, rubble, gravel) was strategically placed in a manner which promotes vertical relief, interstitial spaces and irregular outlines. Materials were placed on points and bars to mimic shoals, and within deeper water, as reefs.

Mudflats: Sand was imported into the embayment in order to decrease the water depth along the shoreline and to provide exposed sand and mudflats. These seasonally exposed areas provide critical foraging and stopover habitat for shorebirds during migration.

Project Highlights and Results

The benefits of the project have been and/or will be:

- An increase in the number/biomass of both adult and young-of-the-year piscivorous fish, avian fauna, and herptofauna;
- Increased public awareness and educational opportunities related to habitat enhancement techniques and the specific habitat requirements of fish/bird/herp species; and
- To foster ongoing partnerships with interest groups and agencies related to habitat management on the Toronto Waterfront.

Trees, Shrubs, and Aquatic Plants: Planting of trees, shrubs and aquatic plants was undertaken during the late spring, summer and fall of 1996 and 1997. To date, a total of approximately 1,600 aquatic plant plugs, 375 potted shrubs and 130 potted trees have been established in this habitat project. Planting activities have been undertaken by staff, summer experience program employees and volunteers. Tree and shrub species include eastern cottonwood, silver maple, white ash, red-osier dogwood, elderberry, staghorn sumac, pussy willow and highbush cranberry. Wetland plant species include cattails, softstem bulrush, blueflag iris, arrowhead, Joe-Pye weed and burreed.

Herptofauna: Reptiles and amphibians responded quite well to the habitat creation, and both American toads and green frogs successfully bred in the north pond in 1997. In addition, midland painted turtles were observed in this same pond the first year.

Fish Monitoring: During the 1995, 1996 and 1997 field seasons, fish were surveyed in and around Embayment B using electrofishing, seine netting and trap netting techniques. Overall these surveys identified an increase in both the species diversity and total biomass of fish within the embayment following the habitat enhancement. Species found include largemouth bass, yellow perch, northern pike, chinook salmon, and a variety of forage species. In addition, adult northern pike in spawning condition were found in the pike channels during the spring of 1997.

Bird Species: A variety of bird species has been observed using the Embayment B area for foraging and resting. Of particular interest is an increase in the number of shorebirds that have taken advantage of the exposed mudflats created through the project.

3.2 TERRESTRIAL HABITAT CREATION/ENHANCEMENT PROJECT

This project was designed to enhance and protect the significant habitat features that have previously evolved at the park, link habitat features through the creation of nodes and corridors, and evaluate specific soil conditioning techniques and land treatments for consideration during ongoing restoration activities at this site.

Project Description and Introduction

The Terrestrial Habitat Creation/Enhancement Project encompasses approximately 8 hectares of the recently lakefilled portion of TTP. Since these areas had been recently disturbed they exhibited various degrees of natural regeneration, from bare soil or rubble cover, to meadow/shrub communities, based on the type of surficial soil composition and the elapsed time since actual filling and grading. Actual soil types vary and include sand/silt, earth fill, brick and concrete rubble and asphalt. The rough and "unplanned" site grading has resulted in some unique habitat features such as seasonally flooded pools, mudflats, and meadow communities evolving on the existing landscape. These areas have become attractive habitats for a variety of shorebirds and waterfowl. The nature of the disturbed habitat at this site has made it attractive for nesting colonial waterbirds also. Colonization by ring-billed and herring gulls has been prevented as part of the annual Gull Control Program at TTP. However, small numbers of common terns have nested at the site in both 1994 and 1995. Tern nesting activities have been facilitated through modifications in gull control to minimize disturbances to nesting birds. Despite some of the "natural" features which have developed, much of the area required rehabilitation.

Terrestrial Habitat Creation/Enhancement Project, Phase 3 - Fall 1999

Terrestrial Habitat Creation/Enhancement Project, Phase 2 - Fall 1999

This site provided an excellent opportunity to undertake habitat creation and enhancement using techniques and principles that are consistent with the TTP Master Plan, and are in keeping with the unique characteristics of the park.

The Terrestrial Habitat Creation/Enhancement Project was divided into three phases of planning and implementation, due to the project area's large size. During the first phase (April 1996 - March 1997), following approval for the project from Environment Canada in August, detailed planning and design preparation commenced. A design workshop was held, hosted by the TRCA and involving representatives from various stakeholder groups, which focused on the design of the project in terms of desired habitat and community types and target and vegetation species selection. The development of design drawings and grading plans resulted from the workshop. Selection and delivery of the fill material needed for the project was completed by late December of 1996. Partial site preparation and grading of approximately one third of the total site was undertaken from mid-December through March 1997. Phases II and III involved the rest of the implementation of the project and are discussed below.

The purpose of the TTP Terrestrial Habitat Project is to create, enhance and rehabilitate terrestrial and aquatic habitats through a multi-year implementation program. The project has been designed to enhance and protect the significant habitat features that have previously evolved; link habitat features through the creation of nodes and corridors; and evaluate specific soil conditioning techniques and land treatments for consideration during ongoing restoration activities at this site.

Project Design

In order to achieve the goals and objectives of the project, a combination of habitat components was deployed in key locations on the completed (lakefilled) terrestrial lands at TTP which serve to maximize the diversity of habitats at localized sites, and ensure that each component complements the other in function and integrity. Due to the extensive size of the finished and unfinished portions of TTP, and the other associated natural and cultural features of the park itself, the establishment of habitat nodes was designed to complement the existing habitat function in this area as well as to integrate with other habitat restoration and enhancement projects at the site.

Landform and Drainage Design

A landform base structure was established that allows for a variety of plant and animal communities to evolve. Slopes vary depending on solar and wind orientation in order to obtain a variety of moisture, exposure and micro-climatic conditions. A variety of soil supplementation techniques was implemented, including the use of compost, imported topsoil/fill and ground cover treatments in order to achieve strategically designated areas of nutrient rich and poor soil conditions. Existing wet depressions were maintained. However, edges were altered and contoured to enhance diversity and function.

During Phase I, the topographical structure of approximately one third of the site was modified through strategic grading and filling operations. This has had the effect of increasing the diversity of the landform by enhancing micro-climatic conditions, providing variable slopes, exposures and moisture regimes. The second year (1997-98), Phase II, activities focused on developing the physical conditions (structure and landform) needed for the establishment of wetland and terrestrial vegetation and structural habitat components within the second third of the project area. Final grading and contouring of the remainder of the project area, including a continuation of the major east-west swale that will link various habitat features within the project area, was completed during Phase III (1998-99).

The aforementioned swale will ultimately function to connect (through protected vegetated and contoured habitat) the various seasonally flooded pools, and eventually, other adjacent habitat areas through culverts. This swale will provide approximately 2.1 hectares of additional riparian habitat at the site, and will function as an east-west habitat corridor. Grading of the swale has included a cut and fill operation designed to maximize surface drainage into this area and build up the ground elevation to the south in order to provide a visual barrier and vegetated buffer zone between the existing roadway and the seasonally flooded wet meadows closer to Lake Ontario.

Most of the grading and contouring undertaken during Phase III has been the result of a cut and fill operation. Any additional material required has been made available through the ongoing lakefilling activities at TTP. This material (which meets Ontario Ministry of the Environment open water fill quality guidelines) was stockpiled at the project location along with some purchased sand, gravel and rock. A variety of aggregates was used to diversify the soil types at the site in order to provide the foundation for a variety of vegetation communities.

In addition to the habitat swale, Phase III involved the construction of a small depressed wetland feature. This depression and surrounding drainage area was designed to function as a vegetated riparian "pot hole" that will seasonally hold water. Drainage was maximized from the surrounding area through extensive grading and the bottom of the depression was lined with approximately 0.5 m of clay.

Seasonally flooded pools totalling approximately 1.8 hectares were protected and enhanced in Phase II of the project. Due to the dry weather experienced during the summer and fall of 1997, there was very little water retention in these areas during that time. However, by the late winter/early spring of 1998, water had collected in all of these depressed areas, and it is clear that the water retention capabilities in these areas have not been effected by the heavy construction activities.

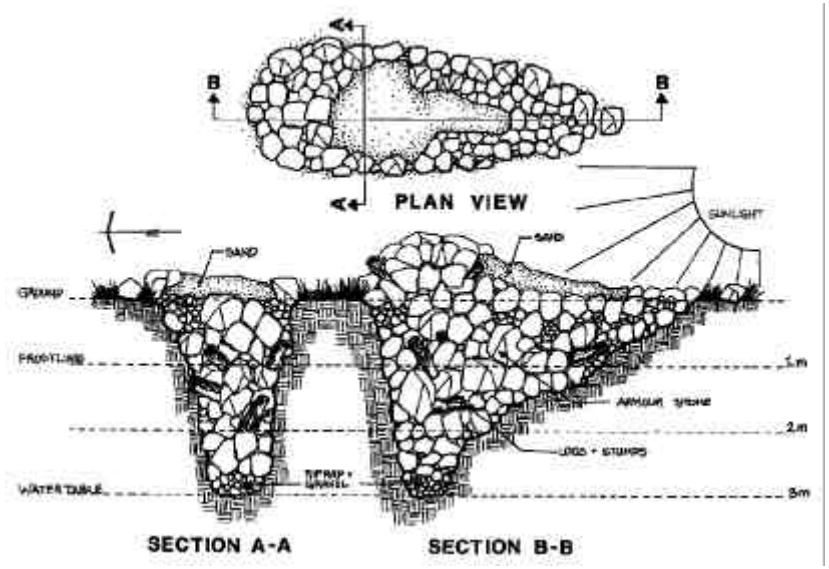
During all three phases of the project, heavy construction work was timed such that there was no impact on migratory shorebirds at TTP.

Habitat Structures

Structural habitat features were established by providing a diversity of soil types and conditions. Aggregate material (rock, rubble, gravel, sand and fill) was strategically placed in a manner that promotes relief, cover, and irregular outline. Woody material (brush bundles, log tangles, root wads) was utilized

Terrestrial Habitat Project - Snake Hibernaculum

Terrestrial Habitat Project - Rock/Rubble Habitat Structure.



in order to provide structural habitat for small mammal and herptofaunal species. These structures were also incorporated into shallow or seasonally flooded ponds in order to provide basking structures for turtles, cover and protection for amphibians and perching areas for birds.

The creation of several structural habitat features for terrestrial wildlife was undertaken in 1997. This included the creation of two snake hibernaculums and a larger above-ground rock pile to provide shelter for small mammals. In addition, sand was imported to the site and placed along several of the southwesterly exposed slopes and banks in order to provide basking locations for reptiles and possible nesting sites for turtles.

Large quantities of brush materials (roots and stumps) have been secured and delivered to the site. It is expected that this material will be installed at selected areas within the project site in 2000 with the assistance of summer staff.

Critical Habitat

Many wildlife species rely on specific habitat features for portions of their life cycles. Emphasis was placed on creating and enhancing this "critical habitat" by providing features and conditions that are required by wildlife species during their reproduction, rearing, overwintering, staging and migrating activities. Examples of these components include the creation of seasonally flooded and protected pools for amphibian reproduction, mudflat areas for migrating shorebirds, flat open areas for nesting colonial waterbirds, and sheltered thickets and den sites for over-wintering birds and mammals.

Coyote in newly planted trees in Phase 2 of the Terrestrial Habitat Project.

Target Species

At the present time TTP provides significant habitat for a large number of resident and migratory wildlife species. Although the specific habitat features and components are designed for multiple species benefit, the following wildlife species groups are targeted in this project:

Amphibians: Green frog, northern leopard frog, American toad

Reptiles: Common snapping turtle, midland painted turtle, map turtle, Blanding's turtle, eastern garter snake, northern red-belly snake, northern brown snake, milk snake, northern water snake

Birds: Migratory shorebirds, common terns, raptor species, migratory and resident songbirds

Mammals: Small rodents, cottontail rabbits and larger predatory mammals such as foxes and coyotes

Where possible, habitat conditions and features are provided for any regionally or provincially significant species, species at risk, threatened or endangered species. In cases where direct habitat cannot be provided for these species, they may benefit from the enhancement and creation of habitat specific to prey and forage species (i.e. peregrine falcons that migrate through TTP will benefit from any habitat for bird of prey species).

Vegetation Establishment

Planting plans and habitat designs outlining the location and extent of various habitat features were developed to ensure that the components of the habitat project fulfilled the project objectives. The designs were planned so that the function of each component is enhanced by the close proximity of another component.

Upon completion of the landform and drainage alteration, a variety of native terrestrial and wetland vegetation was established in key nodes and corridors. The site was "inoculated" with plant material through the use of seeds, cuttings, propagules, soil cores and transplants. Nucleation techniques were used in order to encourage further establishment of the vegetated areas through natural succession.

Maximum benefit to wildlife is achieved by selecting plant species and planting locations that provide valuable food and cover. Planting nodes were used to increase "edge" habitat wherever possible.

Project Highlights and Results

The environmental benefits of this project have been and/or will be:

- Creation and enhancement of approximately 8 hectares of terrestrial and wetland habitat;
- An increase in the number/biomass of both adult and young-of-the-year bird, mammal and herptofaunal species;
- Increased public awareness and educational opportunities related to habitat enhancement techniques and the specific habitat requirements of avian, mammal and herptofaunal species;
- Foster ongoing partnerships with interest groups and agencies related to habitat management on the Toronto Waterfront; and
- Technology transfer to other AOC's or areas within the Toronto Region.

Trees, Shrubs and Aquatic Plants: Extensive tree, shrub and aquatic vegetation planting was undertaken throughout the first 2/3 of the project site during Phase II of the project using a variety of techniques. A total of 600 bare root trees and 2,450 bare root shrubs were planted in the fall of 1997 by TRCA staff. Species were selected that were native to Ontario and previously indigenous to TTP and/or otherwise tolerant of the soil and fill conditions at the site. The species that were selected will provide both shelter and foraging opportunities for resident and migratory wildlife. It should be noted that all

plant species have been selected in consultation with stakeholders including the University of Toronto Botany Conservation Group. The following tree and shrub species were selected:

Eastern Cottonwood	Populus deltoides
Trembling Aspen	Populus tremuloides
Balsam Poplar	Populus balsamifera
Silver Maple	Acer saccharinum
White Ash	Fraxinus americana
White Elm	Ulmus americana
Nannyberry	Viburnum lentago
Alternate-leaved Dogwood	Cornus alternifolia
Red-osier Dogwood	Cornus stolonifera
Silky Dogwood	Cornus amomum
Common Elderberry	Sambucus canadensis
Virginia Creeper	Parthenocissus inserta
Staghorn Sumac	Rhus typhina
Serviceberry	Amelanchier spp.
Chokeberry	Aronia melanocarpa
Snowberry	Symphoricarpos albus
Speckled Alder	Alnus rugosa
Meadowsweet	Spirarea alba
Pussy Willow	Salix discolor
Sandbar Willow	Salix exigua
American Bittersweet	Celastrus scandens

Tree and shrub plantings were concentrated at the north side of the project site in order to provide a vegetated east-west corridor while maintaining the open meadow and seasonally flooded 'flats" to the south.

Transplants of aquatic emergent species including cattail and American bulrush were established in several locations in areas expected to be seasonally flooded. Aquatic plant material was also available as a result of the classroom Aquatic Plants Program, and in this respect a number of softstem bulrushes were planted.

An unexpected opportunity presented itself to transplant the majority of a native prairie and wildflower garden from a local (private) residential site. A total of three pick-up truck loads of plant material including little bluestem, big bluestem, black-eyed susan, Indian grass and skyblue aster were transplanted to the project site in late September. In this respect, we would like to acknowledge and thank Terry Fahey for the contribution of this plant material and for his assistance in transplanting it.

Prior to tree and shrub planting in the fall, much of the disturbed soil within the project area was hydro-seeded with an annual rye cover crop in order to stabilize the soil and provide a cover crop in the spring of 1998.

A major difference between Phase III and the previous work undertaken on this project was the augmentation of the soils with approximately 1,500 m3 of purchased topsoil. One of the goals of this project has been to evaluate specific soil conditioning techniques. Therefore, Phase III of the project was designed to provide a more nutrient rich foundation for vegetation establishment.

Due to the construction timing, trees and shrubs were not established in the Phase III area until the spring and fall of 1999. One hundred and forty five bareroot trees and 1025 bareroot shrubs were planted by TRCA staff. Species planted included; eastern cottonwood, trembling aspen, balsam poplar, green ash, nannyberry, alternate-leaved dogwood, gray dogwood, red-osier dogwood, silky dogwood, common elderberry, staghorn sumac, chokeberry, snowberry, meadowsweet and sandbar willow.

Monitoring: Monitoring activities related to the ongoing Terrestrial Habitat Creation/Enhancement Project commenced in 1997, but were limited to the collection of incidental wildlife observation data (from staff and the public via the TTP Wildlife Hotline) and breeding amphibian monitoring using call surveys. Monitoring of the Phase III site has not been undertaken in any detail yet since the habitat work has not been completed.

During the 1997 and 1998 seasons the following information related to wildlife response/activity was obtained through the monitoring efforts.

Herptofauna: Amphibian call counts were undertaken on three occasions during the months of April, May and early June. Surveys were conducted at night following the Long Point Bird Observatory (LPBO) protocol. Amphibians were not found breeding in this site during the spring of 1997 or 1998. This is being primarily attributed to the lack of water retention in these seasonally flooded pools during these years. Small numbers of American toads have previously been found breeding in this area.

Bird Species: This area continued to function as a migratory stop-over for shorebirds during the spring and late summer. Typically, concentrations of shorebirds can be found staging in this area in mid to late April during spring migration, and from late July to mid September during fall migration.

Species observed during the 1998 spring migration include dunlin, semipalmated sandpiper, least sandpiper, red knot, and greater yellowlegs. On May 17th 1998 a total of 43 short-billed dowitchers were observed, and two green-winged teal and two blue-winged teal were observed during the week of March 30th to April 3rd.

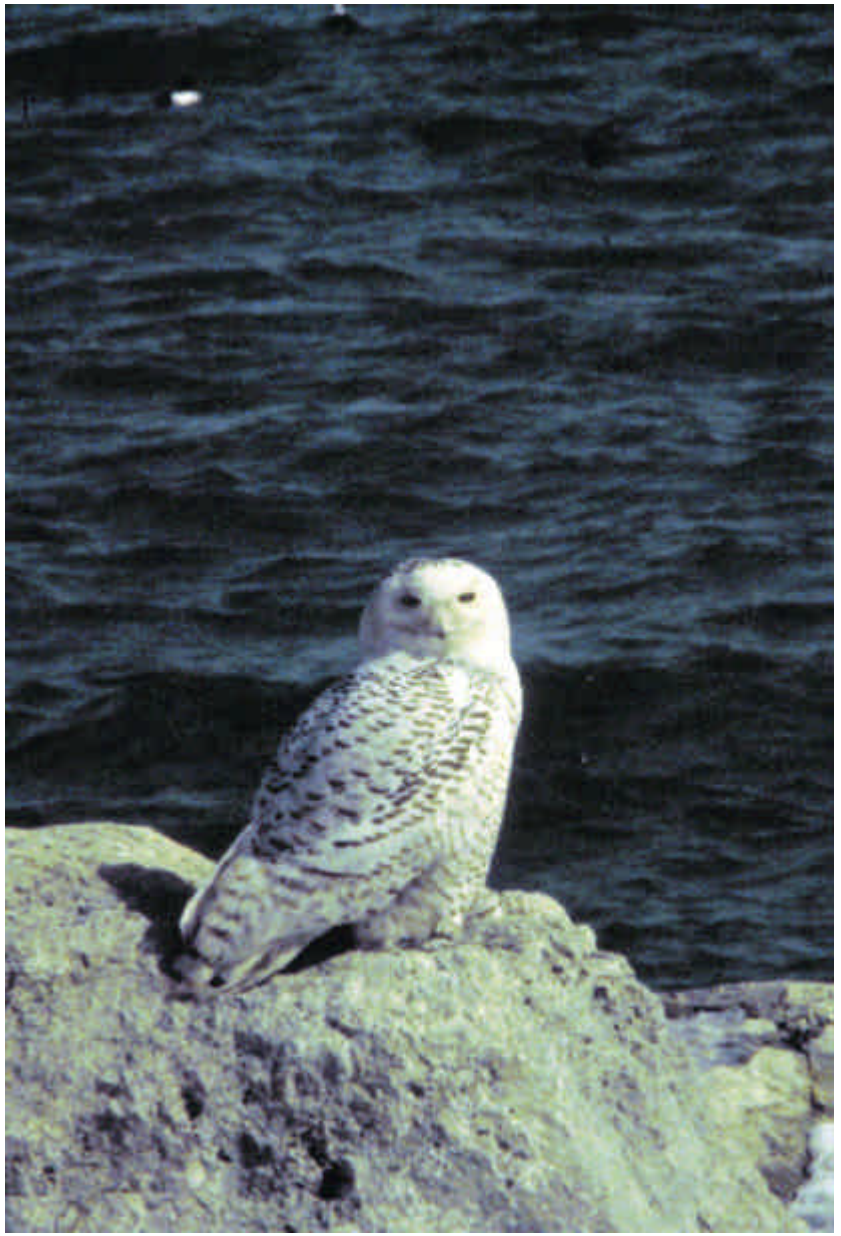
Fall shorebird migrants were observed starting as early as the middle of July, 1998 with small numbers of Baird's sandpiper, white-rumped sandpiper, and lesser yellowlegs being observed. These species along with Wilson's phalarope, spotted sandpiper, least sandpiper, semipalmated sandpiper, semipalmated plover, black-bellied plover and dunlin were observed throughout the remainder of the fall migration which ended by approximately mid September.

The only species found breeding within the project site was killdeer, with a single nest being found on April 25th.

Other bird species that were reported in this area during 1997/98 include: snowy owl, killdeer, northern mockingbird, ring-billed gull, great blue heron, Canada goose, mallard, gadwall, red-winged blackbird, common tern, American kestrel, and northern harrier. There was also a reported sighting of a Bullock's oriole. This observation has not been confirmed, however, this would represent a new species recorded at TTP.

Coyotes: This area is clearly well used by the resident coyotes at TTP. Evidence (tracks, scat, beds etc.) indicates that the area is frequently used for foraging and resting. Staff conducting the excavating and grading activities for the project reported observing coyotes in this area almost daily. Both adult and young coyotes have been observed throughout this site.

In 1999 amphibian monitoring continued using the LPBO Amphibian Monitoring Protocol, and incidental wildlife observations was done. A more detailed account of bird activity (migratory and breeding) within the project site and TTP was conducted by a community volunteer. Point count survey stations within the project site were used to monitor the performance of the habitat features constructed. In addition, vegetation establishment, succession and survival rates were monitored through observational data collection and point-in-time photography.



Snowy Owl on the Shore of Tommy Thompson Park.

3.3 EMBAYMENT C HABITAT ENHANCEMENT PROJECT

Project Description and Introduction

Approximately 100 hectares within TTP consists of embayments and disposal cells. These aquatic habitats exhibit various degrees of natural regeneration, but are limited by the physical structure of the basins. Establishing shorelines with emergent vegetation coupled with a strategic mosaic of critical habitat features and structures will improve the biodiversity and production of the fish and wildlife communities.

Embayment C is a sheltered warm water area that was created in 1975 by placing the spoils of hydraulic dredging activities in the Outer Harbour at TTP to form the peninsulas. This dredging left the aquatic habitat basically as a uniform basin with a predominantly sand substrate. The embayment had minimal shoreline diversification and structural aquatic habitat. The shoreline vegetation community was dominated by willow and totally devoid of emergent vegetation. The area matured over the years and a thin margin of submerged aquatic vegetation became established along the shoreline.

Pre-construction monitoring of Embayment C was completed in 1995 and 1996. Detailed first order surveys for the area were completed in 1996. Landscape plans for the construction of three points within the embayment were competed and endorsed by project partners and the Friends of the Spit by the end of November 1996, and permits were received from both the Ontario Ministry of Natural Resources and the Canadian Coast Guard.

This project involved the rehabilitation and enhancement of Embayment C at TTP in an area west of the channel. The Embayment C project followed a two phased approach. The first phase involved the modification of the shoreline by increasing structural diversity through strategic lakefilling which increased the diversity of the shoreline form. The shoreline modification aspects of Phase 1 laid the foundation for the implementation of the second phase activities. Phase II involved the inoculation of the area with appropriate wetland vegetation. Phase I was completed in 1996/97 followed by Phase II in 1997/98.

The purpose of this project was to provide areas along the shoreline that are conducive to wetland vegetation and diversify the amount of structural habitat along the shoreline and within the embayment.

Project Design

Site preparation and landform grading involved a combination of the use of heavy equipment currently on-site as part of the on-going lakefilling operations and the use of contracted heavy machines. Fill material used included material accepted as part of the lakefilling program and redirected to the project site, purchased sand and aggregate, compost, topsoil and woody (logs, stumps, etc.) material for use in the construction of habitat features.

Underwater Shoal in Embayment C.

Construction began in December 1996 (Phase I) and was completed January 1998 (Phase II). Construction activities during Phase I included the placement of sand fill in two of three proposed points within the embayment. Construction activities during Phase II saw the completion of the final third point. River stone and rock were placed along the most exposed portions of the points to protect and armour the points from erosion. Gravel was integrated into the design in order to diversify the bottom substrate and create gravel shoals (for bass spawning habitat). Large pieces of stone were strategically placed within the basin to create underwater reefs. In addition, vegetation was removed from portions of the shoreline (especially the nonindigenous purple loosestrife) and the existing grade was reduced in order to facilitate flooding and thereby maximize the amount of shoreline edge habitat.

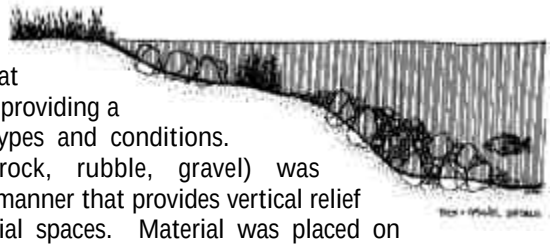
Once the structural enhancements were completed, the newly created points were inoculated with the appropriate wetland plant species. For the first two points, wetland plant establishment began in 1997. For the third point wetland plant establishment began in the summer of 1998. A list of wetland plant species was used to inoculate the third point. All the plant material listed has been supplied by the Royal Botanical Gardens, Burlington, Ontario and is considered native to the northwestern portion of Lake Ontario.

Wetland Plants Species Used to Inoculate Point Three, Embayment C, TTP.

Common Name	**Scientific Name**	**Number**
Arrowhead	*Sagittaira latifolia*	100
Blueflag Iris	*Iris versicolour*	100
Common Rush	*Juncus effusus*	100
Giant Burreed	*Sparganium eurycarpum*	1,260
River Bulrush	*Scirpus fluviatilis*	1,260
Cattail	*Typha x glauca*	1,260
	TOTAL	**4,080**

Specific activities designed to achieve our objectives are detailed below.

Structural Habitat



Aquatic structural habitat diversity was created by providing a diversity of substrate types and conditions. Aggregate material (rock, rubble, gravel) was strategically placed in a manner that provides vertical relief and maximizes interstitial spaces. Material was placed on points and bars to mimic shoals and in deeper water areas to mimic reefs. Woody material (brush bundles, root wads, and log cribs) was utilized in areas of deep water. These structures were also partially submerged and anchored

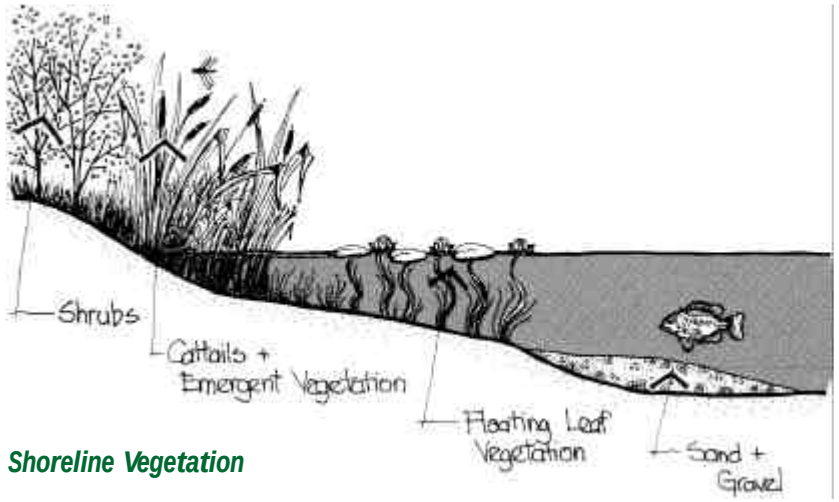
in areas of shallow and moderate depth in order to provide basking and loafing areas for turtles and waterfowl, and to provide additional protection for wave exposed vegetated shorelines.

Terrestrial structural habitat diversity was created through the deployment of woody material (brush bundles, log tangles, stumps) to provide cover and forage areas for both large and small mammals (cottontails, fox, coyotes and small rodents) and herptofaunal species.

Target Species

Native, resident, self-sustaining warmwater fish communities represent the primary target for the rehabilitation of aquatic habitats on the Toronto waterfront. Specific direction from the OMNR and RAP identify northern pike as the target species for restoration. This project creates a shoreline to support local northern pike populations through the provision of a seasonally flooded vegetated shoreline. Studies by the TRCA and OMNR have identified local spawning habitat as a limiting factor for northern pike reproduction on the Toronto waterfront, and at TTP specifically. Other warmwater species benefit from the proposed structural diversity which will increase the opportunities for bass spawning, and provide forage and resting areas for all life stages and species within the fish community.

Specific habitat components have been constructed for other target species, and include basking logs for turtles (midland painted turtles, common map turtles, snapping turtles and, potentially, Blanding's turtles), vernal pools for amphibians (American toad, green frog, leopard frog) and nesting rafts for common terns, if boating access can be controlled. As part of this project, the TRCA pursued options for exclusion of boats from this portion of Embayment C to further the development of wildlife habitat on the site.



Shoreline Vegetation

A variety of emergent, submergent and terrestrial vegetation was established in nodes along the project area shoreline within Embayment C. These nodes were protected as required through the use of woody material as a perimeter barrier to reduce excessive wave action. This not only protects initial plantings, but provides a mechanism for the entrapment of detritus for the development of appropriate wetland substrates. The site was inoculated with plant material through the use of seeds, cuttings, propagules and transplants. The use of nodal plantings assisted natural successional processes in the development of a wetland habitat feature along the shoreline.

Installation of bog mats 'with aquatic vegetation in Embayment C.

Project Highlights and Results

The final product of this project was the creation of a productive and diverse littoral habitat which will support and help sustain a healthy native fish and wildlife community, and be a milestone in the rehabilitation of lost and degraded coastal wetland habitat in the Toronto AOC.

The environmental benefits of this project have been and/or will be:

- The enhancement and rehabilitation of 0.5 km of riparian habitat and 2 hectares of wetland habitat. This project will have an impact on over 6.5 hectares of habitat within TTP.
- An increase in the abundance and richness of both adult and young-of-the-year piscivorous fish, herptofauna and avian fauna.
- Increased public awareness and educational opportunities related to habitat enhancement techniques and the specific habitat requirements of bird, mammal and herptofaunal species.
- Foster ongoing partnerships with interest groups and agencies related to habitat management on the Toronto waterfront.
- Technology transfer with other AOC's or areas within the Toronto Region.

Monitoring

Previous monitoring of TTP has included: vegetation mapping; fish, bird mammal and herptofaunal community monitoring; as well as water and sediment quality assessment; and has involved a standardized methodology including: resident and migratory bird census, amphibian call counts, small mammal trapping surveys, and vegetation quadrant surveys. This multi-year database will provide a baseline for assessing the wildlife community response to habitat enhancement projects through the ongoing monitoring of TTP.

The goals of the monitoring program will be to document plant and wildlife species response over time to the habitat features constructed as part of the project. Copies or summaries of monitoring reports will be forwarded to the Great Lakes 2000 Cleanup Fund with instructions to include in CEAA screening report update. Future monitoring of this project will be undertaken as part of the existing TTP Management Program and include:

- Electrofishing survey - annually
- Amphibian Monitoring - annually (April - June) using Marsh Monitoring Program protocol
- Vegetation Monitoring - Annually to evaluate plant survival, plant colonization and succession
- Breeding and migratory bird surveys

The guiding principal for all TRCA habitat creation and enhancement projects is the philosophy that the provision of diverse habitat will promote colonization by a diversity of wildlife species. The sustainability of native species populations are targeted through the construction of specific habitat features within this diversity matrix.

3.4 NATURAL RESOURCE AREA HABITAT ENHANCEMENT PROJECT

Project Description and Introduction

This project involves the enhancement and rehabilitation of the Environmental Management Area within TTP. Three separate sub-projects have been implemented within this area: Embayment C Pike Spawning Habitat Creation, Access Corridor Node Project and Triangle Pond Habitat Enhancement Project. Phase I of the Natural Area Habitat Enhancement Project at Tommy Thompson Park involved the enhancement of the habitat linkage along the narrow neck of the park (Access Corridor Node) and the creation of a series of pike spawning channels in Embayment C (1996/97). Phase II of the project has focused on the enhancement of a small pond (Triangle Pond) and surrounding terrestrial area that is centrally located within the park (1997 - 1999). A short description of each is presented below.

The overall goal of the Natural Resource Area Habitat Enhancement Project is: *To create a diverse and ecologically stable natural resource along the Toronto Region waterfront, specifically within the Natural Resource Area of TTP, through the use of conservation design principles and the implementation of specific habitat components.*

Access corridor node during construction April 1997.

Access corridor node after planting in the summer of 1997.

Access corridor node Fall 1997.

3.5 Access Corridor Node Project

The Access Corridor Node Project site is located on the narrow neck of TTP between the baselands and the endikement and peninsulas. The site is situated on the western side of the spit directly across from the Outer Harbour Marina between the access road and the water. This site was formerly used as a turning and oil change area for the trucks involved in lakefilling activities.

The Access Corridor Node Project design was completed and endorsed by project partners and Friends of the Spit in January, 1996. Structural alteration for this project began in March, 1997 and was completed by April. Throughout the summer months, the area was "greened up" using wetland plant material and a variety of terrestrial shrubs, trees and wildflowers.

Through natural succession, areas of TTP are providing habitats for a diverse array of fish and wildlife. Access to these critical habitats can be a life or death experience for wildlife. They must travel through terrain that is more suitable to humans than to terrestrial wildlife. The purpose of this project is to provide linkages between critical habitat areas, provide improved access to these areas from the base of TTP and to enhance the habitat quality within these areas.

The purpose of this project is: To provide linkages of wildlife habitats from the baselands of TTP to habitats located out on the spit through the creation of a suitable, sheltered habitat corridor.

With the completion of the Access Corridor Node structural component, the area has been removed from use by the construction trucks entering TTP. The planting of the area was completed in year 2.

3.6 Embayment C Pike Spawning Habitat Creation

The project area is located on the eastern shoreline of Embayment C north of the channel into Cell 3. Before habitat creation, this site was basically a shallow, sandy area severely lacking in suitable fish habitat.

Detailed plans for the construction of a northern pike spawning area were completed and endorsed by project partners and the Friends of the Spit by the end of December, 1996. Construction began in February, 1997 and was completed by the end of the first week of April.

The purpose of this project is: To create functional northern pike spawning habitat through structural habitat diversity.

The pike spawning channels were dug out similarly to those created in Embayment B. However, these channels have never been planted with aquatic vegetation. It was originally planned that two different methods of planting were to be examined: transplanting of live plants and planting of Bogmats. Bogmats are 3 x 5 foot bioengineering media that allow for live plant growth within their coir fibre matrix. The sandy nature of the project site would make planting difficult in this erosion susceptible area. Also, carp and other predators graze the new plants, often digesting their root systems. The Bogmat technology would allow us to plant "carpets" of vegetation, thereby reducing the risk of erosion and providing a barrier to root grazing of the plants.

A northern pike spawning area of approximately one hectare has been created. Although the area was never vegetated, pike were observed in the channels and were caught in spawning condition near the channels during the spring of 1998.

Triangle Pond prior to construction.

3.7 Triangle Pond Habitat Enhancement Project

Project Description and Introduction

Triangle Pond is a small waterbody (0.8 hectares) centrally located within the park that was originally used to dispose of contaminated sediments collected through dredging activities. Before implementation of this project, the pond was featureless with uniform abrupt edges and little in-water or shoreline cover. The pond had a maximum depth of 3.5 metres and supported few emergent and submergent plant species due to this depth and the high degree of turbidity.

Pre-design monitoring was conducted in 1996 to assess existing conditions and included sediment quality, algal community and fish community surveys. The conclusions of this monitoring are summarized below.

Sediment quality

Lead and iron concentrations found in the pond exceeded the Severe Effect Limit. They are considered to be highly toxic and have a significantly higher probability of uptake within the benthic biological community. Oil and grease exceeded the open water guidelines (0.15%) at two stations. Based on these results, the sediment within Triangle Pond will require remediation prior to any habitat enhancement.

Triangle Pond after construction - Spring 1999.

Triangle Pond after first summer growing season - Fall 1999.

Algal community (Primary contributor: Dan Olding, BSc)

Any management plan for Triangle Pond should make provisions for controlling the population of undesirable algal taxa. The abundance of undesirable algae can have profound effects on a system, ranging from aesthetic perceptions to ecosystem impairment. Enhancement efforts involving the augmentation of the natural system within Triangle Pond, will be able to contribute to the management of undesirable algae. Two recommendations for enhancement are: 1) reduction of the depth of the water column, and 2) management of the macrophyte and fish communities to favour zooplankton algal grazers. The reduction in depth of the system should be able to reduce or eliminate mid-summer anoxia and the associated internal loading of nutrients from the sediment to the water column. The decrease in depth will also likely further shift the phytoplankton community from potential bloom forming filamentous blue-greens to more edible green algae.

Fish and Wildlife Community

Triangle Pond was electrofished using a Backpack Electrofisher. The following species of fish were found: common carp, goldfish, and blacknose dace. All the fish in the pond were considered to be stunted in their growth.

The pond is not connected directly to Lake Ontario. Therefore, any fish found in the system have been deposited there by assisted means such as on the feet of birds or by humans.

A number of wildlife sightings have been reported for the Triangle Pond area. In summary, in the pond: 23 bird species, 6 herptile species and 1 mammal species have been observed. Around the pond: 14 bird species, 3 herptile species and 7 mammal species have been seen.

In general the Triangle Pond has functioned as a foraging area for wading birds (herons), belted kingfishers and common terns. The majority of the birds observed in the pond were waterfowl (swans, geese and ducks) that utilize the pond for resting and foraging. Several birds including Canada goose, mallard, red-winged black bird and killdeer have been found nesting at the edge of the pond.

The purpose of this project is: To enhance and diversify the terrestrial and aquatic habitats of Triangle Pond through conservation design and the implementation of specific habitat components.

In order to achieve this goal, a number of objectives must be fulfilled:

- Increase the emergent and submergent vegetation zones within the pond body by altering the bathymetry, expanding the surface area and diversifying the substrates.

- Provide structural habitat within the shallow water zone for basking structures for turtles, cover and protection for amphibians and perching areas for birds. Utilize woody material (brush bundles, log tangles, root woads) within the terrestrial habitat surrounding the pond to provide structural habitat for small mammals and herptofaunal species.

- Remove and reduce the extent of invasive vegetation (purple loosestrife) that currently surrounds the perimeter of the pond.

- Maintain and supplement the existing woody vegetation along portions of the perimeter of the pond area and increase the diversity of riparian vegetation. Establish an emergent wetland plant community within the shallow water zone.

- Create functional habitat corridors to link this project area with other existing habitat features in the Park and to other nearby creation and enhancement initiatives.

- Inform and involve public interest groups and the private sector on methods which conserve, restore, and develop fish and wildlife habitat; and coordinate habitat rehabilitation with other organizations using a cooperative approach and inter-agency partnerships.

Project Design

The techniques used to enhance the pond include diversification of grading and bathymetry, as well as wetland and riparian vegetation and the establishment of critical habitat features for target wildlife species.

Site Grading and Bathymetry

Morphology is the driving force behind community establishment. Site grading, including topography and bathymetry, will influence the characteristics of drainage, protection and vegetation. Substrate type and moisture content will control the establishment of upland and wetland vegetation communities. Alteration to morphology will be directed at providing topography, bathymetry and substrates that will support herptiles, resident and migratory bird species, small mammals and warmwater fish species (e.g., minnows).

Through this project, the bathymetry of the pond was altered to provide a permanent pool depth of approximately 2 metres and an average depth of approximately one metre. The project was designed to provide the conditions suitable for the establishment of a hemi-marsh with an approximate ratio of 50% open water to 50% emergent vegetation.

Previous testing of the soil quality at TTP indicated that the majority of the site does not exceed parkland contamination guidelines. However, testing of the sediments within Triangle Pond indicated an excess of the Severe Affect Limit of the MOE Sediment Quality Guidelines in lead and iron. In order to prevent bioaccumulation, the design incorporated a clean fill cap (sand and fill) placed on top of the affected sediments from depths of 50 cm (minimum) to approximately 3.0 metres.

To achieve the desired habitat features, the pond was initially dewatered using a gas powered pump that operated for several days. Surplus water was pumped into the adjacent Cell 3 Contaminated Dredgeate Facility. Fish and any reptiles found stranded in shallow pools as a result of the dewatering process were removed and released into the nearby cell and embayment areas. Once the pond was dewatered the surrounding area was re-graded and contoured in order to enlarge the overall basin or "footprint" of the pond/wetland complex, and to maximize surface drainage into the wetland.

The surplus fill was placed into the pond using an excavator and bulldozer in order to reduce the overall depth and encapsulate the exposed contaminated sediments within the pond. Additional material in the form of purchased sand

and fill brought to the site through the regular lakefilling operations at TTP were also used to cap the pond sediments, alter the bathymetry and diversify the substrates within the project site.

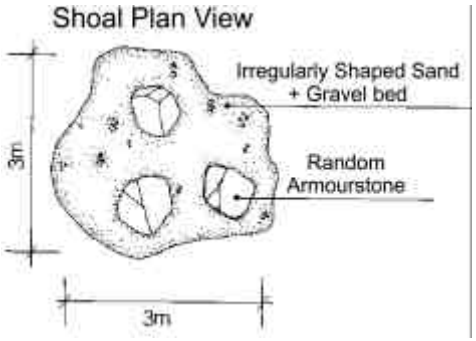
Due to the unstable consistency of the bottom sediments within the pond, all of the heavy equipment construction was undertaken from the periphery of the pond or on a base of imported fill sufficient to support the weight of the machines. Throughout much of the capping component of the project, this required that considerably more fill (2 to 4 metres depth) be placed on the pond sediments. Most of the final contouring and shaping of the wetland design was achieved through selective removal of and replacement of the thick fill cap in order to produce the desired deep pockets and islands, after the initial capping of the pond sediment had been completed.

In one instance, a dump truck equipped with a conveyor belt (stone slinger) was used to deploy clean sand over a portion of the bottom sediment that could not be reached from the edge of the pond. In this case, the slinger was able to throw and spread the sand at a greater distance than could be reached with the excavator.

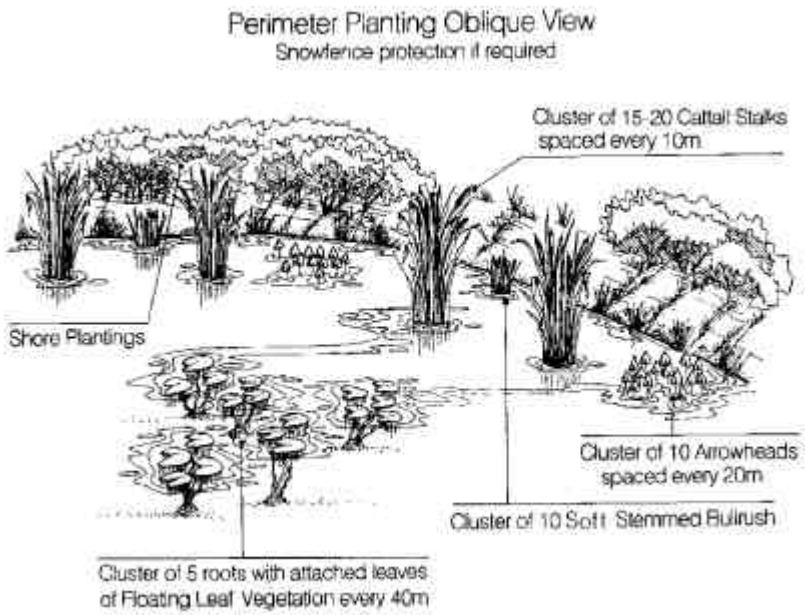
Similarly to other habitat projects at TTP, the construction activities were suspended during the summer and early fall in order to reduce the impact on migratory shorebirds.

Structural Habitat

Structural habitat enhancements provide important basking, feeding, protection and nursery areas for both terrestrial and aquatic wildlife. A number of structural habitat elements have been incorporated into the project to date including: 26 rocks or rock clusters, 39 stumps and 4 upright tree stems to provide perching sites. A variety of aggregate and substrate types were used in the project including rubble, gravel and sand.



Additional structures in the form of brush bundles, floating basking logs, fallen trees and nesting boxes were constructed and installed during the 1999 field season.



Vegetation Establishment: Wetland Plant Community

The TRCA diversified the shoreline of Triangle Pond using a variety of suitable aquatic plants including soft stem bulrush (*Scirpus validus*), cattail (*Typha sp*), giant burreed (*Sparganium eurycarpon*), and arrowhead (*Sagittaria latifolia*). Emphasis was placed on establishing a balanced community. Techniques for collecting and transplanting wetland plant material included or will include Bogmats, nursery grown stock, salvage material and the Aquatic Plants Program.

Due to the timing of the approval and construction activities, the actual wetland planting did not take place until the spring and summer of 1999. The selection of appropriate plant material was based upon community compositions presently existing within TTP and along the north shore of Lake Ontario especially along the Toronto shoreline.

Vegetation Establishment: Riparian Vegetation Community

Edge areas of the Triangle Pond have been enhanced using native plant material. Shrub species selected provide maximum forage, shelter and nesting habitats for migratory and resident bird species and small mammals.

A number of planting beds have been prepared to a depth of approximately one half metre using purchased topsoil. Soil conditions vary throughout the remainder of the project site in order to provide a diversity of nutrient rich and poor soil conditions, which in turn will promote vegetative regeneration of a diversity of plant material.

A total of 100 bare root trees and 770 bare root shrubs were planted by TRCA staff in the spring of 1999. Species were selected that were native to Ontario, and previously indigenous to Tommy Thompson Park and/or otherwise tolerant of the soil and fill conditions at the site. Species were selected that provide both shelter and forage opportunities for resident and migratory wildlife.

The following native tree and shrub species planted:

Eastern Cottonwood	*Populus deltoides*
Trembling Aspen	*Populus tremuloides*
Balsam Poplar	*Populus balsamifera*
Silver Maple	*Acer saccharinum*
Green Ash	*Fraxinus pennsylvanica*
White Elm	*Ulmus americana*
Nannyberry	*Viburnum lentago*
Alternate-leaved Dogwood	*Cornus alternifolia*
Gray Dogwood	*Corna racemosa*
Red-osier Dogwood	*Cornus stolonifera*
Silky Dogwood	*Cornus amomum*
Black Elderberry	*Sambucus canadensis*
Staghorn Sumac	*Rhus typhina*
Chokeberry	*Aronia melanocarpa*
Snowberry	*Symphoricarpos albus*
Speckled Alder	*Alnus rugosa*
Meadowsweet	*Spirarea alba*
Pussy Willow	*Salix discolor*
Sandbar Willow	*Salix exigua*
American Bittersweet	*Celastrus scandens*

In addition to tree and shrub planting in the spring, the disturbed soil within the project area was seeded with a wetland seed mixture in the wetter areas, and meadow wildflower mixture in the remaining areas.

Project Highlights and Results

The environmental benefits of this project have been and/or will be:

- An increase in the number/biomass of both adult and young-of-the-year herptofauna, avifauna, bait fish and small mammals.
- An increase in the forage base for predatory species at risk such as black-crown night heron and long-eared owl.
- Increased public awareness and educational opportunities related to habitat enhancement techniques and the specific habitat requirements of herp/bird/small mammal species.
- Foster ongoing partnerships with interest groups and agencies related to habitat management on the Toronto waterfront.

Most of the loosestrife that formerly surrounded the Triangle Pond was removed during the regrading and alteration of the shoreline. By eradicating this area of purple loosestrife and establishing native plant material, a system more attractive to native fish and wildlife will be created. The occurrence of loosestrife will continue to be monitored at this location in order to determine the need for a release of European beetle, to further control this species.

As part of this project a detailed post-construction monitoring protocol has been developed that will:

- evaluate the effectiveness of the "cap" in removing contaminated sediments from the ecosystem;
- monitor the overall health of the habitat; and
- evaluate the biotic response to the habitat modifications.

Monitoring will continue in 2000 and will include amphibian monitoring using the Long Point Bird Observatory (Bird Studies Canada) Amphibian Monitoring Protocol, and incidental wildlife observations. A more detailed account of bird activity (migratory and breeding) within the project site and TTP as a whole will be documented in the near future. This will include the establishment of a series of transects and point count survey stations within the project site to be used to monitor the performance of the habitat features constructed. In addition, vegetation establishment, succession and survival rates will be monitored through observational data collection and point-in-time photography.

Other achievements of the Triangle Pond Habitat Enhancement Project were:

- Reduced average water depth within the pond to eliminate anoxic conditions.
- Purple loosestrife initially removed from pond edge through grading activities.
- Structural habitat features created within the wetland including 26 rocks or rock clusters, 39 stumps/root wads, and, 4 upright tree stems to provide perching sites.
- Imported 700 m3 of topsoil to augment the soil quality in designated planting areas.
- Provided turtle nesting areas (sandy banks) on the southwest exposed slopes.
- As-built (updated) GPS survey of wetland footprint including structural habitat features for use in future.
- Five lookout points were created around the edge of the wetland area to encourage public viewing of the project.
- Of special interest was the observation of a black-necked stilt foraging around the partially completed pond edge on May 31st, 1998. This represents the first record of this species in the Toronto area.

4 CONCLUSION

The four habitat creation/enhancement projects described within this report are examples of the successful implementation of conservation design principles in practical work. These projects also benefitted greatly from the input obtained through public consultations with interest groups and other stakeholders. As can be seen in the case study descriptions, each project strived to obtain multiple objectives and targeted a large variety of species. As such, the diversity of organisms at Tommy Thompson Park has, and will continue to increase into the future. The creation of new habitats has made the park the premiere waterfront area to view wildlife in the city of Toronto.

The habitat projects implemented at TTP are also contributing to the overall goal of a healthy environment for the Toronto area. In this way, the Toronto and Region RAP is closer than ever to being delisted as an AOC. New recreational opportunities have become available at TTP and the Toronto waterfront may become a prime location for the production of northern pike. More recreational and educational opportunities will arise in the future when the infrastructure plans for TTP are implemented and paths and interpretive trails are built.

Others involved in habitat creation and enhancement projects can benefit from the examples set by TTP. Through the conservation design process, TTP has become a diverse and prolific ecosystem in which an abundance of fish and wildlife survive. This ecosystem will keep diversifying and sustaining organisms, and providing recreational opportunities for humans for many years to come.

References

Fenco MacLaren Inc., Shoreplan Engineering Ltd., EDA Collaborative Inc., Tarandus Associates Ltd., and Ecorp Inc. 1995. Integrated Shoreline Management Plan - Tommy Thompson Park to Frenchman's Bay, Phase 1: Characterization of the Shoreline Ecosystem. MTRCA.

Kehm, W. H. 1988. Tommy Thompson Park: Wetlands Development and Landscape Restoration. In Wetlands: Inertia or Momentum. Conference Proceedings. M. J. Bardecki and N. Patterson Editors. Federation of Ontario Naturalists and Ryerson Polytechnical Institute.

Metropolitan Toronto and Region Conservation Authority. 1982. Environmentally Significant Areas Study(ESA No. 120, Tommy Thompson Park). MTRCA, Toronto.

Metropolitan Toronto and Region Conservation Authority. 1989. Tommy Thompson Park Master Plan and Environmental Assessment. MTRCA.

Metropolitan Toronto and Region Conservation Authority. 1992. Tommy Thompson Park Master Plan and Environmental Assessment Addendum. MTRCA.

Metropolitan Toronto and Region Conservation Authority. 1993. Environmentally Significant Areas Criteria. MTRCA

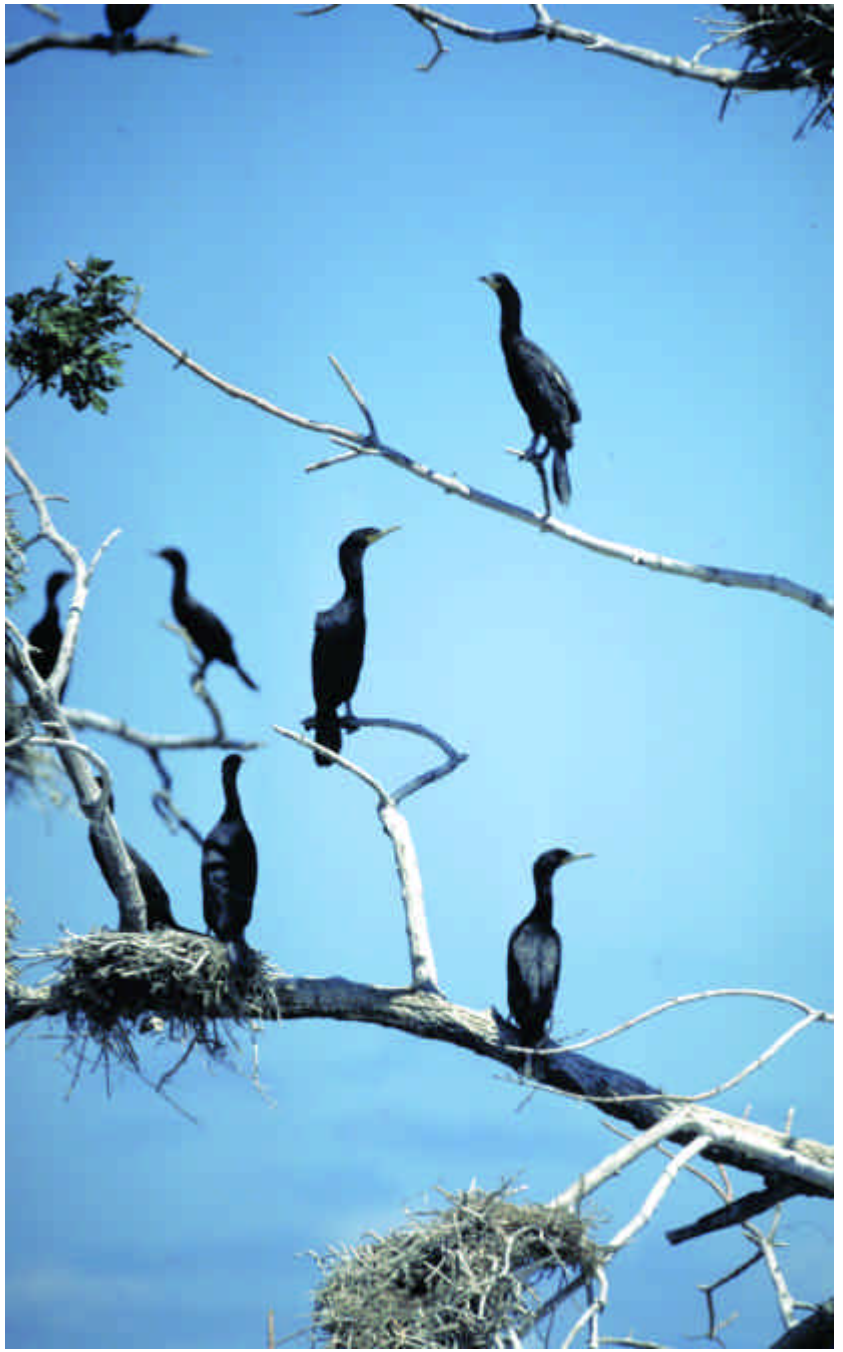
Metro Toronto and Region Remedial Action Plan. 1994. Clean Waters, Clear Choices - Recommendations for Action.

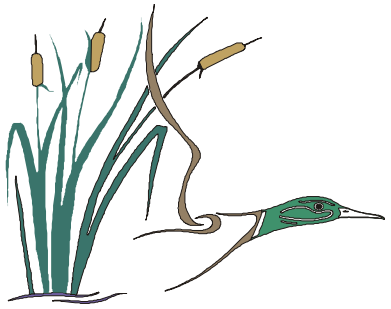
North Shore of Lake Superior Remedial Action Plans and Schollen & Company Inc. 1998. Achieving Integrated Habitat Enhancement Objectives, A Technical Manual. 51 pp.

Parkinson, D., L. Heyming and M. Chase. 1994. Littoral Zone Habitat - Tommy Thompson Park to Carruthers Creek "A GIS Perspective." Metropolitan Toronto and Region Conservation Authority.

Struss, R. H., I. D. Buchanan and C. T. Rance. 1993. Metro Toronto Waterfront Aquatic Habitat Rehabilitation. Ontario Ministry of Natural Resources.

Long Point Bird Observatory and Environment Canada, 1996. Marsh Monitoring Program - Training Kit and Instructions for Surveying Marsh Birds, Amphibians and their habitats. 1996 Revised Edition. Long Point Bird Observatory. Port Rowan. 40pp.





Tommy Thompson Park

PUBLIC URBAN WILDERNESS

Habitat Creation and Enhancement Projects
1995 - 2000

Conservation TORONTO AND REGION

TORONTO

Environment Canada Environnement Canada
GREAT LAKES 2000 CLEANUP FUND
FONDS D'ASSAINISSEMENT DES GRANDS LACS 2000

ONTARIO Great Lakes RENEWAL FOUNDATION