PENETANGUISHENE HARBOUR SHORE HABITAT RESTORATION & MONITORING

Stephan Crispin (presenter) **and James Dougan**

Dougan & Associates (D&A), Ecological Consulting Services, Guelph, Ontario

Cameron Portt

C. Portt & Associates, Fisheries Biologists, Guelph, Ontario

Carol Dimock and Keith Sherman

Severn Sound Remedial Action Plan (SSRAP), Midland, Ontario

ABSTRACT

The Severn Sound Remedial Action Plan (SSRAP) identified degraded fish habitat in Penetang Bay in an area with submerged wood waste from historic lumber industry activities. The adjoining shoreline park is a groundwater discharge zone which was land-filled. The Town of Penetanguishene, in partnership with SSRAP and Great Lakes Cleanup Fund, executed a plan to remove the wood and restore shoreline wetlands.

The wetland project included a public process, assessment of reference wetlands in the Bay, and detailed on-site analysis. Objectives included habitat restoration, enhanced water quality, control of Canada geese, reduced park maintenance and public education. Public participation in wetland restoration and maintenance was a priority.

In 1994, 4000 cu m of wood waste was removed and 4 ha of fish habitat restored. In 1995, two ha of shoreline parkland was excavated to create two wetlands above the high water level of the bay. Wetland seed bank was stockpiled and re-used in the restored wetlands. Fish and wildlife habitat was created incorporating spring flows, seepage zones and graded micro-channels. Upland berms were created around the wetlands. The Town and local service groups donated materials and labour for construction. Land-filled debris was removed for re-use or disposal. Naturalists and students participated in the re-planting of the site with salvaged wetland plants and seed of native shoreline species.

Young-of-the-year brook trout were identified in one of the wetlands in 1996. Ongoing habitat monitoring includes annual species checklisting, and photo-monitoring of successional growth. To date 218 plant species have been recorded; 68% of these being native.

Introduction

Penetanguishene Harbour is located on the south end of Penetang Bay in Severn Sound on Lake Huron, part of the Great Lakes ecosytem (Figure 1). Harbourfront wetlands were originally impacted by sawmill operations between 1870 and 1960, and by landfilling in the 1970's. Shoreline development around Penetang Bay resulted in additional loss of wetlands and fish habitat, and aerial surveys in the late 1980's concluded that about 68% of the historic wetlands around the Bay had been lost. This affected fisheries reliant on coastal wetlands for

spawning and nursery habitat, including northern pike and muskellenge. Algal growth resulting from nutrient enrichment was also identified as a key problem in the Bay (SSRAP 1994).

Severn Sound is one of 42 Areas of Concern on the Great Lakes identified by the International Joint Commission (IJC). The Severn Sound Remedial Action Plan (SSRAP) is a locally-based organization which was formed with federal and provincial support to co-ordinate the remediation of degraded habitats and water quality in Severn Sound. As part of broader scale documentation of problems in Severn Sound, the Interim Fish Habitat Management Plan for SSRAP identified the shoreline at the south end of Penetanguishene Harbour as a potential fish habitat restoration site. Under the co-ordination of SSRAP staff (Keith Sherman and Carol Dimock) financial and in-kind support was obtained from the Great Lakes Clean-up Fund, Town of Penetanguishene, Ontario Ministries of Natural Resources and Environment and Energy, and several community groups (Rotary Club of Penetanguishene, Le Caron and Penetanguishene Secondary Schools, Seniors for Wye Marsh, and other community volunteers) to pursue habitat restoration on this site.

In 1994, Stephan Crispin (landscape architectural intern) and Jim Dougan (ecologist) with Dougan and Associates (D&A), as well as Cameron Portt, fisheries consultant with C. Portt and Associates, were retained by SSRAP and the Town to provide expertise and design for the shore zone clean-up and shore habitat restoration project. In the following paper, the steps to complete this task are described, and available monitoring results are presented. This paper is being presented by Stephan Crispin, B.L.A., from the perspective of his role in the preliminary design studies, public consultation, detailed design and construction supervision for the habitat restoration work. The emphasis of the paper will be primarily on the design issues, construction approach, and lessons that were learned from this habitat restoration project.

1. Background

The lumber industry developed during the 1870's in Penetang Bay and remained active until the 1960's (Bayfield and Gerow 1982). Although it was evident that this industry deposited considerable wood waste in the harbour, the full extent of the deposits were not revealed until 1992 when the lake level dropped by more than a meter for several hours during a seiche event. At that point it was discovered that several hectares of the harbour were occupied by wood waste ranging in size from small lath to substantial sawlogs. This event clarified a 1989 assessment of fish habitat in the Bay which identified virtual absence of submerged aquatic vegetation in the harbour area, representing a severe limitation to the local shore fishery. Boreholes drilled through the harbour ice in the winter of 1993-94 were used to characterize the extent and depth of wood debris.

Historically, wetland cover lined the harbourfront from the Town dock around the base of the Bay, dependent on extensive groundwater seepage along the shore. In the 1970's, wetland areas which had not been destroyed by the lumber mills was buried beneath broken fill, concrete, boulders and asphalt, and converted into a manicured park by the Town. A limited amount of wetland (marsh and shrub thickets) persisted at the mouth of Copeland Creek, a coldwater stream that enters the harbour just west of the Town park, but this area has been encroached upon by marina development.

Following the landfilling and park creation, groundwater discharge created ongoing difficulties for park management and pedestrian trails. Attempts to improve drainage included the installation of weeping tiles, french drains and channels across the park; these measures were largely unsuccessful. The extent of perennial groundwater discharge was sufficient to sustain several small channels across the park and brook trout were observed in one such channel in the spring of 1995.

In addition to the wet soil conditions, the manicured turf in the park had proven increasingly attractive to Canada Geese (*Branta canadensis*). The geese congregate near the park beach, and there were concerns from park users over the presence of droppings from the geese in this area.

2. Assessment of Existing Biological Conditions

Seasonal studies of remnant wetland pockets and surveys of seepage characteristics on the park site were conducted in 1994 and 1995 by D&A. Areas of the harbour where significant woody debris had been deposited were found to be devoid of submergent vegetation, and therefore of minimal value as fish habitat. Aquatic vegetation in the surrounding areas consisted of submergent species, including tape grass (*Vallisneria americana*), water-weed (*Elodea canadensis*), and pond weed (*Potamogeton* spp.). Fish sampling carried out in 1989 by seining at a site south of the area of maximum wood waste, recorded a total of 13 fish species (Table 1). Bird use of the Harbour was previously documented by SSRAP and the Canadian Wildlife Service, and was assessed again in 1995 by personnel from the Long Point Bird Observatory (Chabot and McCracken 1997).

COMMON NAME	SCIENTIFIC NAME	COMMON NAME	SCIENTIFIC NAME
Carp	*Cyprinis carpio*	brook stickleback	*Culaea inconstans*
Blackchin shiner	*Notropis heterodon*	trout perch	*Percopsis omiscomaycus*
Sand shiner	*Notropis stramineus*	Pumpkinseed	*Lepomis gibbosus*
Bluntnose minnow	*Pimephales notatus*	Largemouth bass	*Micropterus salmoides*
White sucker	*Catostomus commersoni*	johnny darter	*Etheostoma nigrum*
Banded killifish	*Fundulus diaphanus*	yellow perch	*Perca flavescens*
3-spine stickleback	*Gasterosteus aculeatus*		

Table 1. Fish species recorded in the Penetang Harbour between July 19 and August 29, 1989 (with permission from C. Portt).

Within the Town park, typical shoreline wetland species were prevalent within the mowed turf cover. In one area of the park, mowing was abandoned as soils were too saturated to permit entry by mowers. Along the harbour shoreline, quality marsh indicator species persisted despite repeated attempts to replace them with turf cover.

3. Review of Reference Sites

In 1994 we examined six wetland areas with marsh, thicket swamp and fen cover located in other areas of Penetang Bay as potential reference systems for the habitat restoration design. Fisheries data collected by C. Portt in 1989, 1992, and 1993 was reviewed to select potential sites for typical plant communities to identify comparable habitat conditions. Based on these surveys, a shoreline fen system was identified approximately 4 km north of the harbour which exhibited a similar range of groundwater discharge, inundation characteristics and plant cover comparable to the original shoreline cover in the Harbour. Wetlands located on Copeland Creek (adjacent to the Town park) also exhibited groundwater-fed conditions and were occupied by a range of native plant communities. These habitats were dominated by tussock-forming sedges (*Carex stricta, Carex lanuginosa*), in conjunction with rushes (*Juncus spp.*), bulrush (*Scirpus americanus*), nutsedge (*Scleria verticillata*), silverweed (*Potentilla anserina*), common gerardia *(Agalinus tenuifolia*), and Ladies-tresses *(Spiranthes spp.*).

These habitats are structurally adapted to lake levels which vary on a seasonal and cyclical basis. Certain characteristics, such as the presence of substantial boulder cover within the wetlands, have helped to reduce the impact of boat wakes and associated wave action on these habitats. From the standpoint of the shore fishery, these habitats are utilized to a varying degree by northern pike (a species of concern in Severn sound) for spawning in the early spring. The amount of habitat available for spawning in particular years varies according to lake levels.

4. Wood Waste Removal

Wood waste removal was completed in September 1994 using a crane-operated grapple fork and "Visor Grab" bucket, located on a barge. This equipment loaded extracted waste onto a second barge, which was off-loaded onto dump trucks and stockpiled on an adjoining shore area for de-watering and sorting. Material was mechanically sorted; the finer material was used for compost and subsequently in wetland construction. Approximately 4000 cubic metres of waste material were removed. Extracted waste included entire sawlogs and sawdust mixed with mud. By late 1995, approximately 4 ha of in-lake fish habitat was restored as submergent aquatic plants were observed to be regenerating.

The wood waste was sorted mechanically, and most of the finer material was utilized for mulch by the Town, or reserved for use on the habitat restoration project. Coarser material was made available to the public for firewood. Some pieces of the largest logs bearing the insignia of the sawmill were salvaged and placed in the local museum.

5. Identification of Shore Habitat Opportunities and Constraints

Opportunities identified based on the site assessment and consultations with SSRAP, Town staff and the Public included the following:

- Presence of existing shoreline wetland pockets on the site, dominated by native wetland species;
- Availability of groundwater and seasonal lake fluctuations which would favour the development of self-sustaining wetland habitats ranging from submergent communities to marsh and swamp; these would restore fish and wildlife habitat which is depleted in the harbour area;
- Potential to restore culvert-lined channels across the park;
- Extracted wood waste to provide a base material for creation of new wetlands;
- Naturalization of the park to discourage loafing behaviour by Canada geese;
- Potential for re-establishment of linkages to adjoining natural habitats outside the Park;
- Community groups available for volunteer roles in wetland construction and ongoing management;
- Community partners available who may provide donations or “in kind’ services.

Certain physical, biological and logistical constraints were identified which might affect the habitat restoration works, as follows:

- Existing moisture conditions could restrict the establishment of nursery materials in restored wetlands;
- Fill containing buried rubble could produce uncertainties affecting grading, planting and drainage;
- Wave action created by large power boats could jeopardize the establishment of wetland plantings;
- Long-term lake level fluctuations (+/- 1.6 m) could create future erosion problems along the shoreline;
- Removal of the wood waste in the harbour before shore habitat restoration could begin.

6. Consideration of Alternative Habitat Restoration Approaches

Four options were initially presented to the Town Council by SSRAP and the consultants, as follows:

A. Remove wood waste only (no shore habitat restoration);
B. Allow portions of the park to naturalize by reducing mowing in the wettest areas;
C. Excavate wetlands within a limited area behind the present shoreline;
D. Excavate wetlands and restore associated natural habitats across the entire waterfront park.

Following a review of the potential constraints and likely public concerns associated with each option, Option C was selected for the development of a Concept Plan.

7. Concept Plan

A Concept Plan (Figure 2) for a linked series of wetlands totalling 2 ha in area, and naturalization of adjoining creeks were prepared by S. Crispin of D&A. Gentle side slopes, berms, soil wedges and rocks were integrated to provide diverse micro-habitats for fish, bird and amphibian species. Existing park trails were connected across the wetlands with small bridges.

Key objectives of the design included the following:

(1) Concentration of groundwater flows to provide baseflow channels for potential fish migration.
(2) Wetland grading to permit periodic inundation in high lake level periods.
(3) Armouring and grading of the wetland entrance to minimize erosion potential.
(4) Nodal plantings of showy native plants to provide immediate aesthetic effects.
(5) Re-naturalization of existing channels through the park.
(6) Planting design utilizing native species to enhance wildlife habitat while maintaining key harbour views.
(7) Re-grading to create islands of better-drained soil that would support upland trees, shrubs and groundcovers.
(8) Re-use of site materials including wetland soil seed bank, wood waste, clean fill materials (i.e. rock, sand).
(9) Reduced maintenance requirements within the park, reflected in a detailed management plan.
(10) Pedestrian access to the shoreline and wetland, and interpretive opportunities (i.e. signs).
(11) Enhanced quality of park runoff entering the Harbour.
(12) Reduced 'loafing' opportunities for Canada geese.
(13) Opportunities for public participation in the planting and on-going maintenance of the wetland.

8. Public Participation

Public process played a critical role in this project, from the development of design strategies and Concept Plan to actual construction of the wetlands. Several forums for public consultation and education with Town and SSRAP staff were carried out in the autumn of 1994 and early 1995 including a day-long workshop, a public meeting and several Town Council meetings. In order to communicate the future appearance of the habitat restoration to the public, a photo-realistic visual simulation of an aerial view of the proposed wetland restoration was prepared using Adobe Photoshop™ (Ver. 3.0) software on an Apple MacIntosh™ computer. This was compared to an actual photo of the existing waterfront park site.

Issues related to the habitat restoration were identified at this workshop by the public, Town staff, Council and SSRAP. These included:

(1) The desire on the part of local naturalists to maximize linkage of restored habitats to existing habitats located outside the park boundaries.
(2) Concerns that views from existing residences facing the Bay would eventually be obstructed by trees.
(3) The prominent location of the site, requiring consideration of aesthetics, safety, nuisance factors (e.g. mosquitoes, Canada geese) and security;
(4) The need to take the multiple recreational uses of the park into account;
(5) The possibility of infestation by purple loosestrife (*Lythrum salicaria*) or other invasive exotic plant species
(6) The need to monitor the results of the proposed habitat restoration;
(7) The rationale for re-establishing wetland cover in a high-profile location within the park as opposed to a peripheral area adjacent to the Copeland Creek Wetland; and
(8) The elimination of approximately 2 hectares of turf area within the 30 hectare park.

9. Detailed Design

Following intensive public consultation, the project proceeded to detailed design. This required finalization of the habitat design, and detailed estimation of materials, equipment and budget required to complete the project. It was recognized that given uncertainties associated with the landfilled materials and groundwater patterns, flexibility would be required during construction. The SSRAP was closely involved in negotiations with potential partners and sources of 'in-kind' materials and labour. This was required to obtain matching financial support from the Cleanup Fund. Ultimately, the main cost associated with construction was for the hiring of an excavation contractor, and construction supervision. Most of the other labour and equipment was provided by the Town or volunteers.

As part of the detailed design, a landscape management plan was devised which specified required maintenance in the restored habitat area. This was a key concern of Town staff who would be involved in the future maintenance of the area. Three Management Zones were identified including Manicured Turf, Wildflower Meadow with Tree and Shrub Plantings, and Wet Meadow / Seepage Zones (Figure 2). The intent within these zones was to a) provide safety and comfort for trail users, b) identify well defined limits to the maintained areas, and c) minimize maintenance requirements within the natural habitat areas, other than occasional litter collection.

10. Wetland Construction

In 1995, 2 ha of shoreline parkland was excavated to create 2 wetlands located above the high water level of the Bay. Wetland construction was initiated in August and completed by mid-September. The habitat creation works were conducted under the supervision of S. Crispin in close consultation with SSRAP and Town staff. A sediment control plan was implemented, utilizing silt curtains, straw bale barriers and a sediment pond to minimize contamination of the Harbour. Topsoil was stripped and stored on site and a substantial amount of on-site wetland seed bank was salvaged for re-use in the created habitats. Buried materials, such as concrete, which were not suitable for berm creation were removed from the site for re-use as fill on other sites, or for deposition in a local landfill.

Substantial surges of groundwater were encountered during excavation that required several days to dissipate. Water from the excavations was pumped into the on-site sediment basin. Deposits of sawdust and wood waste created difficulties in excavation of footings for the pedestrian bridge. During excavation of the easterly wetland, organic soils were encountered which originated from the wetlands buried in the 1960's. The concrete foundation of one of the original sawmills was encountered, and left in place as a cultural heritage element.

The primary soil material in the excavation consisted of dry sterile sands. These were used to create berms around the perimeter of the created wetlands, in order to provide more sheltered habitat and to direct runoff from the surrounding area of the park.

Once the main area of the wetland was excavated and drained, fine grading of channels and pools was undertaken based on the locations of major springs in the excavated area. This required some modification of the original design. Boulders encountered during excavation were incorporated into the wetlands as aesthetic accents and perches for waterbirds.

An adjoining channel was naturalized and reverted to a natural channel form by removing existing metal culverts, and minor re-grading of bank areas. Due to the presence of sands and coarser materials in the bed area, the flows were allowed to adjust the stream channel without additional grading. Subsequent to completion of this project, other channels in the park have also been naturalized.

After fine grading, stockpiled wetland seed bank materials were re-applied to the re-graded site. Upland meadow areas were seeded with a low-maintenance grass-legume blend, supplemented with pockets of native shoreline meadow species. A blend of native wetland species was seeded into nodal locations within the wetland. Local volunteers participated in the initial plantings of the site, utilizing salvaged wetland and upland trees, shrubs and herbaceous plants.

The collaborative nature of this project was evident throughout the construction of the wetlands. Wetland grading was completed by a local contractor assisted by Town equipment and personnel. Donated labour and materials from the Town, local service groups and the Ontario Ministry of Natural Resources' Community Wildlife Involvement Program were used to complete the trails and bridge, while many of the plantings were conducted by local volunteers from naturalist clubs, secondary schools and seniors groups.

11. Monitoring Plan

A Monitoring Plan was developed by D&A and C. Portt for the shoreline habitat restoration. It focused on monitoring changes in plant communities and their diversity over time, utilization by fish and wildlife species, and effectiveness of pedestrian access and interpretive programs. The plan was designed to encourage ongoing monitoring by naturalists and other volunteers, and contained monitoring protocols for fisheries, vegetation, wildlife, hydrology and site infrastructure (recreation, interpretive facilities).

Vegetation monitoring was designed to monitor initial establishment success (species and cover), document successional progress over time, and monitor species composition and habitat complexity. The monitoring approach included the preparation of species checklists for the two wetlands, and photo-monitoring with a standardized 2.5 m tall colour board divided into 0.25 m black and white segments. This was placed at fixed locations around each habitat area. The photo-monitoring method was adapted from an approach described by Van Horn & Van Horn (1996), and is particularly well adapted to recording changes in herbaceous and shrub communities, allowing compilation of quantitative data on vegetation density, height and water depth. It is also useful in the context of the Pentanguishene site as it can document wetland impacts on human views, maintenance issues, and other details.

With respect to fisheries, utilization of the wetland streams by fish species, and changes in substrate, cover and flow were considered monitoring priorities. Wildlife monitoring, specifically of marsh birds and amphibians, was included in the plan. While no wildlife monitoring was conducted under the 1996 program, in 1997 staff from the Long Point Bird Observatory undertook assessments of bird and amphibian communities for locales throughout the Severn Sound area including the Penetang Bay site, but has yet to publish this data. Monitoring is in accordance with the Marsh Monitoring Program developed by Environment Canada (see Chabot and McCracken 1997).

Recording recreational, interpretive and infrastructure use was also recommended using field checklists in the vicinity of the restored wetlands twice per year. The plan also recommended the photo-monitoring as a useful cross-reference of human impacts in the wetlands, and development of a Park User Survey to summarize user information and identify potential improvements to access or interpretative facilities. Monitoring of the stability and performance of the channels connecting the wetlands to the lake was recommended on an annual basis.

Monitoring was conducted for fisheries in 1996 and vegetation in 1996 and 1997 by the consultants authoring this paper. Vegetation monitoring included preparation of checklists of plant species in evidence in Wetlands 1 and 2, descriptions of the distinct habitat types (Table 2), and provision of photographic documentation (as

described above). In 1997, 218 vascular plant species were recorded in the restored habitat, of which 149 (68%) were native species. Many of the introduced species recorded are annuals and biennials associated with primary succession on the site, particularly on the dry sandy berms.

During fisheries monitoring by C. Portt in 1996, no fish were captured in Wetland 1 or the existing stream located west of Wetland 2. However, in Wetland 2, 2 brook trout (*Salvelinus fontinalis*) and 1 sculpin (*Cottus spp.*) were captured near the mouth of the stream draining from the wetland. The presence of young-of-the-year brook trout in August 1996 is particularly encouraging as this species is an important game fish reliant on coldwater conditions and adequate substrates.

Some problems were noted during these monitoring efforts. In 1996, seedlings and shoots were heavily grazed by Canada geese, and seedlings of two weedy shrub species (Manitoba maple and glossy buckthorn) which could affect future wetland character were identified. In addition, rip rap accumulation at the mouth of both wetlands was identified as a potential barrier to fish movement.

Management measures to resolve these problems involved hand-pulling of these readily identifiable weeds by volunteers in 1997 and 1998, and redistribution of the rip rap in the shallow zones, also by volunteers. In 1997, the lake level was higher than normal, and there were no obstructions in the wetland channels and by this time vegetation was sufficiently tall to discourage further foraging by geese.

Habitat Type	**Description**
Successional Dry Meadow	Located on barren sands associated with constructed berms. This area was seeded with shoreline grass-wildflower blend in late 1995. Cover was sparse in 1996, but increased after autumn rains in 1996. Prevalent Species: Wild Carrot (*Daucus carota*), Horseweed (*Conyza canadensis*), Oxeye daisy (*Chrysanthemum leucanthemum*), Evening primrose (*Oenothera biennis*), Bracken Fern (*Pteridium aquilinum*), Brown-eyed Susan (*Rudbeckia hirta)* Quality Indicators: Little Bluestem Grass (*Schizachyrium scoparium*), Goldenrods (*Solidago spp.*), Arrow-leaved Aster (*Aster urophyllus*), Butterfly Weed (*Asclepias tuberosa*)
Wet Meadow/Marsh	Located in wet interior areas of Wetlands 1 and 2 as well as along the banks in the lower reaches of each stream. It originated mostly from salvaged seed bank material (sods) from the original wetlands on site, supplemented with salvaged plants from other locations. Prevalent Species: Common Cattail (*Typha latifolia*), Sedges (*Carex* spp), Rushes (*Juncus* spp), Spike Rushes (*Eleocharis erythropoda and E. smallii*), Canada Bluejoint Grass (*Calamagrostis canadensis*), Tussock Sedge (*Carex stricta*), American Bulrush (*Scirpus pungens*), Softstem Bulrush (*Scirpus validus*), Joe Pye *Weed (Eupatorium maculatum*), Bur-reeds (*Sparganium eurycarpum & S. chlorocarpum*), Swamp Milkweed (*Asclepias incarnata*), Barnyard Grass (*Echinocloa crusgallii*), Spotted Touch-me-not (*Impatiens capensis*), Sensitive Fern (*Onoclea sensibilis*), Blue Flag Iris (*Iris versicolor*) Quality Indicators: Royal Fern (*Osmunda regalis*), Common Gerardia (*Agalinus tenuifolia*), Fringed Gentian (*Gentianopsis crinita*), Grass-of-Parnassus (*Parnassia glauca*), Northern Manna Grass (*Glyceria borealis*)

Submergent/Floating Aquatics	This habitat has flourished along the spring-fed channels within the wetlands, and covered the water surface completely in several locations. The plant material originated primarily from seed bank sources. Prevalent Species: Watercress (*Nasturtium officionale*), Swamp Buttercup (*Ranunclus hispidus*) Quality Indicators: Water-plantain (*Alisma plantago-aquatica*), American Pennyroyal (*Veronica americana*)
Shoreline Wet Meadow	This habitat was prevalent along the unmanaged shoreline prior to wetland construction, and is now re-establishing wherever it was disturbed, from seed and root material. Prevalent Species: American Bulrush (*Scirpus pungens*), Silverweed (*Potentilla anserina*), Canada Blue-joint Grass (*Calamagrostis canadensis*), Creeping Bent Grass (*Agrostis stolonifera*), Purple Loosestrife (*Lythrum salicaria*) Quality Indicators: American Bulrush (*Scirpus pungens*), Canada Blue-joint Grass (*Calamagrostis canadensis*)

Table 2. Summary descriptions of restored shoreline habitats.

Summary & Conclusions

The habitat restoration project described in this paper represented a significant undertaking for the Town of Penetanguishene and SSRAP. From the Town's perspective, it reflected a growing awareness of the key role of communities in the restoration of degraded habitat areas around the Great Lakes basin. Given that the Town had devoted twenty years to the creation of a manicured waterfront park, its partial re-conversion to natural habitat was an important step in increased local awareness. Although the more aggressive option of restoring connections to nearby habitats was not accomplished, this represents a future opportunity. As consultants on this project, we were witnesses to changes in public attitudes on a day-to-day basis, as we saw opponents of the habitat creation become its stewards.

The strategies and methods employed for the wood waste removal and habitat creation, were largely successful in re-utilizing site materials including the existing soil seed bank. These methods, supplemented by imports of seed and salvaged plants, have resulted in a high level of diversity for a small natural area surrounded by urban space.

The fisheries and vegetation monitoring indicate that the restored habitats are already sustaining a significant component of native, quality species since construction was completed in 1995. With respect to fisheries, the two species recorded are positive indicators and additional utilization by fish is anticipated as vegetative cover proliferates and provides shading and more diversified structure.

References

Bayfield, J. and C. Gerow. 1982.
This Was Yesterday. A pictorial history of the early days of Penetanguishene. Bayfield-Gerow, Midland. vii + 191 p.

Chabot, A. and J. McCracken. 1997.
An assessment of marsh bird and amphibian communities in the Severn Sound area of concern: A "State of their environment report". Prepared by Long Point Bird Observatory for Environment Canada, Downsview, Ontario. 35 p.

Environment Canada. 1996.

Rehabilitating Great Lakes Habitats: A Resource Manual. Environment Canada and Great Lakes 200 Cleanup Fund.

Morton, J.K. and J.M. Venn. 1990.
A Checklist of the Flora of Ontario: Vascular Plants. University of Waterloo Biology Series, No. 34.

SSRAP. 1994.
Severn Sound Remedial Action Plan Stage 2 Report: A strategy for restoring the Severn Sound ecosystem and de-listing Severn Sound as an area of concern. Remedial Action Plan, Ont., Report #3B030031, 251 p.

Van Horn, M. and K. Van Horn. 1996.
Quantitative photomonitoring for restoration projects. Restoration and Management Notes 14(1):30-34.

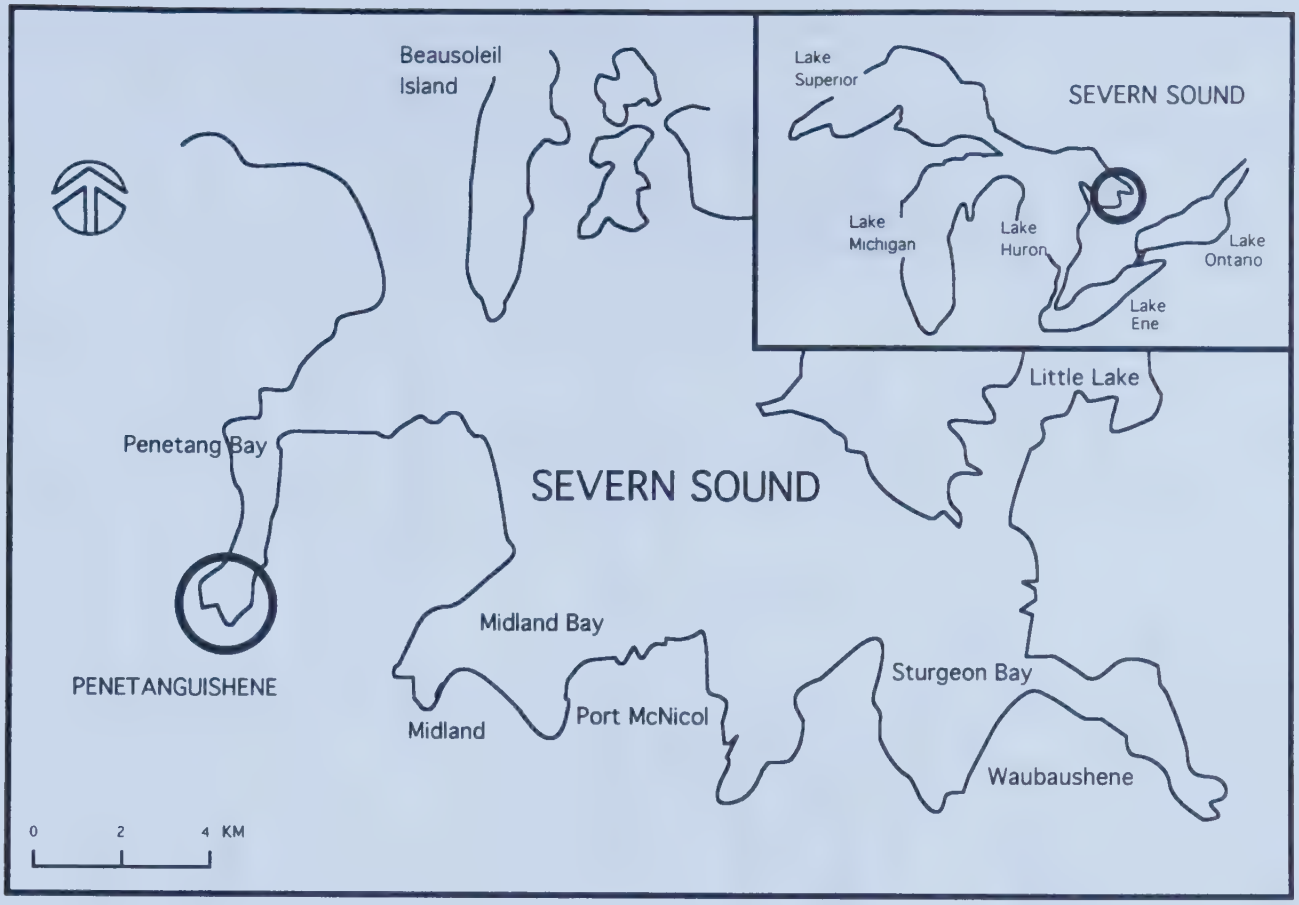

Figure 1 Penetanguishene Harbour Site Location

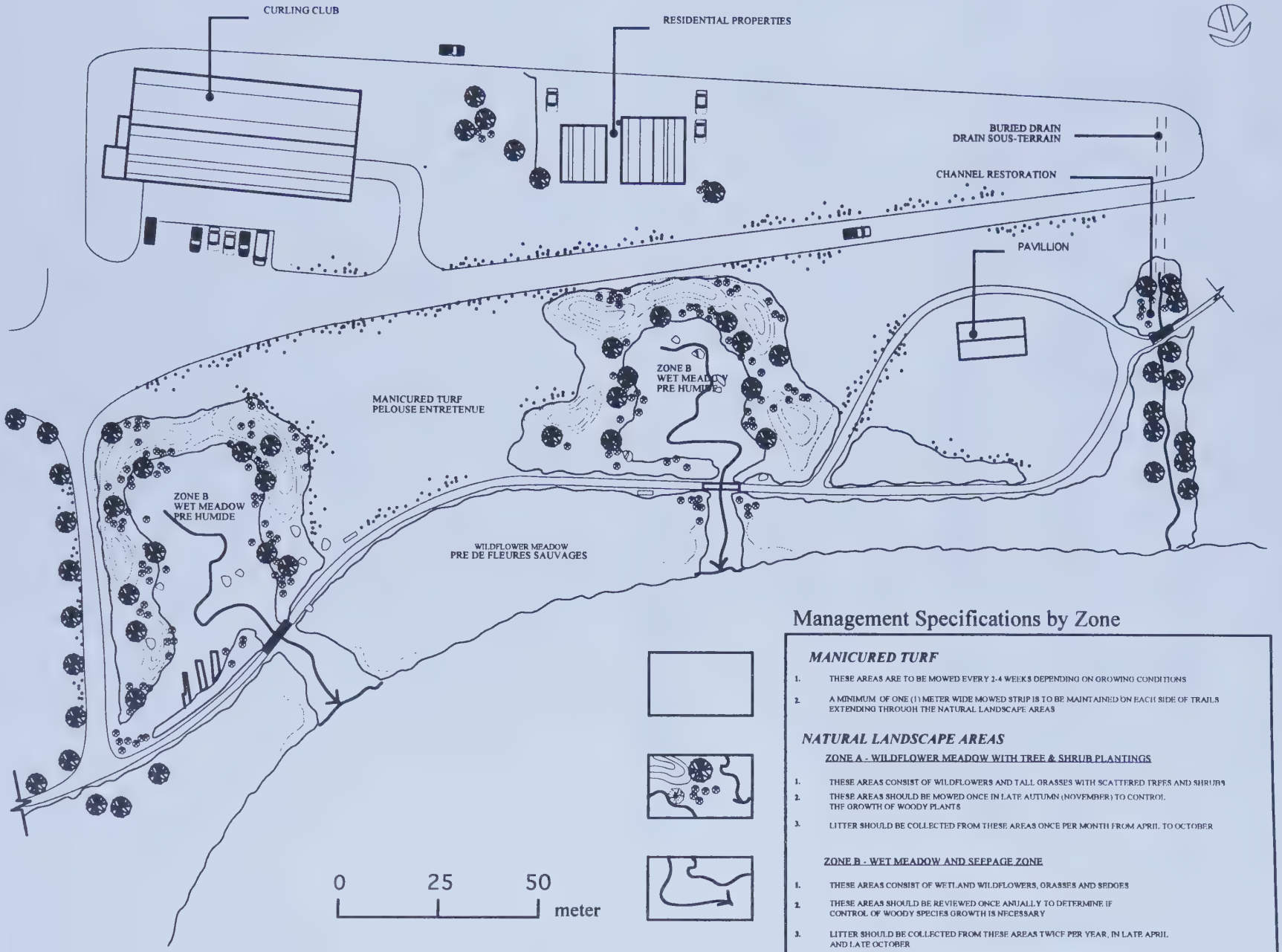

Figure 2. Concept Plan and Management Zones

Reclamation and Restoration of Settled Landscapes

September 27th – 30th, 1998
Markham, Ontario

PROCEEDINGS

Hosted by the

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Canadian Land Reclamation Association
Box 61047, Kensington P.O.
Calgary, Alberta
T2N 4S6

Society for Ecological Restoration, Ontario Chapter
Environmental and Resource Studies Program
Trent University
Peterborough, Ontario K9J 7B8

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