Aerial View of Cold Creek Subwatershed *Photography by Rosemary Hasner*

CHAPTER 4

RESOURCE INVENTORY AND ANALYSIS

After reviewing the background information and relevant plans and policies, the next major step in developing the Cold Creek Conservation Area Management Plan was to inventory and analyze the Cold Creek property. The natural heritage, human heritage, recreation and education resources were examined and mapped.

4.1 NATURAL HERITAGE

A Natural Heritage System refers to the interactions and dependencies between and among the physical, chemical, and biological elements of the environment. It is these interactions that control the hydrologic cycle and the quality of habitat for plants and animals. For the purpose of this Management Plan, only landform, water, and aquatic and terrestrial habitats have been investigated.

4.1.1 Landform

1. ORM and South Slope: The planning area lies primarily within the Oak Ridges Moraine (ORM) and South Slope. The ORM is one of the most important natural resources in the TRCA jurisdiction in terms of its historical, hydrological, topographical and geological significance.

The ORM complex was formed about 13,000 years ago when meltwaters of the withdrawing Wisconsinan glacier deposited till materials (silt, sands, gravels, clay and boulders) between two lobes of the glacier, thus forming the 'interlobate' moraine. The terrain of the ORM varies throughout the Greater Toronto Area but many portions are characterized by a hummocky or hilly appearance, referred to as "knob and kettle" topography. The glacial drift forms the knobs and the dry depressions or glacial lakes are known as kettles or kettle lakes.

The South Slope, or Till Plain, is located south of the ORM and is a band 10 to 11 kilometres in width running parallel to the length of the Moraine. Almost 90% of Cold Creek Conservation Area lies within the South Slope. The South Slope was formed during the same geologic period as the ORM, approximately 13,000 years ago. The area is important for its agricultural capacities.

2. Valley and Stream Corridors: The valley and stream corridors are the critical areas for protecting the aquatic and terrestrial habitats of the Cold Creek Conservation Area. These are natural environment corridors that provide linkages between aquatic and terrestrial habitat areas.

As shown in Map 3A, these corridors for Cold Creek Conservation Area were determined through a review of the TRCA fill line mapping and fill line extension mapping. The fill line mapping relates to the fill regulation component of Ontario Regulation 158 (see Chapter 3).

The total land area that comprises the valley and stream corridor in Cold Creek is 120 hectares. The valley and stream corridor widths in Cold Creek vary from seven metres to 90 metres.

4.1.2 Ground and Surface Water

The quality and quantity of water flowing within and in the surrounding areas of Cold Creek are important elements to consider when developing a management plan for the area. An impairment in the quality or quantity of water in a river system can affect aquatic habitats; alter the diversity and abundance of plant, animal, and aquatic species; reduce enjoyment of natural areas; affect human health; and change flows downstream.

1. Groundwater

Geology: A north/south cross-section through the Conservation Area is presented in Figure 3. The surficial geology comprises of up to 20 metres of clayey silt to silt till (Halton Till), with thin fluvial sand and gravel deposits in the stream valleys. The Halton Till is thickest to the south of Cold Creek and is thinnest at the base of the creek valley. The Halton Till is underlain by 20 to 40 metres of sand and gravel (Oak Ridges Moraine Complex), which are in turn underlain by 20 to 30 metres of clayey silt till (Newmarket Till). The Oak Ridges Moraine Complex thickens to the south. Beneath the Newmarket Till is the Lower Sediment Complex, which comprises two fluvial/lacustrine deposits (Scarborough and Thorncliffe Formations) separated by a clay till (Sunnybrook Till). The thickness of the Lower Sediment Complex ranges from less than 10 metres at the south end of the Study Area to more than 40 metres at the north end of the Study Area. Overall, the overburden thickness ranges from 60 metres underneath Cold Creek to 100 metres beneath the adjacent tablelands.

The bedrock within the Study Area comprises interbedded limestone and shale of the Georgian Bay Formation (Ontario Division of Mines, 1976)[2]. The bedrock surface slopes gently to the south at a rate of approximately four metres per kilometres. A shallow (approximately 20 to 40 metres deep) bedrock valley is assumed to be present to the south of the Conservation Area.

Hydrogeology: Hydrogeology is a science that describes the movement of water beneath the ground surface (groundwater) and its interaction or connection with water which moves upon the ground surface in rivers, lakes and streams. Inflow to the groundwater system (recharge) occurs as infiltrating precipitation in the form of rain fall or snowmelt. Outflow from the groundwater system takes place as discharge to streams (baseflow) and springs, as evapotransportation and as groundwater pumping from wells. The quantity and rate of groundwater flow is dependent on the nature of the geologic material through which it flows.

A perched water table is present within the Halton Till at an average depth of approximately five metres below grade. The groundwater flow direction in this unit is primarily downwards, but because of the low permeability of the Halton Till, the rate at which water infiltrates into the soil in the spring is greater than the rate at which the water flows through the till into the aquifer below. Therefore, the excess water "pools" in the till. The upper surface of this "pooled" water is a subdued reflection of the surface topography. Because the rate of infiltration varies seasonally, the perched water surface fluctuates, with a range of about 0.5 metres close to the streams and ponds and a range up to five metres in the adjacent tablelands. A minor component of the flow in the till is horizontal towards the ponds and streams.

The true water table occurs in the Oak Ridges Moraine Complex (Oak Ridges Moraine Aquifer), at depths up to 25 metres below grade (Romano, 1998)[3]. The aquifer is recharged via a combination of vertical groundwater flow through the Halton Till and horizontal flow through the aquifer. The groundwater in this aquifer flows primarily horizontally to the south.

2. Ontario Division of Mines. 1976. *Paleozoic Geology*, Bolton, Southern Ontario, Map 2338, Scale 1:50,000

3. Romano, CG. 1998. *Groundwater-Surface Water Interaction: A Comparison of Modelling Tools.* Unpublished MSc Thesis, University of Waterloo, Waterloo, Ontario, Canada.

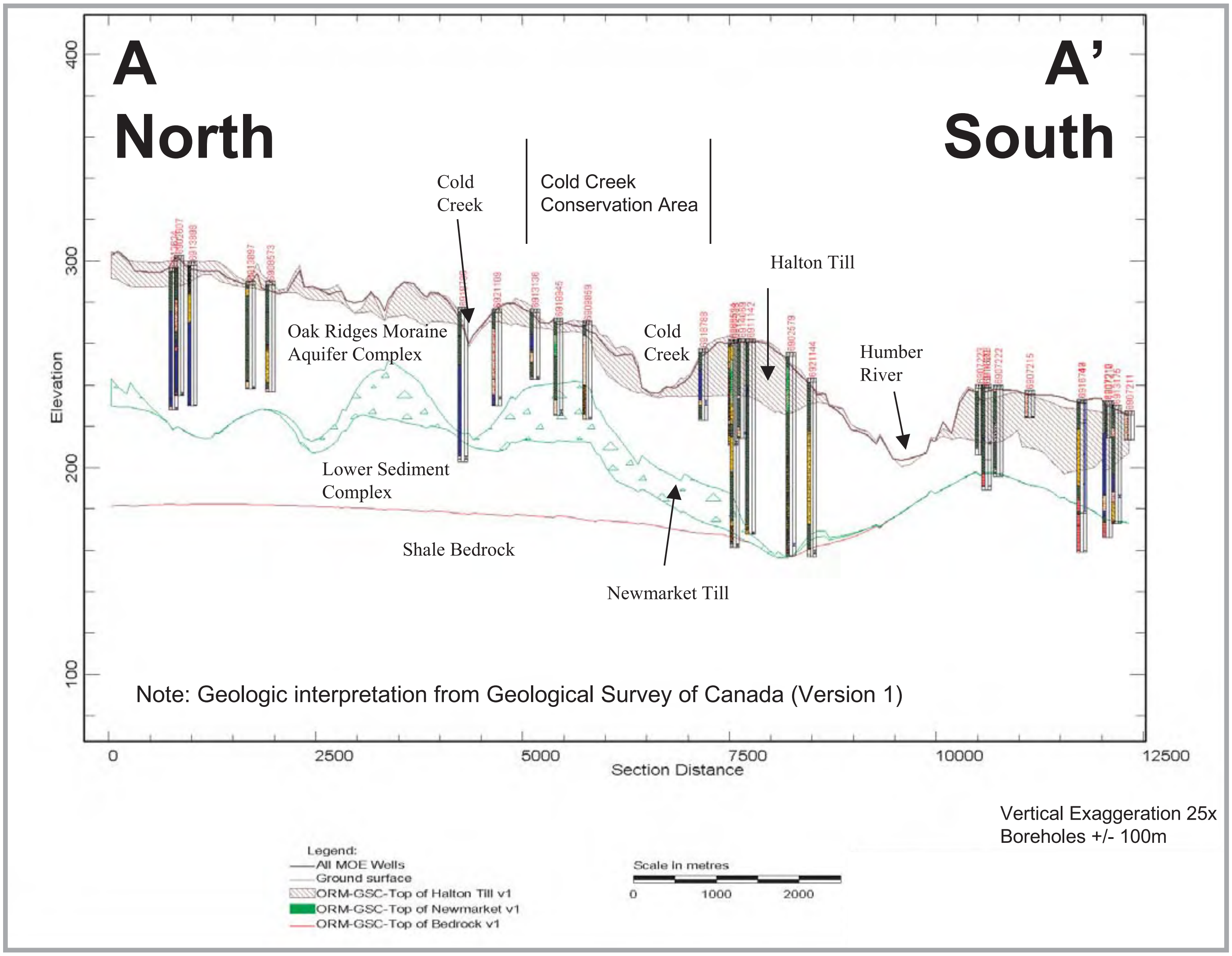


Figure 3 Hydrogeology: Cold Creek North-South Cross Section

Deeper aquifers are present in the Lower Sediment Complex. Groundwater flow in these aquifers is primarily to the south, with discharge occurring to the lower reaches of the Humber River Watershed.

Recharge/Discharge: Local recharge occurs in the tablelands, with a minor local discharge component into Cold Creek. The estimated amount of groundwater recharge ranges from 118 mm/year to 193 mm/year (Romano, 1998). Most of the observed groundwater discharge is associated with reaches of Cold Creek west and southwest of the Conservation Area (Don Haley, TRCA, personal communication). In these reaches (Map 4), it is assumed that the Oak Ridges Moraine Complex is exposed in the streambed.

Groundwater Resources: Most of the local water wells within the Cold Creek Subwatershed rely on the Oak Ridges Moraine Aquifer, although some penetrate into the lower sediments (Figure 3).

2. Surface Water Quality

Water quality data from the Ministry of the Environment's Provincial Water Quality Monitoring Network (PWQMN) provides a statistical basis for assessing the surface water quality in the Cold Creek Subwatershed. Water quality data have been obtained from a monitoring station located north of King Road within the Cold Creek Subwatershed (See Map 4). Data from 1971 have been compared to the 2002 water quality samples. Eight water quality parameters were selected for assessment, based on their relevance to common water use. These eight included: phosphorous, nitrogen compounds, suspended solids, chlorides, bacteria, biological oxygen demand, dissolved oxygen and temperature.

Table 1 compares mean and median concentrations of selected constituents collected monthly from 1969 to 1971 with the mean concentration of two samples collected in June and July, 2002. With the exception of chloride, concentrations of all constituents were similar during the two periods of observation. Although only

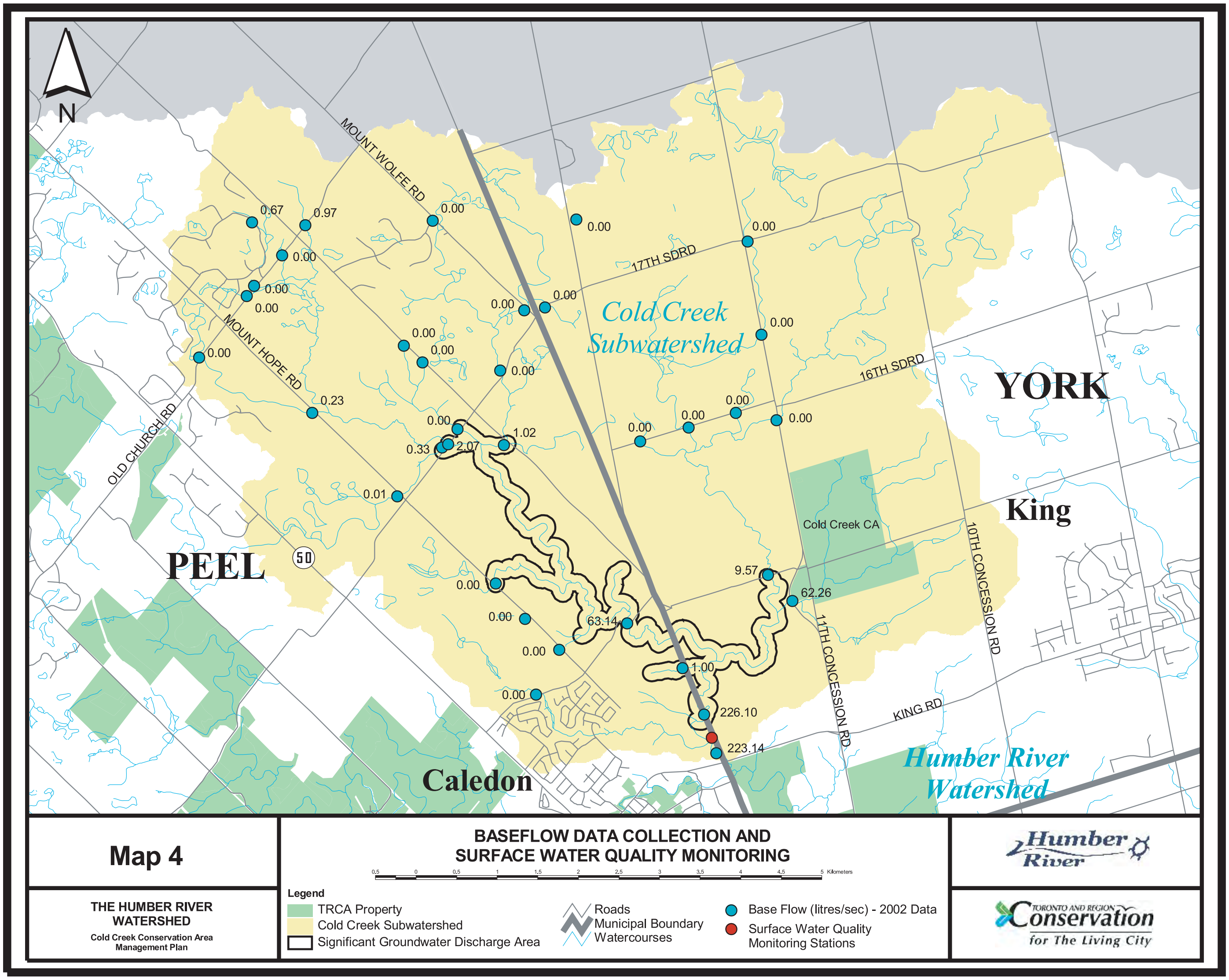


Table 1: Water quality data from Cold Creek from 1969 to 1971 and during the summer of 2002

Parameter	1969-1971			Summer 2002		Guideline
	# obs.	Mean	Median	# obs.	Mean[1]	
Chloride (mg/L)	21	10.8	7	2	18.2	250
Conductivity (uS/cm)	21	497	483	2	501	-
Dissolved Oxygen (mg/L)	21	5.9	5	2	9.9	6
Nitrate (mg/L)	21	0.29	0.18	2	0.24	0.3
Nitrite (mg/L)	21	0.01	0.008	2	0.018	-
TKN (mg/L)	21	0.43	0.33	2	0.38	-
Phosphate (mg/L)	21	0.03	0.01	2	0.015	-
Total Phosphorus (mg/L)	21	0.09	0.04	2	0.05	0.03
Total Suspended Solids (mg/L)	21	19.8	10	2	17.1	25[2]

1. Since there are only two observations, the mean and median in 2002 are the same.
2. Approximate background level.

summer data were available in 2002, concentrations of chloride were generally higher, possibly reflecting a higher density road network (and hence road salt applications) in the area compared to 1971.

Metals were not analyzed during the 1969-1971 period. During the summer of 2002, mean concentrations of copper, zinc, nickel and lead were well below Provincial Water Quality Objectives/Guidelines for these constituents.

The temperature of the water appears to have changed very little since 1971. Water temperatures in June and July during both periods were between 12 and 18 degrees Celsius, which are well below the 21 degree Celsius maximum threshold commonly designated for cold water fisheries.

Total coliforms were not sampled in 2002, but in 1969 to 1971, the average density was 3042 counts/100ml, which compares to the former Provincial Water Quality Objective (for human contact) for this constituent of 1000 counts/100ml.

Total phosphorous exceeded the PWQO for phosphorous (0.03mg/L) during both periods. Concentrations of nutrients typically increase during wet weather and snowmelt conditions. Phosphorous and nitrates come from lawn, garden and agriculture fertilizers as well as eroded soils from construction sites, stream banks and agricultural fields. A detailed investigation of potential nutrients and sediment sources (practical summer rain event) is being carried out through the TRCA's Agriculture Non-Point Source Modeling technique (AGNPS).

3. Rural Water Quality Modeling

The event-based (rainfall and snowmelt) AGNPS model is a tool for rural point and non-point source pollution identification and mitigation. It provides a tool for farmers, municipalities and TRCA to fulfill obligations under the Nutrient Management Act by employing cost effective strategies for implementing Best Management Practices.

The AGNPS model was developed by the U.S. Department of Agriculture in the late 1980's as a decision support tool for designing rural water quality improvements. Application of the AGNPS model in Southern Ontario has been advanced by the Provincial Ministry of Environment and Environment Canada. Through technical support from the Ministry, the utility of the AGNPS model for application in TRCA watersheds was established.

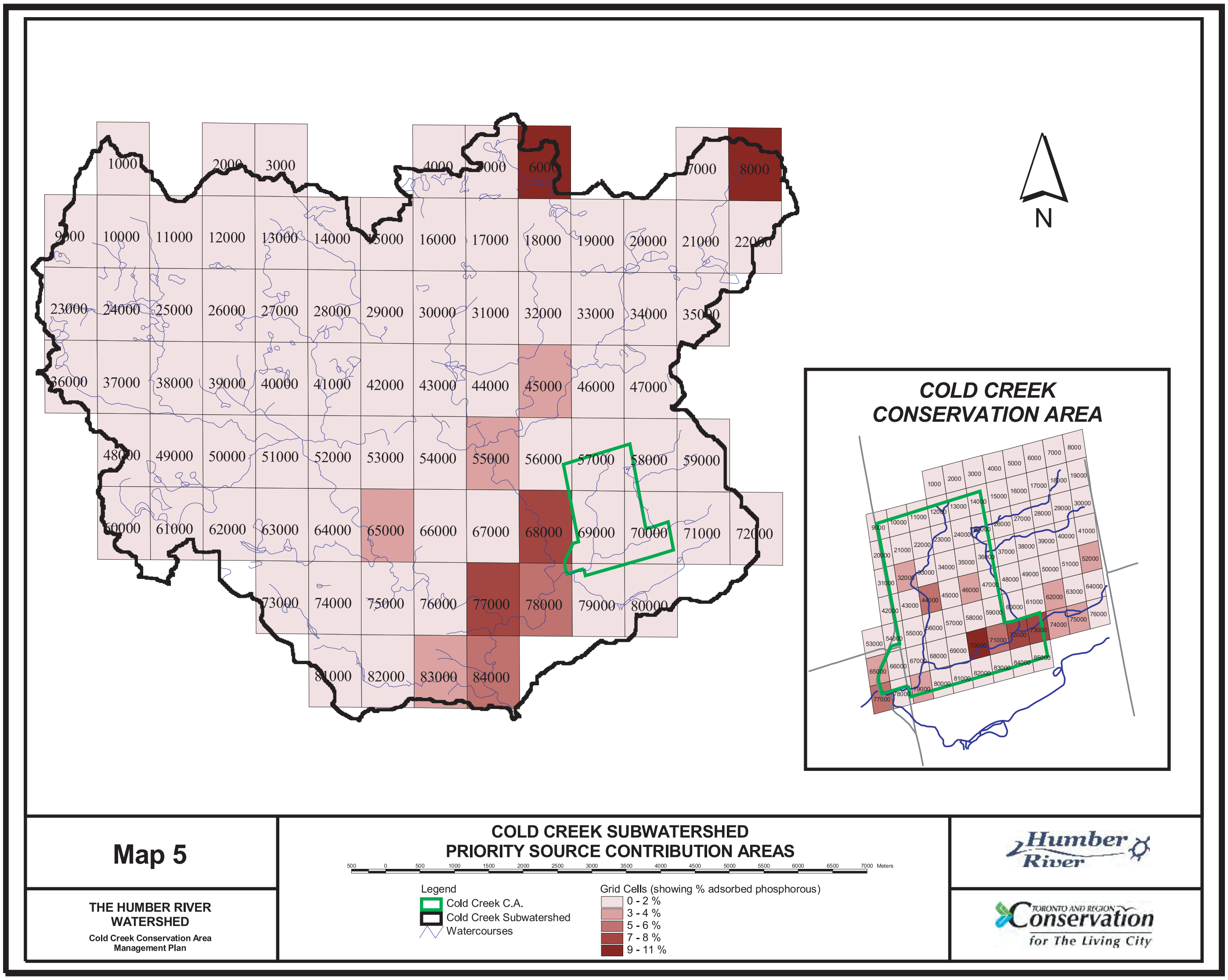
The AGNPS model predicts water quality conditions as a function of topography (slope), soil conditions and land use. Information on fertilizer use (potential source of pollution) and precipitation patterns are entered into the model using proven algorithms for soil transport, channel erosion and water quality predictions. The model's performance in comparison to monitoring programs is very good. As a result, our limited program sources can be directed towards implementation.

The objective of modeling the Cold Creek Subwatershed was to identify, at a subwatershed scale, priority areas for targeting the TRCA rural water quality improvement program. With limited resources and the recognized need to focus our efforts, the model helps staff establish priorities for field level inventories and grant funding. In addition, model runs for the subcatchment draining the Cold Creek Conservation Area served to verify that the Authority property is generally well-managed and is not a significant source of pollution at the subwatershed scale. Detailed runs for the Cold Creek Conservation Area (20 acre grids) revealed a few "local priorities" for follow up investigation by TRCA staff (Map 5).

Results for the model are shown in Table 2, which compares, for a typical summer rain event, the relative pollutant contributions of the tributary draining Cold Creek Conservation Area with the sediment, nitrogen and phosphorus contributions to the Humber River from the Cold Creek Subwatershed.

Table 2: Relative Pollutant Contributions – Cold Creek Subwatershed.

Watershed ID	Cold Creek Conservation Area	Cold Creek Subwatershed
# Total Cells	85	84
Area Base Cells	12	198
Drainage Area	1020	16632
Precipitation	1	1
Runoff Volume	0.04	0.09
Peak Rate	0.46	174.45
Sediment Yield	22.33	524.06
Nitrogen-Sediment	0.14	0.19
Nitrogen-Runoff	0	0.03
Phosphorus-Sediment	0.07	0.09
Phosphorus-Runoff	0	0
COD-Runoff	0.12	0.55
Nitrogen Concentration	0.47	1.7
Phosphorus Concentration	0.02	0.16
COD Concentration	13.48	27.74



Using the model's trace source contribution module, priority areas for follow up action by staff were identified for the Cold Creek Subwatershed and the Cold Creek Conservation Area (see Map 5). Sites within the Cold Creek Conservation Area are not significant sources at a subwatershed or watershed scale.

4.1.3 Aquatic Habitats

Within Cold Creek Conservation Area, there are two permanent watercourses and a number of intermittent streams (Map 6). The permanent streams provide year-round habitat while the intermittent streams have a water attenuation function, woody and organic material contribution and likely provide seasonal habitat for aquatic species.

1. Baseflow

Based on flows recorded from the stream gauge on Cold Creek at the 11th Concession, the ratio of baseflow to total annual flow is approximately 38%, suggesting a fair to good potential for salmonid production.

Base flow data collection stations located on the two main tributaries and at the 11th Concession Road crossing showed that permanent flow in the western tributary begins at the cedar swamp and this stream has a higher baseflow than the eastern one.

2. Water Temperature

Water temperature data suggests the western tributary is the colder of the two and likely receives more ground-water than the southern tributary. Even after the two streams meet, the influence of the western tributary is evident in the low temperature recorded at station 5 (See Table 3).

3. Instream Barriers

Instream barriers are either natural ie., beaver dams or log jams or a result of human activities such as dams, weirs, bridges or culverts. These barriers may impact the aquatic community by eliminating passage, allowing for the establishment of a headpond and subsequent warming of the water and reducing sediment transport. The culvert located at the 11th Concession Road is slightly perched and has a shallow flow through it. It may be a barrier to fish passage during low flow periods. Other culverts do not substantially impact the aquatic community.

4. Riparian Vegetation

Riparian vegetation is defined as any woody or herbaceous plant abutting a watercourse. Ecologically, riparian vegetation slows the rise in water temperature by shading the stream. Riparian vegetation also serves to maintain bank stability (and therefore decrease erosion), contributes organic material and woody debris to the watercourse and provides cover for aquatic organisms. Finally, insects living in vegetation overhanging a river often fall into the water and provide food for fish. Riparian vegetation plays a more important role in stream shade in the smaller first, second and third order streams which are generally narrow and can be shaded almost completely.

In the CCCA, most of the length of permanent watercourses has riparian cover, except for some of the middle reaches of the eastern tributary. In areas where these two tributaries are intermittent, such as the western trap range and downstream of the wetland in the northeastern section of the property, riparian vegetation is insufficient (Map 6).

5. Fish Community

Cold Creek has been sampled numerous times over the years at the crossing with the 11th Concession Road. Data collected has included fish, benthic invertebrate and algal species. Identification and analysis of the algal species data has yet to be completed. Algal species are good indicators of water quality.

Fish species information, dating as far back as 1946 is available for Cold Creek downstream of the 11th Concession Road (Table 4). A total of 11 species have been captured at the two sampling locations (Map 6).

Station HU027WM is downstream of the confluence with the Conservation Area branch of Cold Creek and the more western tributary of Cold Creek outside the property. The larger size of this watercourse may account for the increase in the number of fish species captured, as well as the addition of some fish species that have not been found previously. The fact that a number of the species captured were not found previously and are generally warmwater species is noteworthy and indicates that the warmwater contributing reach located west of CCCA may be slightly warmer than historically and exerting a greater influence.

The presence of coldwater species such as mottled sculpin and brook, rainbow and brown trout at the downstream sampling locations suggests a healthy coldwater community within the Cold Creek Conservation Area. It is likely that some warmwater species such as northern redbelly dace, fathead minnow and pumpkinseed would not be found in the CA and as such, the fish community would be made up of more typical coldwater species.

No significant change has been noted in the quality of habitat found in and immediately adjacent to CCCA in the past 20 years.

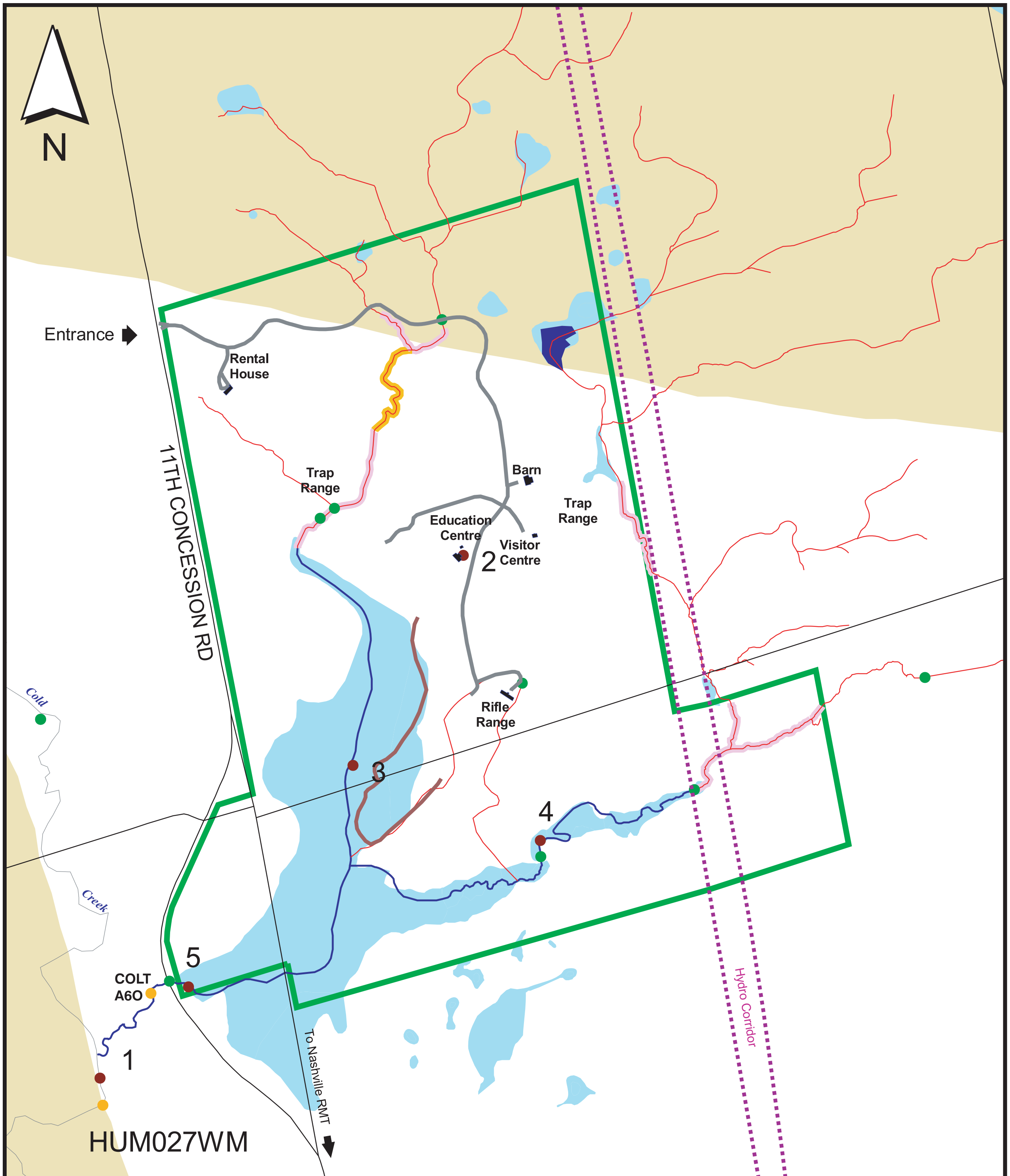
6. Benthic Invertebrates

Species and associated analyses are available for the 1999 and 2001data collection (Appendix 1).

A number of the species found at Station COLT in 1999 and HU0027WM in 2001, including Stempellinella sp. and Trissopelopia sp., are considered riverine species and are typically associated with good water and habitat quality. The relatively higher Hilsenhoff Biotic Index (BI) found at Station HU0027WM indicates higher nutrient conditions which is likely a function of it being found

Table 3: Results of Temperature Sampling.

Time Sampled	Station	Air Temperature (oC)	Water Temperature (oC)
Aug. 13/01 at 3:45	1	26	14.5
1:10 pm	2	28.5	Not taken
1:15 pm	3	27	13.5
1:55 pm	4	28.5	20.5
2:30 pm	5	30	14



Map 6

THE HUMBER RIVER WATERSHED

Cold Creek Conservation Area Management Plan

COLD CREEK CONSERVATION AREA
AQUATIC FEATURES

200 0 200 400 600 800 Meters

Legend

2001 Station/Barrier
- Fish and Invertebrate Sampling
- Air/Water Temperature Sampling
- Instream Barriers

River Type
- Intermittent
- Permanent

- Cold Creek C.A.
- Classified Wetland
- Oak Ridges Moraine
- Hydro Corridor
- Gravel Path
- Boardwalk

- Pond
- Buildings

Riparian Restoration
- Active
- Passive

Humber River

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Table 4. Fish Species Captured Near Cold Creek Conservation Area (CCCA).

Fish Species	1946	1983	1999	2001
American brook lamprey	-	-	-	HU027WM*
rainbow trout	-	-	COLT*	HU027WM
brown trout	-	present	COLT	HU027WM
brook trout	A60*	-	-	HU027WM
white sucker	A60	-	-	HU027WM
northern redbelly dace	-	-	-	HU027WM
brassy minnow	-	-	-	HU027WM
fathead minnow	-	-	-	HU027WM
blacknose dace	A60	-	-	HU027WM
creek chub	A60	-	COLT	HU027WM
pumpkinseed	-	-	-	HU027WM
mottled sculpin	A60	present	COLT	HU027WM

* - Fish and invertebrate sampling station number from the original survey. (See Map 6)

downstream of the confluence with the warmwater tributary and subject to greater impacts from agricultural runoff.

Overall, the benthic invertebrate community at both stations is reflective of a relatively unimpaired system[4].

4.1.4 Terrestrial Habitats

The Terrestrial Habitat Inventory and analysis for Cold Creek Conservation Area has been carried out according to the criteria of Toronto and Region Conservation's Terrestrial Natural Heritage Approach[5]. The study area is described below, under six headings, which link together the various criteria of the Natural Heritage Approach as they apply at the landscape, vegetation community, and species levels (See Table 6). The headings are:

- Quantity of Natural Cover
- Distribution
- Matrix Influence
- Patch Size and Shape
- Landscape Connectivity
- Bio-diversity

The Terrestrial Natural Heritage Approach moves beyond the contemporary model of defining natural heritage systems based on a series of cores and corridors. It recognizes that all habitat patches have some value and make a contribution towards ecological health across the landscape. This Approach enables us to evaluate the Conservation Area's contribution at three levels: 1) the entire TRCA jurisdiction; 2) other defined areas of planning units such as the subwatershed and watershed; and 3) the ORM and other municipal areas.

A key component of the TRCA Terrestrial Natural Heritage Approach is the scoring and ranking of vegetation communities and fauna species, reflecting primarily resistance to urbanization and human encroachment. Species are ranked based on local distribution or local (L) ranks. These L ranks are in some way analogous to the provincial (S) and global (G) ranks assigned to vegetation communities, flora and fauna. The ranks range from L1 to L5. Generally, L1 to L3 species or vegetation communities are of regional conservation concern (i.e., within TRCA jurisdiction).

A complete list of species and vegetation communities for the CCCA, with their associated scores and L-ranks, can be found in Appendices 2 and 3.

1. Quantity

a) Landscape – Total Natural Cover

The Cold Creek Study Area is located in the upper reaches of the main Humber River in the Township of King. The Humber watershed is 90,800 hectares in size with 26,928 hectares (30%) of natural cover, of which 18,959 hectares (21%). is forest and wetland. The CCCA occupies 190 hectares and is almost entirely natural cover of some sort.

The health of the natural system in any region ultimately depends most directly on the total quantity of land that has natural cover. The loss of natural cover directly affects the health of the broader natural system. More specifically, the loss of natural cover leads to diminishing proportions of various natural vegetation communities

4. For more information, see *Status of the Aquatic Community in Cold Creek Conservation Area*, TRCA , July 2002.

5. TRCA, 2002. *Cold Creek Conservation Area- Biological Inventory and Impact Assessment*.

Red Shouldered Hawk
Photography © Cornell University

and reduced populations of native species. These become rarer and eventually may be at risk of extirpation. Rarity or (to put it positively) abundance has conventionally been the major criterion for assessing the conservation concern of a species or an element of natural heritage. If rarity is the rationale for protecting species, then there is no protection for species until they are rare. To move beyond rare species, the TRCA has developed a method of using species to determine the broader function of habitats and the positive or negative influences on them. The TRCA has ranked every fauna and flora species and all vegetation communities native to its jurisdiction according to their abundance, sensitivity and habitat needs.

b) Vegetation Community Abundance

Vegetation communities which score at 4 or 5 under the criterion of Local Distribution are considered rare in the TRCA jurisdiction (Appendix 3). Regionally-rare vegetation communities at CCCA may be restricted to particular geophysical situations that occur here but not commonly across the TRCA jurisdiction, such as clay barrens (CBO1); or they may have been largely eliminated by development, such as broad-leaved sedge organic meadow marsh (MAM3-6); or they may be unusual associations of common and uncommon species, such as a fresh-moist poplar mixed forest (FOM8-1) which in this case has the association of trembling aspen and balsam fir. In each case, the cause of the rarity needs to be investigated in developing a conservation strategy. Conserving habitat only is not sufficient enough to maintain rare communities.

c) Flora Species Abundance

Those plants which are scored four or five under the criterion of Local Occurrence are relatively rare in the TRCA jurisdiction (Appendix 4). This rarity could be the result of natural factors such as limited habitat or range, or it could be due to loss or alteration of habitat due to development pressures. Most of the rare or declining plants found in the Cold Creek Conservation Area have factors associated with their status that are related to habitat dependence or sensitivity. As noted above, using rarity as the sole rationale for protection is insufficient and leads to environmental degradation. Due to urbanization, the direct loss of habitat and the experience of the TRCA jurisdiction natural system, it is assumed that most native plants in the TRCA jurisdiction are undergoing at least slight declines.

d) Fauna Species Abundance

Ten fauna species found at Cold Creek – pied-billed grebe, red-shouldered hawk, Cooper's hawk, golden-crowned kinglet, yellow-rumped warbler, Blackburnian warbler, black-throated green warbler, clay-coloured sparrow, purple finch and striped chorus frog – are considered regionally rare. As is the case with flora, most regionally rare fauna species have other associated factors which explain their vulnerability which need to be taken into account in conservation strategies.

2. Distribution

a) Landscape – Distribution of Natural Cover

Natural cover performs innumerable functions, ranging from supporting native biodiversity to providing recreational and aesthetic opportunities for people, to water-related benefits. If natural cover is distributed evenly across the landscape, then those functions are provided evenly. In the TRCA jurisdiction, habitat cover is weighted

Cold Creek Conservation Area
Photography by Rosemary Hasner

Table 5: Terrestrial Natural Heritage Approach

Objective	Indicator	Measure (analysis)	Scale of Detail (data collection)
Promote the percent natural cover to a quantity which provides targeted biodiversity	Quantity	Total Natural Cover Vegetation Community Abundance Species Abundance	Landscape Vegetation Community Species (Flora and Fauna) Levels
Distribute natural cover to maximize opportunities for intraspecific variation	Distribution	Distribution of Natural Cover in relation to the TRCA Region Distribution of Vegetation Communities of Concern (L1-L3) Distribution of species of Concern (L1-L3)	Landscape Vegetation Community Species (Flora and Fauna)
Improve habitat patches to provide for species needs and promote population variability	Size and Shape	Habitat Patch Size Patch Shape Habitat Interior Area-Sensitivity	Landscape Landscape Landscape Species (Fauna)
Improve the opportunities for species to move safely across the landscape	Connectivity	Natural Cover Connectivity Vegetation Type Connectivity Community Species Mobility	Landscape Vegetation Species (Fauna)
Protect the natural system quality and function from the influence of surrounding land uses	Matrix Influence	Matrix Influence Scores Sensitivity to Development	Landscape Species (Flora and Fauna)
Protect and restore all native vegetation community types and species to adequate levels	Biodiversity	Vegetation Type Representation Geophysical Requirements Species Representation Habitat Dependence	Vegetation Community Vegetation Community Species (Flora and Fauna) Species (Flora and Fauna)

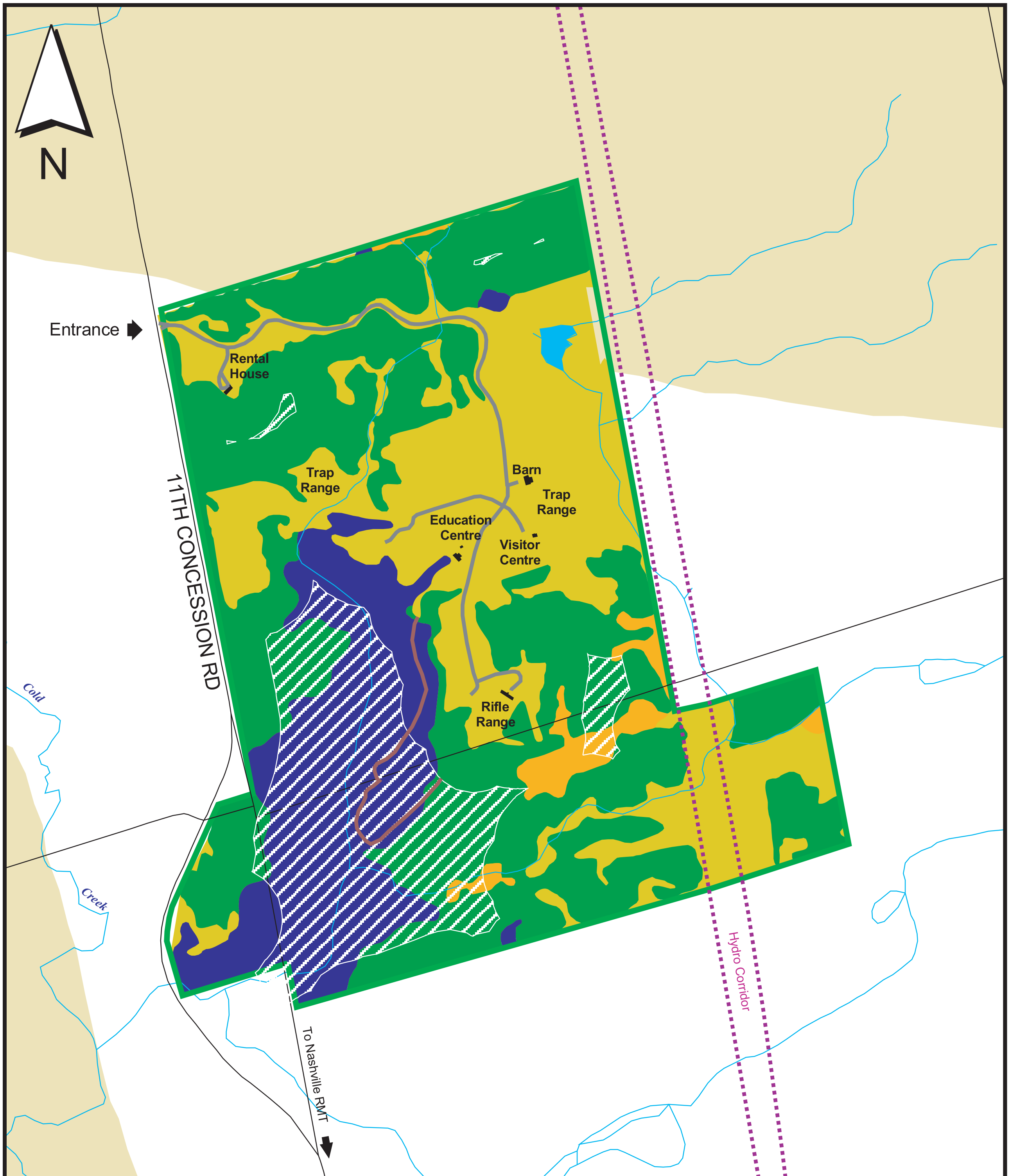
progressively to the north, with a serious deficiency to the south. This means that the northern part of the jurisdiction, including the Cold Creek Conservation Area, bears the burden of ensuring maximum biodiversity for the region as a whole since the largely urbanized southern portion cannot support most of the highly sensitive species.

b) Distribution of Vegetation Communities of Concern

High-ranking vegetation communities are those with ranks L1-L3. The ranks are based upon a combination of two criteria: local distribution and geophysical requirements. This more integrated assessment of conservation concern replaces the more-or-less strictly abundance-related criteria which have hitherto been used.

A total of six of the 42 vegetation communities at the Cold Creek Conservation Area are considered to be of regional concern, with ranks ranging from L1 to L3. Three of these are ranked L2 and the other three are ranked L3. A complete list of the vegetation communities found at Cold Creek, together with their ranks, appears in Appendix 3.

The communities of concern in the Cold Creek Conservation Area consist of four types of wetlands, a clay barren community and a mixed forest community. The most noteworthy of these communities is the large coniferous swamp (SWC3-2 White Cedar-Conifer Organic Coniferous Swamp) ranked L3. The other communities of regional concern are: SWT3-5 Red-osier Organic Thicket Swamp (ranked L3), MAM3-6 Broad-leaved Sedge Organic Meadow Marsh (ranked L2), MAS3-4 Broad-leaved Sedge Organic Shallow Marsh (ranked L3), CBO1



Map 7

THE HUMBER RIVER WATERSHED

Cold Creek Conservation Area Management Plan

COLD CREEK CONSERVATION AREA
TERRESTRIAL HABITAT

200 0 200 400 600 800 Meters

Legend

Cold Creek C.A.
Oak Ridges Moraine
Interior Forest (100 m)

Hydro Corridor
Gravel Path
Boardwalk

Terrestrial Habitat
Forest (47%)
Successional (3%)
Meadow (31%)
Wetland (19%)
River/Pond

Humber River

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Open Clay Barren Ecosite (ranked L2) and FOM8-1 Fresh-Moist Poplar Mixed Forest (ranked L2). Descriptions of many of these communities appear in the biodiversity section below.

Cold Creek's vegetation communities, particularly the swamp and mature forests, make an important contribution to the regional natural heritage system. Most of the conifer swamps have long disappeared from the southern portion of the jurisdiction, having been drained for agriculture and/or replaced by urban development. Conifer swamps are now largely restricted to seepage areas along the Oak Ridges Moraine and some associated with the Iroquois shoreline in the eastern part of the jurisdiction.

c) Flora Species of Concern

The distribution of flora and fauna species of concern in the TRCA jurisdiction shows a concentration of occurrences in the northern parts of the watersheds, corresponding to the distribution of natural cover. In order to protect the full complement of native plants and animals that occur in the region, including those that cannot survive within an urban matrix, it will be necessary to protect the natural heritage system in the northern, rural part of the jurisdiction.

Eighty two of the 341 flora taxa found on the site are native species of regional concern ranked L1 to L3. Locations of these are shown on Map ($7A_1$) and a complete list of the flora species found on the site and their ranks can be found in Appendix 3. These ranks are a summary of the species' scores for four criteria: for sensitivity to development (see under Matrix Influence below) and habitat dependence (see under Biodiversity below) as well as rarity and population trend (see under Quantity above). Species of concern are not necessarily rare plants. However, because of their sensitivity to development and restriction to certain habitats, they are of conservation concern. Many of them are locally rare and/or have declining populations. Current trends are such that they are heading in the direction of rarity. Conservation efforts need to be exercised before a species becomes rare.

Varga. (1997)[6] identified 289 vascular plant species in the Cold Creek wetland complex which included some wetlands in the area surrounding the Conservation Area. Please refer to Appendix 4 for a complete list of the flora species found. Separate columns show the findings of TRCA and Varga.

Creeping snowberry, found in the CCCA, is given the highest rank of L1, is an excellent example of a highly vulnerable plant in the TRCA jurisdiction. This plant of

Coniferous Swamp – Cold Creek Conservation Area
Photography by Rosemary Hasner

cool, coniferous swamps used to occur in Toronto in places such as Mount Dennis (Faull, 1913)[7]. Now it is only found in a handful of swamps on the moraine. Most of its habitat has been eliminated and it is vulnerable to indirect impacts from nearby land uses.

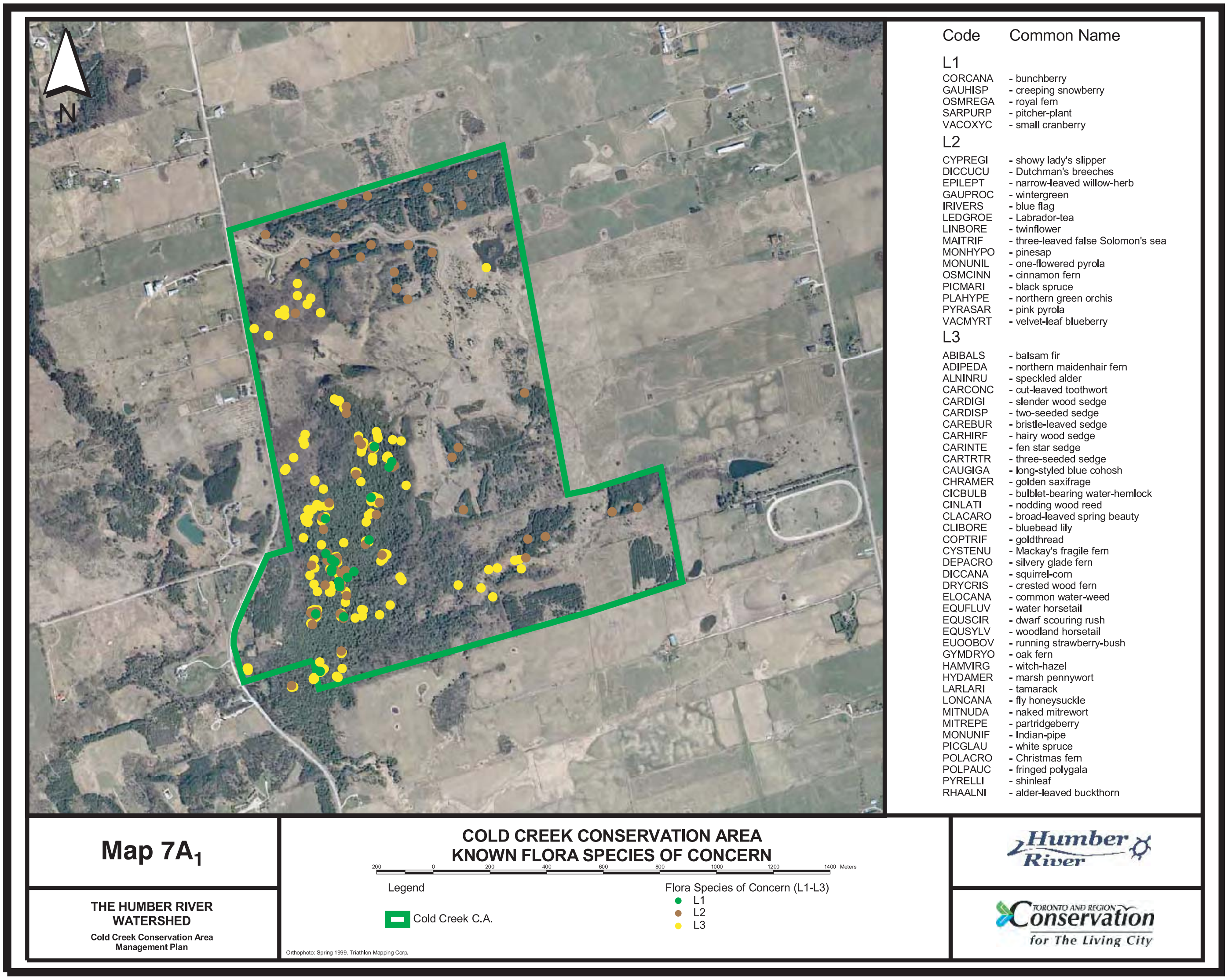
d) Fauna Species of Concern

In the 2002 summer survey, a total of 29 L1-L3 bird species were recorded consisting of one L1 species (red-shouldered hawk), four L2 species (pied-billed grebe, Cooper's hawk, wood thrush and black-throated green warbler) holding 16 potential breeding territories, and 24 L3 species holding 97 potential territories. Surveys in previous years had also documented black and white warbler. The four species of frog recorded at Cold Creek (three L2 and one L3) bring the total of fauna ranked L1-L3 to 34 species. Locations of these fauna species of concern are depicted on Map $7A_2$.

Almost all of the 34 species of concern that occur at CCCA have a distribution very much weighted to the north of the TRCA jurisdiction, outside of the southern, more urbanized portion. Loss of any one of these species at Cold Creek would tend towards an overall reduction in the distribution of that species in the northern part of the region, continuing a trend towards the undesirable level of distribution that presently exists in the southern portion of the region. Species as varied as black-throated green warbler, scarlet tanager and field sparrow have already been almost completely extirpated from the southern portion of the region and are now effectively restricted to the outer reaches of the TRCA jurisdiction and some of the better ravine systems.

6. Vagra, Steve.1997. *Ontario Ministry of Natural Resources Wetland Evaluation Data.*

7. Faull, J.H. 1913. *The Natural History of the Toronto Region.* Toronto: Canadian Institute.



Osmunda regalis – royal fern (L1 species)
Photography by Jeremy Ind

3. Matrix Influence

a) Landscape Matrix Influence

Surrounding each habitat patch in the TRCA region is a matrix of land uses including natural, agricultural and urban. Each of these land uses has an influence on the ecological function of the system. Adjoining natural cover are beneficial agricultural uses (as well as golf courses) which exert a moderately negative influence, while urban uses exert a strongly negative influence. The negative impacts include hydrological changes, incursions by opportunistic fauna such as increased raccoon populations and cats roaming from backyards, invasive exotic plant species, trampling, and collection. The result is varying levels of habitat quality and biodiversity depending on the matrix, irrespective of whether the habitat is "protected" in a park or reserve.

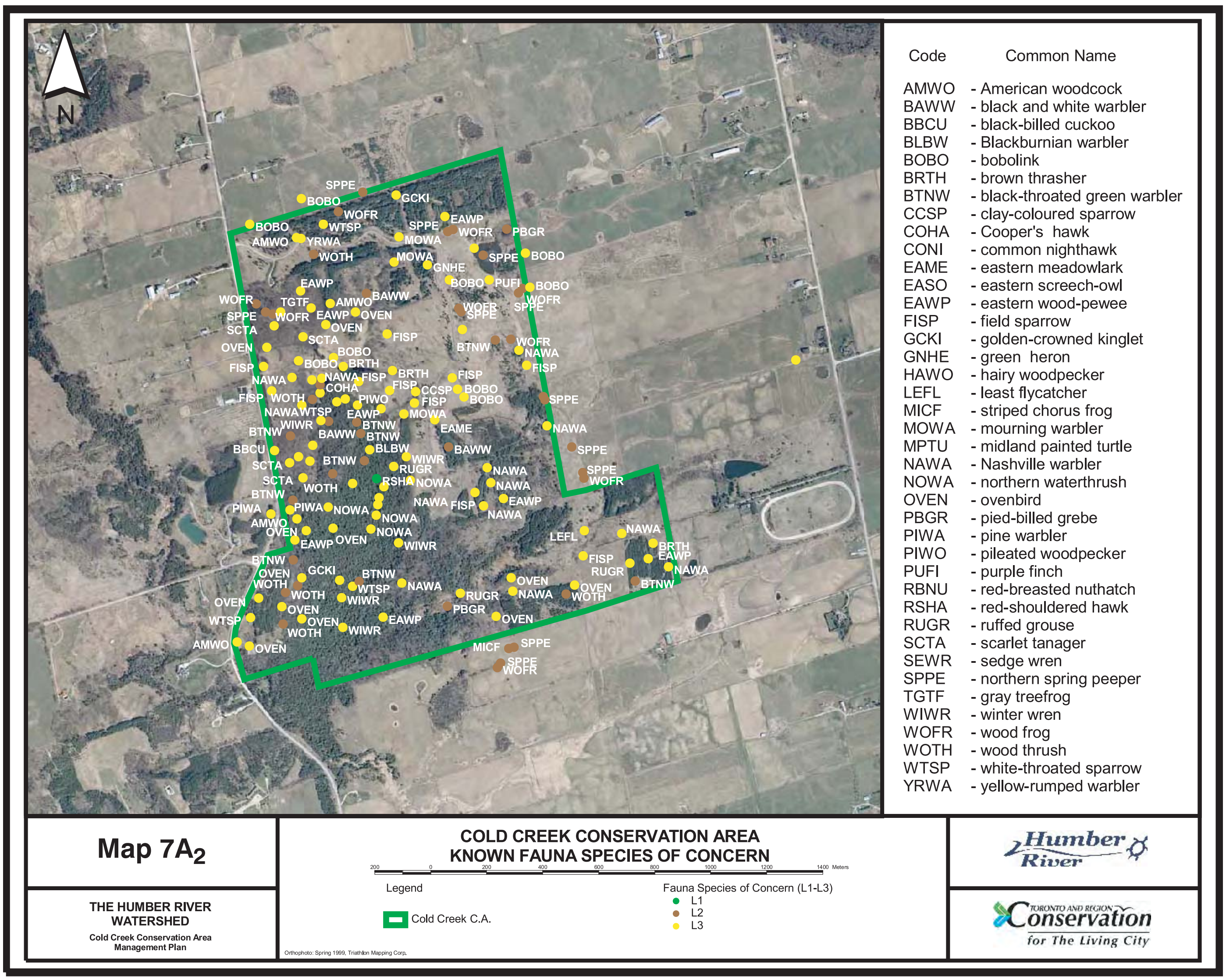
The present land uses surrounding the natural area at Cold Creek are largely a matrix of agricultural and old fields resulting in an overall matrix influence score of

Maianthemum trifolium – three teared taled solomon's seal (L2 species)
Photography by Jeremy Ind

three points (out of a possible five points, see Map 7B) or a "fair" matrix influence. In fact, the landscape analysis assumed agricultural uses on a larger area than is actually the case, as much of the open land is actually old-field natural cover.

b) Species Sensitivity to Development

Regardless of whether or not a habitat is protected, many species are of concern because of their vulnerability to specific impacts that come with adjacent land uses, especially urbanization. The CCCA site contains a significant number of sensitive species (see Appendix 2). Tolerant species include both invasive exotics, such as garlic mustard, and aggressive or tolerant natives ranked L5 such as Virginia waterleaf or tall goldenrod, in the case for flora, and American robin and blue jay as examples of tolerant fauna species. These are wildlife examples that might be expected to persist indefinitely without protection and/or habitat management in the region.



Black-throated Green Warbler
Photography from TRCA Archives

c) Flora

Specific development impacts on flora species include: changes in hydrology and surficial conditions; trampling with its associated plant tissue damage and soil compaction; competition from invasive exotic species that readily move into disturbed or fragmented habitats from gardens or trails; picking and collection; herbivory by increased populations of opportunistic fauna such as Canada geese or squirrels which thrive in fragmented landscapes; soil, water and air pollution.

Many of the 82 species of concern (ranking L1-L3), show a high sensitivity to development, scoring greater than or equal to three points in the sensitivity to development category (see Appendix 3 for a complete list of flora species found at CCCA). Some of the possible impacts and species vulnerable to those impacts are discussed below.

Wetland flora species, especially those associated with swamps, are highly vulnerable to changes in hydrology. Examples of such species at CCCA include creeping snowberry, twinflower, golden saxifrage, cinnamon fern, goldthread and tamarack. Many of these require a steady seepage of cold ground water as they are typical of conifer swamps. Hence, interference with the ground water seepage through drainage or diversion will have a serious impact on these species. Other species, though not restricted strictly to swamps, such as oak fern and hemlock which ranks as L4, require a moist, sheltered environment and would suffer from increased drying especially with canopy opening and exposure to wind and sun.

A number of the flora species of concern identified at CCCA have delicate stems and root systems and are not able to withstand trampling and soil compaction. These include species such as Mackay's fragile fern and star-flower. Other species, notably many of the showy-flowered monocots such as blue-bead lily, only produce one set of leaves per growing season and will not replace them if they are broken off by trampling. The sensitivities of these species should be considered when planning trail development and user allowances (for example, off-leash dogs in areas containing these species could be detrimental to their survival).

Invasive species such as European buckthorn, which is present in a few areas of the Cold Creek site, can often out-compete native species, especially if the latter are small in stature, slow-growing and if there is even slight disturbance. For example, balsam fir is likely to be replaced as a component of understorey regeneration in moist successional forests by European buckthorn and spring ephemerals such as squirrel-corn and broad-leaved spring beauty are liable to be ousted by garlic mustard on the forest floor. Garlic mustard has not yet been found in the Cold Creek Conservation Area but is a region-wide problem that could invade Cold Creek from surrounding lands. Disturbance facilitates the spread of invasive species, while large, intact natural habitats tend to inhibit them.

Forest management can disrupt the natural dynamics of woody debris accumulation or wind-throw mounding. Saprophytes, such as Indian pipe, require an intact forest floor with its intricate litter food web whereas pinesap appears to require dense, young stands of conifers such as fairly young plantations or stands of cedar. These are things to consider when planning the management of the forests or plantations at CCCA.

Elevated numbers of herbivores associated with settlement patterns can result in the decline of certain plant species (Sauer, 1998)[8]. This is due to the fragmentation of the large areas of habitat required by higher-order predators that normally control herbivores, as well as the provision of ample food sources for herbivores with "edge" habitat. White-tailed deer have had a serious impact in some areas of the U.S. and in some southern Ontario parks such as Rondeau. They are a particular concern with woodland herbs such as white trillium and young trees. There is some concern that deer may become a moraine-wide issue although they are not a specific concern at CCCA at this time.

Increased usage of the area may lead to increased pressure for picking and collection of showy plants as people try to transplant them to their gardens. Eye-catching flowers such as the showy lady's slipper or trillium species and unique plants such as the pitcher-plant are prime targets for collectors. Attractive ferns such as Christmas fern may also face some pressure.

Pollution and other forms of chemical alteration of habitat may affect certain plants. While air pollution tends to be a regional rather than a site-specific issue, alterations to soil and groundwater are a frequent threat arising from development, both on-site and on adjacent lands. For

8. Sauer, Leslie. 1998. *The Once and Future Forest.* Washington D.C.: Island Press.

example, run-off from adjacent agricultural lands, existing and proposed golf courses, lawns, roads and/or bridges is often highly concentrated with pesticides, nutrients, oil and road salt. This run-off enters the nearby wetlands and other natural habitat patches and can potentially alter the physical and chemical composition in an unfavourable manner. Many native plants, especially those of wetlands, require natural water input which is relatively low in silt and nutrients. Subsoil and concrete that are dumped in fill are usually highly alkaline, and the resultant alterations in soil chemistry would be harmful to plants requiring low-nutrient or acidic conditions such as pyrolas and their relatives, Labrador tea or wintergreen found in the CCCA on organic soils. Wetlands with altered chemistry, especially high levels of nutrients and silt, tend to be taken over by aggressive species that take advantage of the high fertility, such as reed canary grass.

d) Fauna

At CCCA, 24 of the 34 fauna species that are ranked L1-L3 score three or more points (out of a possible five) in the Sensitivity to Development category and are currently at this site because the surrounding matrix is largely natural and agricultural. These sensitive species can be divided approximately into two groups: those species that prefer forest-interior or closed habitat-types (19 of the 24 species); and four species that require relatively open habitat (brown thrasher, field sparrow, eastern meadowlark and striped chorus frog); leaving one open-water/wetland obligate species, pied-billed grebe. A deterioration of Matrix Influence would adversely affect these species.

Several of the bird species found at Cold Creek nest in low in-the-ground vegetation or on the ground. As such, they are highly susceptible both to increased predation from ground-foraging predators (house cats, raccoons) and to repeated flushing from the nest (by pedestrians, off-trail bikers and dogs) resulting in abandonment and failed breeding attempts. Such sensitive forest-bird species include ruffed grouse, veery, ovenbird, black-and-white warbler and white-throated sparrow. Two of the more open habitat bird species, field sparrow and eastern meadowlark, and Nashville warbler (an inhabitant of open woodland and edges) are ground-nesters (or sometimes slightly elevated in the case of field sparrow; brown thrasher also frequently nests at ground level) and would be severely affected by any increase in pedestrian, vehicular or dog traffic within their habitat. At current local population levels, it appears that sensitive ground-nesting species are able to exist relatively unmolested and undisturbed (note in particular the high number of Nashville warblers noted on the site).

4. Size and Shape

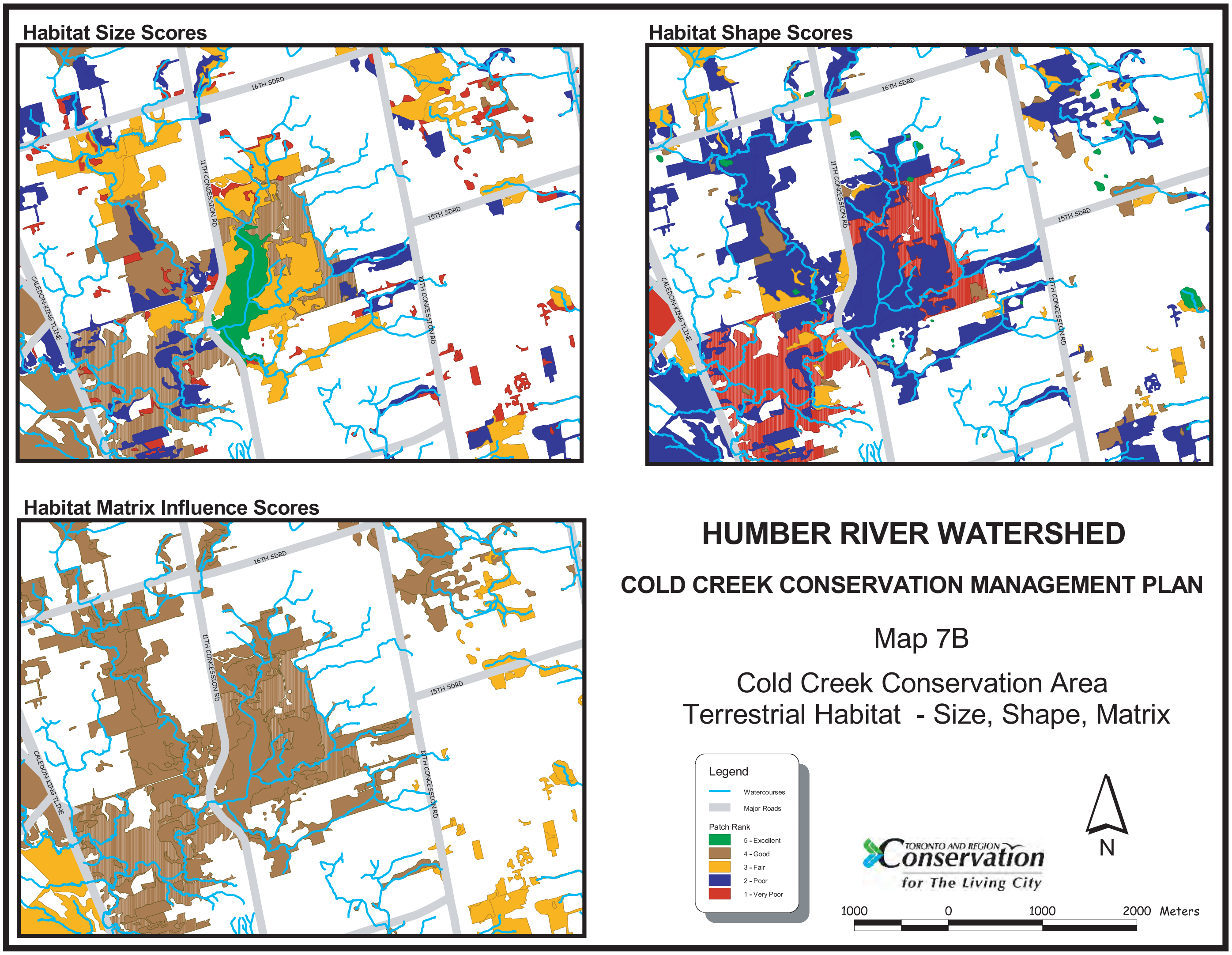
Generally, the function of a habitat patch is exponentially related to its size and shape (Map 7B). Larger and rounder is better, partly because size and shape dictate the amount of habitat interior conditions.

Interior conditions are not found (or restored) everywhere, so a second concept, area-sensitivity, is important to consider. Area-sensitivity, or the need for habitats of a certain minimum size, varies between fauna species along a gradient. (This concept does not apply to flora in a direct way, although exposure to the elements and invasive species incursions is scored under sensitivity to development.) In other words, some fauna (i.e., grey catbird, indigo bunting) can survive in very small forests. Others (i.e., eastern wood-pewee, wood thrush) can use medium-sized forest patches, while species with high scores such as hermit thrush and ovenbird require large forest blocks.

a) Habitat Interior

The term “interior” is applied to those parts of the habitat patch that are greater than a certain distance from the edge. The numerical definition is usually set at 100, 200 or 300 metres from any edge, but even in smaller patches, larger and rounder is better. Forest interior provides shaded, moist, cool conditions and some refuge from external effects, the conditions needed for numerous native plants and animals.

Much of the forest at the CCCA site is somewhat fragmented and only scores three out of a possible five points (“fair” rating) for patch size, and even lower in terms of shape. On the other hand the coniferous swamp, considered a wetland as opposed to forest, scores considerably higher for size (five points out of a possible five!). The rather low patch-size scores of the forest cover are somewhat surprising but can be readily explained by the fact that the large patch of swamp forest in the south-west corner of the site effectively divides the otherwise high scoring woodland patch. This same habitat patch similarly masks the real occurrence of forest interior at Cold Creek since, again, this large habitat patch is considered wetland rather than forest and hence diminishes the apparent forest interior. In fact, if the coniferous swamp was treated as forest cover the south-west quarter of the site would hold an extensive area of 100 metres forest interior and the site’s only area of 200 metres interior. For the purpose of calculating forest interior, the swamp will be considered as forest instead of wetland. To illustrate this, treed swamp appears as a separate category under wetlands on Map 7C.



b) Area Sensitivity

Twenty-four of the 34 L1-L3 ranked fauna species that occur at CCCA are considered area sensitive (i.e., require at least five hectares of preferred habitat), with three species – red-shouldered hawk, least flycatcher and black and white warbler – requiring in excess of 100 hectares of forest. Nine species (including winter wren, black-throated green warbler, Blackburnian warbler, pine warbler, ovenbird and scarlet tanager) require at least 20 hectares of forest habitat; the remaining 12 area-sensitive species (including Cooper's hawk, Nashville warbler, northern waterthrush, white-throated sparrow and the four frog species) require at least five hectares of continuous habitat.

5. Connectivity (Linkage)

Connectivity of natural habitats facilitates the movement of flora and fauna across the landscape. Natural corridors play an important role in maintaining ecological functions by allowing for the genetic flow of plants and animals. For example, connectivity prevents genetic isolation and inbreeding in plant and animal populations by allowing genetic exchange to occur between habitat patches, and it allows fauna to move between areas of crucial habitat. Many species of fauna and flora are habitat specialists and require corridors consisting of their preferred habitat type. The wider a corridor, the greater the opportunity is for habitat specialists. Habitat generalists (more tolerant species) will use virtually any habitat to move, but even they can be thwarted by roads and houses and other facets of development.

a) Landscape Connectivity

All native species in our region are adapted to a highly-connected landscape with complete natural cover. Fragmented landscapes with isolated habitat patches, separated by artificial barriers, have only occurred in the last two centuries. Efforts should be made to link the habitat patches in Cold Creek Conservation Area with patches in the surrounding area to increase connectivity and create wildlife corridors.

White Throated Sparrow
Photography by Rosemary Hasner

b) Species Mobility

While connectivity is a habitat issue for flora species in terms of the dispersal of seed or other propagules across a fragmented landscape, the scoring of this criterion is hard to assess because the sensitivity of flora to inbreeding, for example, varies enormously from species to species. The need of fauna species for habitat connectivity is better understood, and treated below.

Thirteen of the 34 L1-L3 ranked fauna species that are found at CCCA show a requirement for continuity of habitat to facilitate mobility; for example, adults foraging for food during the nesting and fledgling stage of the breeding season.

Perhaps more sensitive to this issue than any of the bird species are the frog species. Spring peepers and wood frogs migrate seasonally, moving to breeding pools in the spring (a variety of permanent and vernal water bodies - ponds, swamps, bogs, lakes and ditches), then returning to woodland habitat for the summer. Grey treefrogs, similarly, breed in permanent or vernal pools, and migrate to forage in moist woodlands for the summer months. If any obstacle to such migrations is imposed on the frog's habitat, their breeding cycle is interrupted and, thus, the population is endangered. To avoid such an impact, it is important to maintain safe corridors between habitat blocks (see: Sensitivity to Development section under Matrix Influence). New roads can expose migrating frogs to predators (as the frogs cross unprotected ground) and the chance of roadkill.

Currently, connectivity, both within the site and between the site and its immediate surroundings, is good with very few physical obstacles to impact on the mobility of various fauna species. This is attested to by the large number of frog breeding sites in and around CCCA. Any development or management proposals should seek to maintain this level of connectivity, thereby protecting the high biodiversity of the site.

6. Biodiversity

According to the TRCA's Terrestrial Natural Heritage Approach, biodiversity is described by vegetation type, flora species, and fauna species representation. Representation is essentially the presence or absence of a species at a site. Traditionally this has been deemed an adequate measure of the quality of a site but this ignores the idea of viability and vulnerability. It is important to tie representation to abundance such that an ideal situation is one where each species represented on a site is present in numbers high enough to maintain its local population, a situation which is only likely to exist where those species' specific habitat requirements are met.

a) Vegetation Community Type Representation

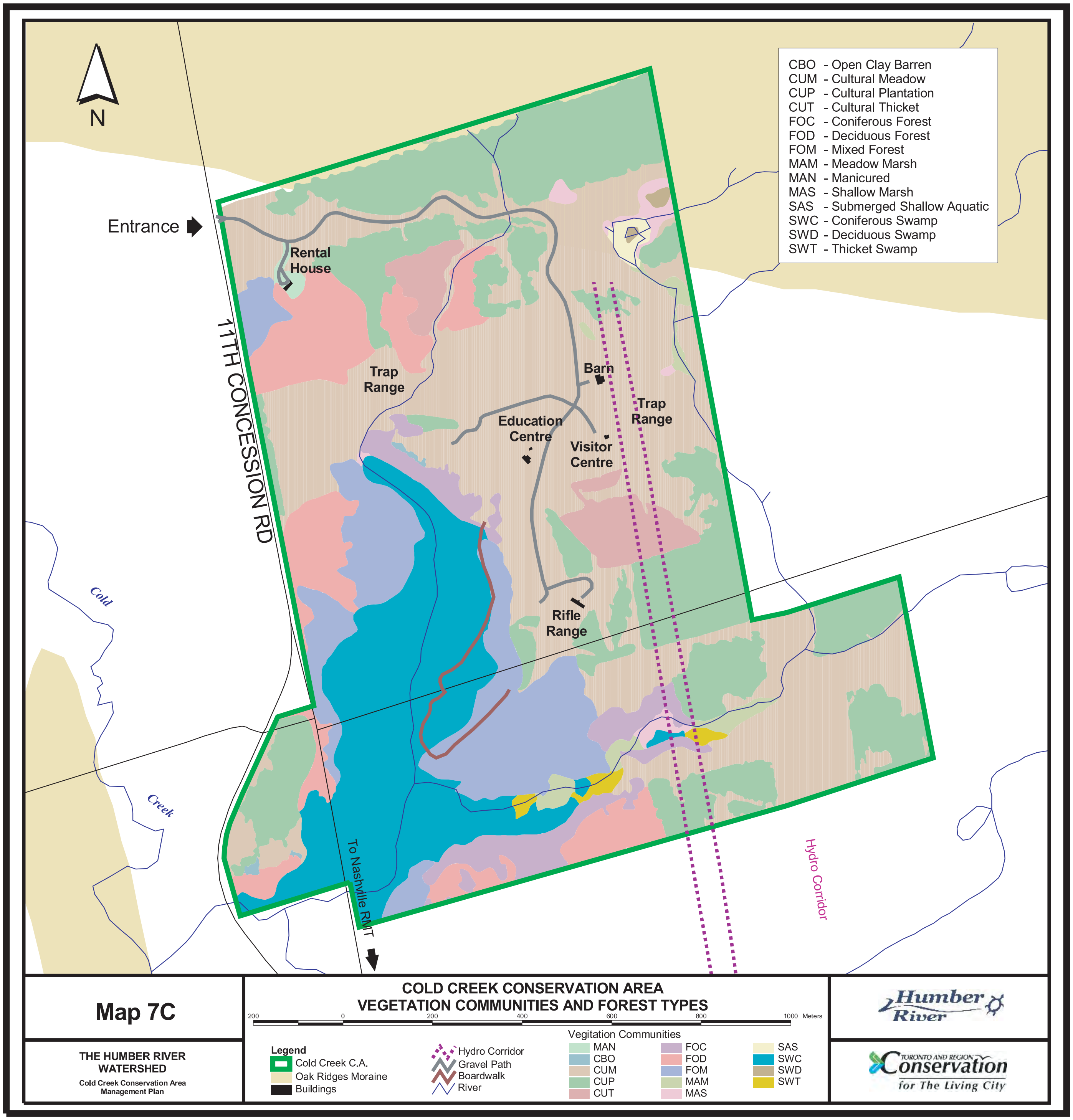
All of the vegetation communities identified in the 2002 field season in CCCA are listed in Appendix 3 together with their scores and ranks. These communities are illustrated on Map 7C. Forty-seven different vegetation community types were observed including 10 that were only represented as complexes or inclusions which occupy areas of less than 0.5 hectares. A small manicured area near the house was not counted. A description of the vegetation community types that were found in the CCCA is provided below.

a.1) Forests

At CCCA there are two broad categories of forests: those that are a result of natural succession processes having taken place (forests of natural origin) and those that result from planting (plantations).

Forests of Natural Origin
There are 15 natural forest community types existing at CCCA. Mature, deciduous forest communities on-site are usually dominated by sugar maple with beech, white ash, basswood and ironwood acting as secondary associates. A

Grey Tree Frog
Photography by Rosemary Hasner



number of mixed forest community types were also present, including Fresh-Moist Sugar Maple – Hemlock Mixed Forest, Fresh-Moist White Cedar – Sugar Maple Mixed Forest and Fresh-Moist Poplar Mixed Forest. A few stands of conifer forest also occur on the site. These comprise mostly pure cedar stands although on a few of the moister sites there is hemlock mixed with the cedar. Most of the forests in CCCA are located adjacent to the swamp and provide a buffer that allows much of the swamp to be considered "interior habitat." Many of these forest communities are ranked L4 or L5 but may be of high quality due to their maturity and rich ground flora. Some of the noteworthy natural forest community types are described here.

Dry-Fresh Sugar Maple Deciduous Forests

These forests are dominated by sugar maple also referred to as hard maple. This species is shade tolerant, being able to regenerate beneath its own shade. These forests have a range of age-classes growing within the same compartment. Growing in association with the hard maple are other tolerant and mid-tolerant tree species such as American

Photography by Rosemary Hasner

beech (FOD5-2 Dry-Fresh Sugar Maple – Beech Deciduous Forest), basswood (FOD5-6 Dry-Fresh Sugar Maple – Basswood Deciduous Forest), white ash (FOD5-8 Dry-Fresh Sugar Maple – White Ash Deciduous Forest) and ironwood (FOD5-4 Dry-Fresh Sugar Maple – Ironwood Deciduous Forest). Other hardwoods common to the Great Lakes/St. Lawrence forest region and Deciduous forest region also occur in these forests. This type of natural compartment is referred to as a climax forest where regeneration of the forest occurs under a developed canopy (favouring tolerant species) and in small openings in the forest canopy. These mature sugar maple forests are noteworthy for their rich ground flora, especially their carpets of spring ephemerals. Many of these spring ephemerals are regional species of concern including cut-leaved toothwort, squirrel-corn, and broad-leaved spring beauty which are all ranked L3 and Dutchman's breeches which is ranked L2.

Fresh-Moist Poplar Mixed Forest

This community is located next to the organic cedar swamp near the southern boundary of the Conservation Area and is of regional concern with a ranking of L2. This mixed forest has trembling aspen and balsam fir as the dominant species in the canopy growing in association with paper birch and cedar. Balsam fir is itself ranked as an L3 species and its inclusion as a dominant species in this forest type partially explains why this community is of regional concern. This forest acts as an important buffer to the swamp and also provides habitat for other regional species of concern such as oak fern and fly honeysuckle both ranked L3.

Plantations

There are 10 plantation community types occurring at CCCA. Seven of these plantations are coniferous, two are mixed coniferous-deciduous and one is deciduous. It should be noted that although the deciduous plantation is actually coded as a natural forest (FOD4-c Dry-Fresh Black Locust Deciduous Forest), it should be considered a plantation as it is dominated by black locust which is an exotic species that propagates by growing suckers from the original planted trees.

The vast majority of the plantations at CCCA are softwood (coniferous) plantations. Softwood plantations have been widely planted on the TRCA properties as part of the land management and conservation programs. Plantation establishment in general has taken place over the past 50 years. Plantations at CCCA are multi-aged and in various stages of maturity and management. Specific recommendations for the management of these plantations are provided in Chapter 6. The most common plantation types found are dominated by white pine, white spruce, or a mixture of native and exotic coniferous tree species.

a.2) Wetlands

There are 13 wetland community types found at the Cold Creek Conservation Area. Of these communities, the largest and most significant is the White Cedar – Conifer Organic Coniferous Swamp. Thicket swamps, dominated by red-osier dogwood or slender willow and many different types of marsh communities, are some of the other wetlands present at the Cold Creek Conservation Area. A description of the conifer swamp follows.

White Cedar – Conifer Organic Coniferous Swamp:
This large conifer swamp is located in the southeast corner of the site and exhibits old-growth characteristics. Organic soils greater than one metres in depth indicate centuries of uninterrupted accumulation. Growing in association with white cedar is a mix of balsam fir, white spruce, tamarack and occasional hardwoods such as black ash and yellow birch. The relative composition of different areas within the swamp varies according to levels of soil moisture. The swamp at CCCA also supports a component of black spruce which is rare to this area of Ontario. The black spruce remaining in the swamp are considered overmature and a remnant of an earlier community type. Shade tolerant balsam fir and white cedar are generally replacing the black spruce. The lack of disturbance in the forest understory has impeded the ability of the black spruce to reproduce on this site and, without intervention, this species will not have a long term future at CCCA. One possibility for maintaining the black spruce component involves planting plugs of black spruce in windthrows that have created natural openings in the canopy (see Chapter 6 for more information about this recommendation). The sensitivity of this ecosystem should not be under-estimated. A large number of regional species of concern were found here, many of which are highly sensitive to trampling and other impacts. Although this community should be considered a wetland, it is shown as a forest community in Map 7C. This was necessary for the calculation of 100 metres forest interior.

a.3) Open and Successional Communities

Six community types found at Cold Creek Conservation Area can be considered open or successional. Among these communities are the dry, open meadows referred to as “old field” that occur on agricultural fields or pasture lands that are out of use. These old fields may contain established species such as hawthorn and wild apple. Regeneration in old field communities creates other, less open, successional communities. Regeneration will occur from surrounding forest tree species. Shade intolerant and mid-tolerant species like white cedar, white ash, white pine and poplars are seeding into the old field areas and

The Boardwalk at Cold Creek Conservation Area
Photography by Rosemary Hasner

may colonize and become established if conditions for their survival are favourable. These habitats can provide variety to the landscape and increased opportunities for some wildlife species. These areas, if left undisturbed, will allow for natural succession to shape the future communities in the Conservation Area. One successional community is classified as Exotic Cultural Thicket (CUT1-c) due to the presence of European buckthorn, an invasive exotic species. If such species are not removed from the site, natural succession could mean future communities will be dominated by such aggressive exotics, thus reducing their quality.

A few small areas of clay barren community are also found at the site. This community type is of regional concern and contains minimal vegetation. The species that are found here include stunted cedar trees, hawkweed species and gray goldenrod.

b) Vegetation Type Geophysical Requirements

Vegetation communities develop under certain site conditions. Certain communities are restricted to particular conditions based on slope, aspect, hydrology, soil character, and dynamic processes. Others occur under less restrictive conditions across a range of sites. Certain communities are associated with particular topographic situations. Conifer and mixed swamp communities require a cool, moist exposure. This means that they are found in bottomlands and north and east facing slopes. The White Cedar-Conifer Organic Coniferous Swamp community occurs only on soils with an organic layer at least 40 cm in depth. These organic soils take centuries to form and cannot be replaced through known ecological restoration techniques. Another important feature of organic wetland soils is that they act as long-term carbon sinks. Some of the regional species of concern that were found in the cedar-conifer swamp require acidic soil offered in “bog-like” microhabitats.

c) Species Representation (Flora and Fauna)

Flora Species

The flora of Cold Creek Conservation Area is noteworthy because of the mix of northern and southern species. The high quality vegetation communities of the site (most notably the cedar-conifer organic swamp and the variety of mature forests) enable it to support a wide range of flora species. A total of 341 flora species were found at Cold Creek by the TRCA 2002 field staff and by Steve Varga from the OMNR in 1997. There are 82 considered regional species of concern and 65 are listed as exotic or non-native species. For a complete list of all vascular plant species and their respective L-ranks found in CCCA, refer to Appendix 4.

Fauna species

The TRCA fauna surveys at CCCA in 2001 documented a total of 73 bird species, seven mammal species and eight amphibian species. Surveys in previous years had also reported black and white warbler on the site, bringing the total of bird species to 74, and the total of resident (breeding) fauna species to 89. Appendix 2 lists all fauna species found at the Cold Creek site together with their conservation ranks.

d) Species - Habitat Dependence

Many species are habitat specialists; that is, they are dependent on very specific conditions or types of habitat. They are sometimes referred to as "obligate" users of those habitats. Many species of fauna require the association of two high-quality habitats for different parts of their life cycle.

Flora

All flora species are dependent, in varying degrees, on certain ecosite characteristics. This varies between species as some are highly adaptable to a wide variety of conditions, while others are dependent on a very narrow range of habitats. Many of the regional species of concern found at CCCA are habitat specialists. A few examples of habitat specialists occurring at CCCA include: oak fern which requires mixed and coniferous swamps and moist forests; Christmas fern, restricted to fresh-moist sugar maple forests or mixed sugar maple-hemlock forests; two-seeded sedge, confined to coniferous, mixed, and thicket swamps, nearly always on organic substrates; and Dutchman's breeches restricted to mature sugar maple forests. Of special interest are the species in the rather large conifer swamp that are dependent on this type of habitat such as creeping snowberry. Included in the large conifer swamp are certain areas of bog-like microhabitat. In these areas, many bog specialists are found including pitcher-plant, round-leaved sundew, small cranberry, black spruce and three-leaved false Solomon's seal.

Polystichum acrostichoides – christmas fern (L3 species)
Photography by Jeremy Ind

Fauna

Certainly, the most interesting of the habitat types that comprise the CCCA is the large and intact coniferous swamp in the south-west corner. The importance of this habitat block is well-illustrated by the occurrence of a fairly dense cluster of species of concern within the swamp, including habitat specialists such as red-shouldered hawk, Blackburnian warbler, black-throated green warbler and black and white warbler. Perhaps more importantly, this coniferous swamp also holds a good population of species that, although not considered habitat specialists, show a marked preference for damp woodland conditions: Nashville warbler (a species which breeds in a variety of habitats but its preferred nesting site is in moss hummocks, as found in such coniferous swamps), winter wren and northern waterthrush (which shows a very definite requirement for surface water).

The variety of vegetation structure (mature forest covering much of the western half, secondary forest in the smaller blocks in the east) and Spatial Landscape (open old-field systems in the north-east quarter, interior forest habitat in the south-west corner) are two aspects of the CCCA site that contribute to the site accommodating such a high number of habitat specialists, and fauna species in general. Both raptor species – red-shouldered hawk and Cooper's hawk – thrive in mature forest, ovenbird and wood thrush both prefer forest-interior habitat, while the Nashville warbler prefers somewhat more open woodland or forest edges. The extensive area of open fields in the north-east corner supports good numbers of field sparrows, alongside bobolinks and eastern meadowlarks.

Deparia acrostichoides- silvery glade fern (L2 species)
Photography by Natalie Iwanycki

4.2 HUMAN HERITAGE

The protection and interpretation of the culture and heritage resources allows us to raise awareness and to reflect on the watershed's diversity, both past and present.

4.2.1 Archaeological Resources

a) Method

Two methods were used to determine the potential of the project area to contain known or unknown cultural heritage resources. First, relevant modern and historic documents held at the Royal Ontario Museum and the Ministry of Culture were examined. Second, the TRCA's Archaeological Site Predictive Model (Burgar 1990)[9] was applied to the project area.

Archival research into historic and modern heritage documents was conducted to determine the presence of any previously reported archaeological sites in the Cold Creek Conservation Area. This research is summarized in the Toronto and Region Conservation Authority's Archaeological Master Plan (Burgar 1990). In addition, the modern data base of recorded archaeological sites, held by the Ministry of Culture, was examined. No archaeological sites had been previously reported within a 1.5 kilometre radius of the property. The nearest registered archaeological site is located 3.5 kilometres to the south.

b) History

The land in the Cold Creek Conservation Area is composed of Lots 10-15 in Concession 10 and Lots 10 and 11 in Concession 11 (Figure 4). The survey of this land was completed in 1799-1800 and was available to settlers shortly thereafter. Evidence suggests that the terrain was hilly in some areas with varying soil conditions, and timbered with hemlock, pine, and hardwood maple. Due to the terrain, the route of the Eleventh Concession Road was altered by the Corporation of the Township of King in 1860-1861. The first Crown patentees were sons and daughters of Loyalists who resided elsewhere in the province and were therefore absentee landlords. Some sold their holdings immediately after their settlement duties were performed and the patent obtained while one, David Bessey, retained his holdings for over 40 years. Often the land passed to speculators, such as the wealthy Niagara merchants Dickson and Street, and the sale of smaller parcels pro rata for tax arrears was seen on some of these township lots in the early to mid-1830's. Only two reserve lots were found within the study area, one of which was acquired by a private individual in the 1840's and the other was sold by the Canada Company. Actual permanent settlement of this area was undertaken by immigrants of English, Irish, Scottish and German background starting in the second quarter of the 19th century. Nearly all these settlers constructed homes of one storey timber construction although the second "Holly Park" house of the 1860's displays some brick construction. Agricultural census returns show that these settlers carried out mixed agriculture with a wide variety of crops and livestock. Fruit growing began to increase in the 1860's and 1870's, and a large proportion of these settlers produced maple sugar. A few grew specialized crops such as hops and flax, some cut timber from their land, and only one family enumerated honey as a farm product. Evidence for trapping was not found with the exception of one fox fur that was taken during the year 1870. The settlers in this area were mainly Presbyterian, although there was also Wesleyan Methodist, Anglican and Catholic families found. Land was donated within the study area for a Presbyterian church, and a Catholic church stood just to the south on Township Lot 9. The main centre of activity focused on the O'Neil "Holly Park" farm on Lot 15. This industrious family erected a sawmill on Lot 15, Concession 11, and ran the local post office between 1878 and 1913. The original Holly Park home, constructed in 1841, was moved and re-assembled in Mulmur Township while the second Holly Park remained in private ownership and was used as a residence as late as 1975. Holly Park was the scene of many social events, and an example of 19th

9. Burger, Robert W.C., 1990. *An Archaeological Master Plan for the Metropolitan Toronto and Region Conservation Authority*. TRCA, Toronto. Ontario.

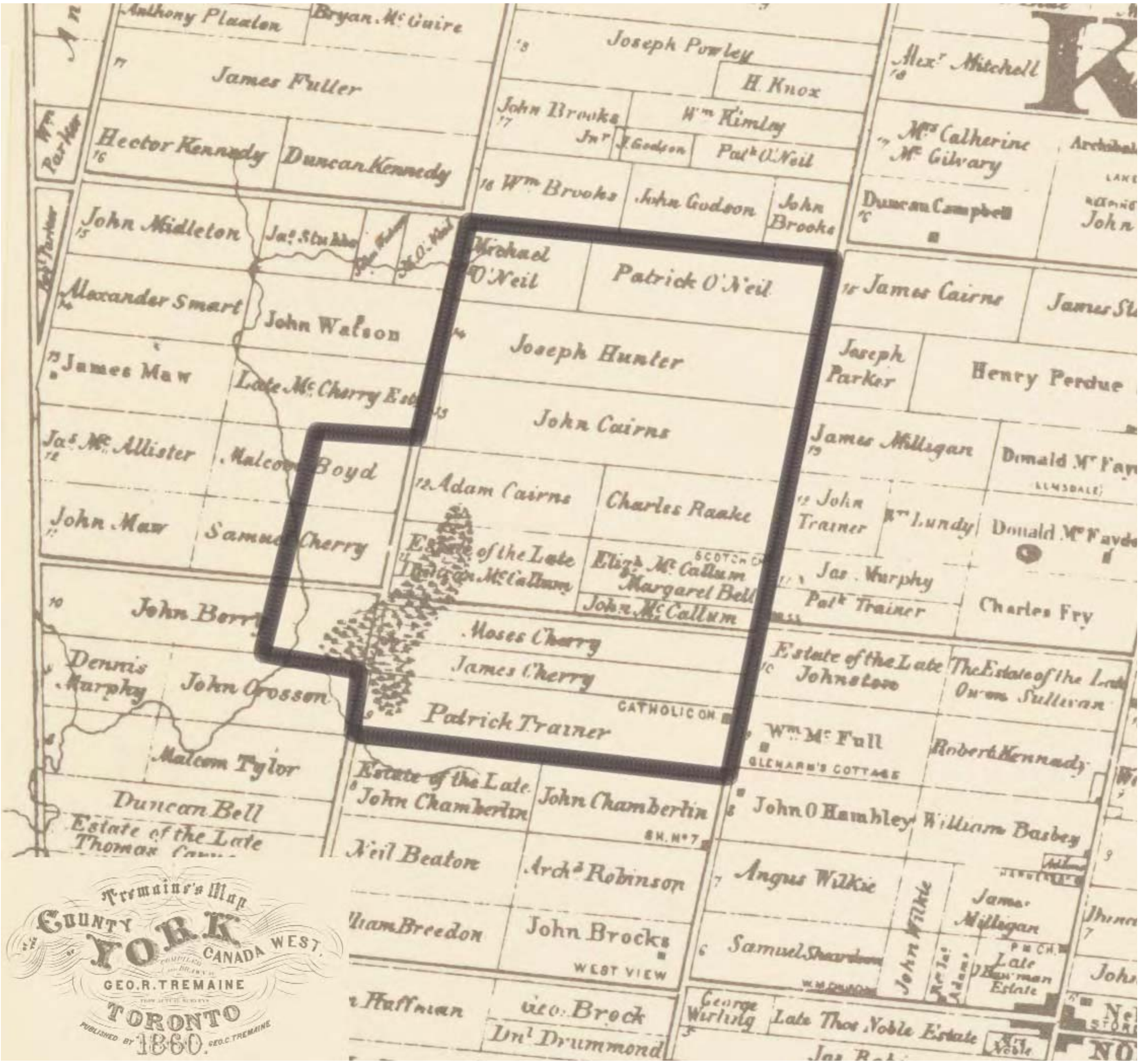


Figure 4: Historical Land Ownership

century poetry commemorating an oyster supper held there has been preserved. The patent plans show a projected railway, the Woodbridge and Sudbury, which was to have cut through the eastern part of Concession 10. This might have increased the importance of the community which, due to its geographic location and the presence of larger towns such as Newmarket and Aurora which were on important transportation routes, Cold Creek and Holly Park were never allowed to develop beyond a small "crossroads" community.

c) Archaeological Potential

Archaeological potential represents the likelihood of finding archaeological sites within a defined area based upon the criteria of the area's distance to a water source, the soil type and drainage capability, and the topography. In planning, determining archaeological site potential provides an immediate indication that sites may be found within a project area. Although all TRCA lands are surveyed for archaeological sites prior to any construction activity or land transfer, site prediction helps to determine the relative amount of land within a project area that is likely to contain heritage resources that may be impacted and, therefore, will require either mitigation or an alteration of the proposed project.

An integral component of the TRCA's Archaeological Master Plan (completed in 1990) was the development of an Archaeological Site Predictive Model (ASPM). This model was designed for use by the TRCA in land use assessments prior to both passive and active development. The ASPM does not predict precise site locations rather, it presents a generalized view of the current understanding of prehistoric settlement patterns in the watershed and applies this knowledge to lands owned by the TRCA.

The ASPM was based on statistical analyses of a well-defined database and mathematically-derived variables. These variables include:

Distance to Water:	1)	-253 metres	(H)
	2)	254 metres^{+}	(L)
Soil Drainage:	1)	Good	(H)
	2)	Imperfect	(M)
	3)	Poor	(L)
Topographic Variability:	1)	Level-gently undulating	(H)
	2)	Undulating	(H)
	3)	Rolling	(M)
	4)	Hilly	(L)

H= High Probability
M=Medium Probability
L= Low Probability

An objective classification of sets of combined variables defined the parameters used to establish High, Medium and Low probability categories. These categories demonstrate the probability that an archaeological site is present in a given locality.

d) TRCA's Archaeological Site Predictive Model Application

An application of the TRCA's Archaeological Site Predictive Model indicated that approximately 170 hectares (90%) of the area within the CCCA is classified as High Probability (Categories 1, 2 and 3) for containing archaeological resources. Of the 170 hectares area, approximately 150 hectares are defined as the highest probability (Category 1) areas which indicate that the vast majority of the CCCA is located within 253 metres of a water source, is on well-drained soil, and has relatively flat topography. Within the Greater Toronto Area (GTA), 34.3% of prehistoric archaeological sites have been found in these Category 1 areas. Approximately 20 hectares within the CCCA are considered High Probability Category 3, which only differs from a Category 1 area in that the soil is imperfectly drained. Within the GTA, 30.1% of registered sites have been found in these Category 3 areas. The remaining 20 hectares (10%) in the project area is determined to be Medium Probability Category 5 which indicates that, while the soil is well-drained and the topography is level or nearly level, the area is beyond 253 metres from water. Prehistoric archaeological sites within the GTA have been located on an area with these characteristics in 3.5% of the registered cases.

Although no sites have been identified at the CCCA, the Archaeological Site Predictive Model indicates very strongly that unknown archaeological sites are present. In particular, the presence of well-defined watercourses associated with a coniferous swamp suggests that the project area may have been visited by Ontario's earliest inhabitants; the Palaeo Indians (ca 10,000 BC). Certainly, the local environment would have provided a rich resource base for nomadic peoples for thousands of years (ca 8500 BC – AD 1000).

4.3 PAST RECREATION AND EDUCATION DEVELOPMENTS

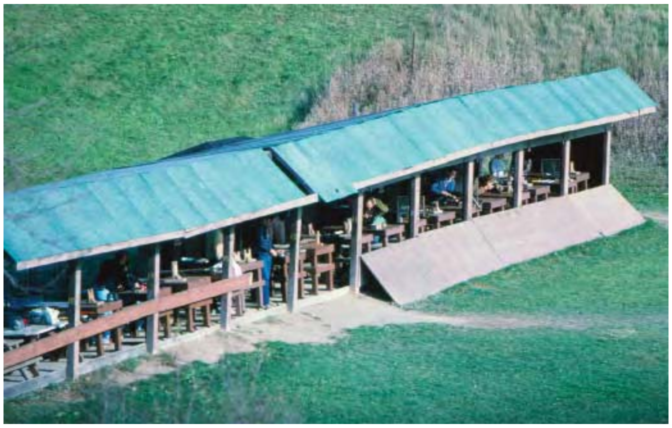
4.3.1 Recreation Facilities

The CCCA was developed to provide outdoor recreation and educational opportunities. The facility development at CCCA included a centre fire rifle range (which was also utilized for handguns), and a trap range. In 1979, the construction of a control building adjacent to the trap range provided washrooms, warming area, ammunition storage and limited refreshment facilities. Also included was a range for archery and an artificial pond. The area surrounding the pond was used for dog training. A 300-metre long elevated boardwalk was also constructed in the coniferous swamp, which permitted visitors to view the swamp without severely impacting the area. In the winter months, CCCA was utilized for husky dog sled trials and cross-country skiing.

4.3.2 Conservation Education Programs

The Cold Creek Conservation Field Centre, which was established in September, 1968, was set up to accommodate school classes on a daily basis during the week and to provide a meeting place on weekends for sports clubs such as the Toronto Anglers and Hunters.

Camping at Cold Creek Conservation Area
Photography from TRCA Archives



Rifle Range (circa 1980's)
Photography from TRCA Archives

Model Airplane Training
Photography from TRCA Archives

Previous Recreational Operations

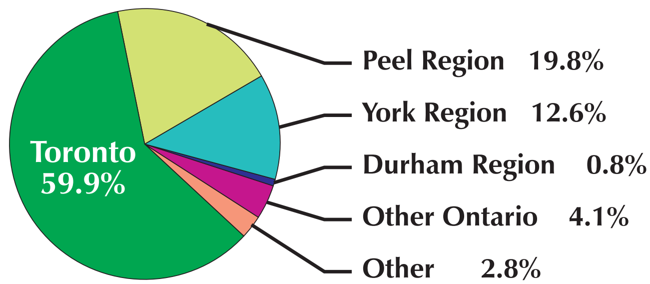
- Rifle Range-100 yards with 26 positions
- Pattern Board for Shot Guns
- Trap Range-2 manual and 2 electric traps
- "Turkey Shoot" Facility
- Archery Range
- Sled Dog Trails
- Facility for Retriever Trials
- Field Centre and Visitor Centre
- Remote Control Airplanes
- Boardwalk through the Coniferous Swamp

4.3.3 Attendance and Users

Use and attendance patterns at Cold Creek Conservation Area showed uniqueness among Authority facilities. Cold Creek drew from a wider geographic area than other Conservation Areas because of the absence of other public shooting facilities in Southern Ontario. The only option that was available to shooters in the region was a membership in a private club, one in Caledon and the other in Whitchurch-Stouffville. In 1987, there was a serious decline in attendance due to reduced operating hours. Over the years, the preferred time for rifle range use was Sundays, though the shooting on this day was curtailed in 1987 due to community concerns over noise.

The facilities were used to provide a variety of public programs including hunter education programs, hunter workshops, dog club events and special programs for schools and youth groups. Past users of the Cold Creek range numbered between 4000 and 4500 persons per year with 21,269 user-days being recorded by 1988.

Figure 5: Visitor Origins by Municipality



Visitor surveys conducted during 1989 indicated that approximately 60% of range users at CCCA did not use any other range facilities such as private gun clubs. Of the users at CCCA, only 27.2% were gun club members.

Cold Creek User Profile
In 1989, the most frequent user of Cold Creek Conservation Area could be characterized in the following manner: An Ontario male, originating in or near Toronto, between the ages of 18 to 54 (92.4 %) and has initiated more than 8 visits, principally for shooting. He learned about the site by word of mouth and he tends not to be a member of a shooting club. He is also interested in a wide range of outdoor activities which are ordered in importance from the most to the least.

Most – hunting, fishing, camping, walking, hiking, swimming, picnicking, canoeing, bicycling
– cross country skiing, horseback riding,
Least – down hill skiing and ice fishing

The visitors to CCCA were outdoors-people whose recreation focused on hunting, fishing, camping and canoeing.

4.4 INFRASTRUCTURE

An infrastructure inspection was carried out in the CCCA in April 2002 to provide a better understanding of the existing conditions of the buildings. The inspection

Cross Country Skiing
Photography from TRCA Archives

Sled Dog Trails
Photography from TRCA Archives

indicated that all buildings in the Conservation Area are in need of attention. Specific observations/recommendations were provided for the following:

a) Water Treatment Building

The existing facility is unstable and has a combination of electrical, water leakage and moisture problems. It is suggested that the water treatment system be either relocated to one of the following locations: a) an above ground building; b) main Visitor Centre; or c) barn, or the existing chamber be repaired. This might require extensive block repair with exterior excavating. Failure to repair the chamber and existing infrastructure could compromise the usage and quality of the water in the Conservation Area.

b) Pump Room

The pump room is located outside the barn and is built into the ground as a chamber. The metal roof with a wooden frame is in poor condition. All four block walls have cracks from ground level to footings and are leaning towards the centre of the building. There is water leakage on the floor which could be from the pipe, tank or ground water.

c) Barn

The barn is approximately 18.5 x 16.6 metres with a 12.4 x 6 metres drive shed attached. The roof is made of asphalt shingles on one side and metal sheeting on the other. The roof is leaking into the hay storage area and inside passage door. The exterior barn boards are in good condition. Some damage has occurred in the ground floor ceiling due to a leak. The doors, sinks and washrooms are in good condition.

d) Visitor Centre

The visitor centre is a 13.6 x 7 metres building with an asphalt shingle roof that is in fair to poor condition. The exterior siding is in good condition but needs general maintenance and repair work. Some window panes are cracked and need repair. Front doors are fine but the south door leading to the basement needs to be replaced. The rest of the interior is in good condition except for some leaks in the sinks and toilets in the men's washroom. Water is leaking into the basement from the exterior around the footings or toilets and sinks. The electrical system is functioning adequately except for some missing switch covers and exposed electrical wires.

e) Education Field Centre

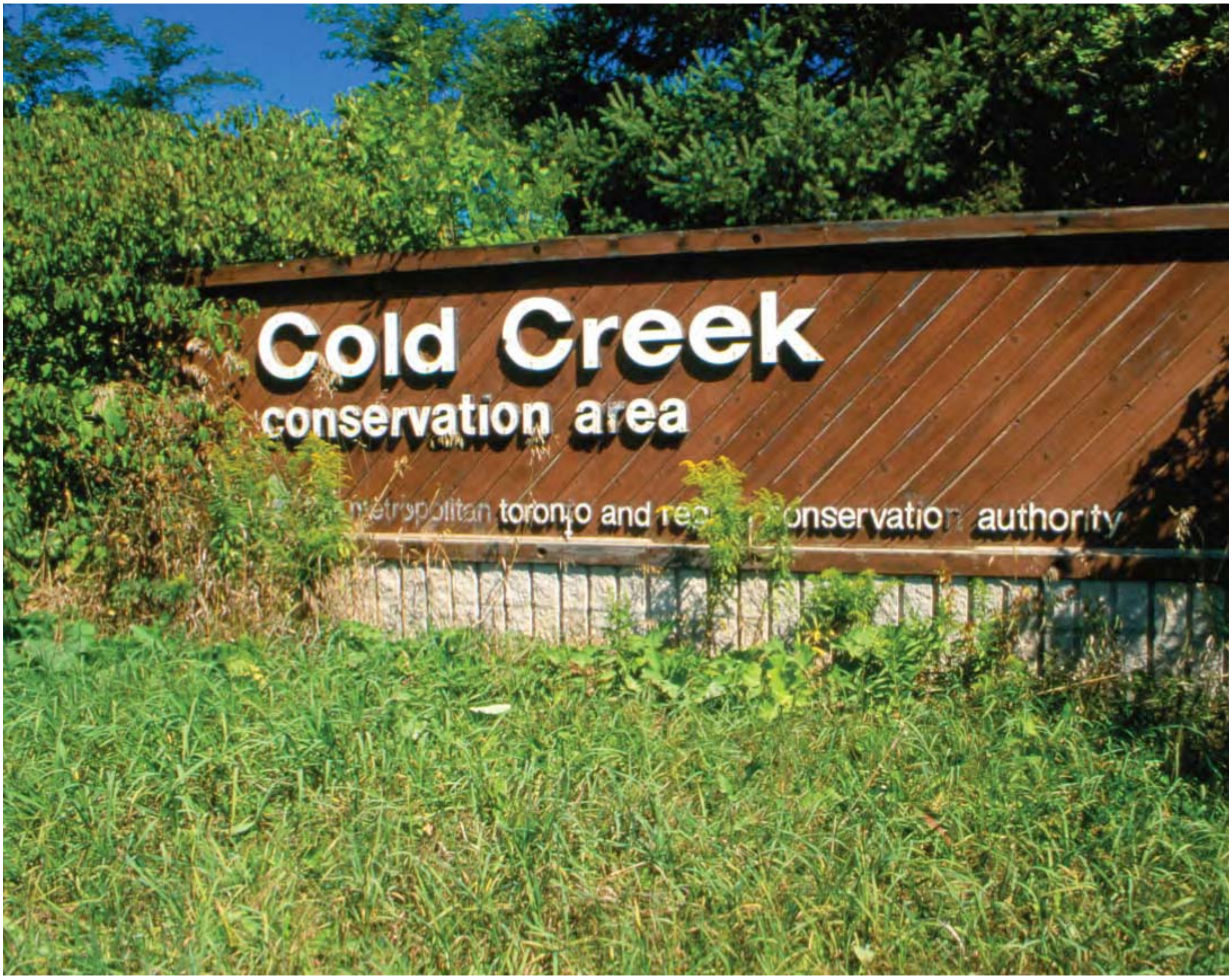
The main building is 18.1 x 7.5 metres with a 6 x 6.6 metres additional area comprised of several rooms. In general, the building is in good condition. The gravel tar roof, concrete block basement walls, eaves-trough and steps are all in good condition. Downspouts are missing, handrails on the deck and the deck itself needs some repairs. Heating is supplied by a 193000 BTU forced air oil furnace and is working fine.

f) Rifle Range Building

The building is approximately 32.7 x 6.3 metres with an additional office area of approximately 4.2 x 2.1 metres. The roof material is asphalt shingles. The west side of the roof is leaking and cracking. The interior structure is in a sound and stable condition but the insulation and sound-reducing material placed throughout the ceiling area, in the main room, shooting area and attic area is falling off rafters and ceiling. The electrical panel in this building has been removed. The building exterior is in good condition but the passage door needs repairs.

g) Shooting Ranges

Rifle and trap shooting operations were carried out in the past at three different locations within the CCCA (see Map 2 for location). Due to concerns regarding the soil quality at these sites, discussions were held with Terraprobe Engineering to seek advice on long-term options for the use and management of affected areas.



Photography by Rosemary Hasner

The primary issue with respect to former shooting ranges is the use of lead in shotgun shells and bullets. At the rifle range, the lead will be concentrated in the soil berm or wooden target mounts immediately in front of the building. Therefore, the volume of affected soil is expected to be relatively small and can be readily accessed and removed. However, in the trap shooting areas the lead shot and broken skeet cover a large area, yet well defined. Lead does not leach or dissolve readily and does not pose an issue to ground water or surface water quality in most cases. The largest concern with lead pellets is their ingestion, either by wildlife (particularly waterfowl) or by small children who may be playing or crawling on the ground.

The following measures are suggested to deal with this issue at the CCCA:

1. A thorough investigation of the site to determine the extent of the affected area and the degree to which the site may be affected by lead.

2. Site clean-up and remediation.

Public use of these sites will not be allowed until the remediation work is completed.