4. Existing Natural Environment Conditions

4.1 Hydrogeology

The geologic setting provides the basis for defining not only the groundwater resources and the characteristics of the City of Vaughan, but also a framework for establishing linkages between groundwater and the surface water. These linkages have been defined on the basis of our understanding of geology of the area as well examination of subsurface information such as water well records.

Groundwater is widely recognized as an important resource providing support for vegetation, animals, and humans. People living in the rural areas obtain their drinking water from wells, and numerous industries rely on groundwater for commercial and industrial use. Aquifers supply farmers with water for irrigation and to develop their products for commercial distribution. Aquatic habitat, in both streams and wetlands, is dependent on specific groundwater conditions. Certain fish species require a specific thermal regime, which may be influenced by groundwater upwelling, and wetland vegetation can be highly sensitive to changes in groundwater quality.

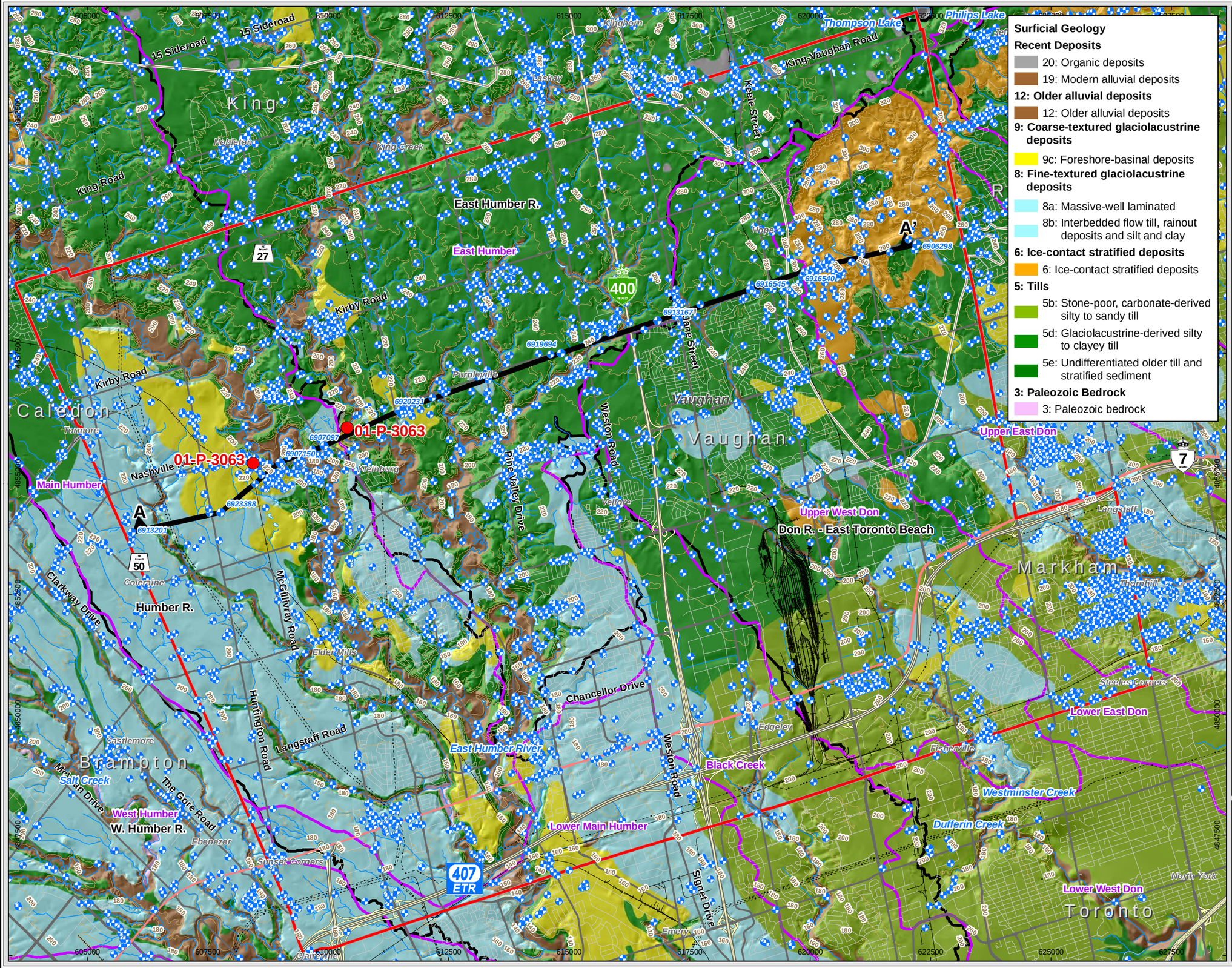
Development of an area like the City Of Vaughan has the potential to locally adjust groundwater recharge, flow patterns and groundwater quality. Such effects are typically in the shallow subsurface. Therefore, an understanding of the groundwater system is important when planning infrastructure such as that proposed for the Official Plan of the City of Vaughan.

The study area includes regionally important groundwater recharge areas (such as Oak Ridges Moraine) as well as discharge areas commonly associated with river valleys. Hydrogeologically sensitive areas are identified on the basis of surficial geology, groundwater recharge and discharge areas, and the locations of water wells.

4.1.1 Data Source and Methodology

Assessment of study area geological and hydrogeological conditions was conducted by way of a desktop study. The desktop study included review of published information including; Ontario Geological Survey mapping (Karrow, 1987), Ministry of Environment water well records (MOE, 2006), Ontario Base Mapping (MNR, 2006), and The City of Vaughan Subwatershed Study (GLL, 1993).

A conceptual understanding of the local hydrogeology was developed from the City of Vaughan Subwatershed study. This conceptualisation was refined through analysis of water well records, geological mapping and local drainage patterns. Figure 3 shows the regional surficial geology at a scale of 1:36,000, location of cross-section and MOE water wells used for preparing the cross-section. To assist in this analysis, one geological cross-section (Figure 4) was also prepared using the MOE Well Record database across the study area. The refined conceptual understanding of the local and regional hydrogeology was then used to highlight areas of sensitivity and environmental functions of the study area.



Surficial Geology

Recent Deposits
- 20: Organic deposits
- 19: Modern alluvial deposits

12: Older alluvial deposits
- 12: Older alluvial deposits

9: Coarse-textured glaciolacustrine deposits
- 9c: Foreshore-basinal deposits

8: Fine-textured glaciolacustrine deposits
- 8a: Massive-well laminated
- 8b: Interbedded flow till, rainout deposits and silt and clay

6: Ice-contact stratified deposits
- 6: Ice-contact stratified deposits

5: Tills
- 5b: Stone-poor, carbonate-derived silty to sandy till
- 5d: Glaciolacustrine-derived silty to clayey till
- 5e: Undifferentiated older till and stratified sediment

3: Paleozoic Bedrock
- 3: Paleozoic bedrock

Legend
- MOE Water Well
- Municipal Well (Acitve as of December 31, 2005)
- Contour (10m)
- Watercourse (TRCA)
- Transmission Line
- Railway
- Freeway
- Expressway / Highway
- Major Road
- Local Road
- Ramp
- Cross-section
- ORM Boundary
- Subwatershed Boundary (TRCA)
- Quaternary Watershed
- Waterbodies (TRCA)
- Vaughan
- Municipal Division

Basemapping from Ontario Ministry of Natural Resources

N W E S

Kilometers

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UTM Zone 17N, NAD 83

Vaughan OP

Surficial Geology, Cross-Section & Water Wells

April 2010
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Figure 3

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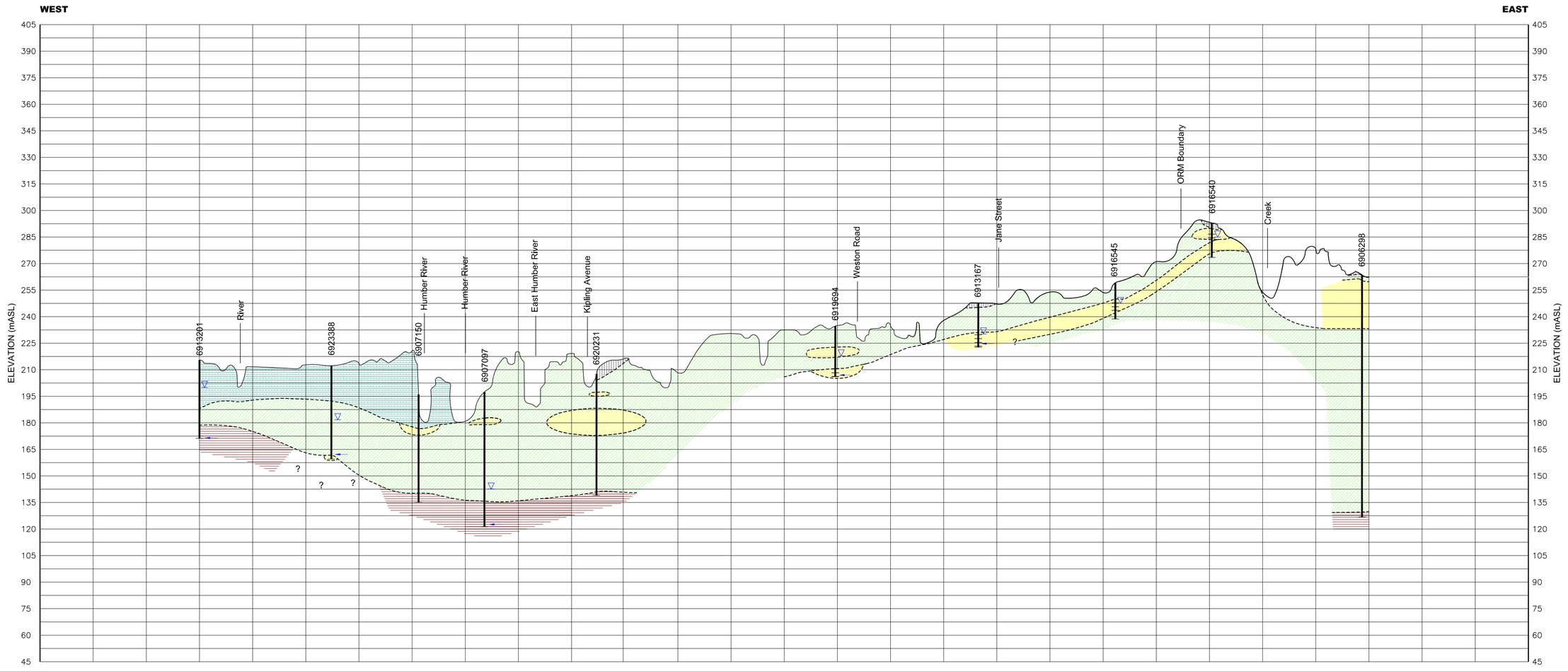


LEGEND

- Topsoil
- Clayey Silt / Silty Clay
- Sand / Silty Sand
- Sand and Gravel
- Till
- Shale

6916540 — Water Well Location and Identification

- Original Ground
- Inferred Stratigraphic Contact
- Screened Interval
- Deepest Water Found

NOTE:

Stratigraphy between boreholes is inferred and may vary from that shown.

HORIZONTAL 1:40,000

400m 0 800m 1600m

15m 0 30m 60m

VERTICAL 1:1500

THE CITY OF VAUGHAN
VAUGHAN OFFICIAL PLAN

GEOLOGICAL CROSS SECTION

Designed By: MR	Drawn By: JS
Checked By: –	Approved By: –
Date Issued: MARCH 2009	Project No.: 70–894

AECOM

FIGURE 4

Mar 06, 2009 – 3:07pm N:\Projects\2007\70894\2008\Final\ACAD\70894-X01_R01.dwg

A Geographic Information System (GIS) platform enabled spatial data sets to be overlaid so that relations among different variables could be detected and sensitive areas identified. For example, areas in which high permeability sediment, wetlands, and streams coincide indicate potential groundwater discharge.

4.1.2 Existing Conditions

4.1.2.1 Physiography and Topography

The landforms (physiography) within the area of investigation have been shaped by a cover of glacial deposits (mixture of clay, silt, sand and gravel), which overlay Devonian and Silurian age limestone and shale bedrock. The Oak Ridges Moraine, a regional geologic feature, occurs within the northeastern portion of the City of Vaughan and is a major landform of particular importance. Its hummocky, knob-and-kettle surface topography reflects the variety of glacial and melt water processes that led to its formation. Most of the rest of the City of Vaughan is covered by a gently rolling plain of glacial soils such as till and glaciolacustrine deposits.

Surficial topographic relief is minimal throughout the study area with the exception of moraine ridges in the northeast. The topographic relief is largely the result of glacial depositions (e.g., moraines, till) and erosion (river valleys) during the Quaternary period that occurred between 135,00 and 12,000 years ago (Eyles, 2002). Relief within the area ranges from approximately 320 mASL in the northeast (corresponding to the moraine), to approximately 150 mASL in the south and southeastern reaches and along the river valley (Figure 3). The area is drained by a number of permanent streams such as Humber and Don Rivers and many other permanent and intermittent creeks as shown on Figure 3 (Surficial geology).

4.1.2.2 Geology

The distribution of subsurface materials influences the rate and direction of groundwater movement in the Study Area. Although the characteristics of the underlying bedrock are important in understanding regional-scale aquifers and groundwater protections, the shallow overburden sediments are most relevant to this study, given their thickness and the relatively shallow impacts associated with potential development of the area. Details of the subsurface geologic (and hydrogeologic) conditions were evaluated through the development of a representative cross-section (Figure 4). The cross-section depicts the extensive till units overlying bedrock throughout most of the study area. The following sections begin with the description of the deepest unit, the bedrock, and progress upward (since this represents a chronological account through geologic time.

a) <u>Bedrock Geology</u>

Regionally, the bedrock is comprised of nearly flat-lying Palaeozoic (Devonian and Silurian) limestones, dolostones and shales underlying the overburden sediments throughout the study area. Water well data in the study area was used to interpret the position of the bedrock surface. The cross-sections provided in Figure 4, indicates bedrock that is not exposed at surface anywhere in Vaughan because it is buried beneath considerable thickness (37 m to greater than 136 m) of the overburden. The surficial geology map, indicates that minor outcrops of bedrock exist in the stream valley near confluence of East and main Humber River in the southwestern corner of Vaughan.

b) Surficial Geology

Above the bedrock are unconsolidated Quaternary age soil/sediments of varying depths, deposited during a complex sequence of glacial advances and retreats, the most recent of which occurred between 10,000 to 15,000 years ago. As the glaciers advanced and retreated, soil material was deposited over the previous surface. As a result, the overburden lying above the bedrock is a complex layered succession of tills (formed beneath the glacial ice), sands and gravel (deposited from glacial outwash), and fine sand, silt and clay (formed in areas of ponded water).

The last main advance of the glaciers in the Vaughan area came from the south, and deposited a fairly thick layer of silty till. The ice advance stopped just at the northern edge of Vaughan, where it met another glacial ice front moving from the north. As the temperature warmed and the ice melted back, the gap between these two ice fronts or lobes filled with their combined melt water sediment, consisting primarily of sand and gravel. These deposits formed the crest of a large, east-west trending ridge that resulted in the most dominant landform in the area, known as the Oak Ridges Moraine (ORM). Finally, as the ice continued to melt back to the south across Vaughan, some patches of sandy outwash were deposited on top of the silty till, particularly in the melt water valleys which had developed.

The lateral distribution of surficial soils is shown on Figure 3. The distribution and thickness of overburden is shown in cross-section in Figure 4. The term “overburden” is used to group the unconsolidated soil deposits lying on the competent bedrock. Within the study area, the thickness of overburden materials is substantial and may be over 130 m thick.

Till, which is a low permeable unsorted mixture of clay, silt, sand, gravel and stones in varying proportions, forms the major component of the overburden in the study area (Figures 3 and 4). It is laterally extensive within the Vaughan area and extends across the entire analysis area. It thins towards the west where it overlies a veneer of glaciolacustrine deposits and underlies bedrock at shallow depth. In places, till contains isolated and thin lenses of sand, silty sand and gravely sand which could potentially serve as a shallow overburden aquifer for local residential water supply (Figure 4). The full vertical extent of till is not known in the middle of the analysis area. The hydrological significance of till is that it inhibits local groundwater recharge thereby reducing the exposure of underlying aquifers to contamination.

Oak Ridges Moraine is illustrated on Figure 3 as ice-contact stratified (orange colour) in the northeast of Vaughan. The core of the Moraine consists of granular soils, primarily of sand and gravel of considerable thickness (Figure 4) while a thin layer of glacial deposits cover these granular deposits along the flanks of the moraine. Sharpe *et al.* (1996) identified a few soil deposits of tens of metres, which become coarser with depth, which grade from medium sand to silty clay laminate. While the core is largely the result of glaciofluvial deposition, the flanks of the moraine better reflect glaciolacustrine sedimentation. The full lateral extent of the buried sands and gravel associated with the moraine is not known. Its sandy and gravely composition gives it a high permeability and combined with the hummocky surface topography, facilitates infiltration.

Glaciolacustrine sediments are composed of laminated clay and silt and have been surficially deposited over till. These deposits are considered to be locally thin and discontinuous. On the surficial

geological map (Figure 3), these deposits are mainly found in the western and southwestern part of the study area can reach up to 25 m in thickness. These soils are not usually as dense as the glacial till although they have similar permeability.

Finally, long narrow stretches of modern alluvial and organic deposits are found along the surficial rivers/streams/creek, as can be seen on Figure 3 along the Humber and Don Rivers and their tributaries. These materials are relatively thin and overlay the till surface. These streams appear to be perched on the till surface in most places although it cuts through the glaciolacustrine deposits at Humber River (see Well no. 6907150 on Figure 4).

4.1.2.3 Hydrogeology

The following features are pertinent to the study:

a) Water Supply Aquifers

Due to the heterogeneity of overburden deposits, it is difficult to characterize a single regional overburden aquifer. However, multiple discontinuous aquifers of varying lateral extent exist throughout the study area. Granular sand and gravel deposits associated with the ORM appear to extend eastward and thin westward (Figure 4) acting as an important aquifer for residential use. Unconfined systems, such as the surficial sand and gravel deposits to the northeast can provide sufficient yield for private wells, as well as for municipal water supply wells. In contrast, confined or semi-confined systems within silty clay material to the west can supply only enough for a single household. Within the study area, over 87% of drilled wells are completed in overburden, indicating that the overburden is an important aquifer for private wells. Bedrock wells comprise only 13% of wells drilled in the study area. Within the bedrock, aquifers exist at specific depths where the rock is characterized by a well-developed network of fractures. Bedrock aquifers are generally of large lateral extent, and can provide sufficient yield for the municipal water supply. Based on PTTW (Permit to Take Water) database of 2005, there are two groundwater based municipal water supply wells within the boundary of Vaughan OP (Figure 3). These wells are drilled in deep bedrock aquifer.

b) Groundwater Flow

Groundwater flow is the result of differences in hydraulic head or, simply stated, water table elevation from one location to another. Groundwater flow directions are important with respect to the capture areas for municipal wells and for the supply to local wells, wetlands and streams. Similar to much of Ontario, most of this area is a recharge area of varying importance, with a strong downward component of groundwater flow to the bedrock aquifers below.

Groundwater flow in the bedrock will be predominately lateral towards regional discharge zones such as Lake Ontario. Regional groundwater flow in the aquifers within the analysis area is south-southeast from the ORM towards Lake Ontario, except where major river valleys exist. Locally, groundwater flow paths bend into river valleys and isolated topographic depressions.

Groundwater flow patterns are more complex in the overburden. In the ORM, the groundwater movement is downward and is consistent with the fact that this part of the region is an important groundwater recharge area. The surficial till and fine-grained lacustrine sediments covering most of the study area inhibit rapid groundwater movement. Under this condition, in most areas, groundwater flow will be downward through the low permeability sediments. Groundwater flow rates are not great in this respect as these soils are usually of low permeability. Where more permeable sand lenses exist, they will conduct groundwater laterally, provided there is an outlet.[1]

c) Groundwater Recharge

Recharge is the term used to describe downward flowing groundwater, that is, from the ground surface towards the water table. Of all precipitation that reaches the ground surface, some is lost to evapotranspiration and some runs off the surface directly into streams. The remainder infiltrates into the ground. Recharge areas are important because they replenish the groundwater which ultimately discharges as baseflow to river/stream valleys and wetlands.

Regionally, significant recharge occurs through the surficial sands and gravels deposits of the Oak Ridges Moraine in the northeastern reaches. The recharge is greatest here due to high permeabilities of the exposed sand and gravel deposits. Till plain consisting of relatively fine-grained clay silty soil covers much of the City of Vaughan. These soils are moderately to slowly permeable although isolated pockets of higher permeable sands and gravels occur locally within the till plain. Infiltration is generally limited on the fine-grained soils of the till plain and in consequence, overland runoff prevails. The patches of outwash deposits and river valley alluvium that occur throughout Vaughan also promote relatively high infiltration and recharge. Recharge also occurs in areas of glaciolacustrine soil deposits overlying the low permeability till in some areas. Generally, the surficial sand accepts significant recharge and acts as a storage reservoir feeding the low downward leakage through the silt and clay below. Where creeks cut into these sediments there is lateral flow and some local discharges occur from these horizontally layered deposits.

d) Groundwater Discharge

Discharge is defined as upward flowing of groundwater. That is, where the water table intersects the ground surface. The most famous and dramatic of discharge is known as artesian wells, where the groundwater discharges under pressure; literally pushed out of the ground. Groundwater discharge is important for a variety of reasons. First, it sustains a minimum flow (baseflow) in some streams, commonly even during the dry months of summer. Without groundwater contributions, many fish-bearing streams in the analysis area would dry up periodically throughout the year limiting the diversity of aquatic habitat. Second, it moderates stream temperatures, particularly during hot summer days, and dampens stream temperature fluctuations. Fish species such as brook trout, mottled sculpin and American brook lamprey are highly sensitive to changes in water temperature. Third, groundwater upwelling supports wetland vegetation and animal habitat. However, the groundwater contribution, or baseflow, varies seasonally, from reach to reach and among stream valleys. For instance, nearly all

1. For example, a pumping well, or a watercourse.

water flowing within a particular stream during the dry summer months or cold winter months may be baseflow. During and immediately after storms and during spring freshet, however, baseflow may comprise only a small fraction of the total stream flow.

Within the area of analysis, groundwater discharge areas are predominantly limited to river/stream valleys and kettle wetlands. For example, the East Don River receives baseflow from the ORM, which is reflected in the distinctive fishery. In the case of Cold creek, which drains the entire central part of Vaughan, the baseflow is generated from the large valleys which are deeply cut into the till plain (GLL, 1993). The well-developed Humber River valleys also receive baseflow where buried granular deposits are exposed along the valley walls. However, the portion of streams that are perched in low permeability tills may derive much of their water from surface runoff. Shallow groundwater also discharges where the sand and gravel of the ORM pinches out beneath the Till and creates stream headwaters which are the source of several creeks (e.g., Rainbow creek in the northwestern reaches) in the analysis area.

In the areas of sand and gravel deposits such as the ORM, groundwater at first infiltrates (recharge) and is then released as baseflow relatively quickly and on a more consistent basis year-round (discharge) than in the till plain areas of the city. Finally, the bedrock that lies beneath Vaughan is part of a more regional groundwater flow system whose primary discharge area is probably further south toward Lake Ontario although a component of its recharge is undoubtedly originates in Vaughan.

4.1.2.4 Water Wells

Examination of the water well database reveals a total of 3,068 reliably located wells on record[2] within the study area (MOE, 2006). Of these, 2,669 (approximately 87%) are screened in the overburden, and 399 (approximately 13%) are screened in bedrock. Of these 2,669 overburden wells, 186 (approximately 7%) are dug wells, screened mainly within the shallow overburden units of till. Dug wells are typically of large diameter, drilled in low permeability soils, and rely on the well storage to provide enough water for single-family use.

Of the 399 bedrock wells, the majority (351 wells or approximately 88%) are finished in the upper 30 m of the bedrock surface. This is because the upper bedrock layers have usually undergone the most physical weathering and exhibit significant vertical joints and fractures, often enhanced by millennia of dissolution. The remainder are found at greater depths. As can be seen from Figure 3, all bedrock wells are in confined aquifers, protected by low permeability overburden aquitards. Where there is only thin drift like in moraine areas, the numbers of bedrock wells are lower as the bedrock aquifers respond as unconfined systems and are not as well protected.

Based on Permit to Take Water (PTTW) database of 2005, there are only two municipal water supply wells within the study area which are located in Kleinburg. One of the wells (both wells have the same permit no.: 01-P-3063) operates on a continuous while the other operates on intermittent basis depending on seasonal demand. These two municipal wells pump water from the bedrock.

2. *It is our experience that up to 30% more unreported wells may exist. However, given the large number of wells, we believe we have a representative coverage for the purposes of this study.*

4.1.3 Potential Hydrogeological Constraints

Three hydrogeological indicators are used to identify potential sensitivities:

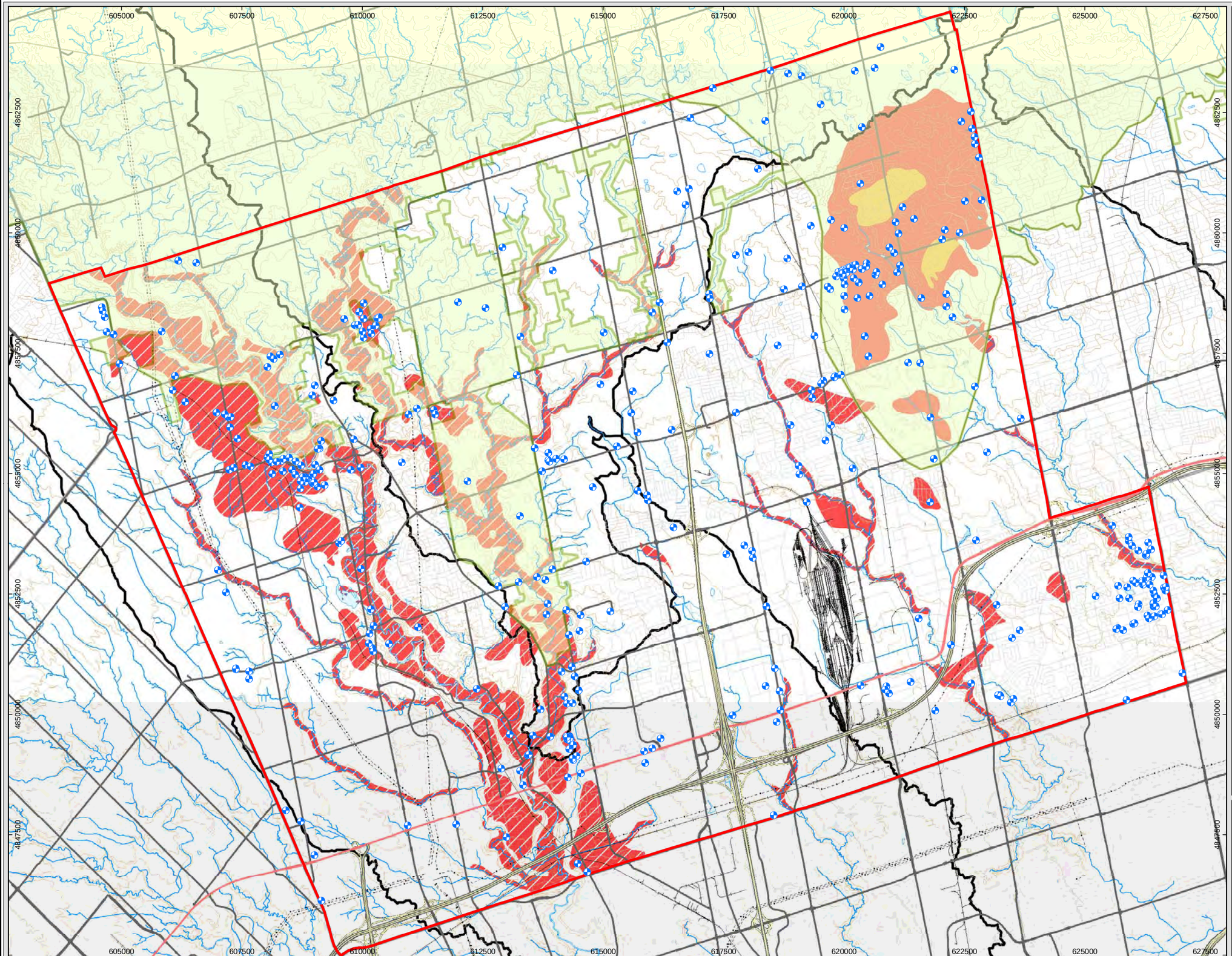
1. proximity to groundwater recharge areas;
2. proximity to groundwater discharge areas; and
3. proximity to water wells set in shallow, unconfined aquifers.

Recharge areas are the water source for the groundwater system. Therefore, the proximity of infrastructure to such areas may affect water resources that are used by humans and/or support the natural environment. The proximity to a discharge area is also significant because these exhibit groundwater upwelling that supports aquatic habitat. Reductions in upwelling in groundwater-fed wetlands could reduce vegetation diversity by desiccating those species that require the most moisture. In extreme cases, disruption by human activities could cause wetlands to dry up unseasonably, and affect the hydroperiodicity of certain species. Given the reliance of so many animal species on wetland habitat, animals may be displaced or unable to survive. Similarly such disruption may redirect groundwater discharge, which could lead to flooding of low-lying areas. Reduced discharge into particularly sensitive reaches of streams could also create an impact to fish habitat and spawning grounds.

The proximity of water wells set in a shallow, unconfined aquifer is significant for two reasons. First the building of infrastructure may temporarily lower the water levels of nearby shallow wells. Nearby water wells set in the same shallow aquifer could be affected. Another long-term effect could be the permanent lowering of the water table created by permeable bedding of buried services such as storm sewers. Second, these wells are sensitive to inadvertently introduced contaminants entering the groundwater system. Shallow, dug wells relying on tile joints to allow water entry are particularly susceptible to contamination due to the short travel distance necessary to reach the aquifer and the absence of any extensive aquitards to intercept the contaminants.

Based on the indicators/criteria discussed above, the ORM (both the core and the flanks) has the highest sensitivity (Figure 5). Given the fact that it is the recharge zone for a considerable amount of the groundwater in the analysis area, any changes to the permeability of the ground surface could create an impact to the groundwater supply and any changes to water quality could contaminate water wells and aquatic habitat. Detailed investigation would be required on a site-specific basis to establish hydrogeologic sensitivity for areas in the vicinity of this boundary. The patches of glacial lake and outwash deposits (yellow coloured areas on the surficial geology map) and river valley alluvium (brown coloured areas on the surficial geology map) that occur throughout Vaughan are also designated as hydrogeologically highly sensitive areas as they provide relative high infiltration and recharge.

Areas of thick till cover (i.e., greater than five m) which occur over most of the analysis area is given a low hydrogeologic sensitivity because they are considered to low groundwater recharge potential and low sensitivity to contamination. The glaciolacustrine silt and clay deposits of similar texture as till, bordering the western and southwestern reaches, are given a low sensitivity due to their low permeability. There also exist areas where “finger-like” extensions of ORM sediments are within a few metres of, if not exposed at, the ground surface. Such locations are local sites for groundwater recharge or discharge, and many shallow



Legend

- MOE Water Well with Sand & Gravel within 5m of Ground Surface
- Watercourse (TRCA)
- Transmission Line
- Railway
- Freeway
- Expressway / Highway
- Major Road
- Local Road
- Ramp
- ORM Boundary
- Quaternary Watershed
- Vaughan
- Municipal Division
- Greenbelt
- Waterbody
- Cartographic Wetland

Hydrogeological Sensitivity

- Highly Sensitive (Glacial Lake & Outwash Deposits)
- Highly Sensitive (Moraine & Fringe Areas)
- Moderately Sensitive Area (Thin Till over Moraine)
- Low Sensitive (Till & Fine Textured Glacio-Lacustrine Deposits)

Basemapping from Ontario Ministry of Natural Resources

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UTM Zone 17N, NAD 83

Vaughan OP

Hydrogeological Constraints

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Figure 5

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wells tap groundwater from these areas. These areas can be designated as moderately sensitive as shown on Figure 5. There are also areas where sand and gravel occur within 5 m of ground surface (see Figure 5). These areas can also be designated as moderately sensitive areas. Detailed field investigations or preparation of multiple geologic cross-sections using MOE water well records can help identify such locations in the analysis area. The identification of the hydrogeologically sensitive areas within the Vaughan OP area is in congruence with the study of recharge area mapping conducted by Gartner Lee Limited for Toronto Region and Conservation (GLL, 2006).

4.2 Fisheries and Aquatic Environment

Typically natural heritage systems focus on the terrestrial portion of the landscape. However, as a system, the connections among terrestrial features (wetlands, woodlots and meadows), aquatic features (watercourses, ponds) and groundwater are important to recognize in order to identify appropriate land use policies.

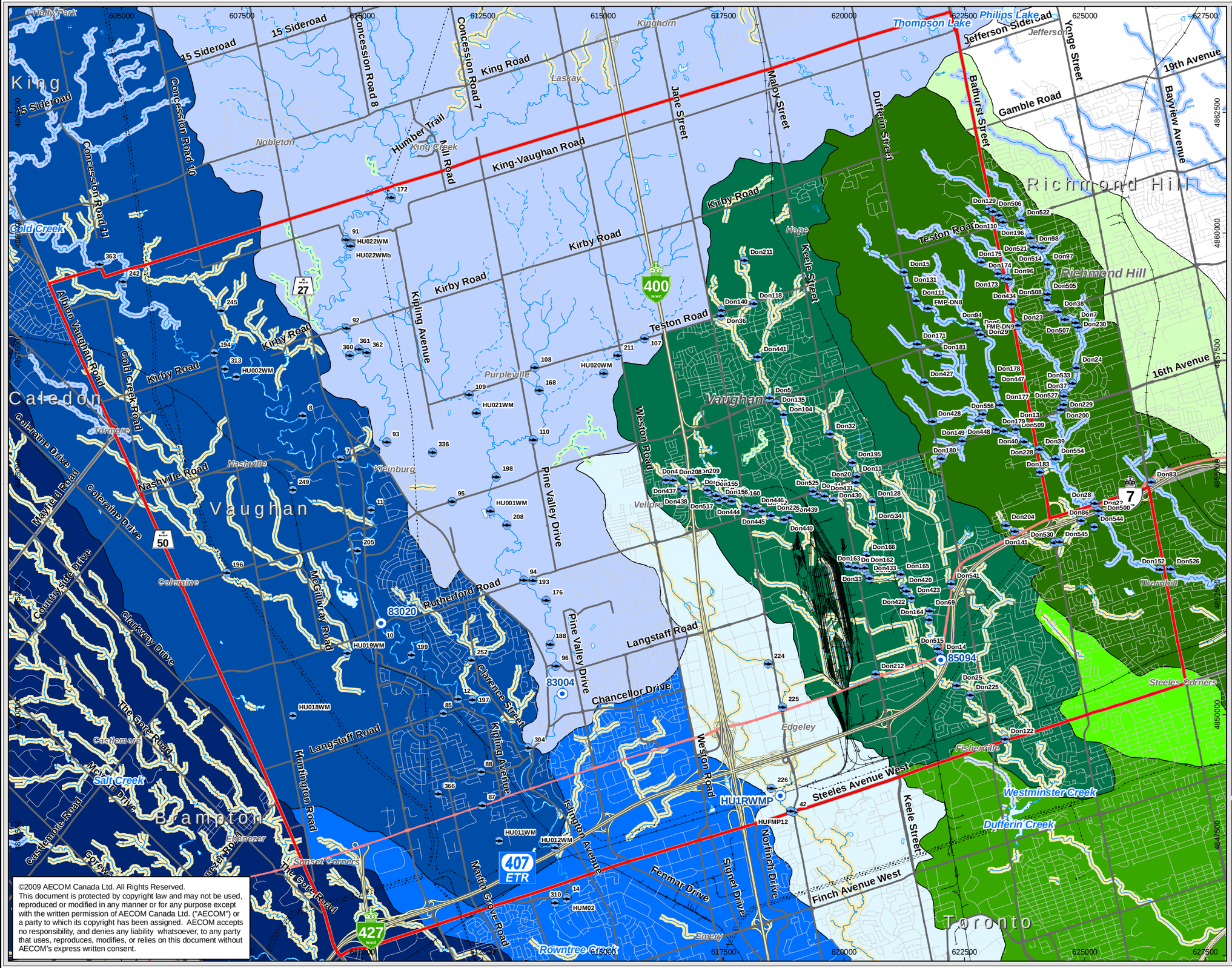
The objective of this section is to identify unique characteristics of the aquatic environment that may require sensitive land use policies to maintain and/or enhance the health of the natural heritage system.

There are two main watersheds in the City of Vaughan (total area 27,500 ha), the Humber River (18,001 ha in Vaughan) and the Don River (9,499 ha in Vaughan). These watersheds are further divided into subwatershed with unique characterization of surficial geology and discharge systems, and fish, plant and insect communities (Figure 6). Each watershed is described below, providing a general discussion of the water quality, common fish species, Species at Risk and presence of non-native species. Species respond to changes in habitat and their physical environment, so the presence or absence of a species may indicate changes in the aquatic environment. This can include changes in land use, nutrient inputs, water chemistry, riparian cover, and levels of contaminants. Using this information, stressors to the aquatic environment and areas that are sensitive to development can be identified. Areas that provide habitat for Species at Risk require special attention when considering development. Redside dace (*Clinostomus elongates*) endangered nationally and threatened provincially, and is now listed under the Ontario Endangered Species Act, 2007. A draft recovery plan has been prepared and efforts are underway to restore the habitat. Northern brook lamprey (*Ichthyomyzon fossor*) is a Species of Concern, nationally and provincially.

4.2.1 Humber Watershed

The land use within the Humber river watershed has been classified as 26.2% urban, 40.2% rural and 32.2% natural. The total drainage of the Humber river watershed is 908 km^2 and supports a population of 600,000 people (OMNR and TRCA 2005).

The major physiographic regions in the Humber watershed are the Niagara Escarpment (limestone bedrock ridge), Oak Ridges Moraine (sand and gravel ridge), south slope (area of sloping glacial till plain), Peel plain (flat, silty clay, former lakebed) and the Iroquois Sand Plain (sand, silt and clay deposits from former Lake Iroquois) (TRCA 2007).



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Legend

- Fish Station (TRCA)
- Water Quality Sampling Station
- Transmission Line
- Railway
- Freeway
- Expressway / Highway
- Major Road
- Local Road
- Ramp
- Vaughan
- Municipal Division
- Waterbody
- Cartographic Wetland

Stream Type & Thermal Assessment

- Permanent, Unassigned
- Permanent, Coolwater
- Permanent, Warmwater
- Permanent, Coldwater
- Permanent, No data
- Intermittent, Coldwater
- Intermittent, No data
- Intermittent, Coolwater
- Intermittent, Unassigned
- Intermittent, Warmwater

Don Sub-Watersheds

- German Mills Creek
- Lower East Don
- Lower West Don
- Upper East Don
- Upper West Don

Humber Sub-Watersheds

- Black Creek
- East Humber
- Lower Main Humber
- Main Humber
- West Humber

Basemapping from Ontario Ministry of Natural Resources

N W E S

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UTM Zone 17N, NAD 83

Vaughan OP

Fish Sampling Stations

April 2010
Project 70894

AECOM

Figure 6

Only a portion of the Humber River watershed is within the City of Vaughan. The Humber River watershed can be divided into five subwatersheds: main Humber, east Humber, west Humber, Black Creek and Lower Humber (TRCA 2007) (Figure 6).

A total of 48 fish species have been found within the Humber watershed from 1946-2004. Four are non-native species including: brown trout (*Salmo trutta*), common carp (*Cyprinus carpio*), goldfish (*Carassius auratus*) and rainbow trout (*Oncorhynchus mykiss*). Within the City of Vaughan a total of 56 sites have been sampled (1946-2006), and 46 fish species were found, three of them are non-native.

Data sources for the Humber River watershed include the Humber River Fisheries Management Plan (2005), Humber River watershed Plan: Draft (2007), Humber River Watershed Report card (2000) and numerous consultant reports from properties in the area. The Humber River Fisheries Management Plan divides the subwatershed into management zones based on the thermal regime (cold water, cool water and warm water), channel characteristics such as stream order and channel slope, as well as the target fish species for management (OMNR and TRCA 2005, Table 39-43) Each management zone was divided into numerous categories (e.g., riparian zone, wetland creation and rehabilitation, habitat rehabilitation, water quality) and evaluated as having high, medium or low priority for management. The management zones within the Humber River fisheries management plan are currently being reworked, to reflect zone management instead of the current reach management. Presence/absence data are presented in Table 1, and distinguishes whether a species was found before or after 1988. Species found within the last twenty years are more likely to reflect recent conditions in the watershed, and are more likely to respond to restoration efforts.

Table 1. Fish Species Found in the Vaughan Portion of the Humber River Watershed

Common Name	Scientific name	Thermal Regime	OMNR Status	COSEWIC Status	S Rank	1946-1988	1988-2006
American brook lamprey	*Lampetra appendix*	Cold	NAR	NAR	S3	X	X
brook trout	*Salvelinus fontinalis*	Cold	NAR	NAR	S5	X	X
brown trout	*Salmo trutta*	Cold	NAR	NAR	SNA		X
mottled sculpin	*Cottus bairdii*	Cold	NAR	NAR	S5	X	X
rainbow trout	*Oncorhynchus mykiss*	Cold	NAR	NAR	SNA		X
banded killifish	*Fundulus diaphanus*	Cool	NAR	NAR	S5	X	
blackchin shiner	*Notropis heterodon*	Cool	NAR	NAR	S4	X	
blacknose dace	*Rhinichthys obtusus*	Cool	NAR	NAR	S5	X	X
blacknose shiner	*Notropis heterolepis*	Cool	NAR	NAR	S5	X	
blackside darter	*Percina maculata*	Cool	NAR	NAR	S4		X
brassy minnow	*Hybognathus hankinsoni*	Cool	NAR	NAR	S5	X	X
brook stickleback	*Culaea inconstans*	Cool	NAR	NAR	S5	X	X
central stoneroller	*Campostoma anomalum*	Cool	NAR	NAR	S4		X
common shiner	*Luxilus cornutus*	Cool	NAR	NAR	S5	X	X
creek chub	*Semotilus atromaculatus*	Cool	NAR	NAR	S5	X	X
emerald shiner	*Notropis atherinoides*	Cool	NAR	NAR	S5	X	X
fantail darter	*Etheostoma flabellare*	Cool	NAR	NAR	S4	X	X
golden shiner	*Notemigonus crysoleucas*	Cool	NAR	NAR	S5		X
hornyhead chub	*Nocomis biguttatus*	Cool	NAR	NAR	S4	X	X
iowa darter	*Etheostoma exile*	Cool	NAR	NAR	S5	X	X
johnny dater	*Etheostoma nigrum*	Cool	NAR	NAR	S5	X	X
longnose dace	*Rhinichthys cataractae*	Cool	NAR	NAR	S5	X	X
northern brook lamprey	*Ichthyomyzon fossor*	Cool	SC	SC	S3		X
northern redbelly dace	*Phoxinus eos*	Cool	NAR	NAR	S5	X	
rainbow darter	*Etheostoma caeruleum*	Cool	NAR	NAR	S4	X	X

Table 1. Fish Species Found in the Vaughan Portion of the Humber River Watershed

Common Name	Scientific name	Thermal Regime	OMNR Status	COSEWIC Status	S Rank	1946-1988	1988-2006
redside dace	*Clinostomus elongatus*	Cool	THR	END	S3	X	X
river chub	*Nocomis micropogon*	Cool	NAR	NAR	S4	X	X
rockbass	*Ambloplites rupestris*	Cool	NAR	NAR	S5	X	X
spottail shiner	*Notropis hudsonius*	Cool	NAR	NAR	S5		X
white sucker	*Catostomus commersonii*	Cool	NAR	NAR	S5	X	X
yellow perch	*Perca flavescens*	Cool	NAR	NAR	S5		X
bluegill	*Lepomis macrochirus*	Warm	NAR	NAR	S5		X
bluntnose minnow	*Pimephales notatus*	Warm	NAR	NAR	S5	X	X
brown bullhead	*Ameiurus nebulosus*	Warm	NAR	NAR	S5	X	X
common carp	*Cyprinus carpio*	Warm	NAR	NAR	SNA		X
fathead minnow	*Pimephales promelas*	Warm	NAR	NAR	S5	X	X
green sunfish	*Lepomis cyanellus*	Warm	NAR	NAR	S4		X
largemouth bass	*Micropterus salmoides*	Warm	NAR	NAR	S5	X	X
mimic shiner	*Notropis volucellus*	Warm	NAR	NAR	S5		X
northern hog sucker	*Hypentelium nigricans*	Warm	NAR	NAR	S4	X	X
pumpkinseed	*Lepomis gibbosus*	Warm	NAR	NAR	S5	X	X
rosyface shiner	*Notropis rubellus*	Warm	NAR	NAR	S4	X	X
sand shiner	*Notropis stramineus*	Warm	NAR	NAR	S4	X	X
spotfin shiner	*Cyprinella spiloptera*	Warm	NAR	NAR	S4		X
stonecat	*Noturus flavus*	Warm	NAR	NAR	S4	X	X
yellow bullhead	*Ameiurus natalis*	Warm	NAR	NAR	S4	X	

Notes: ***S-rank:*** *The Natural Heritage provincial ranking system (provincial S-rank) is used by the MNR Natural Heritage Information Centre (NHIC) to set protection priorities for rare species and natural communities.*

Definitions are as follows:

- ***S1*** *Critically Imperilled; extremely rare in Ontario with 5 or fewer occurrences in the province. These species are especially vulnerable to extirpation.*
- ***S2*** *Imperilled; very rare in Ontario due to restricted range, 20 or fewer populations or steep declines. These species are vulnerable to extirpation.*
- ***S3*** *Vulnerable; rare to uncommon in Ontario due to restricted range, fewer than 80 populations or recent and widespread declines.*
- ***S4*** *Apparently Secure; uncommon but not rare. Usually greater than 100 occurrences in the province.*
- ***S5*** *Secure; common, widespread and abundant in the province.*

MNR Status: *Based on consultation with COSSARO (Committee on the Status of Species at Risk in Ontario), which evaluates the conservation status of species occurring in Ontario.*

Definitions are as follows:

- ***EXT*** *Extinct; a species that no longer exists anywhere.*
- ***EXP*** *Extirpated; a species that no longer exists in the wild in Ontario, but occurring elsewhere.*
- ***END*** *Endangered; a species facing imminent extinction or extirpation in Ontario.*
- ***THR*** *Threatened; a species that is at risk of becoming endangered in Ontario if limiting factors are not reversed.*
- ***SC*** *Special Concern; a species with characteristics that make it sensitive to human activities or natural events.*

COSEWIC rankings*: The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assigns a federal status ranking to all assessed species.*

Definitions are as follows:

- ***EXT*** *Extinct; a species that no longer exists anywhere.*
- ***EXP*** *Extirpated; a species that no longer exists in the wild in Canada, but occurring elsewhere.*
- ***END*** *Endangered; a species facing imminent extinction or extirpation in Canada.*
- ***THR*** *Threatened; a wildlife species likely to become endangered if limiting factors are not reversed.*
- ***SC*** *Special Concern; a species that may become a threatened or endangered species because of a combination of biological characteristics and identified threats.*

The water quality within the Humber River varies considerably, with the highest quality water associated with the headwater, and poorer water quality associated with the lower reaches of the river (TRCA 2007). Water quality data were collected by TRCA in 2006 and 2007 (18 monthly samples) at three stations within the City of Vaughan, in the southern half of the City. All stations showed elevated levels of total phosphorus and ammonia above the Provincial Water Quality Objectives (PWQO) (30 and 20 μg/L respectively) in more than 50% of the monthly samples. More than 50% of the monthly samples exceeded the PWQO guidelines for *E. coli* (100 colonies / 100 mL). Turbidity and total suspended solid values were also relatively high. Only the station south of Highway 407 had chloride levels that were consistently higher than the PWQO value of 200 mg/L. A report card on the health of the Humber watershed was published in 2000 (TRCA), and gave the watershed a D grade for pollutants such as nutrients, turbidity and chloride. The watershed was given a grade of E for bacterial levels. Another issue is the presence of heavy metals and organic contaminants in the watershed. The presence of lawn care and agricultural pesticides such as Atrazine, Diazinon, MECOPROP and Metolachlor are also an issue because of their persistence in the environment (Struger and Fletcher 2007). The watershed was given a C grade for Heavy metals and organic contaminants in the watershed (TRCA 2000). Although nutrient, suspended solid and *E. coli* levels are high, they are not unexpected in this urbanized environment. Water quality conditions further downstream within the City of Toronto are more degraded than within the City of Vaughan (TRCA 2005).

4.2.1.1 Main Humber

The headwaters of the Main Humber river subwatershed rises in the Oak Ridges Moraine, continue through the south Slope and onto the Peel Plain. The characteristic permeable soils of the Oak Ridges Moraine permit relatively large recharge rates and contribute to relatively high base flows in creeks during dry weather. In the lower reaches of the subwatershed less permeable soils with lower recharge rates allow for more surface runoff. The land use within the main Humber is mostly agricultural, with a relatively high amount of natural areas. The upper main Humber River subwatershed has an area of 357 km^2 and is the largest of Humber's subwatersheds and contains 597 km of stream (OMNR and TRCA 2005). Historically, a total of 45 fish species have been found within the subwatershed.

The southern portion of the Main Humber subwatershed is within the City of Vaughan and a total of 38 species were found within this area. The most common species include: common shiner (*Luxilus cornutus*), creek chub (*Semotilus atromaculatus*), longnose dace (*Rhinichthys cataractae*) and white sucker(*Rhinichthys cataractae*). Some of the other species found in the Upper Main Humber include: fantail darter (*Etheostoma flabellare*), largemouth bass (*Micropterus salmoides*), American brook lamprey (*Lampetra appendix*), mottled sculpin (*Cottus bairdii*) and redside dace. Redside dace were found in 7 sampling locations in the Upper Humber subwatershed of the City of Vaughan in 1972, but only at one location in 2001 (north of Highway 407 and east of Martin Grove Road) (Figure 6). Areas of high species diversity exist near Rutherford Road, as well as near Kirby Road. These areas are also the only areas of the Main Humber within the City that had coldwater fish species.

The blackside darter (*Percina maculate*) and the sand shiner (*Notropis stramineus*) are both uncommon in the City of Vaughan. The blackside darter was found in the Highway 27 and Rutherford Road area (Figure 6). The Ontario range was identified as within the tributaries of Lakes Erie, St. Clair and Southern

Lake Huron, but not Lake Ontario (Scott and Crossman 1998). This species was found in 2001 and 2004, so this could represent a range extension of the species, but may reflect the paucity of data on the species range within the Province (Pers Comm, David Lawrie). The species is classified as a cool water species, and it prefers quite pools or creeks and rivers with moderate current, and sand or gravel substrate.

Cattle had access to Redside dace habitat in a 1.6 km reach of Purpleville Creek. A project was initiated in 1996 by the OMNR with assistance by York Region, City of Vaughan, Ontario Streams and local schools to fence the creek, reduce in-stream erosion and improve the habitat in the stream corridor. (Recovery Strategy 2005).

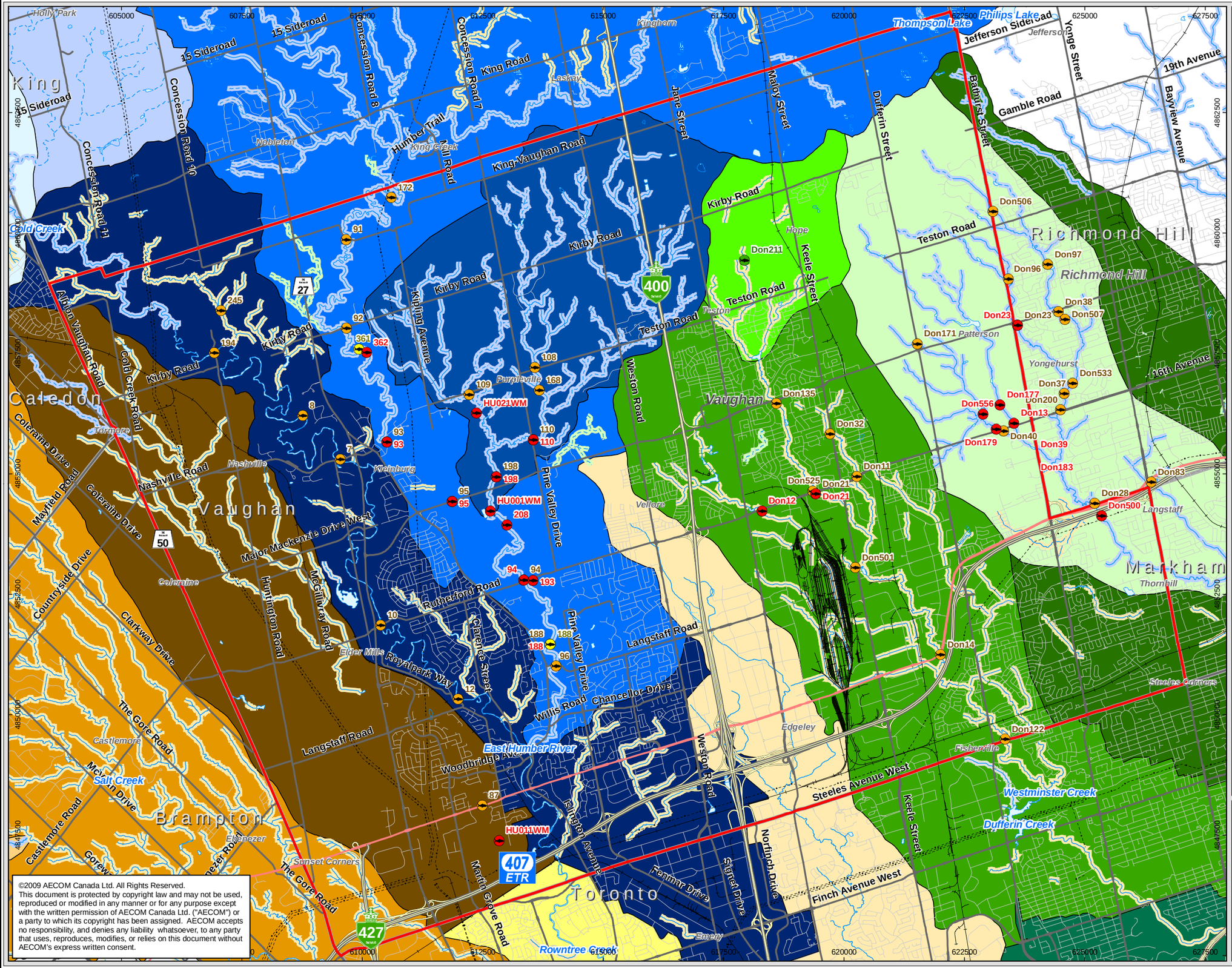
The sand shiner was found in only two locations in the City of Vaughan, one in the south (Highway 7 and Kipling Avenue) in 1972 and the other in the north (Kirby and Huntington Road) in 1999. The sand shiner requires warm water, sand or gravel substrate and rooted aquatic vegetation.

The Humber River Fisheries Management Plan has divided the subwatershed into seven management zones based on habitat categories, channel characteristics such as stream order and channel slope, as well as the target fish species for management (OMNR and TRCA 2005, Table 39). Five of those zones occur within the City of Vaughan (Figure 6). The target species for management include: darter species, brown trout, redside dace, smallmouth bass (*Micropterus dolomieu*), and rainbow trout.

4.2.1.2 East Humber

The headwaters of the East Humber lie within the Oak Ridges Moraine. Soils in this subwatershed are characterized by clay loam, with pockets of sandy loam, loam and silt (TRCA 2007). The soil characteristics permit little infiltration resulting in moderate to high runoff potential. The land use within the watershed is largely agricultural, but with a significant portion of urban development in the southern section. The east Humber watershed drains an area of approximately 200 km^2 and contains approximately 257 km of watercourses (OMNR and TRCA 2005). A total of 50 fish species have historically been found in this subwatershed (OMNR and TRCA 2005).

The southern portion of the East Humber subwatershed is within the City of Vaughan (Figure 6). A total of 39 fish species were found within the subwatershed (1946-2004) including coldwater species such as: brook trout (*Salvelinus fontinalis*), brown trout, mottled sculpin, American brook lamprey and rainbow trout. The most common species include: blacknose dace (*Rhinichthys obtusus*), white sucker, creek chub, and common shiner. The mimic shiner (*Notropis volucellus*) was only found in on location in the City of Vaughan (1995), near Teston Road and Kipling Avenue, in an area of high species diversity (Figure 6). The spotfin shiner (*Cyprinella spiloptera*) was also found only at one location in the City of Vaughan, and that was near King-Vaughan Road and Kipling Avenue (2004). This species prefers warm water with sand or gravel substrates. The redside dace has been found at 10 sampling locations in this subwatershed in the last 20 years (Figure 7). These locations are well distributed throughout the subwatershed and they occur between Langstaff Road in the south and Kirby Road in the north. It was also located in other tributaries pre-1988, but they were not found in the more recent surveys. The northern brook lamprey is only found in two locations in the City of Vaughan, both in the East Humber subwatershed. It was found just north of Langstaff Road and just south Kirby Road.



Map Document: (N:\projects\2007\70894\2010\Final\GIS\Spatial\MXD\s\70894SensitiveFishSpecies-11x17.mxd)
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Legend

Reginally Rare Fish Species

- Redside Dace (1988-2006)
- Northern Brook Lamprey
- Blacknose Shiner
- Redside Dace (pre 1988)

- Transmission Line
- Railway
- Freeway
- Expressway / Highway
- Major Road
- Local Road
- Ramp
- Vaughan
- Municipal Division
- Waterbody
- Cartographic Wetland

Stream Type & Thermal Assessment

- Permanent, Unassigned
- Permanent, Coolwater
- Permanent, Warmwater
- Permanent, Coldwater
- Permanent, No data
- Intermittent, Coldwater
- Intermittent, No data
- Intermittent, Coolwater
- Intermittent, Unassigned
- Intermittent, Warmwater

Humber Fish Management Zones	Don Fish Management Zones
1	1
2	2
3	3
4	4
5	5
6	
7	
9	
10	
11	

Basemapping from Ontario Ministry of Natural Resources

N W E S

Kilometers
0 0.5 1 2

1:75,000
UTM Zone 17N, NAD 83

Vaughan OP

Fish Management Zones & Sensitive Fish Species

April 2010
Project 70894

AECOM

Figure 7

The Humber River Fisheries Management Plan has divided the subwatershed into four management zones based on habitat categories, channel characteristics such as stream order and channel slope, as well as the target fish species for management (OMNR and TRCA 2005, Table 40). The target species for management include: brook trout, redside dace, rainbow trout and darter species.

4.2.1.3 West Humber

The headwaters of the West Humber originate on the South Slope, but the majority of the watershed lies within the Peel Plain. Clay till soils predominate in the subwatershed, resulting in low recharge rates, and low base flows. The northern portion of the watershed is largely agricultural land use, whereas the southern portion of the watershed is dominated by urban residential development associated with the City of Toronto and the City of Brampton. The west Humber subwatershed is roughly the same size as the east Humber subwatershed (200 km^2), and contains 311 km of watercourses. The watercourses within this watershed are particularly sensitive to storm events, resulting in rapidly fluctuating water levels. This subwatershed has a relatively low amount of woody riparian vegetation.

A total of 40 species have historically been found within the subwatershed including: blackchin shiner (*Notropis heterodon*), brassy minnow (*Hybognathus hankinsoni*), brook trout, central stoneroller (*Campostoma anomalum*), Iowa darter (*Etheostoma exile*), redside dace, mottled sculpin, river chub (*Nocomis micropogon*), northern redbelly dace (*Phoxinus eos*) and smallmouth bass. Only the southwest corner of Vaughan is within the West Humber subwatershed and no fisheries data have been collected in this area.

The Humber River Fisheries Management Plan has divided the subwatershed into five management zones based on habitat categories, channel characteristics such as stream order and channel slope, as well as the target fish species for management (OMNR and TRCA 2005, Table 41). One of those zones exists within the City of Vaughan (Humber Fish Management Zone 7). This zone is managed for darter species.

4.2.1.4 Black Creek

Close to 70% of the Black Creek subwatershed is urbanized (OMNR and TRCA 2005). Historically large sections of Black Creek were transformed into concrete channel to direct flow quickly downstream and alleviate the risk of flooding. The risk of flooding is greater in highly developed areas due to impervious surfaces limiting infiltration and causing high amounts of runoff and high peak flows during storm events. Much of the area was developed before stormwater quality and quantity control measures had become commonplace. The Black Creek subwatershed is the smallest subwatershed within the Humber River system with a total area of 68 km^2 and 46 km of watercourses. A total of 18 species were historically found in the Black Creek subwatershed. The historical presence of the redside dace and rainbow (*Etheostoma caeruleum*) and fantail darter indicate that the water quality and habitat within the creek were once of better quality than today.

Only a portion of the eastern side of the City of Vaughan is within the Black Creek subwatershed with fisheries sampling conducted at four locations. Five species were found including; white sucker, fathead minnow

(*Pimephales promelas*), creek chub (*Semotilus atromaculatus*), and brook stickleback (*Culaea inconstans*). All the species are cool water species except the fathead minnow, which is a warm water species.

The Humber River Fisheries Management Plan has divided the subwatershed into two management zones based habitat categories, channel characteristics such as stream order and channel slope, as well as the target fish species for management (OMNR and TRCA 2005, Table 42). One of those zones exists within the City of Vaughan (Humber River Fisheries Management Zone 11). This zone is managed for darter species.

4.2.1.5 Lower Humber

The Lower Main Humber originates in the Peel plain and flows across the Iroquois Sand Plain south of Vaughan to Lake Ontario. This subwatershed is similar to Black Creek watershed in that the area is largely developed (78%) (OMNR and TRCA 2005). Few modern stormwater management facilities are in place in the Lower Humber watershed. Many of the tributaries have been piped and/or channelized

This subwatershed is only 80 km and has a total of 62 km of watercourses. The Lower Main Humber River arises south of Langstaff Road. west of Highway 400 in the City of Vaughan.

Only a small section of the Lower Main Humber watershed is in the City of Vaughan, and fisheries sampling was only conducted at one location (data collected in 2001 and 2004). There were a total of 14 species found at this location, including many cool and cold water species such as: American brook lamprey, fantail darter, rainbow darter and rainbow trout.

The Humber River Fisheries Management Plan has divided the subwatershed into five management zones based on habitat categories, channel characteristics such as stream order and channel slope, as well as the target fish species for management (OMNR and TRCA 2005, Table 43). But only two of those zones occur within the City of Vaughan (Humber River Fisheries Management Zones 5 and 6). The target species for management within these zones are darter species and smallmouth bass.

4.2.2 Don River Watershed

The Don River watershed is 360 km^2 and is divided into two subwatersheds, East Don and West Don within the City of Vaughan. The watershed is highly urbanized (roughly 78%) and has a population of 800,000. The Don River watershed is the most heavily urbanized within the City of Toronto, but areas of new development such as Vaughan and Markham are also contributing to urbanization.

Water discharges from the Oak Ridges Moraine in the north, flowing over the till plain and various glacial lacustrine features, to Lake Ontario in the south (Don Watershed Council 1997). A total of 35 species have been identified within the Don River watershed from 1949 to 2005. Four non-native species were found within the Don watershed including: brown trout, common carp, goldfish and rainbow trout. Only a portion of the Don watershed is in the City of Vaughan, and there were a total of 95 sites that have been sampled for fish. A total of 33 species were recorded in Vaughan, four of which are non-native.

Data sources for the Don River watershed include the Don River State of the Watershed report (MTRCA 1992), Don Watershed Report Card (Don Watershed Council 2000) and The City of Vaughan Subwatershed study (Gartner Lee Limited 1993) as well as numerous consultant reports. A new Fisheries Management Plan is currently being produced by Toronto and Region Conservation Authority. Although the management plan has yet to be completed there has been ongoing discussions with staff at TRCA in order to incorporate important information related to the Don River into this report.

Table 2. Fish Species Found in the Vaughan Portion of the Don River Watershed

Common Name	Scientific name	Thermal Regime	OMNR Status	COSEWIC Status	S Rank	1946-1988	1988-2006
American brook lamprey	*Lampetra appendix*	Cold	NAR	NAR	S3		X
brook trout	*Salvelinus fontinalis*	Cold	NAR	NAR	S5	X	X
brown trout	*Salmo trutta*	Cold	NAR	NAR	SNA		X
mottled sculpin	*Cottus bairdii*	Cold	NAR	NAR	S5	X	X
rainbow trout	*Oncorhynchus mykiss*	Cold	NAR	NAR	SNA		X
black crappie	*Pomoxis nigromaculatus*	Cool	NAR	NAR	S4		X
blacknose dace	*Rhinichthys obtusus*	Cool	NAR	NAR	S5	X	X
blacknose shiner	*Notropis heterolepis*	Cool	NAR	NAR	S5		X
brook stickleback	*Culaea inconstans*	Cool	NAR	NAR	S5	X	X
common shiner	*Luxilus cornutus*	Cool	NAR	NAR	S5	X	X
creek chub	*Semotilus atromaculatus*	Cool	NAR	NAR	S5	X	X
emerald shiner	*Notropis atherinoides*	Cool	NAR	NAR	S5	X	
fantail darter	*Etheostoma flabellare*	Cool	NAR	NAR	S4	X	
golden shiner	*Notemigonus crysoleucas*	Cool	NAR	NAR	S5		X
johnny darter	*Etheostoma nigrum*	Cool	NAR	NAR	S5	X	X
longnose dace	*Rhinichthys cataractae*	Cool	NAR	NAR	S5	X	X
northern redbelly dace	*Phoxinus eos*	Cool	NAR	NAR	S5	X	X
rainbow darter	*Etheostoma caeruleum*	Cool	NAR	NAR	S4	X	
redside dace	*Clinostomus elongatus*	Cool	THR	END	S3	X	X
rock bass	*Ambloplites rupestris*	Cool	NAR	NAR	S5	X	X
spottail shiner	*Notropis hudsonius*	Cool	NAR	NAR	S5	X	X
white sucker	*Catostomus commersonii*	Cool	NAR	NAR	S5	X	X
yellow perch	*Perca flavescens*	Cool	NAR	NAR	S5	X	X
bluegill	*Lepomis macrochirus*	Warm	NAR	NAR	S5		X
bluntnose minnow	*Pimephales notatus*	Warm	NAR	NAR	S5	X	X
brown bullhead	*Ameiurus nebulosus*	Warm	NAR	NAR	S5		X
common carp	*Cyprinus carpio*	Warm	NAR	NAR	SNA		X
fathead minnow	*Pimephales promelas*	Warm	NAR	NAR	S5	X	X
goldfish	*Carassius auratus*	Warm	NAR	NAR	NNA	X	X
largemouth bass	*Micropterus salmoides*	Warm	NAR	NAR	S5	X	X
pumpkinseed	*Lepomis gibbosus*	Warm	NAR	NAR	S5	X	X
smallmouth bass	*Micropterus dolomieu*	Warm	NAR	NAR	S5		X
stonecat	*Noturus flavus*	Warm	NAR	NAR	S4		X

Surface water quality varies considerably throughout the Don River watershed with the highest quality water associated with groundwater inputs from the Oak ridges moraine, and the more degraded water quality associated with the developed southern portion of the watershed.

Water quality data were collected by TRCA in 2006 and 2007 (18 monthly samples) at one station within the City of Vaughan (Figure 6), located in the southern half of the City, near Highway 7 and Centre Street. This station showed elevated levels of total phosphorus and ammonia above the Provincial Water Quality Objectives (30 and 20 μg/L respectively) in more than 75% of the monthly samples. All of the monthly samples exceeded the PWQO guidelines for *E. coli* (100 colonies/ 100 mL). Turbidity and total suspended

solid values were also relatively high. Chloride levels were higher than the PWQO value of 200 mg/L in all of the monthly samples. Unfortunately there were no sampling stations in the headwaters of the Don River. A report card on the health of the Don watershed was published in 2000 (Don Watershed Regeneration Council 2000). The watershed was rated on a number of variables as either improving, worsening or no change. Bacterial levels have been increasing due to inputs from combined sewer overflows. Another concern is the decrease in water quality monitoring due to cut back by the Ontario Ministry of the Environment. Monitoring of suspended solids and nutrients in the water indicates that there has been little change, and definitely no improvement. Another issue is the presence of heavy metals and organic contaminants in the watershed. The presence of lawn care and agricultural pesticides such as Atrazine, Diazinon, MECOPROP and Metolachlor are also an issue because of their persistence in the environment (Struger and Fletcher 2007). The watershed was given a C grade for Heavy metals and organic contaminants in the watershed (TRCA 2000). Although nutrient, suspended solid and *E. coli* levels are high, they are not unexpected in this urbanized environment. Water quality conditions further downstream within the City of Toronto are more degraded than within the City of Vaughan (TRCA 2005).

4.2.2.1 Upper West Don

The headwaters of the Upper West Don originate in the South Slope and Peel Plain. The substrate is relatively impermeable to infiltration, so much of the flow inputs to the stream are from surface runoff. As a result the water levels within the streams are largely influenced by storm events. The majority of the tributaries as well as the main branch of the West Don have been classified as warm water fish habitat. Some of the smaller tributaries are currently unclassified. Only the upper portion of the Upper West Don River lies within the City of Vaughan.

A total of 25 species were found within the Vaughan portion of the West Don including: rockbass (*Ambloplites rupestris*), rainbow darter, redside dace, largemouth bass and northern redbelly dace. The most common species were white sucker, creek chub, blacknose dace and fathead minnow. There were no coldwater fish species found within the subwatershed in either the more recent surveys, or in the historic records. This is to be expected based on the predominance of surface inputs and little influence from groundwater in this portion of the subwatershed.

The blacknose shiner has been found in the watershed north of Teston Road between Jane and Keele Streets (Figure 7). The blacknose shiner is rare within the Don and Humber watersheds, although it is not rare in Ontario. Only one other observation of the species in the City of Vaughan has been recorded, and that was in 1974, in the East Humber River. The species requires clear, cool waters with aquatic vegetation, and sand or gravel bottom for spawning. Its intolerance to turbidity is probably a contributing factor limiting its distribution in the City of Vaughan. The presence of the blacknose shiner in the West Don indicates the unique, relatively undisturbed habitat along this reach.

Historical observations (1946-2006) show redside dace were once well distributed throughout the Upper West Don River subwatershed, including areas that are now developed. Redside dace were found at only two stations since 1988, and they were located near 16th Avenue (Figure 7). This area has considerably more forest cover adjacent to the watercourse, which would provide the required habitat, and food sources for the redside dace.

4.2.2.2 Upper East Don

The Upper East Don River originates in the Oak Ridges Moraine and the majority of the tributaries are classified as permanent coldwater. The characteristic permeable soils of the Oak Ridges Moraine permit relatively large recharge rates and contribute to high base flows during dry weather. Only the upper portion of the East Don river is within the City of Vaughan.

A total of 22 species were found within the Vaughan portion of the East Don including (1949-2005); brook trout, brown trout, mottled sculpin, and redside dace. The species that were most common were blacknose dace, creek chub, white sucker and longnose dace. Although the species richness is lower in the East Don (22 species) compared to the West Don (25 species) there are a total of five coldwater fish species that have been found historically in the subwatershed. Surveys conducted between 2000 and 2005 found four coldwater species including: American brook lamprey, brown trout (introduced), mottled sculpin and rainbow trout (introduced) (Figure 8).

An area of high species richness is located near Bathurst Street and Rutherford Road. This area is also where redside dace have been found in the last 20 years. Redside dace have also been found where Highway 407/ Highway 7 crosses the east Don. Although there is greater species richness found in the West Don, there is greater trophic class diversity in the East Don. Examples of trophic classes in the East Don include: top carnivore, filter feeder (non-parasitic), benthic insectivore, water column insectivore, insectivore and generalist. In the West Don there are only four trophic classes (top carnivore, benthic insectivore, water-column insectivore and generalist). The proportion of generalist species is higher in the West Don compared to the East Don.

4.2.3 Significance and Sensitivity

The thermal regime and the hydrology of a watershed have a profound influence on the associated fisheries and fish habitat of a particular watercourse. Areas of high recharge (identified in the Hydrogeology section) contribute cold clean groundwater to downstream portions of the watershed. The degree of groundwater discharge, amount of riparian cover and stream morphology will influence the thermal regime, and the fish species occurring within a watercourse or portion of a subwatershed.

In determining Sensitive Fish Areas the following three primary criteria were used:

a) the presence of a cold water thermal regime as determined through a management strategy or upon the characteristics of the fish community present;
b) the presence of high fish species diversity; and,
c) the presence of Species at Risk or locally uncommon species (Figure 8).

These criteria were chosen because they indicate the presence of quality habitat and /or the presence of physical and biological functions that are susceptible to land use change. Several of the Sensitive Fish Areas met more than one of the criteria (e.g., coldwater fish species, and Species at Risk), whereas others were identified because only one criteria was met (e.g., presence of uncommon species). Due to

commonality in the use of some criteria, there is definite overlap between the boundaries of the Sensitive Fish Areas identified in this report (Figure 8) and the boundaries of the Fish Management Zones for the Don and Humber River watershed (Figure 7).

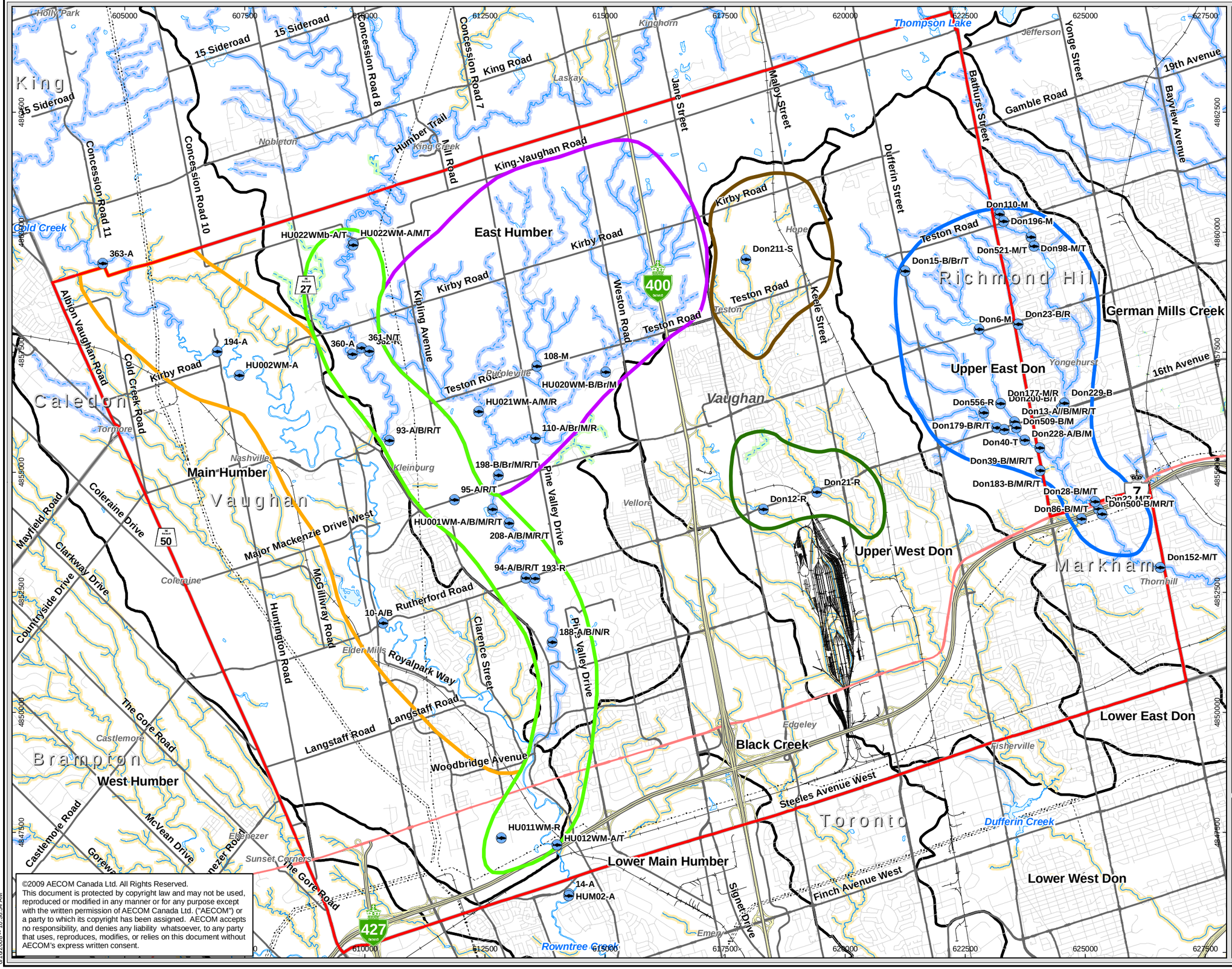
Development within these Sensitive Fish Areas should follow the precautionary principle, and more detailed studies of the area may be required. Restrictions limiting the type of land use or densities permitted may be required, together with the use of innovative mitigation strategies and appropriate construction timing.

Two fish Species at Risk occur in the Don River and Humber River watersheds, the redside dace and the northern brook lamprey. The distribution of redside dace (*Clinostomus elongates*) in Canada is limited to southern Ontario and primarily within western Lake Ontario tributaries. Biological characteristics, habitat specificity and range limitations are three contributing factors that are theorised to affect the survivorship of this species in southern Ontario. The redside dace is a visual feeder and an insectivore; it relies on habitat attributes such as overhanging riparian vegetation as a source of food and shelter as well as relatively clear water conditions for observing prey. Suspended insects within the overhanging vegetation are the primary food source and this species is capable of breeching the surface of the water in order to capture food. For these reasons, the habitat requirements of the species are very specific and are likely factors in limiting their distribution in Canada. Further to this, the southern Lake Ontario populations represent the northernmost extent of the species range suggesting that climate likely contributes to the species distribution. Despite being a globally secure species, the redside dace is listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as Endangered (COSEWIC 2007) and is defined by COSSARO as Threatened within the Province of Ontario (OMNR 2006).

The northern brook lamprey (*Ichthyomyzon fossor*) is classified as a species of special concern by both COSEWIC (COSEWIC 2007) and COSSARO (OMNR 2006). Their range includes the Mississippi and Great Lakes basins. It is found in clear streams, and spawning occurs in fast flowing areas with coarse gravel or rocky substrates. It is a non-parasitic filter feeder, and it feeds on organic detritus, algae and protozoans. The northern brook lamprey is under threat from lampricide used to control the exotic sea lamprey, as well as changes in temperature and pollution. Invasive species pose a threat to native species by competing for resources and preying on other species.

The Rusty Crayfish (*Orconectes rusticus*) is an invasive exotic species that can displace native crayfish species as well as heavily impact aquatic vegetation. Currently, this species is known to be found in only one location in the City of Vaughan, in the East Don river near Rutherford Road. The Rusty crayfish has been found elsewhere in the Humber watershed in 2003.

It is important to note that sampling has not occurred in all streams within the Don or Humber watersheds. For this reason there are potentially other areas of high quality fish habitat that have not been identified.



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Legend

- Fish Species-At-Risk
- Transmission Line
- Railway
- Freeway
- Expressway / Highway
- Major Road
- Local Road
- Ramp
- Subwatershed
- Vaughan
- Municipal Division
- Waterbody
- Cartographic Wetland

Stream Type & Thermal Assessment

- Permanent, Unassigned
- Permanent, Coolwater
- Permanent, Warmwater
- Permanent, Coldwater
- Permanent, No data
- Intermittent, Coldwater
- Intermittent, No data
- Intermittent, Coolwater
- Intermittent, Unassigned
- Intermittent, Warmwater

Sensitive Fish Areas

1 3 5
2 4 6

Code	Fish Species
A	American Brook Lamprey
B	Brown Trout
Br	Brook Trout
M	Mottled Sculpin
N	Northern Brook Lamprey
R	Redside Dace
S	Blacknose Shiner
T	Rainbow Trout

Basemapping from Ontario Ministry of Natural Resources

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UTM Zone 17N, NAD 83

Vaughan OP

Sensitive Fisheries Areas

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Figure 8

4.2.3.1 Humber River

There are several areas within the Humber River watershed that have been identified as having high quality fish habitat, or have uncommon fish species or Species at Risk. The headwaters of the East Humber and Purpleville Creek have high groundwater discharge and provide habitat for coldwater species such as the brook trout, mottled sculpin, rainbow trout and brown trout, as well as the redside dace (Figure 8, Sensitive Fish Area 1). This area (north of Major McKenzie between Jane Street and Kipling Avenue) is largely undeveloped. This area with relatively high amounts of groundwater recharge is also important for maintaining flow to downstream sections during drier periods.

The main branch of the east Humber (extending from the Vaughan border in the south, north along Islington Avenue and Highway 27 to the Vaughan border in the north) also provides an area of high quality fish habitat (Figure 8, Sensitive Fish Area 3). This area has high species diversity, with up to 20 fish species found in one sampling location. This area also has several coldwater species including: rainbow trout, brown trout, brook trout, mottled sculpin and American brook lamprey. This section of the East Humber also has a high concentration of redside dace with the species found in seven sampling sites. The Northern brook lamprey has only been found in two locations in the City of Vaughan, and both are in this stretch of the East Humber.

The main valley corridor of the Upper Humber subwatershed is an area of high species diversity with more than 15 species found in some sampling locations (Figure 8, Sensitive Fish Area 2). The American brook lamprey, which is a coldwater fish species, was found in the vicinity of Kirby Road. Since one coldwater species was found in this area, there is the potential to improve the thermal regime of the area by providing channel shade with native woody vegetation.

4.2.3.2 Don River

There are several areas within the Don River watershed that have been identified as having high quality fish habitat, or have uncommon fish species or Species at Risk. The east Don is characterized as having high groundwater discharge that provides habitat for coldwater species such as the brook trout, mottled sculpin, American brook lamprey, rainbow trout and brown trout, as well as the redside dace. The area bordered by Major McKenzie in the North, Bathurst in the East, Highway 7 in the South and Dufferin in the west has a high concentration of redside dace as well as coldwater fish species (Figure 8, Sensitive Fish Area 5). There is also high species richness in the area, with over 15 species found at some of the sampling locations. This area is also largely undeveloped so there is the potential to maintain habitat quality and provide some habitat improvement. The area within the vicinity of Highway 7 between Bathurst and Yonge St is also an area with high species diversity, numerous coldwater fish species, as well as redside dace. The east Don contributes cold clean water to the watershed and helps maintain adequate flows downstream during the dry summer months.

The west Don is classified as a warm water system, but there are also some cool water fish found there. Redside dace have been found in the vicinity of Carville Road, between Jane Street and Keele Street (Figure 8, Sensitive Fish Area 4). The blacknose shiner was found in the north part of the subwatershed

(bordered by Keele Street, Teston Road, Jane Street and Kirby Road) (Figure 8, Sensitive Fish Area 6). This species is uncommon in the area and its presence is an indicator of habitat quality. This area is still largely undeveloped so there is the opportunity to maintain or enhance good habitat quality.

4.3 Terrestrial Ecology

4.3.1 Vegetation

Sources for the analysis of existing terrestrial vegetation (natural cover[3]) in the City of Vaughan include:

- York Region Significant Woodlands study
- City of Vaughan Subwatershed Study 1993. Gartner Lee Limited
- OPA 160 Official Plan Review, Kleinburg-Nashville Community Plan, Natural Environment – Background Study Report, 2001. AGRA Earth & Environment
- City of Vaughan Focus Rural Area Woodlot Ecosystem Assessment, 2002. AMEC Earth & Environmental Limited
- City of Vaughan Woodland Protection Strategy, 2001. J.H. Stevens, Planning & Development Consultants; and,
- TRCA Ecological Land Classification Layer.
- Wetlands, derived from the Ministry of Natural Resources wetlands

Existing Natural Cover in the City of Vaughan comprises approximately 5,775 ha, or 21% of the total area of the city (TRCA 2004). This is just slightly above the average of 17% natural cover in the Toronto and Region Conservation Authority (TRCA) jurisdiction. The City of Vaughan bridges portions of the upper watersheds of the Don and Humber Rivers. The Humber River Watershed accounts for approximately 65% of the Vaughan land base, while the remaining 35% of City lands is within the Don River watershed. Natural cover is slightly higher in the Humber River portion of the city at 22%, whereas cover in the Don River is only 15% (Table 3). This pattern is consistent throughout the whole extent of the two watersheds; the Don River is more heavily urbanized with less remaining natural cover than the Humber River Watershed.

Table 3. Natural Cover[3] in the City of Vaughan by Watershed According to TRCA Terrestrial Natural Heritage System Information

Cover Type	Humber River Watershed within Vaughan	Don River Watershed within Vaughan	City of Vaughan
Watershed Composition (%)	65	35	100
Natural Cover (%)	22	15	21
Forest Cover (%)	13	9	16
Wetland Cover (%)	1	1	2
Meadow Cover (%)	7	4	3
Successional Cover (%)	1	>1	>1

[3] Natural cover refers to lands with vegetation that may be modified but has not been converted to a different land use. Plantations may be included in this category as well as naturally occurring vegetation communities. (TRCA 2007)

The TRCA has described just over half of the natural cover in the City (53%) using the standardized method of Ecological Land Classification for Southern Ontario (ELC; Lee *et al.* 1998; Figure 10). This system is a structured approach that incorporates both biological features such as dominant plant species composition, and physical characteristics such as soil type, within a hierarchical framework. The detailed ELC information provided by TRCA for a portion of Vaughan is used here as an indicator of overall patterns of natural cover for the whole city. Of the remaining 47%, much of it is in unclassified forest. The data sources used to generate these statistics do not well represent meadow and successional habitats. These are often difficult to distinguish from active agricultural operations. In 1996, there was 9,340 ha of land in agricultural use of which 8,800 represented the Class 1 to 4 soils (Urban Strategies 2008). It is estimated that 8,300 ha (30%) of land remains in agriculture, contributing unique habitat niches for plants and wildlife.

4.3.1.1 Forest Cover

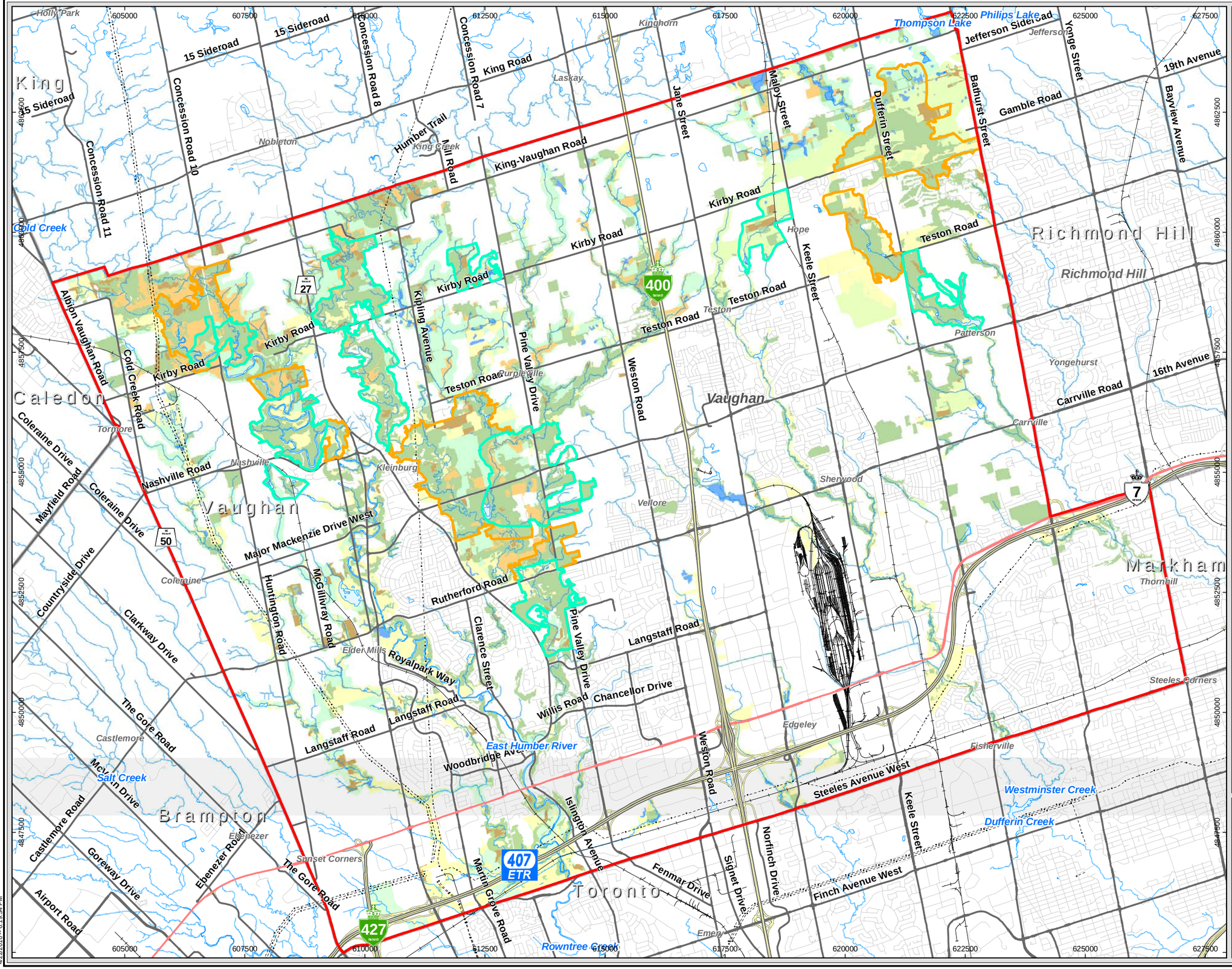
Approximately 16% forest cover remains in the City of Vaughan. This represents 80% of the remaining natural cover, the remainder being wetlands, meadows and successional areas. (Figure 9). From a watershed perspective, remaining forest cover is higher in the Humber River portion of the city at 13%, versus 9% cover in the Don River Watershed (Table 3, Table 4). Forest cover in the City of Vaughan is below the York Region average of 22.5% cover (North-South Environmental Inc. 2005).

Table 4. Composition of Forest Communities

Forest Cover Type	Number Forest Community Types	% of Forest Cover (ha)
All Forests	Total types classified = 61	16% of Vaughan
Deciduous Forests (FOD)	29	48% of classified forest
Coniferous Forests (FOC)	5	8% of classified forest
Mixed Deciduous Forests (FOM)	12	24% of classified forest
Cultural Plantation (CUP)	15	15% of classified forest
Treed Swamps	27	5% of classified forest
Unclassified Forests		62% of all forests

A total of 61 forest community types were identified in the surveyed portions of the City of Vaughan: 29 deciduous, five coniferous, 12 mixed deciduous communities and 15 cultural plantations. Deciduous forest communities are the dominant forest type at 48% cover, followed by mixed deciduous forests at 24%, cultural plantations at 15% and the remaining 8% in coniferous forest cover. Treed swamps contribute an additional 2%. The 13 Sugar Maple-Black Maple Deciduous Forest communities identified in the city are considered to be regionally rare by the Natural Heritage Information Centre (NHIC). Unclassified forests made up 62% of all forests.

Most of the forest cover is found west of Pine Valley Drive in designated ESAs and north of Teston Road, in areas where the water table is relatively high and in association with river valley features. In fact, 52% of the forested communities are below top of bank, in valleyland systems (Figure 9). Natural areas occurring in



Legend

- Watercourse (TRCA)
- Transmission Line
- Railway
- Freeway
- Expressway / Highway
- Major Road
- Local Road
- Ramp
- Sensitive Amphibian Area
- Sensitive Bird Area
- Vaughan
- Municipal Division
- Waterbody
- Cartographic Wetland

Existing Natural Cover (TRCA)

- Forest
- Meadow
- Successional
- Wetland

Potential Natural Cover (TRCA)

- Forest
- Meadow to Forest
- Unknown

Basemapping from Ontario Ministry of Natural Resources

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Vaughan OP

TRCA Existing and Potential Cover

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Figure 9

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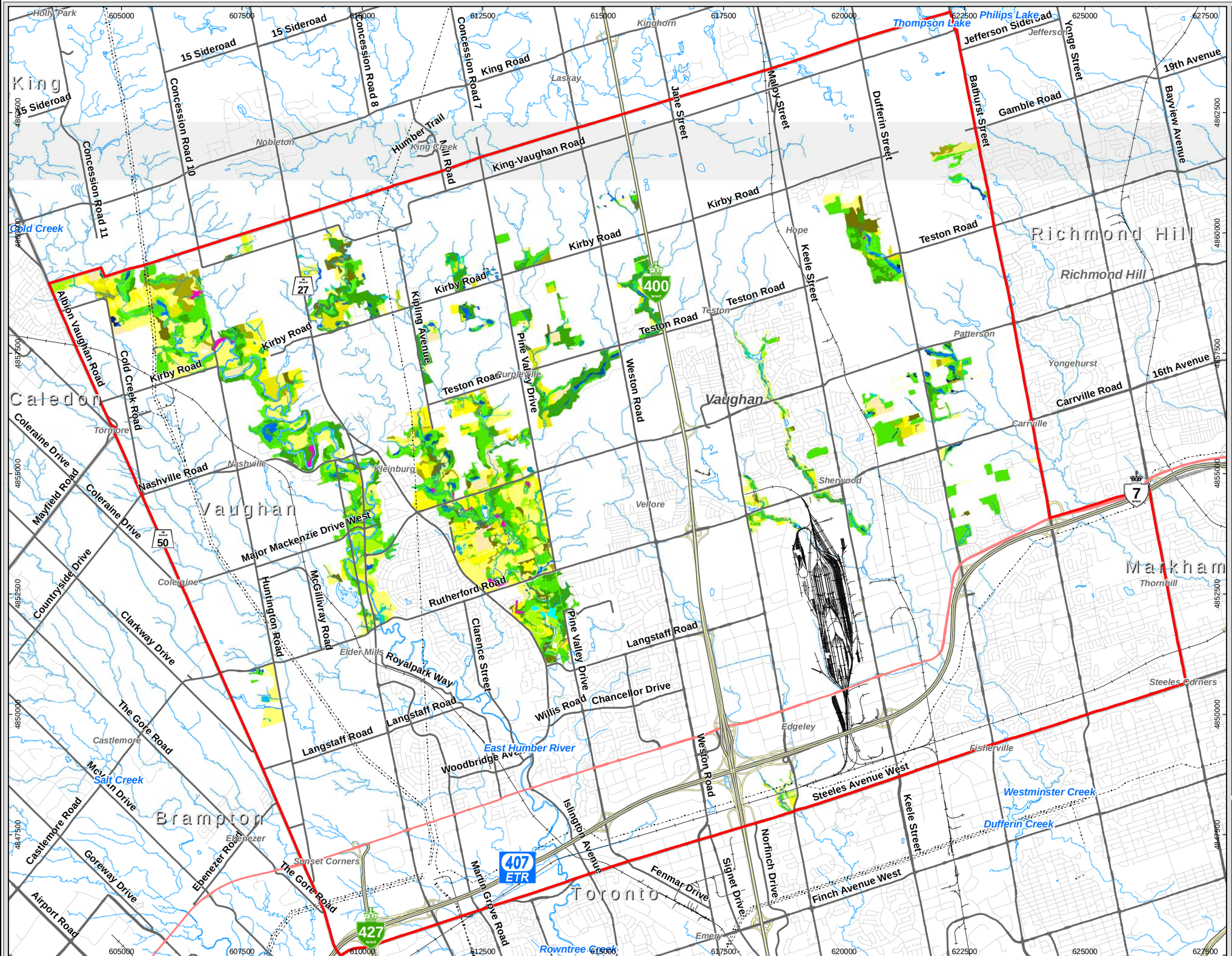

Legend

- Watercourse (TRCA)
- Transmission Line
- Railway
- Freeway
- Expressway / Highway
- Major Road
- Local Road
- Ramp
- Vaughan
- Municipal Division
- Waterbody
- Cartographic Wetland

Vegetation Community (TRCA)

AGR	FOM
BBO	MAM
BLO	MAS
CBS	OAO
CUH	SAF
CUM	SAM
CUP	SAS
CUS	SBO
CUT	SBS
CUW	SWC
Manicured	SWD
FOC	SWM
FOD	SWT

Rare Vegetation Community (FOD6-2, SBO1, SWD1-2)

Basemapping from Ontario Ministry of Natural Resources

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Vaughan OP

TRCA
Ecological Land Classification

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Figure 10

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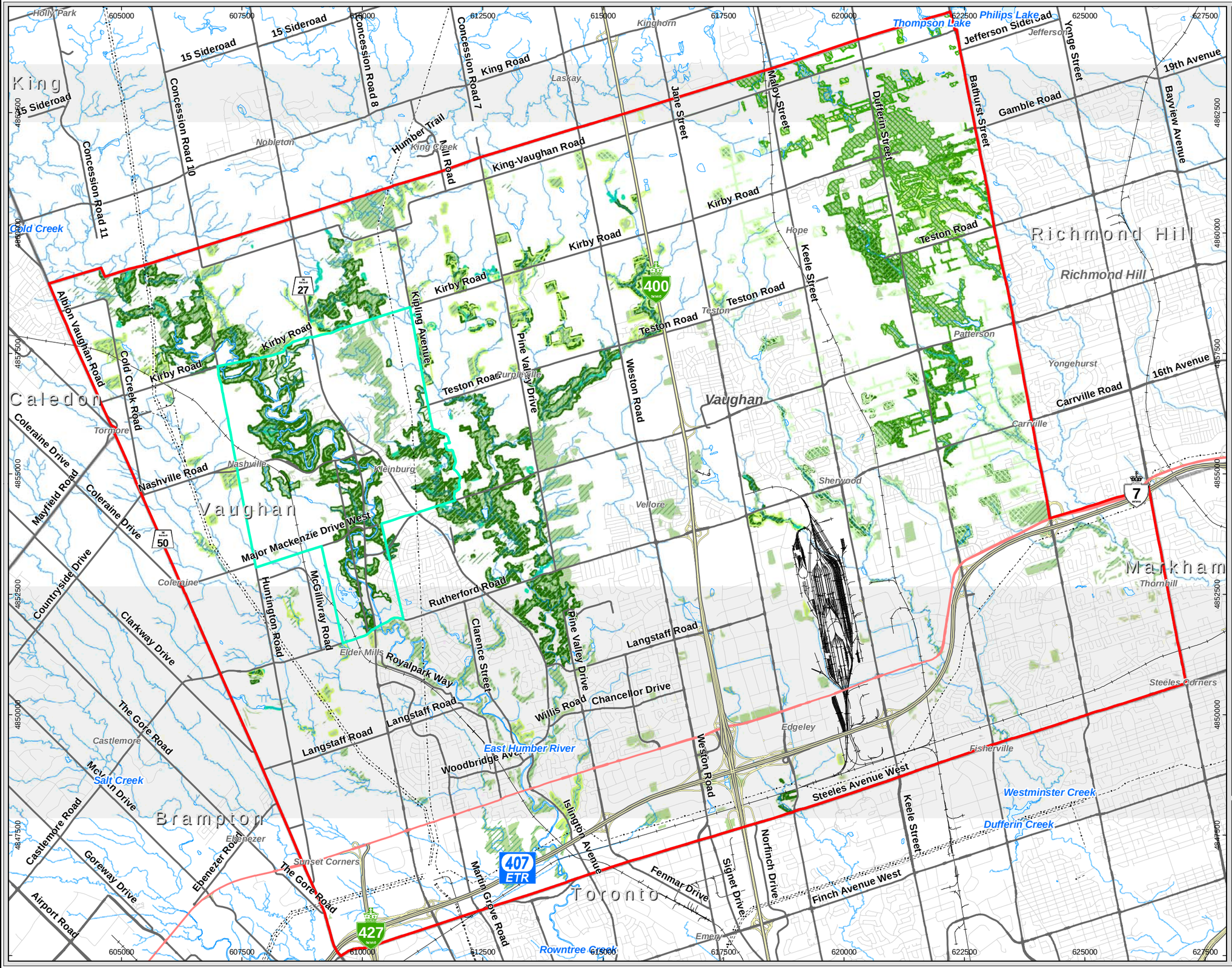
topographical depressions and containing running or standing water are classified as Valleylands. In southern Ontario, valleylands are often the only remaining natural areas within a region, thereby enhancing their importance as stormwater storage systems, nutrient transport systems, wildlife habitat and habitat connectors. A large proportion of the remaining forest cover in Vaughan is in valleyland systems, confirming the importance of these features in a highly urbanized landscape. Upland forests in the southern portion of the city are small and uncommon due to agricultural and urban pressures. The average forest patch size in Vaughan is 6 ha, versus a mean size of 10 ha in York Region (North-South Environmental Inc. 2005, Figure 11). Upland forests are larger and more abundant north of Teston Road and on the Oak Ridges Moraine, where agriculture and development pressures are not as extreme.

Two studies have been conducted in portions of Vaughan, in which individual woodlot quality and importance were evaluated based on criteria such as overall attributes, functions and linkages (Figure 2). Attributes included features such as the presence of ESAs, wetlands, ANSIs, rare species and unique vegetation communities. Both hydrological and forest habitat functions were considered. Hydrological functions include erosion control, groundwater discharge, groundwater recharge and water quality improvement. Forest habitat functions include patch size, maturity and structural diversity. Woodlots linked to other natural cover were also considered to be of higher value than isolated patches. The *Subwatershed Study* (1993) evaluated 56 forest patches in three regions south of Teston Road. Seventy-five percent of the high and moderately ranked woodlots were associated with tributaries in valleyland systems. The *Focus Rural Area Woodland Ecosystem Assessment* (2002) evaluated woodlands primarily north of Teston Road, with a supplementary region in the south. Forty-three of the high and moderately ranked woodlots were in valleylands or had wetland communities within their boundaries. The remaining highly ranked upland forests were large, diverse, mature communities with unique features, or woodlots associated with ESAs.

Forest cover in Vaughan is below the minimum 30% cover recommended by Environment Canada (2004) to achieve and maintain healthy forest ecosystems and watersheds. The proposed percent cover targets are supported by current scientific understanding of landscape level ecosystem functions (Andren 1994, Fahrig 2002, Villard *et al*. 1999). York Region suggests a target of 25% forest cover (calculated including urban areas), and the Terrestrial Natural Heritage System proposed by TRCA targets 30%. Furthermore, it is recommended in the Natural Heritage Reference Manual that forest patches 4 ha and larger should be considered significant forest areas where woodland cover is between 5% to 15% of land cover. Woodland coverage in the City of Vaughan falls within this range. Forests provide a number of ecosystem functions including the provisioning of habitat for migratory birds and other wildlife species, improvement of air and water quality, reduction of stormwater runoff and soil erosion. In order to benefit from these and additional services, and given the scarcity of woodland cover in the City, forest cover and connectivity between communities should be enhanced where possible.



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Legend

- Watercourse (TRCA)
- Transmission Line
- Railway
- Freeway
- Expressway / Highway
- Major Road
- Local Road
- Ramp
- Vaughan
- OPA 160 - Kleinburg - Nashville Community Plan
- Municipal Division
- York Region Significant Forest
- Focus Rural Woodlot Assessment
- Vaughan Woodlot Protection Strategy
- OPA 160

Vegetation Community (TRCA)

- Forest Communities
- Treed Swamp Communities

ORM Woodlands

- Preliminarily Significant Woodland
- Woodland
- Wooded Area (MNR)
- Waterbody
- Cartographic Wetland

Basemapping from Ontario Ministry of Natural Resources

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Vaughan OP

Forest Designations

April 2010
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Figure 11

4.3.1.2 Wetland Communities

Approximately 2% wetland cover remains in the City of Vaughan, which accounts for less than 3% of the existing natural vegetation. From a watershed perspective, this is close to the remaining wetland cover in the Humber River portion of the city at 0.7%, versus 0.4% cover in the Don River Watershed (Table 3, Table 5). This implies that even at this low number, Vaughan has stewardship over a large number of the remaining wetlands within these two watersheds.

Table 5. Composition of Wetland Communities

Wetland Type	Number of Wetland Community Types	% of Wetland Cover
All Wetlands	65	2% of the area of Vaughan
Marsh (MAS)	29	48% of classified wetlands
Treed Swamp (SWD/SWC/SWM)	27	42% of classified wetlands
Thicket Swamp (SWT)	2	8% of classified wetlands
Shallow Water (SAF/SAM/SAS)	6	2% of classified wetlands
Unclassified Wetlands		45% of wetlands not classified

Fifty-five percent of the wetlands have been classified by TRCA using ELC. A total of 65 wetland communities were identified: 29 marshes, 27 treed swamps, 2 swamp thickets and 6 shallow water communities (Figure 9). Of the wetlands classified, marsh communities are the dominant wetland type at 48% cover, followed by treed swamps at 42%, swamp thickets at 8% and the remaining 2% in shallow water communities. A total of 16 community types, representing 11% of wetlands identified by TRCA, have organic soils. Organic soils indicate the presence of groundwater seepage. These community types include 10 treed swamps, five marsh community types and one swamp thicket community type. One Bur Oak Deciduous Swamp community identified in the city is considered to be regionally rare by the Natural Heritage Information Centre (NHIC). Unclassified wetlands not included in the above figures make up the 45%.

The ecological services performed and economic benefits associated with wetland communities are well documented. Ecological services and benefits include provisioning of habitat for a diversity of wildlife species including amphibians and birds, nutrient retention, water filtration, flood control, groundwater recharge and micro-climate stabilization. In addition, wetlands are used both recreationally (i.e., boating, birding, fishing) and for personal harvesting of nuts, berries, fish and lumber. The function and quality of the few remaining fragmented wetlands within Vaughan have the potential to be severely compromised by intense urbanization and agriculture. Wetlands are sensitive to increases in nutrient loads, suspended solids, and organic contaminants from runoff as well as from changes in hydrology (Mitch and Gosselink 2000).

Although the evaluated wetlands within Vaughan are protected under the PPS, the remaining unevaluated wetlands are still vulnerable to loss and further reductions in overall quality. Unevaluated wetlands need protection, and opportunities to connect all remaining units to other communities and enhance existing coverage should be a priority. The MNR currently has drafted a series of wetlands designated “Draft East Humber Wetland Complex” for PSW status; which is currently under review (Figure 13).

4.3.1.3 Meadow

Approximately 3% meadow cover exists in the City of Vaughan, which accounts for approximately 6% of the classified natural vegetation communities. From a watershed perspective, meadow cover is higher in the Humber River portion of the city at 7%, versus 4% cover in the Don River Watershed (Table 3). However, this does not take into account the very large contribution to this habitat provided by the agricultural lands.

Meadows are early successional, open vegetation communities that are dominated by wildflowers and grasses. These communities are created by natural or anthropogenic disturbance, and if deep fresh soils exist and adequate precipitation occurs, will succeed to communities with a woody component. Meadow communities in the City of Vaughan are primarily associated with tributaries and found in riparian areas, both within and along the periphery of forest communities. There are a number of meadow communities with straight edges that are likely abandoned agricultural fields reverting to natural cover. An exceptionally large unit is found at Teston Road and Keele Street (Figures 9 and 10).

Meadow functions are generally undervalued, however these communities provide important buffering services to the forest and aquatic communities they surround. Meadows provide habitat for a diversity of plant and animal species, especially communities that are greater than 10 ha in size. As natural cover, they can also function as connectors between forest and wetland communities.

The Oak Ridges Moraine Conservation Plan Technical Paper on Significant Wildlife Habitat suggests that meadows as small as 10 ha with as few as five breeding pairs of grassland area-sensitive breeding birds should be identified as meeting the test for Significance. This guideline underscores the need to include habitat within a natural heritage network to provide for and manage this feature. These species are most often located on agricultural land that is in rotation from one use to another and therefore agricultural practices are important in maintaining habitat for these species. However, depending on the management regime, (e.g., the timing of hay harvest that, if it occurs in mid June, will kill Bobolink nestlings and make the breeding effort unproductive for that year), the presence of the meadows does not necessarily translate into wildlife benefits.

4.3.1.4 Successional Habitats

Approximately 1% successional cover exists in the City of Vaughan, which accounts for less than 2% of the existing natural vegetation communities in the area. From a watershed perspective, successional cover is only slightly higher in the Humber River portion of the city at 1%, versus 0.6% cover in the Don River Watershed (Table 3). Successional habitats are in a transitional phase and are classified as cultural woodlands and/or thickets. From a wildlife perspective, cultural thicket patches can support a diverse composition of breeding and over-wintering bird species. The thickets provide berries and insects for birds to forage on, and nesting substrates for species such as Northern Cardinal (*Cardinalis cardinalis*) and Gray Catbird (*Dumetella carolinensis*). Larger thickets will also support area sensitive species such as Brown Thrasher (*Toxostoma rufum*), Yellow-billed Cuckoo (*Coccyzus americanas*) and provincially threatened Golden-winged Warbler (*Vermivora chrysoptera*).

In the City of Vaughan successional communities are found along forest boundaries and function as edge habitats (Figure 9). One community also exists along a transmission line in the north. Successional habitats

can be restored to natural cover actively and contribute to vegetation cover, provide a buffering service or connectivity between patches.

The Oak Ridges Moraine Conservation Plan Technical Paper on Significant Wildlife Habitat suggests that thickets as small as 10 ha with 20 or more breeding pairs of area-sensitive breeding birds that require habitat that is transitional between meadows to thickets, should be identified as meeting the test for Significance. Although it is clear, that in order to provide for and manage these species this habitat should be maintained, without active management these areas will continue to succeed into woodlands and forests. This guideline underscores the value of including agricultural lands within a natural heritage network.

4.3.1.5 Sand Barrens

Two sand barren communities have been identified in the northeastern part of the City, on the Oak Ridges Moraine. Sand Barren communities as a broad classification are designated as Provincially rare (NHIC). The two identified communities are on ice-contact stratified deposits, a highly permeable, medium grained sand with small amounts of gravel. The northern most unit classified as a Dry Dropseed Sand Barren, is dominated by Sandy Dropseed (*Sporobolus cryptandrus*), with Canada Blue Grass (*Poa compressa*), Gray Goldenrod (*Solidago nemoralis ssp. Nemoralis*) and Sandbar Willow (*Salix exegua*). The southern most unit, a Dry-Fresh Flat-stemmed Blue Grass-Forb Sand Barren also has Canada Blue Grass, Sandy Dropseed and Gray Goldenrod, with lesser amounts of Staghorn Sumac (*Rhus typhina*) and non-native Ox-eye Daisy (*Chrysanthemum leucanthemum*). Although often anthropogenic in origin, Sand Barren communities have a unique assemblage of rare, disturbance-dependent plant species.

4.3.1.6 Flora

A list of rare and uncommon plant species has been compiled by referring to Gartner Lee Limited internal reports, TRCA's *Environmentally Significant Areas Study* (1982) and NHIC (Table 6, Figure 12 Species at Risk). Rarity was evaluated according Varga *et al.* (2000). Twenty-nine rare plant species have been observed, 13 of which have been reported by Gartner Lee Limited in the last 7 years. Apart from Bee-balm (*Monarda didyma*), which was reported in 1948, the remaining species were observed after 1982. Most detections are in ESAs, although intensive sampling by GLL of Block 12 (between Dufferin Street and Bathurst Street, Teston Road to Major McKenzie Drive) and in the Pine Valley Drive-Pine Valley Crescent area have contributed to many records in these areas. One Nationally and Provincially ranked species, the endangered Butternut (*Juglans cinera*) tree has been reported in the southern part of the city. The population declines of the Butternut tree is attributed to infection by the lethal butternut canker, not habitat loss.

Table 6. Provincially, Regionally and Locally Rare/Uncommon Plant Species

Common Name	Scientific Name	Status[1]	Data Source
Canada Waterleaf	*Hydrophyllum canadense*	Locally Rare (York), Regionally Rare (GTA)	TRCA
Smooth Rock Cress	*Arabis laevigata*	Regionally Rare (GTA)	TRCA
Common Polypody	*Polypodium virginianum*	Locally Rare (York), Regionally Rare (GTA)	TRCA
Sprengel's Sedge	*Carex sprengelii*	Locally Rare (York)	TRCA
Thinleaf Sedge	*Carex cephaloidea*	Locally Rare (York), Regionally Rare (GTA)	TRCA
Tower Mustard	*Arabis glabra*	Locally Rare (York), Regionally Rare (GTA)	TRCA
Golden Saxifrage	*Chrysosplenium americanum*	Locally Rare (York), Regionally Rare (GTA)	TRCA
Black-seeded Clearweed	*Pilea fontana*	Locally Uncommon (York), Regionally Rare (GTA)	TRCA
New York Fern	*Thelypteris noveboracensis*	Locally Rare (York), Regionally Rare (GTA)	TRCA
Northern Green Orchid	*Platanthera huronensis*	Locally Rare (York), Regionally Uncommon (GTA)	TRCA
Skunk Cabbage	*Symplocarpus foetidus*	Locally Rare (York), Regionally Rare (GTA)	TRCA
Woodland Meadow Grass	*Poa alsodes*	Regionally Rare (GTA)	TRCA
Snowberry	*Symphoricarpos alba*	Locally Rare (York), Regionally Uncommon (GTA)	TRCA
Pointed Tick-trefoil	*Desmodium glutinosum*	Locally Rare (York), Regionally Uncommon (GTA)	TRCA, GLL
Black Maple	*Acer nigrum*	Locally Rare (York)	GLL
White Oak	*Quercus alba*	Locally Rare (York)	GLL
Running Strawberry	*Euonymous obovata*	Locally Rare (York)	GLL
Marsh-pennywort	*Hydrocotyle americana*	Locally Uncommon (York), Regionally Uncommon (GTA)	GLL
Bristly Green Brier	*Smilax hispida*	Locally Uncommon (York), Regionally Uncommon (GTA)	GLL
Pennsylvania Bitter Cress	*Cardamine pennsylvanica*	Locally Uncommon (York), Regionally Uncommon (GTA)	GLL
Great Lobelia	*Lobelia siphilitica*	Locally Uncommon (York), Regionally Uncommon (GTA)	GLL
American Brooklyn	*Veronica americana*	Locally Uncommon (York), Regionally Uncommon (GTA)	GLL
Marsh Yellow-cress	*Rorripa palustris*	Locally Rare (York)	GLL
Wood Millet	*Milium effusum*	Locally Uncommon (York), Regionally Uncommon (GTA)	GLL
Hairy-leaved Sedge	*Carex hirtifolia*	Locally Uncommon (York), Regionally Uncommon (GTA)	GLL
Hitchcock's Sedge	*Carex hitchcockiana*	Locally Uncommon (York), Regionally Uncommon (GTA)	GLL
Butternut	*Juglans cinera*	Nationally and Provincially Endangered	GLL
Green Arrow-arum	*Peltandra virginica*	Locally Rare (York), Regionally Rare (GTA), Provincially Rare (S2; Ontario)	NHIC
A. Moss	*Astomum muehlenbergianum*	Locally Rare (York), Regionally Rare (GTA), Provincially Rare (S2; Ontario)	NHIC
Bee-balm	*Monarda didyma*	Locally Rare (York), Regionally Rare (GTA), Provincially Rare (S3; Ontario)	NHIC

Notes: 1. Plant species status is based on Varga et al. (2000) for local and regional significance.

Terrestrial Species

Insects
- Rare Insect (NHIC)

Mammals
- Mammal Species-At-Risk (TRCA)

Amphibians
- Rare Amphibian (NHIC)
- Amphibian/Reptile Species-At-Risk (TRCA)
- Breeding Amphibians (TRCA)
- Regionally Rare Amphibian/Reptile Species (TRCA)
- Breeding Amphibians (GLL)

Birds
- Bird Species-At-Risk (NHIC)
- Bird Species-At-Risk (TRCA)
- Bird Species-At-Risk (GLL)
- Regionally Rare/Area Sensitive Bird Species (GLL)
- Area Sensitive Bird Species (GLL)
- Area Sensitive Bird Species (TRCA)

Plants
- Rare Plant (NHIC)
- Regionally Rare Plant Species (GLL)

Legend

- Watercourse (TRCA)
- Transmission Line
- Railway
- Freeway
- Expressway / Highway
- Major Road
- Local Road
- Ramp
- Vaughan
- Municipal Division
- Wooded Area
- Waterbody
- Cartographic Wetland

Basemapping from Ontario Ministry of Natural Resources

N W E S

Kilometers

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UTM Zone 17N, NAD 83

Vaughan OP

Species-At-Risk, Regionally Rare & Area Sensitive Terrestrial Species

April 2010
Project 70894

AECOM

Figure 12

Map Document: (N:\projects\2007\70894\2010\Final\GIS\SpatialMXDs\Report\MXDs\70894SensitiveTerrestrialSpecies-11x17.mxd)
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4.3.1.7 Significance and Sensitivity

Table 7 summarizes the attributes and functions that are important within the study area, and for which consideration should be provided during the planning process.

Table 7. Significance and Sensitivity of Vegetation Features in the City of Vaughan

Attribute	Location	Sensitivity/Significance
Upland Forest Communities	▶ Primarily north of Teston Road and on the Oak Ridges Moraine	▶ Rare vegetation communities in Vaughan. Are usually the first forests to be removed for agriculture and urban development. Protect remaining patches.
Wetland Communities	▶ Kettle wetlands are located on the Oak Ridges Moraine. Many units in southern part of the city within ESAs and in riparian areas associated with Tributaries.	▶ Provide a number of important ecological, economic and social functions. Retain base flow and vegetation units. Provide protection for undesignated wetlands.
Meadows and Successional Communities	▶ Throughout Vaughan but concentrated north of Teston Road associated with agricultural activities	▶ Require active management to maintain function for wildlife habitat and plant habitat for those species adapted to a frequent disturbance regime.
Sand Barren Communities	▶ 2 communities in northeastern part of city on Oak Ridges Moraine.	▶ Provincially Rare vegetation communities. Protect communities.
Provincially, Regionally and Locally Rare Species	▶ 29 species. Concentrated in ESA's and narrow vegetated cover west of Pine Valley Drive.	▶ Sensitive to urbanization.
Nationally and Provincially Endangered Butternut tree	▶ Southern part of city.	▶ Endangered due to infection by the lethal Butternut canker.

4.3.2 Wildlife

Information has been compiled for all groups of wildlife reported within the City of Vaughan. Standardized methods exist for sampling breeding birds and amphibians. These protocols have been widely applied by many organizations, individuals and agencies, making inventories of birds and amphibians more thorough and complete than those for other wildlife species. Habitat requirements of these two groups are also well understood, thus making them valuable and relatively reliable indicators of habitat quality, function and landscape connectivity. Information on mammals and reptiles can be used to further supplement our understanding of the natural heritage features within the city limits.

4.3.2.1 Breeding Birds

A list of breeding bird species observed in the City of Vaughan within the last 20 years was compiled by referring to the following three resources: 1) Seven 10 km^2 squares surveyed during the second Ontario Breeding Bird Survey (OBBA; 17PJ04, 17PJ05, 17PJ14, 17PJ15, 17PJ16, 17PJ25, 17PJ26) that are encompassed within the city, 2) TRCA data; and 3) Gartner Lee Limited Internal reports. Some of the OBBA squares were only partially encompassed by city limits, resulting in a species list that may include some bird species that were found in the vicinity of, but not necessarily within Vaughan proper.

A total of 147 breeding bird species have been detected in Vaughan, three of which are non-native (Attachment 1). According to the second Ontario Breeding Bird Atlas, the nationally and provincially listed Peregrine Falcon (*Falco peregrinus*), was detected in the breeding season, but no further evidence of breeding was observed. Two additional species were detected within Vaughan that were unexpected

breeders; the Trumpeter Swan (*Cygnus buccinator*) was detected with fledged young, and the Ruddy Duck (*Oxyura jamaicensis*) was considered a probable breeder by holding a permanent territory. Four species were possibly breeding in Vaughan according to observations made during surveys, and the remaining 142 species were confirmed or probable breeders.

Forty area-sensitive bird species have been detected in the City of Vaughan (Attachment 1). Area-sensitive bird species either prefer to breed in larger patches of suitable habitat or are found at higher breeding densities in larger habitat patches. Thirty-two of the area sensitive species are forest associates, four are found primarily in marsh habitats and the remaining five species are found in old-fields, thickets and other open habitat communities. Warbler species accounted for 31% (10 species) of the forest area sensitive species, raptors and owls represented an additional 22% (7 species), and woodpecker species comprised 9% (3 species) of the forest area sensitive bird species observed. The highest concentrations of area sensitive bird species were encompassed within the ESAs to the west of Pine Valley Drive and to the east of Keele Street on the Oak Ridges Moraine (Figure 12). The vegetation communities protected in the ESAs combine to form large contiguous patches of forest, wetland and meadow. The natural communities bordering the Humber River, north of Nashville road also provide habitat for a high concentration of area sensitive bird species. Apart from the ESA protected lands, these valleylands are the only other areas that provide large enough habitat patches for species such as the Black-throated Blue Warbler (*Dendroica caerulescens*) and Scarlet Tanager (*Piranga olivacea*).

Local rarity of breeding bird species was evaluated based on information provided by the second Ontario Breeding Bird Atlas. Bird species observed in the City of Vaughan that were reported in less than 25% of the squares in the region were considered locally uncommon (Table 8). A total of 17 uncommon species were detected in Vaughan, five of which have also been designated as species at risk or provincially rare (NHIC; see section 4.3.2.4). Uncommon species were reported in all Ontario Breeding Bird Atlas squares encompassed by the city, and were therefore well distributed.

Table 8. Locally Uncommon Breeding Bird Species

Common Name	Scientific Name	Data Source
Trumpeter Swan*	*Cygnus buccinator*	OBBA
Ruddy Duck*	*Oxyura jamaicensis*	OBBA
Common Merganser	*Mergus merganser*	OBBA
Wild Turkey	*Meleagris gallopavo*	OBBA, TRCA
Long-eared Owl	*Asio otus*	OBBA, TRCA
Northern Saw-whet Owl	*Aegolius acadicus*	OBBA, TRCA
Red-bellied Woodpecker	*Melanerpes carolinus*	OBBA
Acadian Flycatcher*	*Empidonax virescens*	OBBA, TRCA, GLL
Golden-crowned Kinglet	*Regulus satrapa*	OBBA, TRCA
Blue-headed Vireo	*Vireo solitarius*	OBBA
Magnolia Warbler	*Dendroica magnolia*	OBBA, GLL
Hooded Warbler*	*Wilsonia citrina*	OBBA, TRCA
Cerulean Warbler*	*Dendroica cerulea*	OBBA
Clay-coloured Sparrow	*Spizella pallida*	OBBA, TRCA
Grasshopper Sparrow	*Ammodramus savannarum*	OBBA, TRCA
Purple Finch	*Carpodacus purpureus*	OBBA
Evening Grosbeak	*Cocoothraustes vespertinus*	OBBA

*Note: * Also designated as a species at risk or provincially rare species*

4.3.2.2 Amphibians and Reptiles

A list of amphibian and reptile species detected in the City of Vaughan was compiled by referring to TRCA data, GLL internal reports and NHIC (Table 9). Twelve amphibian and five reptile species have been reported in the city. Of the 17 species reported in the area, one is a Species at Risk and one is a provincially rare species (Figure 12). The Milk Snake (*Lampropeltis triangulum*) is designated as a species of Special Concern by COSEWIC and OMNR. It was detected in one location in 1999 by TRCA. A Jefferson x Blue Spotted Salamander hybrid (*Ambystoma* hybrid) was detected by TRCA in 2005, and reported to NHIC in the 1970s. This hybrid is provincially imperilled (S2), according to the OMNRs Natural Heritage Information Centre (NHIC).

Table 9. Amphibian and Reptile Species Observed in the City of Vaughan

	Common Name	Scientific Name	Data Source
Amphibian	Red-spotted Newt	*Notophthalmus viridescens*	TRCA
	Jefferson X Blue Spotted Salamander*	*Ambystoma hybrid*	TRCA, NHIC
	Spotted Salamander	*Ambystoma maculatum*	TRCA, GLL
	Eastern Red-backed Salamander	*Plethodon cinereus*	TRCA, GLL
	American Toad	*Bufo americanus*	TRCA, GLL
	Gray Treefrog	*Hyla versicolor*	TRCA, GLL
	Spring Peeper	*Pseudacris crucifer*	TRCA, GLL
	Western Chorus Frog	*Pseudacris triseriata*	TRCA
	Wood Frog	*Rana sylvatica*	TRCA, GLL
	Northern Leopard Frog	*Rana pipiens*	TRCA, GLL
	Pickerel Frog	*Rana palustris*	TRCA
	Green Frog	*Rana clamitans*	TRCA, GLL
Reptile	Snapping Turtle	*Chelydra serpentina*	TRCA
	Midland Painted Turtle	*Chrysemys picta*	GLL
	Eastern Gartersnake	*Thamnophis sirtalis*	TRCA, GLL
	Northern Red-bellied Snake	*Storeria occipitomaculata*	TRCA
	Milk Snake*	Lampropeltis triangulum	NHIC, TRCA

*Note: * Also designated as a species at risk or provincially rare species*

Ten species of frog and toad are common in south and central Ontario. The detection of eight of these species in the City of Vaughan illustrates the high diversity of amphibians present within the city limits. Wood Frog and Spring Peeper have been reported most frequently. Pickerel Frog and Leopard Frog are uncommon. Frog and toad sampling is conducted according to the Canadian Wildlife Service Marsh Monitoring Program in which the abundances of individual species are recorded on a scale from 0-3, where a code 3 represents a full chorus in which calls are continuous and overlapping. Full chorus', which may be associated with stable populations, have been recorded for Wood Frog, Spring Peeper and Chorus Frog. It is important to note that although there is a low incidence of wetlands in Vaughan, amphibians have been detected in most riparian areas along tributaries, except in the highly developed southeastern part of the city.

Although amphibians are widespread in the City of Vaughan, the highest concentration of breeding individuals have been detected in the wetland, meadow and forest communities encompassed by the ESAs west of Pine Valley Drive and the valleylands of the Humber River. Reptiles have also been detected most frequently in these areas. Although densities of amphibians appear high in Block 12 (between Dufferin Street and Bathurst Street, Teston Road to Major McKenzie Drive) this is largely an artefact of the intensive surveys conducted in the area by GLL staff, which has resulted in higher probabilities of amphibian detection (Figure 12).

4.3.2.3 Mammals

A total of 22 mammal species have been detected in the City of Vaughan, two of which are non-native (Coyote and Virginia Opossum; Table 10). Many of these are common urban species that are tolerant to disturbance including the Racoon (*Procyon lotor*), Eastern Chipmunk (*Tamias striatus*), Eastern Grey Squirrel (*Sciurus carolinensis*) and Eastern Cottontail Rabbit (*Sylvilagus floridanus*). White-tailed Deer (*Odocoileus virginianus*) and Coyote (*Canis latrans*) are generalists, found in a diversity of habitats including young woodlands, meadows, old fields and valleylands. Mammals such as the Meadow Vole (*Microtus pennsylvanicus*) and Woodchuck (*Marmota monax*) spend most of their time in old fields. Mink (*Mustela frenata*), Beaver (*Castor canadensis*) and River Otter (*Lontra canadensis*) are associated with aquatic habitats (river, pond or lake) within wooded areas. Southern Flying Squirrel (*Glaucomys volans*) and Short-tailed Weasel (*Mustela erminea*) are two forest associates.

Table 10. Mammal Species Observed in the City of Vaughan

Common Name	Scientific Name	Data Source
White-tailed Deer	*Odocoileus virginianus*	TRCA
Short-tailed Weasel	*Mustela erminea*	TRCA
Long-tailed Weasel	*Mustela frenata*	TRCA
Mink	*Mustela vison*	TRCA
River Otter	*Lontra canadensis*	TRCA
Racoon	*Procyon lotor*	GLL
Coyote**	*Canis latrans*	GLL
Porcupine	*Erethizon dorsatum*	TRCA
Meadow Jumping Mouse	*Zapus hudsonius*	TRCA, GLL
Woodland Jumping Mouse	*Napaezapus insignis*	TRCA
Meadow Vole	*Microtus pennsylvanicus*	TRCA, GLL
Muskrat	*Ondatra zibethicus*	TRCA, GLL
Beaver	*Castor canadrnsis*	TRCA, GLL
Eastern Chipmunk	*Tamias striatus*	TRCA, GLL
Woodchuck	*Marmota monax*	TRCA
Red Squirrel	*Tamiasciurus hudsonicus*	TRCA
Eastern Grey Squirrel	*Sciurus carolinensis*	GLL
Southern Flying Squirrel*	*Glaucomys volans*	TRCA
Eastern Cottontail Rabbit	*Sylvilagus floridanus*	TRCA
Little Brown Bat	*Myotis lucifugus*	GLL
Virginia Opossum**	*Didelphis virginiana*	TRCA
Hairy-tailed Mole	*Parascalops breweri*	TRCA

*Notes: * Also designated as a species at risk or provincially rare species*
*** Non-native species*

Apart from the common urban tolerant species discussed, mammals are associated with natural cover and are found in their highest densities close to vegetated portions of the city in the north and west.

One mammal species detected in Vaughan, the Southern Flying Squirrel, has been designated as a species of special concern by COSEWIC and OMNR, and is provincially vulnerable (S3) according to NHIC (see Section 4.3.2.4).

4.3.2.4 Significant Species

Toronto and Region Conservation Authority (TRCA), Natural Heritage Information Centre (NHIC), the second Ontario Breeding Bird Atlas (OBBA) and Gartner Lee Limited internal reports were consulted to compile a list of wildlife species at risk and provincially rare species observed within the City of Vaughan (Table 11).

Table 11. Significant Wildlife Species in the City of Vaughan

	Common Name	Scientific Name	S-Rank[1]	MNR Rank[2]	COSEWIC Rank[3]	Data Source
BIRD	Least Bittern	*Ixobrychus exilis*	S3	THR	THR*	NHIC, TRCA
	Trumpeter Swan	*Cygnus buccinator*	S2S3	--	--	OBBA
	Ruddy Duck	*Oxyura jamaicensis*	S2	--	--	OBBA
	Peregrine Falcon	*Falco peregrinus*	S2S3	END	THR*	OBBA
	Short-eared Owl	*Asio flammeus*	S3S4	SC	SC	OBBA
	Red-headed Woodpecker	*Melanerpes erythrocephalus*	S3	SC	SC	NHIC, TRCA, OBBA
	Acadian Flycatcher	*Empidonax virescens*	S2	END	END*	TRCA, GLL, OBBA
	Loggerhead Shrike[4]	*Lanius ludovicianus*	S2	END	END*	NHIC
	Carolina Wren	*Thryothorus ludovicianus*	S3S4	--	--	OBBA
	Golden-winged Warbler	*Vermivora chrysoptera*	S4	--	THR*	OBBA
	Cerulean Warbler	*Dendroica cerulea*	S3	SC	SC*	OBBA
	Hooded Warbler	*Wilsonia citrina*	S3	THR	THR*	NHIC, TRCA, OBBA
	Henslow's Sparrow[4]	*Ammodramus henslowii*	S1	END	END*	NHIC
ODONATA	Midland Clubtail	*Gomphus fraternus*	S3	--	--	NHIC
	Rapids Clubtail	*Gomphus quadricolor*	S1	--	--	NHIC
	Rusty Snaketail	*Ophiogomphus rupinsulensis*	S3	--	--	NHIC
FISH	Redside Dace	*Clinostomus elongatus*	S3	THR	SC	NHIC, TRCA
	Northern Brook Lamprey	*Icthyomyzon fossor*	S3	SC	SC	TRCA
AMPHIBIAN	Jefferson Salamander x Blue Spotted Salamander	*Ambystoma hybrid*	S2	--	--	NHIC, TRCA
REPTILE	Milk Snake	*Lampropeltis triangulum*	S3	SC	SC*	TRCA, NHIC
MAMMAL	Southern Flying Squirrel	*Glaucomys volans*	S3	SC	SC	TRCA

Notes: Species included on Schedule 1 of the federal Species at Risk Act.

[1] ***S-rank:*** *The Natural Heritage provincial ranking system (provincial S-rank) is used by the MNR Natural Heritage Information Centre (NHIC) to set protection priorities for rare species and natural communities.*

Definitions are as follows:

- ***S1*** *Critically Imperilled; extremely rare in Ontario with 5 or fewer occurrences in the province. These species are especially vulnerable to extirpation.*
- ***S2*** *Imperilled; very rare in Ontario due to restricted range, 20 or fewer populations or steep declines. These species are vulnerable to extirpation.*
- ***S3*** *Vulnerable; rare to uncommon in Ontario due to restricted range, fewer than 80 populations or recent and widespread declines.*
- ***S4*** *Apparently Secure; uncommon but not rare. Usually greater than 100 occurrences in the province.*
- ***S5*** *Secure; common, widespread and abundant in the province.*

[2] ***MNR Status:*** *Based on consultation with COSSARO (Committee on the Status of Species at Risk in Ontario), which evaluates the conservation status of species occurring in Ontario.*

Definitions are as follows:

- ***EXT*** *Extinct; a species that no longer exists anywhere.*
- ***EXP*** *Extirpated; a species that no longer exists in the wild in Ontario, but occurring elsewhere.*
- ***END*** *Endangered; a species facing imminent extinction or extirpation in Ontario.*
- ***THR*** *Threatened; a species that is at risk of becoming endangered in Ontario if limiting factors are not reversed.*

[4] *Extirpated in the City of Vaughan*

SC *Special Concern; a species with characteristics that make it sensitive to human activities or natural events.*

[3]***COSEWIC rankings***: *The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assigns a federal status ranking to all assessed species.*

Definitions are as follows:

EXT *Extinct; a species that no longer exists anywhere.*

EXP *Extirpated; a species that no longer exists in the wild in Canada, but occurring elsewhere.*

END *Endangered; a species facing imminent extinction or extirpation in Canada.*

THR *Threatened; a wildlife species likely to become endangered if limiting factors are not reversed.*

SC *Special Concern; a species that may become a threatened or endangered species because of a combination of biological characteristics and identified threats.*

Fourteen animal species designated by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), have been observed in the City of Vaughan. COSEWIC is a panel of experts that assess a species' risk of becoming extinct and/or extirpated based on science and Aboriginal/community knowledge. Nine of the species designated by COSEWIC are included in Schedule 1 of the federal Species at Risk Act (SARA), which provides them and their habitat legal protection (Table 11). Of the species designated by COSEWIC, three are listed as Endangered, four are listed as Threatened and the remaining seven species are listed as Special Concern (Figure 12).

In consultation with the Committee on the Status of Species at Risk in Ontario (COSSARO), the OMNR is responsible for the evaluation of species at risk in Ontario. Thirteen species at risk designated by the OMNR have been observed in the City of Vaughan. In most cases OMNR/COSSARO designations are consistent with COSEWIC designations. This is true for all species at risk in Vaughan, except for three: 1) the Redside Dace has been upgraded by OMNR/COSSARO from a species of Special Concern to Threatened in Ontario; 2) the Peregrine Falcon has been upgraded from Threatened nationwide to Endangered in Ontario; and 3) the Golden-winged Warbler is listed on Schedule 1 of SARA as Threatened, but has not been designated as a Species at Risk by the OMNR. Four species have been evaluated as Endangered, three species have been evaluated as Threatened and the remaining five species have been listed as species of Special Concern (Figure 12).

A natural heritage provincial ranking system (S-ranks) is used by OMNR's Natural Heritage Information Centre to set protection priorities for provincially rare species and vegetation communities. S-ranks range from Critically Imperilled (S1) to Secure (S5). Twenty wildlife species detected in the City of Vaughan have an S-Rank between S1 (Critically Imperilled) to S3 (Vulnerable). Of the 20 provincially rare species, three bird species, all three Odonata (Dragonfly and Damselfly) species and the Jefferson Salamander X Blue Spotted Salamander hybrid are not also designated by COSEWIC and OMNR (Figure 12).

A total of 21 species have been detected in the City of Vaughan that are designated as Species at Risk or provincially rare species. Five of these records are older than 20 years, and are therefore considered to be historical. Historical records include observations for Henslow's Sparrow (1971), Loggerhead Shrike (1985) and the three Odonata species (1939-1955). Henslow's Sparrow is unlikely to have a breeding population remaining in the city and Loggerhad Shrike have been extirpated. Surveys for insect species are not as rigorous as they are for other wildlife, so it is possible that the three Odonata species are still present in Vaughan, but have not been detected in the recent past.

Most of the designated species at risk and provincially rare species were found in protected Environmentally Significant Areas to the west of Pine Valley Drive, or vegetation communities along the Humber River and its tributaries. The combination of natural cover encompassed by the ESAs and valleylands within the City of Vaughan provide a large, contiguous, relatively well connected patch of wildlife habitat, that has the potential to support a high diversity of vegetation and wildlife species (Figure 12).

4.3.3 Landscape Connectivity

Landscape connectivity is a very important factor in maintaining species populations and species diversity. Large mammals and birds in particular often require large territories for foraging. It is important that habitat patches are connected to facilitate seed dispersal and the movement of species and the transfer of genetic material between populations.

The landscape of Southern Ontario is highly fragmented, with patches of natural area (forest, wetland, thicket, etc) surrounded by agriculture, roads and development. Improvement of landscape connectivity can be achieved by creating corridors between these habitat patches. In general, agricultural land is less of a barrier to species movement than intensive residential or industrial development.

The Don and Humber River valleys provide a substantial amount of natural cover in the City. In most areas the valleys are treed which provides habitat for terrestrial birds and mammals, but it also provides many ecosystem services, such as slowing runoff and providing shade for streams to maintain coldwater fish habitat. The orientation of the Don and Humber River valleys allows for adequate movement of species in a north-south direction. But unfortunately these corridors are largely isolated from each other, so there is little connectivity in the east-west direction. Highway 400 acts as a major barrier to species movement between the Don and Humber watersheds, and there are many barriers to connectivity in the southern portion of the city including, high intensity development and major roads.

Landscape connectivity can be restored, maintained and/or enhanced using a variety of strategies that depend on the remnant cover, the proximity of patches, and the intervening matrix (e.g., agricultural *vs.* residential). Delineating actual corridors for wildlife movement is one approach in which corridor dimensions need to be sensitive to particular species targeted to use the corridors. This may be an appropriate approach for parts of the river network running generally north-south in the City of Vaughan. The other approach is to identify functional connectivity by ensuring that the matrix land uses are permeable to the species that are targeted for movement and/or dispersal. This approach may be more practical for east-west connections.

Currently there is little connectivity between the East and Upper Humber river valleys. The northern portion of the Humber watershed affords the best opportunity to improve landscape connectivity. Much of the northern portion of the City (north of Teston Road) has yet to be developed. There are numerous isolated woodlots that could be enlarged and connected to other woodlots by planting native shrubs and trees. This would also benefit streams in the area by providing more riparian cover.

A similar situation occurs in the Don River watershed, with little connectivity between the East and West Don. The majority of the forested cover is associated with the East Don, but there is the opportunity to improve connectivity and forest cover in the undeveloped portion of the East and West Don, north of Teston Road. Many of the streams in the Don watershed would benefit from improved woody riparian cover, which would in turn provide greater connectivity for terrestrial mammals and birds.

In the context of urban development and fragmented habitat, connectivity also has to be considered in a regional context. That is, what portions of the City of Vaughan should be identified for enhanced landscape connectivity to provide to make the most contribute to biodiversity conservation within the regional conservation network? The answer is now limited by past urban development such that our options are mostly limited to the Greenbelt and ORM. York Region, as a product of its Greenlands Strategy in support of its Official Plan Update, has identified a north-south corridor centered on the Humber River, and the Natural Heritage System of the Greenbelt. This approach is supported by the Vaughan study (See Figure 4 in the main report to which this is appended).

4.4 Designated Areas

4.4.1 Wetlands

Wetlands are defined as lands that are either flooded by shallow water or areas where the water table is close to the surface, have soils that are characteristic of water saturation, and have vegetation that has adapted to wet conditions (Mitch and Gosselink 2000). Wetlands are evaluated by the OMNR according to the Ontario Wetland Evaluation System (2002), in which the importance of a wetland is determined based on biological, social, hydrological and special features. Evaluated wetlands are categorized as either provincially or locally significant. These designations protect wetlands from development and alterations according to the Provincial Policy Statement (OMNR 1999). Wetlands on the Oak Ridges Moraine, on Conservation Authority lands, on Federal lands and wetlands associated with valley lands are all protected to some degree.

Wetlands were never common in the City of Vaughan, considering that only up to 5% of the area of the City of Vaughan (roughly 1,375 ha) would have been classified as wetland in 1800 (Snell 1987). This is a relatively small percentage compared with some townships, which would have had more that 60% of the area as wetlands. The lack of wetlands in the City of Vaughan can be attributed to the underlying surficial geology. The southern portion of the city is dominated by sloping till which is not conducive to wetland formation due to low permeability, and to the fact that water does not accumulate, and is shed to the south. The Oak Ridges Moraine extends into the northeast corner of the City. There are several kettle wetland complexes associated with the Oak Ridges Moraine in this area. There are several other wetlands or wetland complexes scattered throughout the City, but the majority are associated with river valleys (Figures 13 and 14). Although the Hope Wetland complex was evaluated by OMNR, the boundaries of the wetland complex do not appear in the most recent NRVIS data. The boundaries of the wetland complex will be determined from the Wetland Record, and will be provided at a later date. Currently there are only 152 ha of wetland left within the city of Vaughan, only 0.55% of the total area (27,500 ha). This means that over 80% of the wetland area in the city has been lost. The Hope Wetland Complex, the Keele Wetland Complex,

Holly Park
Nobleton Wetland Complex
Black Duck Wetland Complex
Eaton Hall-Mary-Hackett Lakes Wetland Complex
Radio Tower Bog
Philips-Bond-Thompson Wetland Complex
Rouge River Headwater Wetland Complex
King-Vaughan Wetland Complex
King
Cold Creek Wetland Complex
Concession Road 11
Concession Road 10
King Road
Nobleton
King Creek
King Creek Marsh
Mill Road
King-Vaughan Road
Gamble Road
Elgin Mills Road East
Jane Street
Dufferin Street
Keele Wetland Complex
Hope
Kirby Road
Teston Road
Richmond Hill
Cold Creek
Albion Vaughan Road
27
400
Keele Street
Teston
Patterson
Yongehurst
16th Avenue
Carrville Road
Carrville
Tormore Wetland Complex
Vaughan
Weston Road
Coleraine Drive
Mayfield Road
Nashville Road
Nashville
Kleinburg
Vellore
Sherwood
7
Pine Valley Drive
Major Mackenzie Drive West
Countryside Drive
Coleraine
Huntington Road
McGillivray Road
Rutherford Road
Markham
Thornhill
Clarkway Drive
Elder Mills
Royalpark Way
Clarence Street
Langstaff Road
Steeles Corners
The Gore Road
Willis Road
Chancellor Drive
Castlemore
Kipling Avenue
East Humber River
Edgeley
Fisherville
McLaughlin Drive
Salt Creek
Steeles Avenue West
Westminster Creek
Dufferin Creek
Brampton
Ebenezer
Castlemore Road
Goreway Drive
Ebenezer Road
Sunset Corners
407 ETR
Islington Avenue
Martin Grove Road
Fenmar Drive
Signet Drive
Norfinch Drive
Finch Avenue West
Airport Road
Toronto
427
Rowntree Mill Swamps
Emery
605000
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Legend

- Watercourse (TRCA)
- Transmission Line
- Railway
- Freeway
- Expressway / Highway
- Major Road
- Local Road
- Ramp
- Vaughan
- Municipal Division
- East Humber Provincially Significant Wetlands - DRAFT
- Provincially Significant Wetland (MNR)
- Locally Significant Wetland (MNR)
- Unevaluated Wetlands (MNR, TRCA)
- Waterbody

Basemapping from Ontario Ministry of Natural Resources

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Vaughan OP

Wetland Communities

April 2010
Project 70894

AECOM

Figure 13

raine Topography

Thompson Lake

Linton - Kelly Channels

Nobleton Wetland Complex

Black Duck Wetland Complex

Strange Till Plain

Kinghorn

Laskay Lakes

Nobleton Wetland COmplex

Eaton Hall-Mary-Hackett Lakes Wetland Complex

King-Vaughan Wetland Complex

Radio Tower Bog

Philips Pond-Thompson Wetland Complex

Thompson Lake Philips Lake

Philips Lake-Boge River Headwater Wetland Complex

Jefferson

Jefferson Forest

King

Cold Creek Wetland Complex

Cold Creek Headwaters

Concession Road 11

Concession Road 10

King Road

Nobleton

Humber Trail

King Creek

King Creek Marsh

King-Vaughan Road

Jane Street

Maple Spur

Bathurst Street

Gamble Road

19th Avenue

Cook's Area

Elgin Mills Road East

Mill Road

Pine Valley Drive

King-Vaughan Forest

McGill Area

Cold Creek

Kirby Road

Keele Wetland Complex

Maple Spur Channel

Teston Road

Richmond Hill

Maple Uplands & Kettles

400

27

Keele Street

Richmond Hill

Teston

Patterson

Albion Vaughan Road

Tormore Wetland Complex

Cold Creek Road

Kirby Road

Teston Road

Yongehurst

16th Avenue

Caledon

Vaughan

Carrville Road

Tormore

Carrville

Sprengel's Area

Richvale Forest

Coleraine Drive

Mayfield Road

Nashville

Kleinburg

McFayden Forest

Glassco

Weston Road

Nashville Road

Humber River

Sherwood

Vellore

Boyd Forest

Kortright Area

Graham's Woods

McLean's Forest

Baker'S Woods

7

50

Major Mackenzie Drive West

Graham's Forest Complex

Pine Valley Forest

Markham

Coleraine

Huntington Road

McGillivray Road

Boyd Conservation Area And Adjacent Lands

Thornhill

Countryside Drive

Clarkway Drive

Graham's Forest

Carex Peckii Area No. 1

Carex Peckii Area No. 2

Boyd's Rock Cress

Elder Mills

Pine Grove Forest

Elder Mill's Forest

Clarence Street

Steeles Corners

Clarence Street Forest

Smith's Beach Forest

The Gore Road

Edgeley

Castlemore

Langstaff Road

East Humber River

Kipling Avenue

Weston Road

Fisherville

McLaughlin Drive

Salt Creek

Steeles Avenue West

Westminster Creek

Castlemore Road

Brampton

Keele Street

Dufferin Creek

Ebenezer

Ebenezer Road

Sunset Corners

407 ETR

Toronto

Goreway Drive

Woodbridge Cut

Fenmar Drive

Signet Drive

Norfinch Drive

Finch Avenue West

Airport Road

427

Rowntree Mill Swamps

Emery

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Legend

- Watercourse (TRCA)
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- Provincially Significant Life Science ANSI
- Regionally Significant Life Science ANSI
- Provincially Significant Earth Science ANSI
- Regionally Significant Earth Science ANSI
- East Humber Provincially Significant Wetlands - DRAFT
- Provincially Significant Wetland
- Locally Significant Wetland
- Waterbody
- Cartographic Wetland

Basemapping from Ontario Ministry of Natural Resources

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Vaughan OP

Designated Areas

April 2010
Project 70894

AECOM

Figure 14

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the Phillips-Bond-Thompson Wetland Complex and the King-Vaughan Wetland complex (63 ha in total area) are all protected, because they lie on the Oak Ridges Moraine. This means that 41% of the wetlands in the City of Vaughan are protected in association with the Oak Ridges Moraine. In addition the King-Vaughan Wetland Complex and the Phillips-Bond-Thompson wetland complex are also considered a Provincially Significant Wetlands. The Philips-Bond-Thompson Wetland Complex is the only area that contains bogs. Bogs are nutrient poor, peat accumulating systems that have unique vegetation communities and are largely fed by precipitation. The majority of this wetland loss was historically attributed to agriculture, and the threat of additional wetland loss in the future is due to agriculture and changes in hydrology. Changes in the hydrology and water table are the result of the removal of forest cover, urban development and agriculture.

Several large unevaluated wetlands and wetland complexes are found scattered throughout the City. This includes a group of wetlands associated with the headwaters of the East Humber (north of Teston Road, between Weston Road and Highway 27), a wetland at Highway 27 and Rutherford Road, a large wetland at Jane and Rutherford Road, a wetland at Langstaff and Weston Road and several wetlands south of the 407 between Pine Valley Drive and Jane Street.

Table 12. Evaluated Wetlands in the City of Vaughan

Wetland Name	Significance	Year of Last Evaluation	Area (ha)	Wetland Description
Tormore Wetland Complex	Local	September 1993	5.96	▶ Complex composed of six individual wetlands; 100% swamp (NHIC Natural Areas Data Record).
Hope Wetland Complex	Local	June 1990	4.8	▶ Complex composed of four individual wetlands; 79.2% swamp; 20.8% marsh (NHIC Natural Areas Record).
Keele Wetland	Local	July 1995	1.03	▶ Complex of two individual wetlands; 52% marsh; 48% swamp (NHIC Natural Areas Record).
King-Vaughan Wetland complex	Provincial	June 1990	39.1	▶ Complex of 23 individual wetlands; 83.4% swamp and 16.6% marsh (NHIC Natural Areas Record).
Philips-Bond-Thompson Wetland Complex	Provincial	August 1990 Re-evaluated in 2000	61.0	▶ Complex of 50 wetlands 58% marsh, 34% swamp and 8% bog (NHIC Natural Areas Record)
East Humber Wetland Complex	Provincial (Draft)	n/a	n/a	▶ n/a

4.4.2 International Biological Program Sites (IBP)

Between 1964 and 1974, five biome studies were initiated worldwide, concerned with describing and monitoring productivity of biological resources, environmental change and human adaptability to environmental change (National Academy of Science 2008).

Table 13 lists and describes the three International Biological Program Sites within the City of Vaughan. All except Vellore Tract were later designated as Provincially Significant ANSIs.

Table 13. International Biological Program Sites in the City of Vaughan

IBP Site Name	Area (ha)	Site Description
Boyd Conservation Area	74.0	▶ This area contains a diversity of vegetation communities and habitats including upland and riparian deciduous and mixed forest, thicket communities, intermittent swamps and a stream. The area supports a mature American Beech-Sugar Maple-Eastern Hemlock community, and Black Maple specimens are abundant. Moderate to severe harvesting and grazing disturbances are evident throughout the site.
Vellore Tract	35.6	▶ Sugar Maple-American Beech forests of varying age classes dominate this area. Mixed upland forests and open fields are also present. The woodlot is owned and managed by the Faculty of Forestry of the University of Toronto, with varying degrees of harvesting intensity used to demonstrate the effects of silvicultural practices on forest communities.
Baker Woods	29.1	▶ The area contains an intermediate aged to mature Sugar Maple-American Beech-Basswood forest. It has been managed for maple syrup production over the last 50 years, and is therefore heavily dominated by Sugar Maple specimens.

4.4.3 Areas of Natural and Scientific Interest

An ANSI is defined by the OMNR as an area that contains natural features that are provincially or regionally significant (NHIC). Earth Science ANSIs contain important geological features, and Life Science ANSIs contain representative ecological features. ANSIs are considered to be the best representation of a natural area within each site district and can be considered as an ecological benchmark. Provincially designated ANSIs are protected from development under the PPS, however, regionally designated features are only considered protection from a city (Vaughan) and regional (York) perspective in planning applications.

There are a total of six ANSIs within the City of Vaughan, five of which are Life Science ANSIs and one is an Earth Science ANSI (Figure 14). Table 14 lists the ANSIs and rationale for the sites designation.

Table 14. Areas of Natural and Scientific Interest in the City of Vaughan

Site Name	Designation	Area (ha)	Significance	Reason for Significance
Baker's Woods	Life Science	31.0	Provincial	▶ Has been elevated from regional status because it has the best remaining upland mature Sugar Maple deciduous forests located on the till uplands of the Peel Plain in site district 7-4. This forest is known for its mature trees, in which 24% of the trees present have diameters between 51 to 100 cm, with trees of 90 to 240 years old (Hanna 1984).
Boyd Conservation Area and Adjacent Lands	Life Science	57.0	Provincial	▶ Supports 30 vegetation communities, three of which are rare: Water-parsnip marshes, a Tussock Sedge meadow marsh and a Speckled Alder organic thicket swamp. This area has been designated as significant because the mature bottomland terrace, valley slope and associated tableland forests containing large trees are the best representation of these features that currently remain on the Peel Plain. This ANSI is also known for its oxbow wetlands (Hanna 1984).
Kleinberg Woodlots	Life Science	50.0	Regional	▶ Composed of four young to mid-aged upland woodlands with two vegetation communities: Sugar Maple-ash-Eastern Hemlock-White Pine and ash-Red Maple-dogwood (Hanna 1984).
Maple Uplands and Kettle Wetlands	Life Science	250.0	Regional	▶ Site contains a mixture of upland forests, kettle wetlands, old fields and shrub thickets (NHIC Record).

Site Name	Designation	Area (ha)	Significance	Reason for Significance
Humber River	Life Science	50.0	Regional	▶ A flat-bottomed section of the Humber River. It is composed of a mixture of vegetation communities including wet meadow, goldenrod fields, upland sugar maple mixed forests and willow-poplar-ash-elm floodplain (Hanna 1984).
Maple Spur	Earth Science	n/a	Regional	▶ The Maple spur or ridge is made up of large quantities of sand and gravel that rise 30 to 60 m above the Halton Till plain to the south. The sands and gravels of this area have been informally designated as the "Maple Formation".

4.4.4 Environmentally Significant Areas

In Vaughan, an area that has ecological significance may be identified as an Environmentally Significant Area (ESA) and designated for protection by a municipality or Conservation Authority (TRCA). Often times, ESAs overlap with designated ANSIs.

A total of 24 Environmentally Significant Areas are found within the subject lands, accounting for approximately 1,150 ha (4%) of Vaughan's land base (Figure 14).

4.4.4.1 Toronto Region Conservation Authority Environmentally Significant Areas (ESA)

The TRCA (formerly known as MTRCA) undertook an ESA study (1982) in order to "identify areas of environmental significance and to suggest direction for their recognition and management". The long-term objective was to provide a more comprehensive and consistent approach to resource management within the region.

The designation of an area required the fulfillment of at least one of the following seven criteria:

Criteria 1: The area represents a distinctive and unusual landform or feature within the TRCA region, Ontario or Canada.

Criteria 2: The ecological function of the area contributes significantly to the healthy maintenance of a natural system beyond its boundaries in at least one of the three following ways:

a) area serves as a water storage or recharge area.
b) area maintains or provides linkages between 'significant natural biological systems'; and/or
c) area provides essential habitat to support a "significant species and/or significant population or concentration of species".

Criteria 3: The habitats or vegetation communities are evaluated as exceptional and/or of high quality within the TRCA region, Ontario or Canada. Habitats or communities were evaluated as exceptional based on the presence of a number of characteristics

including uncommon species associations, superior specimens, exceptional concentrations of species, maturity, diverse species composition, regeneration capabilities, and species associated with undisturbed/high quality habitats.

Criteria 4: The area contains either a rare or under-represented ecosystem within the TRCA region, Ontario or Canada; and/or a small remnant of a habitat type that has virtually disappeared from the TRCA region.

Criteria 5: The area has an unusually high diversity of biological communities and/or species.

Criteria 6: The area provides habitat for regionally rare indigenous species, or species that are at risk either provincially or nationally.

Criteria 7: The area is large enough in size to provide habitat for species requiring large blocks of suitable habitat, such as area sensitive species or species with large territories/home ranges.

(TRCA 1982)

ESA #	ESA Name	Criteria Met	Reason for Significance
15	**Woodbridge Cut**	1	▶ One of three sites that has the most complete record of Pleistocene geology in Canada. It also represents York Till, a Pre-Wisconsin deposit that is very rare in Ontario (TRCA 1982).
16	**Clarence Street Forest**	4,6	▶ This area provides habitat for Canada Waterleaf (*Hydrophyllum canadense*), a nationally and provincially rare plant species. It is a Sugar Maple-Black Maple forest, which is rare in the region (more common in the Carolinian zone; TRCA 1982).
17	**Elder Mills Forest**	3,5,6	▶ This area contains a diversity of vegetation communities including high quality stands of Eastern Hemlock, Sugar Maple, American Beech and White Pine. This area supports a high diversity of plant and bird species. Historical records of the endangered Acadian Flycatcher also exist for this forest (TRCA 1982).
18	**Smith's Beech Forest**	3	▶ This relatively undisturbed mature American Beech-Sugar Maple forest is considered to be of high quality within this landscape (TRCA 1982).
19	**Pine Grove Forest**	3,5	▶ The mature Eastern Hemlock-Sugar Maple forest is uncommon in the region. This area also contains an exceptionally high diversity of vegetation communities for an area of its size (TRCA 1982).
20	**Boyd's Rock Cress**	6	▶ This area provides habitat for the Provincially Threatened Redside Dace (*Clinostomus elongates*) and regionally rare plant Smooth Rock Cress (*Arabis laevigata*; TRCA 1982).
21	**Pine Valley Forest**	3,6	▶ This forest provides habitat for the provincially threatened Redside Dace. The extensive and relatively undisturbed forests have superior Eastern Hemlock and Black Cherry specimens, in addition to healthy regeneration by Eastern Hemlock, Sugar Maple and American Beech (TRCA 1982).
22	**Carex Peckii Area No. 1**	6	▶ This area provides habitat for a species that was considered regionally rare in 1982, the sedge Carex Peckii*. The sedge grows in a mature forest part of Boyd Conservation Area (TRCA 1982).
23	**Carex Peckii Area No. 2**	**6**	▶ This area provides habitat for the regionally uncommon Hairy-leaved Sedge (*Carex hirtifolia*; TRCA 1982).

ESA #	ESA Name	Criteria Met	Reason for Significance
24	**Graham's Forest**	4,5,**6**	▶ This area has a number of Carolinian Tree species such as Hop Hornbeam, Blue Beech, Black Cherry, Black Maple and Bitternut Hickory. This area supports a high diversity of plant species, particularly in the understorey, including a species that was considered regionally rare in 1982, False Melic Grass* (*Schizachne purpurascens*; TRCA 1982).
25	**Graham's Forest Complex**	3,5	▶ This area supports a high diversity of vegetation communities that results in a moderately high diversity of plant species. The mature, high quality forest units show excellent regeneration and are rare due to the dominance of Hop Hornbeam in the understorey layer. In addition, this unit contains an Eastern Hemlock/White Pine stand, which is an uncommon species association in the region (TRCA 1982).
26	**McLean's Forest**	3	▶ These mature forest communities have excellent Eastern Hemlock and Sugar Maple regeneration. The understorey is dominated by Hop Hornbeam, which is rare in the region, and a number of Carolinian tree species such as Blue Beech, Bitternut Hickory and Black Cherry are present (TRCA 1982).
27	**Graham's Woods**	3,6	▶ This area is primarily composed of a large mature deciduous forest with large Sugar Maple and Red Oak specimens. This forest supports a number of Carolinian species and the regionally rare Woodland Meadow Grass (*Poa alsodes*; TRCA 1982).
28	**Kortright Area**	2c,3,5,6	▶ This area provides an important migratory stopover function. The mature, relatively undisturbed Sugar Maple-Eastern Hemlock-American Beech-White Ash-Ironwood forests are high quality. The area supports a large diversity of vegetation communities, plant and animal species. The area provides habitat for the provincially threatened Redside Dace and regionally rare Common Polypody (*Polypodium vulgare*; TRCA 1982).
29	**Boyd Forest**	3,5	▶ This area supports a high diversity of plant and bird species. The mature Sugar Maple-American Beech forest exhibits healthy regeneration and is of high quality (TRCA 1982).
30	**McFayden Forest**	3, 5, 6	▶ The large mature forests of this site support a high diversity of overstorey species, resulting in a highly variable ground cover. The high quality, mature Sugar Maple-Eastern Hemlock forest supports three Carolinian tree species: White Oak, Black Cherry and Shagbark Hickory. McFayden Forest provides habitat for the regionally uncommon Hitchcock's Sedge (*Carex hitchcockiana*; TRCA 1982).
31	**Sprengel's Area**	3,6	▶ This area provides habitat for the regionally rare Sprengel's Sedge (*Carex sprengelii*) and the provincially threatened Redside Dace. It also supports a high diversity of plant species in all three strata (TRCA 1982).
32	**Glassco**	3, 5, 6	▶ This area provides habitat for the regionally rare Thinleaf Sedge (*Carex cephaloidea*). The mature deciduous and mixed forests support a diversity of plant and avian species (TRCA 1982).
56	**King-Vaughan Forest**	3,5,6	▶ This area provides habitat for the regionally rare Pickerel Frog (*Rana palustris*) and Eastern Ribbonsnake (*Thamnophis sauritus sepentrianalis*). The mature Eastern Hemlock-Sugar Maple forests exhibit signs of excellent regeneration and support a rich diversity of plant and avian species (TRCA 1982).
71	**Richvale Forest**	3,4	▶ The mature mixed Eastern Hemlock-Sugar Maple-American Beech stands exhibit healthy signs of regeneration. High abundance of Black Cherry in the overstorey is also an uncommon feature in this region (TRCA 1982).
72	**Cook's Area**	2a, 6	▶ This area provides habitat for the regionally rare Tower-mustard (*Arabis glabera*). It is also part of a larger, high quality source area (TRCA 1982).
73	**McGill Area**	2a, 3, 6	▶ This area functions as a high quality hydrological source for the Don River. The high quality Sugar Maple-American Beech communities have superior specimens and excellent regeneration. The forest provides habitat for a species that was considered to be regionally rare in 1982, Coarse Fescue* (*Festuca longifolia*; TRCA 1982).

ESA #	ESA Name	Criteria Met	Reason for Significance
na	**Maple Spur of the Oak Ridges Moraine**	na	▶ This ridge is composed of large quantities of sand and gravel that rise up to 60 m above the Halton Till plain (NHIC Record).
na	**North Woodbridge Ravine**	na	▶ Information for this feature is not available.

*Note: * According to Varga et al. (2000), these species have no status within York Region.*

4.4.4.2 TRCA Terrestrial Natural Heritage System Strategy

All of the above listed ESAs are encompassed within the TRCA's Terrestrial Natural Heritage System Strategy (TNHS 2007). The objective of the strategy is to identify and evaluate natural heritage features and functions within the landscape, for inclusion in a Natural Heritage System. The TNHS is composed of both Existing Natural Cover and Potential Natural Cover that can be restored to compliment existing units. A desktop exercise involving digital mapping was used to identify existing and potential cover within the TRCA jurisdiction. The quality, distribution and quantity of natural cover were evaluated according to scientifically rigorous Landscape Ecological Principles and combined to form a system that considered both feature and function, in existing natural communities and areas that could potentially be restored. Instead of considering natural cover on a patch by patch basis, the TRCA analyzed natural cover from a landscape perspective, which is the scale at which most ecological processes function. This holistic process allowed the identification of areas that should be restored to natural cover to enhance existing features. By securing the Potential Natural Cover areas within the Natural Heritage System, natural cover in the Toronto Region will increase from its current 17% to the goal of 30% cover, and likely improve the overall quality and functioning of cover within their jurisdiction (Figure 9).

4.4.5 Conservation Areas

A Conservation Authority Area is a property owned and managed by the local conservation authority. Some have limited access in order to protect sensitive habitat, however most are open to the public for recreational and educational purposes.

The Kortright Centre for Conservation is 26.5 ha in size, and is the only Conservation Area within the City of Vaughan (Figure 14). Humber River and Cold Creek run through the property that has a diverse assemblage of vegetation communities including mature mixed Eastern Hemlock-Sugar Maple-American Beech forest, Crack Willow-Balsam Poplar-White Spruce-American Elm scrub communities, swamps, wetlands and old-fields.

5. Conclusions – Overall Sensitivities

The following table provides a summary of the key terrestrial features and land designations identified for the analysis area.