STUDY AREA AND PHYSICAL SETTING

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2.0 STUDY AREA AND PHYSICAL SETTING

A description of the study area and physical setting is provided in this section in order to set the context for interpretation of the technical component key findings in this Technical Update. **Section 2.1** introduces the study area and municipal boundaries, followed by **Section 2.2** which discusses the delineation of a revised boundary for the study area, used for the purpose of this Technical Update. Details of current and planned land use are outlined in **Section 2.3,** with the potential effects of climate change addressed in **Section 2.4. Sections 2.5 - 2.6** illustrate the physiographic regions, surficial geology and geology.

2.1 STUDY AREA AND LOCATION

The Etobicoke and Mimico Creeks watersheds are generally referenced and managed together because of their proximity to each other and their many similarities. Thus the study area for this Technical Update includes the combined watersheds of Etobicoke and Mimico Creeks and lands between these watersheds draining directly to Lake Ontario (see **Figure 2-1**). These watersheds are located in the Greater Toronto Area, with headwaters in Peel Region in the Town of Caledon, City of Brampton, and City of Mississauga, and lower reaches passing through a small area of the City of Toronto. The Etobicoke Creek watershed is located at the most westerly boundary of the Toronto and Region Conservation Authority jurisdiction, which borders the Credit Valley Conservation jurisdiction. The Mimico Creek watershed is situated between the Etobicoke Creek watershed to the west and the Humber River watershed to the east.

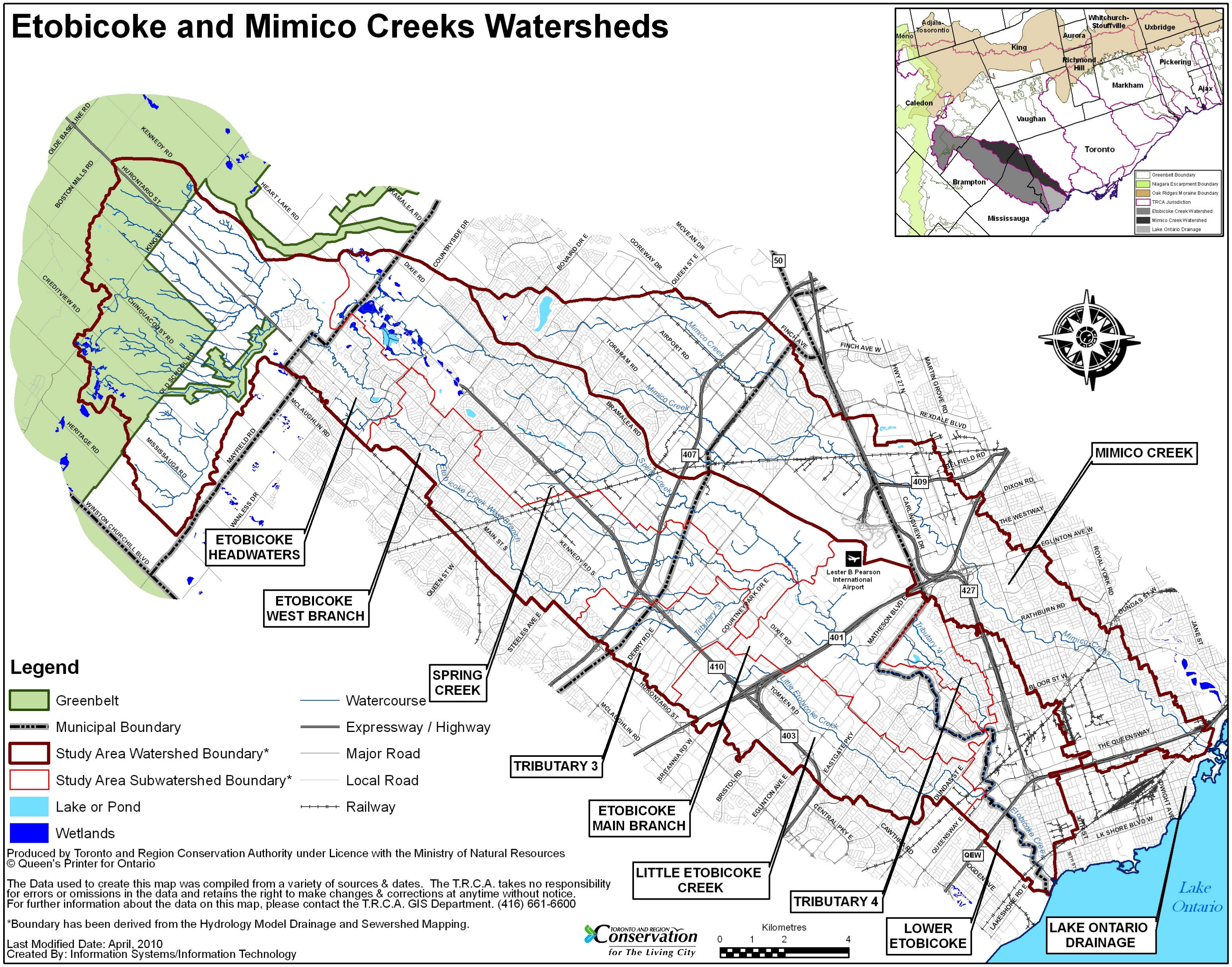
2.2 WATERSHED AND SUBWATERSHED BOUNDARIES

The combined area of the Etobicoke and Mimico Creeks watersheds is 28,873 hectares (ha). Etobicoke Creek drains 21,164 ha and consists of four main branches, namely: Main Etobicoke Creek, Little Etobicoke Creek, Etobicoke Creek West Branch and Spring Creek. Mimico Creek drains 7,709 ha and consists of a main channel fed by an upper west branch and upper east branch. Both Creeks begin on the South Slope of the Oak Ridges Moraine and drain into Lake Ontario.

The watershed and subwatershed boundaries established for this Technical Update have been refined from those reported in *Greening Our Watersheds: Revitalization Strategies for Etobicoke and Mimico Creeks* (TRCA, 2002). Extensive work went into refining the drainage area of these watersheds, as well as updating the watercourse layer, lake and wetland areas.

The watershed boundaries of the Etobicoke and Mimico Creeks watersheds were developed using several methods and tools. These watersheds can be characterized as having mainly two land uses which influence surface water drainage, urban and rural, making it necessary to use several methods to interpret drainage. In the rural areas, a high resolution DEM and GIS tool (ArcHydro) were used to estimate drainage network and delineate boundaries. This approach provides an adequate delineation in the natural, non-developed environment. In the urban areas, storm sewers, roads, and other municipal infrastructure influence the drainage of surface water and increase the complexity of the system, thus the ArcHydro approach is not appropriate.

Figure 2-1: Etobicoke and Mimico Creeks Watersheds and Subwatersheds Boundaries



To delineate the watershed and subwatershed boundaries in the urban areas, the available hydrology models, which look at surface flow under the influence of stormwater management and other municipal infrastructure, were used. The watershed boundary for Mimico Creek was derived from the model reported in the *Mimico Creek Hydrology*, James F. MacLaren Limited, 1978; and for Etobicoke Creek, the *Etobicoke Creek Hydrology* update report by Totten Sims Hubicki, 2007, was used. The catchments delineated in the hydrology models look at major and minor flow in the urban areas of the watershed. As is evident in the lower reaches of the Etobicoke and Mimico Creeks watersheds, the delineation of the resulting subwatersheds follow the storm sewer network. TRCA GIS staff used digital data from municipal partners to provide information on the storm sewer network, which allowed for verification of the hydrology model boundaries.

Discussions within this Technical Update reference specific watershed or subwatershed units within the study area. These units have conditions which are distinctive relative to other areas of the watershed. The Lake Ontario drainage area is an area between the two watersheds, which drains directly into Lake Ontario, and was characterized as an individual unit, as was Mimico Creek because of its homogeneous properties. In summary, the ten watershed/subwatershed units are as follows (see **Figure 2-1**):

Mimico Creek	Little Etobicoke Creek	Etobicoke West Branch
Lake Ontario Drainage	Etobicoke Main Branch	Etobicoke Headwaters
Lower Etobicoke	Tributary 3	
Tributary 4	Spring Creek	

2.3 LAND USE AND POPULATION

Land use in the Etobicoke and Mimico Creeks watersheds has been dramatically altered over the past 200 years and rapid changes have continued in recent decades. *Greening Our Watersheds* (TRCA, 2002) stated that the urban land use in Mimico Creek watershed had increased from 54% in 1978 to 77% in 1998. The watershed at that time was considered fully developed other than what could be accommodated through infill, brownfield or redevelopment opportunities. The report also stated that urban land use in the Etobicoke Creek watershed had increased from 21% in 1978 to 53% in 1998. Currently the majority of these watersheds in the Cities of Toronto, Mississauga and Brampton are urbanized, with the Town of Caledon supporting the only remaining rural lands. However, several urban growth plans are underway for a portion of these rural areas.

2.3.1 Current Land Use and Population

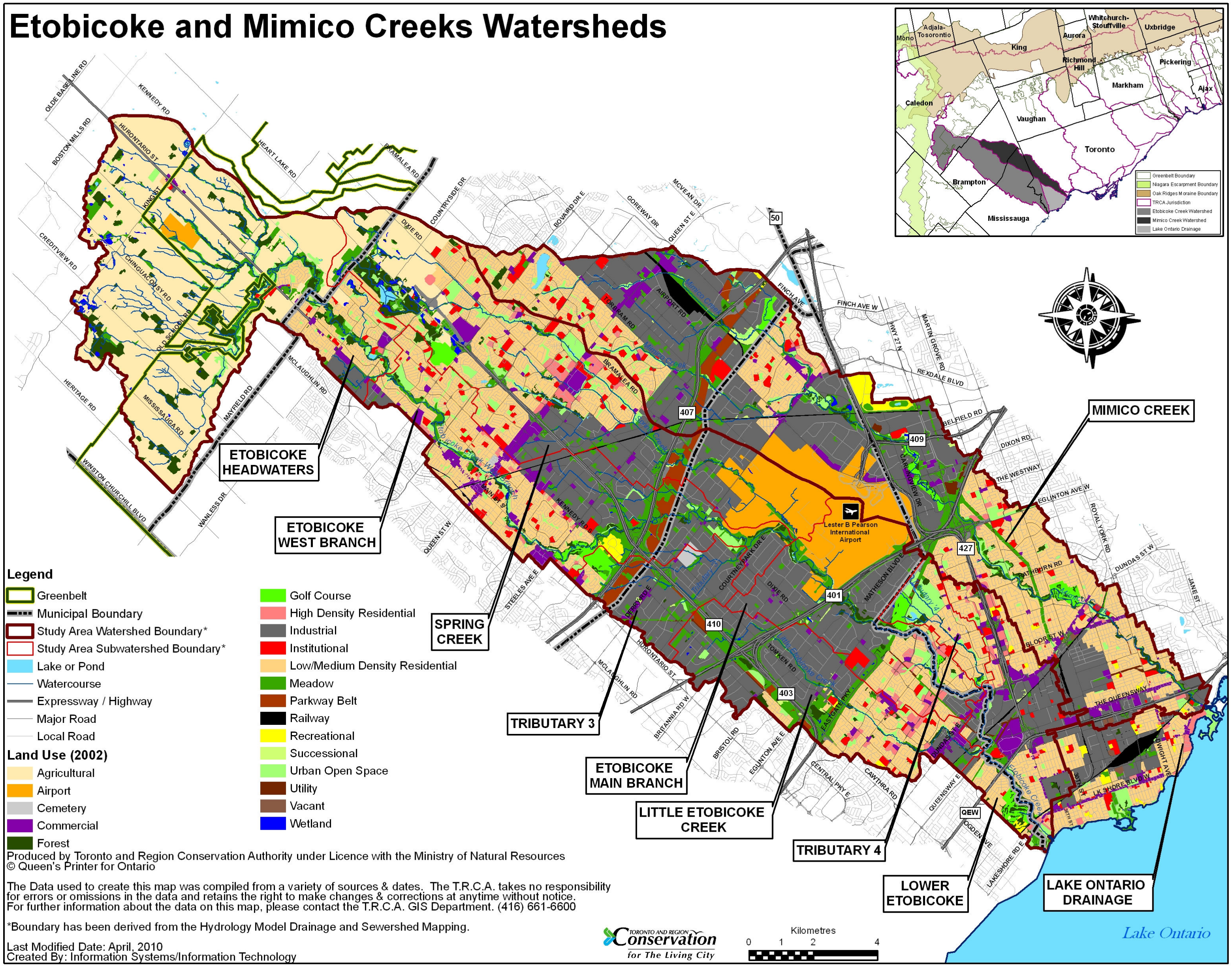
Figure 2-2 illustrates land use in these watersheds. Industrial lands are concentrated in a swath of land (approximately 12 km wide) in the central portion of both watersheds. Institutional land is scattered in smaller blocks throughout the two watersheds, and the headwater areas of Etobicoke Creek in Caledon which remain predominantly rural. Residential land is concentrated in the Cities of Toronto, Brampton and Mississauga.
Canada's largest transportation facility, the Lester B. Pearson International Airport, is located within the City of Mississauga, and while it is largely in the Etobicoke Creek watershed, a portion of its land drains to Mimico Creek.

The Etobicoke Creek watershed consists of three major land uses, including: 63% urban, 22% rural and 15% natural land cover. The majority of urban land use is industrial-commercial-institutional (ICI) and residential, occupying approximately 49% of the watershed. The Lester B. Pearson International airport covers 6% and highways make up approximately 2% of the watershed. Approximately 6% of the watershed is dedicated to other urban lands, such as urban open space and golf courses.

The Mimico Creek watershed supports two major land uses, including 88% urban and 12% natural land cover. The majority of the urban land uses are ICI, and residential areas, which comprise approximately 71% of the watershed. The area covered by the Airport is 6% and other transportation uses, including major highways (i.e. 401, 403, 407, 410, 427 and the Queen Elizabeth Way), make up approximately 5% of the Mimico Creek watershed. Other urban land uses, such as urban open space, recreational and golf course lands, occupy the remaining 6% of the urban lands.

Greening Our Watersheds (TRCA, 2002) reported an estimated population of 42,000 in 1941, and 400,000 in 1996 for the combined watersheds. Based on 2006 census data the population of Etobicoke Creek watershed is estimated at 294,234 and Mimico Creek watershed at 146,792. The combined total estimated watershed population of 441,026 represents a 10% increase in population over the past decade.

Figure 2-2: Land Use



2.3.2 Planned Development

Within the headwaters of the Etobicoke Creek watershed, several urban development plans are underway, namely: Mayfield West Phase 1, Mayfield West Phase 2 Secondary Plan, Snell's Hollow Secondary Plan and Springdale North Secondary Plan (see **Figure 2-3**).

The *Growth Plan for the Greater Golden Horseshoe* (MPIR, 2006) was introduced by the Province to guide the urban growth needed to accommodate a projected population increase of more than 3.7 million people by 2031. The *Growth Plan* designates downtown Brampton (Queen Street and Highway 10) as the only urban growth centre for intensification within the Etobicoke and Mimico Creeks watersheds.

In addition to the planned developments in the Etobicoke Creek watershed and the intensification of downtown Brampton, there are also a significant number of large public infrastructure projects planned to service new and existing developments, these include: public transit improvements (e.g. GO train/bus extensions, Metrolinx rapid transit expansions – such as along Hurontario Street), road extensions and widenings (e.g. Mayfield Road, Queen Street), water and wastewater projects, stormwater management infrastructure improvements, and parks renewal plans.

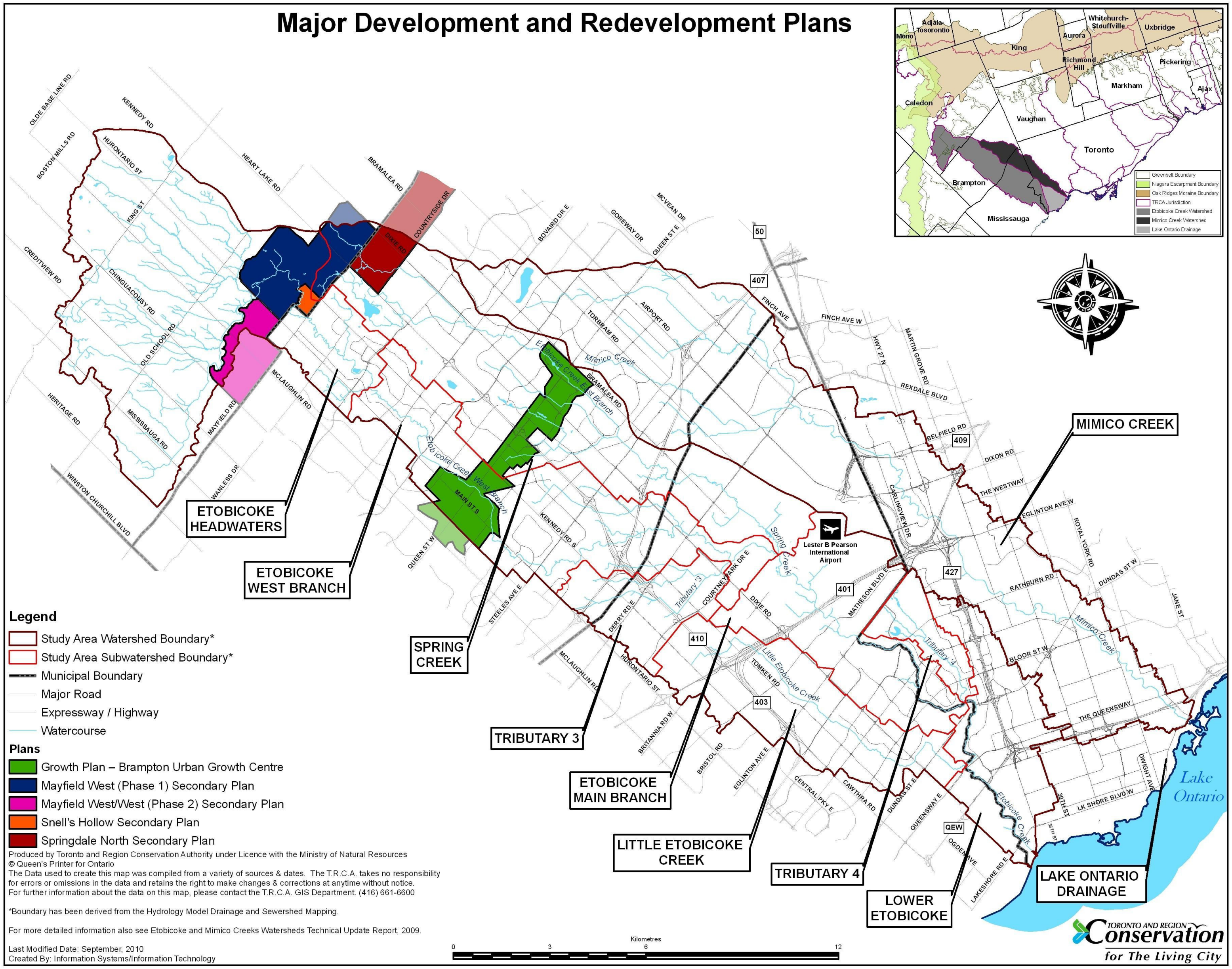
The Province's *Greenbelt Plan* (MMAH, 2005) identifies where urbanization should not occur in order to provide permanent protection to the agricultural land base and the ecological features and functions occurring on this landscape. A significant portion of the remaining agricultural lands in the Etobicoke Creek Headwaters subwatershed fall within the **Protected Countryside** designation of the *Greenbelt Plan* (**Figure 2.2**). Furthermore, the *Greenbelt Plan* identifies the Etobicoke Creek valley system, between the headwaters Greenbelt Area and the Lake Ontario shoreline, as an **External Connection** under the Plan's Natural Heritage System policies. See **Box 1**.

<u>Box 1: Greenbelt Plan</u>

Protected Countryside - Lands designated as Protected Countryside are made up of three specific types of lands: Agricultural System, Natural System and Settlement Areas. Section 3.0 of the Greenbelt Plan sets out policies for each of these three areas, as well as policies regarding parkland, open space and trails. Section 4.0 describes the general policies that apply across the Protected Countryside, based on certain uses including: non-agricultural uses, recreation and tourism uses, infrastructure, natural resource uses, cultural heritage resources, existing uses and lot creation.

External Connections – The river valleys that run through existing or approved urban areas and connect the Greenbelt to inland lakes and the Great Lakes are a key component of the long-term health of the Natural System of the Greenbelt. In recognition of this function, Section 3.2.5 of the *Greenbelt Plan* advocates for municipalities and conservation authorities to promote stewardship activities, land use planning approaches and watershed planning and management approaches to protect and enhance these systems within and beyond the Greenbelt.

Figure 2-3: Major Development and Redevelopment Plans



2.4 CLIMATE

Figure 2-4 and **Figure 2-5** present monthly temperature and precipitation patterns in the Etobicoke and Mimico Creeks watersheds. Measurements were taken by Environment Canada near the southern end of the watersheds (Toronto) and in the middle of the watersheds at Pearson Airport (Environment Canada, 2010). These figures illustrate that in the southern area, near the mouths of the creeks, the temperature is slightly warmer year round and there is more precipitation in the colder months than there is in the northern portion of the watersheds. This difference is likely due to the moderating effects of Lake Ontario and high urbanization in the lower portions of the watersheds. During the 1971-2000 period, average daily temperatures were 18-20° C in summer and -3.5 ° C in winter. Average precipitation was 800 mm/yr at Pearson Airport and 843 mm/yr at the downtown Toronto station, with about 85% of the precipitation occurring as rainfall and 15% as snowfall.

Figure 2-4: Climate Normals - Temperature

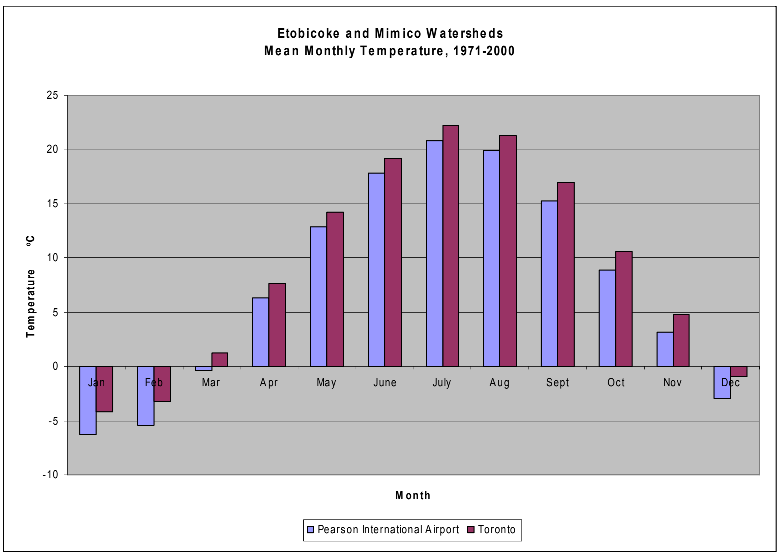
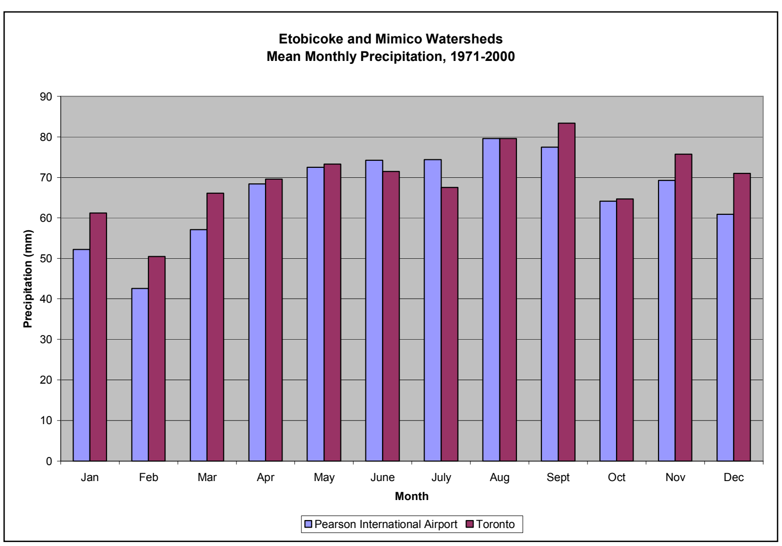


Figure 2-5: Climate Normals - Precipitation



While current climate plays a role in influencing watershed systems, it is also important to consider the potential effects of anticipated future climate conditions. Widely endorsed consequences of future climate change predictions for southern Ontario involve an increased frequency of extreme weather, intense rainfall and higher temperatures leading to increased evapotranspiration, all having potential impact on the hydrologic cycle (see **Box 2**). To further exacerbate the effects of climate change, urban landscapes such as those found in the Etobicoke and Mimico Creeks watersheds, contribute to increased energy absorption and surface runoff, in large part due to the abundance of paved (impervious) surfaces. Southern Ontario is beginning to experience an array of climatic change impacts ranging from increasing temperatures to erratic precipitation, drought, flooding and unpredictable weather.

Box 2: Southern Ontario Climate Change Predictions

Although there are still levels of uncertainty associated with the current state of science of climate modelling with both global and Regional climate models, the model predictions still provide valuable information to guide climate change adaptation and mitigation efforts.

Under the Coupled General Circulation Model 2 (second generation), A2 scenario (CGCM2 A2), southern Ontario is expected to experience an increase in annual temperature in the order of two to six degrees Celsius, with summer temperatures rising by two to five degrees Celsius and winter temperatures increasing by three to six degrees Celsius (MNR, 2007a)—during the summer of 2005, Toronto had 41 days where the average temperature was over 30 degrees Celsius, almost a three-fold increase from the average during 1961–1990 (EC, 2005b). In addition, winter cold extremes that now occur on average every 10 years are expected to occur less than once every 80 years (EC, 2004).

Projections of warmer temperatures are consistent with observed trends in the region where the frost-free period has lengthened and total annual snowfall has decreased. Snow cover, depth and duration have also been reduced, and lake ice coverage has declined, with later dates of freezing and earlier ice-off dates. As temperatures rise in southern Ontario, annual precipitation is expected to become more variable. For most of southern Ontario, under the Coupled General Circulation Model 1 (first generation) (CGCM1), the greatest seasonal changes for precipitation are expected in the winter, where increases are expected on the order of 10 - 30 % by 2100 (EC, 2004); summer precipitation is expected to increase or decrease by up to 10 % further supporting future variability, summer 2007 saw Toronto experience the lowest rainfall total since record keeping began in 1959 (EC, 2007).

Warmer winter temperatures translate into more precipitation falling as rain, instead of as snow. While a significant overall increase in precipitation totals is not anticipated, an increase in occurrence and intensity of extreme rainfall events is expected. The warmer temperatures are expected to increase evaporation which will likely result in a general lowering of water levels in the Great Lakes (NRCan, 2008). This will lead to warmer water temperatures, and will affect the timing of seasonal mixing and overall water quality.

Excerpt from TRCA, 2009

Turning over a new leaf: The Etobicoke and Mimico Creeks Watersheds Report Card 2006 (TRCA, 2006), highlighted the potential impacts of climate change on the Etobicoke and Mimico Creeks watersheds:

- *The number of heat-related deaths could rise because of higher summer temperatures.*
- *Changes in temperature and precipitation may help the survival of insect-(vector) borne diseases, causing increases or invasions into Canada of diseases.*
- *An increase in mid-winter melts could lead to more flooding and more freeze/thaw erosion of stream banks.*
- *More frequent and longer dry periods could lead to water supply problems, lower base flows in the rivers and streams, and adverse impacts on aquatic life.*
- *Increased intensity of storms could lead to flash flooding and sewer surcharging.*
- *Increased evaporation rates could lead to lower lake and pond levels, impacts on intake pipes and effluent discharge.*
- *Increased water temperatures might present problems for fish and other aquatic species, and transform the existing cold-water fishery into either a cool- or warm-water fishery.*
- *Generally, there may be poorer water quality over time.*

In recognition of what can be done on a local scale in Peel Region to mitigate and adapt to changes in our climate, the City of Brampton, Town of Caledon, Credit Valley Conservation (CVC), City of Mississauga, Toronto and Region Conservation Authority (TRCA) and the Region of Peel joined together in 2010 to develop a Climate Change Strategy for the geographic region of Peel. The City of Toronto established its agenda for climate change in 2007, as outlined in *Change is in the Air: Toronto's Climate Change, Clean Air and Sustainable Energy Action Plan* and the follow-up 2008 report *Ahead of the Storm: Preparing Toronto for Climate Change*. Further discussion of predicted climate change impacts on watershed systems is provided in each section of this Technical Update along with recommended actions.

2.5 PHYSIOGRAPHIC REGIONS

Physiographic regions are areas defined by similar topography, soil permeability and geology and along with climate these regions influence the functioning of the hydrologic cycle. **Figure 2-6** shows the major physiographic regions in the Etobicoke and Mimico Creeks watersheds, including the South Slope, Peel Plain and Lake Iroquois Sand Plain (with a small portion of South Slope before Lake Ontario).

The **South Slope** begins south of the Oak Ridges Moraine, and is characterized by a smooth, faintly drumlinized, clay till plain that slopes gently towards Lake Ontario. It also has deeply incised stream valleys. South of the South Slope is the **Peel Plain,** a flatter area covered with a thin layer of silt and clay. The **Lake Iroquois Sand Plain** is the final physiographic area and comprises sand, silt and clay deposits, with the finer materials being closer to the current Lake Ontario shoreline. Much of the north-western part of the Etobicoke Creek watershed follows the flank of the Niagara Escarpment.

2.6 SURFICIAL GEOLOGY AND GEOLOGY

Figure 2-7 illustrates the surficial geology of the study area, which is dominated by low permeability silt, clay and silt till of the Halton Till Formation. There are sands associated with the former Lake Iroquois shoreline, as well as some isolated recent fluvial sand deposits along the river valleys in the lowest reaches of both watersheds near Bloor Street.

The geology of both watersheds generally consists of sediment infilling of a fluvial valley system (known as the Laurentian Channel) in the older bedrock surface. This bedrock valley system drained the upper Great Lakes basin to what is now the St. Lawrence River. The thickness of the sediments ranges from zero (bedrock outcrop) to about 270 m within the Laurentian Channel. The stratigraphic framework for these sediments has been studied in detail over the last 12 years by researchers at the Geologic Survey of Canada (GSC) (Sharp *et al*., 1999) and others (i.e., Eyles, 2002; Karrow, 1991) and is illustrated in **Figure 2-8.** The sediments of the stratigraphic framework are described from the bedrock surface to ground surface in the sections below.

A significant surficial geologic feature of the Etobicoke Creek watershed is the Brampton Esker. The esker was an 8 km long, sinuous, sand and gravel ridge that stretches from Heart Lake southeastward to south of Queen Street in the Etobicoke Creek watershed. Formed by deposits in a meltwater channel that originated from ponded water between the Lake Ontario and Simcoe/Georgian Bay ice lobes; the core consists of coarser grained sands and gravels which probably formed within the meltwater channel. A finer layer of sand and some silt was then deposited over the core as the glacial ice melted. As the Lake Ontario ice lobe re-advanced, a till cap was deposited over the esker, reducing the steepness of the side slopes and the overall height of the esker. Aggregate extraction occurred in a large portion of this feature circa 1950-1990. A hydrogeological study was completed at that time and provided options for post-extraction land use (Morrison Beatty Limited *et al*., 1983). The only significant parts of the esker that remain are preserved in White Spruce Park and the Heart Lake Conservation Area. The extent of the Brampton Esker is shown in **Figure 2-9.** The significance of this feature will be discussed in further detail in the **Groundwater Quantity and Quality Section**. Section 2.4.1 – 2.4.7 describe characteristics of individual geological units. As will be further discussed throughout the report, these units influence groundwater and surface flow conditions.

2.6.1 Scarborough Formation

The Scarborough Formation is the oldest sediment unit found consistently across the study area. These deposits are interpreted as a fluvial-deltaic system fed by large, braided, melt-water rivers draining from an ice sheet (Karrow, 1967; Eyles, 1997). The delta, extending over an area of about 200 km^2 was deposited by a large river flowing from Georgian Bay along the Laurentian River channel to ancestral "Lake Ontario". Lake water levels must have been up to at least 45 to 60 m higher than present, possibly resulting from glacial ice blocking flow into the St. Lawrence valley.

Figure 2-10 illustrates the interpreted thickness of the Scarborough Formation. Although present across much of the study area, the unit is thickest on the west flank of the Laurentian Channel, stretching from Mayfield Road and McLaughlin Road, eastward to Carlingview Drive and Highway 409. The Scarborough Formation is absent in the western portion of the study area where younger sediments lie directly on top of bedrock.

Figure 2-6: Physiographic Regions

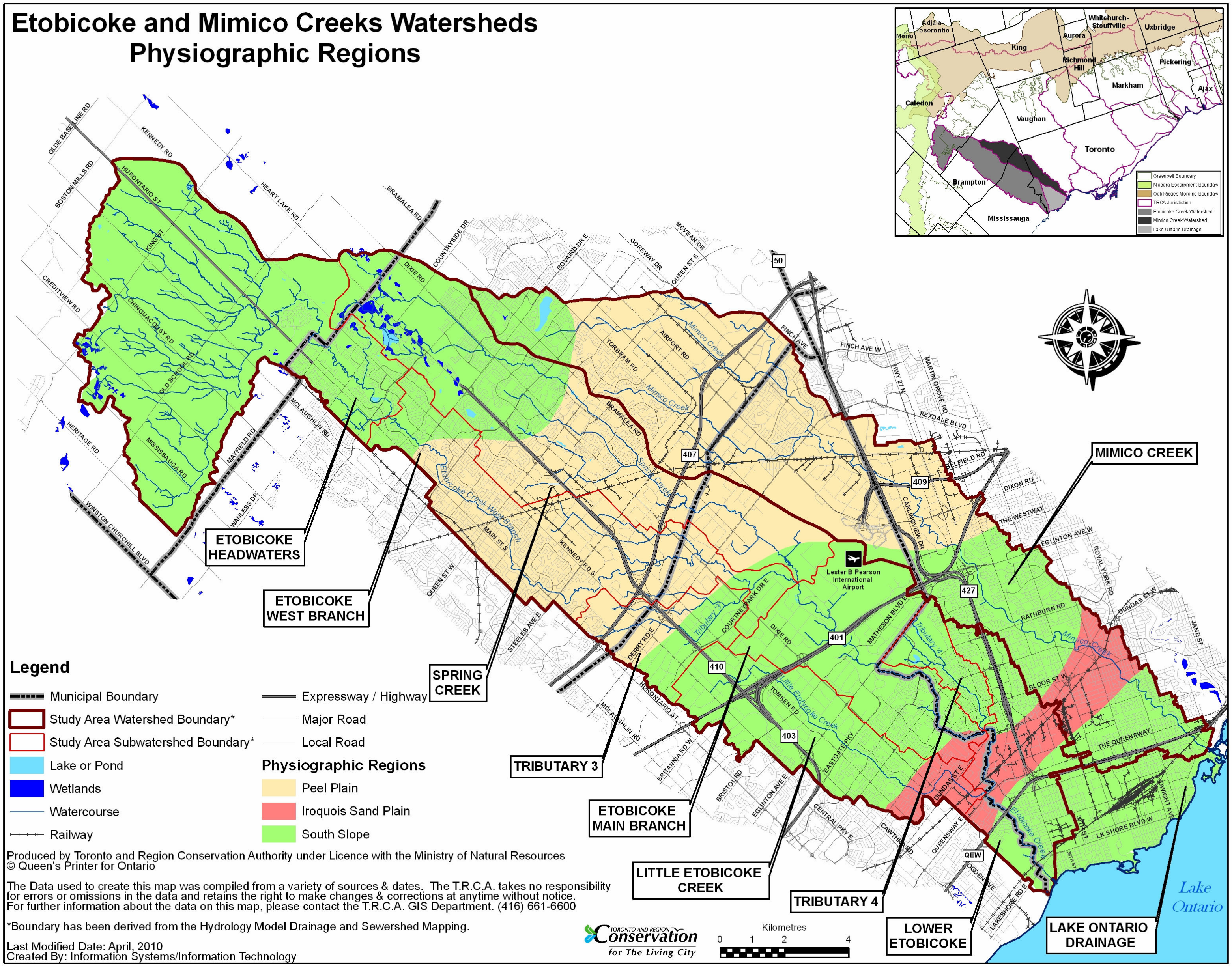


Figure 2-7: Surficial Geology

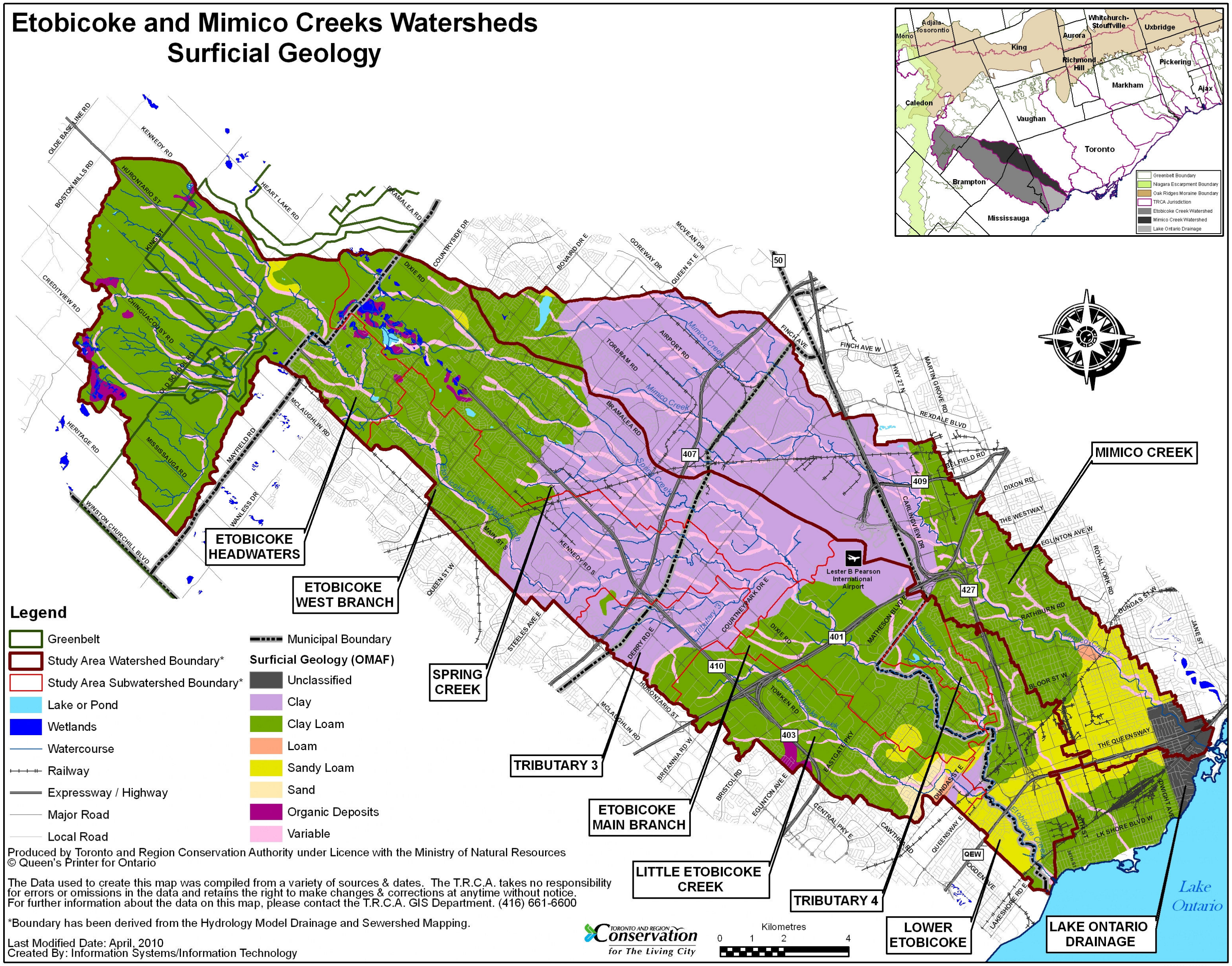
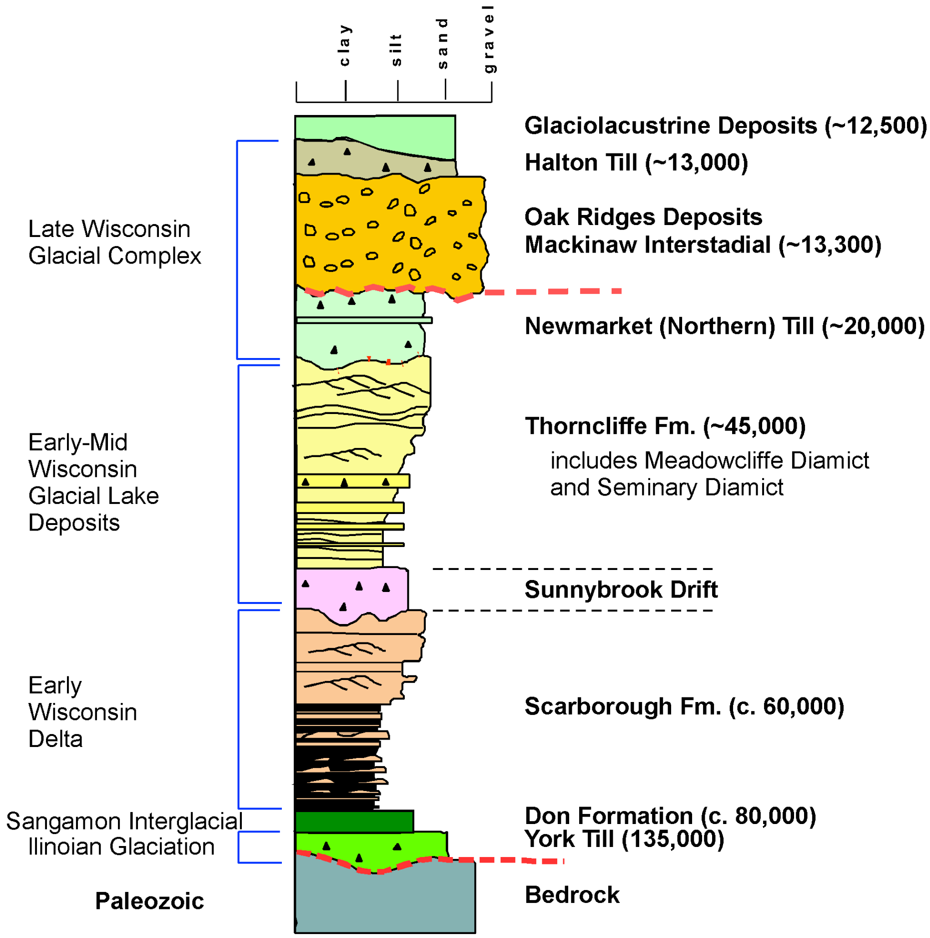


Figure 2-8: Stratigraphic Schematic [1]



[1] Eyles (2002)

Figure 2-9: Extent of Brampton Esker

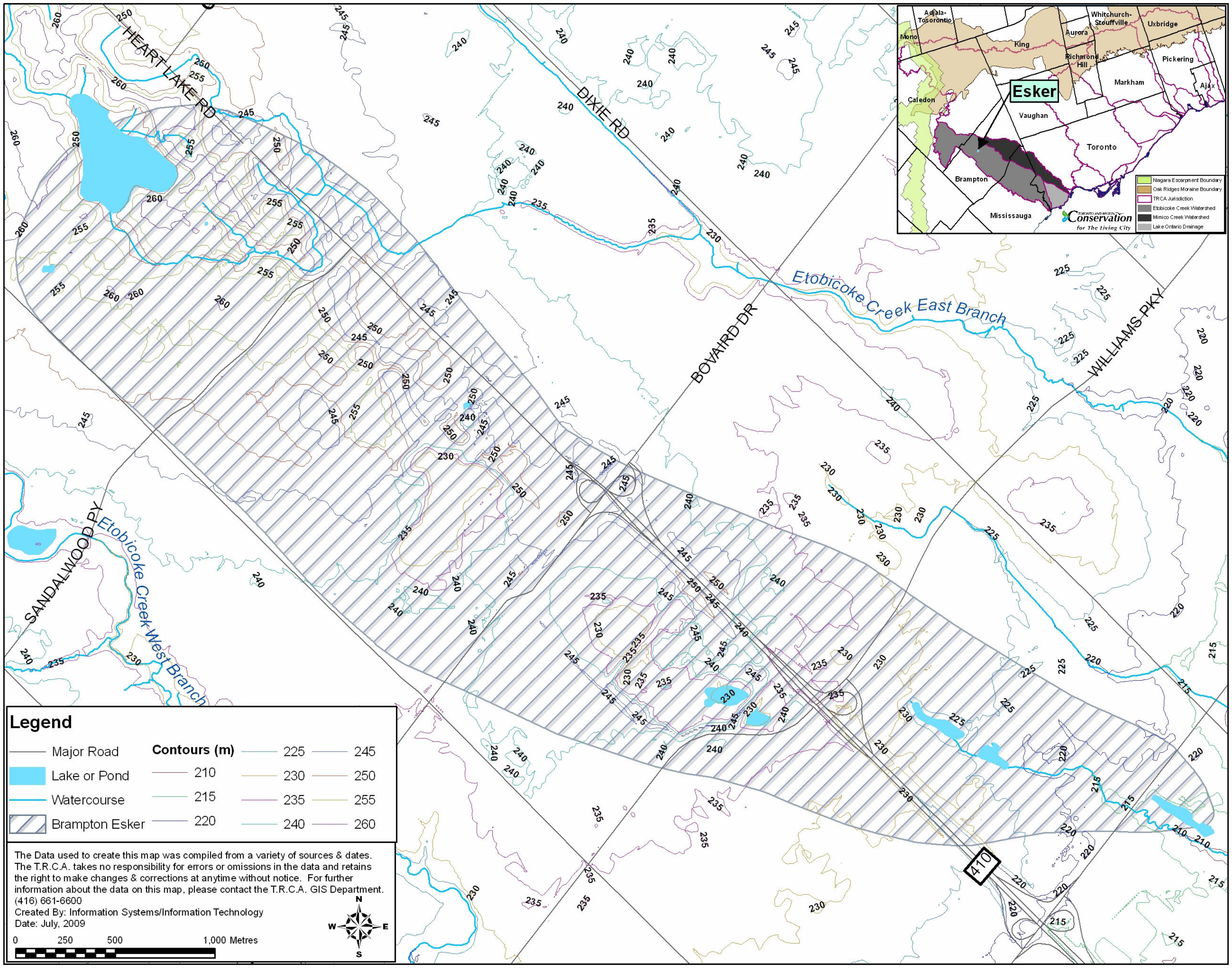
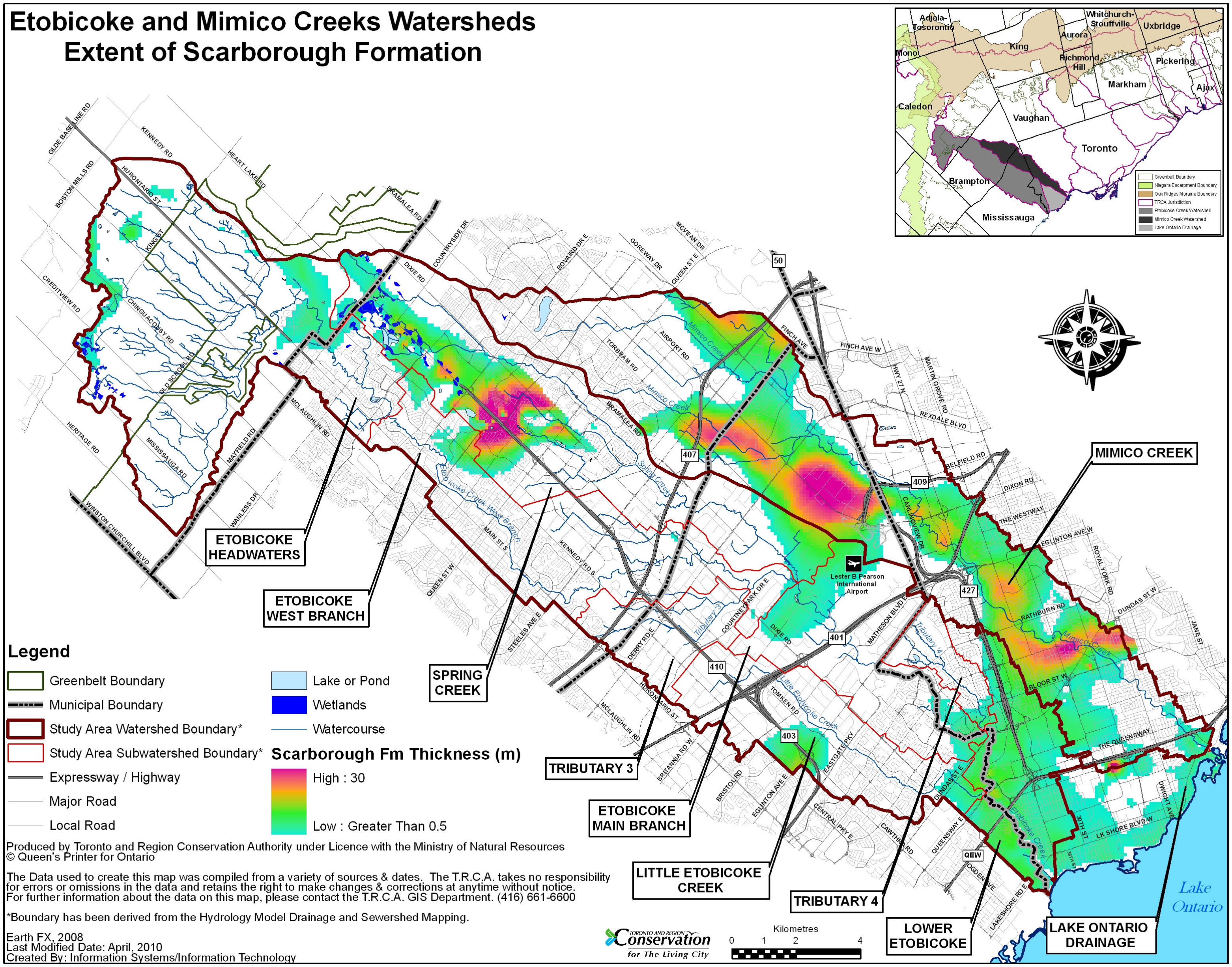


Figure 2-10: Extent of Scarborough Formation



2.6.2 Sunnybrook Diamict

The Sunnybrook diamict (poorly sorted sediment with a wide range of grain sizes) is a massive dark grey clayey silt with scattered rounded stones that separates the Scarborough Formation from the overlying Thorncliffe Formation. This unit is interpreted to be the result of sediment accumulation in a deep, ancestral Lake Ontario, with stones rafted in from the adjacent glacial ice. This unit is only present in Mimico Creek watershed, beneath the headwaters and the outlet and does not occur at surface.

2.6.3 Thorncliffe Formation

The Thorncliffe Formation deposits represent glaciofluvial deposition of sand and silty sand within pre-existing valleys. Further to the south, the deposits comprise predominantly glaciolacustrine silt, sand and pebbly silt and clay deposited by glacial meltwaters entering a deep, ice-dammed ancestral "Lake Ontario". The basal part of this unit is often marked by alternating thin layers of silt and clay.

Figure 2-11 illustrates the thickness of the Thorncliffe Formation, where it is present. This formation is absent over most of the study area, with the exception of an area around the west branch of Etobicoke Creek south of Mayfield Road, and the lower part of the Mimico Creek watershed, within the Laurentian Channel, where it reaches a thickness of about 10 m.

2.6.4 Newmarket Till

The Newmarket Till consists of a massive, stony (3-10 %) and consistently dense silty sand diamicton up to 60 m in thickness, but more commonly ranges between 20-30 m. Within the till, interconnected sand and silt lenses are commonly found. Fractures and joints are also observed that provide the bulk of the permeability within the till. This formation exceeds 60 m in thickness to the west, but is absent from much of the study area.

2.6.5 Oak Ridges Moraine and Mackinaw Interstadial Deposits

Although the Oak Ridges Moraine (ORM) landform lies to the north of the study area, some ORM sediments are present in the Etobicoke Creek headwaters north of Mayfield Road, as shown in **Figure 2-12**. South of this area, discontinuous sands and gravels are found in the same stratigraphic position as the Oak Ridges Moraine sediments would be. These thin layers of sands are known as the Mackinaw Interstadial Deposits and are believed to be sands and gravels deposited in outwash channels and lakes around the same time that the Oak Ridges Moraine was formed.

Generally, these deposits are less than 30 m thick and especially thin south of Mayfield Road. The exception to this rule is the Brampton Esker. The thick (>40 m) sand deposits in this area represent outwash deposits from the ice lobes that helped create the Oak Ridges Moraine.

2.6.6 Halton Till

The latest glacial ice advance over the southern part of the study area came from the Lake Ontario Basin about 13,000 years ago and deposited a layer of Halton Till. This unit comprises sandy silt to clayey silt till interbedded with silt, clay, sand and gravel (Russell *et al*., 2002). In some areas it is very clay-rich where the Halton ice lobe passed over silt and clay. This formation typically ranges in thickness from 3 to 6 m but locally exceeds 15 to 30 m east of Brampton.

2.6.7 Recent Deposits

The uppermost geologic unit consists of a sequence of glaciolacustrine deposits that form a thin layer above the underlying Halton Till, in places overlying the Newmarket Till. These deposits vary from near shore sand and gravel beach deposits of the Lake Iroquois shoreline located within the southern part of these watersheds, to the fine sands, silts and clays of glaciolacustrine pondings that occur north of the Lake Iroquois shoreline. These sediments generally form a thin veneer over the underlying deposits, although locally they can be several meters thick.

Figure 2-11: Extent of Thorncliffe Formation

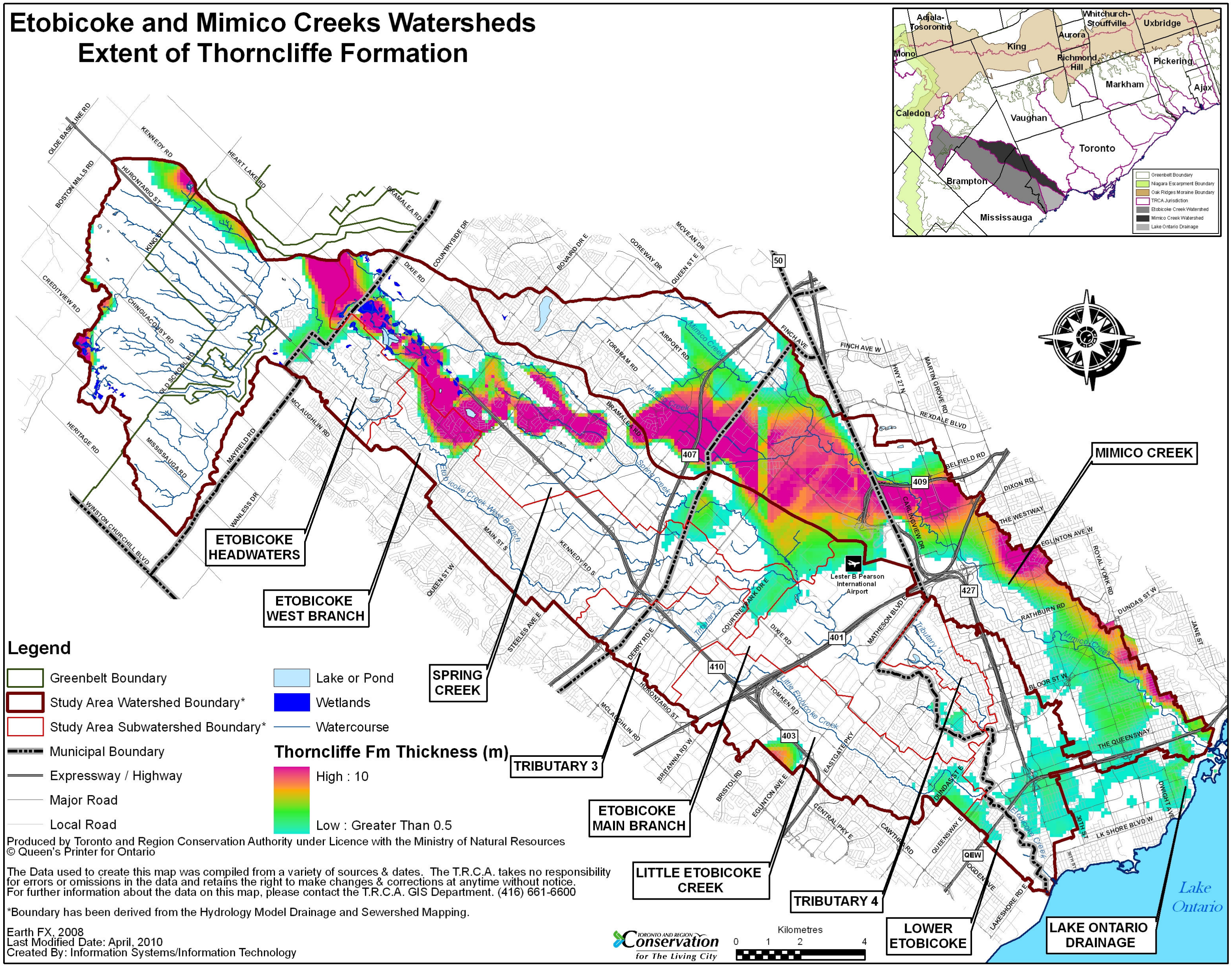
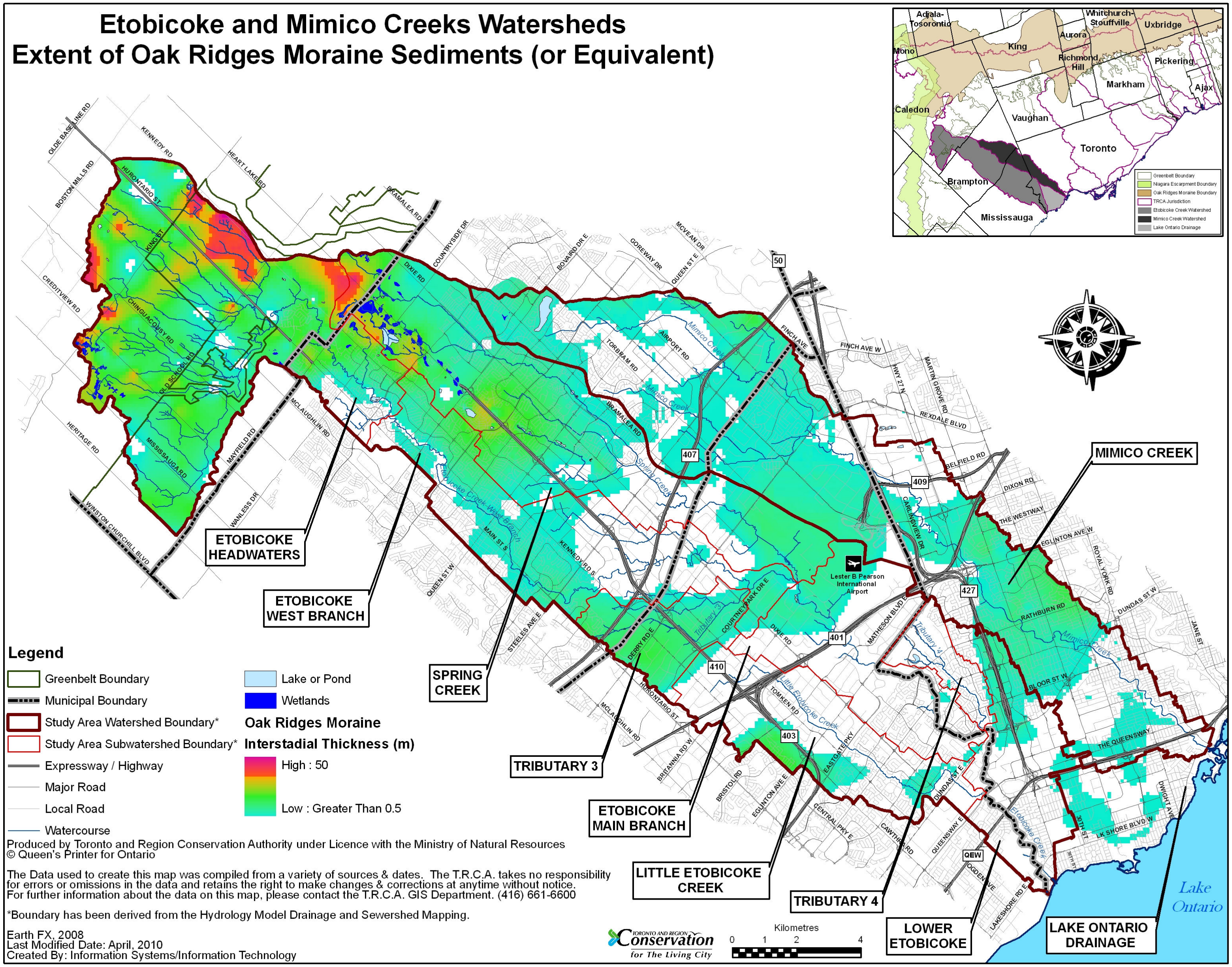


Figure 2-12: Extent of Oak Ridges Moraine Sediments (or Equivalent)



2.7 REFERENCES

Agriculture and Agri-Food Canada. 1998. Canada Land Inventory, National Soil Database.

Cunderlik, Juraj M. 2005. Hydrological extremes in a southwestern Ontario river basin under future climate conditions. *Hydrological Sciences Journal* 50 (4): 631-654.

Eyles, 1997. Environmental geology of a supercity: the Greater Toronto Area. In Eyles, N. (Ed), *Environmental Geology of Urban Areas*, Geological Association of Canada, Geotext #3, 7-80.

Eyles, N. 2002. *Ontario Rocks: Three Billion Years of Environmental Change*. Fitzhenry and Whiteside, Markham, Ontario.

Karrow, P.F. 1967. *Pleistocene geology of the Scarborough area.* Ontario Department of Mines, Geological Report 46.

Karrow, P.F. 1991. *Quaternary Geology of the Brampton Area*. Ontario Geological Survey, Open File Report 5819, 136 p.

Kharin V.V. and F.W. Zwiers 2005. Estimating extremes in transient climate change simulations. *Journal of Climate*. Vol. 18, pp. 1156-1173.

MacLaren, James F. 1978. Mimico Creek Hydrology

Ministry of Municipal Affairs and Housing (MMAH). 2005 *Greenbelt Plan*. Queen's Printer for Ontario. Toronto, Ontario.

Ministry of Public Infrastructure Renewal (MPIR). 2006. *Growth Plan for the Greater Golden Horseshoe*. Queen's Printer for Ontario. Toronto, Ontario.

Morrison Beatty Limited, W.E. Coates & Associates Limited, Knox Martin Kretch Limited. 1983. File No. SP 4.1. *Brampton Esker Hydrology Study Report and Technical Data Catalogue.* Prepared for the City of Brampton.

Russell, H.A.J., R.W.C. Arnott and D.R.Sharpe. 2002. Evidence for rapid sedimentation in a tunnel channel, Oak Ridges Moraine, Southern Ontario, Canada. *Sedimentary Geology*. Vol. 3134, pp. 1-23.

Toronto and Region Conservation Authority (TRCA). 2002. *Greening Our Watersheds: Revitalization Strategies for Etobicoke and Mimico Creeks*

Toronto and Region Conservation Authority (TRCA). 2006. *Turning over a new leaf: The Etobicoke and Mimico Creeks Watersheds Report Card 2006*

Toronto and Region Conservation Authority (TRCA). 2009. *Meeting the Challenge of Climate Change. TRCA Action Plan for the Living City.*

Toronto and Region Conservation Authority (TRCA). 2009. *Preparing for the Impacts of Climate Change on Stormwater and Floodplain Management: A Review of Adaptation Plans and Practices*. Prepared for Region of Peel.

Totten Sims Hubicki. 2007. Etobicoke Creek Hydrology.

Walter Kehm and Associates, PGM Design Associates. 2003. Mayfield West Community: A Summary Report of the Planning and Design Workshops, June 18 and June 25, 2003, Town of Caledon.