

Environmental Monitoring and Reporting PROGRAM HIGHLIGHTS

Environmental Monitoring and Data Management Section
Restoration and Infrastructure Division

2015



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Introduction



2015 proved to be a year of tremendous growth for the Environmental Monitoring and Data Management team at Toronto and Region Conservation (TRCA). We collected more than **11 million** data records from **3653** monitoring sites using **401** instruments. Of the data records collected, **176,637** were observations or characterizations of a plant, animal, bird, fish or insect! Thanks to **83** unique partnerships, the data collected was compiled into **50** reports and were made available to others through more than **200** data sharing opportunities.

Our team also expanded in leaps and bounds when we merged with staff from within the organization involved in lake-based environmental monitoring activities. There are approximately 40 different environment monitoring projects happening along the northwest shore of Lake Ontario and this report highlights a few important ones. For example, TRCA has been collecting data on fish communities in Toronto Harbour since 1989 as a means of evaluating the effectiveness of *Remedial Action Plan* measures for the Toronto and Region Area of Concern. Unique to 2015 was the discovery of a notorious invasive species, the **Asian Grass Carp**, found in multiple numbers weeks apart during routine fisheries surveys. To be on the lookout for this invasive species, our team will be launching an Asian Grass Carp surveillance program in 2016 in partnership with Fisheries and Oceans Canada.

In 2015, our team assumed the role of coordinating monitoring and research projects for **Aquatic Habitat Toronto** (AHT), a group of agencies that have a vested interest in the improvement of aquatic habitat on the Toronto Waterfront. For example, AHT is working with Carleton University on a multi-year **fish-tagging study** in the Toronto Harbour. Thanks to support from our team, plus new funding provided by Environment Canada's Great Lake Sustainability Fund, Carleton researchers were able to outfit 31 new fish with acoustic telemetry transmitters this past fall.

These waterfront monitoring programs are featured in this report, along with many of the other monitoring activities taking place in the streams, rivers, forests, wetlands and meadows within our regional watersheds. For example, this report highlights the critical baseline monitoring data being collected in support of the *Carruthers Creek Watershed Plan* and the Natural Heritage System at Seaton



Introduction

development lands. Additionally, the report showcases some of the remarkable species discoveries of 2015, two new baseline road ecology studies, as well as a new partnership with Parks Canada to manage meadow habitat at Bob Hunter Memorial Park within the Rouge River watershed.

Communication activities also ramped up in 2015 with the creation of a Twitter account. Its intent is to promote the value of the work we do and to share key messages about data findings. We are proud to say that in less than a year our Twitter account has a community of more than 850 followers, comprised of peers, conservation partners and interested members of the general public. Promoting our work through social media has also helped our team, as well as the TRCA community, keep abreast of monitoring news as it happens. Once our Twitter account was up and running, our team turned our attention to the development of a new blog designed to provide more details on what the data are telling us. We also directed these blog articles specifically to our peers and partners through our new *Monitoring Matters! E-newsletter*, which launched this past fall. A few of these blogs were also published in the 2015 summer and fall editions of *Ontario Nature* magazine. Fresh photo and video content to support these new communication activities were captured by an intern we hosted from Fleming College's *Environmental Visual Communications* program for a six-week period this past summer. Through this new partnership, our team has learned that great visuals are worth more than a thousand words!

We are pleased to present the 2015 Progress Report for TRCA's *Environmental Monitoring and Data Management* section, which highlights our key monitoring themes within regional rivers and streams, forests, meadows, wetlands and Lake Ontario Waterfront, as well as shines a spotlight on some of our monitoring projects and central partnerships. We hope through reading it, you gain an appreciation for how environmental monitoring provides the necessary foundation for supporting sound management, policy and planning decisions concerning the natural heritage in the region.



Rivers and Streams

TRCA monitors a number of aquatic indicators in order to assess the ecological condition of rivers, streams and wetlands in regional watersheds, including:

BENTHOS

Benthos (i.e. aquatic bugs) are useful as water quality indicators because they live on or within the bottom of waterbodies (one to three years) and are sensitive to disturbances in the environment. They can include worms, snails, mussels, leeches, crayfish as well as the immature life stages of insects. Their sensitivity to aquatic pollution and ease of sampling make them ideal organisms for monitoring. Data on benthos are collected annually from May to August at 150 regional monitoring stations. A report analyzing benthos data from 2002 to 2012 is underway.



Members of TRCA's aquatic monitoring team are provincial leaders in identifying benthos to the Lowest Practical Level, with staff certified in genus level identification by the Society for Freshwater Science. Each year TRCA offers **professional training** in Ontario Benthos Biomonitoring Network standardized sampling protocols.

FISH COMMUNITIES AND HABITAT



Fish are excellent indicators of stream health because they are easy to collect and identify in the field, are sensitive to changes in their environment, differ in their tolerance to amount and types of pollution and are sensitive to forms of pollution that chemical tests may miss. To help predict what types of fish are likely to be found, in-stream habitat characteristics (e.g. stream widths) and bank assessments are completed together with the fish community surveys.

Each of TRCA's nine watersheds is surveyed for fish communities and habitat features every three years. 2015 marked the fifth year that fish and habitat monitoring activities were focused on the Duffins, Carruthers, and Rouge River watersheds. In 2016 the focus will shift to the Etobicoke Creek and Humber River watersheds. A report analyzing 15 years of fish communities and habitat data is underway.



Rivers and Streams

SURFACE WATER QUALITY

Since 2002, TRCA has partnered with the Ontario Ministry of the Environment and Climate Change (OMOECC) to monitor surface water quality across regional watersheds. The samples are analyzed for a standard suite of water quality parameters, including heavy metals, nutrients and bacteria.



Sampling follows the protocols outlined by OMOECC's Provincial Water Quality Monitoring Network. Surface water quality data helps us to understand the impacts of land use (e.g. agriculture, urban) on the water quality of local streams and watercourses, which ultimately flow into Lake Ontario. The latest data findings are highlighted in the report *2014 Surface Water Quality Summary: Regional Watershed Monitoring Program*.

WATER TEMPERATURE

TRCA collects water temperature data using seasonal and year-round temperature loggers. Temperature is a major factor that determines which aquatic species live in a particular stream.

Tracking water temperature can also indicate the influence of groundwater on a watercourse. For example, Brook Trout rely on groundwater upwellings for spawning. This data also helps to measure the effects of urbanization and climate change on stream health

WEST NILE VIRUS LARVAL SURVEILLANCE

Mosquito larvae have been monitored through TRCA's *West Nile Virus Surveillance and Monitoring Program* since 2003. TRCA initiated this monitoring program on conservation lands in cooperation with regional public health partners after a 2002 human outbreak of the disease occurred in Ontario.



Data collected are used to identify sites of potential concern on TRCA properties and then follow up with appropriate management actions. Our efforts focus on eradicating the vector mosquito larvae, those capable of transmitting the virus to humans before they emerge as biting adults. The latest data findings are highlighted in the report *West Nile Virus Vector Larval Mosquito Monitoring Report – 2015*.



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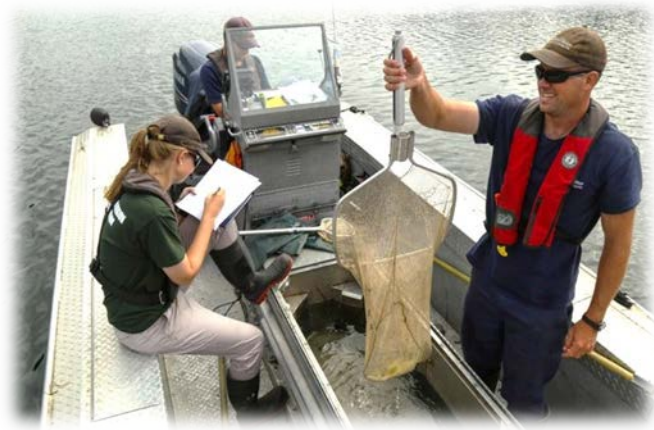


Lake Ontario Waterfront

TRCA monitors a number of aquatic indicators in order to assess the ecological condition of the Lake Ontario waterfront, including:

COASTAL AND INLAND FISHERIES

Fish surveys have been conducted within Toronto Harbour since 1989 in order to track the effectiveness of **Remedial Action Plan** (RAP) remedial measures for the Toronto and Region Area of Concern (AOC). AOCs are formally recognized by the governments of Canada and the United States in the Great Lakes Water Quality Agreement amendments of 1987. Fish surveys, rescues and demonstrations are also conducted within the Toronto Harbour to set baseline conditions as well as track performance and compliance for restoration projects and watershed plans. An update to *The Fish Communities of the Toronto Waterfront: Summary and Assessment 1989–2005* report is currently underway.



WATER QUALITY AND QUANTITY

A variety of monitoring activities focused on measuring water quality and quantity are taking place along the Toronto area waterfront. One of

the larger projects is monitoring water quality in the proximity of the intake for Durham Region's Ajax Water Supply Plant and near the Duffin Creek Water Pollution Control Plant outfall. Over \$1 million has been invested, yielding it one of the most comprehensive monitoring programs for the Great Lakes nearshore environment.



Level loggers and temperature loggers are also installed at various restoration sites along the Toronto area waterfront for monitoring purposes.

ADDITIONAL SURVEYS

Various benthos, vegetation and sediment surveys are taking place along the Toronto waterfront in support of restoration and aquatic habitat research projects. TRCA also provides support to Restoration and Infrastructure staff on the installation of waterfowl nesting platforms and motion-activated trail cameras for various projects.

Forests, Meadows and Wetlands

TRCA conducts monitoring activities and assessments in order to assess the ecological condition of forests, meadows and wetlands in our regional watersheds, including:

BIOLOGICAL INVENTORIES

Since 2000, TRCA has collected inventory data on flora and fauna species as well as vegetation communities in support of the Terrestrial Natural Heritage Program. These sites change from year to year based on funding as well as land planning and management priorities. In 2015, eight **terrestrial biological inventories and assessments** were completed (see Appendices).



Inventories are done during the optimum time of year for seeing or hearing a particular species. For example, spring breeding frogs come out of the forest and head for their breeding ponds during the first warm rains of the season. Having knowledge of which species are where helps TRCA make informed land management decisions.

REGIONAL RANKS AND SCORES

Annual inventory analyses also contribute to the update of ranks and scores for regional species of conservation concern and vegetation communities. This ranking and scoring system is designed to proactively identify the conservation needs and priorities of the region's plants and animals, linking their needs to planning and land management decisions at the local and regional level. Based on this usage of a local ranking and scoring approach, 684 species in TRCA's jurisdiction are now designated as Regional Species of Conservation Concern.

TRCA, along with its partners, have applied ranks and scores at different landscape scales. For example, at the regional scale they have been used to help define the *Terrestrial Natural Heritage System Strategy* targets and aid in the creation of Recovery Plans for species and communities. At the watershed scale, they have been used in the development of watershed plans and report cards as well as natural heritage system planning for larger municipal official plans or secondary block plans. This information has also been used extensively at the site scale in land management (e.g. trail planning) and identifying site development limits and buffers.

Lists of flora, fauna and vegetation community ranks and scores are updated annually and can be accessed **online** in our Resource Library.

Forests, Meadows and Wetlands

LONG-TERM FIXED PLOTS

In 2008, TRCA implemented terrestrial monitoring at a number of fixed plots in forest, wetland and meadow habitats region-wide. This program monitors and measures how species and vegetation communities are responding over time to landscape influences in urban, urbanizing and rural land use zones. Urban areas tend to exert more negative influences from the surrounding land use areas than rural zones.

The 2015 *Terrestrial Long-term Monitoring, Spatial and Temporal Trends* report tells the story of how TRCA's wetland, forest and meadow communities changed between 2008 and 2014, including an examination of the differences in ecological health between urban and rural sites. While many of the measures of biodiversity analyzed appear to be stable at this time, almost all are showing impairment due to urbanization. If the jurisdiction foresees the conversion of more rural land to urban land uses, we will expect to see drastic declines in ecosystem health in the years to come. More research needs to be done on development and land-use planning that maintains habitat for sensitive species while still meeting the demands of a growing population. By continuing long-term monitoring across our watersheds we can inform conservation land management to negative trends in ecosystem health and provide a window of opportunity to reverse any impacts.

TERRESTRIAL VOLUNTEER MONITORING

TRCA's Terrestrial Volunteer Monitoring Program trains volunteers to monitor the forest, wetland, and meadow habitat in the Greater Toronto Area. By engaging volunteers, TRCA can provide an opportunity for citizens to contribute to environmental protection in a meaningful way, and to learn more about local native species and their habitat needs.



The goal of the program is to assess biodiversity through surveys that collect data on a set of mammal, bird, amphibian, plant and lichen species at fixed sites across the region. The severity of invasion by eight high priority invasive plants is also monitored. Tracking the sites over time allows us to measure our success at protecting and enhancing regional biodiversity.

The latest data findings are highlighted in the 2013 report *Terrestrial Biodiversity in the Toronto region 2003 – 2012: A decade of monitoring under the Terrestrial Volunteer Monitoring Program*.



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Monitoring Spotlights

2015 Notable Biodiversity Records

Smooth greensnake (*Opheodrys vernalis*)



Several smooth greensnakes were found in a city park in Toronto's west-end, confirming the persistence of this rare species after several years of occasional reports from members of the public. This location is one of only two known breeding locations for this species in the city.

Northern shoveler (*Anas clypeata*)

A northern shoveler was observed at Carruthers Marsh in early June 2015 suggesting that the species may have nested locally. This constitutes a new, possible nesting record for the region. Shovelers have been reported nesting as nearby as Cranberry Marsh, just a few kilometres east of Carruthers Creek.

Daisy-leaved grape fern (*Botrychium matricariifolium*)

This locally rare, succulent fern was located at North of Finnerty Sideroad Study Area in 2015. Prior to this, only two known records existed within the jurisdiction. It was last observed in 2003 in the upper reaches of the Duffins Creek watershed with one earlier 2001 record in the Albion Hills Conservation Area. This find is

highlighted because populations are usually small, making detection quite difficult.

Sessile-fruited arrowhead (*Sagittaria rigida*)



This plant was spotted in Carruthers Creek marsh. This is the first sighting of this plant in over 75 years. The last sightings of this plant were in 1913 and 1940 in Toronto.

Spotted coral-root (*Corallorhiza maculata*)



In 2015, this beautiful member of the orchid family was found at a site on the Oak Ridges Moraine. Lacking the ability to photosynthesize, it has formed parasitic relationships with certain fungi in the soil for survival. A truly fascinating plant!



Monitoring Spotlights

Asian Grass Carp Discovery in Toronto Harbour

On Monday, July 26th, 2015, a TRCA monitoring crew thought they would be moving fish in preparation for a new wetland creation area at Tommy Thompson Park. The day turned out to be a whole new kettle of fish! Staff netted an invasive male Asian Grass Carp (*Ctenopharyngodon idella*), weighing 14.7 kg or 32.4 lbs and measuring 1.02 m in length. A lone male Grass Carp had been found by the mouth of the Don in 2003 but it was infertile. This newly found specimen, however, was discovered to be capable of reproduction.

Immediately a call was made to the Fisheries and Oceans Canada (DFO) so they could confirm the find. A team from the Asian Carp Program in DFO's Aquatic Invasive Species Division, as well as the Ontario Ministry of Natural Resources and Forestry (OMNRF), arrived shortly afterwards to join forces with us in combing the confined wetland for more Grass Carp. The three agencies promptly assembled five electrofishing boats, one trap net boat and two trammel net boats to survey the outer harbour in Tommy Thompson Park. The next day, a



second male Asian Grass Carp was captured, weighing 10.2 kg (22.5 lbs) and measuring 0.97 m in length. By Friday, July 30th, 2015, no other Asian Grass Carp had been found and the search was called off. Then during the evening hours of September 1st, 2015, our staff caught another two Asian Grass Carp while monitoring fish species near the Toronto Islands Marina. A third Asian Grass Carp was found in the same vicinity, late the next day during a coordinated search with DFO and OMNRF. The first fish found weighed 23 pounds, the second was 36 pounds and the third was 20 pounds.

DFO, in partnership with other agencies involved in fisheries surveys, are trying to prevent the invasion of several Asian Carp species (Bighead, Black, Grass, Silver) as they make their way up the Mississippi River towards tributaries that feed into the Great Lakes. We already know that Common Carp greedily consume native vegetation and muddy the waters, making the environment uninhabitable for native fish species. If other Asian Carp species become established in Ontario waterways, they will likely displace native fish in the same way. Sport and commercial fishing activities in Ontario will be greatly affected and revenue lost. To be on the look-out for this invasive fish, TRCA will be launching launch an Asian Grass Carp surveillance program in 2016.



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Monitoring Spotlights

Aquatic Habitat Toronto: Acoustic Telemetry Study

TRCA coordinates the activities of Aquatic Habitat Toronto (AHT), a group of agencies that have a vested interest in the improvement of aquatic habitat on the Toronto Waterfront. AHT is focused on completing the goals of the *Toronto Waterfront Aquatic Habitat Restoration Strategy* and the *Fishing in Your Backyard: An Urban Recreational Fisheries Strategy for the Lake Ontario Northwest Waterfront*, as well as supporting numerous other aquatic habitat projects along the Toronto area waterfront.

One of the research projects is a multi-year fish-tagging study in the Toronto Harbour in partnership with Carleton University and Fisheries and Oceans Canada. Thanks to this 'high-tech' fish tagging study, TRCA resource managers are learning how fish are using restored habitats in order to enhance or expand restoration efforts throughout the Toronto Harbour. TRCA has tagged over 300 native and non-native fish with acoustic transmitters since 2010 in an effort to track their feeding and spawning activities 24 hours a day year-round. In 2015 researchers outfitted 31 new fish with transmitters thanks to additional funding provided by Environment Canada's Great Lake Sustainability Fund, which will see the project continue for the next 3 years.



Understanding the mysteries of fish behavior, including where and how long fish are spawning and feeding throughout the seasons, will help TRCA continue to manage aquatic habitat along Toronto's waterfront. The goal is to support a community of desirable native fish species as well as a self-sustaining recreational fishery. Future plans for the project include expanding the study area to pick up acoustic signals from tagged fish travelling between the northwest shore of Lake Ontario. This information will help to answer questions about how fish move regionally and how agencies can work together to improve the health of Lake Ontario. A short article about this project was also featured in the 2015 Summer Edition of Ontario Nature magazine.



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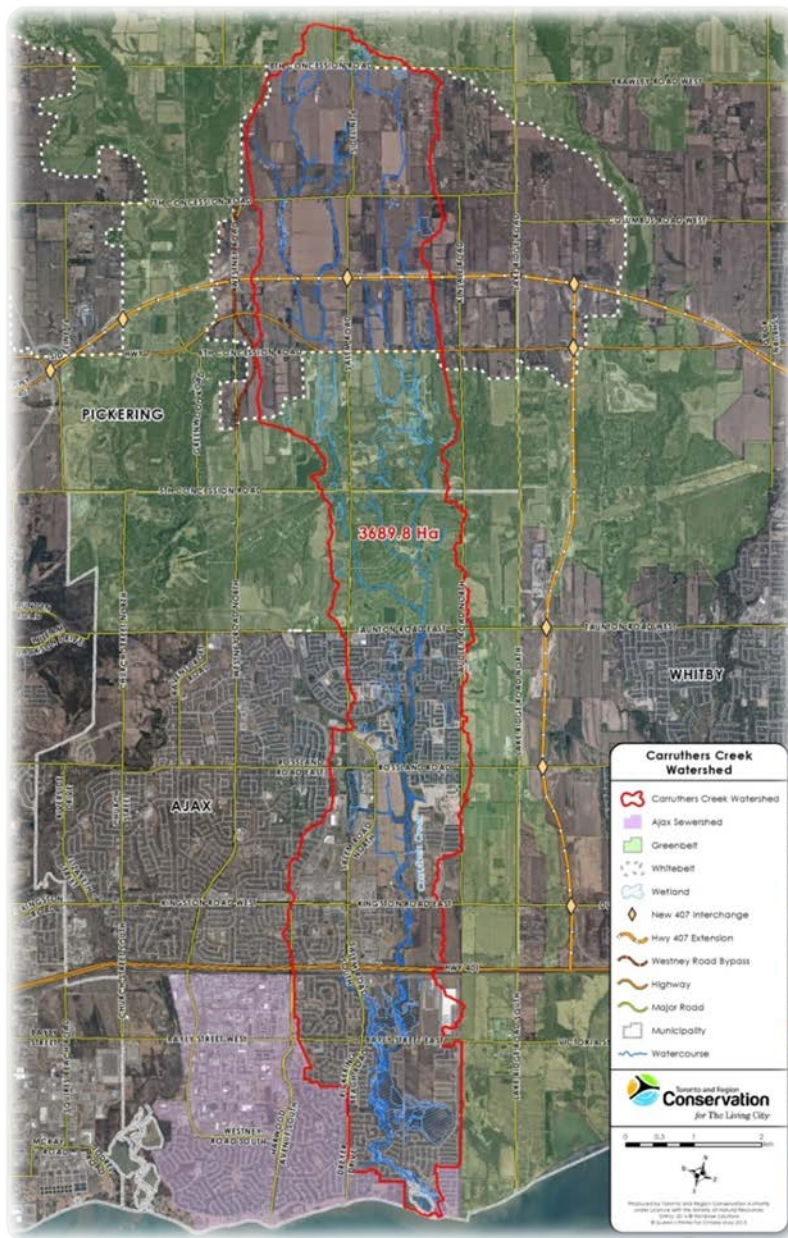


Monitoring Spotlights

Carruthers Creek Watershed Plan

Located in Durham Region, Carruthers Creek watershed is a small watershed with a drainage area of approximately 3,690 hectares. Since 2015, TRCA has been collecting field data in and around the Carruthers Creek watershed in support of a watershed plan, which is being completed collaboratively with Durham Region. Data collection has focused on stream connectivity, headwaters, and water quality as well as the fish, benthos, flora, and fauna communities that inhabit the area.

Monitoring data will help to identify key features or systems in the watershed (e.g. wetlands, headwaters) that are sensitive to land use changes. The existing urban areas south of Highway 7 also merit special consideration, specifically with respect to cumulative impacts. These areas may be subject to flood and erosion vulnerability, particularly the lands south of Bayly Street. The terrestrial data collected will help determine the extent of the natural heritage system to be conserved. Given its small size, physiography, and low level of urbanization, the data collected will be invaluable in protecting and managing the natural resources that exist within Carruthers Creek watershed.



Monitoring Spotlights

Meadow Monitoring in Bob Hunter Memorial Park

In 2015, TRCA installed twenty long-term meadow monitoring plots within Bob Hunter Memorial Park (BHMP), a greenspace situated on in the Rouge River watershed. The current condition of the meadows at BHMP has been documented by a detailed monitoring program.

The meadow plots situated here are a result of a larger high-priority restoration project that finalized in 2010 as part of the South East Collector Trunk Sewer compensation, which also saw forest and wetland areas established. The goal of BHMP is for it to be managed as a living laboratory utilizing different management treatments. The monitoring component will help to determine which management technique(s) are best suited in these conditions to support meadow flora and biodiversity. Meadow flora species are adapted to regular disturbance, and subsequently require management plans if they are to be maintained as meadow.

The idea is for these treatments to be implemented, monitored, and reviewed adaptively every few years. Scientifically, the monitoring data will provide a comparison of biodiversity changes, and draw conclusions regarding treatment influences. This management strategy is an opportunity to enhance knowledge about meadows and current methods for managing them.



Monitoring Spotlights

Ontario Stream Assessment Protocol Training

Through support from the Ontario Ministry of Natural Resources and Forestry (OMNRF) and in partnership with other agencies, TRCA has been administering annual **training courses** that certify environmental professionals on the **Ontario Stream Assessment Protocol** (OSAP) since 2005. The OSAP course is designed specifically for field crew staff and resource managers involved in stream surveys and management, and the methodologies taught are recognized as standards by OMNRF as well as Fisheries and Oceans Canada.

Twenty attendees participated in the 2015 OSAP course at Durham College Campus in Oshawa where they learned the methodologies needed for evaluating benthos, fish communities, physical habitat and water temperatures in wadeable streams. The course was offered in Thunder Bay in 2014 and this may be a possibility again in 2016.



Introductory benthos and Ontario fish identification courses are also offered concurrently the weekend preceding the OSAP course each spring. The goal in offering these courses is to transfer knowledge to partners and peers, as well as improve the accuracy and standardization of ecological data collected in Ontario watersheds.

Monitoring Spotlights

Remedial Action Plan: Degradation of Aesthetics

Toronto is one of 40 locations around the Great Lakes where local environmental degradation may be causing harm to the wider Great Lakes system. These locations, referred to as **Areas of Concern (AOCs)**, are located in Canada (15 sites), the United States (25 sites), and in some cases are shared between the two countries (5 sites). AOCs were formally recognized by the governments of Canada and the United States in the Great Lakes Water Quality Agreement amendments of 1987. The status of an AOC is determined by assessing the state of local environmental conditions against fourteen different Beneficial Use Impairments (BUIs), as identified in the Great Lakes Water Quality Agreement. Each Beneficial Use Impairment describes a human or ecological use of the ecosystem that has been lost or impaired as the result of environmental degradation (Toronto and Region Remedial Action Plan 2015).

The Toronto and Region AOC is currently deemed to have eight BUI impairments, three BUIs that are not impaired, and three BUIs that require further assessment (Toronto and Region Remedial Action Plan 2015). One of the impaired BUIs, which TRCA is responsible for reporting on, is **Degradation of Aesthetics**. A standardized protocol for quantifying aesthetics was developed to assess water odour, colour and clarity at various monitoring sites. These measures contribute to an overall Aesthetics Quality Index (AQI) score and condition for each site. AQI conditions include Excellent, Good, Fair, and Poor. Poor sites are those that have objectionable aesthetics and therefore prevent the members of the public from using those areas.

WHAT ARE THE DATA TELLING US?

Over three years, 485 unique sites were sampled by TRCA for a total of approximately 2,000 aesthetic records. Only 7 out of 485 sites were assessed as Poor, meaning 98.3% of sites had acceptable aesthetic conditions. The lower Don was one of the sites with the poorest aesthetic conditions, but this will likely be addressed through the proposed remediation scheduled for the **Don Mouth Naturalization and Port Lands Flood Protection Project**.

Further results will be available in the 2016 report *RAP Aesthetics: BUI Status Re-Designation Document for Degradation of Aesthetics*.



Monitoring Spotlights

Road Ecology Studies

In search of wildlife, TRCA was out day and night in 2015 collecting wildlife data for two baseline road ecology studies:

OAK RIDGES MORaine CORRIDOR PARK

The Oak Ridges Moraine Corridor Park road ecology study involved documenting the abundance of wildlife species found in and around the park's boundaries. The objective of this preliminary study was to assess where wildlife were crossing trails and roadways in order to determine if mitigation measures (e.g. ecopassages, fencing, habitat restoration) were needed to prevent injury to wildlife and facilitate movement between populations. TRCA conducted surveys for two weeks every month – one week of daytime surveys followed by a week of nighttime surveys. A total of 540 field observations were made, of which 467 were encounters along the roadways rather than trails. Approximately 68% of the observations were of frogs and toads, 17% were reptiles, 14% were mammals, and 1% was birds. About 98% of the turtle observations were of fatalities while 68% of snake encounters were of live animals. The results of this study may lead to more detailed studies, stewardship activities, and recommendations for future land management or regional transportation planning actions. Results of this study are discussed in the *Oak Ridges Moraine Corridor Park Road and Trail Ecology: Baseline Monitoring Results* report.

STREAM CROSSINGS: HUMBER AND ROUGE RIVERS

2015 marked the first pilot year for the stream crossing road ecology study in the Humber River and Rouge River watersheds, which is in partnership with the University of Toronto. The objective of this study is to provide baseline data on the abundance of individual wildlife species crossing roads and document existing crossing structures (e.g. culverts). Twelve sites were selected for this study, which involved terrestrial monitoring crews collecting data for a two-week period every month during the day and at night. An offshoot of this study involved a partnership with researchers in the Department of Environment and Resource Studies at the University of Waterloo, who are studying population genetics of the eastern milksnake (Special Concern designation in Ontario) across the landscape. Our monitoring crews assisted with the study by collecting tissue samples from all snake species found and providing them to Waterloo researchers for further DNA analyses.



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Monitoring Spotlights

Salmonid Surveys in Duffins Creek

2015 was a record year for Atlantic Salmon travelling upstream to spawn in Duffins Creek. Between August 14th and September 22nd, 2015, TRCA recorded eight Atlantic Salmon in the temporary Resistance Board Weir set-up near the mouth of Duffins Creek. This is the most Atlantic Salmon caught in one season at the weir since operations began in 2013. The largest Atlantic Salmon captured this year was a male, weighing 4200 g and measuring 695 mm in length! In total for this year's season, characteristics of 462 Salmonid species were recorded during 37 individual sampling events (780.5 hours) at the weir before the fish continued their migration upstream.



2015 marks the third year TRCA has been involved in environmental monitoring of all Salmonid species migrating upstream in Duffins Creek. Funded by the Ontario Ministry of Natural Resources and Forestry (OMNRF), TRCA supports the Lake Ontario Atlantic Salmon Restoration Program (LOASRP) program by both installing the Duffins Creek Resistance Board Weir and recording the characteristics (e.g. length, weight, gill parasites, sea lamprey scars) of all Salmonid species caught during their spawning migration periods. TRCA also collects genetic samples from Atlantic Salmon caudal fins to assist researchers in determining which strain of stocked fish is proving most successful. The day-to-day operations of the Duffins Creek Resistance Board Weir are performed in consultation with the OMNRF.

Since 2006, more than forty partners and sponsors for the LOASRP program have been focused on restoring a self-sustaining native Atlantic Salmon population to Lake Ontario since their extirpation (i.e. local extinction) in the late 1800s. Atlantic Salmon were one of the first fish species in the Great Lakes to disappear as a result of degradation of streams, over-fishing and ecosystem changes in the lake. The fish production and stocking component of the LOASRP focuses on raising three different genetic strains of juvenile Atlantics and subsequently stocking them in a few select Lake Ontario tributaries, including Duffins Creek. All stocked fish are genetically tagged so that any recaptured fish can be traced to specific stocking events or identified as wild recruits. The expectation is that it will take another decade or more to realize a self-sustaining population of Atlantic Salmon in Lake Ontario. More information about the LOASRP program can be found on their Web page <http://www.bringbackthesalmon.ca/>.



Monitoring Spotlights

Sea Lamprey Control

Since 2005, TRCA has worked in contract partnership with **Fisheries and Oceans Canada** (DFO) to collect Sea Lamprey during their spawning season (mid-April to mid-June) in an effort to reduce the impact on fish communities within Lake Ontario. DFO also applies lampricide upstream of the Duffins Creek weir to control any larvae that may have made it past the weirs. Larvae can reside in the bottom sediment of streams for three to six years.

The Sea Lamprey is an invasive parasitic fish native to the Atlantic Ocean that voraciously feed on the bodily fluids of other fish using their suction cup mouth lined with teeth. The first reported occurrence of Sea Lamprey in the Great Lakes was in the 1830's and it is believed that they entered the Great Lakes through the shipping channels. In the 1940's and 50's Sea Lamprey had a significant role in the collapse of the Lake Trout and Whitefish fisheries, which have both been historic economic mainstays of the Great Lakes fishery.



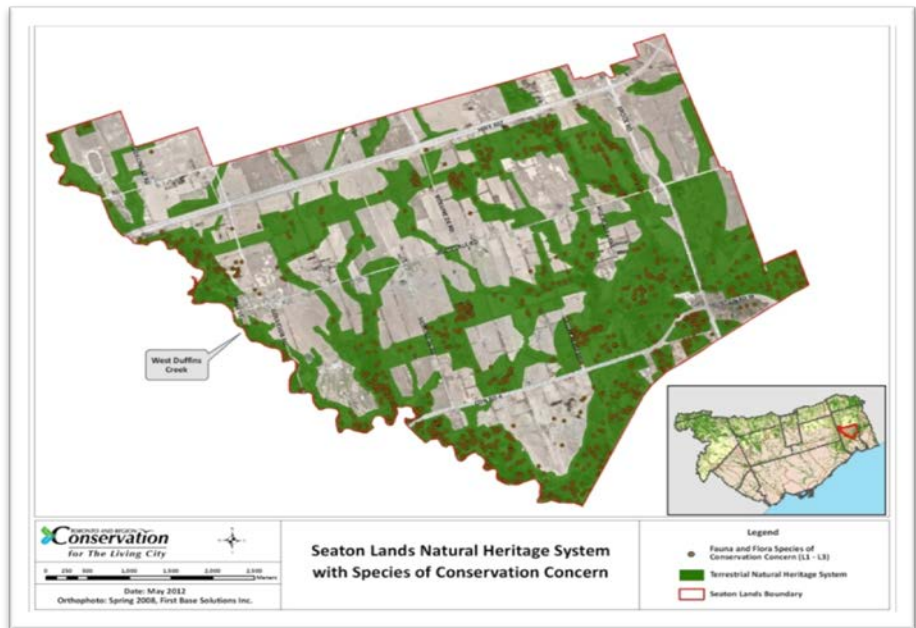
The 2015 Sea Lamprey season finished on June 26, 2015. TRCA caught 1249 Sea Lamprey in the Humber River trap and 233 Sea Lamprey in the Duffins Creek trap. The traps are built into the first weirs immediately upstream of Lake Ontario in each river in order to capture the adult Sea Lamprey as they migrate upstream to spawn. This year two American Eels (Endangered in Ontario) were captured in the Humber River traps!

The 2015 catch contained half the number of Sea Lamprey than the year before. Sea Lamprey go through periods of a recession every few years, therefore, additional data collection over time will confirm if the low numbers observed are directly related to control measures. A fungus called *Scopulariopsis* or “white tooth disease” may be contributing to the decline observed but research has not confirmed this yet.

Monitoring Spotlights

Seaton Development Lands

The *Central Pickering Development Plan* (OMMAH, 2006) outlines the blueprint for a new urban community within the Seaton development lands that will house up to 70,000 people and create 35,000 jobs on the west side of Duffins Creek. This project is unique because 53% (1,520 of 2,285ha) of the planning area is designated as a Natural Heritage System (NHS) and will be retained in public ownership. The Ontario Ministry of Natural Resources and Forestry in



cooperation with TRCA identified the NHS for Seaton, which includes wetlands, forest blocks, valleys, floodplains, meadows, headwater streams, and the Lake Iroquois shoreline, along with generous buffers and wildlife corridors to protect these features. The urban development portion will incorporate advanced water management techniques such as **Low Impact Development** strategies to help mitigate the impacts of urbanization on the natural environment.

Due to the size and scale of this development, its sustainability aspects and the sensitivity of the nearby ecosystems, TRCA initiated a large-scale monitoring program in 2014 to evaluate the NHS on the Seaton development lands. TRCA will be monitoring both the aquatic and terrestrial ecosystem (pre, during, and post development) to determine if the sustainability practices and the large NHS are sufficient to protect the ecological integrity of the sensitive natural heritage features within the project boundaries. Currently, there are long-term monitoring plots setup to monitor changes in vegetation, bird and frog communities as well as sites to monitor fish and benthos communities. Conductivity loggers, used to estimate chloride concentrations, as well as year-round temperature loggers and water quality monitoring stations are also in place. Results from this monitoring program are expected to largely influence future planning decisions regarding the Seaton development lands and potentially future development activities in other TRCA watersheds.



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Monitoring Spotlights

SENSITIVE FISH POPULATIONS

The **Seaton development lands** are home to important local populations of the provincially endangered **Redside Dace** (*Clinostomus elongatus*) as well as the sensitive **Brook Trout** (*Salvelinus fontinalis*). In early November 2015, TRCA visited the Seaton development lands to conduct visual surveys of Brook Trout redds during their fall spawning period. Redds are a hollow in a river bed, scooped out as a spawning area by trout or salmon.

TRCA monitoring crews were pleased to report 20 Brook Trout redds in the shallow headwater streams located near groundwater upwellings. Brook Trout are the only remaining native Salmonid fish species naturally occurring within TRCA's jurisdiction (in headwater sections of the Humber, Rouge, and Duffins watersheds). They are known to prefer streams that have a year-round supply of cold, clear, well-oxygenated waters. For these reasons, Brook Trout are often used as indicators of excellent habitat and water quality conditions. These habitat specialists can be impacted by an



increase in impervious surfaces (e.g. roads, parking lots) in urbanizing areas because there is less opportunity for groundwater recharge, resulting in reduced baseflows and warmer stream temperatures.

The provincially endangered Redside Dace is another important fish species found within the Seaton development lands. Its presence has been confirmed during Regional Watershed Monitoring Program fish community and habitat surveys, which have been conducted every three years in the Duffins Creek watershed since 2003. In addition, targeted sampling for Redside Dace was conducted in 2015 to help determine the extent of their range within the Seaton development lands. Due to its sensitive nature, TRCA used **underwater cameras** to confirm their presence at some locations. This is an important fish species to monitor because it is a habitat specialist, preferring coolwater habitat conditions with overhanging vegetation. Its absence will signal that urban development activities are significantly altering the physical habitat as well as the cool, clear, flowing water conditions that Redside Dace depend on. Beyond the Seaton development lands, limited populations of Redside Dace persist in the Carruthers Creek, Don River, Duffins Creek, Humber River and Rouge River watersheds.



Monitoring Spotlights

Water Quality near Duffins Creek Marsh

On the west side of Duffins Marsh, in Pickering, a pilot treatment system channel connecting directly to Lake Ontario was created by TRCA's Restoration and Infrastructure Division in 2014 with funding support from the Ontario Ministry of Environment and Energy. The channel was constructed to reduce the movement of contaminants entering the lake from nearby industry stormwater catchments. The goal of **the project** is to determine whether or not the installation improved water quality conditions at this site. Water quality monitoring data collected throughout this channel include measurements of flow, temperature, water levels and water chemistry. Automated ISCO water samplers collect hourly samples based on flow intervals after high intensity rain storms. The picture below shows how water quality changes over a twenty-hour period following a rain event.



This unique project provides the opportunity to monitor the impact of an engineered stormwater management facility on water quality. If this restoration projects proves successful, similar design works to improve water quality may be implemented at other waterfront locations across the jurisdiction.

Appendices



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Reports and Publications

GENERAL REPORTS

Many of these reports can be accessed online through TRCA Monitoring's [Resource Library](#):

2014 Caledon East Technical Brief *December 2015*

2014 Surface Water Quality Summary *December 2015*

2014 Watershed Monitoring and Reporting Progress Report *March 2015*

2014 West Nile Virus Vector Larval Mosquito Monitoring Report *March 2015*

Amberlea Creek Erosion Control Project: Pre and Post-Restoration Stream Monitoring Data *December 2015*

Characterization of Water Temperature Variability within a Harbour Connected to a Large Lake *August 2015*

Cold Creek Conservation Area: Terrestrial Biological Inventory and Assessment *March 2015*

East Point Park Wetland: Water Level Conditions *December 2015*

Erosion and Flood Control Baseline Data for Deerlick Creek in Brookbanks Park, Toronto *June 2015*

Erosion and Flood Control Baseline Data for Deerlick Creek in Brookbanks Park, Toronto *June 2015*

Erosion and Flood Control Baseline Data for Highland Creek in Hauge Park, Scarborough *June 2015*

Erosion Control Baseline Data for West Etobicoke Creek Along the Etobicoke Creek North Trail (Mississauga) *December 2015*

Evaluating the Effect of Natural Channel Design on Fish Communities *December 2015*

Fauna Ranks and Scores *March 2015*

Flora Ranks and Scores *April 2015*

Frenchman's Bay Vegetation Survey: Species by Percent *August, September and November 2015*

Glen Haffy: Terrestrial Biological Inventory and Assessment *June 2015*

Indian Line: Terrestrial Biological Inventory and Assessment *June 2015*

Lake Ontario Fish Communities and Fisheries: 2014 Annual Report of the Lake Ontario Management Unit *March 2015*

Lower Don River: Jet Probe Survey 0–3 m *November 2015*



Reports and Publications

Major Creek: Terrestrial Biological Inventory and Assessment *March 2015*

Mayfield West Phase 1 Comprehensive Adaptive Management Program Monitoring: Year 2 (2014). *April 2015*

Mimico Linear Aquatic Vegetation Survey *August 2015*

Natural Channel Design Monitoring Project: Geomorphic Assessment *September 2015*

Natural Channel Design: Benthic Macroinvertebrate Summary *October 2015*

Natural Channel Design: 10 Year Report Terrestrial Biological Inventory and Assessment Summary *August 2015*

Ontario Power Generation Terrestrial Long-term Monitoring Project (2015 Monitoring Season). *December 2015*

Petticoat Creek Watershed Aquatic Ecology Characterization Report *December 2015*

Port Perry Bay Enhancement Project: Submergent Aquatic Vegetation Survey *August 2015*

Professors Lake Bathymetry *January 2015*

Stouffville Creek: Terrestrial Biological Inventory and Assessment *May 2015*

Terrestrial Long Term Monitoring: Spatial and Temporal Trends 2008–2014 *August 2015*

Terrestrial Volunteer Monitoring Program Review *March 2015*

The Sun–Canadian Pipeline Erosion Control Project Pre–Restoration Baseline Stream Monitoring Data *December 2015*

Town of Richmond Hill: Terrestrial Biological Inventory and Assessment *September 2015*

Upper Petticoat Creek: Terrestrial Biological Inventory and Assessment *February 2015*

PRESENTATIONS / POSTERS

A.D. Latornell Conservation Symposium: Severity, Biological Thresholds and Potential Impacts of Freshwater Stream Salinization Due to Road Salt in Toronto, Canada *November 2015*

Ontario Biodiversity Summit: Species Ranks and Scores Poster *May 2015*

ARTICLES

For the most recent environmental monitoring news articles please visit [TRCA News](#) online:

An endangered species in Ontario: The slippery, but sensitive American Eel *June 2015*

Fewer lamprey in 2015 than in previous years. Natural cycle or control methods? *June 2015*

Helping wildlife cross the road: TRCA's road ecology baseline studies. *August 2015*



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Reports and Publications

How do regional plants and wildlife rank? TRCA's unique scoring approach in natural heritage systems protection. *September 2015*



YOUTUBE VIDEOS

These videos can be viewed by visiting the TRCA Monitoring YouTube [playlist](#):

[2015 Toronto Waterfront Electrofishing with TRCA](#) *July 2015*

[Environmental Monitoring and Data Management: Leaders in Monitoring Aquatic and Terrestrial Habitats](#) *June 2015*

[Fish Tales – Toronto Harbour Acoustic Telemetry Study](#) *December 2015*

[Searching for Invasive Grass Carp in Toronto Harbour](#) *December 2015*

[Spring Salamander Surveys](#) *July 2015*

[Surface water quality sampling in the Greater Toronto Area](#) *December 2015*

In the face of urbanization, green frogs seem to be the most resilient in the Greater Toronto Area. *November 2015*

Monitoring sensitive fish species on Seaton development lands *December 2015*

[Ontario Nature: Rusty Crayfish is Here to Stay](#) *Fall 2015*

[Ontario Nature: Tracking Fish in Toronto Harbour](#) *Summer 2015*

Surveying Salmon in Duffins Creek: 2015 Update *October 2015*

Toronto Harbour tagging study uncovering the mysteries of fish behaviour. *July 2015*

TRCA's involvement in the discovery of five invasive Asian Grass Carp this summer. *September 2015*

What are the plant and animal communities telling us? Summary of TRCA's Terrestrial Long-term Monitoring Program (2008–2014) *September 2015*



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Regional Watershed Monitoring Activities by Watershed

	ETOBICOKE	MIMICO	HUMBER	DON	HIGHLAND	ROUGE	PETTICOAT	DUFFINS	CARRUTHERS	OTHER	TOTAL
FISH COMMUNITIES AND HABITAT						25		21	3		49
BENTHOS	14	5	35	23	11	25	4	21	3	4	145
WEST NILE VIRUS	4	1	19	7	2	3	1	6	1	3	47
SURFACE WATER QUALITY	8	2	11	5	1	7	1	9	1	1	46
BASEFLOW	33	13	25	10	7	8	2	12	4	3	117
STREAM FLOW	4	1	7	11	1	4	1	8	3	2	42
PRECIPITATION	4		12	4	2	5	1	6		2	36
SNOW COURSE	1		3	1		2		3			10
GROUNDWATER	2		9			3		4			18
BIOLOGICAL INVENTORIES (HA)			859	161	224	18			665		1926
TERRESTRIAL FIXED PLOTS	21	3	71	19	5	19	6	37	2	10	193
TERRESTRIAL VOLUNTEER SITES	5	1	17	8	3	7	1	7		3	52
CLIMATE MONITORING	1		6			3		4			14
WATER TEMPERATURE	3	2	5	3	2	25	1	21	3	1	66

NOTE: CLIMATE INCLUDES BOTH METEOROLOGICAL STATIONS AND 'STAND ALONE' AIR TEMPERATURE STATIONS. OTHER INCLUDES TRIBUTARIES OF FRENCHMAN'S BAY AND TORONTO WATERFRONT.



Regional Watershed Monitoring Activities by Region

	DURHAM	PEEL	TORONTO	YORK	OTHER	TOTAL
FISH COMMUNITIES AND HABITAT	23		7	19		49
BENTHOS	30	27	47	39	2	145
WEST NILE VIRUS	8	10	12	17		47
SURFACE WATER QUALITY	12	8	13	13		46
BASEFLOW	20	46	36	15		117
STREAM FLOW	13	9	15	5		42
PRECIPITATION	7	9	8	12		36
SNOW COURSE	3	3	1	3		10
GROUNDWATER	4	7	1	6		18
BIOLOGICAL INVENTORIES (HA)	665	594	382	285		1926
TERRESTRIAL FIXED PLOTS	45	58	30	60		193
TERRESTRIAL VOLUNTEER SITES	9	11	18	13	1	52
CLIMATE MONITORING	4	2	1	7		14
WATER TEMPERATURE	25	5	16	20		66

NOTE: CLIMATE INCLUDES BOTH METEOROLOGICAL STATIONS AND 'STAND ALONE' AIR TEMPERATURE STATIONS. OTHER REFERS TO DUFFERIN / SIMCOE.

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2015 Durham Region Monitoring Locations



Legend

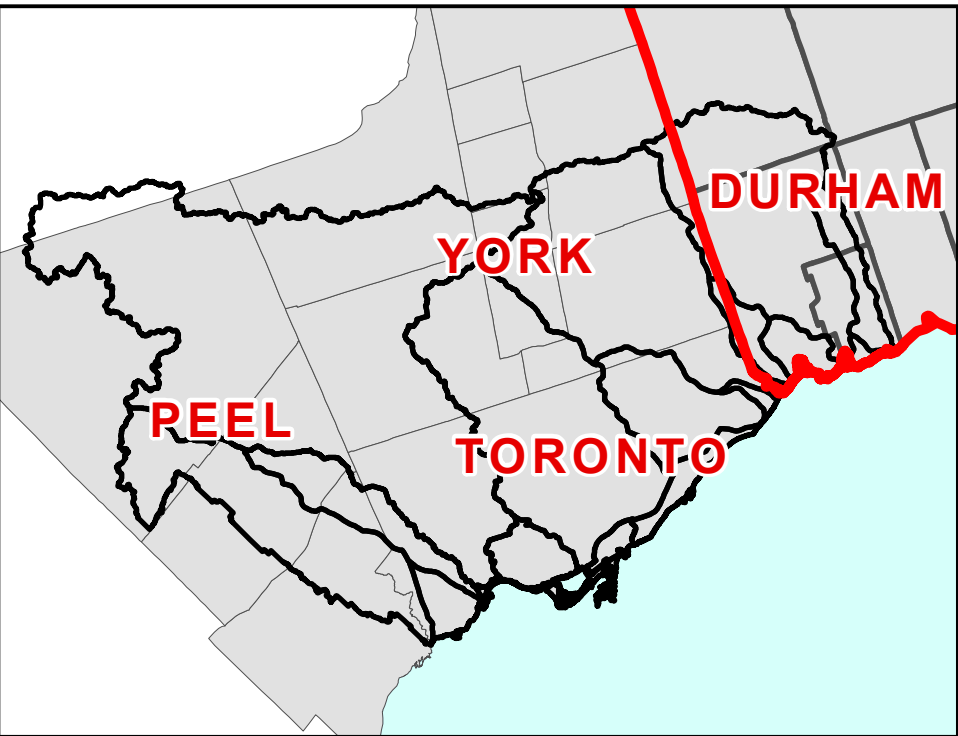
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| ■ Aquatic Species & Habitat | ● Terrestrial Inventories |
| ■ Baseflow Stations | ▲ Terrestrial Volunteer Program |
| ■ Benthic Macroinvertebrates | ◆ Water Temperature (Seasonal) |
| ● Climate Stations | ◆ Water Temperature (Year Round) |
| ● Groundwater Quality | ■ West Nile Virus |
| ● Groundwater Wells | — Municipal Boundary |
| ● Precipitation Gauges | — Highway |
| △ Snow Gauges | — Watercourse |
| ▲ Stream Gauges | — Waterbodies |
| ● Stream Water Quality | — Watershed Boundary |

Date: 3/29/2016

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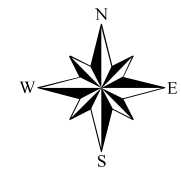
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2015 Peel Region Monitoring Locations



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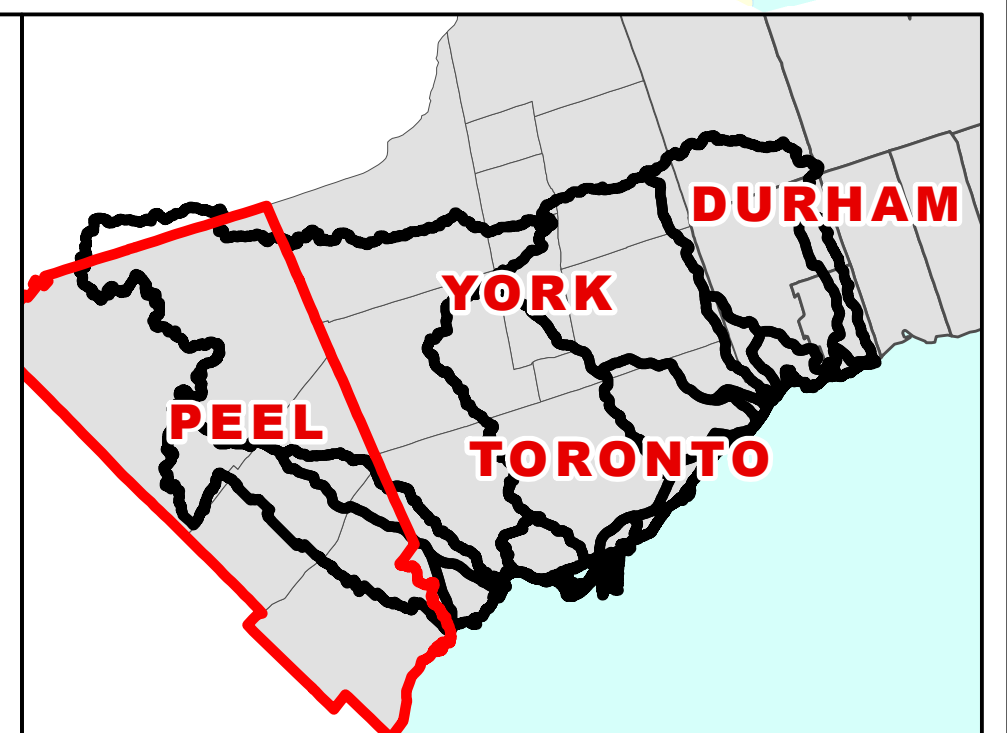
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| 🟢 Benthic Macroinvertebrates | 🌊 Water Temperature (Year Round) |
| 🔴 Climate Stations | ■ West Nile Virus |
| 🟢 Groundwater Quality | — Municipal Boundary |
| 🟠 Groundwater Wells | — Highway |
| 💧 Precipitation Gauges | — Waterbodies |
| 🔵 Snow Gauges | — Watercourse |
| ▲ Stream Gauges | 🟡 Watershed Boundary |
| 🟢 Stream Water Quality | |
| ▲ Terrestrial Fixed Plots | |

Date: 3/29/2016

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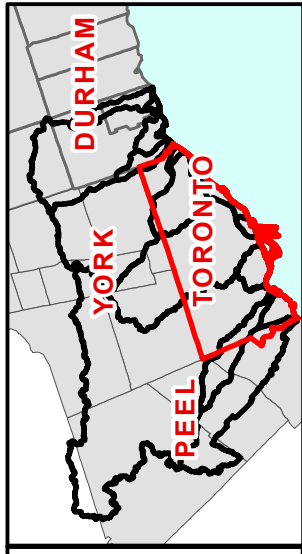
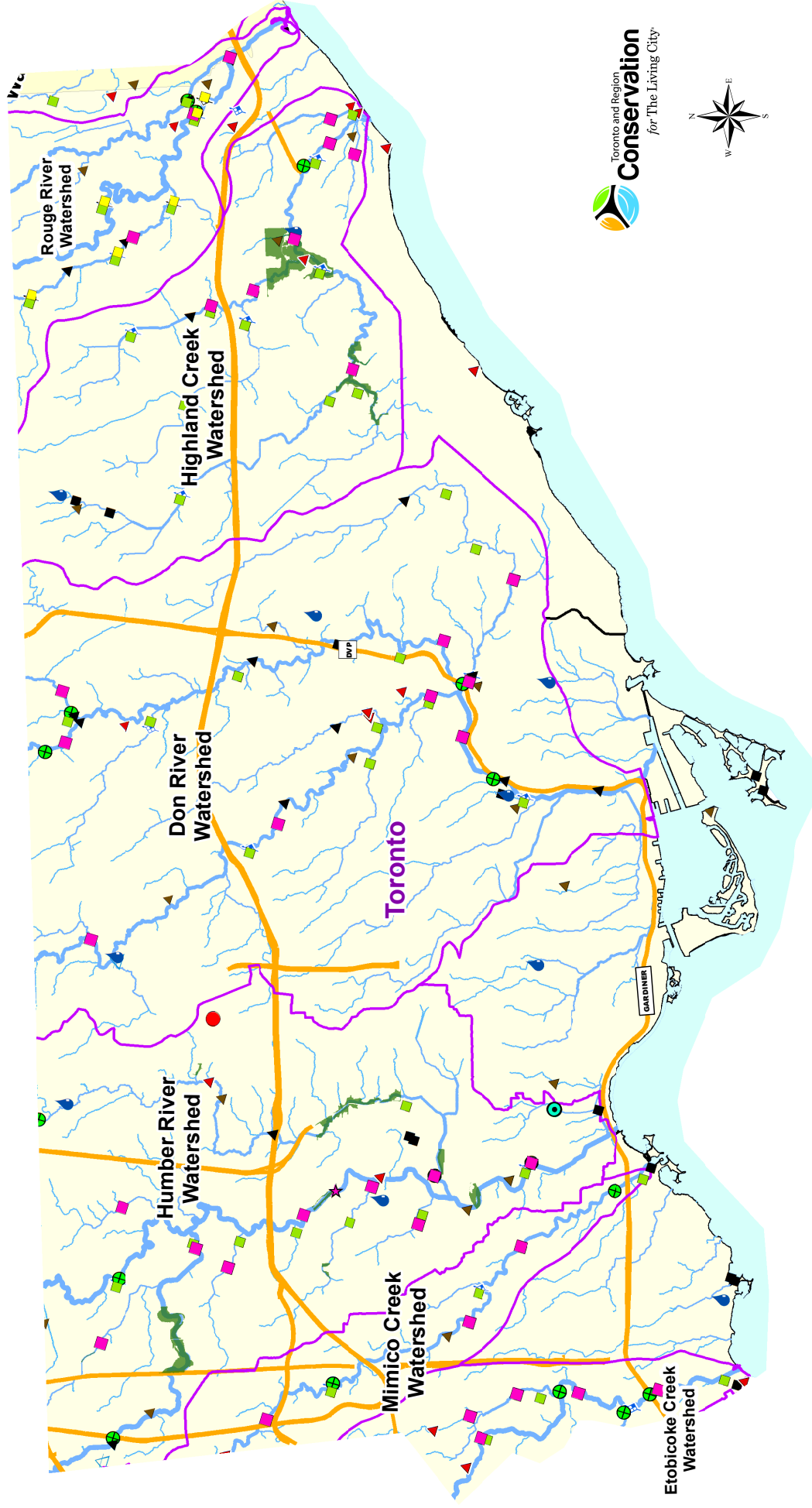
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2015 City of Toronto Monitoring Locations



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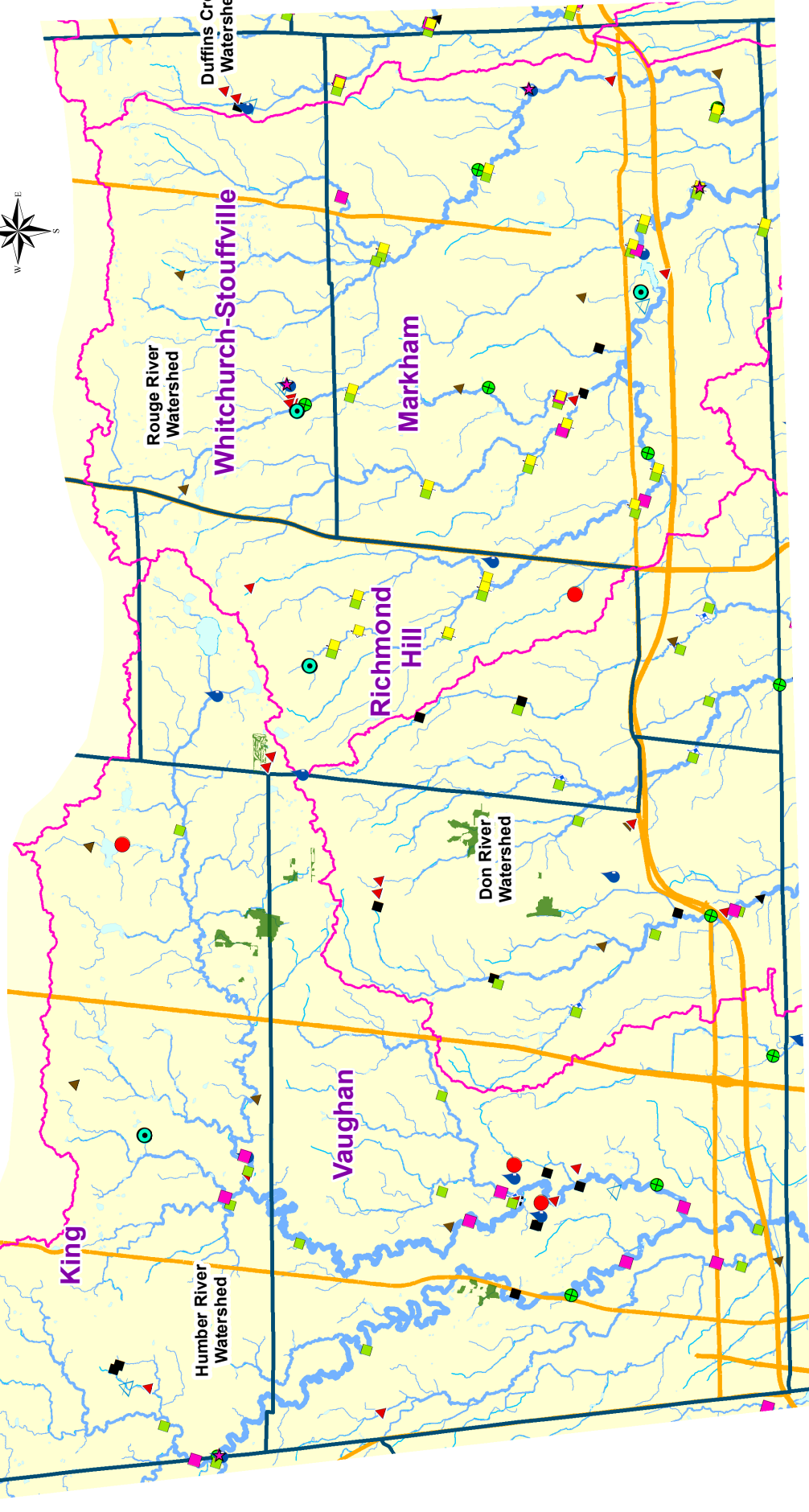
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- Groundwater Quality
- Groundwater Wells
- Precipitation Gauges
- △ Snow Gauges
- ▲ Stream Gauges
- Stream Water Quality
- Terrestrial Fixed Plots
- Terrestrial Inventories
- Terrestrial Volunteer Program
- West Nile Virus Monitoring
- ◆ Water Temperature (Seasonal)
- ◆ Water Temperature (Year Round)
- Highway
- Watercourse
- Watershed Boundary

Toronto & Region Conservation Authority



2015 York Region Monitoring Locations



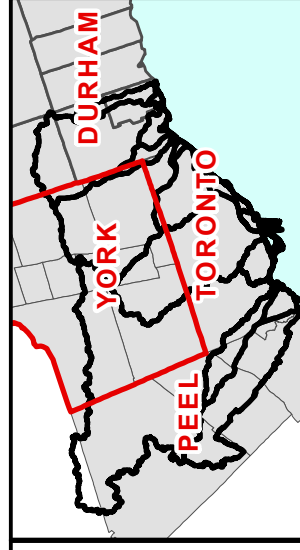
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- ★ Air Temperature Loggers
- Aquatic Species & Habitat
- △ Baseflow Stations
- Benthic Macroinvertebrates
- Climate Stations
- Groundwater Quality
- Groundwater Wells
- Precipitation Gauges
- △ Snow Gauges
- ▲ Stream Gauges
- Stream Water Quality
- ▲ Terrestrial Fixed Plots
- Terrestrial Inventories
- ▲ Terrestrial Volunteer Program
- West Nile Virus
- ◆ Water Temperature (Seasonal)
- ◆ Water Temperature (Year Round)
- Municipal Boundary
- Highway
- Waterbodies
- Watercourse
- Watershed Boundary

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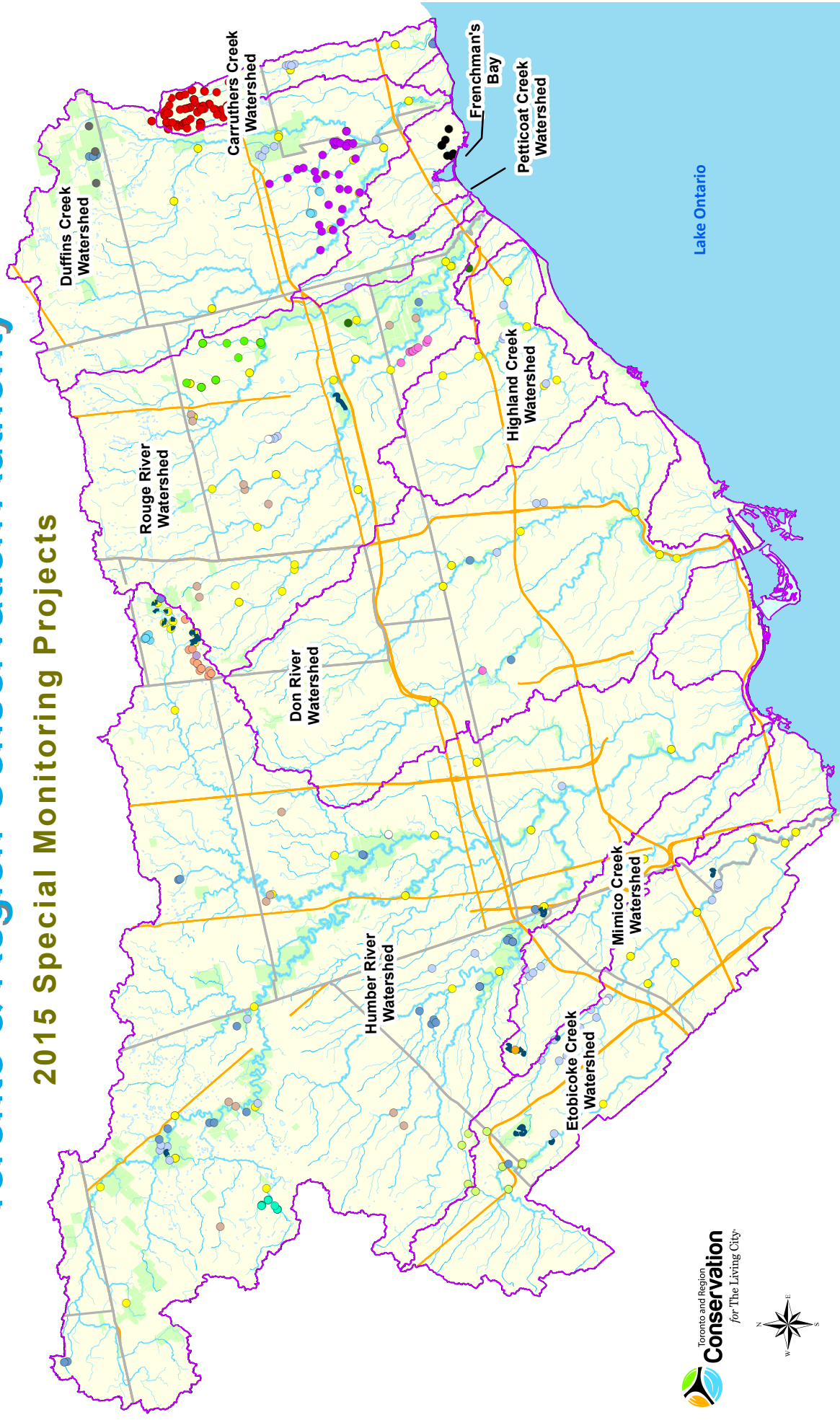
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2015 Special Monitoring Projects



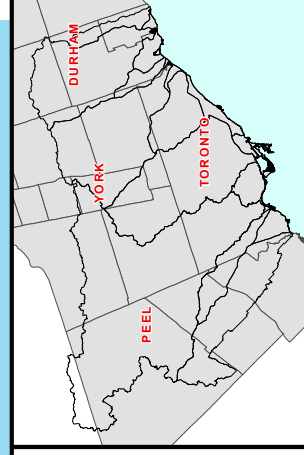
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|------------------------|-------------------------------------|---------------------------------|--------------------|
| Bob Hunter Park | Morningside Temperature | OSAP Fish & Habitat | Municipal Boundary |
| Caledon East | Natural Feature Water Balance Study | Remedial Action Plan Aesthetics | Highway |
| Carruthers Headwaters | Natural Channel Design | Road Ecology - ORMCP | Waterbodies |
| Fisher Study | Ontario Power Generation | Road Ecology - Stream Crossing | Watercourse |
| Level Logger Retrieval | Professor's Lake Bathymetry | Rouge National Urban Park | TRCA Property |
| Mayfield West | Oak Ridges Moraine LTMP | Seaton Development Lands | Watershed Boundary |
| | | Fisheries Monitoring Stations | |

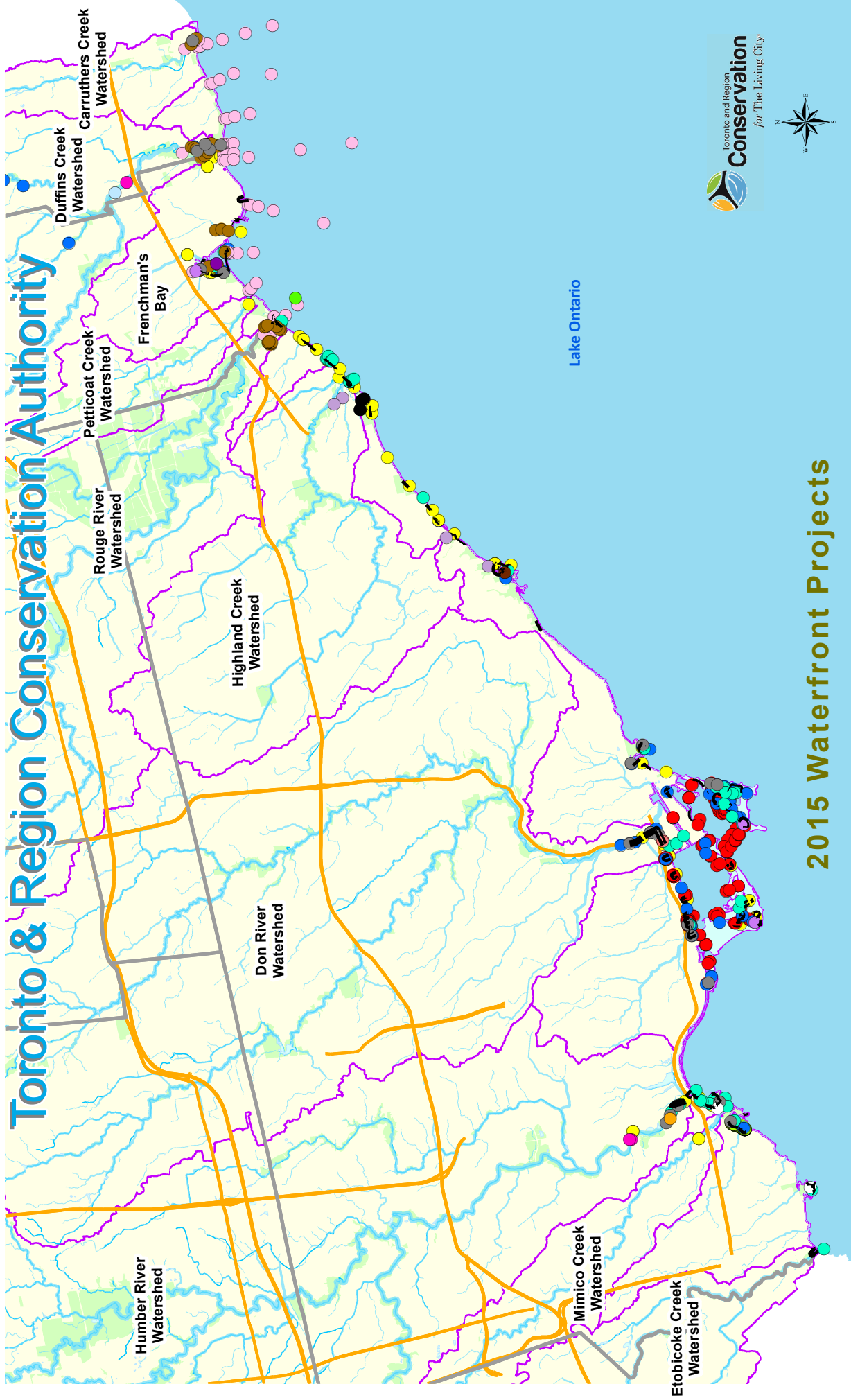
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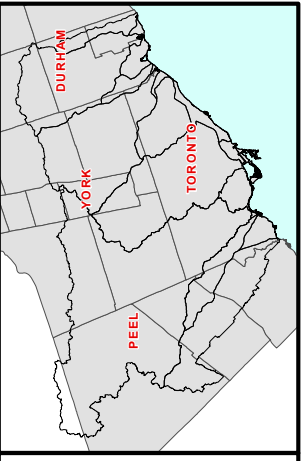
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Kilometers



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2015 Waterfront Projects



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Legend

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|--------------------------------|---------------------------------|-----------------------------------|--------------------|
| Acoustic Telemetry (Receivers) | Fisheries Monitoring Stations | Remedial Action Plan Aesthetics | Municipal Boundary |
| Ajax Water Quality | Frenchman's Bay Vegetation | Resistance Board Weir | Highway |
| Bluffers Vegetation Survey | Grebe Nesting Platforms | Sea Lamprey Control | Waterbodies |
| Clam Biomonitoring | Humber Cormorant Nest Counts | Sediment and Benthic Sampling | Watercourse |
| Cladophora Sampling | Keating Channel Turbidity | Temperature Logger | TRCA Property |
| Durham Region Wetlands | Mimico Linear Vegetation Survey | Tern Nesting Raft Deployment | Watershed Boundary |
| East Point Level Loggers | | Wildlife Assessment Trail Cameras | |

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Kilometers

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Aquatic Habitat Toronto
Bluffers Park Marina
Canadian Sportfishing Association
Carleton University
Central Lake Ontario Conservation
City of Mississauga
City of Toronto
City of Vaughan
Colonel Samuel Smith Park Marina
Credit Valley Conservation
Fisheries and Oceans Canada
Durham Region
Environment Canada
Enviroscience Inc.
Frenchman's Bay Marina Working Group
Ganaraska Region Conservation
Great Lakes Fishery Commission
Great Lakes Sustainability Fund
Halton Region Conservation
Hamilton Conservation
Invasive Species Centre
Kawartha Conservation
National Research Council
Natural Resources Canada
Nottawasaga Valley Conservation

Ontario Federation of Anglers and Hunters
Ontario Ministry of Natural Resources & Forestry
Ontario Ministry of the Environment & Climate Change
Ontario Power Generation
Ontario Streams
Parks Canada
Peel Region
Ports Toronto
Royal Ontario Museum
SLR Consulting
Toronto and Region Remedial Action Plan
Toronto Urban Fishing Ambassadors
Town of Ajax
Town of Brampton
Town of Caledon
Town of King
Town of Oakville
Town of Pickering
Town of Richmond Hill
Transport Canada
Trout Unlimited Canada
University of Toronto
University of Waterloo
York Region
York University

