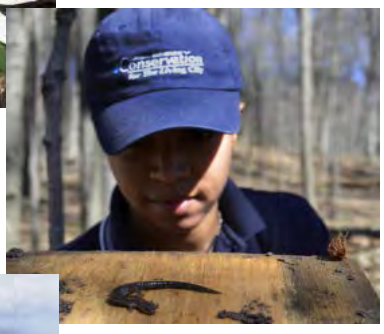
Toronto and Region Conservation for The Living City

2012

Watershed Monitoring and Reporting Progress Report



Watershed Monitoring and Reporting Section
Ecology Division

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1 Introduction

"One of the major challenges of our generation is balancing the growth and development associated with our increasing population with the necessity to protect and maintain natural systems that provide numerous ecological services." (Wallace *et al*., 2013)

Aquatic and terrestrial ecosystems that support diverse communities of plants and animals are considered to be healthier and more resilient to both natural and human induced stressors (e.g. chemical spills, floods, invasive species, land use change, climate change). Gauging the status of our aquatic and terrestrial habitats and the flora and fauna that they support is an important step towards understanding how successful we are at protecting and managing these ecosystems. Measuring and reporting on the state and health of our watersheds over time offers a way for agencies, regional and local municipalities, community groups, businesses and other stakeholders, to identify when land use practices and/or management strategies, techniques or actions may need to be modified such that negative trends can be reversed or prevented.

The Watershed Monitoring and Reporting (WM&R) section is part of the Ecology division within the Toronto and Region Conservation Authority (TRCA). The mission of the WM&R is to improve the health and sustainability of the Toronto region's watersheds through the collection, analysis and dissemination of scientifically defensible data which is used to guide decision making. Monitoring and reporting on the health and sustainability of our watersheds is achieved through the coordinated effort of various agencies, groups and individuals which are involved in numerous ways in different monitoring programs or sampling projects. These programs and localized projects are critical for the successful tracking of changes in watershed conditions over time at regional, watershed, or local scales. Furthermore, they help identify indicators and drivers of change which contribute to an overall greater understanding of trends. This knowledge can then be shared with others and applied to areas outside of the TRCA's jurisdiction or various other projects.

Going forward, the work conducted by the WM&R section will help contribute to the TRCA's 10-Year Strategic Plan 2013-2023 (in preparation). The collected data and its reporting not only contributes to measuring the performance of our management decisions but also contributes to facilitating a region-wide approach to sustainability while telling the story of the Toronto region and its ecosystem health. The dissemination of this knowledge either through written word, or through verbal communication accelerates innovation and fosters new partnerships which help create communities that promote sustainable citizenship. These communities more fully integrate nature, make use of ecosystem function while promoting sustainability, and help manage regional water resources so that their quality and availability are not hindered for current and future generations.

This report is designed to provide an overview of the activities undertaken by the WM&R section during 2012. The report identifies the types of data available along with highlights from the Regional Watershed Monitoring Program (RWMP) and other projects undertaken by the WM&R section. This information is be used to promote and facilitate additional opportunities for data sharing and collaboration. Due to differences in the timelines and types of analysis, data interpretation and reporting is at varied stages of availability. A detailed list of the various reports and other products that have been developed by WM&R staff is provided in Section 4 of this report. Since the work undertaken by WM&R staff is multi-faceted, a staff directory with

contact information is provided (Section 4). Tables in Appendices A and B provide a summary of the sampling effort undertaken by WM&R staff during 2012 and maps at the end of Section 2 and Section 3 identify sampling locations.

2 Regional Watershed Monitoring Program

Healthy Rivers and Shorelines and *Regional Biodiversity* are key elements of the Toronto and Region Conservation Authority's strategic business plan. The ability to track and report on changes to these elements is vital to the success of an organization that is responsible for watershed planning, management and reporting in the greater Toronto region.

The RWMP is a science based, long-term monitoring initiative developed by the TRCA. Its purpose is to collect aquatic and terrestrial ecosystem data at the watershed and sub-watershed scale, and across the region as a whole. The program provides the data and information that informs the key planning and reporting mechanisms of the TRCA. Since its inception in 2001, the program has enhanced the planning and coordination of monitoring activities, helped standardize protocols, and has filled several key data gaps that were identified. It also facilitates the communication of data availability and data sharing both internally and with external agencies.

The scope of the RWMP focuses on key components of the terrestrial and aquatic ecosystems, including:

- ***Terrestrial Habitat and Species*** - staff and trained volunteers monitor flora and fauna species and biological communities through biological inventories and fixed plot surveys;
- ***Aquatic Habitat and Species*** - including aquatic insects, fish populations, algae, stream temperature and the physical shape of the stream;
- ***Stream Water Quality*** - assesses a variety of water chemistry variables/parameters such as nutrients and metals;
- ***Stream Water Quantity*** - stream gauges and in-stream measurements monitor changes in the water levels of the region's watercourses;
- ***Groundwater Quantity and Quality*** - assessed at a series of wells throughout the region.
- ***Meteorology*** - assesses the contribution of rain and snow to the hydrology of the region; and,

The data collected are shared with partner municipalities and other agencies, and are used for planning, implementation and reporting purposes. Partnerships with academic institutions facilitate achievement of common research objectives as well as data sharing in support of academic study. All elements of the program are designed to provide data sets that allow for interpretation at the watershed and regional scales. In certain circumstances, data can be assessed at the site scale and can be used as a "flag" to identify potential issues or direct additional assessment. Where restoration and recovery plans are implemented, future monitoring will track the progress of such enhancement initiatives.

All program elements are strongly focused on the collection of scientific data. When possible, community outreach and education are incorporated. This is accomplished through the involvement of trained volunteers (e.g. Terrestrial Volunteer Monitoring Program), through partnerships with community groups and other non-governmental organizations, and through special events that demonstrate to or involve the community.

2.1 Terrestrial Habitat and Species

Staff Lead: Sue Hayes

Support Staff: Gavin Miller, Paul Prior, Natasha Gonsalves, Michael King, Rivka Shachak, Derek Tune, Simone Akai and Chana Steinberg

Funding: City of Toronto, Peel Region, Durham Region, York Region and Toronto Remedial Action Plan

Figure 1: Ring-necked duck (*Aythya collaris*) pair spotted at Reesor Rd. and Old Finch Rd.

Background and Significance

The Terrestrial Natural Heritage (TNH) component of the RWMP was established in 2000 and builds on data collected during the preceding 15 years under the Environmentally Significant Areas work. The core focus of the TNH program has been systematic inventories of habitats and species throughout the region. This data informs watershed planning and reporting, land management planning, remedial action planning (RAP), and provides information to partner municipalities and other agencies. Terrestrial data has been key to the development and testing of terrestrial ecosystem modelling and the development of the Terrestrial Natural Heritage System Strategy (TRCA 2007a). Annual data analysis updates the ranking of regional species and vegetation communities of conservation concern, and informs conservation, recovery and site restoration planning activities. In 2008, TRCA implemented terrestrial monitoring at a number of fixed plots throughout the Toronto region. This new component of the program will identify trends in species and vegetation communities that are occurring over time.

Highlights

- Fourteen biological inventory sites that covered approximately 1000 hectares were inventoried for vegetation community, and flora and fauna species. Breeding bird surveys were updated at five inventory sites. As part of the regional fixed monitoring plot program, data was collected at 24 forest vegetation, 29 forest bird, 24 red-backed salamander, 22 wetland vegetation, 24 wetland bird, 20 amphibian and 18 meadow bird plots distributed across the TRCA jurisdiction.

- Clasping-leaved pondweed *(Potamogeton perfoliatus)*, a native aquatic plant thought to be extirpated from the jurisdiction was rediscovered at Peel Tract during botanical surveys. Although it is found in other areas of Ontario, it has not been seen in the Greater Toronto Area (GTA) since 1913.

- A pair of ring-necked ducks summered at the created wetland at Reesor and Old Finch. This species has never been reported as nesting in the TRCA jurisdiction (**Figure 1**). Although no nesting evidence was observed during this period, there is certainly potential for this species to succeed at this location. In fact, this rather small wetland is fast becoming one of the most impressive wetland bird haunts away from the lakeshore. In 2012, there were nesting attempts from both common moorhen (*Gallinula chloropus)* and American coot (*Fulica Americana)* along with successful nestings by at least two pairs of pied-billed grebes (*Podilymbus podiceps)*; and the presence of a lone least bittern (*Ixobrychus exilis)* in the early summer. As long as human disturbance around the edges of the wetland is prohibited, and the negative impact of nesting trumpeter swans can be averted, there is tremendous potential at this site for more nesting success for several native waterfowl species.

- Swamp dewberry *(Rubus hispidus)*, a low growing member of the rose family, was discovered at the edge of a swamp community at Ken Park in Brampton. It is believed that this has been the first observation of this species since the 1950s.

- First known breeding record of Louisiana Waterthrush (*Parkesia motacilla*), a Species at Risk, was observed during breeding bird surveys. A pair of this rare Carolinian species was present throughout the breeding season on one of the TRCA's east-end properties.

- Unfortunately, a very healthy population of the non-native red-eared slider (*Trachemys scipta elegan*), often a released pet, was recorded at Toogood Pond (**Figure 2**). The smaller native painted turtle (*Chrysemys picta*) is persisting at this site but it faces stiff competition from the sliders.

Figure 2: The native painted turtle species (*Chrysemys picta*) outnumbered by the non-native Red-eared slider (*Trachemys scripta elegan*).

- A globally-rare Schweinitz' sedge (*Carex schweinitzii*) (**Figure 3**) and adder's tongue fern (*Ophioglossum pusillum*) were found during a terrestrial inventory at a site near West Goodwood. The adder's tongue fern has not been seen in the TRCA jurisdiction for about 100 years. It is a species found in high-quality fen-like wetlands such as those on the Bruce Peninsula. The Schweinitz' sedge has been found several times over the past 20 years in seepage wetlands, however it is not widespread throughout the jurisdiction and seems to be in localized populations in the northeast part of the jurisdiction.

- An emerging disease *Caliciopsis pinea* canker, has tentatively been identified on white pine (*Pinus strobus*) (**Figure 3**). It was found during forest vegetation plot monitoring visits to the Duffin Heights located in the east end of the TRCA jurisdiction. A variety of pests and diseases such as Gypsy moth (*Lymantria dispar)*, Emerald Ash Borer (*Agrilus planipennis)* and Butternut canker (*Sirococcus clavigignenti-juglandacearum)* are carefully monitored for during annual forest health visits.

Figure 3: Left: Schweinitz' sedge (*Carex schweinitz)* **Right:** Tentatively identified *Caliciopsis pinea* canker observed on White pine (*Pinus strobus*)

2.2 Terrestrial Volunteer Monitoring Program

Staff Lead: Theresa McKenzie

Support Staff: Team of volunteers (132 participants during 2012)

Funding: City of Toronto, Peel Region, Durham Region and York Region

Figure 4: Mink (*Mustela vison*), one of 50 native indicator species. Photo courtesy of Tom Lusk.

Background and Significance

The Terrestrial Volunteer Monitoring Program (TVMP), in operation since 2002, uses trained volunteers to survey 10 hectare fixed sites distributed throughout the region. Volunteers collect data on the presence of a set of 50 native amphibian, mammal (**Figure 4**), bird, plant and lichen indicator species (TRCA 2008). Since 2009, they also conduct two surveys each year to determine the extent of invasion of each site by eight invasive exotic plants (TRCA 2008a). Data are analyzed by TRCA to report on the condition of the terrestrial ecosystem and major habitats of the region, document differences between areas of urbanization, and to monitor change over time.

Highlights

- A total of 448 survey visits were completed across 55 sites.
- The TVM program's 5-year report (TRCA 2008) was cited in the peer reviewed journal, Environmental Management (Furberg & Ban 2012).
- A report on the severity of invasion by eight high priority invasive plant species at TVM sites during 2009-2011 was prepared (TRCA 2012) and presented at the Terrestrial Invasive Plant Species Conference hosted by the Invasive Species Centre in Sault Ste. Marie, Ontario.
- The worst invader, common buckthorn (*Rhamnus cathartica*), was found in 92% of sites. Common buckthorn is a concern because it invades our native forests and grows very densely, crowding out and replacing native trees, and reducing both the light and space available for ground flora. It reduces faunal diversity by reducing suitable habitat for them. No regional species of conservation concern nest in common buckhorn.

- Garlic mustard (*Alliaria petiolata*) which also invades forests was found at 83% of sites. There are few forests in the region that are not impacted by multiple invasive plants.

- The invasive plant monitoring report concluded that the new monitoring approach and protocols were effective in providing good, cost effective information on the severity of invasion by the selected priority species in our region (TRCA 2012). Not surprising was the fact that statistically significant differences were found in the level of invasion by urbanization zone, with natural cover in the urban zone more heavily invaded than that in the rural. The cause of this is the movement of people through natural areas who act as a key mechanism for the dispersal of invasive plant seeds.

2.3 Fish Community Monitoring

Staff Lead: Jeff Vandenberg, Melanie Croft-White, Jan Moryk

Support Staff: Nelson Amaral, Mike Brestansky, Mark Szonda, Samantha Delargy, Samantha Everson, Sarah Irvine, Max Osburn, Ryan Scott, Julie Hennigar, Sarah Scharfenberg, Nicole Thackeray

Funding: City of Toronto, Peel Region, Durham Region, York Region and Toronto Remedial Action Plan

Background and Significance

The aquatic habitat and fish community monitoring component of the RWMP includes fish community and habitat sampling at approximately 150 sites throughout the region. About one-third of these sites are monitored annually, on a three year rotation. Standardized sampling methods are used to allow for the comparison of the fish community with the physical conditions of streams, both spatially and temporally across the jurisdiction.

Highlights

- A total of 48 RWMP sites were sampled in 2012.
- No new invasive fish species were found at RWMP sites monitored in 2012.
- Chinook Salmon (*Oncorhynchus tshawytscha*) were captured in the Duffins Creek watershed at a RWMP site for the first time in all years of RWMP sampling.
- Round Gobies (*Neogobius melanostomus*) were captured at one site in the Carruthers Creek watershed. They have not been previously captured in this watershed during RWMP sampling. These fish were preserved and samples were sent to McMaster University for analysis (see Section 3.7).
- More than 10 years of Fish, Invertebrate, Site, and Habitat (F.I.S.H) data from over 150 sites are now available in an online tool to TRCA staff. The tool, which uses Google Earth as a user platform, allows for quicker data retrieval and geospatial association of site information and other attributes. The tool will be updated as new data become available.

2.4 Surface Water Quality

Staff Lead: Ray Biastoch, Angela Wallace, Nelson Amaral

Support Staff: Michael Brestansky, Mark Szonda, Derek Smith (Wet Weather Flow)

Funding: City of Toronto, Peel Region, Durham Region, York Region and Toronto Remedial Action Plan

Figure 6: TRCA staff collecting water quality samples.

Background and Significance

Since 2002, TRCA has partnered with the Ontario Ministry of the Environment (OMOE) to monitor surface water quality throughout the TRCA's jurisdiction. Surface water quality data is used to help understand the impacts of agricultural and urban areas on the water quality of streams and Lake Ontario. Long-term data is used to infer trends over time which helps us to make informed decisions about managing and protecting our water resources. Surface water monitoring of streams also helps us measure the effectiveness of programs and policies that are designed to protect and restore the quality of our water resources (http://www.ene.gov.on.ca/environment/en/monitoring_and_reporting/provincial_water_quality_monitoring_network/index.htm Accessed 15 March 2013).

Highlights

- Surface water quality samples were collected monthly at 38 RWMP sites (**Figure 6**). The 38 sites were comprised of 13 OMOE Provincial Water Quality Monitoring Network (PWQMN) sites, and 25 TRCA sites. An additional 6 sites were also visited as part of special projects. These included 3 Seaton/Duffins Heights sites and 3 sites within TRCA conservation parks.

- The bi-annual inter-laboratory comparison QA/QC program began in December 2012. The objective of the program is to determine which laboratories produce results consistent with the OMOE laboratory, which processes core RWMP samples. Laboratories use different detection methods, and this program ensures that laboratories contracted to process special project samples will yield results consistent with the OMOE laboratory. In this way, long-term data continuity is ensured and changes to water quality as a result of different laboratory detection methods, rather than stream conditions, are avoided.

- The 2011 Surface Water Quality Summary report was completed in March 2012. Of note was that high concentrations of contaminants continued to be found at areas of concern identified in 2008, 2009, and 2010. Elevated levels of chloride, copper, iron, *Escherichia coli*, phosphorus, and other contaminants are undesirable and detrimental not only in TRCA streams and rivers, but also in Lake Ontario.

2.5 Water Temperature Monitoring

Staff Lead: Melanie Croft-White, Jan Moryk

Support Staff: Michael Brestansky, Mark Szonda

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Funding: City of Toronto, Peel Region, Durham Region, York Region and Toronto Remedial Action Plan

Figure 7: TRCA staff installing a year round water temperature logger attached to a cement block.

Background and Significance

Water temperature data is collected as part of the aquatic monitoring component of the RWMP. Since aquatic organisms are highly dependent on the temperature of the water they inhabit, much of the diversity of aquatic organisms within a stream can be associated with water temperature. Tracking water temperature can also help indicate the influence of groundwater on the watercourse. Coldwater streams are of particular importance since certain fish species such as Brook Trout (*Salvelinus fontinalis*) rely on groundwater upwellings for spawning. In addition, the data collected by the RWMP may be able to show long-term changes in water temperature over time caused by anthropogenic factors such as increased development and land use changes, or climate change.

Highlights

- A total of 67 water temperature loggers were active throughout nine watersheds during 2012.
- A year-round temperature monitoring program began in 2011. The purpose is to fill in data gaps regarding spring, fall, and winter stream temperature conditions. In the fall of 2011, ten temperature loggers were installed as part of a pilot project to test the deployment and functionality of the new loggers throughout the fall and winter season. In the spring of 2012, these loggers were retrieved and data from the loggers was downloaded.
- An additional 10 year-round temperature loggers (total 20), and additional 2 real time loggers (total 4), and an additional 1 wired logger (total 1), were installed in 2012.
- A dataset spanning 12 years of stream temperature monitoring is now available. Analysis of the dataset and trends is currently underway.

2.6 Benthic Invertebrates

Staff Lead: Angela Wallace, Jessica Fang

Support Staff: Ryan Scott, Sarah Scharfenberg, Julie Hennigar, Samantha Delargy, Samantha Everson, Sarah Irvine, Max Osburn, Nicole Thackeray

Funding: City of Toronto, Peel Region, Durham Region, York Region and Toronto Remedial Action Plan

Figure 8: the predacious diving beetle (order Coleoptera) is frequently found in benthic samples although it does not inhabit the benthic substrate of streams.

Background and Significance

The benthic macroinvertebrates (BMI) biomonitoring program started in 2001 and has been used to track changes in aquatic biota and water quality across the TRCA jurisdiction for over 10 years. BMI monitoring is conducted yearly at approximately 150 sites across the TRCA jurisdiction as well as at a number of additional sites for special projects.

There are a wide variety of animals without backbones which inhabit the substrate and sediment of watercourses for at least portion of their lives (**Figure 8**). Those visible without the use of a microscope such as aquatic worms, juvenile insects, snails, etc. are referred to as benthic macroinvertebrates. Organisms in this diverse group have different ecological requirements and different sensitivities to disturbances in their environment: some may be tolerant and others may be intolerant of disturbances, environmental change, and poor water quality. BMI tend to be sedentary with short life cycles and therefore reflect the environmental conditions at that particular location. Additionally, the relatively high abundance of BMI and the low cost of equipment to collect them make BMI ideal organisms for biomonitoring purposes.

Highlights

- A total of 143 RWMP sites were sampled in 2012.
- Identification of BMI samples collected in 2011 to the lowest practical level (LPL; usually genus/species) has been started with an expected completion date of April 2013. It is anticipated that the 2012 BMI samples will be completed by summer 2013. The TRCA is a provincial leader in identifying BMI to LPL, and it is expected that the ecological information provided by LPL identification will improve the RWMP's reporting to decision makers due to the increase in the ability to detect and track changes in its watersheds.

- Field work for a comparison study to compare TRCA's current BMI sampling method and the Ontario Benthos Biomonitoring Network (OBBN) method was completed. The OBBN method is the standard protocol adopted by the Province of Ontario years. The OBBN program began after the RWMP BMI program was started. Sampling, using both methods, occurred at 30 randomly selected RWMP. These samples have been identified to the LPL. The analysis, which is expected to be completed in 2013, will be used to help decide whether to continue with the TRCA method or to switch to OBBN. If the switch to OBBN methods is possible, the advantages are that RWMP data will be compatible on a provincial scale, while the integrity and continuity of the RWMP long-term dataset is maintained.

- More than 10 years of fish, invertebrate, site, and habitat data from over 150 sites are now available in Google Earth to WM&R and other TRCA staff. This data discovery tool contributes to the mission, objectives, and strategies of the WM&R business plan through improved communication, presentation, dissemination, and accessibility of RWMP data. The principal advantages to using Google Earth for this application are: small files that can be emailed, sites and associated data that can be quickly located, accessed retrieved, and copied into other software for further analysis. It also enables the use of Google Earth functions such as searching by address, intersection, or landmark feature; and choosing map, satellite imagery, or street view background in order to better assess once are of interest.

2.7 Fluvial Geomorphology

Staff Lead: Nelson Amaral

Support Staff: Mike Brestansky, Mark Szonda

Funding: City of Toronto, Peel Region, Durham Region, York Region and Toronto Remedial Action Plan

Figure 9: TRCA staff measuring the "control" cross-section of a stream at a RWMP site.

Background and Significance

A total of 150 fluvial geomorphology sites were established throughout the nine watersheds in the TRCA jurisdiction between 2001 and 2003. Detailed geomorphic data was collected at each site in order to quantify and characterize the channel dimensions along with various bed and bank properties. Fluvial geomorphology measures the physical characteristics of the stream channels and strives to understand how the natural setting and human land use in a watershed determine the shape of watercourses. It also attempts to predict the physical changes that will occur to a stream channel in response to alterations in watershed conditions, and how these changes will impact human infrastructure and aquatic habitat. The adjustment of watercourses to changes in the environment may take thousands of years (e.g. in response to de-glaciation) but channel modifications may occur in less than a decade, as is frequently the case with direct human activity in a watershed. Understanding how these processes, both natural and anthropogenic, operating at different time scales, alter the width, depth, and platform of a channel is critical for identifying areas in a river system that may be prone to erosion, flooding, or other problems.

Highlights

- In 2012, a total of 50 RWMP geomorphic stations in 3 watersheds (Duffins Creek, Petticoat Creek and Carruthers Creek) were sampled. In addition, station GR-12 was surveyed in 2012 because a large beaver dam restricted access to the site in 2011. Monitoring efforts include: re-evaluating channel stability through stability indexes, re-measuring channel dimensions along an established "control" cross-section (**Figure 9**) reassessing particle size distribution, and re-measuring bed chains and erosion pins in streambeds and banks. Geomorphic stability indices such as the Rapid Geomorphic Index (RGA) were also calculated for each site.

- A decade of geomorphic data has now been collected for each of TRCA's nine watersheds. RWMP can now begin to compare the data collected over the past decade to show any large-scale changes in the stream channels on the watershed scale.

2.8 West Nile Virus Vector Monitoring

Staff Lead: Jessica Fang

Support Staff: Sarah Scharfenberg

Funding: City of Toronto, Durham Region, Peel Region, and York Region

Figure 10: TRCA staff collecting mosquito larva.

Background and Significance

West Nile virus (WNV) is primarily an avian pathogen that first appeared in Ontario in 2001. The disease is transmitted to humans by mosquitoes that become infected by feeding on infected birds. Two key mosquito species, *Culex pipiens* and *Culex restuans*, are the primary species responsible for spreading the disease to humans in Ontario. From 2003 to 2010, number of human WNV cases has declined. However, in 2011 and 2012, the number of human WNV cases in Ontario rose to 64 and 259 cases, respectively. (Public Health Agency of Canada 2012. <*www.phac-aspc.gc.ca/index-eng.php*>).

As a major owner of natural lands, including substantial wetland areas, the TRCA has had an interest in the WNV issue. As a measure of due diligence and at the request of regional health units, TRCA has been monitoring larval mosquito populations in TRCA's natural wetlands and selected stormwater management ponds (SWMPs) since 2003. The core objectives of the WNV Monitoring and Surveillance Program are to:

- assess abundance of mosquito larvae in TRCA wetlands and select SWMPs,
- collaborate with the Regional Public Health Units,
- investigate standing water complaints associated with TRCA properties,
- educate the public, and
- take proactive management measurements to reduce risk of WNV transmission when warranted.

Highlights

- In 2012, monitoring began on May 14th and ended on August 17th. A total of 44 sites were monitored across TRCA's jurisdiction, including 38 wetlands and 6 SWMPs. Each site was visited four times at approximately three-week intervals (**Figure 10**).

- TRCA used the data collected in 2012 to determine vector mosquito hotspots, WNV vector and non-vector species composition and abundance at complaint sites, and to generate the Annual Report: *West Nile Virus Vector Mosquito Larval Monitoring and Surveillance – 2012*. Available on www.trca.on.ca; key word: West Nile Virus.

- The sampling season in 2012 yielded 6358 mosquito larvae from wetlands and 1317 mosquito larvae from SWMPs. As in previous years, the wetland habitats sampled supported a greater diversity of the mosquito population with 10 different mosquito species being found in wetlands while only 6 species were found in SWMPs.

- Among the wetland sites, 44% of the larvae collected were non-vector species, while the remaining 56% were vectors. The predominant non-vector species was *Culex territans (*44%), and the predominant vector species was *Culex pipiens* (39%). Among the SWMPs sites, vector species comprised 94% of the mosquito population. C*ulex pipiens* which represented 90% of the mosquito larvae collected was the predominant vector species found in SWMPs. *Culex territans*, the only non-vector species found in the SWMPs, comprised 6% of the mosquito community.

- From 2003 to 2010, the numbers of human WNV cases have declined in Ontario. However, in 2011 and 2012, the number of human WNV cases in Ontario rose to 64 and 259, respectively. Within the TRCA jurisdiction, there were 134 reported human WNV cases in 2012: 91 cases in the City of Toronto, 20 cases in Peel Region, 16 cases in York Region, and 7 cases in Durham Region. These reported numbers of human WNV cases in 2012 were the second highest since the discovery of the virus in 2002. TRCA's monitoring data had shown that the numbers of human WNV cases in Ontario is positively correlated with number of *Culex pipiens* larvae collected in a given year.

- An exceptionally high number of *Culex pipiens* were collected at Grenadier Pond in High Park. In total, 1207 *Culex pipiens* larvae were collected at this one site; this was 53% of *Culex pipiens* in all wetlands combined.

- WNV risk assessment resulted in three wetlands and one SWMP being identified as WNV vector larvae hotspots. These sites were Grenadier Pond in High Park, Topham Pond, Albion Hill Pond 2, and L'Amoreaux Park North Pond. Larvicide treatments were applied to all of these hotspots.

2.9 Groundwater Quality and Quantity

Staff Lead: Jeff Vandenberg

Support Staff: Don Ford, Jehan Zeb, Andrew Taylor, Michael Brestansky, Mark Szonda.

Funding: Ministry of the Environment and TRCA

Figure 11: TRCA staff checking equipment at a groundwater well monitoring site.

Background and Significance

Approximately three million residents in Ontario rely on groundwater from municipal and private wells as their primary source of drinking water. Many communities are dependent on groundwater supplies to maintain existing domestic, commercial, industrial, agricultural and institutional operations. The increasing demand for groundwater in Ontario is elevating the stress placed on this vital resource through overdrawing and contamination.

The Provincial Groundwater Monitoring Network (PGMN) was established in order to assess current groundwater conditions and provide an early warning system for changes in water levels and water quality. A partnership was formed between the OMOE and Conservation Authorities to efficiently utilize staff and resources. The MOE's role in the network is to set policy direction, strategic objectives and maintain the Provincial Groundwater Monitoring Information System (PGMIS) database for the program. As a program partner, the mandate of the TRCA is to maintain the telemetry systems, collect water level data, and collect and arrange for chemical analysis of water quality samples at dedicated wells on an ongoing basis.

Highlights

- In 2012, a total of 16 sites were sampled (**Figure 11**). A full report on Groundwater Quality will be produced later in 2013.

- One well in the network at the Kortright Center was decommissioned in 2011, due to a broken well casing. In 2012, a newly constructed well at the Kortright Center replaced the decommissioned well and was added to the PGMN network.

- The PGMN telemetry system was originally configured as an analog system, with 18 sites in TRCA's jurisdiction having telemetry installed. The phone company, which had been moving away from analog signals to digital, discontinued the analog system entirely as of December 2008. Because of this change, additional site visits were necessary to download data manually. To date the OMOE has been purchasing new digital telemetry equipment as funding becomes available. TRCA has equipped 17 sites with telemetry and is scheduled to install telemetry at the newly constructed Kortright Center well in early 2013. Additional sites are expected to be upgraded to the digital system as funding becomes available.

- During 2010, the OMOE wanted to address the problem of logger slippage as part of the recommendations for the PGMN program. When loggers were being removed from the well during downloading or maintenance it was noted that slight changes in depth were occurring which was affecting depth readings over time. To prevent logger slippage, TRCA started installing downrigger cables of a specified length to each logger where this slippage was likely to occur. These installations were started in 2010, and carried on into 2012 with the newly constructed well at the Kortright Center being equipped. To date, TRCA has equipped 16 sites with downrigger cables.

2.10 Water Quantity - Stream Flow, Precipitation and Snow Course

Staff Lead: Derek Smith

Support Staff: Bill Kerr, Craig Mitchell, Lisa Moore, Jamie Duncan, Rita Lucero, Matt Derro, Paul Greck, Greg Dillane, Leland Wilbur

Funding: City of Toronto, Peel Region, Durham Region, York Region and Toronto Remedial Action Plan

Figure 12: TRCA technician conducting flow metering using Area-Velocity Method

Background and Significance

One of the indicators monitored under the RWMP is water quantity which includes stream flow, rainfall, and snowfall. Stream flow data has been collected in TRCA's jurisdiction for over 50 years and was originally implemented by the federal government to meet its international obligations related to the Great Lakes. Today, the TRCA has installed numerous stream gauges as part of the RWMP and Flood Management Services (FMS). Typically, the data is used for stormwater management, water budget development, flood control structure operation and flood warning, infrastructure modeling, and land use effect models to watercourses.

Similarly, precipitation gauges are widely used to document storm flows, annual discharges, and for flood forecasting. The data is regularly found in road and sewer design details, water balance and flood models, water quality/quantity reports, and emergency bulletins. In Toronto and the surrounding area there are over 100 rain gauges which are owned and operated by all levels of government, educational institutions, and the private sector, of that total, the TRCA has 33 gauges. Stations in this network were strategically located in order to provide good coverage of TRCA's jurisdiction and all of its watersheds. Originally conceptualized for flood warning purposes, it has evolved into a regional database regularly utilized by numerous organizations and the TRCA.

Unlike the stream and precipitation networks, which are fully automated, the TRCA manually monitors snow accumulation at ten locations in order to determine the antecedent condition of the watershed prior to the spring thaw. The stations were selected to provide a jurisdictional assessment of snow characteristics including: snow depth, water equivalent, snow density, snow crust, and underlying soil attributes (e.g. frozen). The data is submitted to the Ministry of Natural Resources (MNR) and TRCA flood duty officers bi-weekly in order to assess the snow melt flood threat in our watersheds.

Highlights

- In 2012, water flow and level data was collected at 37 TRCA stream gauges where data is continually recorded every 10 or 15 minutes (**Figure 13**). Annually, each station is serviced by flushing wells, surveying benchmarks, and sensor calibrations, while monthly they are downloaded, maintained (e.g. desiccant replacement), level is verified, data is corrected and stage-discharge curves are applied. Furthermore, stage-discharge measurements are conducted throughout the year where curves are either verified or generated depending on the hydraulic conditions. Of the 37 TRCA stream gauges, 16 stations are part of the TRCA Real Time (RT) Flood Warning Network, of which four are used to observe dam reservoir storage (**Figure 14**).

Figure 13: Various "stand-alone", non-real time stream gauges. From left to right, West Duffins Creek, Taylor Massey Creek South, and Plunkett Creek.

Figure 14: Various RT stream gauge stations (from left) Taylor Massey Creek, McFall Dam, and the real-time gauging home page.

- TRCA also conducts manual snow course measurements at ten stations across the jurisdiction

- Updates/modifications to the stream and precipitation gauge networks in 2012 included the following; 1) G. Ross Lord Dam rain gauge was relocated to improve catch efficiency by eliminating wind influence. 2) Numerous stream gauges were upgraded with new equipment ultimately standardizing all stand alone stream gauges. The transition has increased network maintenance efficiency and homogenizes data collection and QA/QC efforts.

- In 2012, TRCA hydrometrics staff completed intensive job shadowing with OHS in anticipation of transferring all OHS duties to TRCA's FMS group. Starting January 2013, all stream gauge network operations will be conducted by TRCA staff.

- Water quantity data collected by the TRCA's stream and precipitation gauging stations are being used for the City of Toronto's Wet Weather Flow Monitoring study. In addition, numerous requests for TRCA hydrometric data have been made by various government and non-government agencies, educational institutions, and the public.

- The TRCA installed several stream gauges for the Credit Valley Conservation Authority (CVC) and Water Survey of Canada (WSC) on both Duffins Creek and the Credit River. The new stations are part of both the CVC's and WSC's real-time gauging initiatives.

- In 2010, fisheries staff identified the need for real-time water temperature data to assist them with directing field activities and simplify data collection. With installations already at Todmorden and McFall Dam stream gauges, the RT temperature network was further expanded with sensors installed at Krosno Creek, West Humber at Highway 7, and Taylor Massey Creek North in 2012.

- Precipitation data was collected from 33 stations (**Figure 15**). The precipitation network consists of 29 three-season tipping bucket gauges and four, four-season gauges (three weigh gauges and one "heated" tipping bucket) (**Figure 15**). Of the 33 stations, 13 are telemetered; with 8 being a part of the TRCA RT gauging network (**Figure 14**).

Figure 15: Various precipitation gauges. From left to right: 3-season "stand-alone" rain gauge, a 4-season RT weight gauge with windscreen, and a 4-season heated rain gauge.

- In the summer of 2012, the TRCA acquired an acoustic Doppler current profiler (ADCP) flow monitoring system to be used in the development of watercourse stage-discharge relationships during high flow periods. The device ultimately improves technician safety and increases measurement turn-around time by over 75% when compared to traditional methods. Since its acquisition, the device has added as much as two meters to several stream gauge maximums. This type of metering success will be crucial for future flood management decision making (**Figure 16**)

Figure 16: TRCA FMS technician using an Acoustic Doppler Current Profiler from a bridge.

2.11 Water Quantity - Baseflow

Staff Lead: Leland Wilbur

Support Staff: Ian Hay, Greg Dillane, Derek Smith, Rita Lucero, and Jamie Duncan

Funding: City of Toronto, Peel Region, Durham Region, York Region and Toronto Remedial Action Plan

Figure 17: TRCA staff measuring baseflow and active channel width.

Background and Significance

The main purpose of the Low Flow Program is to develop data that allows for a better understanding of the interconnections between the groundwater and surface water systems. The program also helps to establish contacts and relationships with water users as a basis for promoting awareness and stewardship activities. The long term goal of the TRCA Low Flow Program is to guide the management and protection of baseflow levels to protect aquatic life and sustainable human use of surface water.

Baseflow conditions represent the lowest stream flows that typically occur in a watercourse, and are usually supplied primarily by groundwater discharge occurring along the stream corridor and the gradual release of water from wetlands. The term low flow refers to the amount of stream flow that is sustained in a watercourse during extended periods of dry weather. In the case of the TRCA Low Flow Monitoring Program, low flow conditions occur in the drier summer season between June and September. The TRCA Low Flow Monitoring Program was established in 2000 and conducts ongoing jurisdictional monitoring of low flows during the drier summer season and is an important contribution to the Regional Watershed Monitoring Program (RWMP). The program consists of more than 1100 individual monitoring stations, with ongoing summer monthly monitoring occurring at an average of 68 stations per year. These 68 stations are called “Indicator Stations” and are usually located at the outflow of each major sub-watershed. The other stations are more intensely distributed within each watershed and are measured systematically every five to seven years in order to obtain provide a higher resolution of ground and surface water interactions.

Highlights

- Fieldwork for 2012 focused on the Humber River watershed. A total of 136 transect measurements were conducted across all watersheds, which included all of the 68 indicator stations. Some sites were measured more than once due to special circumstances. The measurements were conducted from the start of June to the end of August with the help of a summer student (**Figure 17**).

- The Humber River watershed was gauged in detail in 2012. Over 90 different measurements, including two complete sets of measurements at all of the 25 different indicator sites was completed. The remaining watersheds were all gauged at the indicator sites as well.

- The spring and winter months of 2012 saw roughly 60% of normal precipitation amounts which resulted in generally lower baseflows through the summer months. Areas of the West Humber, which has little hydraulic connection with the Oak Ridges Moraine, ran completely dry in the summer months.

- Baseflows in 2012 were generally 10% below recent years across all of the watersheds. The biggest exception was the Carruthers Creek watershed which was about 30% higher than historical averages.

- TRCA watersheds were under Level 1 Low Water Conditions in May and July of 2012. During these Level 1 Conditions, the TRCA released media advisories on its website to strongly encourage individuals to conserve water in order to achieve a reduction of 10% overall water usage. This would assist in minimizing the impacts of low water on the aquatic ecosystem.

2.12 Meteorological Monitoring

Staff Lead: Derek Smith

Support Staff: Craig Mitchell, Bill Kerr, Rita Lucero, Jamie Duncan, Leland Wilbur, and Greg Dillane

Funding: City of Toronto, Peel Region, Durham Region and York Region

Figure 18: TRCA staff involved in meteorological monitoring.

Background and Significance

The TRCA identified Climate Change as an important issue related to its watershed management mandate in the mid 1990's. While it is well known that urbanization has an impact on natural systems, the additional stress of climate change will serve to further modify our natural systems and create new or increased challenges to the TRCA's management objectives (Haley 2006). For example, early attempts to deal with increased volumes of water in waterways were centered on stormwater management by reducing peak flow to match pre-development conditions. While this practice is now commonplace, urban infrastructure falls short of dealing with extreme weather such as rainfall greater than a 100 year storm (Haley 2006).

Conservation Authorities are in a unique position to be able to deal with climate change from both an adaptive and mitigation perspective since we are strategically placed to provide our clients with effective direction and input around managing local ecosystems under the challenges that climate change can create (Haley 2006). TRCA partners continue to rely on our data collection services and monitoring expertise to provide them with as much information regarding their watersheds as possible. This, in context with the TRCA's FMS, infrastructure/water budget modelling, and natural heritage needs lead to the development of the TRCA's meteorological (MET) network. Currently, the MET network consists of a variety of sensory devices including generic climate stations, evaporation pans, air temperature stations, and speciality instrumentation (designed by York University).

Highlights

- All MET stations continued to operate normally in 2012. Currently, the TRCA has six MET stations, two evaporation pans, and eight air temperature stations deployed (Figure **19**). Monitored parameters include: rainfall, wind direction and speed, air and soil temperature, relative humidity, solar radiation, snow depth, barometric pressure, soil moisture, evaporation, evapotranspiration (ET) and leaf wetness. Similar to our water quantity monitoring, the MET network is designed for remote operations and long-term deployment (>15 years). Construction of the TRCA MET network began in the spring of 2006 with the acquisition of two MET stations from Natural Resources Canada (NRC) and one from Guelph University. Since that time, partnerships with both Guelph and York Universities have surfaced where they are investigating evapotranspiration respectively.

Figure 19: Various TRCA MET stations, pictured from left to right: Claremont (Transport Canada), evaporation pan (Glen Haffy Conservation Area), and Richmond Hill (16th Ave Fire Hall).

- The Kortright and Downsview ET monitoring stations continue to operate normally and are maintained by York University (Figure **20**).

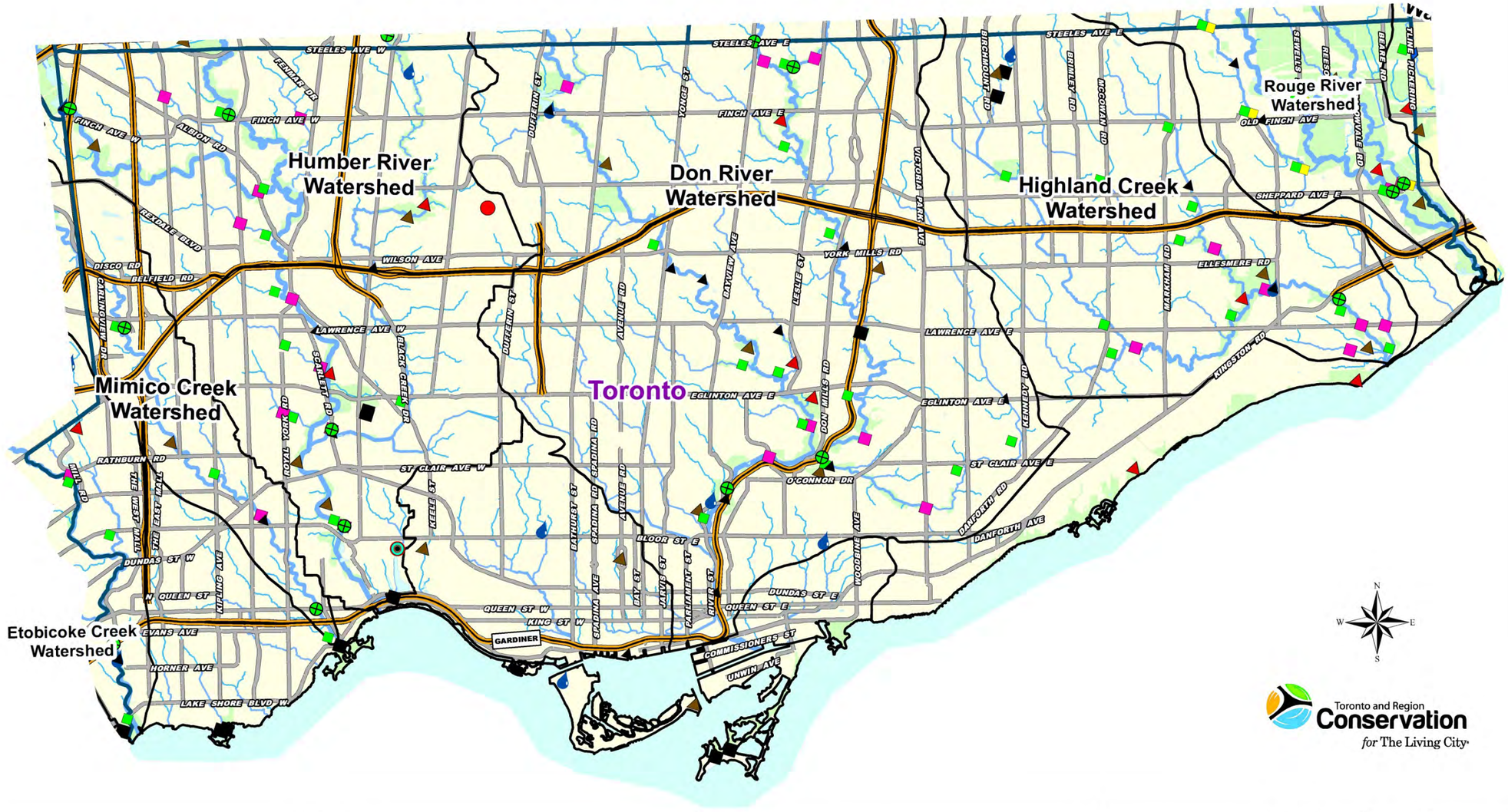
- In 2012 early spring temperatures extended the monitoring season by over a month and activities were able to start as early as March. Data QA/QC and processing is now complete up to November 2012 and will be uploaded to TRCA's Envirobase database.

- Continued air temperature monitoring for TRCA aquatic biology program in 2012. Since 2005, eight air temperature stations were also deployed with the intent to correlate air temperature fluctuations with tributary water temperatures. The sensors have been recording data every five minutes and operate year round.

Figure 20: Automated Bowen Ratio Energy Balance system used to determine “actual” evapotranspiration values, located at Kortright Conservation Area (left) and Downsview Park (right).

Toronto & Region Conservation Authority

City of Toronto Monitoring Locations



Toronto and Region Conservation for The Living City

Legend

- Stream Water Quality
- Groundwater_Well
- Groundwater Quality Monitoring
- Fluvial Geomorphology
- Stream Gauges
- Precipitation Gauges
- BMI Monitoring
- Aquatic Species & Habitat
- Baseflow Monitoring Site
- Climate Monitoring
- Terrestrial Volunteer Monitoring
- Terrestrial Fixed Plots
- West Nile Virus Monitoring
- Municipal Boundary
- Highway
- Major Road
- Waterbodies
- Watercourse
- TRCA Property
- Watershed Boundary

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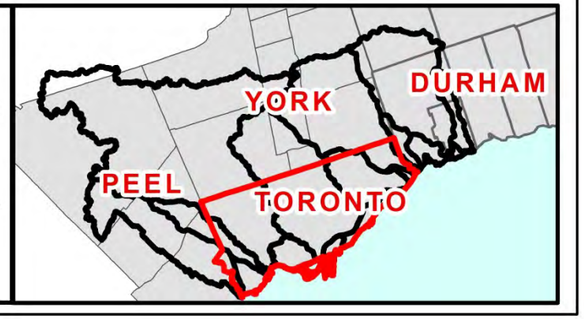

Toronto & Region Conservation Authority

Peel Region Monitoring Locations

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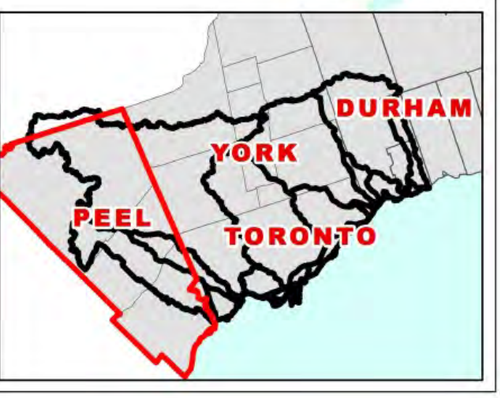

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Toronto & Region Conservation Authority

York Region Monitoring Locations

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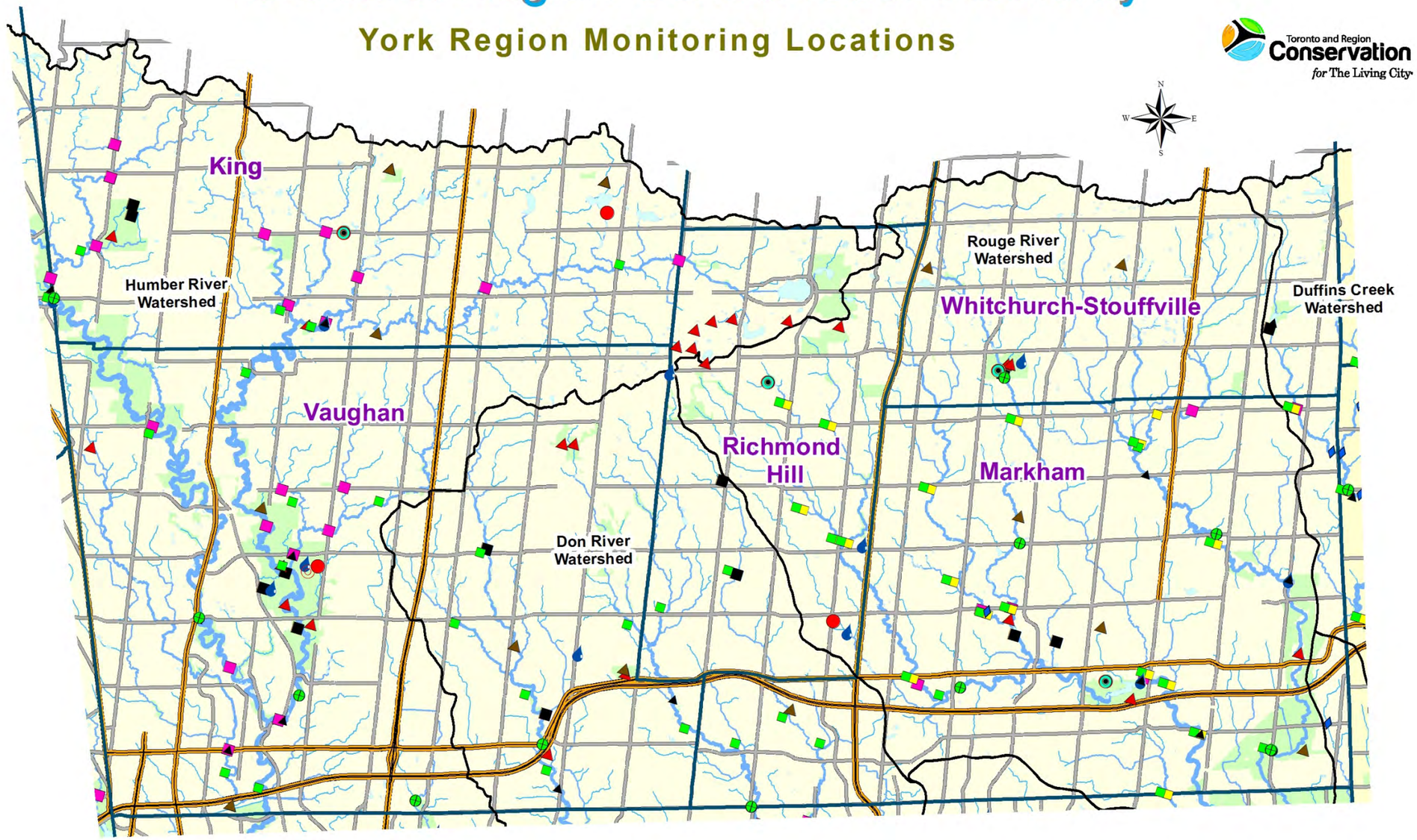

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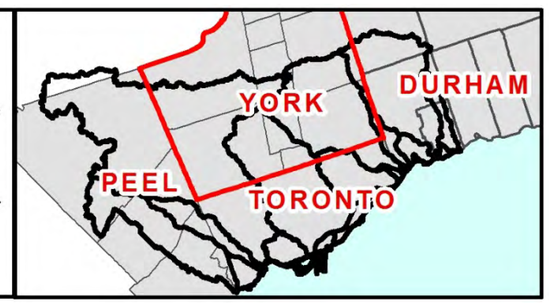
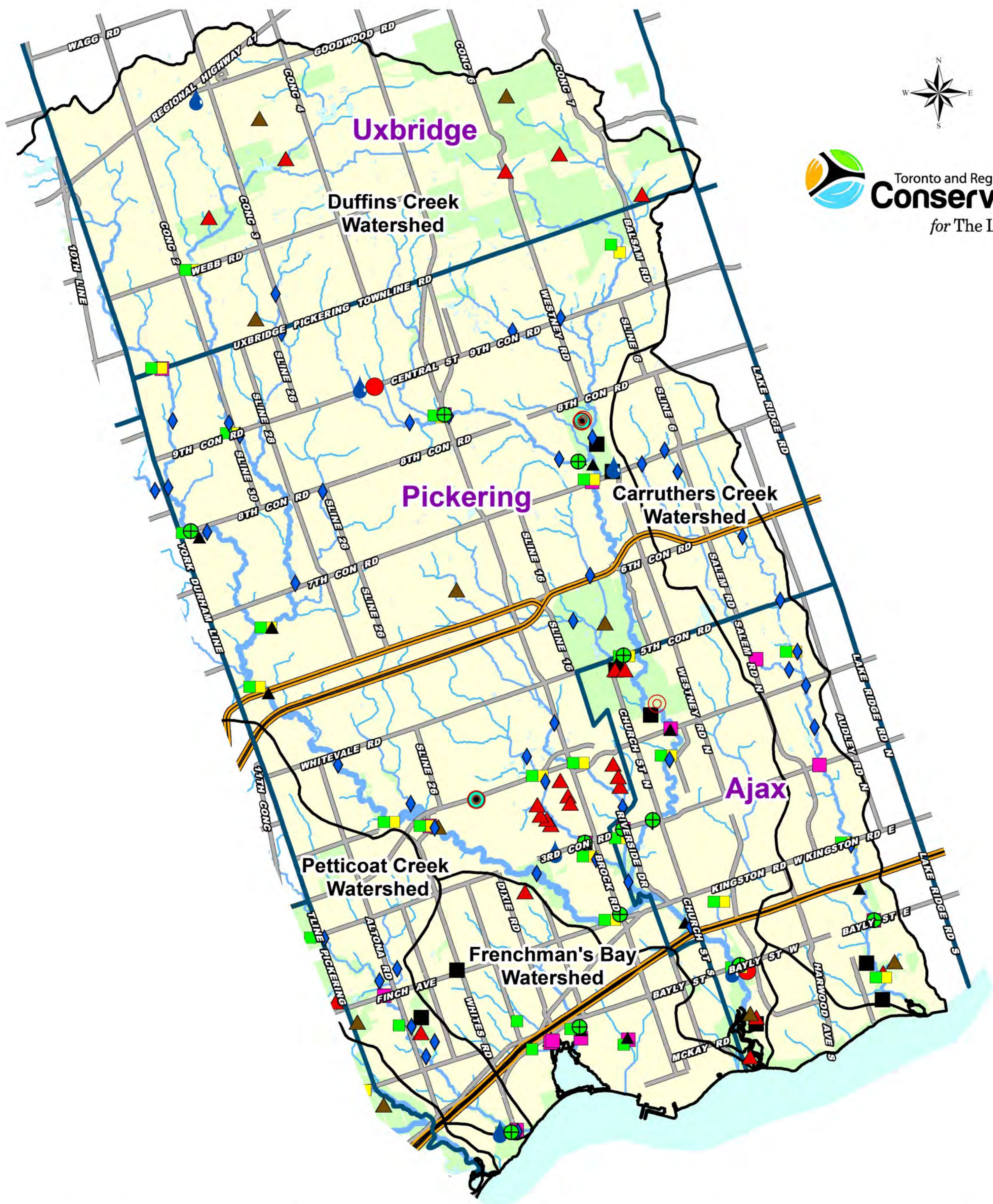


Toronto & Region Conservation Authority

Durham Region Monitoring Locations



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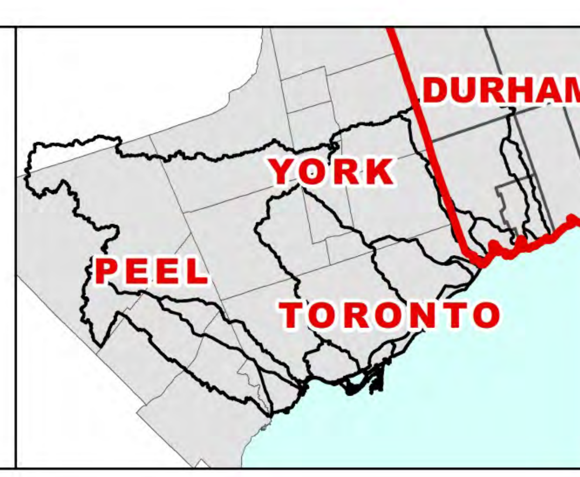

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3 Special Projects

In addition to the RWMP, numerous special projects are undertaken annually by TRCA. These projects employ staff from various sections and divisions within the TRCA in order to address research questions related to restoration and mitigation techniques and to provide valuable baseline information on watershed condition. These projects are often centered around localized issues and are often shorter in duration and narrower in focus compared to the RWMP. Where possible the monitoring for these special projects follows the same sampling methodology and protocols as the RWMP. This consistency in methodology increases efficiency and provides continuity in the data, allowing the data to be easily compared to RWMP monitoring sites. Both data sets are often relied upon for hypothesis testing and trend analysis at various geographical scales. The following sections give a brief overview of each of the special projects that the WM&R section was involved in during 2012. A map outlining monitoring locations of the various described special projects is located at the end of this section,

3.1 Natural Channel Design

Staff Lead: Dean Young

Support Staff: Michael Brestansky, Mark Szonda, Nelson Amaral, Jeff Vandenberg, Julie Hennigar, Glen Geddes, Sarah Gates, Sue Hayes, Paul Prior, Gavin Miller, Natasha Gonsalves, Mike King, Derek Tune, Rivka Shachak, and Simone Akai

Funding: City of Toronto, Peel Region, Durham Region and York Region

Figure 21: NCD site 21 under development.

Background and Significance

Reconstruction of stream channels to restore, rehabilitate or enhance geomorphic and ecological functions is becoming an increasingly common management approach in Canada and internationally, particularly in urban and urbanizing contexts like those that exist in much of the Greater Toronto Area (**Figure 21**). The intent of the natural channel design (NCD) approach is to replicate the channel form that would naturally occur given the hydrologic and sediment regimes of the upstream drainage area, and thus achieve the stability associated with this dynamic equilibrium condition. This approach also intends to recreate self-sustaining in-stream and riparian habitats that exhibit healthy ecological functions, manifested by diverse and productive aquatic and terrestrial communities. Natural channel designs incorporate the characteristics of natural rivers and streams including meandering plan form, bed forms, channel bed and banks constructed of natural materials, bioengineering techniques and native vegetation plantings. Considering the complexity of channel forming processes and the inherent uncertainty associated with approaches to natural channel design, projects are largely experimental with long term outcomes subject to considerable uncertainty. Because of the large uncertainty in predicting river response to intervention, the need for an adaptive approach to river management and design is acknowledged and advocated in Ontario. There is little evidence broadly available regarding the short and long term effectiveness of natural channel designs and therefore a lack of feedback with which to evaluate and improve current practices.

To address the general lack of systematic evaluations of the effectiveness of NCD projects in Ontario, the Toronto and Region Conservation Authority (TRCA) initiated development of a program to monitor and evaluate completed projects in the Greater Toronto Area watersheds in 2005. The first project undertaken as part of the Natural Channel Design Monitoring Program involved identifying a suite of monitoring parameters and data collection methods and frequencies suitable for evaluating whether or not the original design objectives of new or recently completed NCD projects are being met. The monitoring protocol titled, “Evaluating the Effectiveness of Natural Channel Design Projects: A Protocol for Monitoring Natural Channel Design Projects” (TRCA, 2009a), was developed based on an extensive literature review and input from

experienced practitioners of natural channel design and watershed monitoring (TRCA, 2009b). The second project of the Natural Channel Design Monitoring Program, initiated in 2005 and continuing to 2014, involves monitoring and evaluation of a number of completed NCD projects in the TRCA jurisdiction. The project scope included periodic monitoring and evaluation of 30 NCD project sites over a ten (10) year timeframe between 2005 and 2014. The ten year timeframe of the evaluations was set with the intent of examining the information produced at a midway point in implementation of the project to provide an opportunity to make adjustments to the study design or monitoring protocols being applied if necessary. Monitoring parameters assessed included;

- Geomorphic characteristics (cross-sections, longitudinal profiles, bank and substrate character., erosion pins);
- Engineered elements (functioning of riffles, pools, vanes, bioengineering, mitigation of fish barriers, etc.);
- Aquatic habitat and communities (fish and benthic invertebrates)
- Riparian vegetation communities (ELC vegetation type and regional species of concern inventories, including invasive species) and
- Amphibians and breeding bird surveys.

Highlights

- In 2012, four Natural Channel Design (NCD) geomorphic stations, one located in the Don River and three located in the Rouge River were setup and sampled. All sites scheduled for geomorphic surveying in 2012 were completed.

- In 2012, six NCD sites were re-surveyed for breeding fauna (breeding birds and amphibians), two were re-surveyed for both fauna and vegetation and one new site was surveyed for the first time (both fauna and vegetation). Please refer to the Natural Channel Design Terrestrial Monitoring Methodology for more information (TRCA 2009).

- A new species of land snail was found during routine biological inventories at an NCD site in Brampton – *Helix lucorum.* It is believed to be introduced from Eastern Europe where it's eaten as escargot. This is believed to be the first occurrence in North America.

- Six NCD sites were surveyed/sampled for aquatic habitat, fish and benthic macroinvertebrates in 2012. The fish sampling in particular is being used to evaluate the effectiveness of the natural channel designs to restore or improve fish habitat, in comparison to an untreated reach directly upstream or downstream of the treated site.

3.2 Caledon East

Staff Lead: Christine Tu-Parker, Jan Moryk, Sharon Lingertat, Don Ford

Support Staff: Michael Brestansky, Mark Szonda, Jehan Zeb

Funding: Region of Peel

Figure 22: Brook Trout during fall spawning season in Boyce's Creek.

Background and Significance

To address growth planning within Caledon East (CE), the Region of Peel (the Region) completed a Class Environmental Assessment (EA) in November 2007. The EA included assessing implications to the natural system due to water taking increases from existing water supply wells. Extending from this assessment, the Region together with TRCA have coordinated annual monitoring and review efforts since 2007 as per the Natural Heritage Monitoring Program (NHMP). The NHMP was developed by TRCA on behalf of the Region and is part of a larger Environmental Management Plan for the Caledon East Existing Water Supply System to further mitigate the effects of water taking and to accurately identify areas where adaptive management may be required. The NHMP undertaken by TRCA for Caledon East includes three monitoring tasks: 1) biological monitoring of the fish community, 2) trout spawning activity and 3) seepage meter data collection.

Highlights

- Since the NHMP's inception, annual fish community monitoring has been completed in two creeks draining Caledon (Centerville Creek and Boyce's Creek) during August. During 2012, fish community sampling was also done in the spring in order to assess Brook Trout (*Salvelinus fontinalis*) hatching success.

- Annual fish spawning surveys (**Figure 22**) were completed in both creeks. The purpose of these surveys is to quantify the amount of Brook Trout spawning redds which is used as a measure of spawning magnitude. Between the end of September and early November of 2012, several redds were identified in both creeks indicating the occurrence of spawning.

- The second year of TRCA groundwater seepage meter monitoring was completed. An analysis of data revealed high variance amongst and within seepage meter sites. A decision was made to remove the seepage meters in 2013.

- The 2012 technical brief was completed. The report synthesizes and interprets groundwater, flow, stream temperature and biological data as they may relate to water takings and the health of fish and fish habitat. This report also discussed the data in context with silt spills which occurred in 2011 and 2012 in Boyce's Creek. Analysis of data revealed a decrease in Brook Trout abundance, an increase in Brook Trout weight and length, an increase in stream temperatures, and an increase in groundwater pumping rates. Currently, the influence of pumping on stream temperatures is unclear as pumping rates and stream temperatures have not been compared directly.

- Data collected by consultants for the Region of Peel is also annually reviewed and commented upon by TRCA staff. Comments are sent back to the region for consideration.

3.3 Nobleton Phosphorus Offset

Staff Lead: Angela Wallace

Support Staff: Nelson Amaral, Michael Brestansky, Mark Szonda

Funding: York Region

Figure 23: Staff collecting surface water quality samples in one of the local creek in the township of Nobleton.

Background and Significance

This project was initiated to monitor surface water quality before, during, and after septic tank decommissioning in the Township of Nobleton. Local creeks in the core of Nobleton showed a combination of high phosphorus, ammonia, nitrate and *E.coli* counts, consistent with failing septic systems. A new water pollution control plant (WPCP) was built to service the Village of Nobleton in York Region. The WPCP was completed in November 2009 and began treating water in June 2012. The new WPCP was designed to reduce contaminant load (phosphorus, *E. coli*) to local waterways from leaky septic systems. Septic tanks are currently being decommissioned and sewage is being routed to the new WPCP. As of March 2012, there were 210 connections to the new sewer system with approximately 94 septic systems completely decommissioned. This is approximately 12% of the total number of septic systems to be decommissioned. Decommissioning of all septic tanks is scheduled to be completed by the end of 2014.

TRCA, on behalf of York Region, has been conducting a surface water monitoring program to track the effectiveness of the septic tank decommissioning to reduce the contaminant load to local waterways. TRCA has completed the surface water quality monitoring from 2009 to 2012 and is scheduled to continue the monitoring during decommissioning and for one year after the completion of decommissioning.

Highlights

- Baseline sampling (prior to septic tank decommissioning) indicated that phosphorous, ammonia and bacteria were all elevated in the streams downstream of the older residential area of Nobleton.
- Six samples were collected in 2012 as part of the decommissioning phase (**Figure 23**).
- Sampling will continue to be collected on a bi-monthly basis during the decommissioning phase (2013-2014); samples will be collected for at least one year after decommissioning is complete (~2015).
- A report summarizing the progress was produced in 2012. (TRCA 2012).

3.4 South-central Ontario Reference Conditions/Biocriteria Project

Staff Lead: Angela Wallace

Support Staff: Michael Brestansky, Mark Szonda, Jessica Fang

Funding: RWMP

Background and Significance

Presently, there is very little information about what constitutes a "normal" southern Ontario benthic stream community. The purpose of the Reference Conditions/Biocriteria Project is to describe normal ranges of biological condition for streams in southern Ontario's many different physiographic regions. Once this has been done, biocriteria (numerical pass-fail thresholds) for a variety of indices can be derived. Several groups (e.g. OMOE, various Conservation Authorities) are participating in the collection of benthic invertebrate and water quality samples across southern Ontario. The collaborative study hopes to collect almost 500 samples over a five year period. Priorities for this year include sampling as many new sites as possible, entering all data into a database and generating interim biocriteria by grouping similar physiographic regions.

Highlights

- WM&R staff have visited 44 sites and sampled 24 sites in 2011/2012.
- The project team has visited over 500 sites; unfortunately, 332 were unsampleable for various reasons (e.g. dry, no permission).
- To date, the collaborative team has collected 140 samples in 2011/2012 and hope to collect an additional 75-100 samples in 2013 (**Figure 24**).

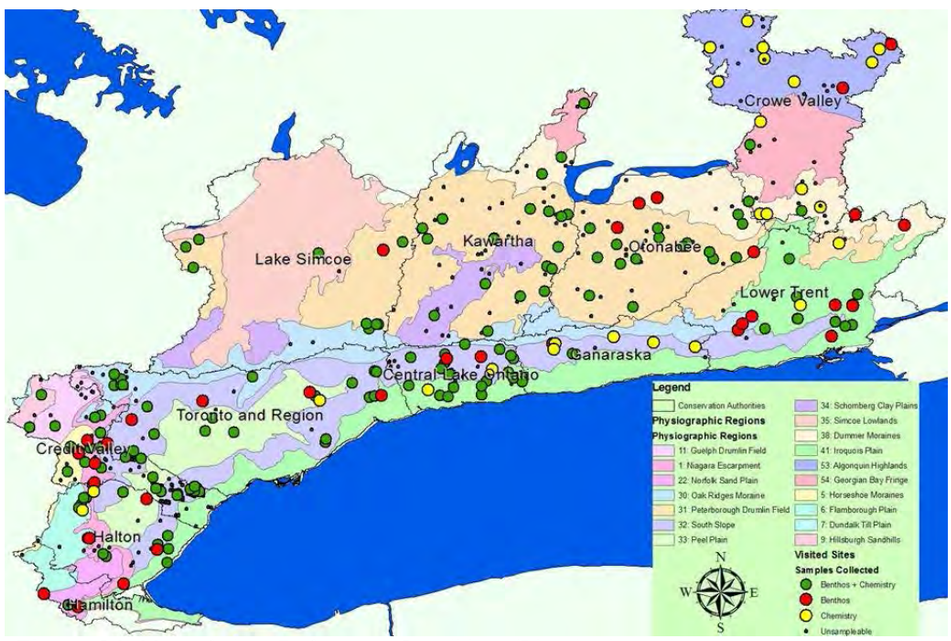


Figure 24: Map of sites Reference Conditions/Biocriteria projects sampling locations.

3.5 Duffin Heights Monitoring Program

Staff Lead: Scott Jarvie

Support Staff: Angela Wallace, Sue Hayes, Michael Brestansky, Mark Szonda, Jessica Fang, Gavin Miller, Natasha Gonsalves, Paul Prior, Mike King, Derek Tune, Rivka Shachak, and Simone Akai

Funding: York Region

Figure 25: TRCA staff collecting samples in Ganatsekiangon creek.

Background and Significance

The Duffin Heights Neighbourhood (DHN) is an approved development area in the City of Pickering. This area is generally located on both sides of Brock Road between Rossland Road and Taunton Road. Construction began in the DHN in 2009. The specific site is bounded by the Canadian Pacific Rail line to the north, the hydro transmission tower line to the south, the municipal boundary with the Town of Ajax to the east, and the Ganatsekiagon Creek (**Figure 25**) to the west.

The objective at the DHN monitoring program is to gather information on the site under pre- and post-development conditions in order to quantify changes in the terrestrial and aquatic flora and fauna communities, as well as physical site attributes that can be related to urbanization impacts. This data, gathered using standardized scientific protocols, can be used to support adaptive management and additional mitigation measures during the development phases.

TRCA biologists established fixed plots in the DHN in 2008. Plots were placed in forest habitat types using the TRCA's Long Term Monitoring Project (LTMP) protocol. The general purpose of the regional LTMP plots is to detect changes and trends in the flora and fauna communities over time. Such habitats were identified across the entire area in 2002 when it was subject to an inventory of vegetation communities, flora, and fauna species according to the TRCA field inventory protocol (TRCA 2007a). This biological inventory provided a one-time picture of the flora and fauna communities present. Data regarding surface water quality, fluvial geomorphology, stream flow and discharge, as well as aquatic fish and benthic community were also gathered.

Highlights

- Ganatsekiagon Creek is dominated by coldwater species including Mottled Sculpin and Rainbow Trout. Brook Trout and American Brook Lamprey were also found in the upper portion of the main channel near Taunton Road but were not found downstream. The endangered Redside Dace was captured as well as the extirpated (stocked) Atlantic Salmon.

- The main tributary of Urfe Creek continues to be comprised of mainly coolwater fish with a mix of both coldwater and warmwater fish (e.g. Mottled Sculpin, Longnose Dace, Rainbow Darter).

- A total of 50 benthic macroinvertebrate samples from 10 sites have been identified. The most common families found at the DHN sites were midges (Chironomidae), and mayflies (Baetidae); the historical data from the RWMP sites (DF004WM, DF005WM, DF007WM, DF008WM) show that there has been variability in the metrics over time which is not related to the DHN.

- Surface water quality in both streams was found to be generally good; data showed an increase in chloride, sodium and ammonia over time but these increases were occurring before the DHN development was started.

- Aquatic monitoring continued in 2012; fish sampling was not conducted at all sites because some sites are known Redside Dace habitat and could not be disturbed (therefore excluded from permit by OMNR collection permit in order to protect the species); two new fish sampling sites were added – one was sampled but the other was dry at the time of sampling.

- Based on five years of data, the overall proportion of forest-species within the local bird community dropped from the initial 45% (at baseline conditions) to 29% in 2012. As residential development continues it will be important to continue to monitor these conditions to determine if the initial disturbance caused by construction is a long term impact on the forest bird community.

- An emerging disease *Caliciopsis pinea* canker, has tentatively been identified on white pine (*Pinus strobus*).

3.6 Remedial Action Plan Aesthetics Monitoring

Staff Lead: Melanie Croft-White

Support Staff: Michael Brestansky, Mark Szonda, Julie Hennigar, WM&R Field staff, Restoration Services field staff

Funding: Toronto and Region Remedial Action Plan, Environment Canada, Ontario Ministry of the Environment.

Figure 26: TRCA staff collecting water samples to be used for the RAP.

Background and Significance

Toronto and Region is one of 43 areas in the Great Lakes identified as an Area of Concern (AOC). The status of an AOC is determined by assessing the state of the regions environmental conditions against 14 different "Beneficial Use Impairments", aesthetics being one of them. Each site was assessed for water colour, water clarity, debris and water odour by trained staff using a standardized protocol (**Figure 26**). Monitoring began in June 2012 and will continue through 2013.

Highlights

- 903 aesthetic records were collected at 357 sites across TRCA's jurisdiction
- 80% of sites had clear colourless water with no debris or odour
- Only 2% of the sites were found to have trash (in large amounts)
- Precipitation was found to have significant impact on aesthetics.
- Aesthetic quality index was calculated and found that the poor quality sites are concentrated at the mouth of the Don River and the Waterfront.

3.7 Round Goby partnership with McMaster University

Staff Lead: Jan Moryk

Support Staff: Michael Brestansky, Mark Szonda, WM&R field Staff.

Funding: RWMP and McMaster University

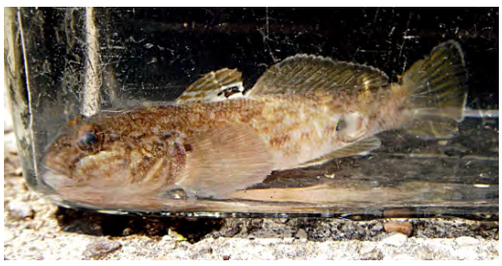


Figure 27: Image of a Round Goby captured at one of the RWMP monitoring locations.

Background and Significance

The Round Goby (*Neogobius melanostomus)* has been present in Lake Ontario since the early 1990's. Its first occurrence was in Lake St. Clair during 1990 and by 1997 it had invaded all the great lakes. Its presence has negatively impacted the lake's native fish community (Charlebois *et al*. 1997). However, only recently (during the 2007-2009) has the TRCA's RWMP captured the species in our rivers and streams and only at sites relatively close to the lake. Continued monitoring is necessary in order to assess how our native fish community responds to the Round Goby's expansion into our streams and rivers.

Starting in 2010, the WM&R section and McMaster University (Dr. Sigal Balshine) began a partnership aimed to further Round Goby research. When Round Gobies are captured as part of the RWMP, the specimens are preserved and sent to Dr. Balshine's laboratory. Dr. Balshine and her students are trying to answer various gaps in research surrounding the Round Goby and their expansion into various lotic and lentic systems. This partnership will continue in 2013 as more specimens are anticipated to be captured during the RWMP's sampling schedule.

Highlights

- To date, Round Gobies have been captured at a total of six RWMP sampling location spanning six watersheds (Etobicoke Creek, Mimico Creek, Humber River, Don River, Duffins Creek, Carruthers Creek). Approximately 30 specimens have been preserved.
- In 2011, three McMaster University students worked in the field with WM&R staff. The students gained electrofishing experience while sharing their knowledge about Round Goby behaviour and sexual dimorphism. A similar exchange of skills and knowledge is anticipated for 2013.

3.8 Ontario Power Generation

Staff Lead: Sue Hayes

Support Staff: Paul Prior, Gavin Miller, Natasha Gonsalves, Simone Akai, Derek Tune, and Rivka Shachak

Funding: Ontario Power Generation

Figure 28: Image of OPG lands where monitoring occurs.

Background and Significance

In 2009, TRCA biologists were contracted by Ontario Power Generation (OPG) to establish a local monitoring project on their land in the vicinity of the Pickering power plant, to the east of Frenchman's Bay (**Figure 28**). To this end several terrestrial fixed plots were set-up following the TRCA's Long-term Monitoring

Project (LTMP) protocol in forest, wetland and meadow habitat types within the study area. The purpose of these plots is to detect changes and trends in the flora and fauna communities over time at this site. Standardized scientific data collection protocols enable us to assess the response of the terrestrial system to various landscape changes. The effects of increased natural cover through reforestation efforts or increased use of the natural area due to increased urbanization can be quantitatively documented. The assessment of changes in these natural systems can then be used to better guide management actions on site with the aim of improving overall biodiversity.

Highlights

- In 2011, a report summarizing the flora and fauna communities at OPG based on the initial data collected in 2009 and 2010 was completed (TRCA 2011b). These first two years of monitoring data will represent the baseline conditions at OPG. Changes detected through subsequent years will be assessed with reference to this baseline.

- In 2012, terrestrial biologists collected the fourth year of data at the long-term monitoring stations at OPG. It was observed that garlic mustard *(Alliaria petiolata*), had increased in cover from 5% in 2011 to 25% in 2012. This species is one of the worst non-native invasive plants found in the TRCA jurisdiction and threatens the health of forest ecosystems.

3.9 Natural Feature Water Balance Monitoring Study

Staff Lead: Laura DelGiudice

Support Staff: Sue Hayes, Paul Prior, Gavin Miller, Natasha Gonsalves, Mike King, Derek Tune, Rivka Shachak, and Simone Akai, Derek Smith, Don Ford, Daniel Morodvanschi, Evan Bears

Funding: Great Lakes Sustainability Fund, Toronto RAP, Peel Region, York Region

Figure 29: TRCA staff checking monitoring equipment.

Background and Significance

Natural features, such as wetlands, woodlands, and watercourses are integral components of the watersheds of the Toronto Region, and are often negatively affected following urban development. Impacts to these features can be linked to, among other things, changes in hydrology, including changes in water quantity, quality, volume, duration, frequency, and timing of flow. Physically protecting a natural feature by incorporating it into the urban land use fabric is only one step in ensuring its continued function. Negative impacts can also occur when land use changes do not make considerations for stormwater management and its effect on the hydrology of natural features. Due to changes to the water budget components (runoff, evapotranspiration and infiltration) following development, urbanization can have profound effects on a feature's hydrologic function. For example, wetland hydrology can dramatically change if the installation of the sewer system and the stormwater is either entirely directed towards or away from the feature. The wetland may either become too wet or too dry to provide conditions for the flora and fauna it supports. This will continue to have indirect and prolonged consequences to the overall health of the natural systems of the Toronto region.

TRCA, in partnership with Credit Valley Conservation (CVC), has generated an interim guideline to help assess and address the hydrologic impacts of urban development on natural features through the review of development proposals. This guideline has been incorporated as a new criterion within the TRCA and CVC stormwater management criteria document (other criteria include water quantity, quality, recharge and erosion), which promotes the use of Low Impact Development measures in order to better mitigate the harmful hydrologic effects of urbanization. However, the scientific studies needed to document hydrological and ecological impacts, and establish defensible water management criteria for protection of the natural features will be improved by the monitoring undertaken through this study.

The purpose of this project is to gain better understanding of wetland, woodland and watercourse hydrology, and how sensitive different features are to changes in hydrology caused by changes in land use (e.g. urbanization). Hydrological and ecological conditions are monitored on a long-term basis to examine baseline conditions and compare the monitoring results to conditions that occur after development occurs within the catchment. The main goal of this initiative is to assist with future land-use planning and impact assessment, but secondary benefits may result for ecological restoration initiatives and the evaluation of the watershed integrity..

Highlights

- In 2012, monitoring instrumentation occurred at a Baif wetland site located in Richmond Hill (Figure 29). Baif wetland is the first of a series of monitoring sites that will be included in this study. Others will include sites in Durham region and elsewhere within the GTA.
- Four wetland vegetation transacts were set-up at the Baif site along with a nested set of piezometers and surface water level loggers to quantify hydrological conditions at Baif Wetland. Breeding amphibian and bird monitoring stations were also established.
- Gattinger's panic grass *(Panicum philadelphicum ssp. gattingeri*) was found in the wetland, which is a species that has never before been found in TRCA's jurisdiction.

3.10 Rusty Crayfish Monitoring Study

Staff Lead: Jessica Fang

Support Staff: Michael Brestansky, Mark Szonda, Julie Hennigar, Ryan Scott, Sarah Scharfenberg, Samantha Delargy, Samantha Everson, Sarah Irvine, Max Osburn, Nicole Thackeray

Figure 30: An image of a Rusty crayfish (*Orconectes rusticus*).

Funding: RWMP

Background and Significance

An invasive species is particularly successful when its ecological niche is unoccupied in its new ecosystem. The rusty crayfish (*Orconectes rusticus*) (**Figure 30**), however, is very capable of outcompeting native crayfish species and displacing them. Thus, native crayfish are not expected to buffer the range expansion of this large and aggressive invader, which is present in southern and western Ontario (Phillips *et al.* 2009).

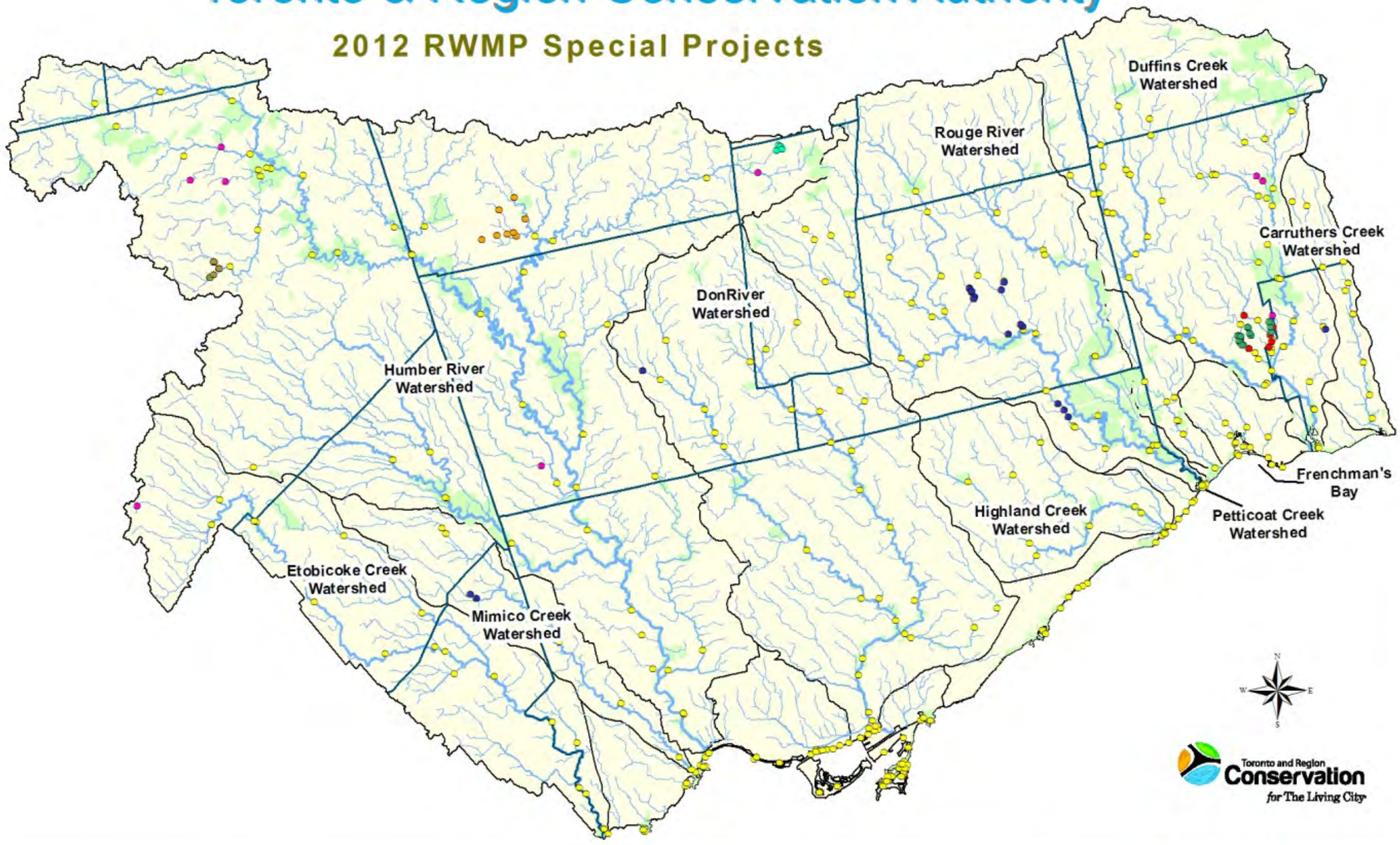
Originally from the Northeastern United States, rusty crayfish has expanded its range presumably due its bait bucket releases (Phillips *et al.* 2009). Once established, it can reduce the benthic macroinvertebrate community, macrophyte biomass, as well alter aquatic habitats.

Rusty crayfish was first collected by TRCA staff in 1983/1985 in the Duffins Creek watershed. However, there are no other historic data available. In 2012, RWMP electrofishing crews collected shocked crayfish, native crayfish were identified and released, whereas rusty crayfish were preserved and the gender, length, and weight of each specimen was recorded. The objective of this project is to examine the health conditions of the rusty crayfish, including abundance, sex ratio, hybridization, length-weight relationship (condition factor), and the correlation to a variety of habitat characteristics.

The collection of these data will is anticipated to fill in data gaps regarding the current distribution and abundance of rusty crayfish within the TRCA jurisdiction. Analyses are expected to reveal what stream characteristics and habitat the rusty crayfish prefers, the reproductive ability or health of their populations, and their ability to hybridize with the northern Clearwater crayfish (*Orconectes propinquus)*. Additionally, benthic macroinvertebrate and fish community composition at rusty crayfish sites will be analyzed to determine what impact the presence of rusty crayfish have on lower and higher levels of the food web. This project is an important first step in assessing if and how the rusty crayfish can be prevented from spreading to other streams and watersheds.

Toronto & Region Conservation Authority

2012 RWMP Special Projects



Toronto and Region Conservation for The Living City

Legend

SpecialProjects

Project

- Duffin Heights
- Natural Channel Design
- Nobilton Phosporus Offset
- Caledon East Natural Heritage Monitoring Project
- Duffins Heights Natural Heritage Monitoring Project
- South-central Ontario Reference Conditions/Biocriteria Project
- Water Balance for Natural Features Project
- Aesthetics Monitoring
- Municipal Boundary
- TRCA Property

Date: March 22, 2013
Created by: T.R.C.A. Information Services/ Information Technologies

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4 Staff Contributions

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Dean Young Project manager, Sustainable Technologies Evaluation Program Earth Ranger Center T: (289) 268-3904 dyoung@trca.on.ca	

4.1.1 Technical Advisory and Support Staff

Andrew Taylor	Jamie Duncan	Ming Gou
Bill Kerr	Jason Tam	Natasha Gonsalves
Craig Mitchell	Jehan Zeb	Paul Greck
Gavin Miller	Lisa Moore	Paul Prior
Greg Dillane	Mike Brestansky	Rita Lucero

4.1.2 Seasonal Staff

Chana Steinberg	Mark Szonda	Samantha Delargy
Daniel Morodvanschi	Matt Derro	Samantha Everson
Derek Tune	Max Osburn	Sarah Gates
Evan Bearss	Michael King	Sarah Irvine
Glen Geddes	Nicole Thackeray	Sarah Irvine
Ian Hay	Rivka Shachak	Sarah Scharfenberg
Julie Hennigar	Ryan Scott	Simone Akai

4.2 Training and Workshops

The TRCA's Ecology Division is committed to the belief that both the transfer of knowledge and continuous education are critical elements to effective management of our environmental resources. In addition to attending various training sessions, staff in the Watershed Monitoring and Reporting Section conducted several workshops for both internal and external participants.

4.2.1 Conducted by TRCA Staff

- Terrestrial Volunteer Monitoring Seasonal Training for 2012 was conducted during March 2012, May 2012 and September 2012 with a total of 127 attendees (Theresa McKenzie).
- Southern Ontario Stream Monitoring and Research Team: Statistical Analysis Workshop. April 2012 Course Administration. (Scott Jarvie, Angela Wallace)
- WNV vector mosquito larvae Identification workshop (for Halton Health Unit staff) at Boyd Office. May 2012 (Jessica Fang).
- Class 2 Backpack Crew Leader Electrofishing Course conducted for 20 people (6 internal, 14 external), on May 29 2012 at Boyd Office (Jeff Vandenberg, Nelson Amaral, Scott Jarvie, Michael Brestansky)
- Water safety Training Course – Internal May 29 2012 (wader safety instructor) – Jeff Vandenberg

- Sedge Identification Technical Training course conducted for 16 participants (external). June 2012. (Gavin Miller and Natasha Gonsalves).
- Ontario Benthos Biomonitoring Network Training course (As Chris Jones's (OMOE) assistant – Durham College, June 2-3 2012 (Jessica Fang).
- Ontario Stream Assessment Protocol Training course – Durham College, Oshawa. June 4-8, 2012. (Scott Jarvie – course administration, Jeff Vandenberg, Jan Moryk, Jessica Fang).
- Ontario Stream Assessment Protocol Training course – Internal training session June 2012. (Jeff Vandenberg, Mike Brestansky, Mark Szonda, Julie Hanigar)

4.2.2 Attended by TRCA Staff

- Great Lake Cooperative Science and Monitoring Consortium, Nearshore Water Quality Workshop, Claremont Conservation Area; Pickering Ontario; January 2012. (Derek Smith)
- Floods Happen Workshop, Black Creek Pioneer Village; Toronto, Ontario; March, 2012. (Derek Smith, Craig Mitchell, Leland Wilbur, Greg Dillane, Rita Lucero, Jamie Duncan)
- Southern Ontario Stream Monitoring and Research Team: statistical analysis workshop. April 2012 (Natasha Gonsalves, Jessica Fang, Jan Moryk, Melanie Croft-White, Nelson Amaral, Angela Wallace)
- River Ice Management Workshop; Black Creek Pioneer Village; Toronto, Ontario; July, 2012. (Derek Smith, Craig Mitchell, Leleand Wilbur, Greg Dillane)
- Ontario Wetlands Conference: the history and future of our wetlands. February 2012 (Paul Prior)
- Environment Canada CANWARN Severe Weather Watcher Training; Albion Hills Conservation Area, Palgrave, Ontario; September 2012. (all RWMP staff)
- Canadian Dam Association Annual Workshop, Saskatoon, Saskatchewan; October 2012. (Craig Mitchell)
- Provincial Flood Forecasting and Warning Workshop, Black Creek Pioneer Village; Toronto, Ontario; October, 2012. (Derek Smith, Craig Mitchell, Leleand Wilbur, Greg Dillane, Rita Lucero, Jamie Duncan)
- Ontario Invasive Plant Council. October 2012 (Gavin Miller)
- A.D. Latornell Conservation Symposium. Conservation Ontario. November 17-19, 2012. (Melanie Croft-White, Jan Moryk, Scott Jarvie, Nelson Amaral, Jessica Fang, Jeff Vandenberg, Ray Biastoch)
- Ontario Road Ecology Group Annual General Meeting, Toronto Zoo. November 2012 (Paul Prior and Sue Hayes)

4.3 Professional Activities

Watershed Monitoring and Reporting Section staff annually participates in a variety of professional activities such as presenting at conferences and contributing to numerous committees. In addition numerous reports or journal articles are completed based on the data collected under RWMP or through special projects.

4.3.1 Presentations

- Ontario Ministry of Environment Technical Support meeting: Are Toronto Streams Sick? A look at the fish and BMI communities in the Toronto Region in relation to the urban stream syndrome. February 2012 (Angela Wallace).
- National Fish and Wildlife Conservation Congress: The Utility of a Local Scoring and Ranking Approach in Natural Heritage Systems Protection Poster Presentation May 28, 2012. (Sue Hayes).
- Terrestrial Invasive Plant Species Conference, Sault Ste. Marie, Ontario: TRCA Terrestrial Invasive Plant Monitoring, 2009 - 2011. August 21, 2012 (Theresa McKenzie).
- Provincial Flood Forecasting and Warning Workshop, *Dam Operations and Safety*. Black Creek Pioneer Village; Toronto, Ontario; October, 2012. (Craig Mitchell)

4.3.2 Reports and Publications

- Caledon East Natural Heritage Monitoring Program – Terrestrial Component (Year 3 -2011). March 2012
- Caledon East 2011 Technical Brief. March 2012
- 2011 West Nile Virus Larval Mosquito Monitoring Program Annual Report. March 2012.
- Terrestrial Fixed Plot Monitoring – Regional Baseline Conditions Report. March 2012
- 2011 RWMP Progress Report. April 2012.
- 2011 Addendum: Ontario Power Generation - Terrestrial Long-term Monitoring Project (Year 3). June 2012
- Watershed Report Cards (drafts) (August 2012)
- Terrestrial Biological Inventory and Assessments
  - Scarborough Shoreline. February 2012
  - Bethesda Side Road and Leslie Street Study Area. March 2012
  - Marie Curtis Park. March 2012
  - Bloomington Wetland. March 2012
  - Seneca College King Campus. March 2012
  - Mimico Waterfront Linear Park. March 2012
  - William Granger Greenway – Pine Grove to Boyd. November 2012
  - Kortright Conservation Area – Fauna Assessment. November 2012
  - Clubine Tract. December 2012
- Are Toronto's Streams sick? A look at the fish and benthic invertebrate communities in the Toronto Region in relation to the urban stream syndrome (draft) submitted to Environmental Monitoring and Assessment. (December 2012).
- Annual Fish Collection Records Report 2012.
- Toronto and Region Conservation Authority (TRCA). 2012. Nobleton Phosphorous Offsetting Summary Report 2011. 11 pp + appendices

4.4 Committees

Watershed Monitoring and Reporting Section staff participated on the following committees:

- Database Working Group – Toronto and Region Conservation (Scott Jarvie, Angela Wallace, Nelson Amaral, Sue Hayes, Ray Biastoch)
- Southern Ontario Conservation Authorities Terrestrial Monitoring Network – Toronto & Region Conservation, Conservation Halton, Credit Valley Conservation, Central Lake Ontario Conservation (Theresa McKenzie & Sue Hayes)
- Ontario Ministry of Natural Resources Ecological Land Classification Update Technical Team (Gavin Miller)
- City of Toronto Biodiversity Series: Reptiles and Amphibians of Toronto Guide Production Team (Paul Prior)
- Natural Areas Inventory Management and Technical Team – Credit Valley Conservation (Sue Hayes)
- Jefferson Salamander Recovery Team – Ontario Ministry of Natural Resources (Sue Hayes)
- Database Working Group – Toronto and Region Conservation (Scott Jarvie, Angela Wallace, Nelson Amaral, Sue Hayes).
- Durham Region West Nile Virus Response Committee (Jessica Fang).
- York Region West Nile Virus Liaison Committee (Jessica Fang)
- Modeling Climate Change Impacts on Ecology of Vector-borne Diseases Committee, York University (Jessica Fang)
- Southern Ontario Stream Monitoring and Research Team (SOSMART) (Scott Jarvie)
- PGMN Central Working Group - (Jeff Vandenberg)
- Conservation Ontario Watershed Report Card – Technical Working Group (Scott Jarvie)
- York Region Low Water Response Team – York Region (Jamie Duncan and Rita Lucero)
- Lower Humber Weirs Removal Steering Committee (Craig Mitchell)

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Appendix A

2012 WM&R Monitoring Activities by Watershed

	Etobicoke	Mimico	Humber	Don	Highland	Rouge	Petticoat	Duffins	Carruthers	Other[1]	Total
Fish Species & Aquatic Habitat	0	2	0	1	0	36	0	23	3	0	65
Benthic Macroinvertebrates	13	5	36	23	10	25	3	21	3	4	143
Fluvial Geomorphology	0	0	0	0	0	1	9	31	10	0	51
West Nile Virus Monitoring	4	2	12	5	1	8	1	9	1	1	44
Surface Water Quality	4	2	12	5	1	8	1	9	1	1	44
Baseflow	4	2	93	7	6	7	2	8	3	4	136
Stream Flow	4	1	7	9	2	2	1	8	1	2	37
Precipitation	4	0	10	4	2	5	1	6	0	1	33
Snow	1	0	3	1	0	0	2	3	0	0	10
Groundwater Quality & Quantity	2	0	9	0	0	3	0	6	0	0	20
Terrestrial Natural Heritage[2]	20	20	550	15	0	85	0	310	0	0	1000
Terrestrial Volunteer Monitoring	5	1	19	8	2	7	1	7	1	4	55
Meteorological (Climate Monitoring)[3]	1	0	6	0	0	3	0	4	0	0	14
Water Temperature	5	1	6	1	1	25	3	21	3	1	67

[1] *Other minor watersheds including tributaries of Frenchman's Bay and Toronto Waterfront*

[2] *Italicized numbers are the number of hectares monitored*

[3] *Includes both meteorological stations and "stand alone" air temperature stations*

Appendix B

2012 WM&R Monitoring Activities by Region

	Durham	Peel	Toronto	York	Other[1]	Total
Fish Species & Aquatic Habitat	25	2	9	29	0	65
Benthic Invertebrates	29	26	43	43	2	143
Fluvial Geomorphology	48	0	0	3	0	51
West Nile Virus Monitoring	12	7	13	12	0	44
Surface Water Quality	12	7	13	12	0	44
Baseflow	16	50	35	32	3	136
Stream Flow	11	9	12	5	0	37
Precipitation	6	9	7	11	0	33
Snow	3	3	1	3	0	10
Groundwater	6	7	1	6	0	20
Terrestrial Natural Heritage[2]	310	240	0	450	0	1000
Terrestrial Volunteer Monitoring	10	13	18	13	1	55
Meteorological (Climate Monitoring)[3]	4	2	1	7	0	14
Water Temperature	26	6	12	22	1	67

[1] *Dufferin/Simcoe*

[2] *Italicized numbers are the number of hectares monitored*

[3] *Includes both meteorological stations and "stand alone" air temperature stations*