



City Stream Watch 2016 Summary Report





City Stream Watch 2016 Summary Report

MVCA SNC RVCA

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Thank you to our 2016 Funding Partners:

Community Foundation of Ottawa: \$10,000 towards labour and materials for RVCA City Stream Watch Restoration Project.

Great Lakes Guardian Community Fund (GLGCF): \$25,000 in support of labour and materials for RVCA City Stream Watch Urban Creek Restoration Project.





Introduction

The collective goals of the City Stream Watch Program at the three Conservation Authorities are to:

- Provide consistent data collection, data management and reporting of urban and rural stream health across the City of Ottawa
- Target restoration initiatives and landowner stewardship actions based on monitoring results

Mississippi Valley Conservation

With the recent focus on development and restoration activities in the Kanata West Development area, Mississippi Valley Conservation (MVCA) and the Friends of the Carp River (FCR) have undertaken several initiatives aimed at assessing and furthering the health of the Carp River Watershed. The Carp River Watershed/Subwatershed Study (2004) recommended enhancements to habitat and flow, and targeted stewardship activities as key objectives in restoring the overall health of the river. In 2012, MVCA staff and FCR undertook a field study to identify priority areas for restoration and stewardship actions, to assess expanding upon the monitoring efforts downstream of the Kanata West Area and to test a pilot citizen science based volunteer monitoring program in the Carp Watershed. Based on the success of this initial work, there is interest in continuing and expanding upon these efforts by offering the City Stream Watch program in the Carp River watershed and other watersheds within the City which are subject to similar changes in land use and associated impacts.

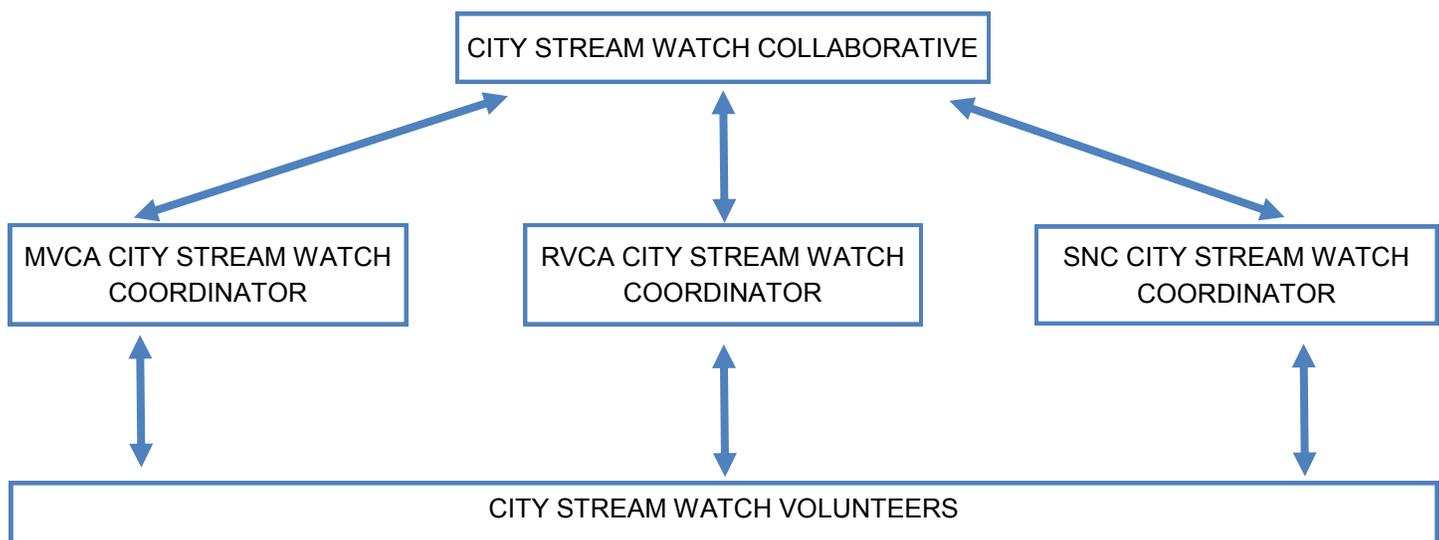
Rideau Valley Conservation Authority

The Rideau Valley Conservation Authority (RVCA) and key partners collaborated to develop the *Lower Rideau Strategy* which lists a number of environmental issues and/or threats along many of the tributaries. These include poor water quality, loss of vegetation (including wetlands and forest), loss of biodiversity, changes in hydrology and stream alterations. The report recommended that to improve conditions along these tributaries, local agencies need a coordinated approach to promote good land stewardship practices and provide public educational opportunities. These recommendations are objectives of the City Stream Watch program. Although the *Lower Rideau Strategy* does not include all of the tributaries that City Stream Watch works on; it does include the tributaries of the Ottawa River that are monitored by our program, which face the same issues and threats, and the same recommendations apply.

South Nation Conservation

Within the South Nation Conservation's (SNC) jurisdiction in the City of Ottawa there are a number of urban streams, tributaries of the South Nation River, which have been impacted by development and urbanization. These streams have limited or no riparian green space which negatively impacts water quality and the aquatic habitat due to increased runoff, erosion, pollution, and water temperature. Implementing the City Stream Watch Program in the SNC watershed will address these issues while also focusing on recommendations from the City of Ottawa's Water Environment Strategy. Furthermore, the City Stream Watch Program will lead to improvements in program consistency between the three Conservation Authorities within the City of Ottawa and greater overall understanding and collaboration.

City Stream Watch Organizational Chart





Stream Habitat Assessment Methodology

The City Stream Watch program uses a stream characterization assessment protocol for surveying streams. The protocol was originally developed by the Ontario Ministry of Natural Resources and Forestry (MNR), but was modified by the RVCA to facilitate for more effective monitoring and ease-of-use with volunteers.

The program has ongoing stewardship and restoration activities across various creeks. It also has focused monitoring on a six year cyclical basis for each stream to help track long term changes and to measure the effectiveness of previous activities. Throughout the field season, staff and volunteers will survey 100 m segments of streams at a time, from the mouth to the headwater reaches, assessing the following:

- Stream/channel morphology (stream wetted width and depth, bankfull width, flow velocity)
- Location (UTM coordinates, the start and end of each 100 m section)
- Water chemistry parameters (water temperature, dissolved oxygen, pH, and conductivity)
- Weather conditions (Overhead cloud cover)
- Photographs (upstream and downstream of section)
- Alterations (human influence) and land use
- Instream morphology (channelization, temporal flow class, riffles, pools and runs), instream habitat (substrate type, vegetation abundance and type, vascular plant habitat and cover, shoreline shading, undercut banks, presence of woody debris and detritus)
- Influence of beaver dams, storm-water outlets, tributaries and migratory obstructions to fish passage
- Shoreline alterations, riparian conditions including vegetation, bank stability and erosion, bank composition and structures, as well as shoreline vegetation types and area covered
- Pollution and garbage observed and agricultural impacts
- Other observations including wildlife, presence of invasive species, groundwater indicators
- Enhancement and restoration opportunities are identified per section



CSW volunteer with MVCA measuring a stream segment



CSW volunteer and RVCA staff recording beaver dam observations



CSW volunteers and RVCA staff measuring wetted width of a stream



CSW volunteers and MVCA staff taking water

Headwater Drainage Feature Protocol

The City Stream Watch program added the Headwater Drainage Feature (included in the Ontario Stream Assessment Protocol—OSAP) protocol to the program in 2013. This protocol measures zero, first and second order headwater drainage features (HDF). It is a rapid assessment method characterizing the amount of water, sediment transport, and storage capacity within headwater drainage features. RVCA is working with Toronto and Region Conservation Authority (TRCA) and the MNR to implement the protocol with the goal of providing standard datasets to support science development and monitoring on headwater drainage features.

Additionally, this module provides a mean of characterizing the connectivity, form and unique features associated with each HDF (OSAP Protocol, 2013). An initiative is underway to evaluate how these data can help in understanding the cumulative contributions of individual headwater drainage features on the downstream watershed state (see Stanfield et al., 2013).

Headwater drainage features have not traditionally been a component of monitoring efforts, and as such, little is known about their form and function in the landscape (OSAP, 2013). These features may provide directly, both permanent and seasonal habitat for fish by the presence of refuge pools, seasonal flow, or groundwater discharge. They may also provide indirect habitat contributions through the export of food in the form of detritus and invertebrates (Wipfli and Gregovich 2002). These features are important sources, conveyors or stores of sediment, nutrients, flow, and may have an important role for terrestrial species, such as amphibians (OSAP, 2013).

HDFs include small streams, springs, wetlands, swales and ditches and have variable flow conditions from perennial to ephemeral streams. Regardless of the form of the HDF (natural or human made), science is suggesting that they play an important role as the interface between land and water for water and sediment transport and as corridors for the migration of biota (OSAP, 2013). As a result of their importance and a lack of information for headwater drainage features, the City Stream Watch program has incorporated monitoring of these systems for each catchment.

In 2016 the MVCA City Stream Watch program sampled 16 HDF sites focusing in Mississippi Mills, in areas that drain directly to the Mississippi River upstream of Almonte.

In 2016 the RVCA City Stream Watch program sampled 54 sites in Brassils Creek, tributary of the Rideau River; Graham Creek, Greens Creek and McEwan Creek all catchments of the Ottawa River watershed. CSW also aided in the Tay River watershed.

In 2016, the SNC City Stream Watch program sampled 50 sites in the McKinnon's Creek Subwatershed.

For more information regarding sample locations please see the individual 2016 catchment reports for each sub-watershed.



A piped pond outlet headwater drainage feature in the Greens Creek catchment located in the city's east end



RVCA staff reading water chemistry parameters of a headwater drainage feature during the spring

Fish Sampling Methodology

Due to the diverse attributes of each stream site, a variety of fish sampling methods are used to identify the presence of which species are inhabiting the reach. This enables for sampling within a variety of habitat types. Fish sampling is done in accordance with protocols and best practices in order to live-release the fish after sampling is finished.

Seine Net (OSAP module)

- Rectangular, with a three-dimensional box in the middle
- The net is actively moved through the water, creating a wall
- Fish are directed towards the purse in the middle and collect there
- Ideal for pool habitat



Windemere Trap

- Resembles a lobster trap but has a metal frame covered in mesh
- Mesh funnels at either end guide the fish into the trap
- Used in shallow areas, with slow or fast moving water
- Used on electrofishing sites in peak spawning periods



Fyke Net

- Modified hoop net (series of hoops and funnels covered in mesh, with a lead line and wings)
- Depending on size, can be used in shallow or deeper waters and are good alternatives in places that are difficult to seine or electrofish
- Nets can be set up from 24 hours to multiple weeks, but checked every 24 hours to release any fish that have been caught



Electrofishing (OSAP module)

- Effective way to sample fish in a variety of habitats
- One of the key tools used to effectively sample fish communities
- Electricity is passed through the water which causes a muscle response reaction in fish, temporarily stunning them
- Netters scoop fish from the stream and place in a recovery bucket
- Electrofishing very seldom kills fish if the correct procedures are used
- Electrofishing is completed by staff that have been certified according to provincial standards



Thermal Classification Methodology (OSAP module)

Temperature is an important parameter in streams as it influences many aspects of physical, chemical and biological health. Temperature data loggers are deployed in each of the monitored streams from April to late September to give a representative sample of how water temperature fluctuates. Many factors can influence fluctuations in stream temperature including: springs, tributaries, precipitation runoff, discharge pipes and stream shading from riparian vegetation. Water temperature is used along with the maximum air temperature (using the revised method in Stoneman and Jones, 1996) to classify a watercourse as either warm water, cool-warm water, cool water, cold-cool water or cold water.

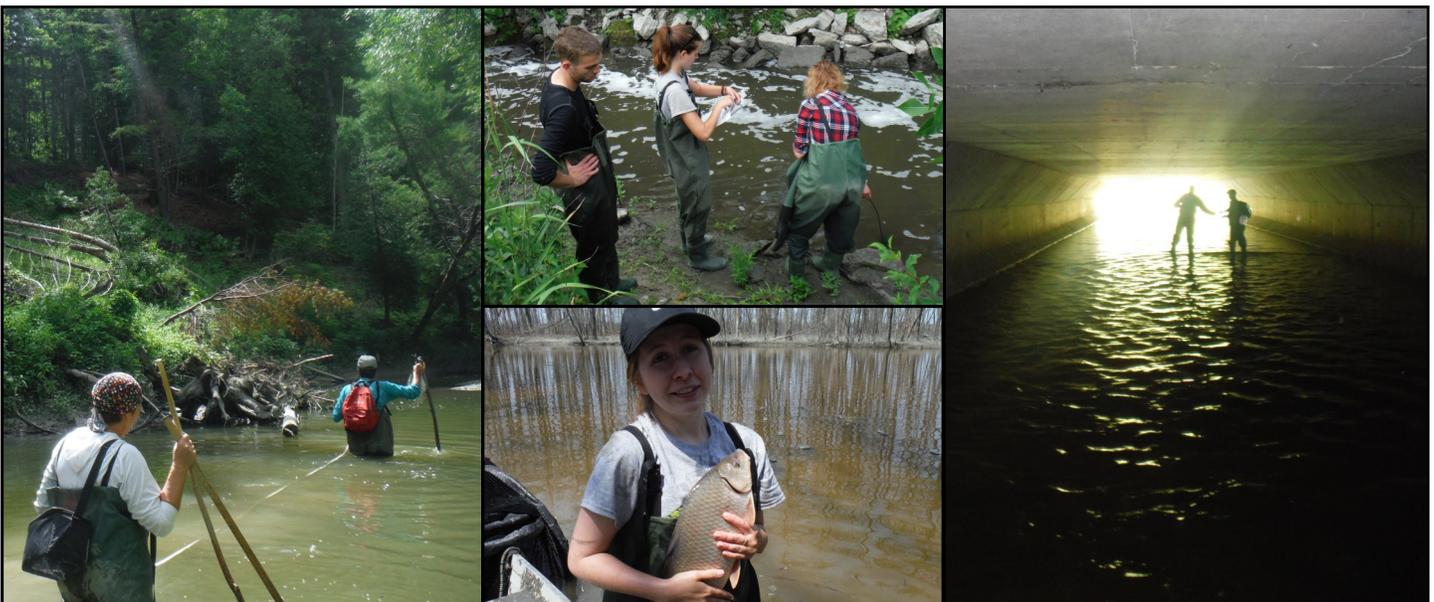
Table 1 Water temperature range classification based on a standardized air temperature of 25 °C

Status	Water Temperature °C
Cold	< 15
Cold-cool	15-17
Cool	17-20
Cool-warm	20-23
Warm	> 23

Data Management/Users

All data collected is maintained in databases at MVCA, RVCA and SNC. Data collected is valuable and used on a variety of levels. Various agencies and community organizations throughout the City of Ottawa use City Stream Watch data for:

- Watershed reporting
- Identifying potential rehabilitation and restoration projects (riparian and instream)
- Analyzing program success
- Background data for planning and regulations reviews
- Sharing information with other agencies (NCC, City of Ottawa, Fisheries and Oceans Canada, MNRF, Ministry of the Environment and Climate Change, etc.), consultants and non-governmental organizations
- Fish community information sent to MNRF (stored in National Heritage Information Centre—NHIC /Natural Resource and Values Information System—NRVIS databases)
- Reports to public landholders on potential projects, important issues and current conditions
- Sharing with the public on websites
- Species at risk information sent to MNRF (stored in NHIC database)
- Consultant information requests
- Other projects



CWS volunteers with RVCA measuring stream length in Greens Creek (left). RVCA staff and Ministry of Environment summer students taking water quality parameters in Graham Creek during a fish sampling session (top); RVCA staff holding a Quillback collected in Greens Creek with a fyke net (bottom); CSW Volunteers with RVCA wading in Graham Creek through the Hwy 417 and 416 underpass during stream surveys (right)



MVCA City Stream Watch 2016 Summary

The *City Stream Watch 2016 Summary Report* highlights accomplishments from the 2016 field season surveying Kizell Drain, Shirley's Brook and Carp C River and describes the nature and extent of volunteer projects. To find the full reports on information collected in our creeks, please see their individual reports. These are shared on our website at: <http://mvc.on.ca/city-stream-watch/>.

Stream Study Details

The following table outlines the monitoring activities performed on Kizell Drain, Shirley's Brook and the Carp C tributary in 2016. In total, approximately 8.4 kilometres of stream was surveyed with the help of 4 volunteers from the community participated in multiple days of the program throughout the field season for a total of 25.5 volunteer hours. Furthermore, our team of summer students participated in an invasive species pull to address a population of Dog-strangling Vine that was found along Shirley's Brook.

The number of sections surveyed is highly dependent on the number of landowners that grant us permission to access their land. This year's watercourses flowed through active and abandoned agricultural lands, an industrial neighbourhood, past residential properties as well as through City and National Capital Commission park space. Permission response was generally positive and we would like to thank the landowners for their participation.

Two temperature probes were launched on each stream to help us understand the thermal ranges and its impact on potential fish habitat available in the upstream and downstream portions of the water courses. As well, one site on Shirley's Brook and one on Carp C Tributary were electrofished this season to enhance our baseline fish population distribution data. Kizell Drain was electrofished by MVCA in 2005 and 2009 so it was not repeated this year. In our findings, 20 different minnow species were found who prefer a range of cool to warm water habitat.

Table 2 Summary of MVCA City Stream Watch survey accomplishments

Activities	Poole Creek	Carp Creek	Huntley Creek	Watt's Creek	Corkery Creek	Carp A Tributary	Feedmill Creek	Kizell Drain	Shirley's Brook	Carp C Tributary
	2013	2013	2014	2014	2015	2015	2015	2016	2016	2016
Number of Sections Surveyed	28	22	118	28	40	14	28	35	45	4
Number of Volunteers	8	5	17	5	13	3	5	3	6	0
Total Volunteer Hours	31	23	79	25	100	13	25	9.5	16	0
Number of Fish Sampling Sessions	0	1	1	0	3	1	0	0	1	1
Number of Temperature Probes	0	0	2	0	3	1	0	2	2	2



MVCA City Stream Watch Plans for 2017

In 2017, MVCA plans to:

- Survey the following creeks
 - ◆ Carp Creek
 - ◆ Huntley Creek
 - ◆ Constance Creek – simplified survey
- Invasive species removals on
 - ◆ Upper Carp Creek – Himalayan Balsam
 - ◆ Shirley's Brook – Dog-strangling Vine
- Shoreline planting event on Huntley Creek
- Contact landowners for potential shoreline restoration projects



Kizell Drain



Shirley's Brook



Carp C Tributary

If you are interested in volunteering with MVCA's City Stream Watch program please call our office at 613-253- 0006 or go online at: <http://mvc.on.ca/volunteer-contact/>



MVCA City Stream Watch Plans for 2017

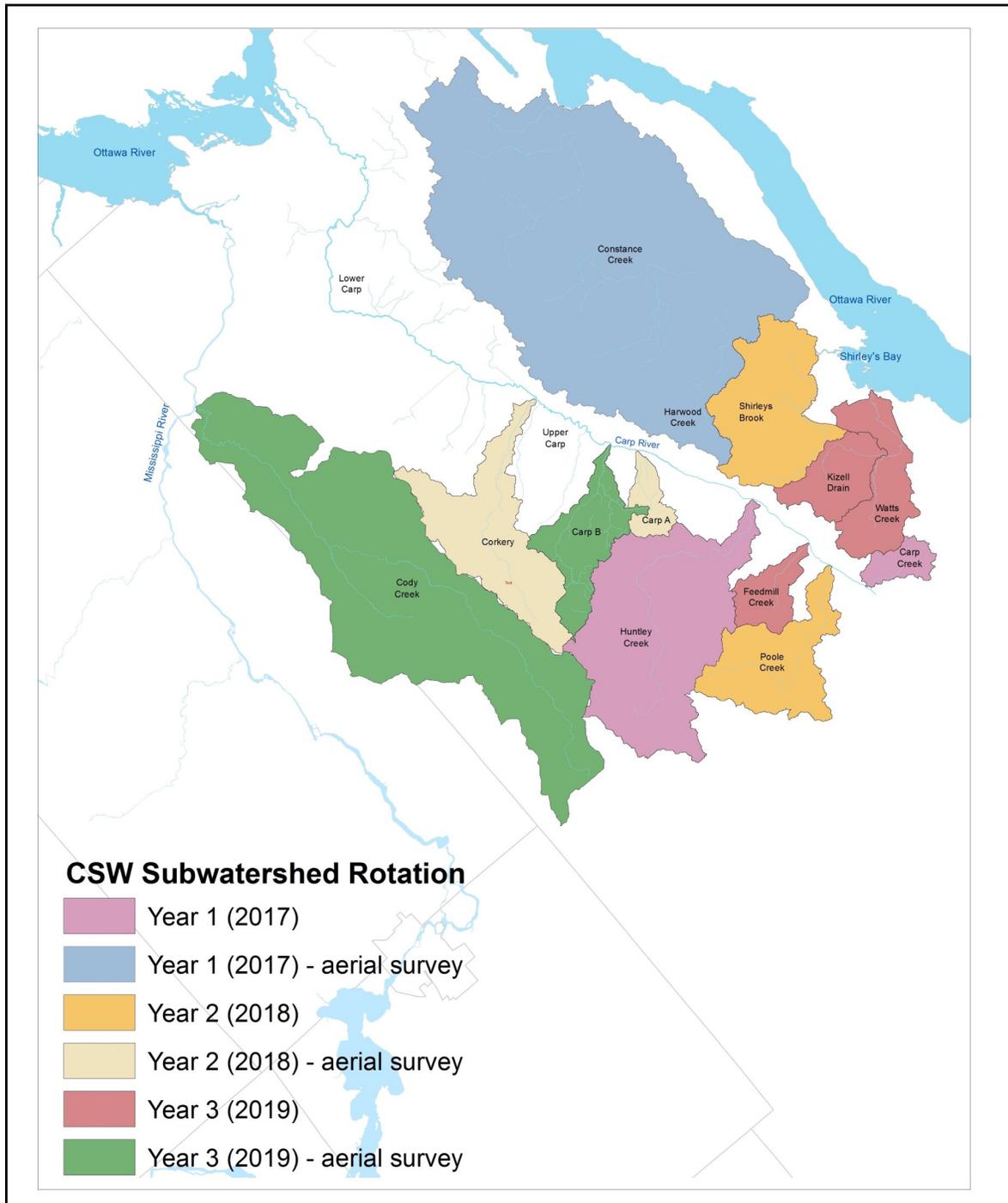


Figure 1 MVCA City Stream Watch subwatershed rotation

*aerial surveys monitor changes in subwatershed land use with aerial imagery

SNC City Stream Watch 2016 Summary

The *SNC City Stream Watch 2016 Summary Report* highlights achievements from the 2016 field season and describes the scope and magnitude of projects which were completed by SNC staff and community volunteers. This is the third year for the City Stream Watch program at SNC and we are very pleased with the degree of uptake by the local communities and the development of the program since its initiation in 2014. Overall, a total of 8 volunteers participated with City Stream Watch and contributed to the survey and monitoring of 4 km's of streams. SNC's City Stream Watch Reports are available online at: <http://www.nation.on.ca/water/reports>.

Stream Study

The City Stream Watch program for SNC targeted McKinnon's Creek, a tributary of the Bear Brook River, for the 2016 field season in addition to other areas within the Bear Brook River Subwatershed. McKinnon's Creek begins at its headwaters south of Orléans, ON (Figure 2). It flows southeast towards Navan, ON across both agricultural and urban land before entering the main branch of the Bear Brook River south of Navan. Landowners on both banks of McKinnon's Creek were contacted prior to beginning field surveys in order to gain access permission along the entire length of the stream, which was acquired along some points of its flow to sample and monitor.

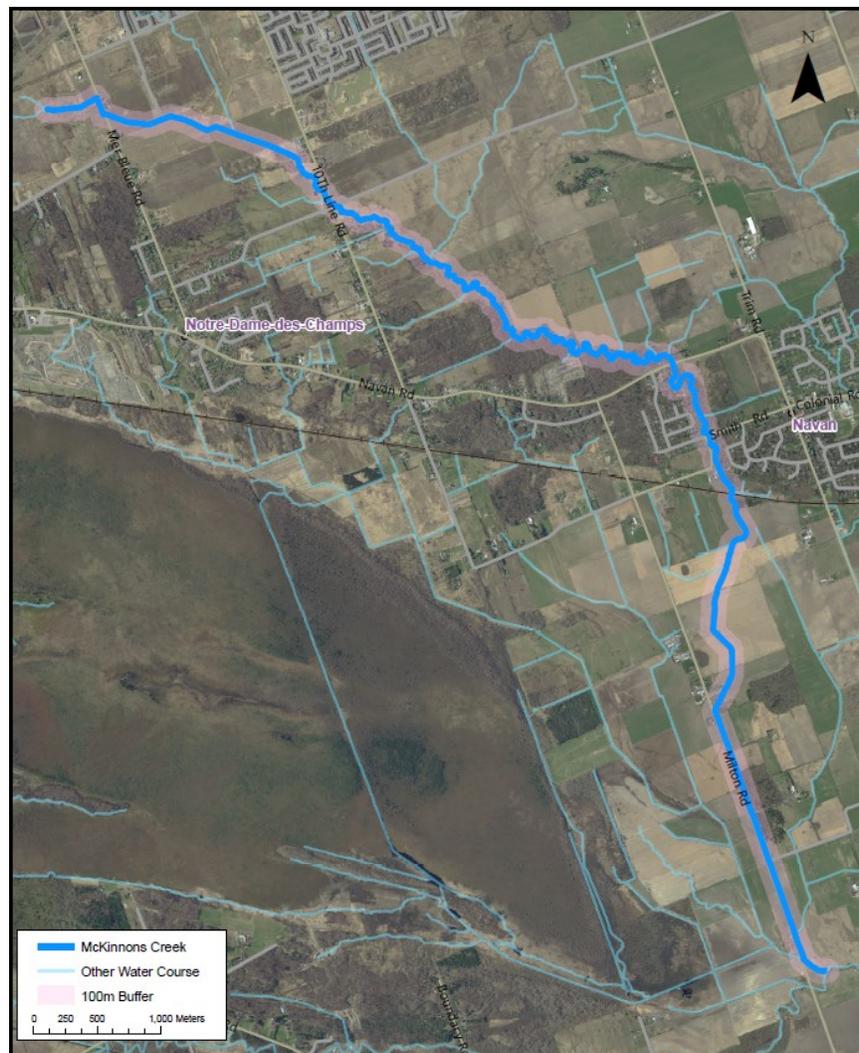


Figure 2 McKinnon's Creek and its flow from headwaters near Mer Bleu Road to where it meets the Bear Brook River along Milton Road

SNC Volunteer Contributions

A total of 8 volunteers assisted with the SNC City Stream Watch program in 2016 for over 50 hours of work. Numbers of volunteers that contributed during the 2016 City Stream Watch program were lower than what was achieved in 2015, but was expected with the lower number of sections to sample in McKinnon's Creek. SNC staff and volunteers were able to sample 39 sections within McKinnon's Creek. Without volunteer assistance, SNC staff would not have been able to complete nearly as much stewardship work as was accomplished. Table 3 displays a summary of the SNC City Stream Watch accomplishments for the 2016 field season and details of volunteer assistance.

Table 3 A summary of SNC's City Stream Watch accomplishments for the 2016 field season and volunteer contributions.

Activity	McKinnon's Creek
Sections Surveyed	39
Fish Sites	10
Fish Sampling Sessions	10
Benthic Monitoring Sites	10
Baseflow Monitoring Sites	3
Temperature Probes Deployed	10
Demonstration Events	1
Number of Volunteers	8
Number of Volunteer Hours	50



Volunteers and SNC staff taking water quality measurements within McKinnon's Creek



Wild rice—an important food source for waterfowl—was commonly found within McKinnon's Creek and its tributaries



Insects and wildlife found within and along McKinnon's



SNC staff identify and evaluate fish migration barriers



Riffle sections within McKinnon's Creek were located and documented



Electrofishing was the method used to sample for fish in McKinnon's Creek

Fish Sampling in McKinnon's Creek

Fish communities were sampled at 10 different sites along McKinnon's Creek and yielded interesting results. In total, over 1600 fish were sampled within the creek. This information will allow SNC to understand which species live in which sections of the river. Further, SNC can prioritize restoration work on areas where lowered fish diversity is discovered.



Fish sampled in the stream were weighed and counted. Pictured here is a rock bass found at one sampling site



A field crew member taking a baseflow measurement in McKinnon's Creek

Baseflow Monitoring

Baseflow monitoring was completed at 3 sites within McKinnon's Creek. This type of monitoring allows SNC to gain an understanding of how much groundwater enters McKinnon's Creek during the dry parts of the summer.



A SNC employee works to take baseflow measurements with highly accurate scientific equipment

SNC Plans for 2017

In 2017, SNC City Stream Watch efforts will be focused on the headwater areas of the Bear Brook River (Figure 3). This system begins east of Leitrim in the City of Ottawa and flows east towards Edwards. Eventually, the few tributaries that meet near Carlsbad Springs become the Bear Brook River and flow further east to the South Nation River. The Bear Brook River enters the South Nation River near Ettyville.

There will be many opportunities to assist with CSW 2017:

- Tree Planting Projects
- Invasive Species Removal
- Habitat Enhancement Projects
- Fish and Benthic Sampling Activities
- Stream Monitoring
- Garbage Clean-ups

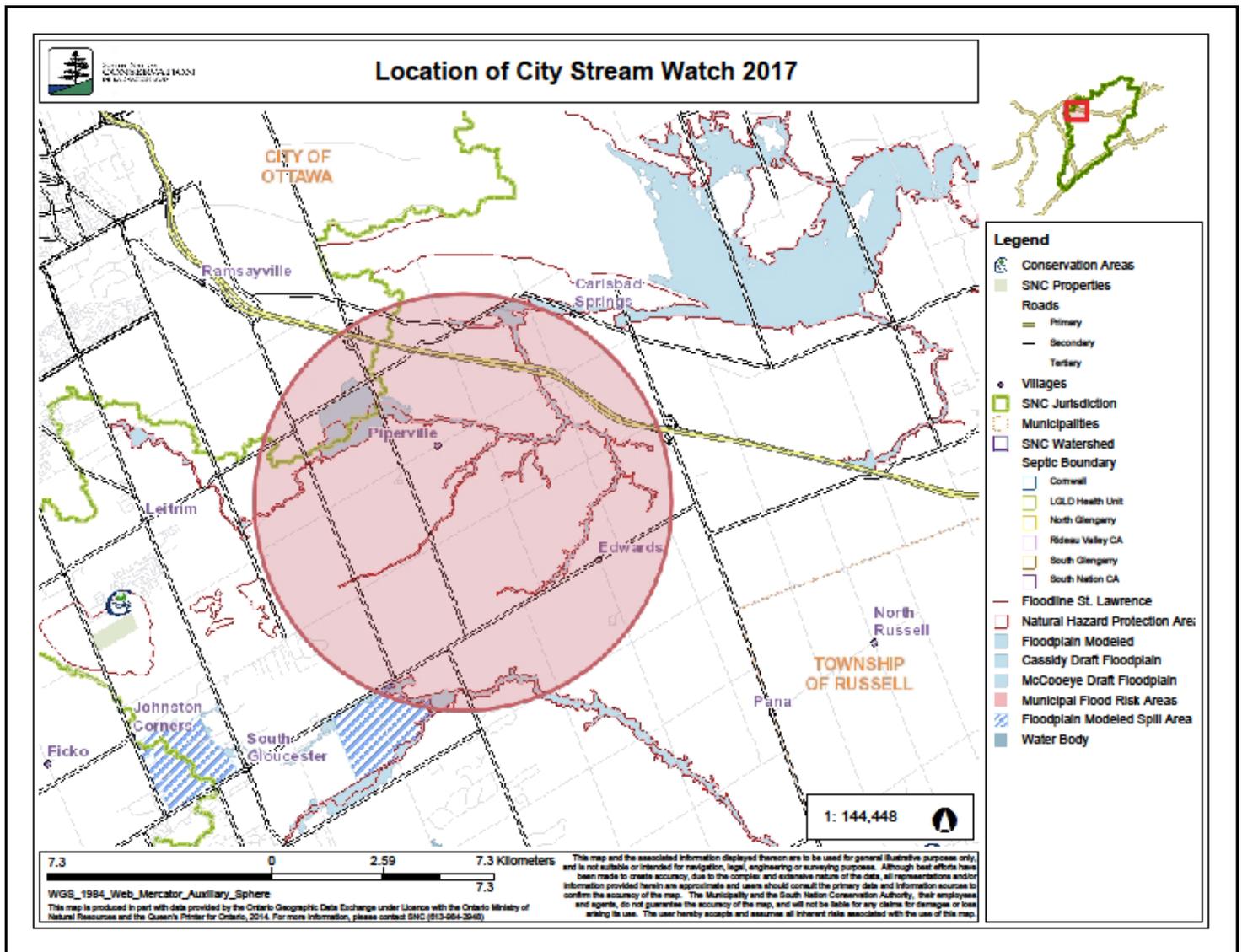


Figure 3 The headwater areas of the Bear Brook River are shown. Sampling areas are indicated as those within the red circle

To volunteer with SNC's City Stream Watch program, please contact:

City Stream Watch Coordinator

South Nation Conservation

(613) 984-2948

info@nation.on.ca

RVCA City Stream Watch 2016 Summary

The *City Stream Watch 2016 Summary Report* highlights accomplishments from the 2016 field season and describes the nature and extent of volunteer projects. The RVCA City Stream Watch program has cyclical monitoring of 25 streams, tributaries of the Rideau River and the Ottawa River in the City of Ottawa. To find information collected on these streams, please see their individual reports that are shared on our website at: <http://www.rvca.ca/programs/streamwatch/index.html>

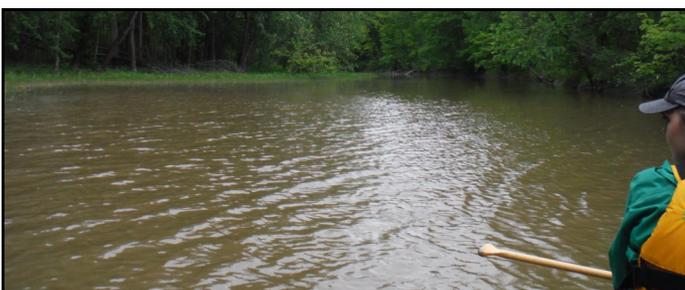
This year, a total of 286 volunteers from the community participated in the program throughout the field season, contributing a total of 1090 hours working on various projects. Approximately 26.5 kilometers of streams were surveyed as part of the 2016 cycle in Brassils Creek, Graham Creek, Greens Creek and McEwan Creek.

Stream Study and Comparison

This year RVCA City Stream Watch monitored four creeks in the City of Ottawa. Tributaries of the Ottawa River studied were: McEwan Creek, which was surveyed in 2010 and 2016; Greens Creek and Graham Creek which were both surveyed in 2005, 2010 and 2016. Brassils Creek, tributary to the Rideau River, was surveyed in 2006, 2010 and 2016. Table 4 is a comparison summary of monitoring activities carried out throughout reporting cycles between 2005 and 2016. Each year the number of sections surveyed is different depending on the number of sections where permission to access the creek is granted by land owners, additional tributaries and branches surveyed, as well as whether or not water is flowing in the upper reaches of the creek at the time of surveying. On Brassils Creek, limited access resulted in fewer sections surveyed in 2016, the low water conditions did not affect the surveys since surveys were completed before they were dry. All open surface water sections on Graham Creek and McEwan Creek were surveyed in 2016. Greens Creek was surveyed in its entirety from its mouth at the Ottawa River all the way to its headwaters in Ramsey Creek and Borthwick Creek. On all four creeks, volunteer numbers and hours decreased in comparison to the numbers seen in 2010, which can be attributed to improvements that were made to the Stream Characterization protocol and field sheets in 2014. The changes have made the stream survey process more efficient resulting in less time spent surveying each section. Increased efficiency in stream surveys allowed more volunteer effort to be spent on restoration and stewardship projects involved in CSW in 2016.

Table 4 Stream study comparison between 2005, 2006, 2010 & 2016 of Rideau Valley Conservation Authority City Stream Watch cycles. N/A: in 2005-6 volunteer numbers were not tracked by creek

Activities	McEwan Creek		Graham Creek			Greens Creek			Brassils Creek		
	2010	2016	2005	2010	2016	2005	2010	2016	2006	2010	2016
Number of Sections Surveyed	24	25	67	64	53	124	135	134	68	82	54
Number of Volunteers	9	16	N/A	90	45	N/A	104	68	N/A	26	24
Total Volunteer hours	26	54	N/A	364	133	N/A	480	309	105	170.5	106
Number of Fish Sampling Sites	5	8	3	6	8	2	6	11	2	6	5
Number of Temperature Probes	2	3	2	4	4	2	4	5	2	4	4



RVCA volunteer canoeing in a stream survey at Greens Creek



CSW volunteers and RVCA staff removing invasive species in Graham Creek (photo courtesy of: Water Rangers)



City Stream Watch 2016 Summary Report

RVCA Community Response

A total of 286 volunteers spent 1090 hours with the RVCA City Stream Watch program in 2016. Dedicated volunteers are the backbone of the program. Many volunteers participated multiple times and assisted with surveys and events on more than one creek this year, listed in Table 5.

Table 5 Rideau Valley Conservation Authority City Stream Watch Accomplishments for 2016

Metric	Brassils Creek	Greens Creek	Graham Creek	McEwan Creek	Sawmill Creek	Mud Creek	Black Rapids	Brewer Pond	Remic Rapids	Jock River	Rideau River	Total
Headwater Drainage Feature Sites Surveyed	20	12	13	9								54
Number of Stream Sections Surveyed	54	134	53	25								266
Number of Fish Sampling Sites	4	10	8	7								29
Number of Fish Sampling Sessions	5	20	8	9								42
Number of Temperature Probes	4	5	4	3								16
Demonstration Events								2		1	1	4
Training Sessions			1									1
Number of Garbage Clean-up Events	1	7	1	2	3							14
Kilometers (km) of Stream Cleaned	0.6	5.83	0.85	0.95	0.87							9.1 km
Invasive Species Removal Events			2	1	1	1	1	1	1	1	1	10
Squared Meters (m ²) of Shoreline Cleared			12000	2000	800	N/A	3000	280	80	400	41000	59560 m ²
Shoreline Planting Events							1				1	2
Number of Trees & Shrubs Planted							589				343	932
Adopt a Stream		yes			yes							2
Restoration Projects							1					1
Number of Volunteers	24	68	45	16	26	1	27	28	1	29	21	286
Number of Volunteer Hours (hrs)	106	309	133	54	88	1	124	94	2	116	63	1090 hrs



Drought Conditions - Rideau Valley Watershed



Low Water Conditions

During the summer of 2016, the Rideau Valley watershed experienced periods of *severe* drought. Since May, RVCA issued drought condition statements that ranged from moderate to severe, the latter being sustained from August to December and moderately severe in late June. Precipitation levels were measured at less than 40% of the long-term average, as the water supply was unable to meet local demand. The lack of rainfall affected the success and function of farm crops, municipal and private wells, lawns and gardens, navigation and ultimately the health of the lakes, rivers and streams.

Low water conditions were readily observed throughout the watershed, as many of the streams were highly fragmented or completely dry. Aquatic species such as amphibians, fish, mussels and other macroinvertebrates were affected, as suitable habitat may have been limited.

City Stream Watch

Low water levels and flows were common across our city streams, and are reflected in our overall evaluation. Given the atypical conditions, all assessments were subject to the effects of low water, and may not reflect the overall health of the systems. The City Stream Watch program will continue to monitor conditions over the long term to better understand the effects of climate and precipitation patterns.



Species at Risk

Rideau Valley Conservation Authority plays a role in the conservation of species at risk in Ontario in partnership with provincial and federal governments, as well as other groups by providing services that aid in the protection of these vulnerable aquatic species and their habitats. RVCA reviews proposed development projects in our watershed and provides technical advice and information services with respect to aquatic resources. The guidance provided by RVCA is based on not only information sources such as the Department of Fisheries and Oceans Canada and the Ontario Ministry of Natural Resources and Forestry; but also from data collected through our various programs, including our monitoring efforts from City Stream Watch. Even in our urban streams we have species at risk that reside in these areas. In the creeks we monitored in this cycle year of city stream watch we had many species at risk to be on the look out for and a few pleasant surprises.

Brassils Creek, a tributary to the Rideau River, is an area with observations of the bridge shiner, a species of Special Concern listed under the Species at Risk Act (SARA), the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), and the Ontario Endangered Species Act (ESA). Greens Creek, a tributary to the Ottawa River, has a very unique green corridor that is habitat for a variety of species of flora and wildlife; it is known to be historical habitat for the Hickorynut mussel and the False Hop Sedge, both endangered species (SARA, COSEWIC, ESA). This year during our City Stream Watch sampling and monitoring activities in various urban streams, we encountered snapping turtles, northern map turtles, river redhorse, monarch butterfly and milk snake, all listed as species of Special Concern under SARA, COSWEIC and ESA.



Some species at risk observed in the RVCA City Stream Watch 2016 cycle: milk snake (top left), river redhorse (bottom left), monarch butterfly (top right), and northern map turtle (bottom right); all listed under ESA, SARA and COSEWIC as species of Special Concern

RVCA Volunteer Projects

Volunteer projects are carried out either for educational or rehabilitation purposes. City Stream Watch in the Rideau Valley watershed carries out the following types of volunteer projects:

- Removing invasive species that will outcompete native plants
- Stream garbage clean-up events
- Planting trees and shrubs along stream corridors
- Habitat restoration and rehabilitation (bioengineering, habitat creation, wetland restoration)
- Learning about and participating in fish sampling sessions and species identification
- Learning about and participating in benthic invertebrate sampling sessions and taxonomic identification
- Learning about fly fishing

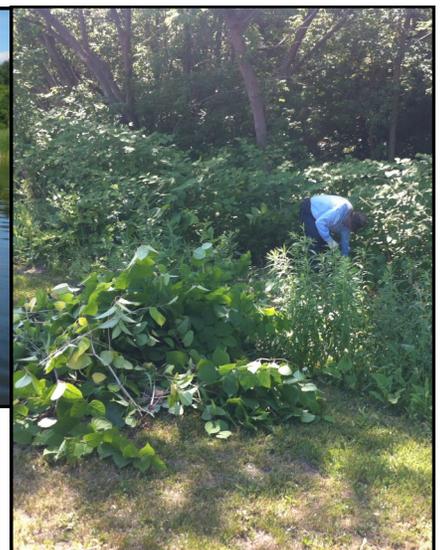
The following is a summary of volunteer projects carried out by the RVCA in 2016. Over the course of the field season, RVCA City Stream Watch ran 28 special events outside of regular sampling activities.

RVCA Invasive Species Removal

Invasive species can be introduced into the environment through a variety of human and natural influences including aquarium and horticultural activities, pet trades, live bait industry, recreational boating, global shipping containers and ballast water. These species are known to have major implications for stream habitat as they can outcompete native species thereby negatively effecting local wildlife, fish and plants.

There are a number of invasive species that have been observed along creeks in the City of Ottawa. Many are known to be very prolific and can be found along an entire stream length. In response to the growing number of invasive species observed during stream surveys, the City Stream Watch Program began removing targeted species in 2010. Removal efforts have been focused on certain species in targeted areas where volunteer removal efforts can halt the spread along the shoreline and make a significant difference in stream habitat. Special effort is made to return to targeted areas for additional removals in subsequent years and to encourage repopulation of the area by native plant species by spreading native seed mixes where appropriate.

In 2016, ten invasive species removal events were carried out on nine creeks by the City Stream Watch Program with support from the Canadian Forces Ottawa Fish and Game Club and City of Ottawa. The species targeted for removal this year were Himalayan balsam, Japanese knotweed, European water chestnut, European frog bit, flowering rush, garlic mustard, glossy and common buckthorn. The removal methods for invasive species were taken from the Ontario Federation of Anglers and Hunters (OFAH) website, research literature and local community members who have been involved in various types of removals.



CSW volunteers and staff removing invasive species in various streams: Himalayan balsam in Graham Creek (left; photo courtesy of Water Rangers), European water chestnut in the Rideau River (above) and Japanese knotweed in Sawmill Creek (right)

RVCA City Stream Watch 2016 Example Targeted Invasive Species in Ontario

European Water Chestnut (*Trapa natans*)

Originating from Eurasia and Africa, it was introduced in North America as an ornamental plant in 1874 (Hummel and Kiviat 2004). In India, China and other parts of Asia it is cultivated for its nutritional and medicinal uses. In contrast to North America, in Europe it is listed as endangered and in some cases as an extirpated species. It removes heavy metals and nitrogenous substances, thriving in waters with high anthropogenic nutrient input and soft substrates (Hummel and Kiviat 2004).

Aside from displacing native floating plants, dense mats block sunlight and prevent growth of submerged vegetation. It has detrimental effects on wildlife that relies on submerged plants as a food source and shelter; and it depletes dissolved oxygen which can negatively impact sensitive fish species (Hummel and Kiviat 2004). Management includes chemical, biological and physical control. Physical is one of the best ways to manage its growth, as with its removal it includes the heavy metals and nutrients it had filtered.

Bottom photos courtesy of: Ontario Federation of Anglers and Hunters.



Himalayan Balsam (*Impatiens glandulifera*)

Native to the western Himalaya's, Himalayan balsam is a prolific invasive species found throughout many Ottawa creeks. Introduced as a garden ornamental, this aggressive annual is highly capable of out-competing many native riparian plants.

It is also a bountiful nectar producer, and could be detracting pollinators from surrounding native flowering species (Clements et al 2008). This, along with the displacement of native riparian plant species, have negative ecological impacts resulting in a reduced biodiversity in riparian plant communities. When dense patches of Balsam die off in the fall, large areas of soil are exposed contributing to bank erosion in higher winter and spring flows (Clements et al 2008).

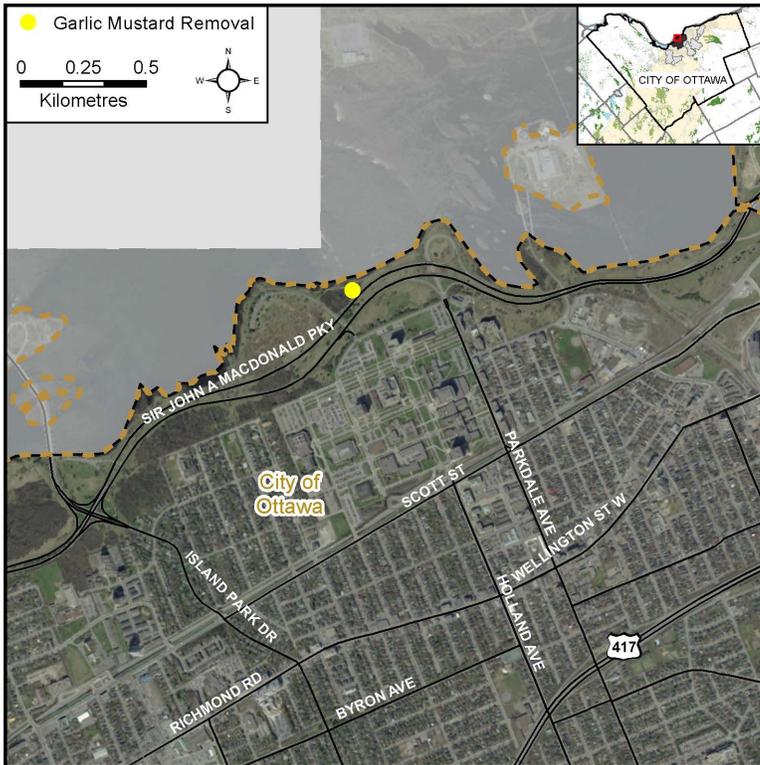
Fortunately, we have had great success in managing this species, as interrupting its growth cycle is extremely effective in controlling it. In order to strategically remove the plant we tackled both Graham and McEwan Creeks starting in the

Japanese Knotweed (*Fallopia japonica*)

An indigenous plant of Eastern Asia, Japanese knotweed, was brought over to North America as an ornamental and livestock forage in the late 18th century (Anderson 2012). Although its distribution has not been extensively documented in Canada until recent years, there have been many confirmed sightings in Ottawa.

This perennial plant degrades riparian habitats resulting in not only reduced native plant diversity, but also a decline in invertebrate, amphibian, reptile, bird and mammal communities (Anderson 2012). Knotweed is one of the most aggressive plant invaders, so its control requires substantial amounts of labor. We continue our successive efforts in our second season at a site in Sawmill creek as we continue monitoring the spread of this invader.



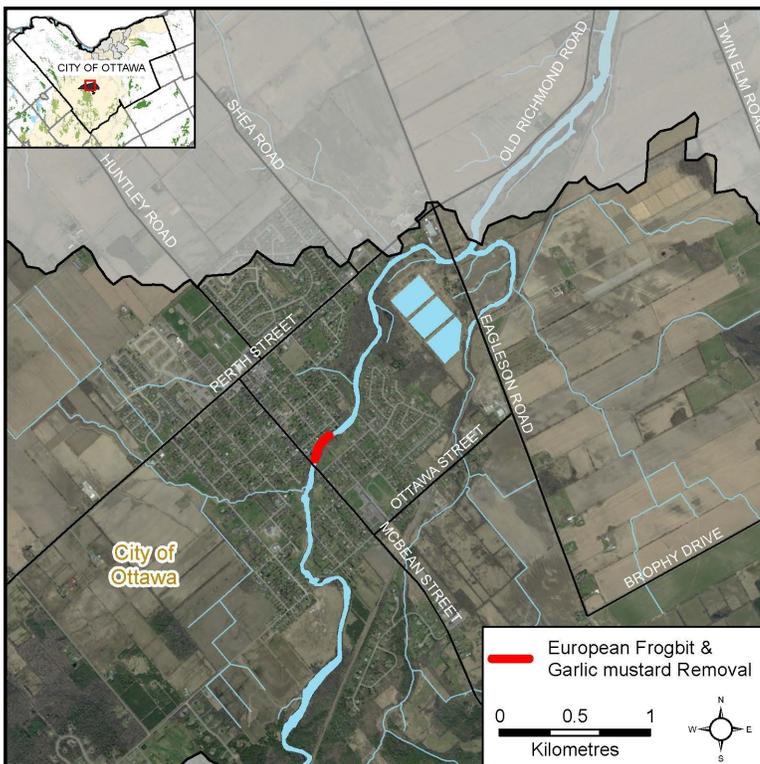


Remic Rapids Wetland Garlic Mustard Removal
 This 0.15 hectare wetland feature, adjacent to the Ottawa river, was designed and constructed in 2015 by the Rideau Valley Conservation Authority (RVCA) partnered with the National Capital Commission (NCC). Consisting of a shallow water basin wetland, it provides habitat for amphibians as well as birds and acts as a water supply for wildlife. During monitoring, garlic mustard was noted growing in its first year vegetative state. A total of 6 person hours were spent removing the plants from an 80 m² area. Future site monitoring will allow us to observe how native plants re-establish.



First year growth, the non flowering stage, of Garlic Mustard being removed by a CSW volunteer with RVCA in Remic Rapids Wetland

Figure 4 Garlic mustard removal at Remic Rapids Wetland



Jock River Embayment European Frog Bit and Garlic Mustard Removal
 Constructed in 2014 by RVCA, the wetland embayment is an area that was created to provide fish habitat. Riparian, as well as aquatic planting and seeding of native plant species was accomplished in its creation, however invasive species were present this year. Volunteers removed frog bit present in the water as well as garlic mustard growing in the riparian zone. Within 12 volunteer hours a 400 m² section was cleared.



CSW volunteers and RVCA staff removing the invasive European Frog Bit at the Jock River Embayment

Figure 5 European frog bit and garlic mustard removal at the Jock River Embayment

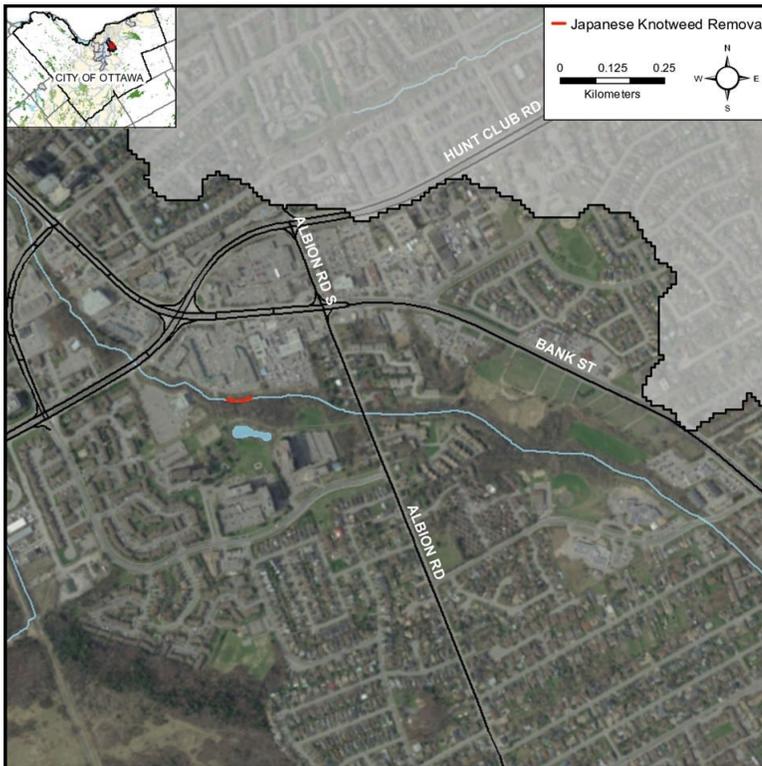


Figure 6 Japanese knotweed removal along Sawmill Creek

Sawmill Creek Japanese Knotweed Removal

Three removal events took place along Sawmill Creek in June. The goal of this pilot project, that started in 2015, was to see if repeated cutting and removal of Japanese knotweed throughout the growing season would exhaust the plant enough to reduce the extent of spread. In 2015 we used the cutting approach, this year the density was similar to the previous year, this season we removed the entire plant including rhizomes. In total, 7 volunteers spent 21 volunteer hours to remove 355 kg of Japanese Knotweed from a 50m stretch of shoreline, clearing an area of 900m². Post effectiveness monitoring will be continued in 2017.



RVCA City Stream Watch volunteer removing Japanese knotweed along Sawmill Creek

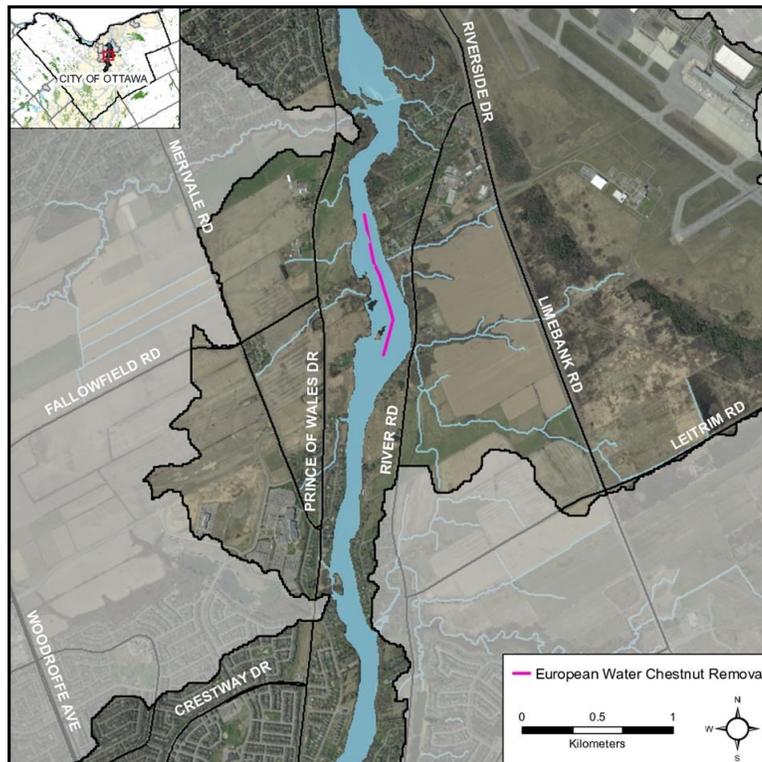


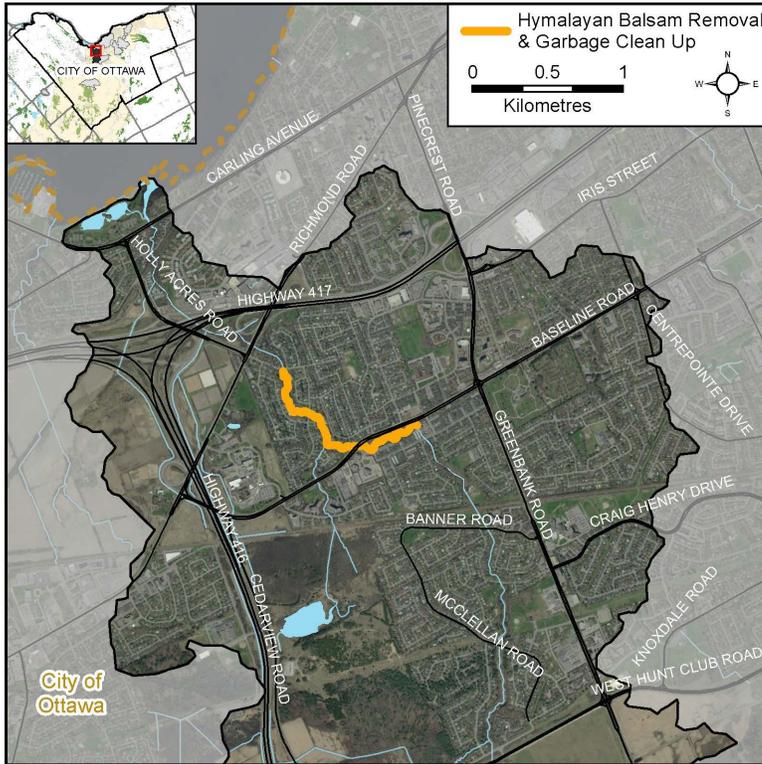
Figure 7 European water chestnut removal along the Rideau River

Rideau River European Water Chestnut Removal and Float the Rideau (Ottawa Flyfishers Society)

The first sighting of European water chestnut on the Rideau River was reported to Ducks Unlimited Canada (DUC) in 2014. In 2015 and 2016, City Stream Watch, the City of Ottawa, DUC and Boy Scouts joined efforts to control the spread of this invasive species. A removal event was organized on the Rideau River in June as a follow up from last year's removal efforts. A reduction in the abundance of the plant was noticed this year compared to 2015. Eight CSW volunteers spent 24 volunteer hours in canoes and boats pulling this aquatic invasive plant, clearing an area of 40,000 m². As part of the *Float the Rideau* event the OFS organized in August, RVCA staff joined them further inspecting other areas of the Rideau, and no more chestnut was observed.



Volunteers & staff from RVCA, City of Ottawa & DUC removing European water chestnut from the Rideau River



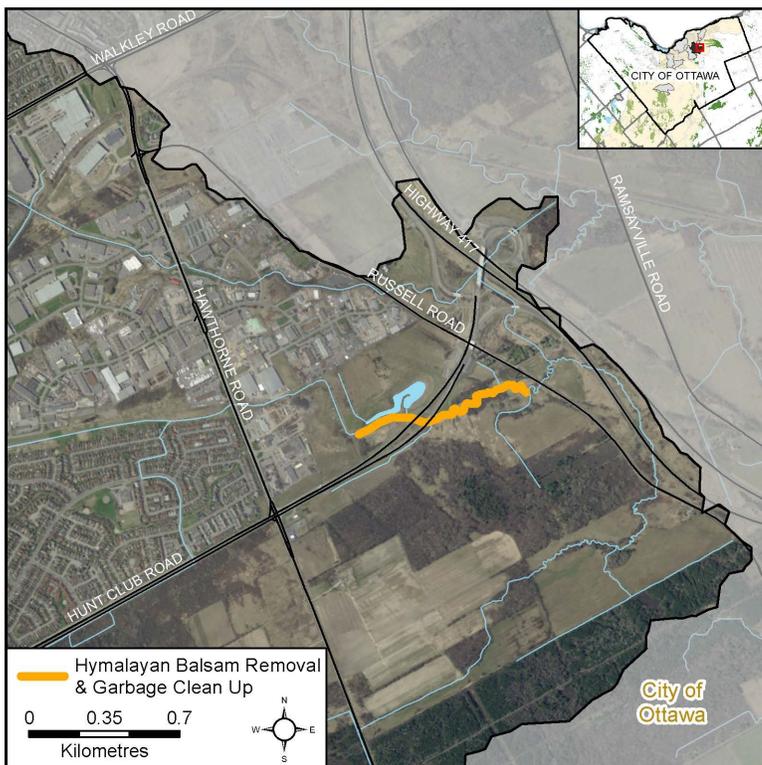
Graham Creek Himalayan Balsam Removal & Garbage Clean-up

As part of this year's stream surveys, areas densely invaded with Himalayan balsam were identified. These areas showed displacement of native plants, so efforts were focused in dense patches. City Stream Watch Staff and 8 volunteers removed the invasive plant and stream bottom garbage from an area covering 1200 m², along 1290 m of shoreline; the effort required a total of 16 volunteer hours and additional staff support over two days in July.



Volunteers and RVCA staff removed Himalayan balsam and garbage at Graham Creek

Figure 8 Himalayan balsam removal on Graham Creek



McEwan Creek Himalayan Balsam Removal & Garbage Clean-up

Himalayan balsam was observed this year in many sections during stream surveys on McEwan Creek. High water depth fluctuations in this system allow for riparian plants to easily carry downstream, hence City Stream Watch volunteers and staff returned to the most upstream sightings this year to remove the plants. At this removal event in July, 450 m of shoreline were cleared of invaders and garbage in a total of 6 person hours. An additional 500 m of stream was also cleared of garbage on a separate day over 21 person hours.



CSW volunteer and RVCA staff removing Himalayan balsam along the shoreline of McEwan Creek

Figure 9 Himalayan balsam removal on McEwan Creek



RVCA City Stream Watch volunteers removed 28 bags of garbage in spring Ccean-up at Sawmill Creek



RVCA CSW collaborative members of the Canadian Forces Ottawa Fish and Game Club and RVCA staff



CSW volunteers and RVCA staff at the Tim Hortons Cleaning the Capital event in Sawmill Creek.

Stream Garbage Clean-up and Debris Removals

Each year City Stream Watch plans stream garbage clean-ups to remove debris of anthropogenic origin from the creeks and shorelines where it is needed most. In 2016, three stream garbage clean-up day events took place along two different creeks, Greens Creek and Sawmill Creek. In addition to that, a five-day effort was made to remove hazardous waste from Greens Creek. Small garbage Clean-ups were also done concurrently with our stream surveys in Greens Creek, McEwan Creek, Brassils Creek and Graham Creek. In total, approximately 9.1 km of creek length and shoreline was cleared of garbage in various streams.

Sawmill Creek—Spring Clean-up and Tim Hortons Cleaning the Capital

In April and September, the Canadian Forces Ottawa Fish and Game Club joined City Stream Watch for three cleanup events near Towngate Mall in Sawmill Creek. The club targeted problem areas they had identified, removing garbage as well as obstructive woody debris that was acting as a fish migratory obstruction. The spring Clean-up yielded 28 bags of garbage collected by 16 participants over three hours. The fall event, part of the Tim Hortons Cleaning the Capital 2016, was a three hour visit to the site where 9 volunteers and staff removed 11 garbage bags.

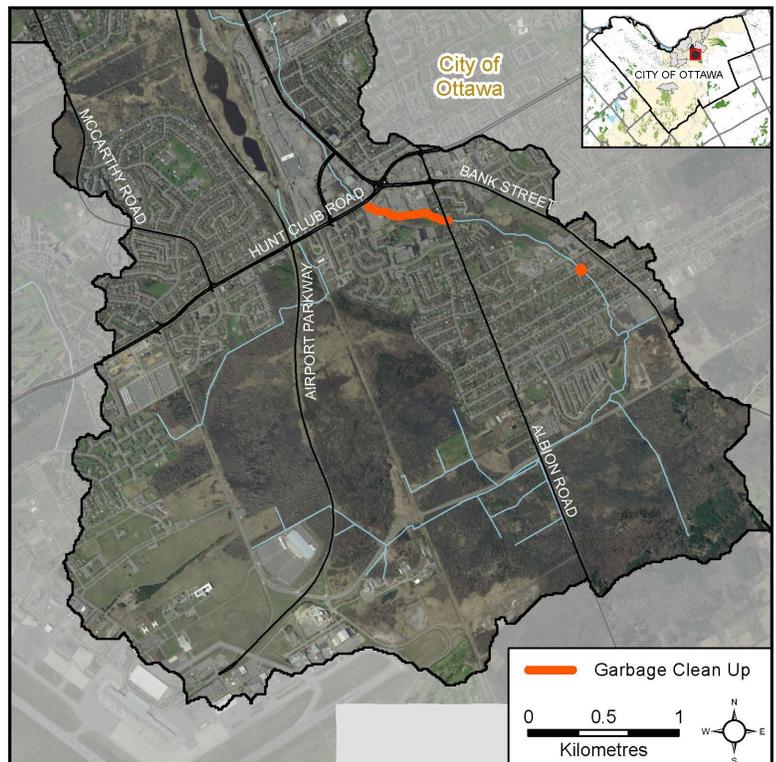


Figure 10 Stream garbage clean-up events on Sawmill Creek

Adopt-A-Stream: Greens Creek Fish Migratory Obstruction

Volunteers from Adopt-A-Stream had indicated there was a large fish migratory obstruction at St. Joseph Boulevard in Greens Creek. This debris jam was 3 m high, comprised mostly of large tree trunks, other woody debris, sediment and garbage that had accumulated. The obstruction covered the entire width of the channel (approx. 22 m). City Stream Watch staff contacted the City of Ottawa who removed the debris in this challenging location during fall.



Debris Jam obstructing the entire stream at St. Joseph Boulevard bridge, brought to our attention by Adopt-A-Stream volunteers in Greens Creek (left). This City of Ottawa removed this debris in late fall of 2016 (right).

Greens Creek Garbage Clean-up

This one day event was a part of a major Clean-up endeavor taken on by City Stream Watch staff and volunteers. In one day we covered 630 m of stream and shoreline collecting all types of garbage, including some hazardous waste. We had 9 participants and 18 volunteer hours to collect 6 garbage bags, spray paint cans, large metal debris, tires, scaffolding and scrap metal.



CSW volunteers with RVCA picking up garbage in Greens Creek



Hazardous waste, mostly spray paint cans collected on Greens Creek.

Greens Creek Hazardous Waste Collection

Throughout the stream surveys along Greens Creek this year we noticed a lot of empty paint cans and containers in the riparian areas and collecting on woody debris jams. City Stream Watch and volunteers decided to take on the daunting task over five days, a total of 62 volunteer hours, to removing all this hazardous waste over 4.5km stretch of the creek from St. Joseph Blvd to Innes Rd. It was not an easy job, but the reward came in the form of 200 spray paint cans, various paint cans and solvent containers. A special thank you to the City of Ottawa staff for aiding in the waste disposal.

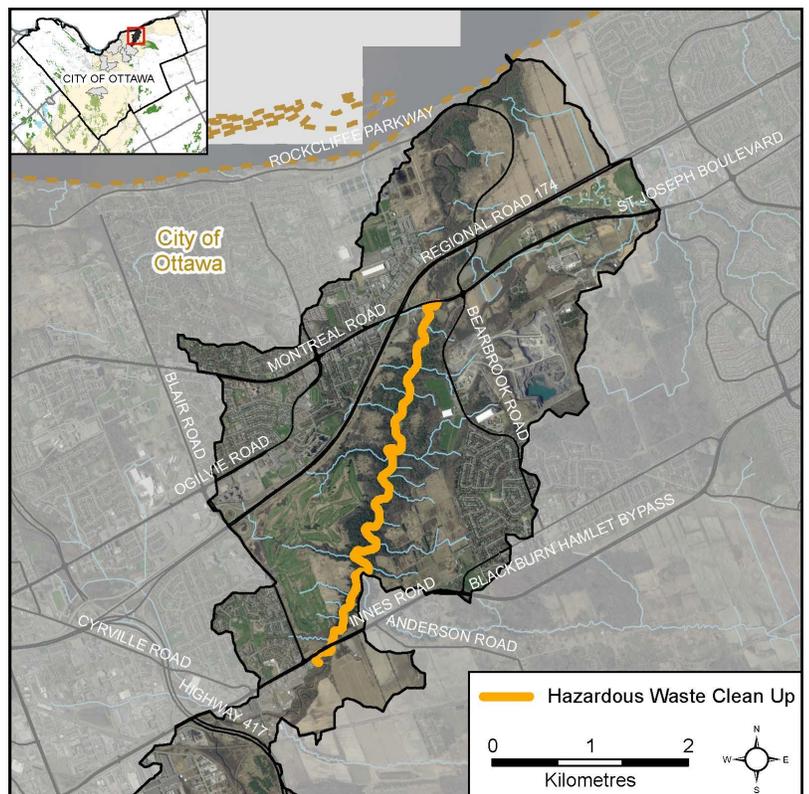


Figure 11 Area in Greens Creek where hazardous waste, such as paint cans, was collected by CSW volunteers and RVCA staff over 5 days

RVCA Shoreline Planting and Restoration Projects

David Bartlett Park on the Rideau River Riparian Tree Planting

In April, the Shoreline Naturalization Program and City Stream Watch volunteers returned to a past riparian planting site along the Rideau River at the North end of Manotick Island. The group planted semi-mature trees to enhance the existing shoreline revitalization project where various trees and shrubs had been planted in previous years. Thirteen volunteers contributed a total of 39 volunteer hours to the project. A total of 343 trees and shrubs were planted.



Volunteers and RVCA Staff planting trees and shrubs in Manotick at the David Bartlett Park on the Rideau River

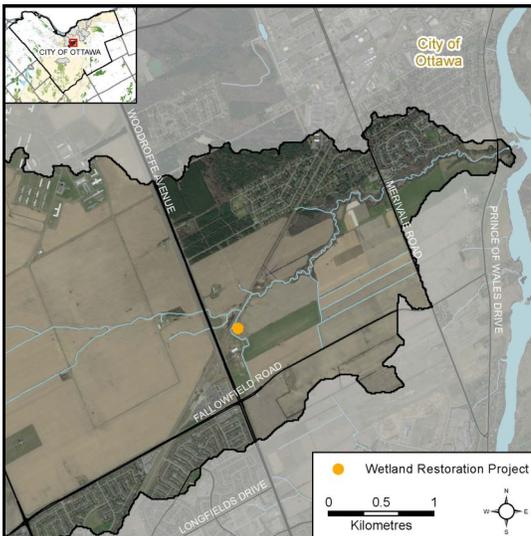


Figure 12 Black Rapids Wetland Restoration Project

a variety of side slopes and swales, as well as the installation of woody material (root wads, basking logs and sweeper trees). Work included the removal of 1225 m² of the invasive Glossy Buckthorn, and the revegetation of riparian zones with native trees and shrubs.

This wetland restoration will improve water quality, provide rare wetland habitat within the catchment for sensitive species and increase overall biodiversity of the local ecosystem. Enhancement of wetlands of this size near the headwater areas may provide additional benefits such as decreasing warming water temperatures, retaining nutrients and sediments and allowing for protection of the stream after disturbance events (Environment Canada 2003).

City Stream Watch volunteers supported the project through stabilization work:

- Planting of 589 native trees and shrubs
- The installation of erosion control mats
- A total of 27 volunteers at 124 volunteer hours



Black Rapids Wetland Restoration Project panoramic view

Black Rapids Wetland Restoration Project

The RVCA partnered with the National Capital Commission to design, enhance, restore and reconnect a wetland adjacent to Black Rapids Creek. The newly enhanced wetland feature is located close to the Fallowfield Road and Woodroffe Avenue intersection. The feature was expanded from an area of 3500 m² to 7000 m² consisting of a wetland with



Volunteer shrub and tree planting
Black Rapids Wetland

day at the

RVCA Workshops and Demonstrations

Workshops and demonstrations are an important and popular part of the City Stream Watch program because they give volunteers the opportunity to learn how to identify various fish species and benthic invertebrates that are present in our watershed as well as the sampling methods that RVCA staff use in the field.

Spring Volunteer Orientation

In spring 19 volunteers attended a 2 hour orientation session. In it RVCA staff demonstrated stream survey, fish and benthos collection methods; as well as giving a talk about native and invasive species.

The Ultimate Aquatics Workshop

In the fall, 26 volunteers and fly fishers braved the cold to attend the popular Ultimate Aquatics Workshop at the Jock River Landing Park, dedicating 104 person hours to the workshop. This event is a collaboration between City Stream Watch and the Ottawa Flyfishers Society (OFS) which gives volunteers the unique opportunity to learn about benthic invertebrate identification and fly fishing all in the same day. The Ottawa Flyfishers Society was formed in 1983 to unite local area fly fishers. The Society is dedicated to fostering and furthering the practice of activities associated with the art of fly fishing, conservation and resource renewal.

Rideau Valley Conservation Authority staff:

- Introduced the basics of the OBBN protocol (Ontario Benthos Biomonitoring Network) used by RVCA
- Assisted volunteers on how to collect, process and identify benthic macro invertebrates to order level

Ottawa Flyfishers Society members:

- Explained the relationship between stream functions, habitat, benthos and their importance to fish and fly fishing
- Gave an introduction to fly fishing and provided samples of fly ties
- Paired up with volunteers to provide hands on instruction in fly casting and practical experience



CSW volunteers at the spring orientation session



CSW volunteers using D-nets to collect benthic invertebrates with the kick and sweep method



CSW volunteers getting fly casting instructions from members of the Ottawa Flyfishers Society (left); examples of stonefly based fly ties (middle); volunteers identifying aquatic invertebrates (top right); and examples of damselflies



Tree Fest Ottawa

This initiative is a fall tree festival in the city that promotes awareness towards trees and the environment. The festival itself is organized by a group of volunteers and along with community partners to create events and exhibits to engage the public with trees and the environment in an interactive way.

Tree Fest Ecology Day at Brewer Pond: Fish and Benthos Workshop

Rideau Valley Conservation Authority staff introduced fish and benthic macro-invertebrate sampling techniques. Members of the public were invited to participate in the demonstrations. In this two hour workshop, we had 9 volunteers join us in the water, including our very own

Photo courtesy of:
Tree Fest Ottawa

Member of Parliament for Ottawa Centre and Minister of Environment and Climate Change Canada, Catherine McKenna.

Fish and benthic invertebrates collected were displayed for the audience to learn more about the different species that are residing in Brewer Park Pond. This was another opportunity to educate the public about our monitoring efforts at Brewer Pond since its connection to the Rideau River was restored.

Tree Fest Day of Action at Brewer Pond: Invasive Flowering Rush Removal

Rideau Valley Conservation Authority Staff and volunteers:

- Learned how to identify Flowering Rush to distinguish them from native rushes
- Carefully removed 15 bags of flowering rush plants
- Cleared 280 meters of shoreline of the invasive rush



RVCA City Stream Watch volunteer removing the invasive flowering rush at Brewer Pond



RVCA staff identifying the invasive flowering rush at Brewer Pond



M.P. Catherine McKenna, Rideau Valley Conservation Authority Staff, Carleton University students and members of the public discovering fish and benthic invertebrates in the restored Brewer Park Pond along the Rideau River (Ecology Day at Tree Fest Ottawa)

RVCA Plans for 2017

In 2017 as part of our City Stream Watch program we will be monitoring the following creeks:

- Becketts Creek
- Pinecrest Creek
- Stevens Creek

There will be many opportunities to assist with:

- Stream habitat assessment surveys
- Fish community sampling
- Stream garbage cleanups
- Invasive species removals
- Riparian tree and shrub planting
- Workshops and demonstrations
- Bioengineering projects
- Habitat enhancement and restoration

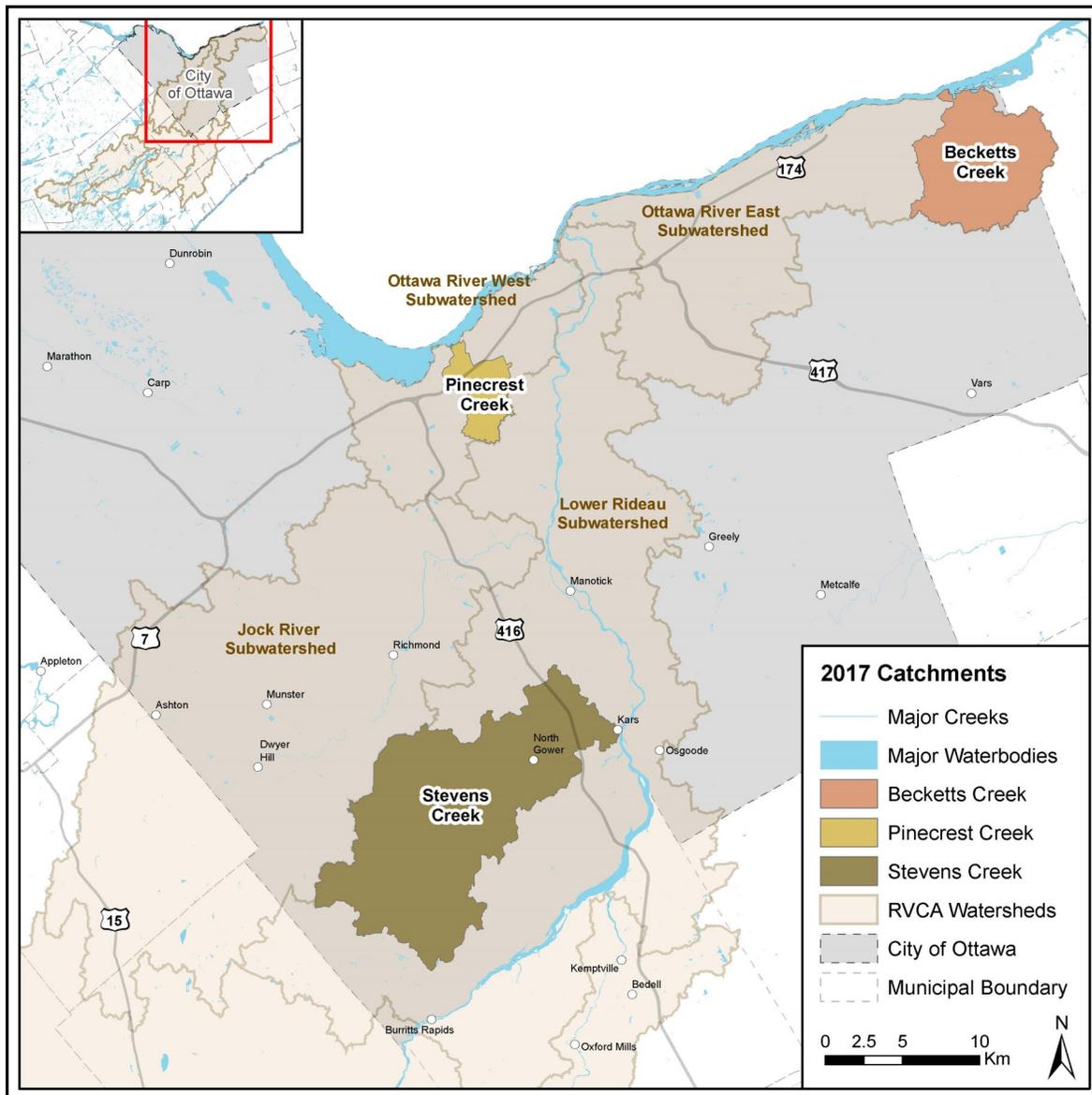


Figure 13 Location of Rideau Valley Conservation Authority 2017 City Stream Watch monitoring activities

To volunteer with RVCA's City Stream Watch program, please visit our website or contact:

City Stream Watch Coordinator

(613) 692-3571

citystreamwatch@rvca.ca

<http://www.rvca.ca/programs/streamwatch/index.html>

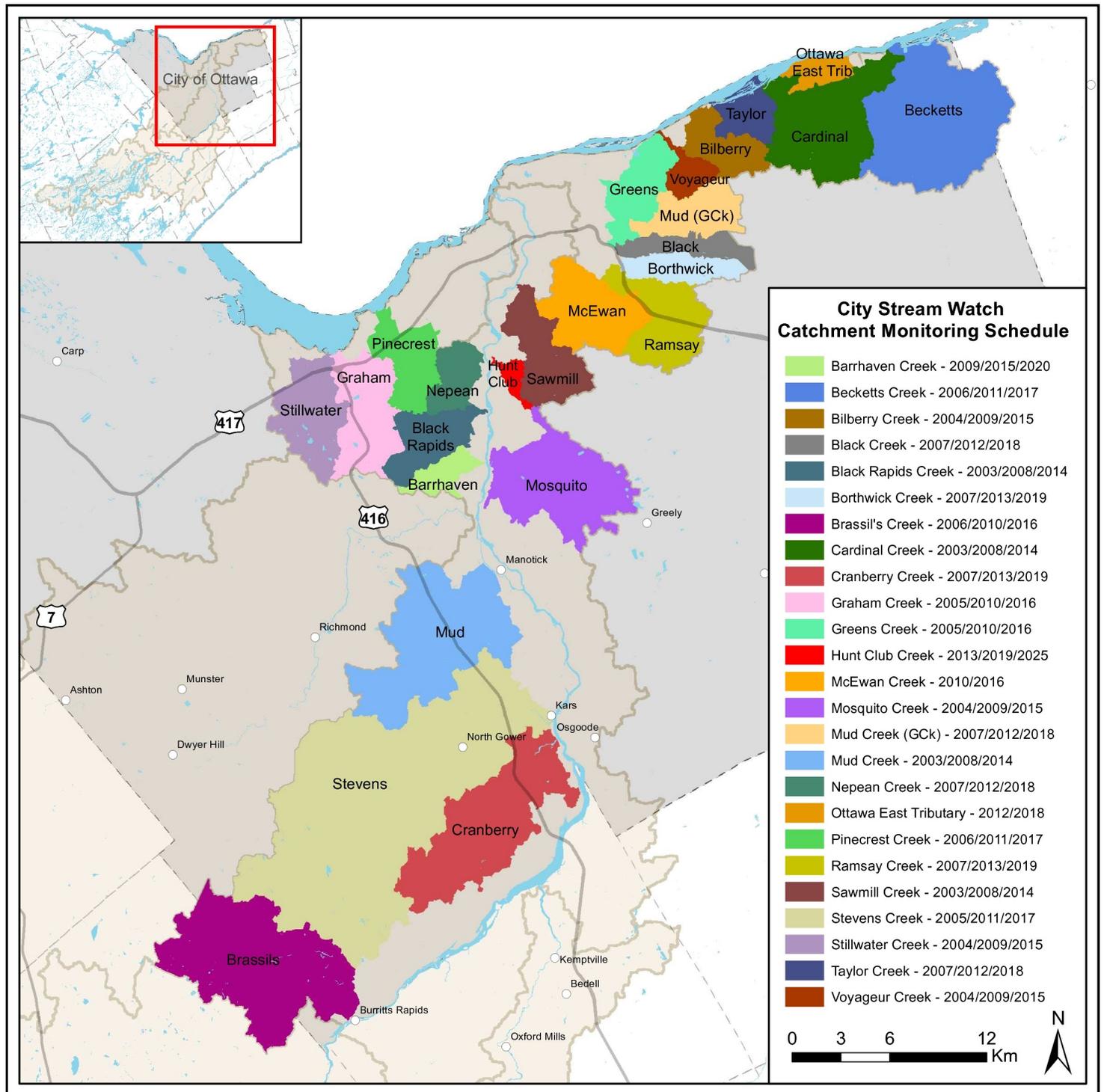


Figure 14 Creek Catchment locations and schedule of Rideau Valley Conservation Authority City Stream Watch monitoring activities



Acknowledgements

A big thank you to all of our 2016 volunteers. You continue to make the program a success and contribute to important data collection and rehabilitation projects along our urban and rural streams within the City of Ottawa.

Thank you to the City Stream Watch collaborative for continuing with their program guidance, ideas, volunteer recruitment and help.

Thank you to all media outlets for helping to spread the word about the City Stream Watch program and events.

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GLOSSARY OF ACRONYMS

CCME	Canadian Council of Ministers of the Environment. Provide Canadian Environmental Quality Guidelines (CEQG's)		
COSEWIC	Committee on the Status of Endangered Wildlife in Canada	NRVIS	Natural Resources and Values Information System
CSW	City Stream Watch	OBBN	Ontario Benthos Biomonitoring Network
DUC	Ducks Unlimited Canada	OFAH	Ontario Federation of Anglers and Hunters
ESA	Endangered Species Act	OFS	Ottawa Flyfishers Society
FCR	Friends of the Carp River	OSAP	Ontario Stream Assessment Protocol
GLGCF	Great Lakes Guardian Community Fund	PWQO	Provincial Water Quality Objectives
MNRF	Ministry of Natural Resources and Forestry	RVCA	Rideau Valley Conservation Authority
MVCA	Mississippi Valley Conservation Authority	SARA	Species at Risk Act
NCC	National Capital Commission	SNC	South Nation Conservation
NHIC	Natural Heritage Information Centre	TRCA	Toronto Region Conservation Authority