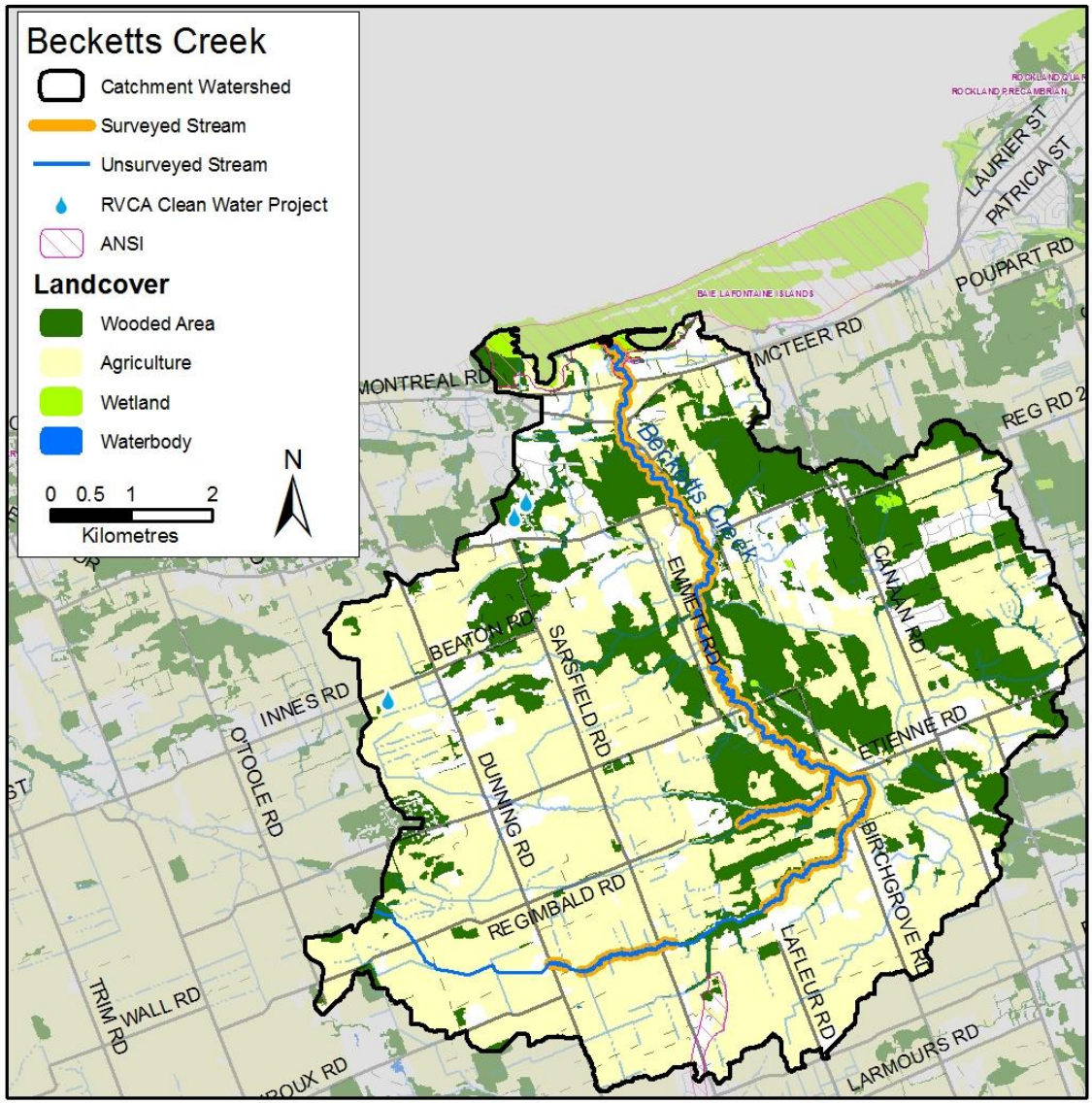
Becketts Creek 2011 Summary Report

Area	59 square kilometres, 1.39% of the Rideau River watershed
Land Use	59.62% agriculture 5.54% urban 23.24% forest 10.74% rural land-use 0.01 % waterbody 0.59% wetlands 0.26% unclassified
Surficial Geology	64% clay, 7% diamicton 6% gravel 2% organic deposits 5% bedrock 22% sand
Watercourse Length and Type	*Total length*: 28 km *Watercourse type*: 99% natural 1% channelized *Flow type*: 100% permanent
Invasive Species	There were 6 invasive species observed along Becketts Creek
Fish Community	25 fish species were sampled in 2011. Game fish present include largemouth bass, Northern pike, brown bullhead, walleye, black crappie, silver redhorse, shorthead redhorse, yellow bullhead and yellow perch.
Species at Risk	Species at risk known to be present in the Becketts Creek subwatershed include snapping turtle, bobolink and butternut.



Vegetation Cover

Types	Hectares	% of Cover
Wetlands	34.9	2.5
Wooded areas	1273.2	90.5
Hedgerow	13.3	0.9
Plantation	85.2	6.1
TOTAL COVER		**100%**

Wooded Area

Size Category	Number of Woodlots	% of Woodlots
<1 ha	251	97.7
1-9 ha	6	2.3
10-30 ha	0	0
>30 ha	0	0

Wetland Cover

0.59% of the watershed is wetland. Wetlands make up 2.5% of the vegetation cover.

The Rideau Valley Conservation Authority, in partnership with six other agencies in Ottawa (City of Ottawa, Heron Park Community Association, Ottawa Flyfishers Society, Ottawa South Community Association, Rideau Roundtable and National Defense HQ – Fish and Game Club) initiated the City Stream Watch program in 2003.

Becketts Creek 2011 Summary Report

The Becketts Creek subwatershed drains approximately 59 square kilometres of land. Becketts Creek is 28 kilometres in length and begins south of Sarsfield and has several tributaries and agricultural drains emptying into it. The creek flows north, just east of the town of Cumberland, crossing Rural Road 174 before its confluence with the Ottawa River. Land use in the subwatershed is mainly agricultural and rural, and there is a significant waterfall approximately three kilometres upstream of the mouth. Portions of Becketts Creek and various tributaries have municipal drain status. In 2011, 136 sections along the main branch of Becketts Creek were surveyed, in addition to 22 sections surveyed on an additional branch of Becketts. The areas along the main branch that were not surveyed were areas where the program did not have permission to access. The following is a summary of the 158 macro-stream assessment forms completed by technicians and volunteers.

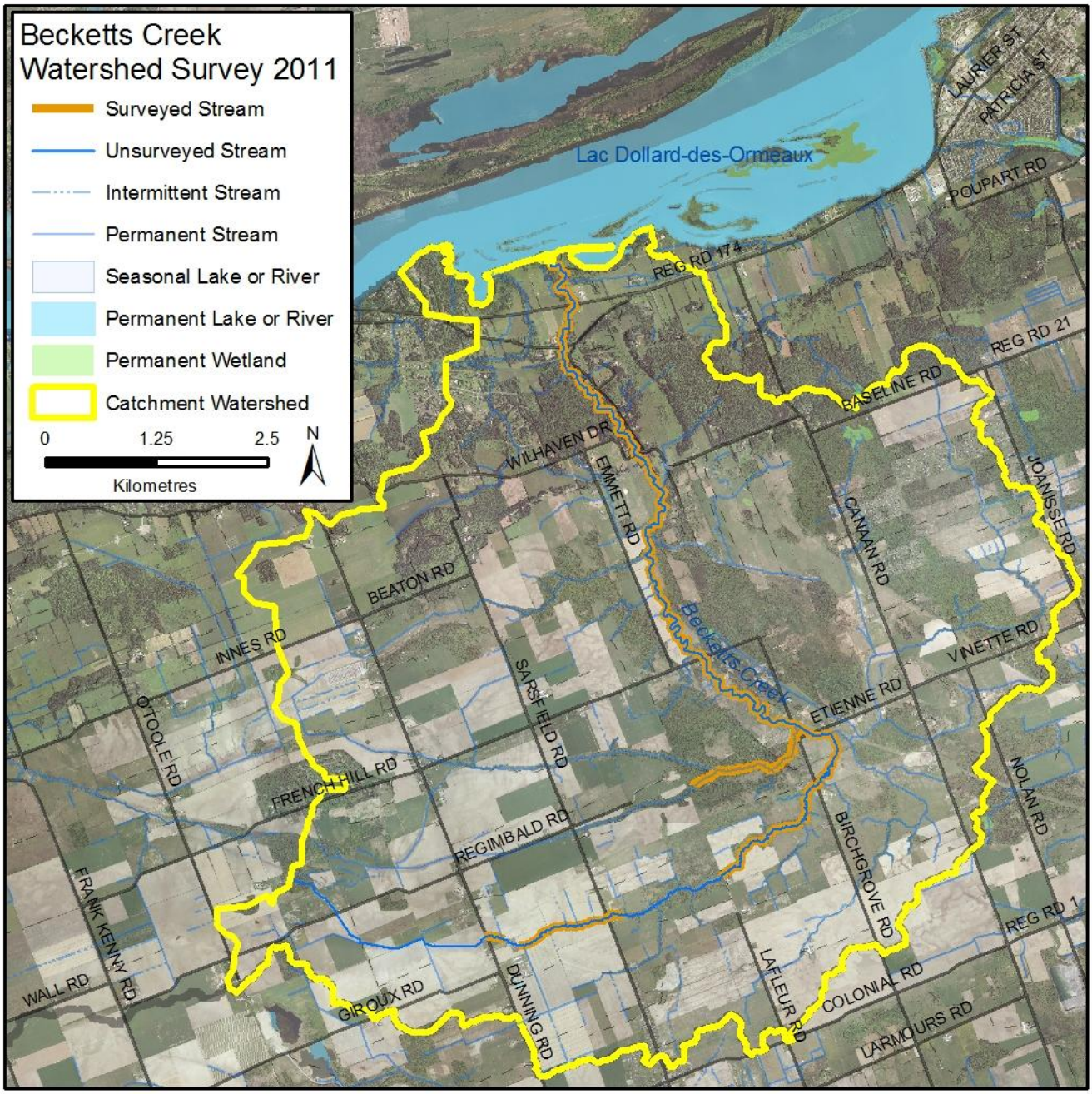


Figure 1. Air photo of Becketts Creek Subwatershed and Surveyed Area

Becketts Creek 2011 Summary Report

Anthropogenic Alterations to Becketts Creek

Figure 2 illustrates the classes of anthropogenic alterations observed along Becketts Creek. Of the 158 sections sampled, 57 percent of the stream remained without any human alteration. Sections considered natural, but with some anthropogenic changes made up nine percent of the sections sampled, and 20 percent accounted for sections that were considered "altered" but still had natural features. Fourteen percent of the sampled areas were "highly altered" with few natural portions. Areas that were listed as "altered" or "highly altered" were associated with road crossings, culverts, stormwater inputs, channelized sections or areas that had little or no buffer and little aquatic or wildlife habitat.

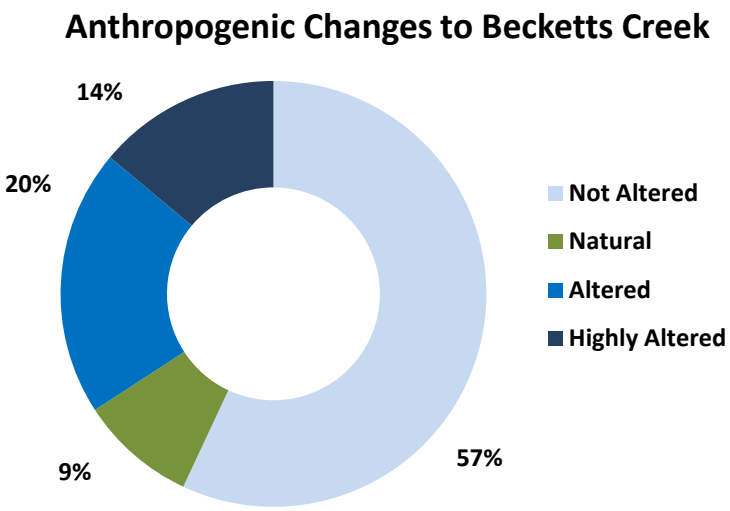


Figure 2. Classes of Anthropogenic Alterations Occurring along Becketts Creek

Photo of an anthropogenic alteration along Becketts Creek

Land Use Adjacent to Becketts Creek

Figure 3 demonstrates 11 different land uses identified along the banks adjacent to Becketts Creek. Surrounding land use is considered from the beginning to end of the survey section (100 metres) and up to 100 metres on each side of the creek. Land use outside of this area is not considered for they surveys but is nonetheless part of the subwatershed and will influence the creek. Natural areas made up 71 percent of the stream, characterized by forest, scrubland and meadow. The other major land use was agricultural. There were several areas adjacent to the creek where forest was being cleared and tile drains were being installed; this will have a future influence on the creek but is not reflected in the 2011 data. The remaining land use consisted of residential, pasture, abandoned agriculture, infrastructure, industrial/commercial and other. "Other" was where the banks of the Ottawa River were adjacent to the stream.

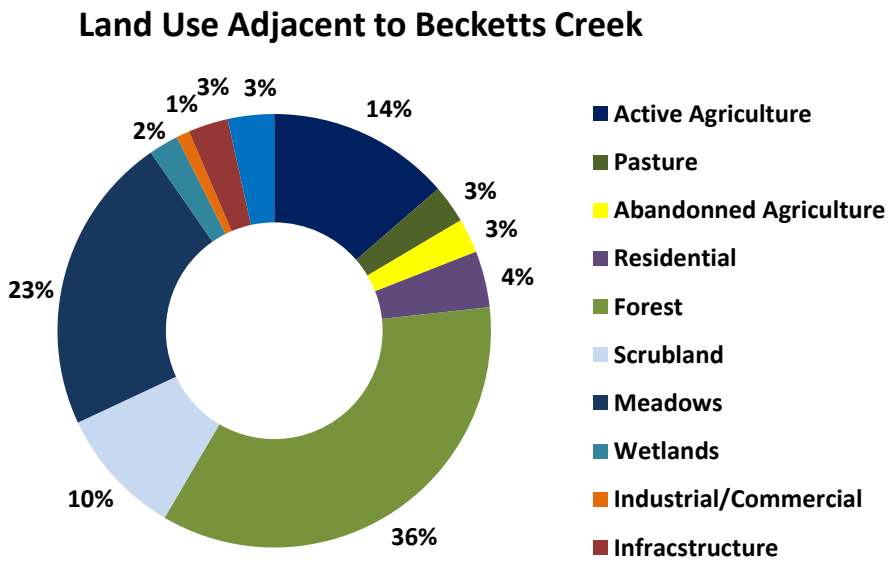


Figure 3. Land Use Identified Along Becketts Creek

An example of land use observed along Becketts Creek, meadow and forest

Becketts Creek 2011 Summary Report

Channel Type

Streams are naturally meandering systems and move over time, and there are varying degrees of sinuosity (curviness), depending on the creek. However, in the past, humans have altered creeks and channelized areas, which can be quite detrimental to stream function and health. Only one percent of Becketts Creek was considered channelized.

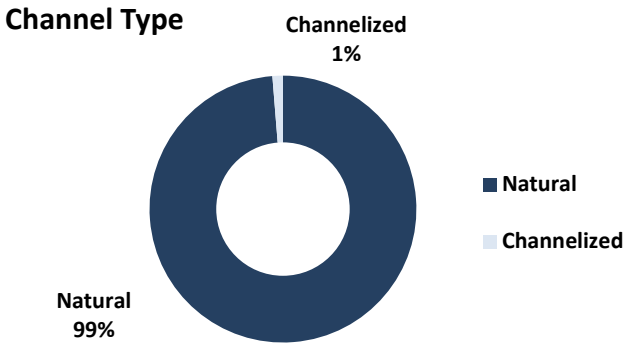


Figure 4. Channel Type Observed Along Becketts Creek

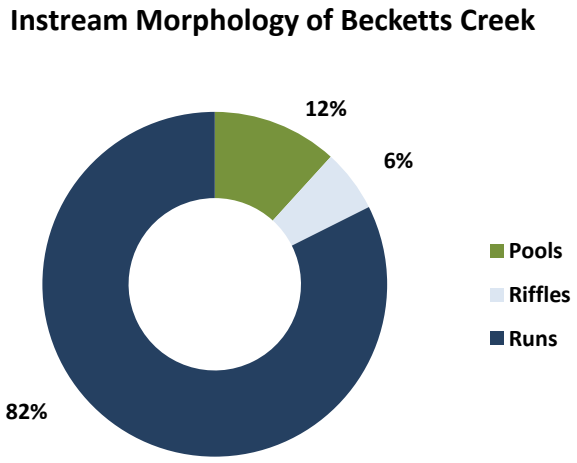


Figure 5. Instream Morphology of Becketts Creek

Instream Morphology

Pools and riffles are important features for fish habitat. Riffles are areas of agitated water, and they contribute higher dissolved oxygen to the stream and act as spawning substrate for some species of fish, such as walleye. Pools provide shelter for fish and can provide refuge in the summer if water levels drop and water temperature in the creek increases. Pools also provide important over-wintering areas for fish. Runs are usually moderately shallow, with unagitated water surfaces, and areas where the thalweg (deepest part of the channel) is in the center of the channel. Becketts Creek is fairly uniform; eighty-two percent consists of runs with 12 percent pools and six percent riffles, illustrated in Figure 5. One of the major riffles along the stream is a series of waterfalls.

Instream Substrate

Diverse substrate is important for fish and benthic invertebrate habitat because some species will only occupy certain types of substrate and will only reproduce on certain types of substrate. Boulders create instream cover and back eddies for large fish to hide and/or rest out of the current, and cobble provides important over wintering and/or spawning habitat for small or juvenile fish. Other substrates also provide instream habitat for fish and invertebrates. A variety of substrate can be found instream along Becketts Creek, although 58 percent observed was clay. Other types of substrate that occurred in smaller proportions include gravel, sand, cobble, boulder, muck, silt, detritus and bedrock.

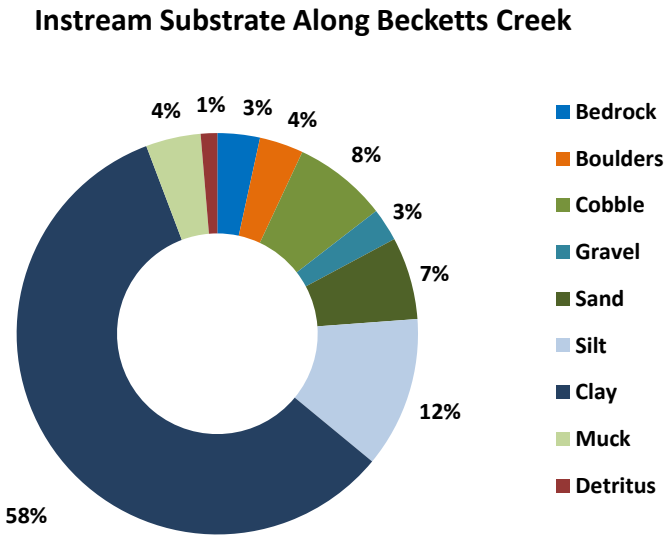


Figure 6. Types on Instream Substrate Along Becketts Creek

Becketts Creek 2011 Summary Report

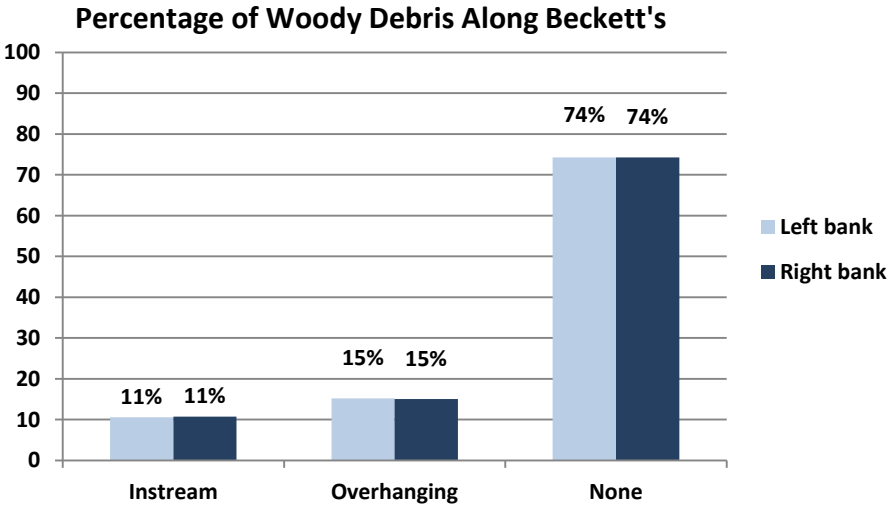


Figure 7. Amount of Woody Debris Observed Along Becketts Creek

Instream woody debris (logs, branches) is important for fish and benthic habitat, by providing refuge and feeding areas. Overhanging branches and trees provide a food source, nutrients and shade. The majority of Becketts Creek has a low percentage of instream woody debris and few overhanging branches and trees. Seventy-four percent of the left bank and right bank have no instream woody debris.

Photo of woody debris in Becketts Creek

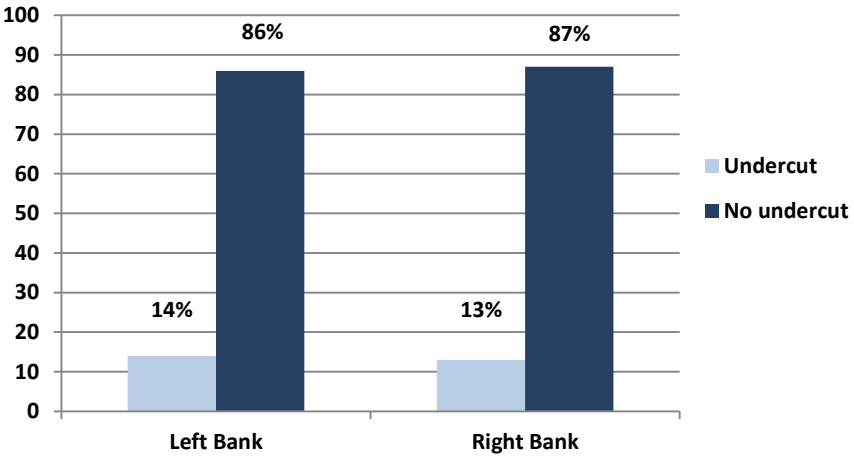


Figure 8. Amount of Undercut Banks Along Becketts Creek

Undercut banks are a normal and natural part of stream function. The overhanging banks provide excellent refuge areas for fish. On Becketts Creek, only 14 percent of the left bank and 13 percent of the right bank was undercut.

Photo of shaded area along Becketts Creek

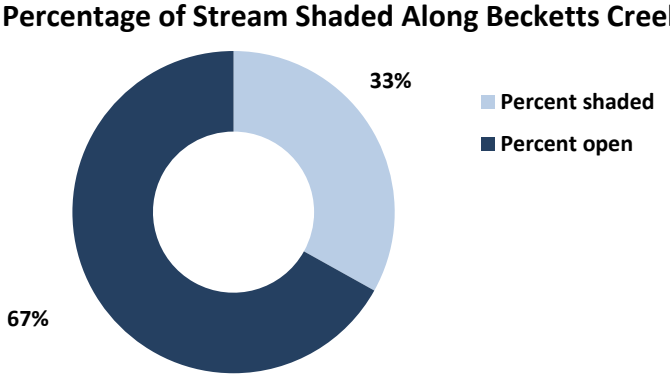


Figure 9. Overall Shading Along Becketts Creek

Grasses, shrubs and trees all contribute towards shading a stream. Shade is important in moderating stream temperature, contributing to food supply and helping with nutrient reduction within a stream. Along Becketts Creek, only 33 percent was shaded. Sixty-seven percent was considered open.

Becketts Creek 2011 Summary Report

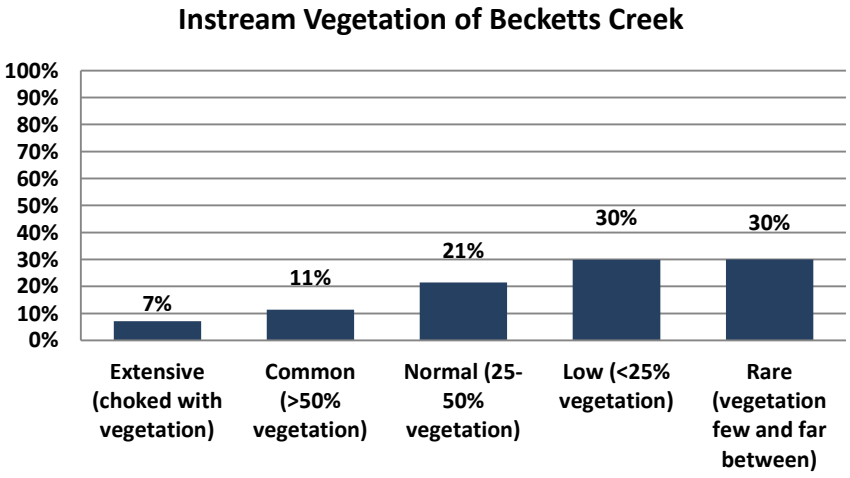


Figure 10. Amount of Instream Vegetation in Becketts Creek

Amount of Instream Vegetation

Instream vegetation is an important factor for a healthy stream ecosystem. Vegetation helps to remove contaminants from the water, contributes oxygen to the stream, and provides habitat for fish and wildlife. However, too much vegetation can be detrimental. Figure 10 demonstrates the frequency of instream vegetation in Becketts Creek. Becketts Creek did not have a healthy level or variety of instream vegetation for most of its length; only 32 percent was considered to have common or normal levels, and in these areas. Sixty percent of the stream was considered to have low or rare levels and seven percent of the surveyed areas had extensive levels (choked with vegetation). Over 50 percent of the instream substrate was clay, in which it would be difficult for instream vegetation to grow. In addition, flashy water level fluctuations could make it challenging for instream vegetation to establish itself.

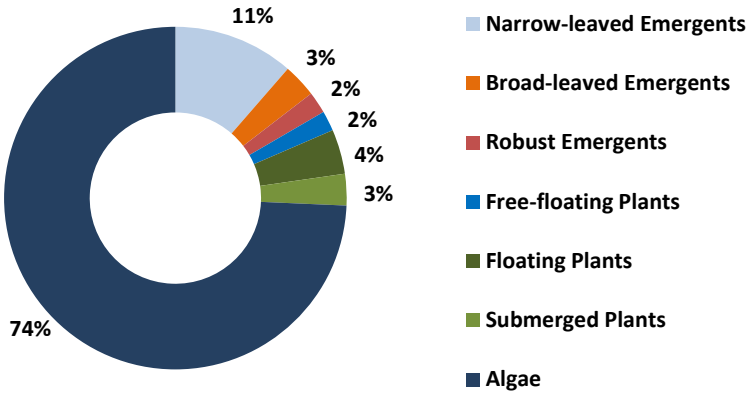


Figure 11. Types of Instream Vegetation in Becketts Creek

Types of Instream Vegetation

The majority of Becketts Creek did not have a healthy diversity of instream vegetation. Seventy-four percent of sections surveyed consisted of algae. Narrow-leaved emergents made up 11 percent of the vegetation, and other types, such as broad-leaved, robust, free-floating, floating and submergent accounted for the remaining 14 percent.

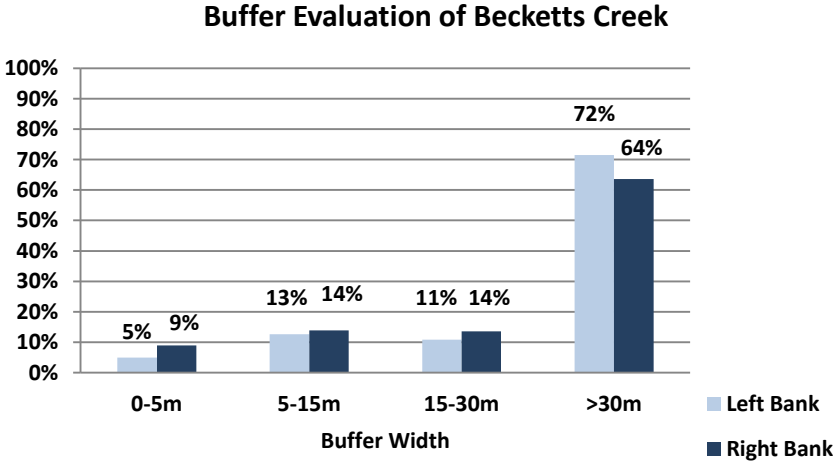


Figure 12. Buffer Evaluation of Becketts Creek

Buffer Evaluation

Natural buffers between watercourses and human alterations are extremely important for filtering excess nutrients running into the creek, infiltrating rainwater, maintaining bank stability and providing wildlife habitat. Natural shorelines also shade the creek, helping maintain baseflow levels and keeping water temperatures cool. According to the document *How Much Habitat Is Enough* (Environment Canada, 2004), it is recommended that a stream have a minimum of 30 metres of riparian area or more (the more the better). Figure 12 demonstrates the buffer conditions of the left and right banks separately. Along Becketts Creek, five to nine percent had a buffer of zero to five metres and 13 to 14 percent had a buffer of 5 to 15 metres. Eleven to 14 percent had a buffer of 15 to 30 metres. Over 60 percent of the buffer on Becketts Creek meets the recommendations from the Environment Canada document.

Becketts Creek 2011 Summary Report

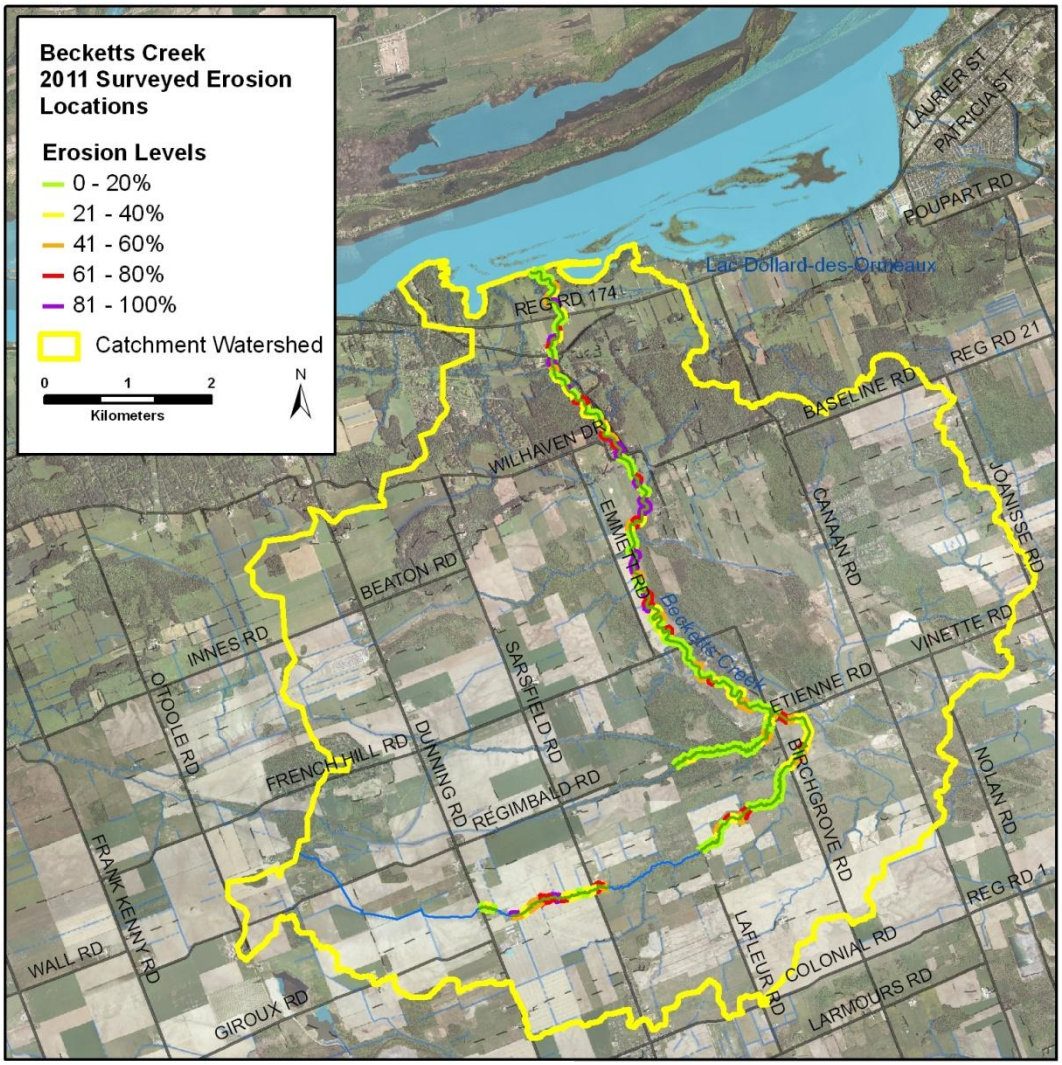


Figure 13. Left and Right Bank Stability of Becketts Creek

Erosion

Erosion is a normal, important stream process and may not affect actual bank stability; however, excessive erosion and deposition of sediment within a stream can have detrimental effects to important fish and wildlife habitat. Bank stability indicates how much soil has eroded from the bank into the stream. Poor bank stability can greatly contribute to the amount of sediment carried in a waterbody as well as loss of bank vegetation due to bank failure, resulting in trees falling into the stream and the removal of aquatic plants, which provide habitat. City Stream Watch recorded bank stability separately for left and right banks to obtain greater detail on the areas experiencing erosion. For Becketts Creek, stability was the same for both banks, although areas of erosion differed. Figure 13 shows the areas of erosion along Becketts Creek. Sixty-six percent was considered stable and thirty-three percent considered stable.

Wildlife

The diversity of fish and wildlife populations can be an indicator of water quality and overall stream health. Table 1 is a summary of all wildlife observed during stream surveys.

Wildlife	Observed
Birds	terns, killdeer, sandpiper spp., red-winged blackbirds, ducks, orioles, robins, great blue heron, mallards, grey catbird, crow, goldfinch, alder flycatcher, hawk, Canada geese, belted kingfisher, pileated woodpecker, chickadees, grackle, bluejay, mourning dove, wild turkeys, white-throated sparrow, hummingbird, warbler, song sparrow, green herons, nuthatch, turkey vultures, hairy woodpecker
Mammals	muskrat, chipmunk, deer tracks, mice, raccoon tracks, squirrels, beavers, vole, river otter, animal slides/paths, rat, red squirrel
Reptiles/Amphibians	turtle, leopard frog, green frog, bullfrog, tadpoles, American toad, painted turtle, wood frog, Eastern red slider (exotic species)
Aquatic Insects	whirlygig beetles, waterboatmen, waterstriders, caddisflies, nematodes, gastropods, oligichaeta, crayfish, *hemipteran spp., coleoptera spp,* isopods, mayflies
Other	cabbage whites, mosquitoes, clam shells, Eastern tiger swallowtails, horseflies, deerflies, ebony jewelwings, damselflies, dragonflies, bumblebees, ladybugs, leeches, spiders, cicada, crickets, centipedes, caterpillars, hornets, assassin bug, wasps, argiope spiders

Table 1. Wildlife Observed Along Becketts Creek

Becketts Creek 2011 Summary Report

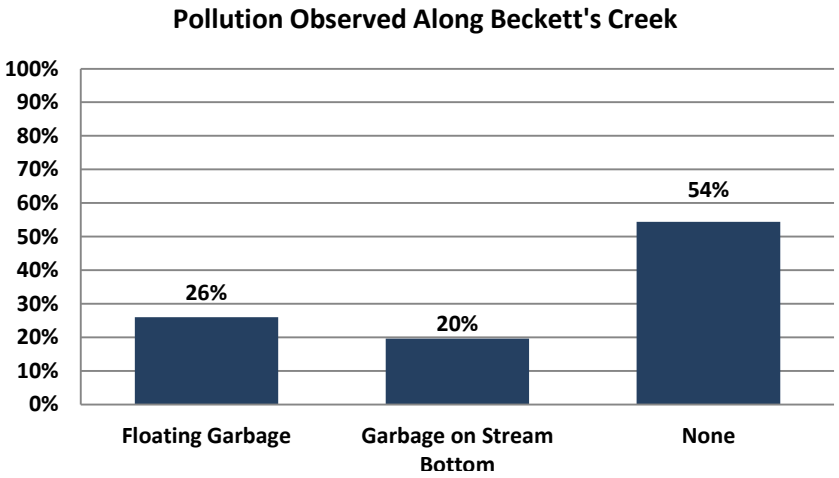


Figure 14. Frequency of Pollution/Garbage Occurring in Becketts Creek

Pollution/Garbage

Figure 14 demonstrates the incidence of pollution/garbage in Becketts Creek. Pollution and garbage in the stream is assessed visually and noted for each section where it is observed. Fifty-four percent of sections surveyed did not have any garbage. Twenty-six percent had floating garbage and 20 percent had garbage on the stream bottom, although it was not observed in large quantities. No observations of oil and gas trails or unusual colouration of the channel were made. The most common type of garbage observed were plastic items (wrappers, cups, bottles, etc.). Other types of garbage observed included tires, metal rebar, styrofoam, aluminum cans, glass, plywood, garbage can, shovel, pool, CD packaging, asphalt, car, cardboard, copper wire, buckets, propane tanks, paint cans, old oil drums, aluminum siding, appliances, beach balls, bicycle, sled, plastic sheeting and tarps.

Invasive Species

Invasive species can have major impacts on streams and species diversity. Invasive species are one of the largest threats to ecosystems throughout Ontario and can outcompete native species, having negative effects on local wildlife, fish and plant populations. Costs to control and mitigate damage from invasive species can be quite high; it is estimated that spending from 16 invasive species amounts to between $13.3 and $34.5 billion (Government of Canada, 2004), and over 180 non-native species have been found in the Great Lakes area, with a new species arriving in the Great Lakes on average of every six to nine months (Government of Canada, 1999). These species originate from other countries and are introduced through global shipping containers, ship ballast water, pet trades, aquarium and horticultural activities, the live bait industry, recreational boats, fishing gear and more (OMNR, 2008). In Becketts Creek, invasive species were observed in 82 percent of the surveyed sections, and often more than one species was present in the same area. The five species observed were purple loosestrife (*Lythrum salicaria*), Manitoba maple (*Acer negundo*), garlic mustard (*Alliaria petiolata*), wild parsnip (*Pastinaca sativa*) and flowering rush (*Butomus umbellatus*). Out of the five species, garlic mustard and flowering rush are of greatest concern. Garlic mustard interferes with the relationship between tree roots and the soil, affecting the growth of the trees, making it problematic in natural areas. It spreads aggressively and needs constant pulling for several years in order to control. Flowering rush will spread rapidly and can form dense colonies, outcompeting other native aquatic plants.

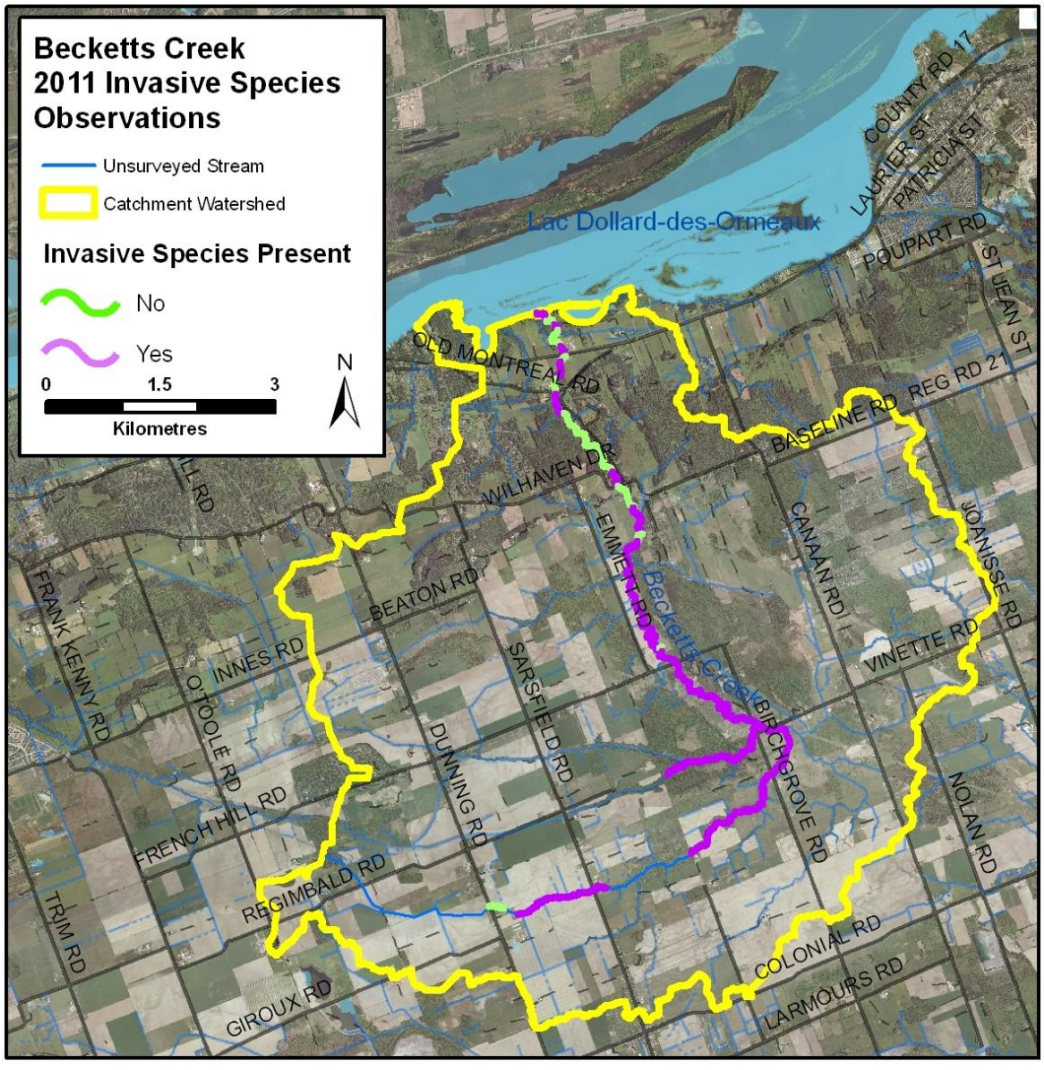


Figure 15. Locations of Invasive Species Along Surveyed Sections of Becketts Creek

Becketts Creek 2011 Summary Report

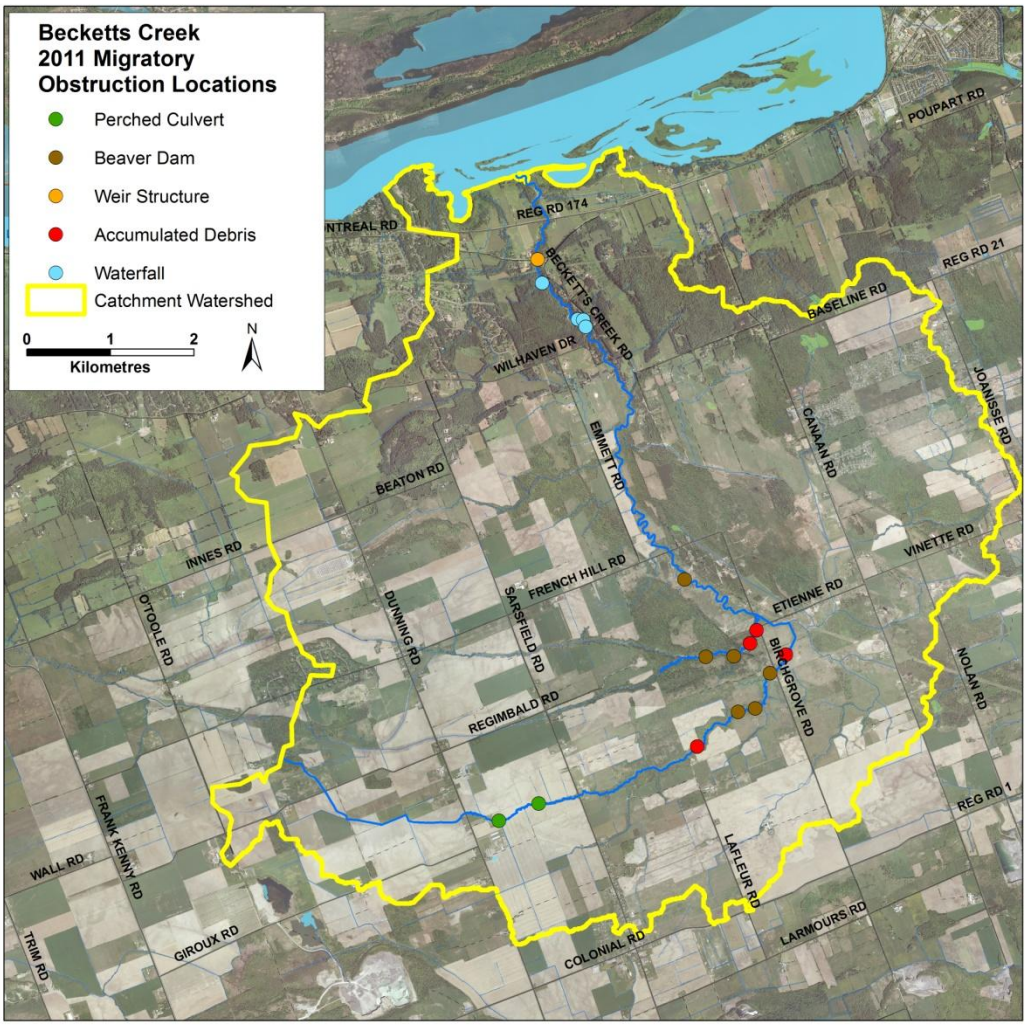


Figure 16. Location of Migratory Obstructions to Fish Passage Along Becketts Creek

Migratory Obstructions

It is important to know locations of migratory obstructions because these can prevent fish from accessing important spawning and rearing habitat. Migratory obstructions can be natural or manmade, and they can be permanent or seasonal. Several migratory obstructions to fish passage were observed along Becketts Creek. There are a series of waterfalls located upstream of Old Montreal Road. These are natural barriers that fish would not be able pass over. Other migratory obstructions include one weir (under Old Montreal Road), four beaver dams, two perched culverts and 11 locations of accumulated woody debris. Often, woody debris floating downstream can get caught on fallen trees or branches and build up, possibly creating a seasonal migration barrier. The water levels in 2011 were extremely low, and the accumulated debris may not have been an obstruction in other years with normal water levels. In some sections, low water levels created barriers but are not included on the map because this was due to low water conditions.

Thermal Classification

Temperature is an important parameter in streams as it influences many aspects of physical, chemical and biological health. Many factors can influence fluctuations in stream temperature such as:

- Springs (groundwater and surface water interaction)
- Tributaries
- Precipitation runoff
- Discharge pipes
- Stream shading from riparian vegetation

The greatest factor of fluctuating temperature is solar radiation and runoff from developed areas. Typically, streams with large amounts of riparian canopy cover will yield lower temperatures while areas with no trees may be warmer. The method for temperature classification is taken from Stoneman and Jones, which is an accepted method by both Ministry of Natural Resources and Department of Fisheries and Oceans for assigning thermal classification. Classification is based on temperature data for each stream, taken at 4:00pm, anywhere between July 1 and August 31, on days where maximum air temperature exceeds 24.5°C and the previous two or three days have had similar temperatures. Although dataloggers are set to record temperatures between April and October, only the days that meet the temperature requirements are used in classification. The water temperature is used along with the maximum temperature of those days to classify as warmwater, coolwater or cold water.

Another important methodology of temperature classification is through fish community data. Fish have different temperature requirements, and these are also considered when classifying the stream. For example, if a species is recorded in a stream that requires cold water, there could be cold water inputs influencing that stream, at that location.

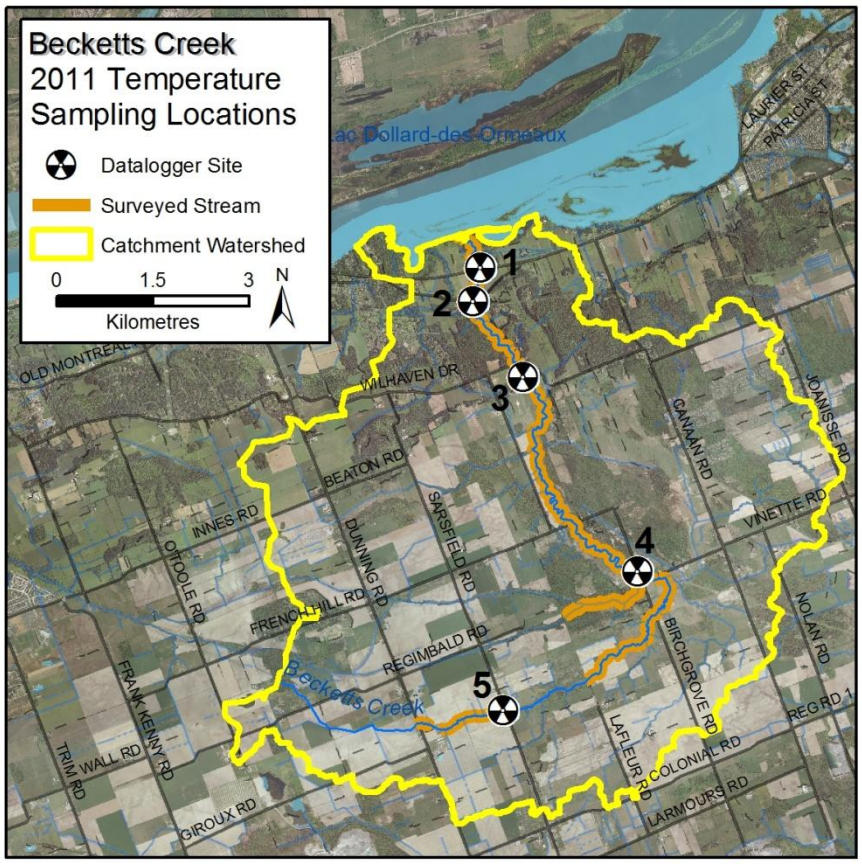


Figure 17. Temperature Datalogger Locations Along Becketts Creek

Five temperature dataloggers were deployed in Becketts Creek to give a representative sample of how temperature fluctuates and differs along the stream. The dataloggers were installed in April and retrieved in late September. Dataloggers are either secured to blocks on the bottom of a stream or attached to rebar secured to the bottom. The datalogger at site five was missing, but the other four were retrieved.

RVCA staff installing a temperature probe on Becketts

When analyzed on the nomograph (figure 18), it appears that Becketts Creek is a warmwater system. All temperature dataloggers were within that range, aside from datalogger 4 on one day.

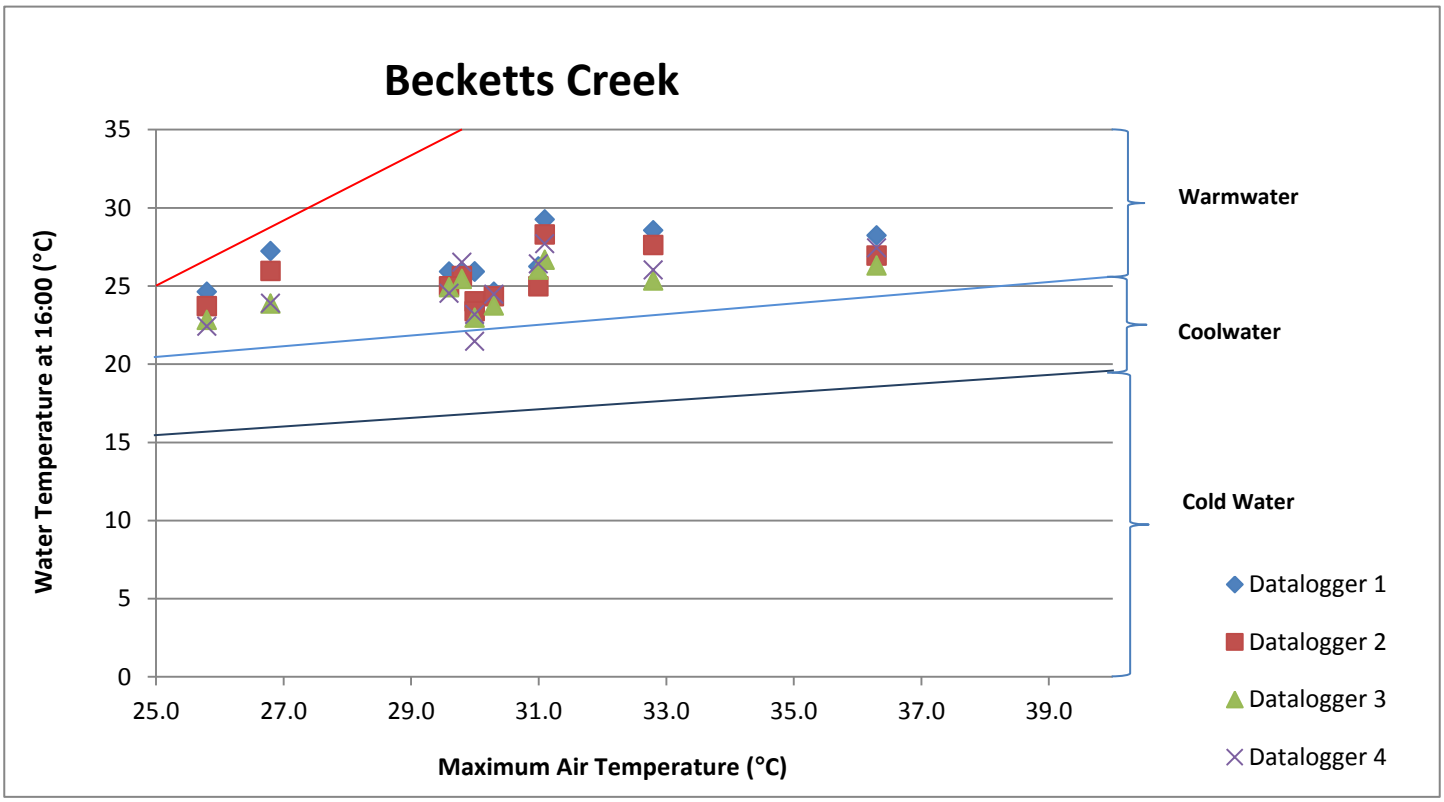


Figure 18. Temperature Data from Becketts Creek

Becketts Creek 2011 Summary Report

Month	Range	DO (mg/L)	DO (%)	Conductivity (µs/cm)	pH
May	low	7.15	76	275	7.63
	high	10.3	95	573	8.5
June	low	7.65	85	322	7.89
	high	10.52	102	603	8.43
July	low	3.14	38	322	7.66
	high	12.69	145	792	8.2
August	low	3.18	33	603	7.81
	high	11.62	133	890	8.5

Table 2. Maximum and minimum Levels of Dissolved Oxygen, Conductivity and pH in Becketts Creek during 2011 surveys

Water Chemistry

During surveys, a YSI probe was used to collect values on dissolved oxygen, conductivity and pH. In 2011, RVCA issued a Level 1 Drought for the watershed, beginning September 26, 2011 and ending January 10, 2012. Low water levels were observed during monitoring. Drought conditions would have had an effect on the parameters below. The 2011 data is summarized in Table 2.

Dissolved Oxygen: A measure of the amount of oxygen dissolved into a medium, such as water. The lowest acceptable concentration of dissolved oxygen is 6.0 mg/L for early stages of warmwater fish and 9.5mg/L for cold water fish (CCME, 1999). A saturation value of 90% or above is considered healthy (WOW, 2004).

Conductivity: The ability of a substance to transfer electricity. This measure is influenced by the presence of dissolved salts and other ions in the stream.

pH: A measure of relative acidity or alkalinity, ranging from 1 (most acidic) to 14 (most alkaline/basic) , with 7 occupying a neutral point.

Fish Sampling

A total of eleven sites between the mouth and the headwaters of Becketts Creek were sampled for fish between May and July. The two sites near the confluence of the Ottawa River were sampled once for a five day period in June using large fyke nets. The other eight sites were sampled one to three times between May and July, using a variety of sampling equipment, including windemere traps, a seine net and an electrofisher. The fish sampling sites are shown in Figures 19, 20 and 21. Habitat and spawning information on the species captured are listed in Table 3.

Species Legend

BlCra - black crappie
Blueg - bluegill
BnMin - bluntnose minnow
BrBul - brown bullhead
BrSti - brook stickleback
CA_MI - *Cyrpinid spp.*
CoCar - common carp
Coshi - common shiner
CrChu - creek chub
GoShi - golden shiner
Logpe - logperch
NoPik - Northern pike
Pumpk - pumpkinseed
RhiSp - *Rhinichthys spp.*
RoBas - rock bass
ShRed - shorthead redhorse
SiRed - silver redhorse
TaMad - tadpole madtom
Walle - walleye
WhSuc - white sucker
YeBul - yellow bullhead
YePer - yellow perch

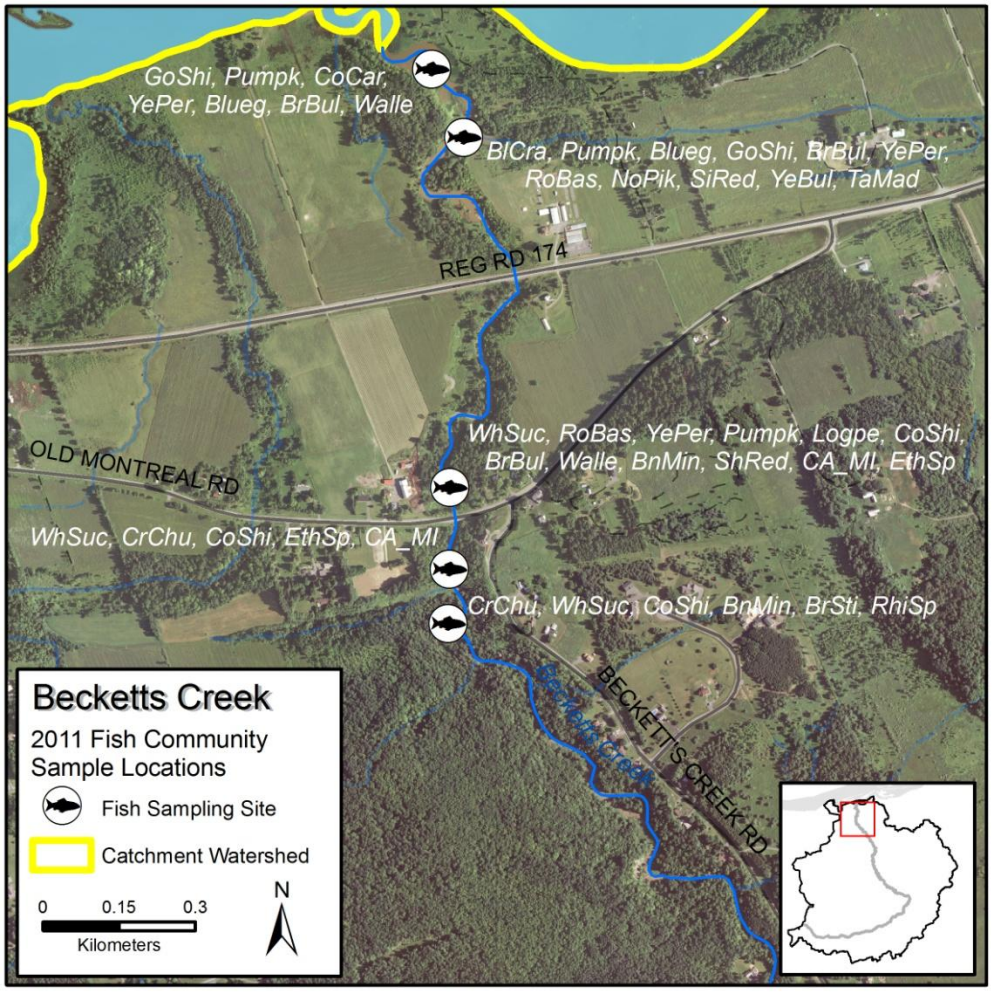
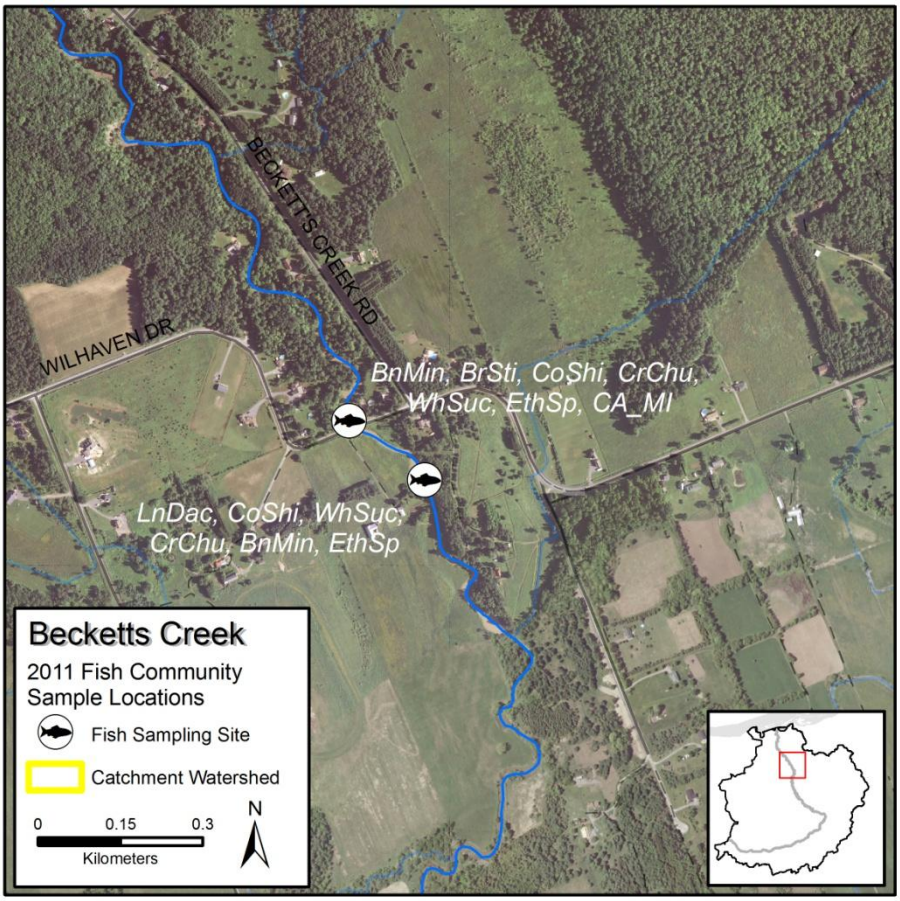
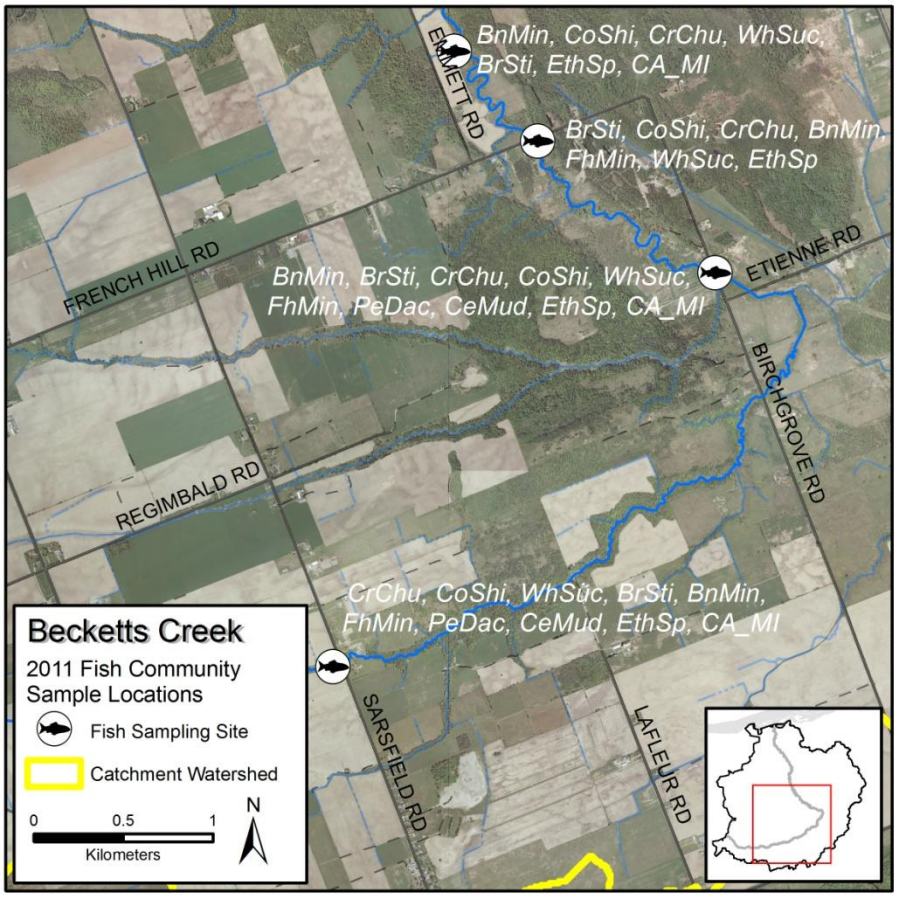


Figure 19. Locations and of Fish Sampling and Species Recorded on Becketts Creek

Becketts Creek 2011 Summary Report





Figures 20 &21. Locations and of Fish Sampling and Species Recorded on Becketts Creek

Species Legend

BnMin - bluntnose minnow
BrSti - brook stickleback
CA_MI - *Cyrpinid spp.*
CeMud - central mudminnow
Coshi - common shiner
CrChu - creek chub
EthSp - *Etheostoma spp.*
FhMin - fathead minnow
LnDac - longnose dace
PeDac - pearl dace
WhSuc - white sucker

Fish Community Summary

A total of twenty-seven different fish species were collected. All fish were live released back to the stream after fish sampling. *Etheostoma spp.* indicates that either Johnny darters or tessellated darters were captured. To differentiate between those species, the fish must be removed from the system and brought back to lab; to avoid this, they are only identified to genus level. Minnow species that were caught but too small to identify are classified as *Cyprinid spp*. One dace species was captured that was too small to identify between blacknose and longnose dace, and is labeled *Rhinichthys spp*. Eight volunteers spent a total of 42 hours fish sampling on Becketts Creek.

Volunteers and CSW staff bringing in the seine net

Species Name	Latin Name	General Habitat	Spawning Period	Spawning Temp (°C)
black crappie	*Pomoxis nigromaculatus*	bays, ponds, lakes or calm rivers with abundant aquatic vegetation	spring	16-26
bluegill	*Lepomis macrochirus*	ponds, lakes or calm rivers and streams with heavy aquatic vegetation	spring	19-27
bluntnose minnow	*Pimephales notatus*	bottoms of shallow lakes or ponds or gravelly streams with little aquatic vegetation	spring	20-28
brook stickleback	*Culaea inconstans*	spring-fed ponds or cold streams with heavy aquatic vegetation or wetland areas of lakes	spring	8-19
brown bullhead	*Ameiurus nebulosus*	bottom of shallow, warmwater bays, lakes or ponds and larger slow-moving rivers with abundant aquatic vegetation	late spring/ early summer	14-29
central mudminnow	*Umbra limi*	ponds or pools in streams with heavy aquatic vegetation and organic substrate	spring	~13
common carp	*Cyprinus carpio*	shallow, calm, warm rivers or lakes with heavy aquatic vegetation	spring	17-28
common shiner	*Luxilus comutus*	prefers streams or shorelines of clear lakes	spring	14-28
creek chub	*Semotilus atromaculatus*	prefers small creeks or shorelines of small lakes	spring	13-27
fathead minnow	*Pimephales promelas*	calm ponds or flowing streams	spring	16-29
golden shiner	*Notemigonus crysoleucas*	clear, still areas in shallower, larger watercourses with abundant aquatic vegetation	spring	20-27
logperch	*Percina caprodes*	lakes, rivers or streams with sand, gravel or cobble substrate	late spring/ early summer	10-15
longnose dace	*Rhinichthys cataractae*	riffle areas of clear, small streams or lakes with gravel or boulder substrate	spring	11-24
Northern pike	*Esox lucius*	calm, warm rivers or bays with heavy aquatic vegetation	spring	2-18
pearl dace	*Margariscus margarita*	beaver ponds or cool headwater creeks, ponds or small lakes	spring	17-18
pumpkinseed	*Lepomis gibbosus*	bays, lakes, ponds or calm streams with abundant submergent vegetation	spring to summer	13-29
rock bass	*Ambloplites rupestris*	rocky areas of shorelines along lakes or warm water reaches of streams	May to July	14-24
shorthead redhorse	*Moxostoma macrolepidotum*	shallower, clear lakes or rivers with sand or gravel bottom	spring	11-21
silver redhorse	*Moxostoma anisurum*	lakes but prefers calm streams with large, deep pools	spring	13
tadpole madtom	*Noturus gyrinus*	calm, clear ponds, streams, shallow lakes with soft bottoms and heavy aquatic vegetation	spring/ summer	n/a
walleye	*Sander vitreus*	shallow, large lakes or turbid rivers or creeks with some type of instream structure (logs, vegetation)	spring	4-12
white sucker	*Catostomus commersonii*	warmer, shallow bays, lakes or large tributaries	spring	6-23
yellow bullhead	*Ameiurus natalis*	slow-moving streams or shallow, clear bays of lakes or ponds with heavy aquatic vegetation	spring	n/a
yellow perch	*Perca flavescens*	warm or cool ponds, lakes or rivers with moderate levels of aquatic vegetation	spring	7-22

Table 3. Species List with Habitat and Spawning Requirements for Becketts Creek Fish Community

Fish Species Status, Trophic and Reproductive Guilds and Sensitivity to Sediment/Turbidity – Becketts Creek

Table 4 was generated by taking the fish community structure of Becketts Creek and classifying the fishery type, Species at Risk status, thermal classification, trophic guild (feeding preference) and their sensitivity to sediment and turbidity for reproduction, feeding, and respiration. Ten game fish species were captured between sites one and three. Upstream of site five is a significant waterfall, am gamefish would not be able to migrate past this. According to Cudmore-Vokey and Minns (2002), most species within Becketts Creek are significant to the baitfish fisheries aside from ten species that are significant to the recreational industry and two that are significant to the commercial industry. The fish community structure consists of 12 cool water species, eight warm water species and four cool/warm species. No species at risk fish were captured. All species captured in Becketts Creek had low to medium sensitivity to turbidity for reproduction. Most species had a low to medium sensitivity to turbidity for feeding, aside from black crappie, Northern pike, rock bass, walleye and yellow perch, that have a high sensitivity. For respiration, most species had high or unknown sensitivity to turbidity except for brown bullhead, central mudminnow, golden shiner and Northern pike.

MNR Code	Common Name	Scientific Name	Fishery Type	Status	Thermal Class	Trophic Guild	Sensitivity to Sediment/Turbidity		
							Reproduction	Feeding	Respiration
319	black crappie	*Pomoxis nigromaculatus*	recreational	none	cool	Insectivore/ piscivore	L	H	unknown
314	bluegill	*Lepomis macrochirus*	recreational	none	cool/ warm	insectivore	L	M	unknown
208	bluntnose minnow	*Pimephales notatus*	bait	none	warm	omnivore	L	M	unknown
281	brook stickleback	*Culaea inconstans*	bait	none	cool	insectivore	L	M	unknown
233	brown bullhead	*Ameiurus nebulosus*	recreational/ limited commercial	none	warm	insectivore	L	L	L
141	central mudminnow	*Umbra limi*	bait	none	cool/ warm	insectivore/ omnivore	M	M	L
186	common carp	*Cyprinus carpio*	recreational	none	warm	omnivore	M	L	unknown
198	common shiner	*Luxilus comutus*	bait	none	cool	insectivore	M	M	unknown
212	creek chub	*Semotilus atromaculatus*	bait	none	cool	insectivore/ generalist	M	M	H
209	fathead minnow	*Pimephales promelas*	bait	none	warm	omnivore	L	L	unknown
194	golden shiner	*Notemigonus crysoleucas*	bait	none	cool/ warm	omnivore	M	M	L
342	logperch	*Percina caprodes*	bait	none	cool	insectivore	M	M	H
211	longnose dace	*Rhinichthys cataractae*	bait	none	cool	insectivore	M	M	H
131	Northern pike	*Esox Lucius*	recreational	none	cool	piscivore	M	H	L
214	pearl dace	*Margariscus margarita*	bait	none	cool	insectivore	M	M	H
313	pumpkinseed	*Lepomis gibbosus*	recreational	none	cool/ warm	insectivore	L	M	unknown
311	rock bass	*Ambloplites rupestris*	recreational	none	warm	insectivore	L	H	unknown

MNR Code	Common Name	Scientific Name	Fishery Type	Status	Thermal Class	Trophic Guild	Sensitivity to Sediment/Turbidity		
							Reproduction	Feeding	Respiration
171	shorthead redhorse	*Moxostoma macrolepidotum*		none	cool	insectivore	M	L	H
168	silver redhorse	*Moxostoma anisurum*		none	warm	insectivore	M	L	H
236	tadpole madtom	*Noturus gyrinus*	limited recreational	none	warm	insectivore	M	L	unknown
334	walleye	*Sander vitreus*	recreational/ commercial	none	cool	piscivore	M	H	H
163	white sucker	*Catostomus commersonii*		none	cool	insectivore/ omnivore	M	L	H
232	yellow bullhead	*Ameiurus natalis*	recreational	none	warm	insectivore	L	L	unknown
331	yellow perch	*Perca flavescens*	recreational	none	cool	insectivore/ piscivore	M	H	unknown

Table 4. Summary of Status, Sensitivity and Classification for Fish Community in Becketts Creek

Large fyke net set at the mouth of Becketts Creek

Juvenile shorthead redhorse

Comparison of Becketts Creek Between 2006 and 2011

The following tables provide a comparison of Becketts Creek between the 2006 and 2011 survey years. Different sections were surveyed in 2011 and 2006; therefore, a comparison has only been made for the applicable sections.

Anthropogenic Alterations	2006	2011
None	77	55
"Natural" conditions with minor human alterations	19	13
"Altered" with considerable human impact but significant natural portions	3	19
"Highly altered" by humans with few natural portions	2	13

Table 5. Comparison of Anthropogenic Alterations Between 2006 and 2011

Between 2006 and 2011, anthropogenic alterations along Becketts Creek have increased. Part of the change is likely related to a difference in the macro stream protocol used. In 2010, anthropogenic alterations were further defined, which would have caused some land uses to shift categories. Most of the alterations along Becketts Creek can be attributed to its reduced buffer between the creek and human influence, which occurs in many areas that were surveyed. Other areas classified as altered include road crossings, shoreline armouring and tile drains. During 2011 surveys, active buffer removals in some areas were observed.

Becketts Creek 2011 Summary Report

Bank Stability	2006 (%)	2011 (%)
Stable	57	66LB, 65RB
Unstable	43	34LB, 35RB

Table 6. Comparison of Bank Stability Between 2006 and 2011

Stability along Becketts Creek has improved between 2006 and 2011, although there were still areas where minor and major erosion was observed. In some instances, eroding slopes can slump into the stream, lessening the slope and becoming more stable over time.

Levels of Instream Vegetation	2006	2011
Extensive	2	3
Common	9	10
Normal	35	24
Low	38	34
Rare	16	29
None	n/a	0

Table 7. Comparison of Instream Vegetation Levels Between 2006 and 2011

Levels of vegetation have increased slightly in the extensive and common categories and by 13 percent in the rare category. The percentage of vegetation levels in the normal and low categories have decreased. The category "none" was added in 2006, although on all sites surveyed there was some level of vegetation observed.

Pollution/Garbage	2006	2011
None	66	73
Floating garbage	14	13
Garbage on stream bottom	19	15
Oil or gas trails	0	0
Unusual colouration	n/a	0

Table 8. Comparison of Pollution/Garbage Levels Between 2006 and 2011

The amount of garbage on Becketts Creek has decreased in the compared areas. In 2006, 66 percent of the sections surveyed were garbage free, and in 2011, it increased by seven percent. In 2006, one percent had oil and gas trails, but it was not in the compared section. In 2011, a lot of garbage occurred outside the compared areas, and therefore, is not reflected in the comparison but is still an issue.

Photo of yellow perch

Fish Species	2007	2011
black crappie		X
blacknose dace	X	
bluegill		X
bluntnose minnow	X	X
brook stickleback	X	X
brown bullhead	X	X
central mudminnow	X	X
common carp		X
common shiner	X	X
creek chub	X	X
Cyrpinid spp.		X
Etheostoma spp.	X	X
fathead minnow	X	X
golden shiner		X
largemouth bass	X	
logperch	X	X
longnose dace	X	X
Northern pike		X
Northern redbelly dace	X	
pearl dace		X
pumpkinseed	X	X
Rhinichthys spp.		X
rock bass	X	X
shorthead redhorse		X
silver redhorse		X
tadpole madtom		X
walleye		X
white sucker	X	X
yellow bullhead		X
yellow perch		X
Total	**16**	**27**

Table 9. Comparison of Fish Species Between 2007 and 2011

Becketts Creek 2011 Summary Report

Fish sampling was conducted along Becketts Creek in 2007 and 2011. In 2007, two sites were surveyed with a seine net, concentrated at the Old Montreal Road and French Hill road crossings. Sixteen species were caught. In 2011, eleven sites were sampled using a variety of methods (large fyke net, seine net, electrofisher, windemere traps). These sites were spread out between the mouth and the headwaters, and a total of 27 species were captured. The increase in species caught can be contributed to increased sampling effort and a greater variety of sampling equipment, allowing staff to sample all different types of habitat.

Photo of a tadpole madtom

The following table highlights past monitoring and restoration efforts that have been carried out in the Becketts Creek subwatershed.

Highlight of Monitoring and/or Restoration Work

Year	Accomplishment	Description
2006	116 macro stream surveys were completed on Becketts Creek by City Stream Watch staff and volunteers.	A total of 101 volunteer hours were spent carrying out stream habitat surveys on Becketts Creek.
2007	Two sites sampled for fish by City Stream Watch staff and volunteers; a total of 17 fish species were captured.	Seven volunteers spent a total of 21 hours assisting with seine netting. All fish were released live back into the creek.
2011	158 macro stream surveys were completed on Becketts Creek by City Stream Watch staff and volunteers	31 volunteers spent a total of 254.5 hours carrying out stream habitat surveys on Becketts Creek and a branch of Becketts Creek.
2011	11 sites along Becketts Creek were sampled by City Stream Watch staff and volunteers; a total of 25 fish species were captured.	8 volunteers spent a total of 42 hours assisting with seine netting. All fish were released live back into the creek.
ongoing	RVCA Stewardship projects.	Three Rural Clean Water projects have been carried out in the Becketts Creek subwatershed.

Table 10. Monitoring and Restoration Highlights in the Becketts Creek subwatershed

Left photo: a bioengineering and buffer enhancement opportunity, right photo: a car sunk in Becketts Creek

Based on data collected by City Stream Watch staff and volunteers, a variety of projects have been identified along Becketts Creek to help improve environmental conditions. Figure 22 illustrates the potential instream projects, and Figure 23 illustrates the potential shoreline restoration projects. Table 11 summarizes the numbers and details of the projects identified on both maps.

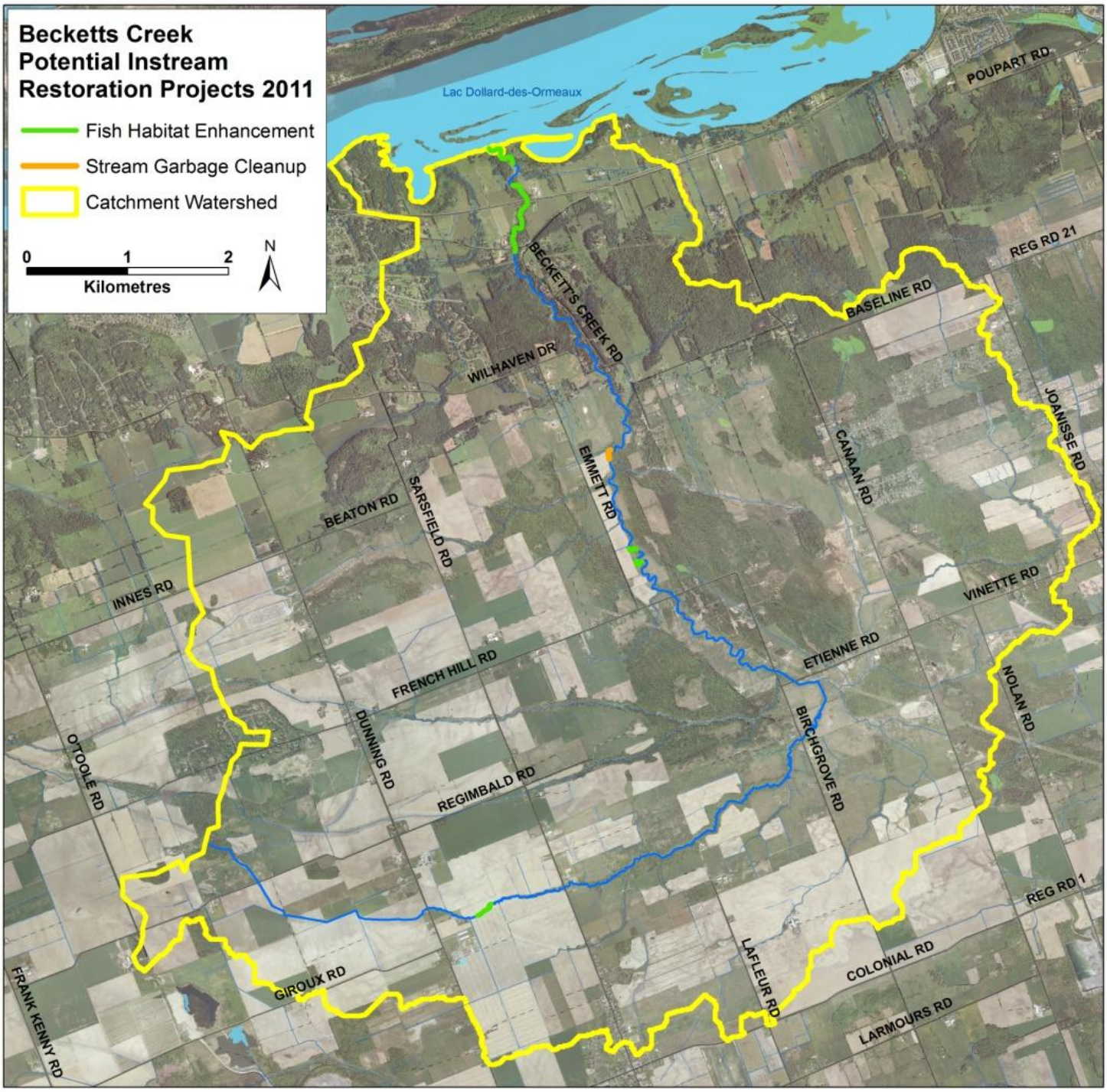


Figure 22. Map of Potential Instream Projects Along Becketts Creek

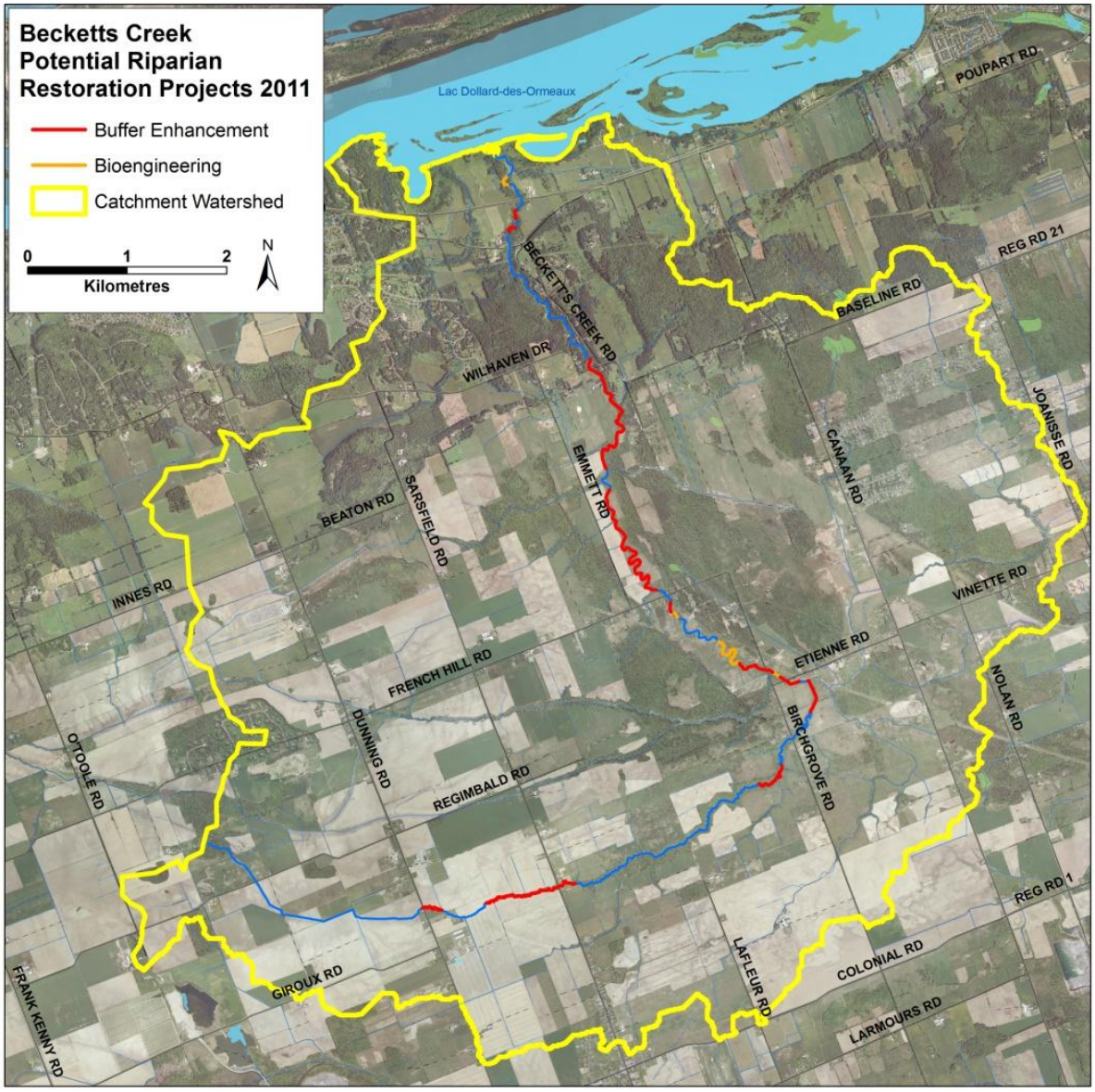


Figure 23. Map of Potential Shoreline Projects Along Becketts Creek

Local Actions for Improvement of Becketts Creek

Type of Project	Description
Riparian Planting/Buffer Enhancement	Riparian plantings and buffer improvements with native species have been identified for 10 sites, for a total of 6.2km of stream
Bioengineering	Areas in need of bioengineering (natural erosion control) have been identified for 8 sites, for a total of 1.6km of stream
Fish Habitat Enhancement	5 sites have been identified for fish habitat improvements, for a total of 1.3km of stream; these sites include creating riffles, instream structure (root wads, etc.), enhancing walleye spawning and enhancing spawning for muskellunge and Northern pike.
Stream Garbage Cleanup	There has been one site identified for a stream garbage cleanup between Wilhaven and French Hill Road; it is an old car and machinery would be required for removal
Invasive Species Removal	5 invasive species observed were purple loosestrife (Lythrum salicaria), Manitoba maple (Acer negundo), garlic mustard (Alliaria petiolata), wild parsnip (Pastinaca sativa) and flowering rush (Butomus umbellatus). If you see a suspected invasive species, you can report it to the Ontario Federation of Anglers and Hunters **invading species hotline: 1-800-563-7711**

Table 11. Potential Rehabilitation Projects in the Becketts Creek subwatershed

Becketts Creek 2011 Summary Report



For information on the overall 2011 City Stream Watch Program and the volunteer activities, please refer to the City Stream Watch Summary report, 2011. To view the macrostream protocol used, please see the City Stream Watch website: http://www.rvca.ca/programs/streamwatch/index.html

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