Brassils Creek 2016 Summary Report

Watershed Features	
Area	67.53 square kilometres 1.59 % of the Rideau Valley watershed
Land Use	14 % agriculture 2% urban 38% forest 1% rural 10% meadow 35% wetlands
Surficial Geology	1% clay 1% diamicton 2% gravel 28% organic deposits 66% paleozoic bedrock 2% silt
Watercourse Type	Thermal Conditions (2016) **Warmwater**
Invasive Species	Nine invasive species were identified in 2016: *European frogbit, rusty crayfish, common buckthorn, purple loosestrife, banded mystery snail, Manitoba maple, curly-leafed pondweed, flowering rush* and *Japanese knotweed*
Fish Community	27 fish species have been captured in the Brassils Creek catchment

Wetland Cover
35% of the catchment is wetland

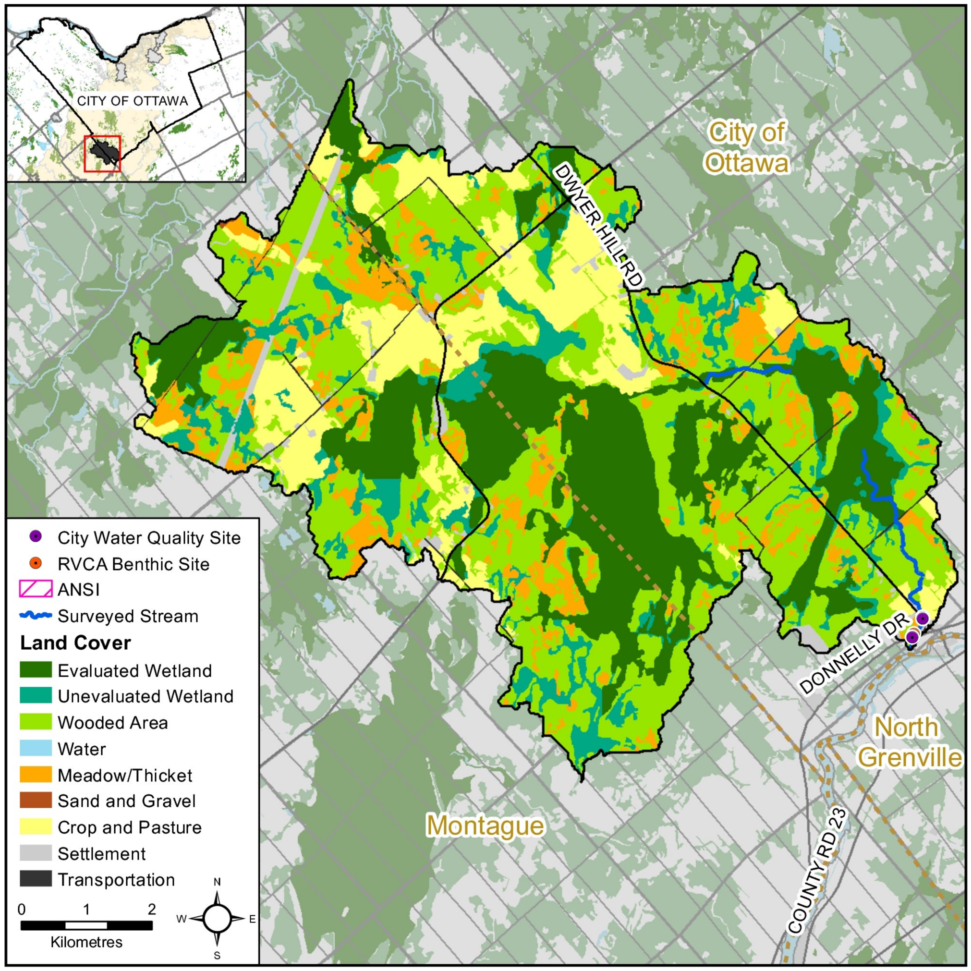
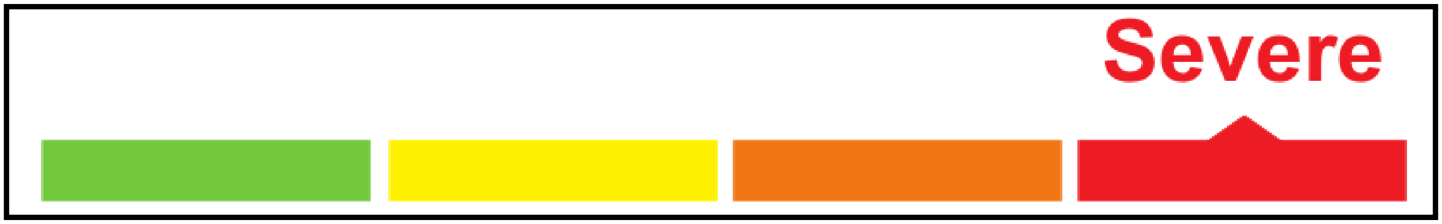


Figure 1 Land cover in the Brassils Creek catchment

Marsh and swampland in Brassils Creek

The Rideau Valley Conservation Authority, in partnership with seven other agencies in Ottawa (City of Ottawa, Heron Park Community Association, Ottawa Flyfishers Society, Ottawa Stewardship Council, Rideau Roundtable, National Defence HQ - Fish and Game Club, and the National Capital Commission) form the 2016 City Stream Watch collaborative.

Drought Conditions - Rideau Valley Watershed



Low Water Conditions

During the summer of 2016, the Rideau Valley watershed experienced periods of *severe* drought. 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 our 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 and macroinvertebrates were affected, as suitable habitat may have been limited.

City Stream Watch

Low water levels and flows were common across many of our city streams, and is 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.

Introduction

Brassils Creek is located in the Marlborough region and flows through both Rideau-Goulbourn and Montague townships. Brassils Creek begins west of Roger Stevens Dr, flowing east to Dwyer Hill Rd, then south through the community of Burritts Rapids. A considerable portion of the stream is located within the boundaries of the Marlborough Forest, as the catchment is dominated largely by forest and wetland habitat. The Marlborough Forest is comprised of a variety of wetlands, forests, thickets and meadows, and is considered a significant source of local diversity and ecological function. Some alterations in the catchment have been noted, and include influences from agriculture, infrastructure and residential land use.

Through conservation efforts undertaken by Ducks Unlimited Canada, several wetland habitats were enhanced and/or created within the catchment. A total of six dykes were constructed within the Marlborough region, with three located directly on Brassils Creek.

Water quality conditions on Brassils Creek are generally regarded as “good” to “fair”, with no change in the water quality rating observed over a 12 year reporting period (RVCA, 2012).

In 2016, the City Stream Watch conducted surveys on 54 sections (5.4 km) of Brassils Creek. The following is a summary of our observations and assessment within this region.

Brassils Creek Overbank Zone

Riparian Buffer Width Evaluation

The riparian zone is the interface between the water and the land surrounding a stream or river. Well-vegetated shorelines are of critical importance in protecting water quality and promoting for healthy aquatic habitats. Natural shorelines intercept sediments and contaminants that could impact water quality conditions and harm fish habitat. Furthermore, well established buffers protect the banks against erosion, improve habitat for fish by shading and cooling the water and provide protection for birds and other wildlife that feed and rear young near water. The recommended target (from Environment Canada’s Guideline: How Much Habitat is Enough?) for the protection of aquatic habitat is to maintain a minimum 30 meter wide vegetated buffer along at least 75 percent of the stream length. Brassils Creek was observed as having adequate buffer conditions over 85 percent of the left bank and 93 percent of the right. (Figure 2).

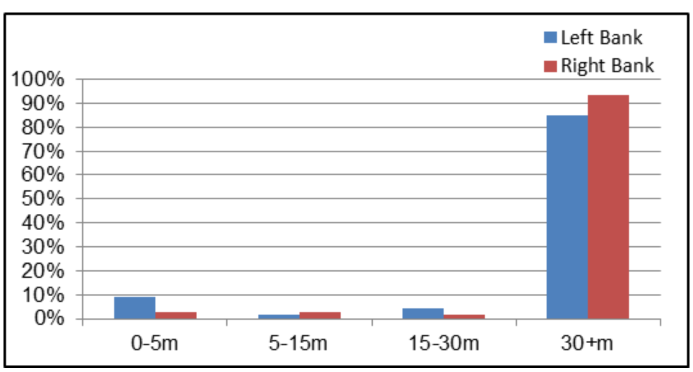


Figure 2 Vegetated buffer width along Brassils Creek

Reduced buffer conditions were generally associated with residential land use and infrastructure (ie. road crossings).

Adjacent Land Use

Land use surrounding the creek is categorized into 11 classes, and assessed within 100m of each shoreline. These classes include: active and abandoned agriculture, pasture land, residential areas, forests, scrubland, meadows, wetlands, industrial /commercial zones, recreational areas, and infrastructure. Land use outside of this 100m buffer is not considered, but may still have influence within the catchment.

Natural areas including forest and scrubland were identified in 48 -74% of all surveyed sites (Figure 3).Wetland habitat was prominent in Brassils Creek, and observed in 43% of surveyed stream. Meadow, infrastructure and residential land were relatively low across the surveyed area, and observed in 15-19% of all sites.

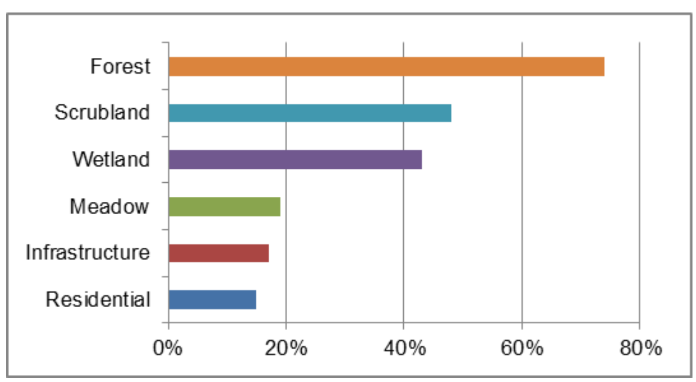


Figure 3 Land use presence along Brassils Creek

Brassils Creek Shoreline Zone

Erosion

Stream erosion is the process by which water erodes and transports sediments, resulting in dynamic flows and diverse habitat conditions. Excessive erosion can result in drastic environmental changes, as habitat conditions, water quality and aquatic life are all negatively affected. Bank stability was assessed as the overall extent of each section with “unstable” shoreline conditions. These conditions are defined by the presence of significant exposed soils/roots, minimal bank vegetation, severe undercutting, slumping or scour, and potential failed erosion control measures.

Brassils Creek was dominated by extensive riparian buffers, with minimal shoreline erosion detected. Instances of shoreline instability were noted in proximity to residential areas, however the majority of sites showed only minor evidence of erosion (Figure 4).

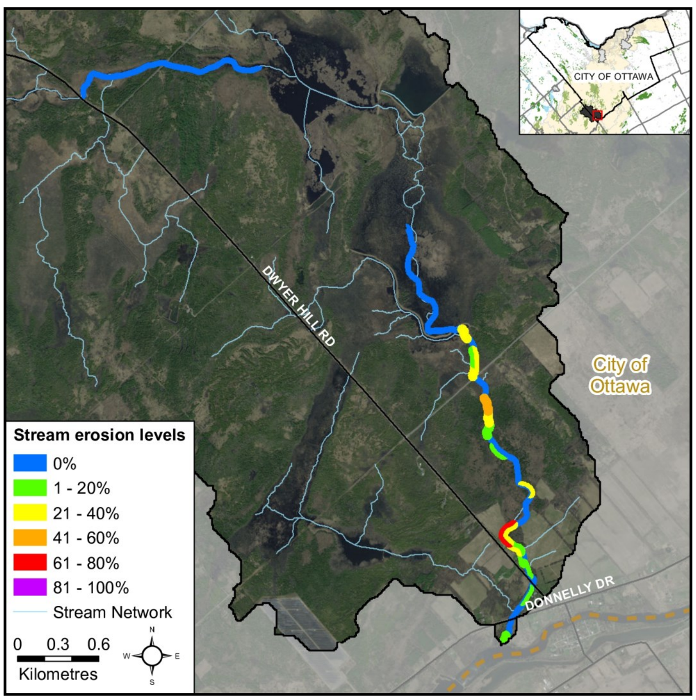


Figure 4 Erosion levels along Brassils Creek

Typical shoreline conditions along Brassils Creek

Undercut Stream Banks

Stream bank undercuts can provide excellent cover habitat for aquatic life, however excessive levels can be an indication of unstable shoreline conditions. Bank undercut was assessed as the overall extent of each surveyed section with overhanging bank cover present.

Bank undercut was identified in approximately 28% of all surveyed sites, with an average coverage extent of only 16% in those sections (Figure 5). Undercut zones were generally isolated to the lower reaches of the system, as hydric soils were dominant upstream of Paden Rd.

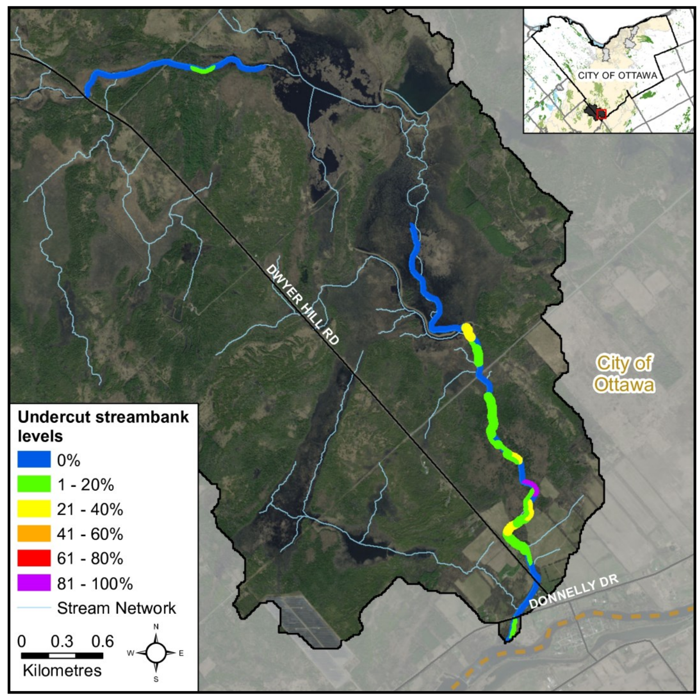


Figure 5 Undercut stream banks along Brassils Creek

Upturned root mass along Brassils Creek

Stream Shading

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. Stream cover is assessed as the total coverage area in each section that is shaded by overhanging trees/grasses and tree canopy, at greater than 1m above the water surface.

Brassils Creek was characterized by relatively low direct cover, with shading at or below 40% within the 75th percentile. The most frequent cover level was assessed at 0%, and accounts for approximately 30% of the surveyed stream (Figure 6). Despite having significant forested sections, the low cover extent is generally associated with the wetland dominated reaches. Stream shading was found to be most prevalent in the lower reaches where dense forest cover was common (Figure 7).

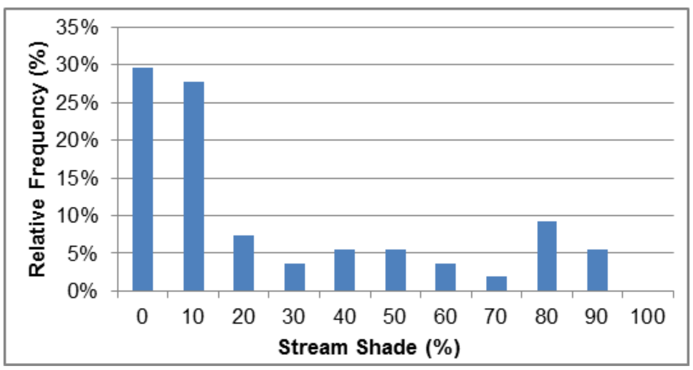


Figure 6 Distribution of stream shade levels on Brassils Creek

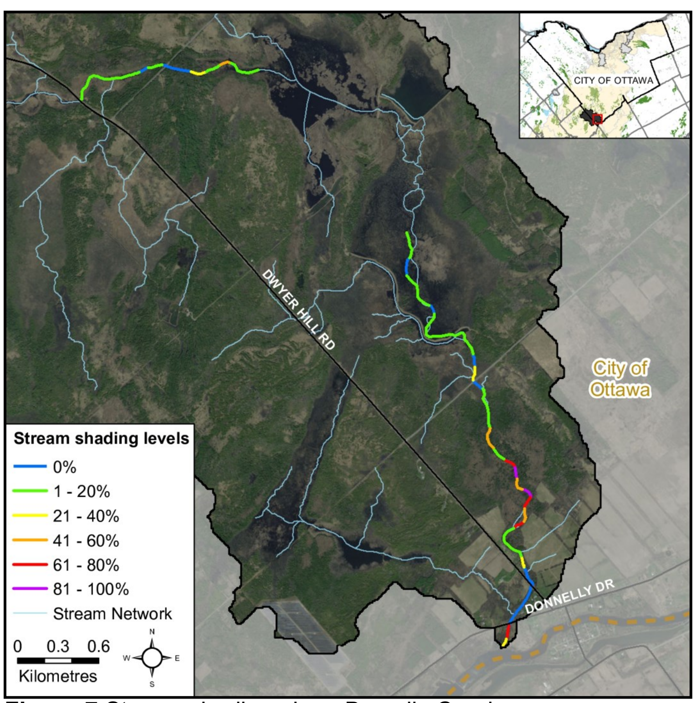


Figure 7 Stream shading along Brassils Creek

Riparian Buffer Alterations

Alterations within the riparian buffer were assessed within three distinct shoreline zones (0-5m, 5-15m, 15-30m), and evaluated based on the dominant vegetative community and/or land cover type (Figure 8).

The riparian buffer zone along Brassils Creek was found to be predominantly natural, with 96% of the left bank and 100% of the right bank evaluated as having natural vegetative communities. Alterations to the shoreline were isolated to the left bank and identified in only 4% of sites, with highly altered conditions accounting for 2%, inclusively. These alterations were generally associated with road crossings and residential land use.

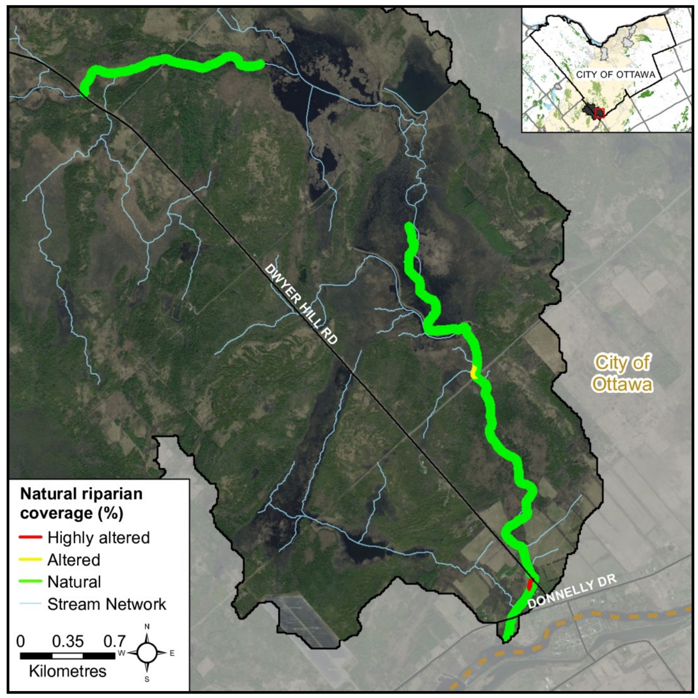


Figure 8 Riparian buffer alterations within Brassils Creek

Shoreline alteration (ie. road crossing) along Brassils Creek

Overhanging Trees and Branches

Trees and branches that are less than one meter from the surface of the water are defined as overhanging. At this proximity to the water, trees and branches provide a food source, nutrients and shade which helps to moderate instream water temperatures.

Overhanging trees and branches were identified in 55% of all surveyed sites with an average coverage extent of 35% in those sections (Figure 9). Stream overhang was found to be most prevalent in the lower reaches as forest cover was common.

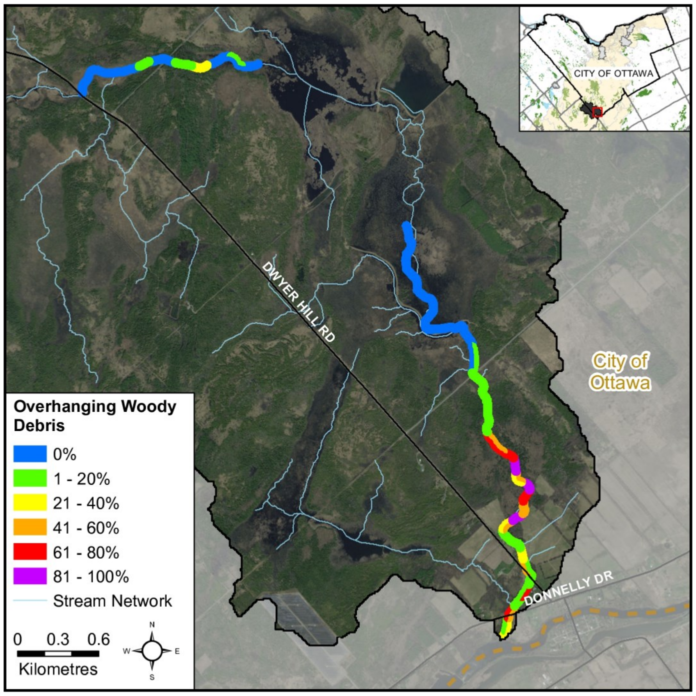


Figure 9 Overhanging trees and branches along Brassils Creek

Overhanging trees and branches on Brassils Creek

Anthropogenic Alterations
Stream alterations are classified based on specific functional criteria associated with the flow conditions, the riparian buffer, and potential human influences (Figure 10).

Brassils Creek is considered unaltered or natural for 98% of its length, with alterations observed in only 2% of sections. Altered conditions were generally associated with residential land use, road crossings and the presence of weir structures.

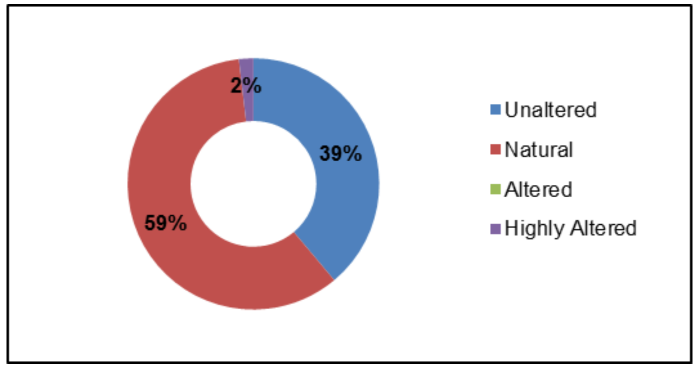


Figure 10 Anthropogenic alterations along Brassils Creek

Alterations along Brassils Creek (ie. Ducks Unlimited weir)

An unaltered section of Brassils Creek highlighting low water conditions in 2016.

Brassils Creek Instream Aquatic Habitat

Habitat Complexity

Habitat complexity is a measure of the overall diversity of habitat types and features within a stream. Streams with high habitat complexity support a greater variety of species niches, and therefore contribute to greater diversity. Factors such as substrate, flow conditions (pools, riffles) and cover material (vegetation, wood structure, etc) all provide crucial habitat to aquatic life. Habitat complexity is assessed based on the presence of boulder, cobble and gravel substrates, as well as the presence of instream woody material.

Diverse habitat cover was identified throughout Brassils Creek, with considerable coverage across the surveyed stream (Figure 11). Based on the assessment criteria, wetland locations were classified as having low habitat complexity as rock structure was uncommon through these reaches. This does not indicate impairment within these regions, as wetlands provide crucial habitat to a variety of species.

High complexity habitat was associated with extensive cobble, boulder and gravel substrates, in addition to prevalent woody materials.

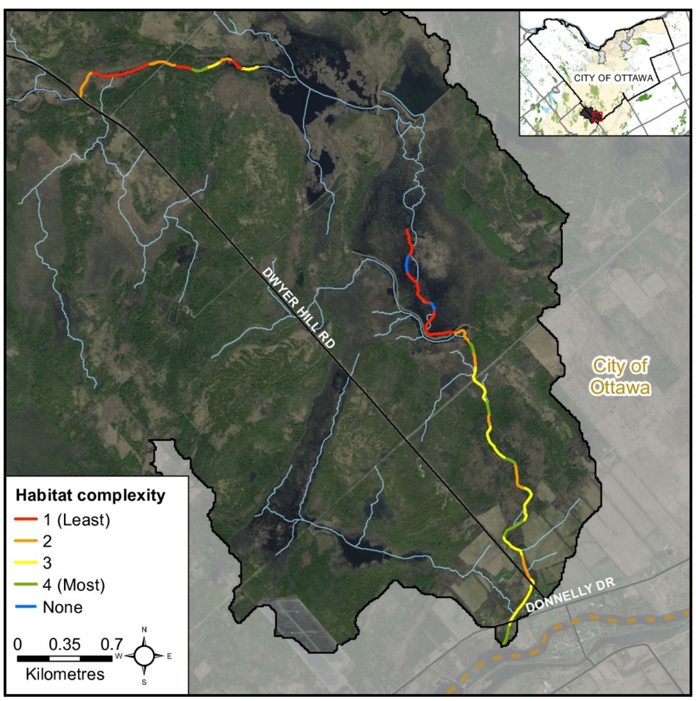


Figure 11 Instream habitat complexity in Brassils Creek

Instream Substrate

Diverse substrate is important for fish and benthic invertebrates as many species rely on specific substrate types to complete their life cycles. The absence of diverse substrate types may limit the overall diversity of species within a stream.

Cobble substrate was identified in approximately 70% of all surveyed sites, and was evaluated as the dominant substrate throughout most of the lower reaches (Figure 12 & 13). Exposed bedrock was identified in 50% of the surveyed stream, and was isolated to the lower reaches downstream of Paden Rd. Silt substrates were generally associated with the wetland region between Paden and Dwyer Hill Rd, and observed in over 63% of sites. Gravel, boulders and sand were identified in 37% - 41% of sites, with most observations made in the lower reaches. Clay substrate was uncommon in Brassils Creek, and identified in only 6% of the surveyed stream.

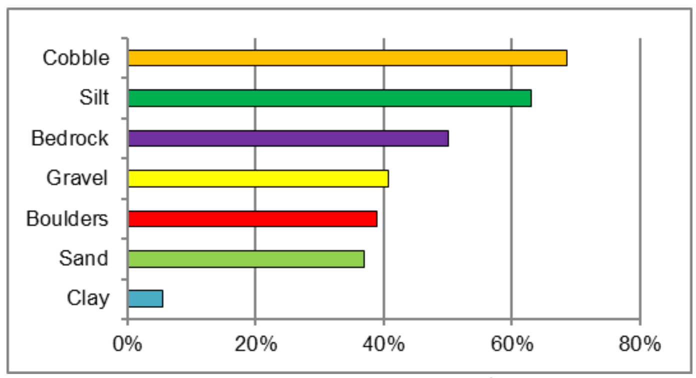


Figure 12 Instream substrate along Brassils Creek

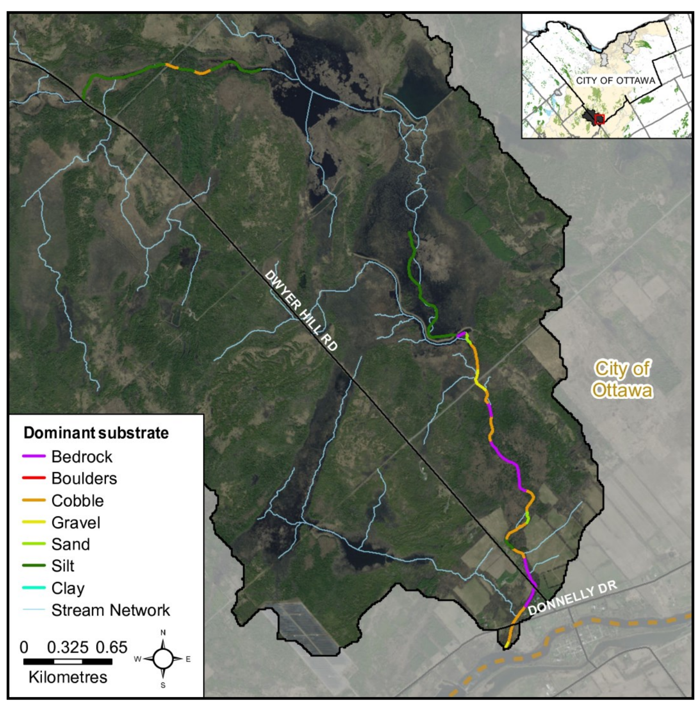


Figure 13 Dominant instream substrate in Brassils Creek

Instream Morphology

Pools and riffles are important habitat features for aquatic life. Riffles are fast flowing areas characterized by agitation and overturn of the water surface. Riffles play a crucial role in contributing to dissolved oxygen conditions and directly support spawning for some fish species. Pools are characterized by minimal flows, with relatively deep water and provide thermal, habitat and flow refuge for aquatic species. Runs are moderately shallow, with unagitated surface flow and areas where the thalweg (deepest part of the channel) is in the center of the channel.

Riffle zones on Brassils Creek were largely isolated to the lower reaches in proximity to Dwyer Hill Rd (Figure 14 & 15). Riffle habitat was identified in 44% of all surveyed sites, and was associated with extensive cobble, boulder and bedrock substrates. Pool habitat was most common throughout the system and was identified in approximately 87% of all surveyed sites.

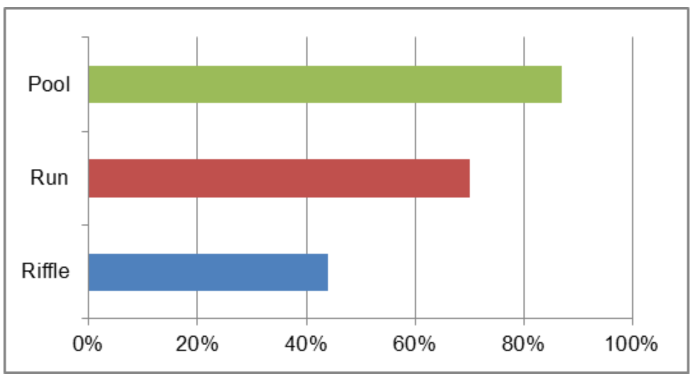


Figure 14 Instream morphology along Brassils Creek

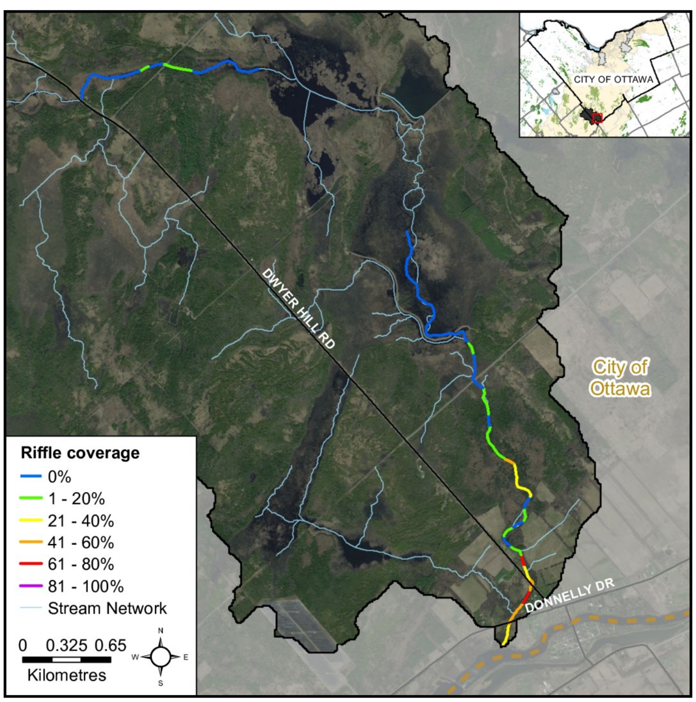


Figure 15 Riffle coverage in Brassils Creek

Vegetation Type

Instream vegetative communities are a crucial component of aquatic ecosystems, providing both direct and indirect support to aquatic life. Aquatic plants promote for stream health by:

- Providing direct riparian/instream habitat
- Stabilizing flows/reducing shoreline erosion
- Contributing to dissolved oxygen through photosynthesis
- Maintaining temperature conditions through shading

Aquatic plant diversity on Brassils Creek was found to be highly diverse, with all evaluated plant communities present (Figure 16). Narrow-leaved emergents were the most common plant type observed and identified across 85% of all surveyed sites. Robust and broad-leaved emergents were observed in 63% to 65% of sites, in addition to floating and free-floating presence in 57% to 59% of the surveyed stream. Submerged plant communities were dominant within the wetland zones, and identified in 56% of sites overall (Figure17).

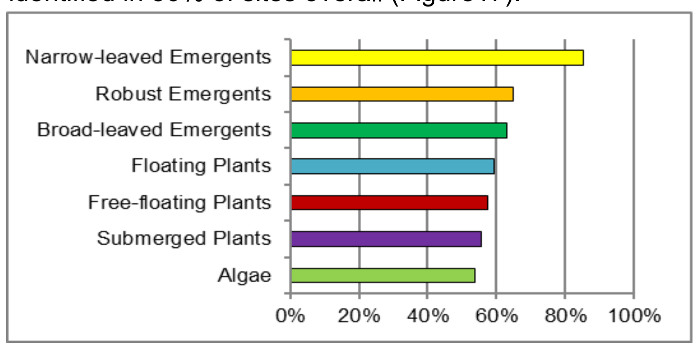


Figure 16 Aquatic vegetation presence along Brassils Creek

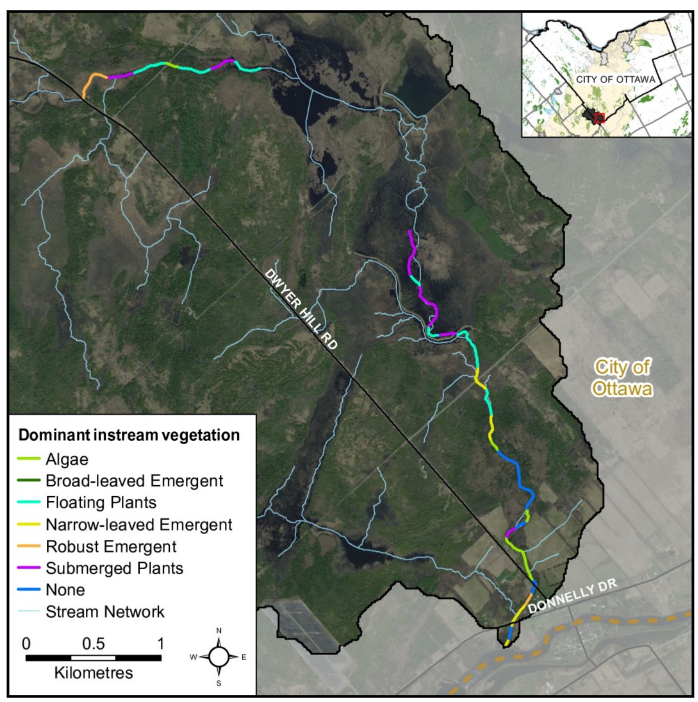


Figure 17 Dominant instream vegetation in Brassils Creek

Instream Vegetation Abundance

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. Too much vegetation can also be detrimental.

Instream vegetation abundance was found to be divided between either common/extensive levels or rare/none (Figure 18). Low to absent (ie. low, rare, none) levels accounted for 52% of observations with normal levels evaluated at only 3%. Common and/or extensive conditions were identified at 44%, and were generally associated with wetland habitat. Although wetlands habitats are typically comprised of extensive natural vegetation, considerable levels of invasive species were also identified. *European frogbit* was common throughout these reaches, and contributed directly the overall levels observed.

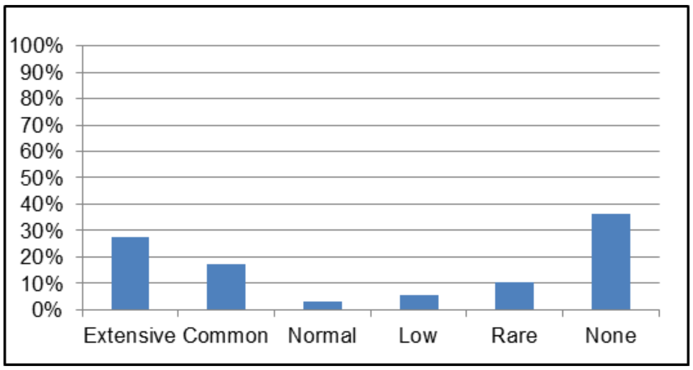


Figure 18 Instream vegetation abundance in Brassils Creek

Contrasting sites with low (above) and common/extensive (below) instream vegetation abundance

Brassils Creek Stream Health

Invasive Species

Invasive species can have major implications 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. Invasive species were observed along 74% of the surveyed stream, with a total of 9 species identified (Figure 19).

Invasive species abundance (ie. the number of observed invasives per section) was assessed to determine the potential range/vector of many of these species (Figure 19). Invasive presence was identified in 74% of sites on Brassils Creek, with 96% of these sections having 2 or fewer species. Higher density (3—4 species) and/or isolated invasive communities were identified in the lower reaches, and were generally associated with the presence of *banded mystery snails, rusty crayfish, common buckthorn* and *curly-leafed pondweed*. Invasive abundance within the wetland reaches was also common and directly associated with the presence of *European frogbit*.

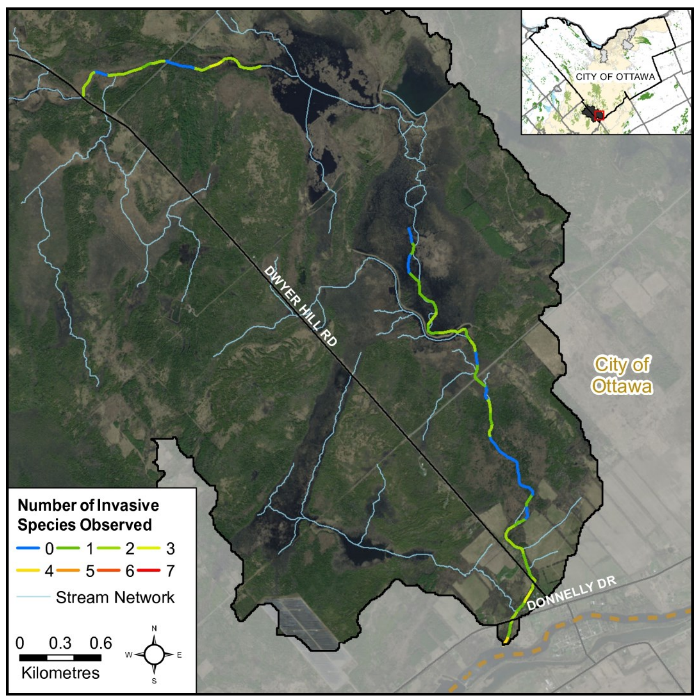


Figure 19 Invasive species abundance along Brassils Creek

Invasive *European frogbit* identified in Brassils Creek

Pollution

Pollution was identified in 28% of all surveyed sections on Brassils Creek (Figure 20). Common waste identified included general domestic products (ie. bottles, plastics, etc.) and firearm casings/shells. Garbage was identified along the stream bottom in 9% of all sites, with floating debris identified in 22% of all surveyed locations.

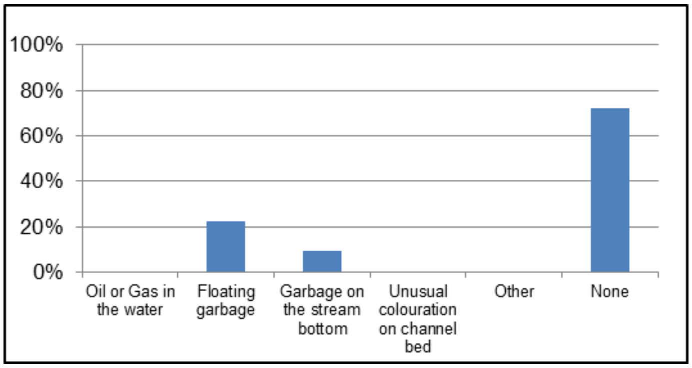


Figure 20 Pollution observed within Brassils Creek

Walk bridge along Heaphy Rd

Mudpuppy captured in 2010 at Dwyer Hill Rd

Wildlife

The diversity of fish and wildlife populations can be an indicator of water quality and overall stream health (Table 1). Wildlife observations are noted during standard monitoring and survey activities, and do not represent an extensive evaluation of species presence/ absence. Species of note or special consideration include: *snapping turtle*

Table 1 Wildlife observed along Brassils Creek in 2016

Birds	american crow, american robin, black-capped chickadee, common raven, eastern kingbird, eastern phoebe, great blue heron, grey catbird, hawk spp, killdeer, kingfisher spp, mallard, northern cardinal, osprey, red-winged blackbird, sparrow spp, turkey vulture, woodpecker spp
Reptiles & Amphibians	bullfrog, green frog, leopard frog, mink frog, northern water snake, painted turtle, snapping turtle, wood frog
Mammals	american red squirrel, north american beaver
Benthic Invertebrates	caddisfly, leech, mayfly, snail, water strider, whirlgig beetle, leaches, water strider
Other	butterfly, damselfly, deer fly, dragonfly, eastern swallowtail, horse fly, mosquito

Northern water snake identified in Brassils Creek

Mink frog identified in Brassils Creek

Brassils Creek Water Chemistry

Water Chemistry Assessment

During the stream characterization survey, a YSI probe is used to collect water chemistry information. Dissolved oxygen (DO), specific conductivity (SPC) and pH are measured at the start and end of each section.

Volunteers measuring water chemistry

Dissolved Oxygen

Dissolved oxygen is a measure of the amount of oxygen dissolved in water. Guidelines supported under the Canadian Council of Ministers of the Environment (CCME) suggest that for the protection of aquatic life the lowest acceptable dissolved oxygen concentration should be 6 mg/L for warmwater biota (red line in Figure 21) and 9.5 mg/L for coldwater biota (blue line in Figure 21) (CCME, 1999).

Warmwater conditions were largely maintained through the lower reaches of Brassils Creek (downstream of Paden Rd), however low oxygen conditions were consistently observed within the wetland areas (Figure 21). Wetlands tend to maintain lower oxygen conditions and play a crucial role in the nutrient cycling/ decomposition process. Several local fish species have adaptations which permit for survival within these environments, however these conditions would limit the overall diversity of fish present.

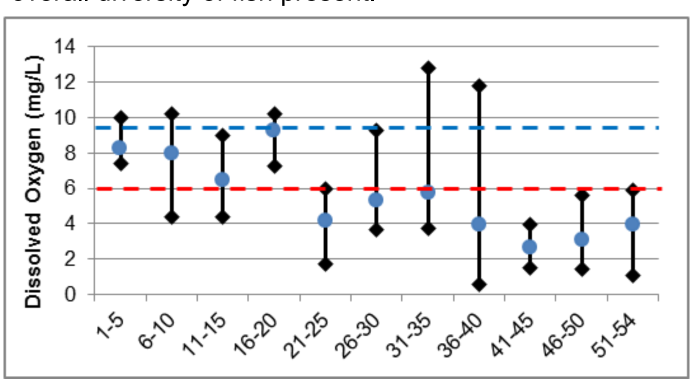


Figure 21 Dissolved oxygen ranges in Brassils Creek

Conductivity

Conductivity in streams is primarily influenced by the geology of the surrounding environment, but can vary drastically as a result of surface water runoff. Currently there are no CCME guidelines for stream conductivity, however readings which are outside the normal range observed within the system are often an indication of unmitigated discharge and/or storm-water input. The average specific conductivity observed within Brassils Creek was 417 μs/cm (green line in Figure 22).

Conductivity levels on Brassils Creek were relatively stable overall, with only minor indications of potential impairment (Figure 22). Slightly elevated levels were identified in proximity to agriculture and residential land use, as well as in the upper extents of our surveyed area.

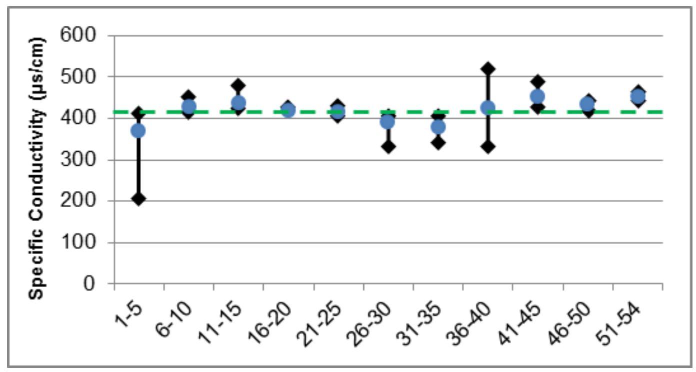


Figure 22 Conductivity ranges in Brassils Creek

pH

Based on the Provincial water quality objectives for pH, a range of 6.5 to 8.5 should be maintained for the protection of aquatic life.

Average pH throughout Brassils Creek was approximately 7.8, with some minor exceedances above the Provincial standard observed (Figure 23). Variation in pH was occasionally found to parallel elevated conductivity readings, and is likely associated with adjacent agriculture or residential land use.

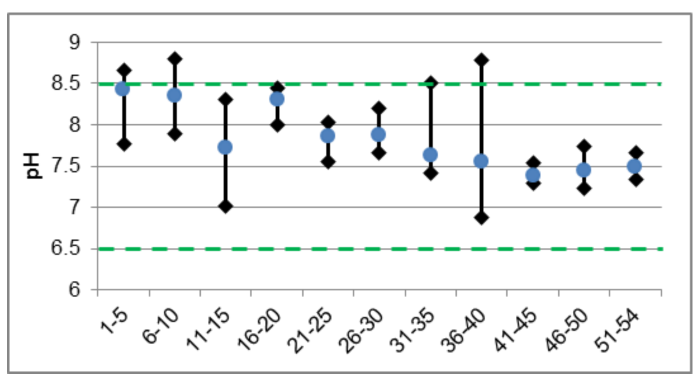


Figure 23 pH ranges in Brassils Creek

Oxygen Saturation (%)

Oxygen saturation is measured as the ratio of dissolved oxygen relative to the maximum amount of oxygen that will dissolve based on the temperature and atmospheric pressure. Well oxygenated water will stabilize at or above 100% saturation, however the presence of decaying matter/pollutants can drastically reduce these levels. Oxygen input through photosynthesis has the potential to increase saturation above 100% to a maximum of 500%, depending on the productivity level of the environment. In order to represent the relationship between concentration and saturation, the measured values have been summarized into 6 classes.

1) <100% Saturation / <6.0 mg/L Concentration

- Oxygen concentration and saturation are not sufficient to support aquatic life and may represent impairment.

2) >100% Saturation / <6.0 mg/L Concentration

- Oxygen concentration is not sufficient to support aquatic life, however saturation levels indicate that the water has stabilized at its estimated maximum. This is indicative of higher water temperatures and stagnant flows.

3) <100% Saturation / 6.0—9.5 mg/L Concentration

- Oxygen concentration is sufficient to support warmwater biota, however depletion factors are likely present and are limiting maximum saturation.

4) >100% Saturation / 6.0—9.5 mg/L Concentration

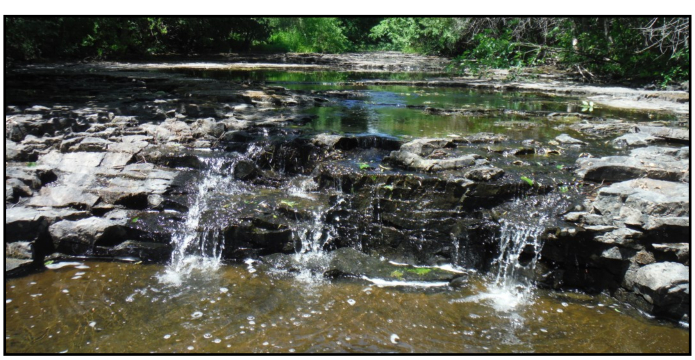
- Oxygen concentration and saturation levels are optimal for warmwater biota.

5) <100% Saturation / >9.5 mg/L Concentration

- Oxygen concentration is sufficient to support coldwater biota, however depletion factors are likely present and are limiting maximum saturation.

6) >100% Saturation / >9.5 mg/L Concentration

- Oxygen concentration and saturation levels are optimal for warm and coldwater biota.



Riffle on Brassils Creek with optimal oxygen conditions

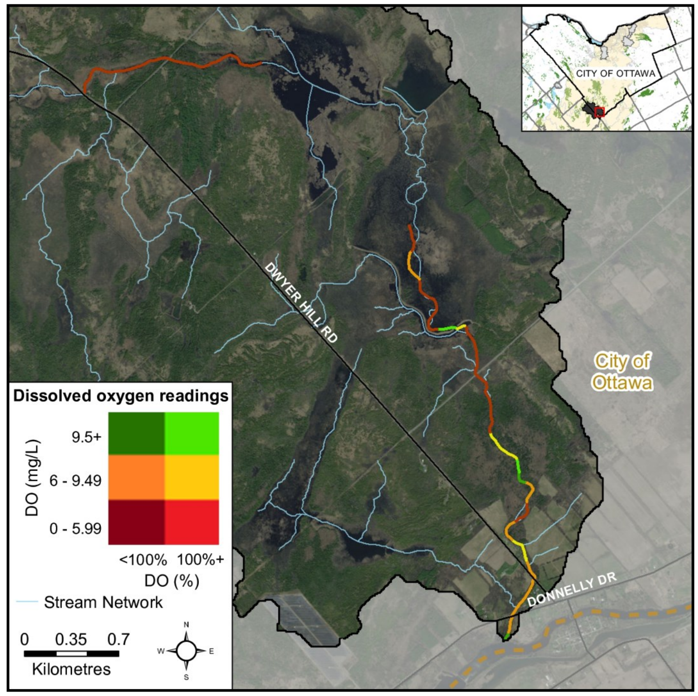


Figure 24 A bivariate assessment of dissolved oxygen concentration (mg/L) and saturation (%) on Brassils Creek

Dissolved oxygen conditions on Brassils Creek were generally poor, with 85% of sites evaluated as under-saturated (Figure 24). Significant low water conditions likely resulted in higher peak temperatures and stagnant flows, reducing the overall oxygen capacity and input to the system. Several refuge zones were identified with adequate oxygen levels for both warm and coolwater species, however these regions were periodically disconnected and/or fragmented. Severe oxygen depletion was evident within the wetland reaches of Brassils Creek, and may have influenced the conditions observed downstream.

Beaver dam on Brassils Creek with depleted oxygen conditions

Specific Conductivity Assessment

Specific conductivity (SPC) is a standardized measure of electrical conductance, collected at or corrected to a water temperature of 25ºC. SPC is directly related to the concentration of ions in water, and is commonly influenced by the presence of dissolved salts, alkalis, chlorides, sulfides and carbonate compounds. The higher the concentration of these compounds, the higher the conductivity. Common sources of elevated conductivity include storm water, agricultural inputs and commercial/industrial effluents.

In order to summarize the conditions observed, SPC levels were evaluated as either normal, moderately elevated or highly elevated. These categories correspond directly to the degree of variation (ie. standard deviation) at each site relative to the average across the system.

Normal levels were largely maintained throughout Brassils Creek, with only minor instances of potential impairment (Figure 25). Highly elevated conditions were identified in three distinct regions, and generally associated with proximity to agriculture and residential land use.

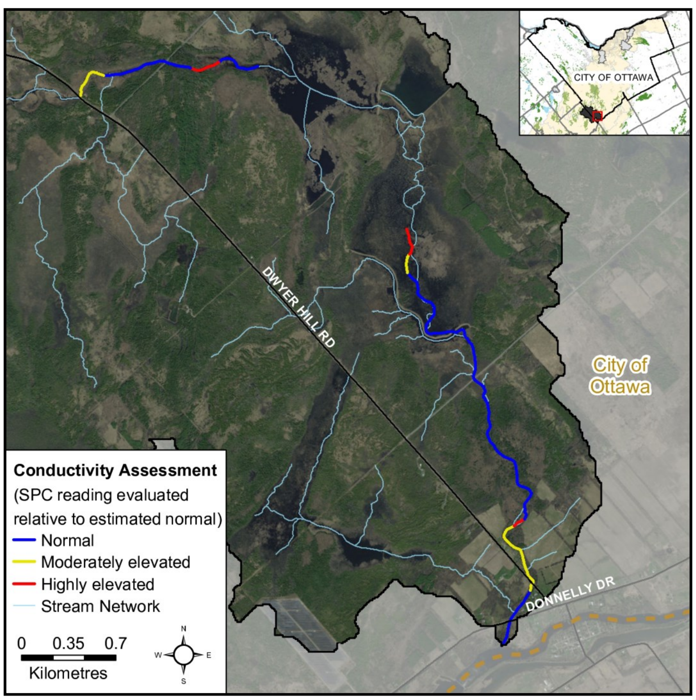


Figure 25 Relative specific conductivity levels on Brassils Creek

Areas of Concern

Based on an overall evaluation of the water quality results, several areas of Brassils Creek show potential impairment. These regions generally correspond with outflow and/or proximity to developed areas. The following sites are associated with inadequate oxygen conditions, elevated conductivity and variable pH levels (Figure 26).

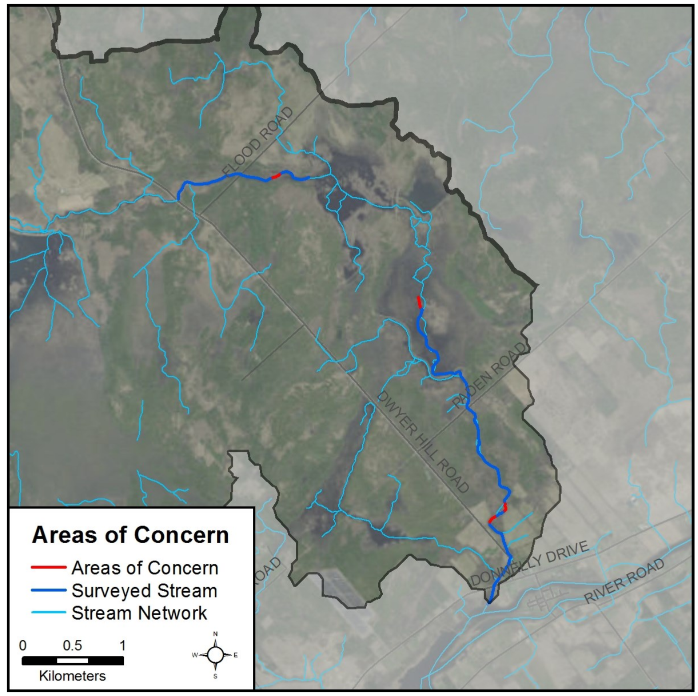


Figure 26 Brassils Creek areas of concern based on water chemistry evaluation

Stream section on Brassils Creek with elevated conductivity levels

Brassils Creek Thermal Classification

Thermal Classification

Many factors can influence fluctuations in stream temperature, including springs, tributaries, precipitation runoff, discharge pipes and stream shading from riparian vegetation. Three loggers were deployed in late April to monitor water temperatures in Brassils Creek (Figure 27). Water temperatures are used along with the maximum air temperature (using a revised Stoneman and Jones method) to classify sampling reaches into one of five categories that correspond to the thermal preferences of local fish communities (Figure 29). Brassils Creek is classified as a warmwater system, however a complete evaluation was not possible in 2016. Only a single data logger was retrieved, as logger ID-1 and ID-2 were either lost or compromised due to low water conditions.

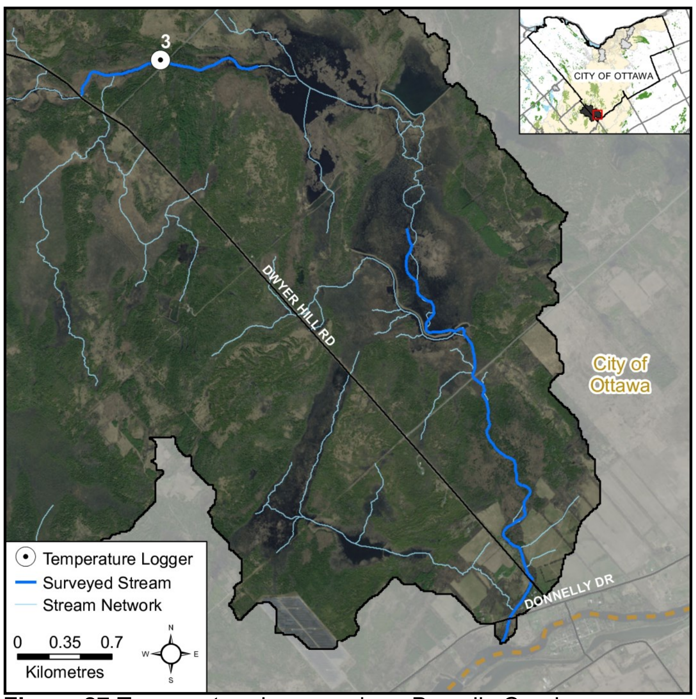


Figure 27 Temperature loggers along Brassils Creek

Groundwater

Groundwater discharge areas can influence stream temperature, contribute nutrients, and provide important stream habitat for fish and other biota. During stream surveys, indicators of groundwater discharge were assessed and identified (Figure 28).

Groundwater indicators were generally limited to the lower reaches of the stream, and evaluated based on the presence of mineral films.

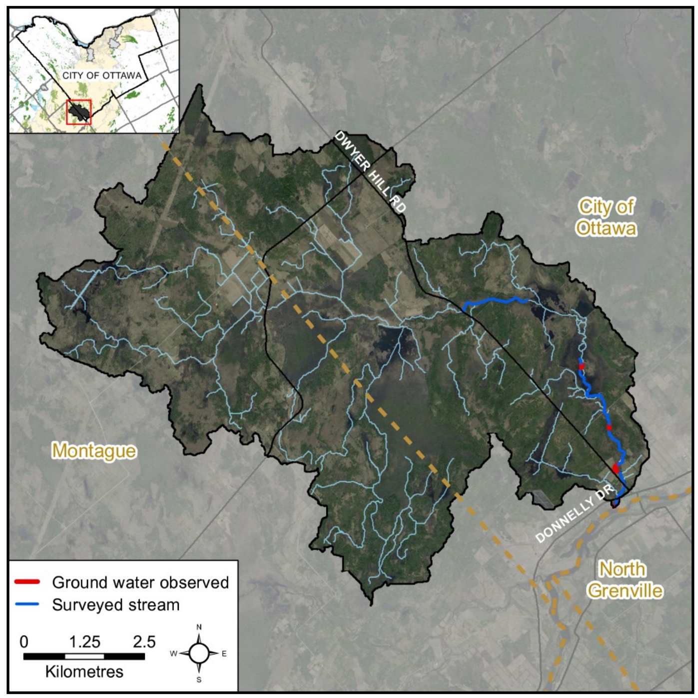


Figure 28 Groundwater indicators observed in Brassils Creek

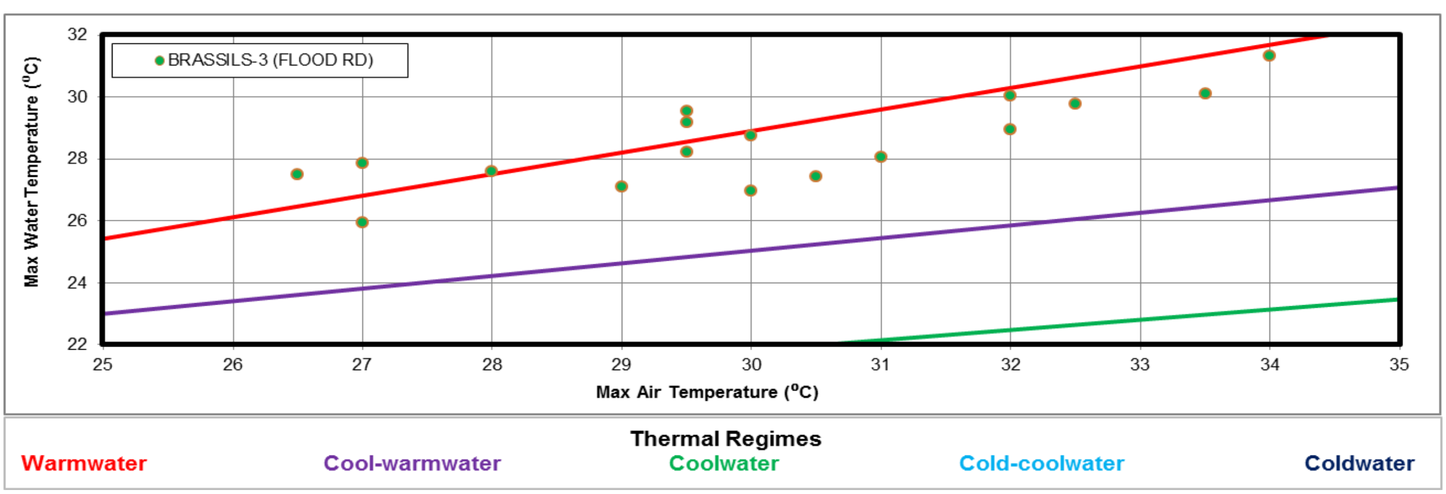


Figure 29 Thermal Classification for Brassils Creek

Brassils Creek Fish Community

Fish Community

Historic fish sampling records indicate the presence of 27 distinct species within Brassils Creek (Table 2). RVCA fish sampling efforts have identified all of the listed species. No species of note or special consideration were identified.

Fish sampling records include data from 27 separate sampling events and 9 sites (Figure 30).

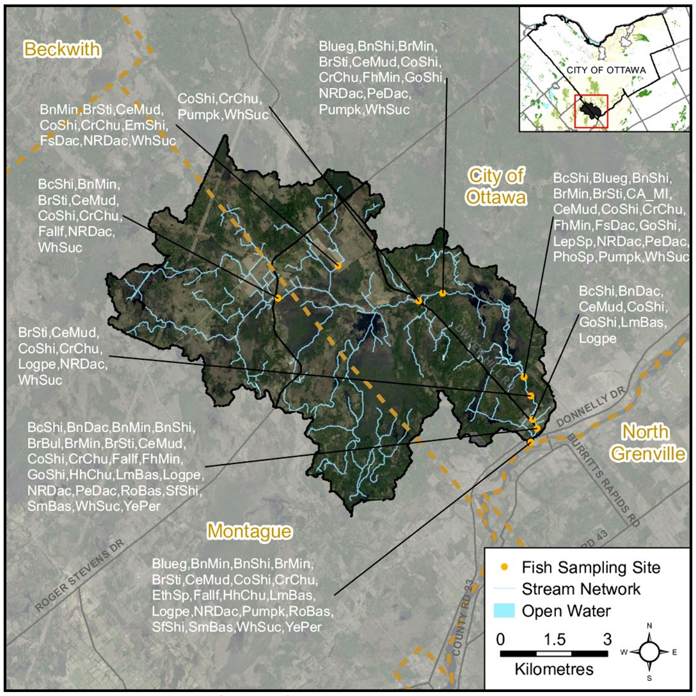
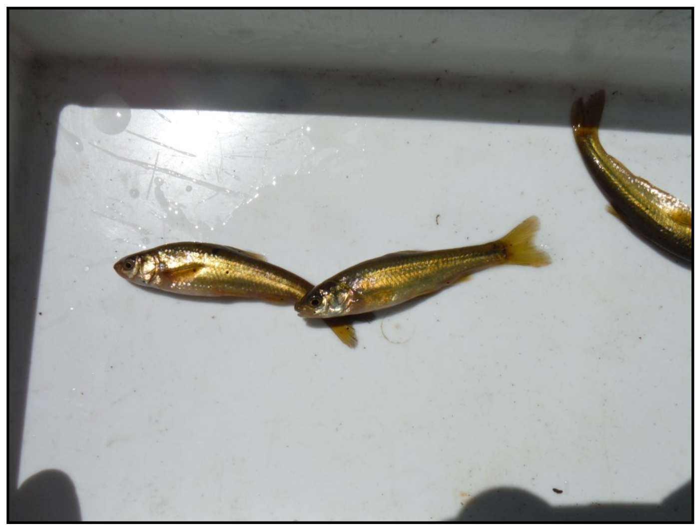


Figure 30 Brassils Creek fish sampling locations

Electrofishing site along Donnelly Dr, Burrits Rapids

Table 2 Fish species observed in Brassils Creek (2000-2016)

Species	Code	Species	Code
Blackchin shiner	BcShi	Fathead minnow	FhMin
Blacknose dace	BnDac	Finescale dace	FsDac
Blacknose shiner	BnShi	Golden shiner	GoShi
Bluegill	Blueg	Hornyhead chub	HhChu
Bluntnose minnow	BnMin	Largemouth bass	LmBas
Brassy minnow	BrMin	Logperch	Logpe
Brook stickleback	BrSti	Northern pearl dace	PeDac
Brown bullhead	BrBul	Northern redbelly dace	NRDac
Cyprinid Sp.	CA_MI	Pumpkinseed	Pumpk
Central mudminnow	CeMud	Rock bass	RoBas
Common shiner	CoShi	Smallmouth bass	SmBas
Creek chub	CrChu	Spottail shiner	SfShi
Emerald shiner	EmShi	White sucker	WhSuc
Fallfish	Fallf	Yellow perch	YePer



Brassy minnows captured on Brassils Creek

Northern pearl dace captured on Brassils Creek

Migratory Obstructions

Migratory obstructions represent limitations to fish dispersal within a system and may restrict access to important spawning and rearing habitat. Barriers can be natural or man-made features, with either seasonal or permanent influence.

Beaver activity was common throughout Brassils Creek, with two active dams identified in proximity to Paden Rd (Figure 31). Several natural grade barriers were also identified and correspond with changes in the underlying bedrock. Some minor seasonal debris dams were observed, and were typically associated with low water conditions.

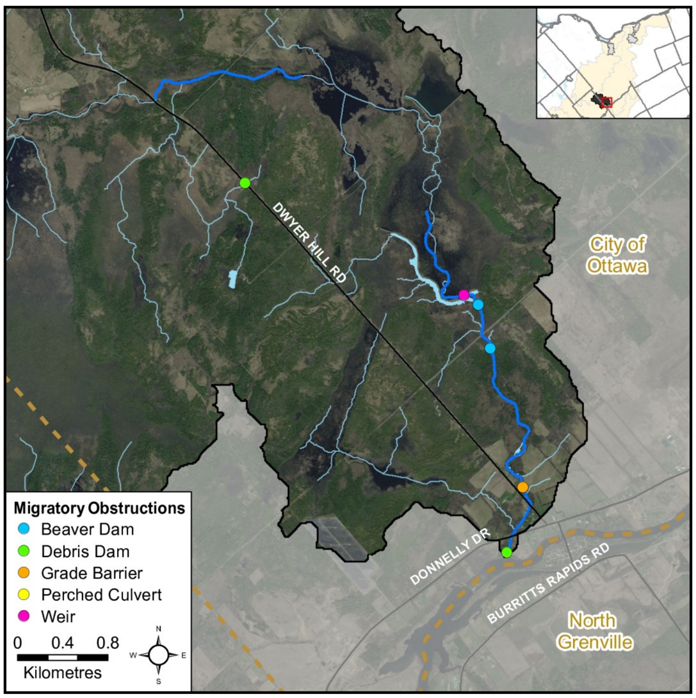


Figure 31 Brassils Creek migratory obstructions

Ducks Unlimited weir located on Brassils Creek

Beaver Dams

Beaver dams are considered potential barriers to fish migration. Beaver activity was common throughout Brassils Creek, with two large active dams identified upstream and downstream of Paden Rd (Figure 32). Historic beaver activity was evident in the upper surveyed stream, as breached and submerged structures were identified.

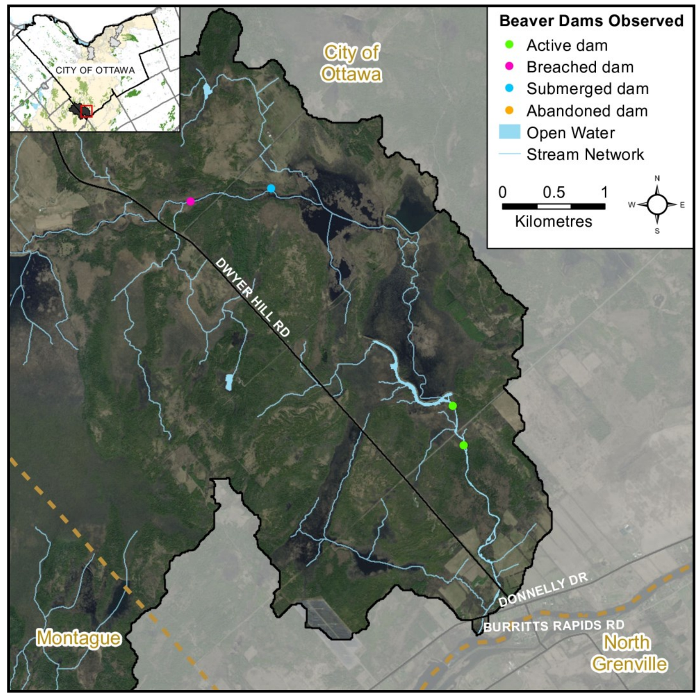


Figure 32 Beaver dams observed on Brassils Creek

Active beaver dam along Brassils Creek

Headwater Drainage Feature Assessment

Headwaters Sampling

Headwater drainage features (HDF) represent the origin from which water enters a watershed. These features convey surface flows directly from groundwater discharge, rain and melt water to the greater catchment area. HDF's have not traditionally been a component of most monitoring efforts, as their form and function on the landscape are not well established. These features may provide direct and seasonal fish habitat, as well as thermal refuge as a result of groundwater influence (OSAP Protocol, 2013). Furthermore, HDF's may be important sources, conveyors and storers of sediment, nutrients and flow, and may have an important role for terrestrial and wetland species. The RVCA is currently working with other Conservation Authorities and the Ministry of Natural Resources and Forestry to implement a sampling protocol with the goal of providing standard datasets to support scientific development and monitoring of these features. This protocol provides a direct means of characterizing the sediment and flow capacity, connectivity, form and unique features associated with each HDF (OSAP Protocol, 2013). Feature are evaluated through a rapid assessment protocol and sampled at road crossings.

In 2016 the CSW program assessed 19 sites in the Brassils Creek catchment area (Figure 33).

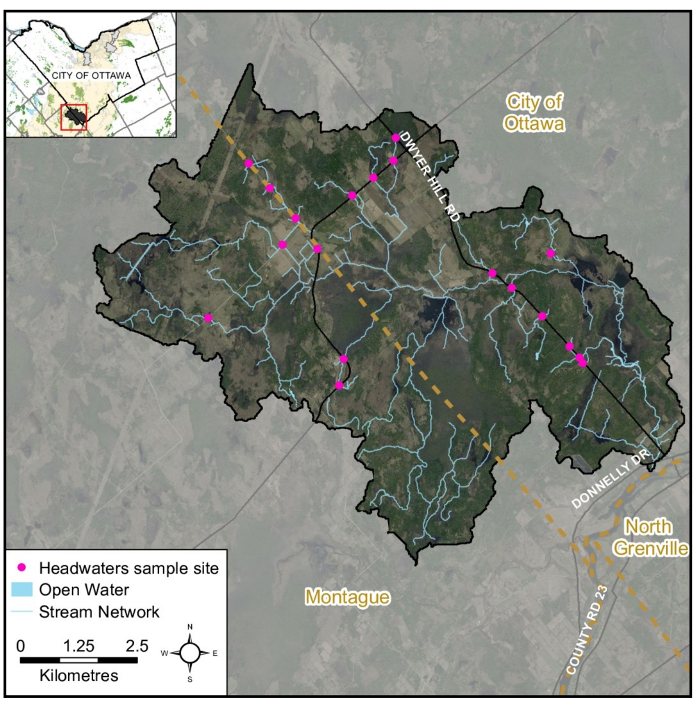


Figure 33 Brassils Creek HDF sampling sites

Feature Type

The headwater sampling protocol assesses the feature type in order to understand the function of each feature. The evaluation includes the following feature classifications: defined natural channel, channelized or constrained, multi-thread, no defined feature, tiled, wetland, swale, roadside ditch and pond outlet. By assessing the form of the HDF, we can better understand the function it provides within the catchment as it relates to the hydrology, sediment transport capacity and habitat conditions.

The Brassils Creek catchment is comprised predominantly of natural feature types, including wetlands and natural streams (Figure 34). Altered feature types include roadside ditches, channelized stream and swales.

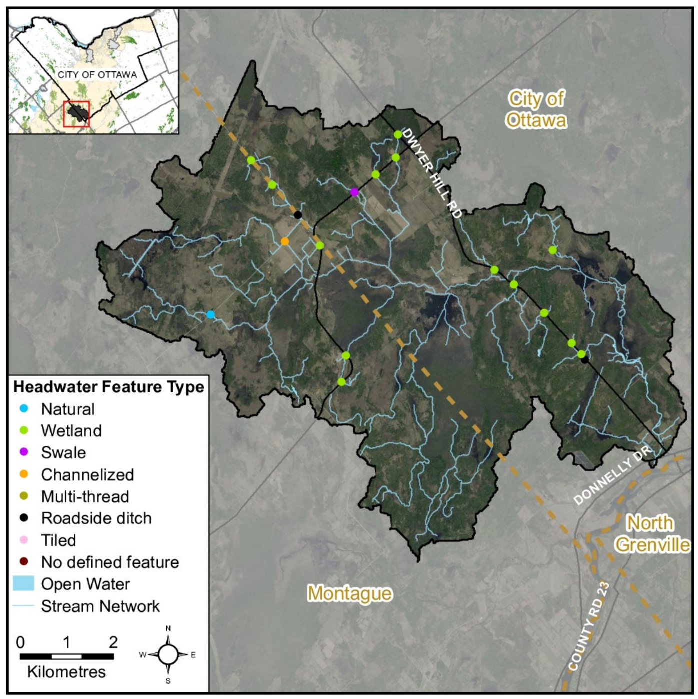


Figure 34 Brassils Creek HDF feature types

Channelized headwater feature in the Brassils Creek catchment

Headwater Feature Flow

Flow conditions within an HDF can be highly variable as a result of seasonal factors, moisture conditions, rainfall events and snow-melt. Flow conditions are assessed in the spring and in the summer to determine if features are perennial and flow year round, if they are intermittent and dry up during the summer months or if they are ephemeral systems with irregular flow patterns that generally respond to specific rainstorm events or snowmelt. Flow conditions in headwater systems can change from year to year depending on local precipitation patterns.

Intermittent flow conditions were identified throughout most of the catchment area in 2016 (Figure 35). The effects of low water were evident across all monitoring sites, as dry surface features were common.

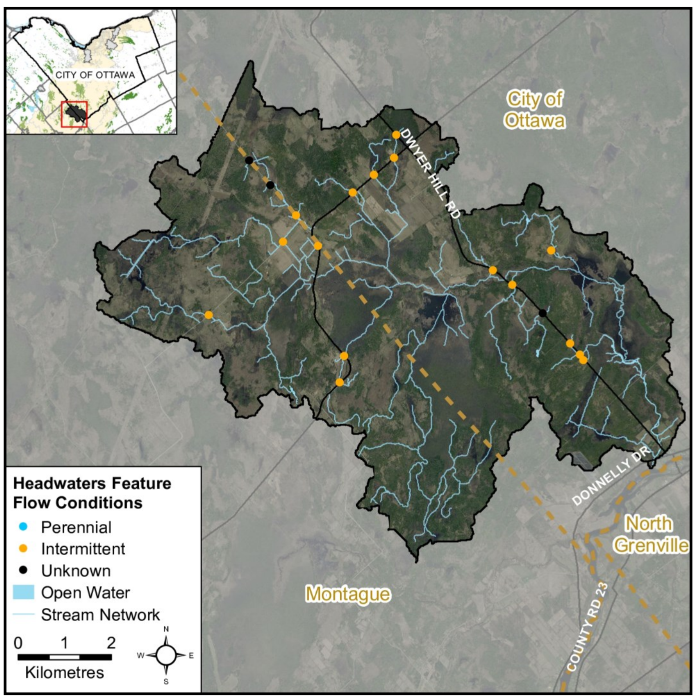


Figure 35 Brassils Creek HDF flow conditions

Intermittent headwater flow feature along Dwyer Hill Rd

Feature Channel Modifications

Channel modifications were assessed at each headwater drainage feature sampling location. Modifications include channelization, dredging, hardening and realignments.

The Brassils Creek catchment was subject to standard road feature modifications, including channel straightening and in some instances dredging. Unaltered (ie. natural) conditions were also common, and account for 47% of the surveyed sites (Figure 36).

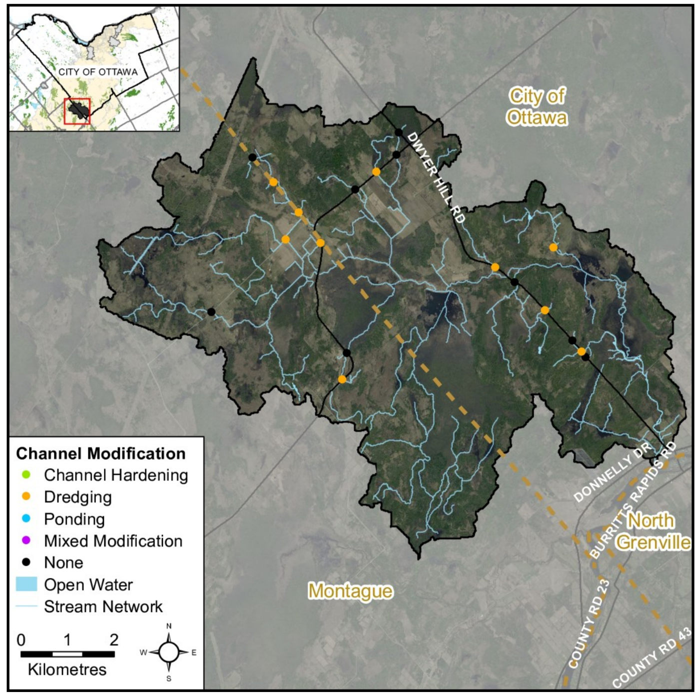


Figure 36 Brassils Creek HDF channel modifications

Spring (above) and summer (below) headwater flow conditions (Dwyer Hill Rd)

Headwater Feature Vegetation

Feature vegetation is evaluated as the dominant vegetation type found directly within the stream channel. Vegetation within the feature plays a significant role in flow and sediment movement, as well as providing critical aquatic and terrestrial habitat. Vegetation types include: no vegetation, lawn, wetland, meadow, scrubland and forest.

Feature vegetation within the Brassils Creek catchment was identified as either wetland, scrubland, forest or as having no defined vegetation (Figure 37). Natural vegetation types were common within the catchment and represent 74% of the surveyed sites.

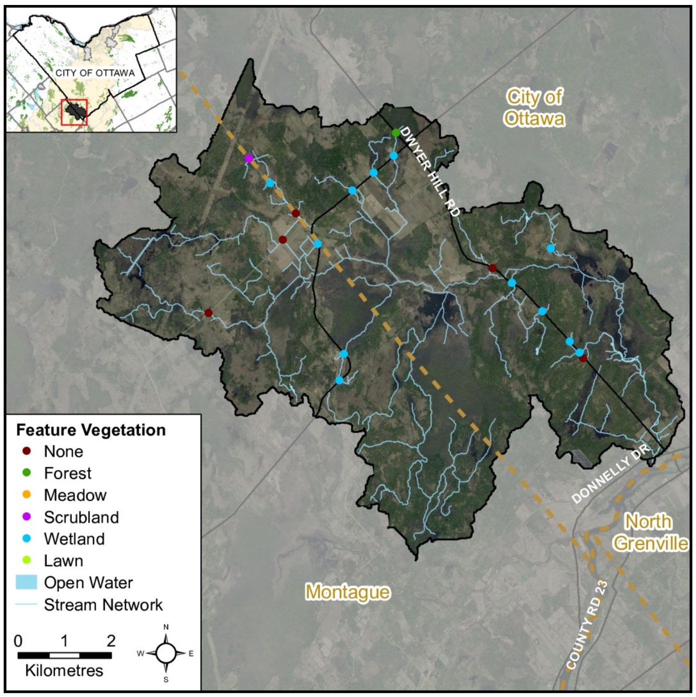


Figure 37 Brassils Creek HDF feature vegetation

Wetland flow feature located along Roger Stevens Dr

Headwater Feature Riparian Vegetation

Riparian vegetation is evaluated as the dominant vegetation type observed within 3 standardized shoreline zones. The vegetative community is assessed at 0-1.5m, 1.5-10m and 10-30m from the stream bank.

Riparian conditions within the Brassils Creek catchment were predominately natural, with 79% of sites evaluated as having natural cover vegetation adjacent to the primary flow feature (Figure 38). Four sites were evaluated as “other”, and correspond with agricultural land use.

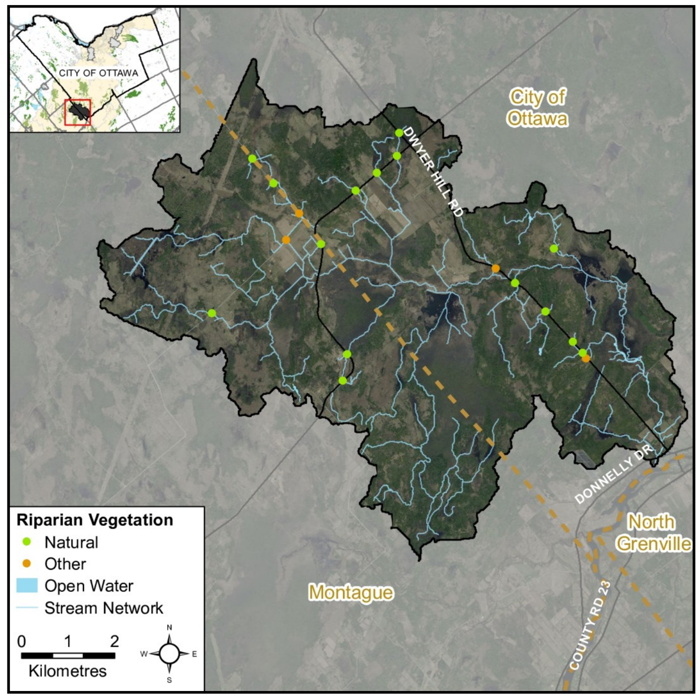


Figure 38 Brassils Creek HDF riparian vegetation

Wetland buffer vegetation along Dwyer Hill Rd

Headwater Feature Sediment Deposition

Assessing the amount of recent sediment deposited in a channel provides an index of the degree to which the feature could be transporting sediment to downstream reaches (OSAP, 2013). Evidence of excessive sediment deposition might indicate the requirement for further assessment and potential implementation of best management practices.

Sediment deposition within the Brassils Creek catchment was predominantly low, with 84% of sites categorized as having minimal to no immediate sedimentation (Figure 39). Extensive levels of deposition were identified at two sites, and were associated with dredging and/or agricultural land use.

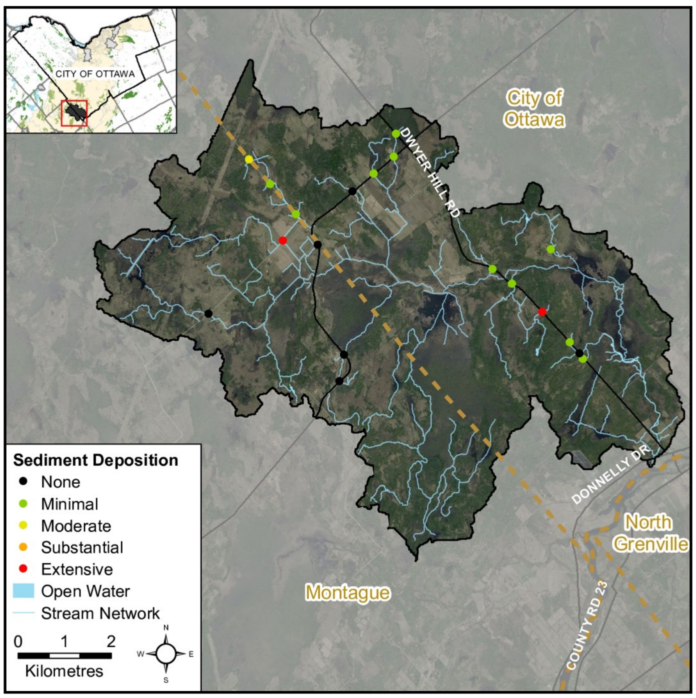


Figure 39 Brassils Creek HDF sediment deposition

Extensive sediment deposition within the Brassils Creek catchment

Headwater Feature Upstream Roughness

Feature roughness is a measure of the amount of material within the bankfull channel capable of slowing water velocity and stabilizing flows (OSAP, 2013). Materials on the channel bottom that provide roughness include vegetation, woody debris and boulders/cobble substrates. Roughness can promote for reduced erosion downstream of the feature, as well as providing important habitat to aquatic organisms.

Feature roughness varied between sites, with high to extreme levels common throughout the catchment (Figure 40). Minimal levels were limited to two sites, and were associated with dredging and/or agricultural land use.

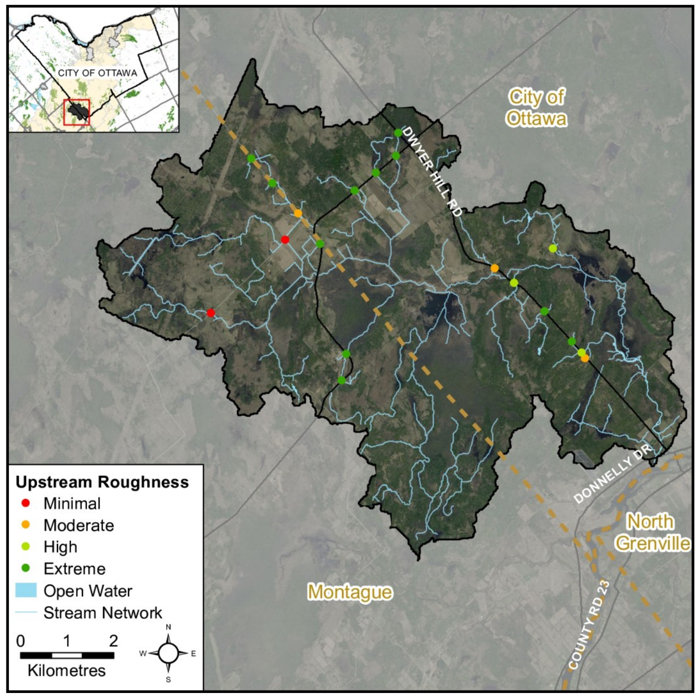


Figure 40 Brassils Creek HDF feature roughness

Headwater feature along Roger Stevens Dr with *extreme* roughness conditions

Stream Comparison Between 2010 and 2016

The following tables provide a comparison of observations on Brassils Creek between the 2010 and 2016 survey years. Brassils Creek was also surveyed in 2005, but the surveying protocol has changed significantly since that time so data from 2005 cannot be compared to data from 2010 and 2016. In order to accurately represent current and historical information, the site data was only compared for those locations which were surveyed in both reporting periods. In some instances, this resulted in changes to our overall summary information. This information is therefore only a comparative evaluation and does not represent the entirety of our assessment.

Water Chemistry

Water chemistry parameters are tracked throughout the entire surveyed stream and reflect the general conditions, stability and quality of the environment. Shifts in these conditions can be indicative of general ecological changes within the environment, but also enable us to better understand the natural level of variability within the system (Table 3).

Between 2010-2016, pH levels on Brassils Creek were found to be relatively equal, with slightly less variable conditions evaluated in 2016. Stream conductivity was found to have increased slightly, however this shift appears to fall within the standard level of variability identified across the system. Dissolved oxygen conditions were found to be in decline, with an average decrease in concentration of 1.2 mg/L overall. Despite low water conditions in 2016, Brassils Creek was found to be relatively stable, with little variation between 2010 and 2016. Reduced oxygen conditions within the system are likely associated with low flows and/or increased stream temperatures.

Stream temperatures were monitored via stationary temperature logger (*see thermal classification—Page 13)* and concurrently during stream sampling. General temperature observations identified little variation between study years, with average water temperatures remaining stable between 21.3 –21.9 ºC. In order to account for differences in climate factors such as daily air temperature and precipitation, a standardized stream temperature assessment[1] was also utilized. Between 2010-2016, the stream temperature factor was found to have increased by 0.1 ºC for every 1ºC of air temperature.

Low water conditions were generally associated with reduced stream function, as the pH, oxygen, conductivity and temperature were found to be in a state of decline. Despite these influences, Brassils Creek was found to be relatively stable compared to all other 2016 streams. This may be due in part to the predominantly natural state of the stream, with 83% of the catchment area evaluated as having natural land cover.

Table 3 Water chemistry comparison (2010 / 2016)

Water Chemistry (2010—2016)				
YEAR	**PARAMETER**	**UNIT**	**AVERAGE**	**STND ERROR**
2010	pH	-	7.78	+/- 0.39
2016	pH	-	7.83	+/- 0.05
2010	Sp. Conductivity	us/cm	403	+/- 24
2016	Sp. Conductivity	us/cm	418	+/- 4
2010	Dissolved Oxygen	mg/L	6.76	+/- 0.45
2016	Dissolved Oxygen	mg/L	5.56	+/- 0.28
2010	Water Temperature	ºC	21.3	+/- 1.1
2016	Water Temperature	ºC	21.9	+/- 0.3
2010	Standardized Stream Temperature[1]	ºC Water / 1ºC Air	0.85	+/- 0.01
2016	Standardized Stream Temperature[1]	ºC Water / 1ºC Air	0.95	+/- 0.01

[1] ***Standardized Stream Temperature:*** Temperature data is collected via logger and standardized based on the following conditions:

- Daily maximum air temperatures must exceed 24.5 ºC
- No precipitation for 3 days preceding measurement
- Measurements to be taken between 4:00PM—6:00PM
- All temperatures points to be collected in July/August
- Logger must be deployed in flowing waters

Invasive Species

Invasive species presence was compared between 2010-2016 to determine if the overall distribution of these species had changed (Table 4). In general, invasive species presence was observed to have decreased overall, however several species were found to have expanded their range within Brassils Creek. Species such as *common buckthorn* and *rusty* crayfish were found to have increased in 2016. Conversely, *purple loosestrife* and *European frogbit* were found to be in decline and may be associated with on-going management efforts and/or low water conditions.

Table 4 Invasive species presence (2010 / 2016)

Invasive Species	2010 (%)	2016 (%)	+/-
Total	100%	74%	▼
Common buckthorn	17%	22%	▲
European frogbit	53%	30%	▼
Flowering rush	2%	2%	-
Purple loosestrife	94%	20%	▼
Rusty crayfish	11%	28%	▲

Pollution

Garbage accumulation on Brassils Creek was found to be in decline from 2010 –2016 (Table 5). In 2010, garbage was identified in 47% of all surveyed sections. By comparison, only 28% of sites in 2016 were found to have some form of garbage/pollution. Efforts were also undertaken in 2016 to further reduce potential waste within Brassils Creek. Clean up efforts accounted for 11% of the identified waste areas, further reducing the overall levels observed.

Table 5 Pollution levels (2010 / 2016)

Pollution/Garbage	2010 (%)	2016 (%)	+/-
Total	47%	28%	▼
Floating garbage	17%	22%	▲
Garbage on stream bottom	34%	9%	▼
Other	2%	-	-

Instream Aquatic Vegetation

Aquatic vegetation presence was compared between 2010-2016 to determine if the overall distribution of these plant communities had changed (Table 6). The presence of narrow-leaved and free-floating plants was found to have increased in 2016 and may be associated with favourable habitat due to low water conditions. Broad-leaved emergents were also found to have increased, however the level of change was minimal. Floating and submerged plant presence was found to have decreased slightly, and may simply be associated with natural variability.

Table 6 Instream aquatic vegetation (2010 / 2016)

Instream Vegetation	2010 (%)	2016 (%)	+/-
Narrow-leaved emergents	77%	96%	▲
Broad-leaved emergents	55%	63%	▲
Robust emergents	66%	65%	-
Free-floating plants	6%	57%	▲
Floating plants	64%	59%	▼
Submerged plants	66%	56%	▼

Fish Community

Fish sampling was conducted on Brassils Creek by the City Stream Watch program in 2003, 2006, 2010 and 2016 (Table 7). In total, 27 species of fish have been captured through City Stream Watch fish sampling efforts. In 2003, 13 species were captured across 5 sites, with most species recaptured in the following sample sessions. Three of the species captured in 2003 were only identified in this sampling year, and have not been recaptured in subsequent monitoring sessions. In 2006, only 6 fish species were identified, with all records verified during subsequent sampling sessions.

In 2010, 24 fish species were identified across 12 sites, as sampling efforts were increased significantly. 2016 sampling resulted in the capture of 14 distinct species, with no new records identified.

Table 7 Fish species comparison from 2003 / 2006 / 2010 / 2016

Species	Code	2003	2006	2010	2016
Blackchin shiner	BcShi			X	
Blacknose dace	BnDac	X			
Blacknose shiner	BnShi			X	X
Bluegill	Blueg			X	
Bluntnose minnow	BnMin	X		X	
Brassy minnow	BrMin	X		X	X
Brook stickleback	BrSti	X	X	X	X
Brown bullhead	BrBul			X	
Central mudminnow	CeMud	X	X	X	X
Cyprinid sp.	CA_MI		X		X
Common shiner	CoShi	X		X	X
Creek chub	CrChu	X		X	X
Emerald shiner	EmShi	X			
Fallfish	Fallf	X		X	
Fathead minnow	FhMin			X	X
Finescale dace	FsDac	X			
Golden shiner	GoShi			X	X
Hornyhead chub	HhChu			X	X
Largemouth bass	LmBas		X	X	
Logperch	Logpe		X	X	X
Northern pearl dace	PeDac	X		X	X
Northern redbelly dace	NRDac	X	X	X	X
Pumpkinseed	Pumpk			X	X
Rock bass	RoBas			X	
Smallmouth bass	SmBas			X	
Spottail shiner	SfShi			X	
White sucker	WhSuc	X	X	X	X
Yellow perch	YePer			X	X


Smallmouth bass captured in Brassils Creek

Monitoring and Restoration

Monitoring and Restoration Projects on Brassils Creek

Table 8 highlights recent monitoring and restoration work that has been done on Brassils Creek by the Rideau Valley Conservation Authority. Potential restoration opportunities are listed on the following page.

Table 8 Monitoring and restoration activities on Brassils Creek

Accomplishment	Year	Description
City Stream Watch Stream Monitoring	2006	68 stream surveys completed on Brassils Creek
	2010	82 stream surveys completed on Brassils Creek
	2016	54 stream surveys completed on Brassils Creek
City Stream Watch Fish Sampling	2006	2 fish community sites were sampled in Brassils Creek
	2010	6 fish community sites were sampled in Brassils Creek
	2016	5 fish community sites were sampled in Brassils Creek
City Stream Watch Thermal Classification	2006	2 temperature probes were deployed in Brassils Creek
	2010	4 temperature probes were deployed in Brassils Creek
	2016	4 temperature probes were deployed in Brassils Creek
City Stream Watch Headwater Drainage Feature Assessment	2016	19 headwater drainage feature sites were sampled in the Brassils Creek catchment
City Stream Watch Stream Cleanups	2016	City stream watch volunteers assisted in cleaning over 0.6 km of shoreline during 1 event


Volunteers assisting during stream surveys on Brassils Creek


Bull frog observed in Brassils Creek


Cardinal flowers observed along Brassils Creek


Swamp milkweed observed along Brassils Creek

Riparian Restoration Opportunities

Riparian restoration opportunities were assessed in field and include potential enhancement through riparian planting, erosion control, invasive species management and/or wildlife habitat creation.

Riparian conditions were found to be predominantly natural as no sites were evaluated for potential enhancement. Site evaluation was strictly limited to the surveyed stream, and does not include any assessment outside this extent.

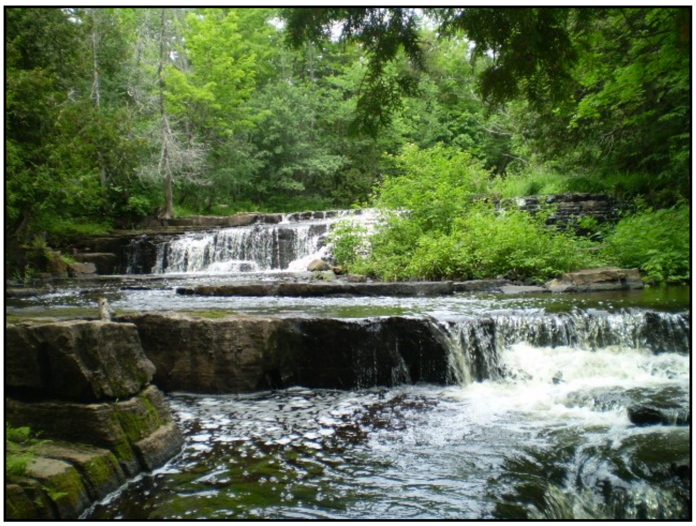
Instream Restoration Opportunities

Instream restoration opportunities were assessed in field and include potential enhancement through channel modification, stream cleanups, and fish habitat creation.

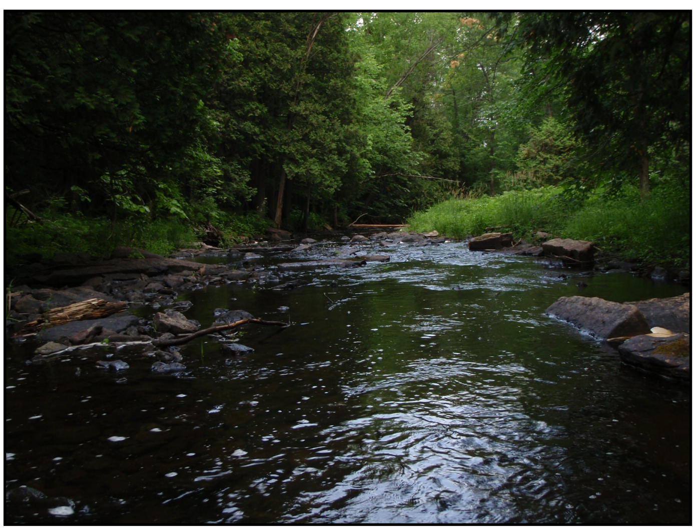
Instream conditions were found to be predominantly natural as no sites were evaluated for potential enhancement. Site evaluation was strictly limited to the surveyed stream, and does not include any assessment outside this extent.

Low Water Conditions—Brassils Creek

2010



Stepping-stone falls (Brassils Creek—Summer 2010)



Upstream of Dwyer Hill Rd (Brassils Creek—Summer 2010)

2016

Stepping-stone falls (Brassils Creek—Summer 2016)

Upstream of Dwyer Hill Rd (Brassils Creek—Summer 2016)



References

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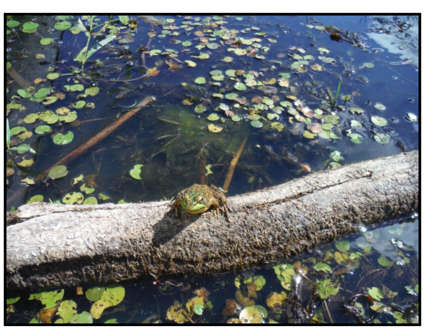
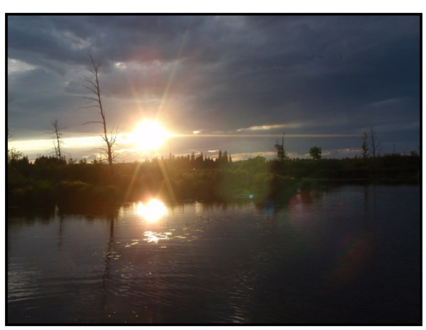


For more information on the overall 2016 City Stream Watch Program and the volunteer activities, please refer to the City Stream Watch 2016 Summary Report.