The BRWP RiverWatch Program

Hurd's Creek
Catchment Report

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"Helping Ourselves to a Healthy Environment"

Introduction

Hurd’s Creek is one of 29 tributaries in the Bonnechere River watershed that the BRWP has been monitoring from time to time since the early 2000s. Hurd’s Creek is approximately 17 km long and begins at Lake Clear and flows into the Bonnechere River in the town of Eganville. Hurd’s Creek is unique from other tributaries in that it consists of a 4 km *dam controlled reach* leaving Lake Clear and a 13 km *natural reach* flowing from the dam down to the Bonnechere River. Water level in the first 4 km is determined by the Renfrew Power Generation control dam.

The Hurd’s Creek catchment is within the Township of Bonnechere Valley in the central-eastern portion of the Bonnechere River watershed (Figure 1). The catchment area is approximately 139.6 km^2. This catchment area has varying land uses; 67% of the watershed is comprised of forested areas, 13.2% is agricultural (hay), 2.5% of the watershed is considered wetland area, and 0.7% is developed area (BRWP 2012a).

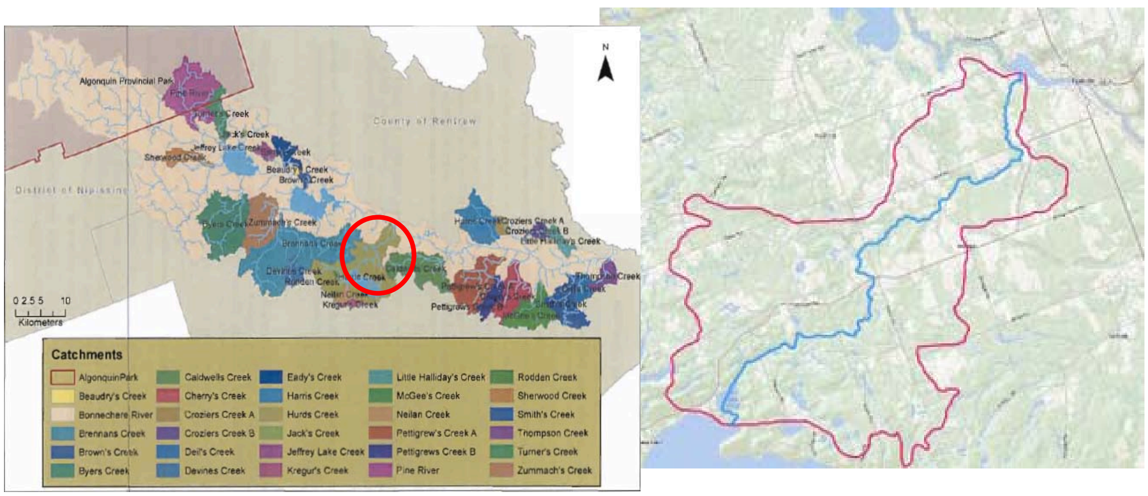


Figure 1. a) Map of the Bonnechere River watershed and all stream catchments. Hurd’s Creek is circled. B) Hurd’s Creek with catchment boundaries.

Over the past decade an assessment of stream condition has been conducted at each end of Hurd’s Creek using benthic macro invertebrates. In 2004-2006, students at Opeongo High School, under the direction of the BRWP Coordinator, monitored the Augsburg Rd (site A) in the fall and spring with a resulting stream condition rating of GOOD.

The BRWP RiverWatch program assessed the condition of Hurd’s Creek at its confluence with the Bonnechere River as GOOD in 2009, FAIR in 2010 (BRWP 2011) and GOOD in 2011 (BRWP 2012b) based on the composition and abundance of in-stream macroinvertebrates. A second site where the stream leaves Lake Clear was rated as FAIR in 2010. It was thought that the difference in stream health between the upper and lower reaches of the stream was due to the slow moving water at site 2, which had macroinvertebrate species that were tolerant to poor water quality conditions, most likely as a result of being poorly oxygenated.

A catchment survey of Hurd's Creek was done by the BRWP RiverWatch team in July 2013 using a modified macro-stream assessment protocol adapted from the CityStream Watch (2011) used by the Rideau Valley Conservation Authority. Eleven 100m surveys were conducted along the 13 km natural reach section of the creek. These surveys documented stream, streambed and bank characteristics as well as land use up to 100m on each side of the surveyed bank. The objectives of this study were to gather credible baseline information on stream and bank characteristics by non-professionals that provide a detailed overview of the stream and bank characteristics of Hurd's Creek, if there is a problem, and if so to have some insight into possible mitigation and that can be referred to in the future to document change.

This stream was very wide and deep in places, with varying levels of water flow ranging from slow wetland pools to rapid, churning rapids in forested areas. The max wetted width, which is the maximum distance from the edge of the water level on one bank to the other was measured at 28.1 meters (averaged over the 11 surveys). Due to the large width of this stream, GPS coordinates were taken at the survey sites, and then online geo-referencing tools were used to measure stream widths at these coordinates. The max wetted depth (maximum depth of present water levels) was an average of 0.78 meters. These factors indicate that this stream contains a permanent flow and water is present year-round.

Anthropogenic Impacts

Figure 2 demonstrates that 100% of the surveyed creek was in a natural state, with minor human alterations.

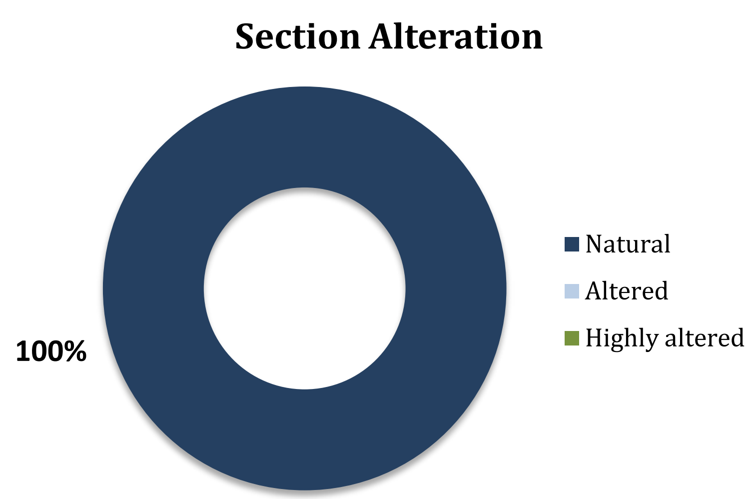


Figure 2. Section alterations to Hurd's Creek.

Adjacent Land Use

The land use adjacent to Hurd's Creek varied, and there were five different types of land use identified in Figure 3. The surveys captured land use within the 100 m transects, and up to 100m on either side of the stream. Thus these statistics will differ from the catchment percentages for land use. The large majority of the near-stream was classified as natural land use, 50% was considered forest, while

46% was wetland area. The vegetated areas adjacent to the stream are an important means to filter out excess nutrients running off the land, as well as absorbing excess rainwater and providing habitat for wildlife. Wetland areas are also critical to filtering out toxins and providing wildlife habitat (CityStream Watch 2011). About 5% of the land use was considered active agriculture, with cattle observed having access right down to the stream edge. As well, 0.4% was classified as infrastructure and 1% as residential. There were a few residential homes observed in the lower portion of Hurd's Creek.

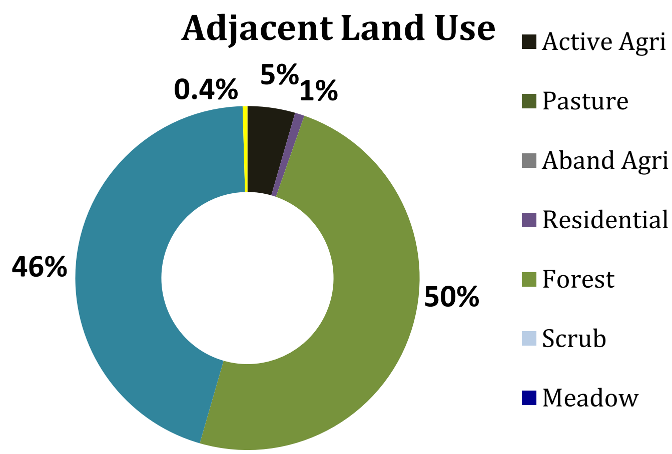


Figure 3. Classes of land use occurring along Hurd's Creek. Photo on right depicts adjacent forest and wetland vegetation, the two dominant classes of land use observed along the stream. Photo taken in July 2013.

Channel Type

Figure 4 demonstrates that the reach of Hurd's Creek surveyed was 100% natural, containing pools, riffles and runs with unaltered stream banks. While the surveyed portion of the stream was considered 100% natural, there was a control dam observed in an unsurveyed area further upstream that divided the creek into two reaches. The creek maintained a natural sinuosity, with no alteration to form any kind of straightened channel, ditch or drain.

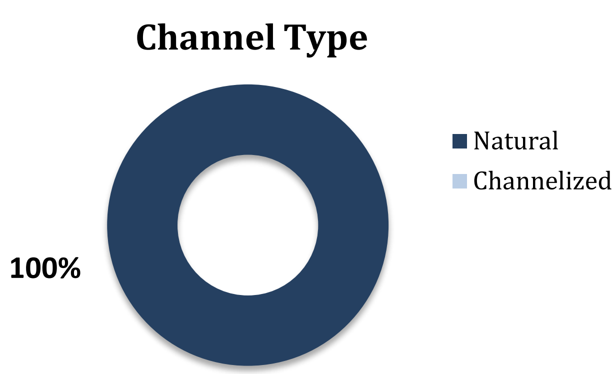
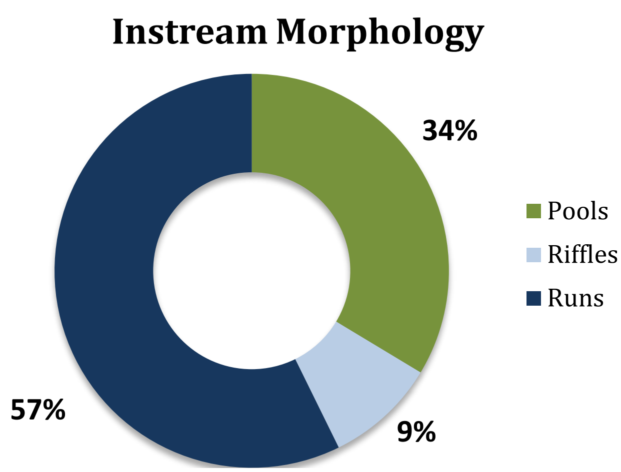


Figure 4. Channel type observed on Hurd's Creek.

Instream Morphology

The types of features found in a stream are dependent on the stream substrate and depth. Figure 5 shows that 57% of the surveyed area of Hurd's Creek were characterized by runs; areas of moderately shallow unagited water, where the thalweg (deepest part of the channel) is found in the center of the stream. 34% of the surveyed stream was characterized by pools; areas where deeper pockets of water are found, typically between riffles. Pools are important shelter area for stream wildlife, providing refuge if stream levels decrease, as well as over-wintering areas. Riffles were observed in 9% of the surveyed stream. Riffles are areas with agitated water surface, with moderate to rapid current velocity and are important for oxygenating the water (CityStream Watch 2011). Areas where the stream narrowed upon entering forested sections were normally characterized with riffle instream morphology, while pools were present largely in the wetland areas.



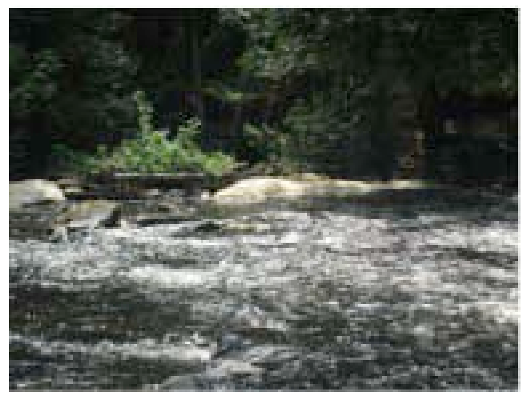


Figure 5. Instream morphology of Hurd's Creek. Photo on the right depicts an area of stream featuring riffles, which aid in water aeration. Photo taken in July 2013.

Instream Substrate

Diverse instream substrate types will allow for a greater diversity of instream wildlife, as different species will secure different habitat niches. There was a variety of substrate types found in Hurd's Creek, a large majority of substrates were finer-grained particles such as muck (36%) and sand (37%) (Figure 6). However, there were a variety of larger-particles substrates such as gravel (3%), cobble (11%), boulders (8%), and bedrock (5%). Cobble are important habitat for overwintering and/or spawning for small and juvenile fish, while boulders provide back eddies for larger fish to hide and rest out of the current (CityStream Watch 2011).

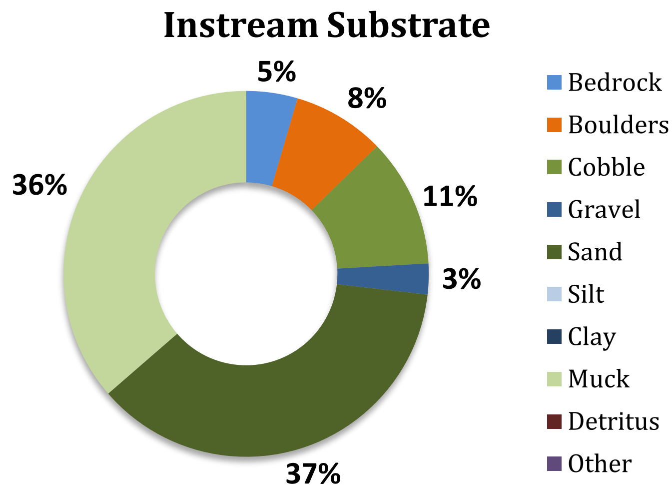


Figure 6. Types and percentages of instream substrate along Hurd's Creek.

Instream Habitat

Figure 7 demonstrates that the percentage of the left and right sides of the surveyed stream areas containing boulders or cobble did not differentiate much; boulder habitat (9% left, 8% right), cobble habitat (17% left, 18% right). Again, these types of instream habitats are important for fish refuge and provide spawning habitat (CityStream Watch 2011). Figure 7 shows that a large percentage of the stream surveyed did not contain these critical habitats (74% both).

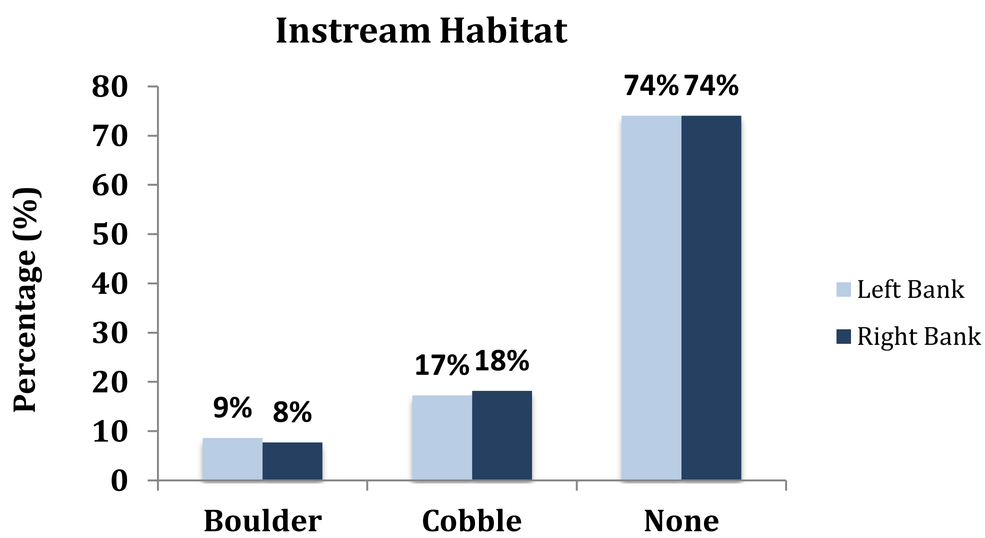


Figure 7. Percentage of instream habitat found on left and right side of Hurd's Creek.

Woody Debris

Trees along the banks of streams are important components of the stream habitat. They provide shade over the stream, which helps to moderate the water temperature. As well, their root systems help to stabilize stream banks. Trees and/or branches that have fallen into the stream provide refuge and feeding areas for fish and benthic wildlife (CityStream Watch 2011). Figure 8 shows that there was slightly more woody debris instream on the right hand bank then the left (19% on right, 12% on left), and this was approximately the same amount of woody debris that was also overhanging Hurd's Creek providing shade (20% left, 18% right). The majority of the stream however, did not contain any woody debris (69% left, 63% right).

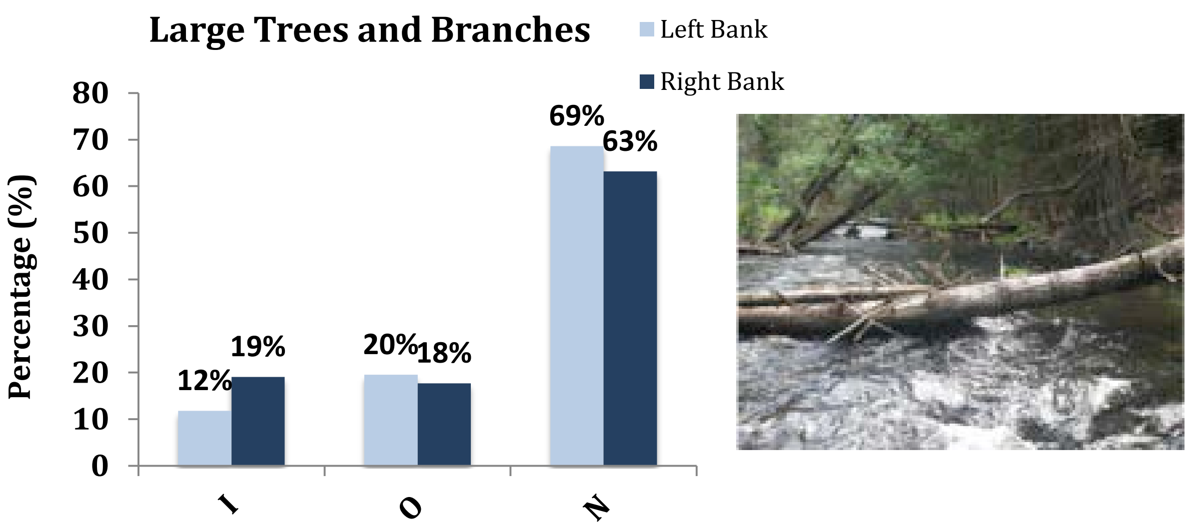


Figure 8. Percentage of woody debris found on the left and right banks of Hurd's Creek. Photo on the right depicts an example of woody debris instream and overhanging Hurd's Creek. Photo taken in July 2013.

Vascular Plants

Vascular plants are important to stream habitat because they can help to stabilize banks with their root systems, and they provide shelter, protection and habitat for macroinvertebrates (CityStream Watch 2011). Figure 9 shows that there were equal amounts of plants on both sides of the surveyed stream, and that the majority was found instream (65% both sides). About 5% of vascular plants were found to be overhanging and 30% of the surveyed stream contained no vascular plants on either side of the stream.

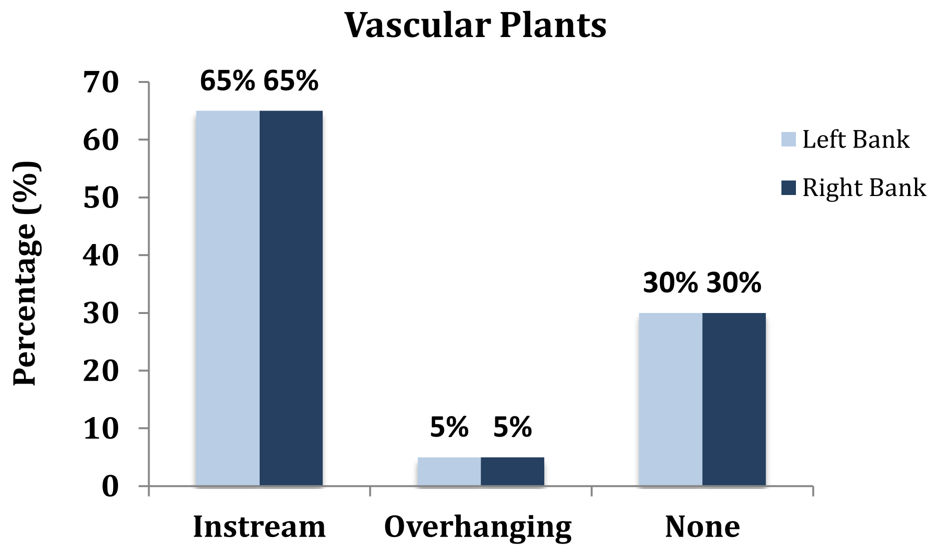


Figure 9. Percentage of vascular plants found on the left and right bank of Hurd's Creek.

Undercut Banks

Figure 10 shows that the left bank was slightly more undercut then the right (16% left versus 10% right), however this is still a relatively low amount overall. Undercut banks are part of a normal stream ecosystem and provide refuge areas for fish.

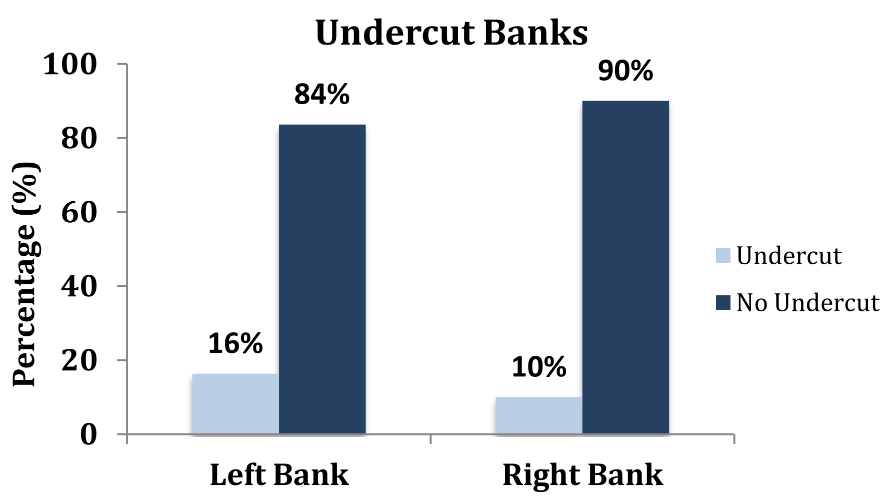
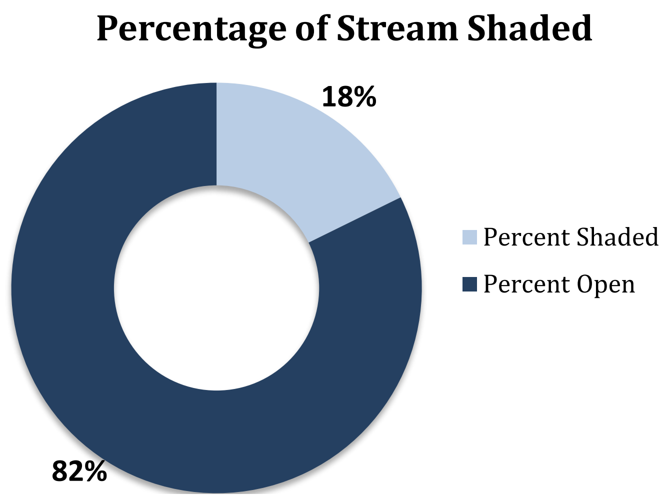


Figure 10. Percentage of undercut banks on the left and right banks of Hurd's Creek.

Shade is an important component to a stream ecosystem as it moderates the temperature of the stream. Shade is typically provided by an assortment of grasses, shrubs and trees and so this also contributes to other factors of stream health, such as providing a food supply (CityStream Watch 2011). Hurd's Creek is a fairly open stream system, with 82% of the stream open, and only 18% shaded (Figure 11).



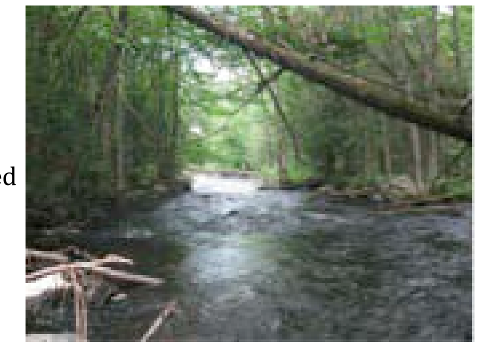


Figure 11. Percentage of Hurd's Creek that is shaded versus open. The photo on the right depicts a shaded portion of Hurd's Creek. Photo taken in July 2013.

Instream Vegetation

Instream vegetation plays an important role in maintaining a healthy stream ecosystem. Plant processes help maintain clean and oxygenated water through the removal of contaminants and production of oxygen through photosynthesis (CityStream Watch 2011). However, vegetation is only beneficial within a normal range, as too much vegetation (or the wrong kind of vegetation) can be detrimental to stream health and an indicator of poor water quality. Hurd's Creek had a range of different vegetation amounts. Figure 12 shows that the majority of the surveyed stream fell into the common (>50% vegetation) or normal (25-50%) categories (71%), however 12% of the instream vegetation was also categorized as low (<25%) and 9% rare (few vegetation). Low and rare vegetation may be a product of the stream substrate, as 5% of the stream surveyed contained bedrock (Figure 6). As well, 8% of the instream vegetation was considered extensive, meaning that the area surveyed was choked with vegetation. Vegetation completely filled the substrate and water column in these areas, and can indicate a problem within the stream. This area could be experiencing poor water quality, such as an input of nutrients that could allow the plants to proliferate. It would be beneficial to monitor water quality in these areas to ascertain if nutrients are indeed a factor.

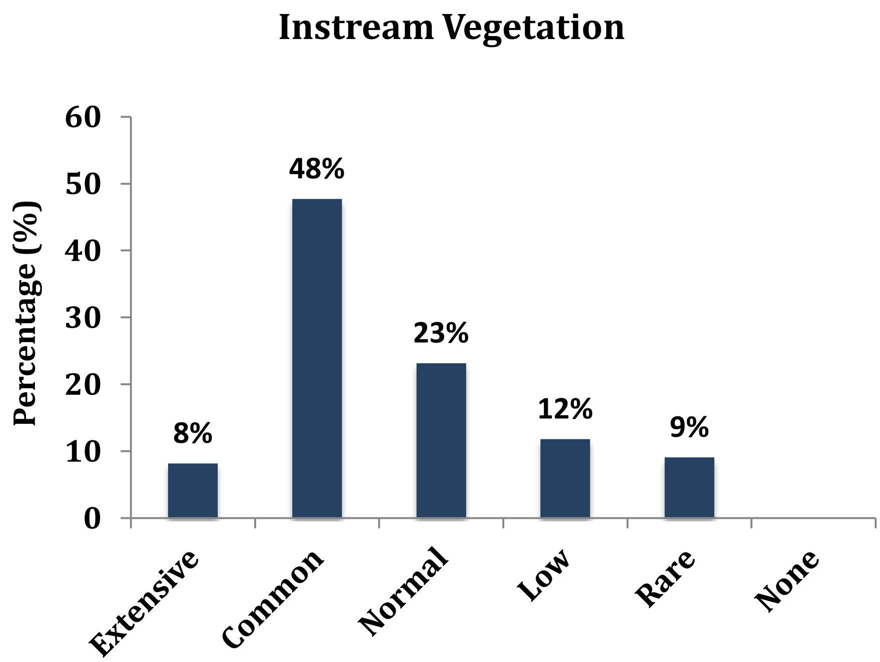


Figure 12. Percentage of instream vegetation separated into classes (extensive: choked with vegetation, common: >50% vegetation, normal: 25-50% vegetation, low: <25% vegetation, rare: few vegetation, none: zero vegetation) found within Hurd's Creek.

Vegetation Types

It is also important to determine the types of instream vegetation, as different substrate types or varying water quality may lead to different types of vegetation proliferating. For instance, poor water quality may lead to a proliferation of algae, which can be detrimental to instream health if it becomes extensive. Also, a wide variety of vegetation types will allow a greater diversity of wildlife to coexist. Figure 13 shows that the two main dominant types of vegetation found in Hurd's Creek was submerged plants (44%) and floating plants (32%), these types of plants are important for stream ecology as they provide habitat structure for wildlife within the stream, especially juveniles, as small fish were often observed in conjunction with these types of vegetation. Free-floating plants accounted for 6% of the vegetation within the stream, and narrow-leaved emergent (3%) and broad-leaved emergent (4%) also accounted for a small proportion. Algae was the third most dominant type of vegetation found in the surveyed portions of Hurd's Creek (13%). Again, algae can be an indictor of poor water quality and so may be associated with an input of nutrients.

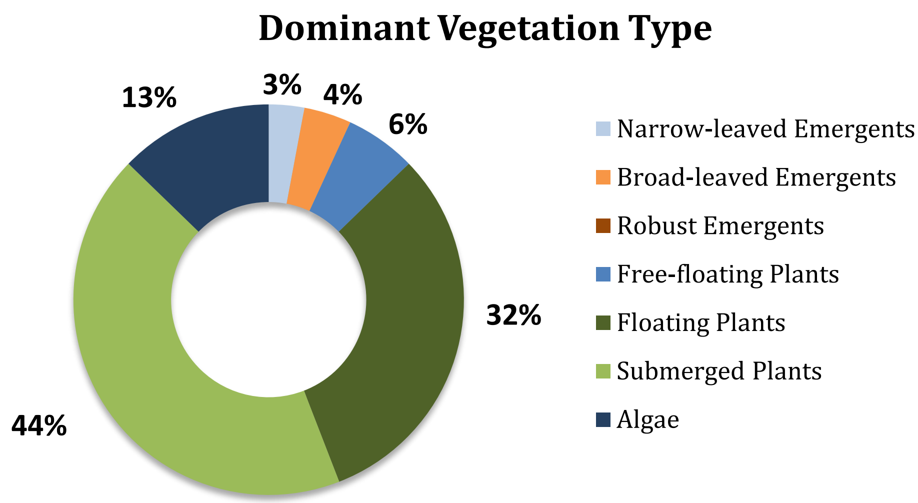


Figure 13. Percentage of the dominant vegetation types found in Hurd's Creek.

Bank Erosion

Bank erosion is part of the normal process within a stream ecosystem, however if it becomes extensive it can lead to sedimentation within the stream, which can affect fish and wildlife habitat. Erosional tendencies within a stream will be largely dependent on the stability of the banks. A stable bank will resist erosional processes and will likely have a higher level of bank vegetation that will help to stabilize the soils. An unstable bank does not have the support system to retain the soil, and will lead to greater sedimentation and even bank failure if erosional processes are great enough (CityStream Watch 2011). Figure 14 demonstrates that the majority of the surveyed banks of Hurd's Creek are stable, and only 8% of the left side bank (which also saw a slightly higher degree of undercutting; Figure 10) was considered as unstable.

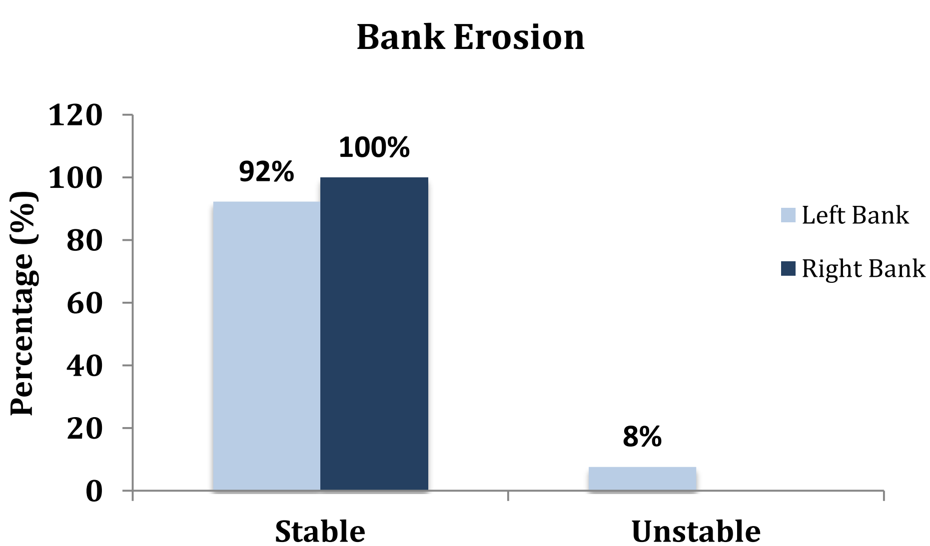


Figure 14. Percentage of bank erosion found on the left and right banks of Hurd's Creek.

Vegetation Types

Figure 15 shows that the three dominant types of bank vegetation were coniferous trees (25% left, 30% right), deciduous trees (19% left, 17% right) and wetland plants (31% left, 30% right). This is in line with the statement made in Figure 2 that the two main types of land use were forest and wetland areas. Trees are important to stream health as their root systems help to stabilize the banks and prevent erosion and sedimentation, as well leaf litter contributes nutrients into the stream (CityStream Watch 2011). Furthermore, wetlands are vital to healthy ecosystems as they remove pollutants, protect against flooding and erosion and provide habitat for wildlife (Cappiella and Frely-McNeal 2007). Shrubs (Tall; 4% left, 6% right, Low; 3% left, 1% right) and grasses (Tall; 4% both, Short; 10% left, 9% right) can provide habitat for wildlife along the stream. Dead trees can provide cavity holes and habitat for wildlife in the area (5% left, 3% right).

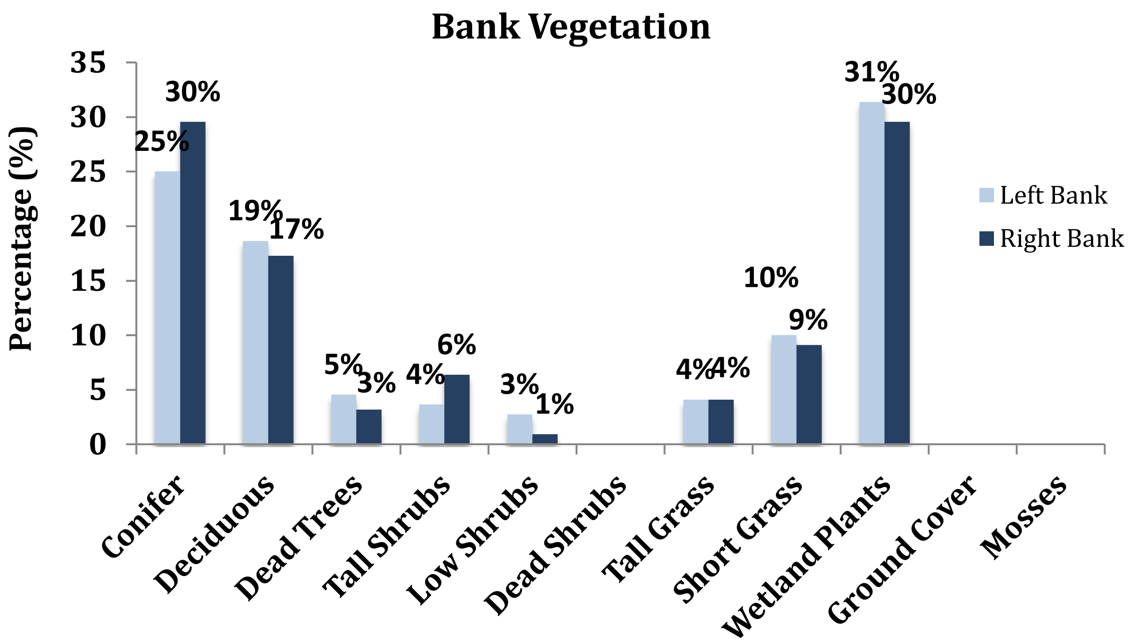


Figure 15. Percentage of vegetation types found on the left and right banks of Hurd's Creek.

Photo on left depicts tall grasses and wetland vegetation growing adjacent to Hurd's Crreek. Photo taken July 2013.

Shoreline Classification

Figure 16 shows that the majority of the surveyed areas of Hurd's Creek were classified as natural (93% left, 100% right), meaning that there was no significant human disruption and that the shoreline is in a natural state with a thick riparian zone. As we travelled further downstream, 7% of the left bank was classified as ornamental, where all the natural vegetation had been removed and replaced with either turf grass or other non-native vegetation and artificial structures may be present (CityStream Watch 2011).

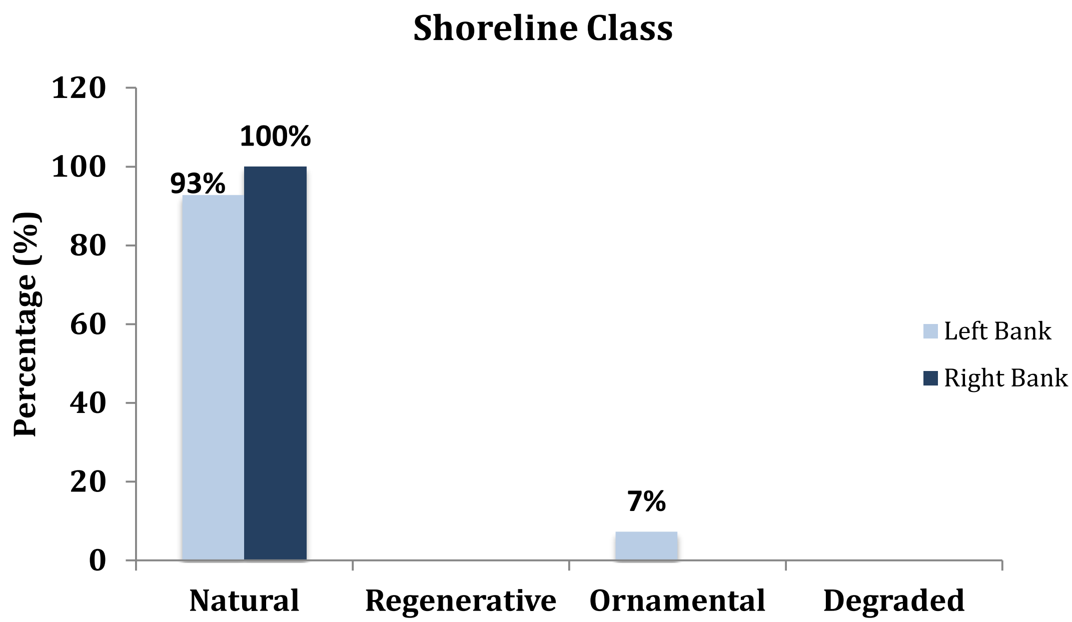
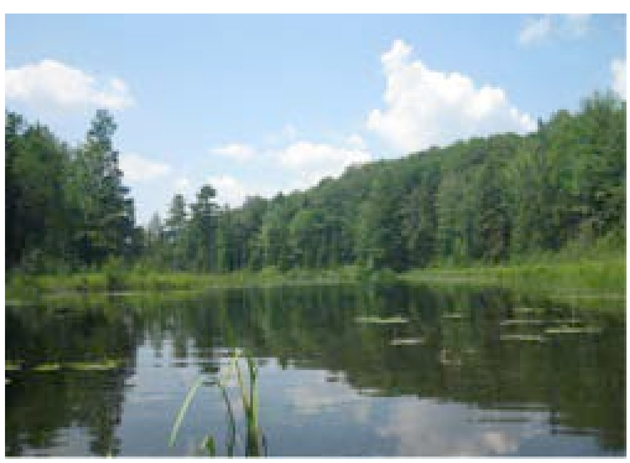


Figure 16. Percentage of shoreline classes (natural, regenerative, ornamental and degraded) found along the left and right banks of Hurd's Creek.



The photo on the left depicts a natural shoreline classification. Wetland grasses were found on the banks of the stream, while forests accounted for the adjacent land use to Hurd's Creek. Photo taken July 2013.

Vegetated Riparian Buffer Zones

Riparian buffer zones containing vegetated areas between the stream and any sort of human activity are important features of a healthy stream ecosystem. These natural buffers are able to filter excess nutrients that flow from urban, rural (sewage) or agricultural (fertilizer) areas, and will also help to dampen any flooding or erosional processes by absorbing rainwater (CityStream Watch 2011). The recommended buffer width for a stream is 30m or more (Environment Canada, 2004). Figure 17 shows that the majority of the surveyed portions of Hurd's Creek maintained a 30m+ vegetated buffer area. About 9% of the left bank was in the 5-15m buffer range, and this was observed in areas where the shoreline class was considered ornamental.

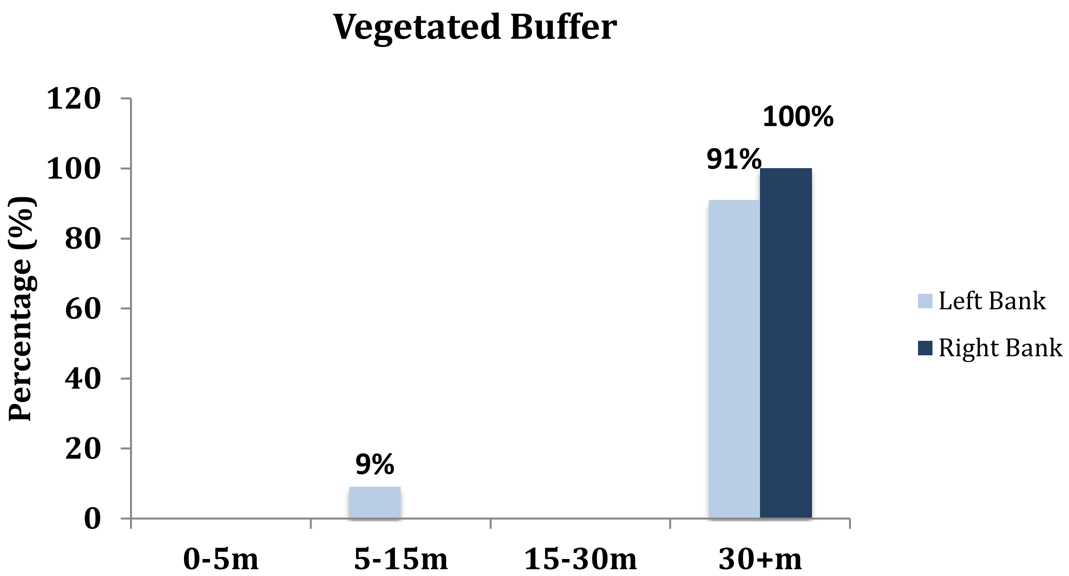


Figure 17. Percentage of vegetated buffer width classes found on the left and right banks of Hurd's Creek.

Water Quality

Water quality measurements were taken at the mouth of Hurd's Creek between June and September in 2011 (BRWP 2013) as well as certain parameters were measured as part of the BRWP RiverWatch catchment survey in July 2013. Temperature is a key parameter in creek ecosystems and can influence aquatic organisms within the creek when it is outside of their tolerance range (Environment Canada 2013). Factors such as the removal of riparian vegetation along stream banks may affect temperature as there is less shade provided over the stream. Figure 18 shows a fairly significant difference between the 2011 temperature measurements (20.4) and the 2013 measurements (27.3). This may be due to the month or even time of day the temperatures were taken. Or there may have been some changes to the stream characteristics, resulting in a loss of shade for example.

SpC refers to the specific conductance, i.e. the ability of water to conduct an electrical current. This is largely dependent on the amount of dissolved ionic constituents in the water sample (BRWP 2013). The SpC was found to be low at 0.4 us/cm in the samples from Hurd's Creek (Figure 18).

Dissolved oxygen (DO) is the amount of oxygen that is freely available in the measured water sample (Gardner 2006). DO is inversely related to temperature, and becomes more soluble as temperatures decrease (BRWP 2006). DO is required by the wildlife inhabiting the stream and there may be detrimental effects if the levels of DO drop below what the CCREM has determined as "safe limits" (CCREM, 2005). DO levels above 5.0mg/L will protect other life stages of warm water biota, while levels above 6.0mg/L will protect early life stages of warm water biota. Figure 18 demonstrates that DO levels in Hurd's Creek were found to be above these safe limit ranges at 7.7mg/L and hence are adequate for the protection of the biological community residing in the stream.

The pH scale gives a range of the relative acidity of water, with 0-6 being more acidic (H+ ions), 7 being neutral acidity, and 8-14 being more alkaline (OH- ions) (Environment Canada 2013). Water bodies with a pH between 6.5-9 will allow the greatest diversity of aquatic organisms, however young fish and aquatic insects are most sensitive to fluctuating pH levels outside the normal range (Environment Canada 2013). The pH levels at Hurd's Creek were within the normal range for both years sampled, and did not fluctuate by much (7.9 in 2011 and 8.0 in 2013; Figure 18).

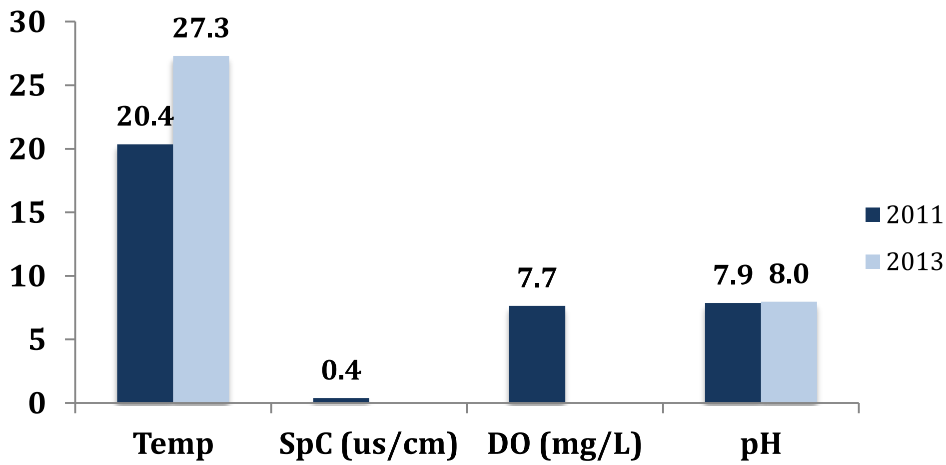


Figure 18. Measurements of water quality parameters in 2011 and 2013 for Hurd's Creek.

Concentrations of Major Ions

Previous water quality studies done on the Bonnechere watershed have found that water chemistry data are strongly influenced by the location and type of land use (BRWP 2013). There is a west-east hydrogeological gradient with a predominance of Leda clays to the east in this watershed, which would affect the major ions found in the eastern portions. However, there is also a change in land-use in the eastern portion of the watershed, with increasingly agricultural areas, which could also affect the relative concentrations of the major ions (Anderson and Richardson 2013). Hurd's Creek is found in the central portion of the Bonnechere watershed and the concentrations of the major ions (in mg/L) can be observed in Figure 19.

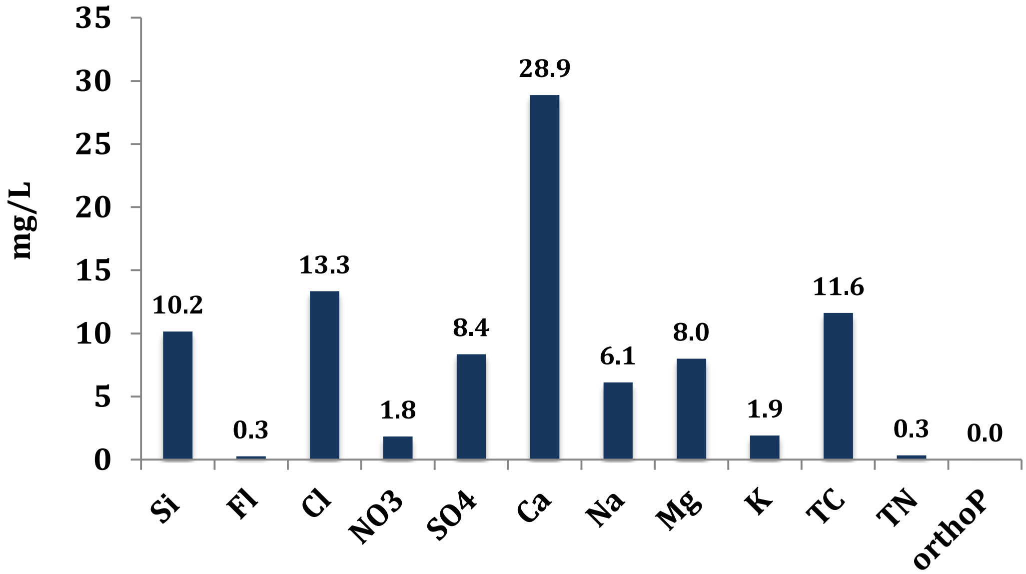


Figure 19. Concentrations of major ions (mg/L) measured in Hurd's Creek water samples from 2011.

Conclusions

The results from this survey indicate that the 13 km *natural reach* section of Hurd's Creek is in GOOD condition. The majority of the surveyed area of the stream was found to be in a natural state, composed largely of forest and wetland area, with little alteration to stream dynamics. However, there was one small control dam observed in a non-surveyed portion of the stream that was regulating waterflow to the lower reaches of the stream. Stream substrate was largely made of finer-grained particles such as muck and sand, which does not provide ideal habitat for stream organisms, however there was some instream woody debris and vascular plants that provided refuge, feeding and habitat areas for fish and macro-invertebrates. Vegetation instream was made up largely of submerged plants, floating plants, and algae that ranged in areas of the stream surveyed from extensive vegetation choking the water column to rare. The extensive vegetation and algae could indicate a problem with water quality, as excessive inputs of nutrients could be promoting a proliferation of vegetated mass in some areas of the stream. Nutrient levels sampled in 2011 showed that nitrogen species and orthophosphate were in low concentrations. Nutrient concentrations were not measured during the 2013 surveys. The majority of the stream banks were not undercut, nor where they eroded. There was one section of the surveyed stream where unstable banks may have been due to cattle access to the creek, this was at a single location.

This new method of surveying streams within the Bonnechere Watershed has many merits as it looks at many sections of the stream, rather than a single survey site, which may not be representative of overall stream health and would not provide a spatial or temporal perspective. It is very important for the BWRP in future to standardize their sampling method, so that comparisons can be made between years about the condition of stream health. This modified stream protocol from the CityStream Watch is fairly easy to replicate and requires little training (unlike the macro-invertebrate species identification). This method could provide adequate baseline information upon which to build a database of stream health over the years to come using a standardized method.

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