Riparian Health Assessment of the Gaspereau River

F209-125
January 2020
Kelli-Nicole Croucher, Watershed Coordinator
Eric Arbeau, Student Intern

EOS Eco-Energy Inc.
P.O. Box 6001, 131D Main Street
Sackville, NB E4L 1G6
www.eosecoenergy.com

This project was made possible with support from the following organization:


NB Wildlife
Trust Fund
www.nbwtf.ca
Fonds en fiducie pour la faune
du Nouveau-Brunswick
www.tffnb.ca

Acknowledgements

EOS Eco-Energy wishes to thank and acknowledge the following groups and individuals for their support and assistance with the project. Thank you to the New Brunswick Wildlife Trust Fund for providing funding for this project. Thank you to Roland Chiasson for volunteering his time & expertise for an assessment.

Introduction

Riparian areas are the strip of land running parallel to rivers, streams, brooks, lakes, or wetlands. They are sometimes commonly referred to as shorelines. Riparian areas are one of the most productive and valuable natural resources. Healthy riparian zones provide a number of ecosystem services which protect and strengthen the environment, such as improved water quality, water storage and flood mitigation, erosion protection, and groundwater recharge. In addition, healthy riparian zones will benefit wildlife greatly as species living in riparian zones and the river are dependent on the riparian zone for habitat and food requirements. Healthy riparian zones lead to healthy aquatic ecosystems. They help improve water quality and reduce sediment going into the river which can be detrimental to aquatic ecosystem by suffocating fish and burying aquatic insects. Riparian vegetation provides shelter on land for amphibians, mammals, birds, and insects, and overhanging vegetative cover also helps keeps water cool and provides in-stream habitat for fish and aquatic insects. In addition, vegetation acts as a food source for wildlife on land, as well as for fish and aquatic life when debris fall into the river. Riparian zones are also used as travel corridors for wildlife and stopover areas for migratory birds.

There are many unknowns in terms of watershed health in our region due to the lack of a watershed group covering the area until the recent establishment of EOS's Chignecto Watersheds Committee in 2017. Land uses in the area include forestry activity, residential and commercial developments, municipal sewage lagoons and private wells, and agriculture, all of which can have varying degrees of impact on our riparian zones. Degradation of riparian zones diminishes their capacity to provide critical ecosystem functions, which in turn impacts aquatic ecosystems. Riparian assessments are among the first steps required to protect our aquatic ecosystems by improving our understanding of watershed processes and identifying restoration needs within the watershed.

This summer EOS Eco-Energy received funding from the New Brunswick Wildlife Trust Fund to perform a riparian health assessment of the Gaspereau River based on the Alberta Cows & Fish Riparian Health Assessment for Streams and Small Rivers – Field Workbook (Fitch, L., B.W. Adams and G. Hale, 2009. Riparian Health Assessment for Streams and Small Rivers – Field Workbook. Second Edition. Lethbridge, Alberta: Cows and Fish Program. 94 Pages.). The riparian assessments consisted of a series of observations on vegetation coverage, exposed soils, bank stabilization, invasive species, and altered stream banks in order to assign a health score (e.g. unhealthy, healthy with problems, healthy) and identify areas in need of riparian restoration. This final report summarizes the results of our riparian health assessments.

Methodology

From July to September 2019, EOS performed riparian health assessments using the Alberta Cows & Fish Riparian Health Assessment for Streams and Small Rivers – Field Workbook to assign a riparian health assessment score (e.g. healthy, healthy with problems, unhealthy), providing a baseline of riparian health of the Gaspereau River. A copy of the field sheet used for the assessments can be seen below in Figure 1.

RIPARIAN HEALTH ASSESSMENT - FIELD SHEET

Landowner/Lessee: _____ Date: _____ Reach No.: _____

Stream/River: _____

Site Description: _____ Scores or N/A

_____ Actual / Possible

1. Vegetative Cover of Floodplain and Streambanks
   6 4 2 0 ___/___
2. Invasive Plant Species
   Canopy Cover
   3 2 1 0 ___/___
   Density/Distribution
   3 2 1 0 ___/___
3. Disturbance-increaser Undesirable Herbaceous Species
   3 2 1 0 ___/___
4. Preferred Tree and Shrub Establishment and Regeneration
   6 4 2 0 ___/___
5. Use of Trees and Shrubs
   Preferred Trees and Shrubs - Browse
   3 2 1 0 ___/___
   All Trees and Shrubs – Use other than browse
   3 2 1 0 ___/___
6. Standing Decadent and Dead Woody Material
   3 2 1 0 ___/___
7. Streambank Root Mass Protection
   6 4 2 0 ___/___
8. Human-Caused Bare Ground
   6 4 2 0 ___/___
9. Streambank Structurally Altered by Human Activity
   6 4 2 0 ___/___
10. Reach Structurally Altered by Human Activity (excl. banks)
    3 2 1 0 ___/___
11. Stream Channel Inclement (vertical stability)
    9 6 3 0 ___/___

TOTAL SCORE = ___/___

PTS	18/60	24/60	30/60	33/60	36/60	39/60	42/60	45/60	54/60
%	30	40	50	55	60	65	70	80	90

← Non-Functional (Unhealthy) → Functional At Risk (Healthy with problems) → Functioning (Healthy) →

T3

Figure 1: Riparian Health Assessment Field Sheet used to assign a Riparian Health Score

The riparian health assessments involved paddling down the river and making a series of observations on vegetation coverage, exposed soils, bank stabilization, invasive species, and altered stream banks in order to assign a health score and identify areas in need of protection or restoration. The EOS watershed coordinator was accompanied on the assessments by a conservation biologist with plant ID and habitat assessment experience. In each event that the characteristics of the riparian area changed; a new assessment was started.

Assessment sites were marked using a GPS and pictures were taken for documentation purposes. In-situ water quality measurements (temperature, pH, conductivity, total dissolved solids (TDS), dissolved oxygen (DO), and salinity) were taken at each assessment using a HI9829 Hanna Multiparameter Meter.

Following the assessments, data was summarized into a final report for publication on the EOS website.

Results

Overall 21.33 km of the Gaspereau River was assessed from Coburg Road down to the mouth of the Gaspereau River (see below in Figure 2). The different colours represent the different assessments completed as follows: **Lime green**, August 20th, 2019 assessment starting at Coburg Road; **Fuchsia**, July 20th, 2019 assessment down to the powerlines on Route 15; **Turquoise**, July 10th, 2019 assessment from the powerlines on Route 15 down to Main St. (Port Elgin); **Red**, July 22nd, 2019 assessment from Main St. (Port Elgin) down to the Trans Canada Trail bridge; and **Blue**, July 11th, 2019 assessment from the Trans Canada Trail bridge to the Northumberland Strait.

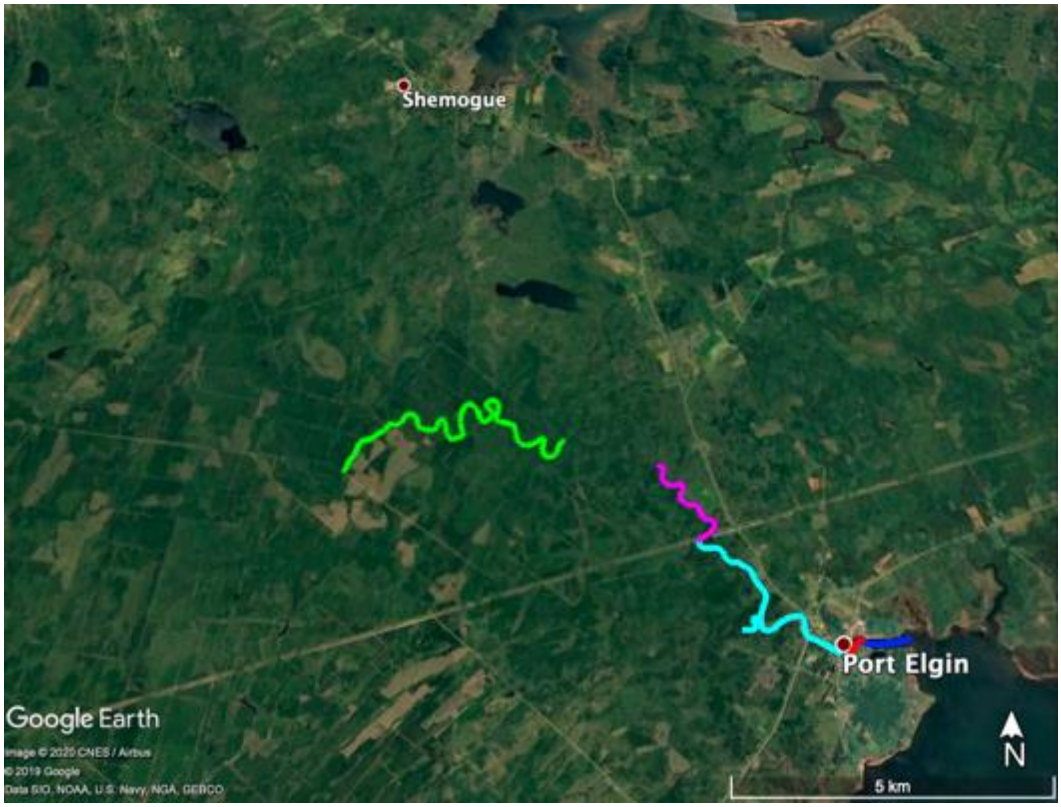

Figure 2: Map showing assessed areas of the Gaspereau River

A total of 26 riparian health assessments were completed. An assessment was taken approximately every 0.5 km. Riparian assessments consist of a series of observations on vegetation coverage, exposed soils, bank stabilization, invasive species, and altered stream banks in order to assign a health score and identify areas in need of riparian restoration.

Some indicators of a healthy riparian area include abundant vegetation with very little exposed soil, bare ground, or altered banks (as demonstrated in Figure 3). In particular, the vegetation should consist of

deep-rooted plant species (e.g. trees & shrubs); few (if any) invasive weeds and disturbance-caused plants; lightly browsed vegetation by livestock or wildlife; and the presence of seedlings and saplings for successful regeneration of woody species.

Figure 3: Examples of healthy reaches of the Gaspereau River

Indicators of an unhealthy riparian area include signs of bank erosion; undercut banks; bare ground (sometimes with rutting or hummocking) from livestock or human activity; standing dead woody vegetation; lack of preferred tree and shrub establishment and regeneration; and an abundance of invasive weeds or disturbance caused plants (Figure 4).

Figure 3: Examples of unhealthy reaches of the Gaspereau River

The results of the riparian health assessments are colour coded according to their health score, which is demonstrated below in Table 1.

Table 1: Riparian Health Ratings Colour Designation

Unhealthy	**30-59**
Healthy with problems	**60-79**
Healthy	**80-100**

The assessment results have been summarized in Tables 2 – 7, starting from the most northern section of the river assessed (Coburg Road access point) and continuing down the river outflow into the Northumberland Strait. There are 8 questions regarding vegetation, and 5 concerning soil and hydrology. An overall health rating is given, as well as a rating on the state of the vegetation and soil/hydrology.

An excel file was prepared noting flora and fauna identified during the assessments, as well as in-situ water quality measurements taken (temperature, pH, conductivity, TDS, DO, and salinity). A large number of photos were also taken throughout the assessments. This report provides a sample, however there are more that could be made available upon request.

Table 2: Assessment starting at Coburg Road and heading downstream on August 20, 2019

Riparian Health Assessment							
Vegetation	**Assessment 1**	**Assessment 2**	**Assessment 3**	**Assessment 4**	**Assessment 5**	**Assessment 6**	**Assessment 7**
Vegetative Cover of Floodplain and Streambanks	6/6	6/6	4/6	2/6	6/6	4/6	4/6
Invasive Plant Species (Canopy Cover)	2/3	2/3	2/3	2/3	2/3	2/3	2/3
Invasive Plant Species (Density/Distribution)	2/3	2/3	2/3	2/3	2/3	2/3	2/3
Disturbance-increaser Undesirable Herbaceous Species	2/3	2/3	2/3	2/3	3/3	2/3	2/3
Preferred Tree and Shrub Establishment and Regeneration	6/6	6/6	4/6	4/6	6/6	4/6	6/6
Utilization of Preferred Trees and Shrubs	2/3	2/3	3/3	2/3	2/3	2/3	2/3
Live Woody Removal Other than Browsing	2/3	2/3	3/3	2/3	3/3	2/3	2/3
Standing Decadent and Dead Woody Material	2/3	2/3	2/3	1/3	2/3	2/3	2/3
Vegetation Rating	**24/30 = 80%**	**24/30 = 80%**	**22/30 = 73%**	**17/30 = 57%**	**26/30 = 87%**	**20/30 = 67%**	**22/30 = 73%**
Soil/Hydrology							
Streambank Root Mass Protection	4/6	4/6	4/6	4/6	4/6	4/6	4/6
Human-Caused Bare Ground	6/6	6/6	6/6	6/6	6/6	6/6	6/6
Streambank Structurally Altered by Human Activity	6/6	6/6	6/6	6/6	6/6	6/6	6/6
Reach Structurally Altered by Human Activity	0/3	0/3	0/3	0/3	3/3	3/3	3/3
Stream Channel Incisement (Vertical Stability)	6/9	6/9	6/9	6/9	9/9	9/9	9/9
Soil/Hydrology Rating	**22/30 = 73%**	**22/30 = 73%**	**22/30 = 73%**	**22/30 = 73%**	**28/30 = 93%**	**28/30 = 93%**	**28/30 = 93%**
Overall Rating	**46/60 = 77%**	**46/60 = 77%**	**44/60 = 73%**	**39/60 = 65%**	**54/60 = 90%**	**48/60 = 80%**	**50/60 = 83%**

Table 3: Assessment starting at Coburg Road and heading downstream on August 20, 2019 (continued)

Riparian Health Assessment							
Vegetation	**Assessment 8**	**Assessment 9**	**Assessment 10**	**Assessment 11**	**Assessment 12**	**Assessment 13**	**Assessment 14**
Vegetative Cover of Floodplain and Streambanks	6/6	6/6	6/6	4/6	2/6	6/6	6/6
Invasive Plant Species (Canopy Cover)	2/3	2/3	2/3	2/3	2/3	2/3	3/3
Invasive Plant Species (Density/Distribution)	2/3	2/3	2/3	2/3	2/3	2/3	3/3
Disturbance-increaser Undesirable Herbaceous Species	2/3	2/3	2/3	2/3	2/3	2/3	3/3
Preferred Tree and Shrub Establishment and Regeneration	6/6	6/6	6/6	4/6	4/6	6/6	6/6
Utilization of Preferred Trees and Shrubs	2/3	2/3	2/3	2/3	2/3	2/3	2/3
Live Woody Removal Other than Browsing	3/3	2/3	1/3	3/3	3/3	2/3	2/3
Standing Decadent and Dead Woody Material	2/3	2/3	2/3	3/3	3/3	2/3	2/3
Vegetation Rating	**25/30 = 83%**	**24/30 = 80%**	**23/30 = 77%**	**22/30 = 73%**	**20/30 = 66%**	**24/30 = 80%**	**27/30 = 90%**
Soil/Hydrology							
Streambank Root Mass Protection	6/6	6/6	6/6	4/6	2/6	6/6	4/6
Human-Caused Bare Ground	6/6	6/6	6/6	6/6	6/6	6/6	6/6
Streambank Structurally Altered by Human Activity	6/6	6/6	6/6	6/6	6/6	6/6	6/6
Reach Structurally Altered by Human Activity	2/3	3/3	2/3	3/3	2/3	2/3	3/3
Stream Channel Incisement (Vertical Stability)	9/9	9/9	9/9	9/9	6/9	6/9	9/9
Soil/Hydrology Rating	**29/30 = 97%**	**30/30 = 100%**	**29/30 =97%**	**28/30 = 93%**	**22/30 = 73%**	**27/30 = 90%**	**28/30 = 93%**
Overall Rating	**54/60 = 90%**	**54/60 = 90%**	**49/60 = 82%**	**48/60 = 80%**	**42/60 = 70%**	**50/60 = 83%**	**55/60 = 92%**

Table 4: Assessment upstream of the Route 15 powerlines on July 30, 2019

Riparian Health Assessment				
Vegetation	**Assessment 1**	**Assessment 2**	**Assessment 3**	**Assessment 4**
Vegetative Cover of Floodplain and Streambanks	6/6	6/6	4/6	4/6
Invasive Plant Species (Canopy Cover)	3/3	3/3	2/3	3/3
Invasive Plant Species (Density/Distribution)	3/3	3/3	2/3	3/3
Disturbance-increaser Undesirable Herbaceous Species	2/3	3/3	3/3	2/3
Preferred Tree and Shrub Establishment and Regeneration	6/6	4/6	4/6	2/6
Utilization of Preferred Trees and Shrubs	1/3	2/3	2/3	3/3
Live Woody Removal Other than Browsing	2/3	1/3	3/3	3/3
Standing Decadent and Dead Woody Material	3/3	3/3	3/3	3/3
Vegetation Rating	**26/30 = 87%**	**25/30 = 83%**	**23/30 = 77%**	**23/30 = 77%**
Soil/Hydrology				
Streambank Root Mass Protection	4/6	6/6	6/6	2/6
Human-Caused Bare Ground	6/6	6/6	6/6	4/6
Streambank Structurally Altered by Human Activity	6/6	6/6	6/6	4/6
Reach Structurally Altered by Human Activity	2/3	2/3	1/3	0/3
Stream Channel Incisement (Vertical Stability)	9/9	9/9	6/9	9/9
Soil/Hydrology Rating	**27/30 = 90%**	**29/30 = 97%**	**25/30 = 83%**	**19/30 = 63%**
Overall Rating	**53/60 = 88%**	**54/60 = 90%**	**48/60 = 80%**	**42/60 = 70%**

Table 5: Assessment from the Route 15 powerlines to Main St. in Port Elgin on July 10, 2019

Riparian Health Assessment						
Vegetation	**Assessment 1**	**Assessment 2**	**Assessment 3**	**Assessment 4**	**Assessment 5**	**Assessment 6**
Vegetative Cover of Floodplain and Streambanks	4/6	4/6	4/6	2/6	4/6	6/6
Invasive Plant Species (Canopy Cover)	2/3	3/3	3/3	3/3	3/3	3/3
Invasive Plant Species (Density/Distribution)	2/3	3/3	3/3	3/3	3/3	3/3
Disturbance-increaser Undesirable Herbaceous Species	2/3	3/3	3/3	3/3	3/3	3/3
Preferred Tree and Shrub Establishment and Regeneration	2/6	4/6	4/6	4/6	2/6	4/6
Utilization of Preferred Trees and Shrubs	2/3	2/3	2/3	1/3	2/3	2/3
Live Woody Removal Other than Browsing	0/3	3/3	3/3	3/3	2/3	1/3
Standing Decadent and Dead Woody Material	3/3	3/3	3/3	3/3	3/3	3/3
Vegetation Rating	**17/30 = 57%**	**25/30 = 83%**	**25/30 = 83%**	**22/30 = 73%**	**22/30 = 73%**	**25/30 = 83%**
Soil/Hydrology						
Streambank Root Mass Protection	4/6	4/6	4/6	2/6	2/6	2/6
Human-Caused Bare Ground	4/6	4/6	6/6	6/6	6/6	4/6
Streambank Structurally Altered by Human Activity	6/6	6/6	6/6	6/6	6/6	6/6
Reach Structurally Altered by Human Activity	0/3	1/3	3/3	3/3	2/3	2/3
Stream Channel Incisement (Vertical Stability)	9/9	9/9	9/9	9/9	6/9	6/9
Soil/Hydrology Rating	**23/30 = 77%**	**24/30 = 80%**	**26/30 = 87%**	**26/30 = 87%**	**22/30 = 73%**	**20/30 = 67%**
Overall Rating	**40/60 = 67%**	**49/60 = 82%**	**53/60 = 88%**	**48/60 = 80%**	**44/60 = 73%**	**55/60 = 92%**

Table 6: Assessment from Main St. to the Trans Canada Trail bridge in Port Elgin on July 22, 2019

Riparian Health Assessment	
Vegetation	**Assessment 1**
Vegetative Cover of Floodplain and Streambanks	6/6
Invasive Plant Species (Canopy Cover)	3/3
Invasive Plant Species (Density/Distribution)	3/3
Disturbance-increaser Undesirable Herbaceous Species	3/3
Preferred Tree and Shrub Establishment and Regeneration	2/6
Utilization of Preferred Trees and Shrubs	3/3
Live Woody Removal Other than Browsing	0/3
Standing Decadent and Dead Woody Material	3/3
Vegetation Rating	**23/30 = 77%**
Soil/Hydrology	
Streambank Root Mass Protection	0/6
Human-Caused Bare Ground	4/6
Streambank Structurally Altered by Human Activity	4/6
Reach Structurally Altered by Human Activity	0/3
Stream Channel Incisement (Vertical Stability)	9/9
Soil/Hydrology Rating	**17/30 = 57%**
Overall Rating	**40/60 = 67%**

Table 7: Assessment from the Trans Canada Trail Bridge to the Outflow into the Northumberland Strait on July 11, 2019

Riparian Health Assessment	
Vegetation	**Assessment 1**
Vegetative Cover of Floodplain and Streambanks	2/6
Invasive Plant Species (Canopy Cover)	3/3
Invasive Plant Species (Density/Distribution)	3/3
Disturbance-increaser Undesirable Herbaceous Species	3/3
Preferred Tree and Shrub Establishment and Regeneration	2/6
Utilization of Preferred Trees and Shrubs	3/3
Live Woody Removal Other than Browsing	1/3
Standing Decadent and Dead Woody Material	3/3
Vegetation Rating	**20/30 = 67%**
Soil/Hydrology	
Streambank Root Mass Protection	0/6
Human-Caused Bare Ground	4/6
Streambank Structurally Altered by Human Activity	4/6
Reach Structurally Altered by Human Activity	0/3
Stream Channel Incisement (Vertical Stability)	9/9
Soil/Hydrology Rating	**17/30 = 57%**
Overall Rating	**36/60 = 60%**

Discussion

The stretch of river downstream from Coburg Road was accessed at the end of a logging road with some sections of clear-cutting in the vicinity of the river (Figure 4). This first section of the river had 14 assessments taken, 9 assessments were healthy and 5 assessments were healthy with problems (table 2 & 3). In terms of vegetation ratings, 7 assessments were healthy, 6 assessments were healthy with problems, and 1 assessment was unhealthy. For soil/hydrology ratings, 9 assessments were healthy and 5 assessments were healthy with problems.

Figure 4: Aerial view of forest loss in the vicinity of the assessment downstream from Coburg Road

The first 4 assessments (~ 2 km) of the river were healthy with problems. This is mostly due the human impact and clearcutting in this area. There were invasive and disturbance caused plants present. However, the biggest issue was the lack of streambank root mass protection (4/6) and the reach being structurally altered by human activity (clearcutting, 0/3). Clearcutting was noticeable while walking the river for the first kilometer with thinned out trees or younger (1-3 inch trunk) conifer plantations (Figure 5). The Coburg Road access point also appeared to be a popular gathering spot for campfires as beer cans and other food packing was scattered around the end of the road down to the banks of the river. This continued throughout this reach of river, with debris and garbage being found a ways downstream. There was also a good amount of industrial debris within the first few kilometers (e.g. tires, oil canisters, beams of wood, material scraps from erosion fencing, etc.).

Figure 5: View of conifer plantation from river

After the first 4 assessments (2 km), the river was rated healthy, aside from assessment 12 which was healthy with problems (table 2 & 3). This was due to lack of human impact as well as the good vertical stability of the stream channel (the riparian zone was very wide, with minimal to no slope, allowing the stream access to its floodplain during high water events). For the most part, this stretch of river was wide, shallow and rocky in most areas, and could be easily walked through. Tree cover was consistent through this section and a good mix of younger trees and plants could be seen amongst the mature trees along the river. There were a lot of frogs, mussels, and minnows present. We also saw moose tracks. The one assessment that came as healthy with problems (assessment 12) was due to a lack of streambank root mass protection. As we progressed further down the river, we saw a change from lots of trees and shrub species in the riparian area providing deep roots and bank stability, to a riparian area with exposed banks scattered with mosses, ferns, and grasses. Bank erosion was also present in this stretch with roots exposed, undercutting and disturbance caused plants present. There was also a lot of deadwood present (Figure 6).

Figure 6: Cases of bank erosion along the Gaspereau River

Our assessment was performed on a very warm and sunny day, so the water temperatures were quite high (27.27$_{o}$C) in the shallow sections that did not have much overhanging vegetation to provide shade.

However, other sections of the river became quite deep and channelized (~ 75$_{o}$ angle bank). These sections were also narrower and better shaded with overhanging vegetation, leading to lower water temperatures down to 19.90$_{o}$C.

Some other notable characteristics of this stretch included a couple beaver dam/wood build ups presenting a barrier across the river (Figure 7). The wide, shallow river also had such low water levels it appeared to disappear sometimes among emergent aquatic vegetation (Figure 8). The low water levels and warm water temperatures also resulted in massive stretches of the river covered in algae (Figure 9).

Figure 7: Cases of beaver activity along the Gaspereau River

Figure 8: Emergent vegetation in the Gaspereau River

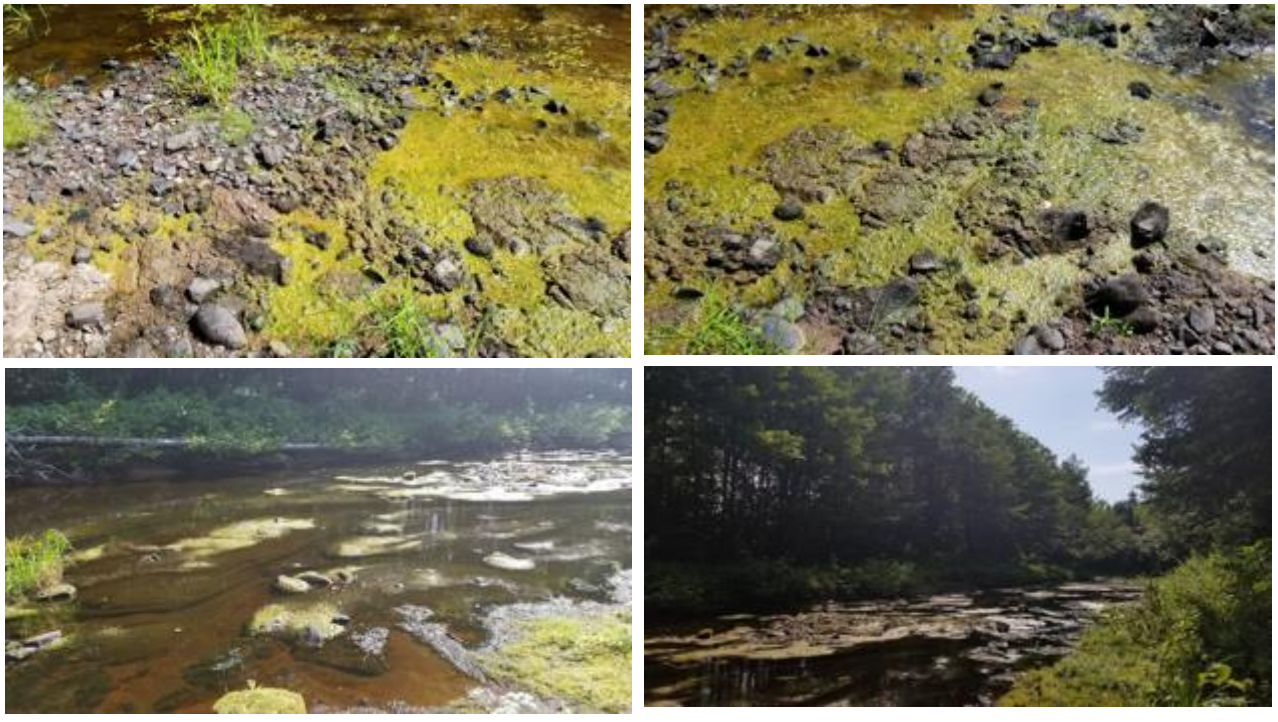

Figure 9: Algae growing in the Gaspereau River

A big challenge of this project was site accessibility. To start, there were a limited number of access points to get into the river. The Coburg Road/logging road access point we took advantage of we not in favorable driving conditions until later in the summer (after having attempted to drive it at the start of the summer). Similarly, as we started to get more rain at the end of the summer/start of fall, the logging roads became unfavorable to drive again making it difficult to access the final section of the river towards Route 940 as we had wanted to. In addition, the river frequently changed from being wide and shallow enough to walk in (Figure 10), to channelized and deep, where you would want a canoe to paddle through or would have to climb up the steep riverbanks to follow alongside the river.

Figure 10: EOS staff pulling canoe through shallow section of the river

This resulted in EOS staff having to alternate paddling for a few kilometers and carrying the canoe for a few kilometers. Ultimately, we decided to just walk entire stretches to be more time efficient, however the stretch of the river at the end of this first assessment was deep and channelized. Due to time constraints with walking in and out of the river we were unable to do this section. Based off the surrounding land-use and google maps it can be assumed that it would be very similar to the assessments preceding and proceeding, and overall healthy in nature.

Our next assessment was accessed by portaging through the powerline clearing on Route 15 to assess upstream (Table 4). Four assessments were completed for the assessment upstream of the powerlines on Route 15. Overall, 3 assessments were healthy and 1 was healthy with problems. In terms of vegetation ratings, 2 were healthy and 2 were healthy with problems. For soil/hydrology rations, 3 were healthy and 1 was healthy with problems. This stretch of river was very similar to the first section in that the first 3 assessments were healthy and the 4th assessment was healthy with problems. Assessment 4 was the section of river next to the powerline clear-cut (Figure 11).

Figure 11: Powerline clearing off Route 15

It scored a 77% in vegetation and a 63% for soil/hydrology. While it had some preferred, deep rooted vegetation (e.g. alder, sweetgrass), it also had disturbance caused plants present and was lacking any

preferred tree and shrubs for regeneration due to the clear-cutting. The bank was lacking in streambank root mass protection and was quite channelized with some slight undercutting present and exposed roots emerging from the banks. Overall this river reach was mostly channelized, with good overhead tree cover (primarily coniferous with some maple, as well as alder and meadowsweet present) with a mix of old and young trees along the right-hand bank facing downstream. The left-hand bank facing downstream had scattered trees and more grassy fields. There were also a few cottages on that side of the stream. The riverbed changed from rocky upstream to very silty downstream. The rocky river bottom had lots of macrophyte growth. This stretch of river marked the end of signs of tidal influence on the river. We stopped our assessment based on having to stop and carry the canoe for several kilometers again when the river widened out and water became very stagnant and slow moving upstream.

The stretch of river downstream from the Route 15 powerlines to the Main Street bridge in Port Elgin (Table 5). Six assessments were completed for this stretch of river. Overall, 3 assessments were healthy and 3 were healthy with problems. For vegetation ratings, 3 assessments were healthy, 2 assessments were healthy with problems, and 1 assessment was unhealthy. For soil/hydrology, 3 assessments were healthy and 3 assessments were healthy with problems.

Assessment 1 started up by the powerlines on Route 15, so it was similarly rated healthy with problems due to the lack of bank stabilizing vegetation, channelized banks, and the reach being structurally altered by humans. There was lots of disturbance caused plants and aquatic vegetation present in this stretch with the bottom of the river made up of rocks covered in silt (Figure 12)

Figure 12: River bottom of rocks covered in silt

There was also evidence of this access point being a popular campfire spot and hunting spot (hunting stands along the river). Lots of gaspereau were swimming in this stretch of river. Progressing downstream the river widened out again with grassy, easily accessible flood plains and mud flats present depending on the tide. There was also a stretch where the river bank on the right-hand side facing downstream was on a ~ 90$_o$ with sedimentary rock (Figure 13).

Figure 13: Sedimentary rock shoreline

Assessment 5 & 6 scored lower in soil/hydrology (healthy with problems) as we approached the Village of Port Elgin. The streambank & reach were structurally altered for the Route 16 bridge which was accompanied by rock rip-rap. There were also some wooden shore stabilization structures down near the riverside park in Port Elgin (Figure 14).

Figure 14: Wooden shore stabilization near the Main St. bridge in Port Elgin

The last two assessments were from the Main St. bridge down to the Trans Canada Trail bridge (Table 6) and from the Trans Canada Trail bridge to the river outflow (Table 7). Both these assessments were healthy with problems overall. Their vegetation ratings were both healthy with problems and their soil/hydrology ratings were unhealthy. This stretch of river goes through the heart of Port Elgin, passing under 2 bridges and passing the community dock. Human streambank alteration lowers the soil/hydrology scores in these assessments. This stretch of the river is also tidally influenced and transforms into mudflats at low-tide (Figure 15). The bottom stretch of this river has experienced drastic streambank erosion (Figure 16). In October 2019, after our assessment was complete, EOS partnered with NatureNB, the Village of Port Elgin, and Shediac Bay Watershed Association to plant 130 trees along an eroded section of the Gaspereau River to help stabilize the streambank and help protect the village sewage lagoon.

Figure 15: Mudflats at low tide at bottom of Gaspereau River

Figure 16: Streambank erosion and downed trees along the Gaspereau River

In total, 26 assessments were completed of the Gaspereau River. The overall riparian health assessment determined that 58% (15 reaches) of the river is healthy, and 42% (11 reaches) of the river is healthy with problems; while no reaches of the river were found to be unhealthy (Table 8).

Table 8: Summary of the Overall Health of the Gaspereau River

	Healthy	Healthy with Problems	Unhealthy
Overall Assessment Score	58%	42%	0%
Vegetation Rating	46%	46%	8%
Soil/Hydrology Rating	58%	38%	4%

Impacts and Community Benefits

The goal of this project was to assess the riparian health of the Gaspereau River in order to maintain or improve a healthy riparian zone. Healthy riparian zones mean thriving terrestrial and aquatic habitats for mammals, amphibians, insects, fish, and birds. This will have a positive impact on traditional uses by maintaining populations for fishing, hunting, and trapping.

Healthy riparian zones also provide many ecosystem services such as improved water quality, water storage and flood mitigation, erosion protection, groundwater recharge, and providing habitat for terrestrial and aquatic wildlife. These ecosystem services provide the community with many social, environmental, and economic benefits. They also help build a more sustainable and resilient community in the face of climate change. A healthy riparian zone can help store water and mitigate flood impacts.

Recommendations and Next Steps

The riparian health assessment data gathered from this project will provide a record of the current state of riparian health of the Gaspereau River. Using this data, we can plan restoration projects for problem areas and work to prevent potential future problems by maintaining the healthy reaches of the river. In the future, we would like to extend our assessments to the sections of the Gaspereau we were unable to get to, as well as other streams within the watershed.

Looking at the summary of our assessment results (Table 8), 58% (15 reaches) of the river were found to be healthy, and 42% (11 reaches) of the river was deemed healthy with problems; while no reaches of the river were found to be unhealthy. Some of the issues could be addressed by increasing and maintaining native vegetation along shorelines. Planting this deep-rooted, native vegetation along the banks/riparian area will help stabilize the soil/hydrology of the streambanks, as well as encourage further growth of vegetation. There could also be a planned river clean-up. From talking to community members, it was discovered that there used to be annual river clean-ups back in the 90s to remove garbage, debris, and beaver dams. Based on the garbage and debris seen during the assessments, the river could benefit from a clean-up.