Introduction

Three staff members and three volunteer board members were mentored in bank restoration techniques by the Kennebecasis Watershed Restoration Committee. NWAI staff visited five restoration sites in the Kennebecasis Watershed while KWRC staff visited the Nashwaak Watershed to discuss restoration potential here.

MacPherson Brook, a cold-water stream in the community of Giants Glen, was identified during a 2016 geomorphic assessment and in our 2017-2020 Action Plan as an important source of cold water that should be protected and restored. The site is located between 269 and 273 Giant's Glen Road near the mouth of MacPherson Brook [46.2990, -66.7842] (Fig. 1). Approximately 14 years ago the landowner 269 Giant's Glen Road placed a number of large rocks on the edge of the brook to reduce flooding. This reduced the capacity of the floodplain and pushed the water into the opposing bank, which began to collapse. The substrate of this bank is fine and sandy, which allowed the water to cut into the bottom of the bank, leading it to slump down. The landowner of the collapsing bank estimated that he had lost ~3-5 m of land over the last 14 years, along with many trees.

Figure 1. Location of MacPherson Brook bank repair [red square].

In 2017, the eroding section was ~30 m long by 4.5 m high (Figs. 2 & 3). Continuous erosion has been releasing sediment into the Nashwaak River, degrading water quality and aquatic habitat. In addition, sediment had built up a small island in the middle of the mouth of the brook, which was exacerbating the erosion as it was pushing water into both banks.

Figure 2. The downstream end of the eroding bank in May 2017.

Figure 3. The upstream end of the eroding bank in May 2017.

The brook was known as a thermal refuge for fish in mid-summer, based on conversations with locals. This was confirmed by placing temperature loggers in the brook and in the main stem of the river. The brook remained below 20°C all summer (Fig. 4), and was the only tributary analyzed in the watershed this summer to do so, while the main stem rose to 28°C or higher in some locations. Restoration of this site would reduce sediment loading and enhance a cold-water source to the Nashwaak River - safeguarding the thermal diversity of the watershed and improving water quality and aquatic habitat for native salmonids. The Nashwaak River is an important salmon-producing tributary of the Saint John River and is one of DFO's priority rivers for restoration under their 2014 Recovery Potential Assessment.

This work is also in line with Atlantic Salmon Federation's 2013 Recovery Strategy for Wild Atlantic Salmon.

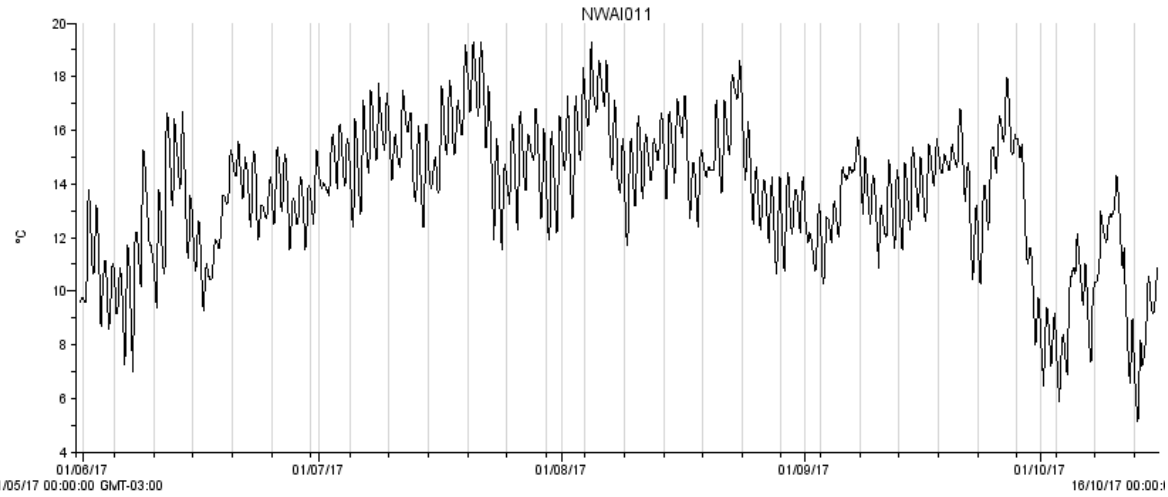

Figure 4. The temperature profile from the logger just upstream from the eroding bank. This was the only tributary recorded that remained under 20°C all summer.

Objectives

The objectives of the project were to 1) increase capacity of the NWAI to restore the Nashwaak River; 2) restore an eroding river bank at the mouth of a cold-water tributary; 3) improve water quality and salmon habitat and safeguard the thermal diversity of the Nashwaak Watershed; and 4) communicate the importance of cold-water tributaries and thermal refuges to the public.

Overview of project

The engineering survey was carried out in early July by HILCON Ltd and NWAI, followed by design work with input from the Atlantic Salmon Federation. The design was stalled somewhat by the landowner who was unhappy about losing trees on the top of the bank. Therefore, a new design with a slightly steeper slope was agreed upon. A stamped engineering drawing was produced by HILCON Ltd on August 14th. Input from the Atlantic Salmon Federation was incorporated. The WAWA permit was issued on September 13th and the work began on September 15th. [See attached stamped engineering design and WAWA permit.]

A sediment fence was installed the day before work began to prevent sediment from coming down the bank and entering the stream. Water levels were extremely low while the work was happening.

Figure 5. Step 1. A sediment fence was installed before work began.

Vegetation was removed along the top of the bank. Trees were only removed if absolutely necessary. Only one large tree had to be removed. The bank was reshaped to a 1.5:1 slope and a R50 (300 mm diameter rocks) rock toe was installed. The rock toe was buried ~0.5 m and extended ~1 m up the bank. Existing rocks were mixed in with the R50 to achieve a more natural look.

Figure 6. Step 2. We began reshaping the bank and digging the trench where the R50 would be placed.

Figure 7. Step 3. R50 riprap was mixed with existing rocks and placed in a trench at the toe of the slope.

Hay was scattered over the slope to prevent the fine sediment from blowing away due to the drought. Erosion control blankets were wrapped over the bank and secured with sod staples. Edges of the blankets were covered with a scoop of dirt and the blanket was wrapped over top. Sections of blankets were overlapped by ~10 cm. We ran the blankets over the top of the bank and secured them ~1 m beyond the top.

Figure 8. Step 4. The erosion control blankets were laid on top of the rock toe and dirt was place on the end on the blanket to hold it in place before the blankets were rolled up over the slope. Not shown is a layer of hay that was placed under the blankets.

A professional hydroseeder sprayed grass seed on top to ensure that vegetation would become established this season. >200 live willow stakes were hammered into the lower half of the bank and on the opposing bank where the machinery had damaged some vegetation. About half of the stakes were taken from vegetation that had to be removed to allow access. All stakes were soaked in the river for at least 24 hours. The landowner agreed to water the bank daily. This work was completed by September 21st.

Figure 9. Step 5. The erosion control blankets were rolled up and hydroseeded. >200 willow stakes were planted in the lower half of the bank.

Silver maple, sugar maple, red oak, and white oak seedings were planted on top of the bank in early October. We anticipate planting additional maple seedlings in the spring when conditions are better.

Figure 10. The bank in December 2017 at high water.

Figure 11. Tree seedlings were planted on top of the bank while willow stakes were planted in the lower half of the bank.

A rock weir consisting of 9 rocks that were 600 mm in diameter was placed at the downstream end of the repaired bank, close to the mouth of the brook. This is where there was a build up (island) of sediment that had some off of the bank. The island was pushing water into both banks and exacerbating the erosion. Machinery sat on the lower bank and reached into the stream. Staff watched for sedimentation of the stream and was prepared to stop work if large turbidity became too high. However, due to low flow conditions we did not have to stop and the sediment dropped out of the suspension very quickly.

Figure 12. The island that had formed at the mouth of the brook from sediment that had eroded off the bank.

Figure 13. Nathan Wilbur from Atlantic Salmon Federation designed the rock weir and supervised the work.

This weir will act as a grade control and reduce scouring of the channel bed. In low flow conditions, it will also concentrate flow to allow for fish passage into the cold-water tributary. Fish (juvenile brook trout and black nosed dace) were noted swimming through the rock weir almost immediately upon completion of work.

Figure 14. The rock weir (after) at low flow conditions.

Visual inspection after a heavy rainfall revealed that there was much less fine suspended sediment and the rock weir was slowing the velocity of the water around the mouth. As of November, finer substrate had begun infilling gaps in the rock weir and rock toe, which will provide additional support.

Figure 15. The rock weir functioning well after heavy rains in November 2017.

Figure 16. MacPherson Brook after a heavy rain in January 2018 (photos from landowner Jeff McIssac).

Problems encountered & how they were solved:
No major problems were encountered, though the restoration was done later in the year that we anticipated due to one of the landowners changing his mind several times about the removal of trees. We were also unable to plant as many trees as anticipated on his property due to his change of mind. Due to weather conditions in the summer of 2017 (hot, dry, extreme low water), survival of willow stakes was low, and the grasses suffered despite being watered daily. The NWAI is committed to re-staking the willows and planting more tree seedlings in the spring when conditions are much better for growth, and reseeding the bank.

The NWAI had hoped to partner with St Mary's First Nations Aboriginal Fisheries Strategy staff on this project, as mentioned in our letter of support; however, at the time of project the group was involved in a search for a missing person and we later unavailable due to their own project commitments. Our relationship with the St Mary's First Nation AFS staff remains strong and we partnered on other projects in 2017. Both groups have committed to continuing the partnership in 2018.

Figure 17. NWAI and DFO staff at the project site in October 2017.

Before and After Photos

Figure 18. Looking downstream at the mouth of MacPherson Brook before (left) the rock weir was installed, a gravel island had built up and was channeling water to either side, which was causing more bank erosion. After (right) the installation of the sunken rock weir at low flow conditions.