PARISH aquatic services
A Division of Matrix Solutions Inc.

MILL CREEK
REMOVAL OF STRUCTURES
2017 INSTREAM RESTORATION RECOMMENDATIONS

Report Prepared for:
SOUTHEASTERN ANGLERS ASSOCIATION

Prepared by:
PARISH AQUATIC SERVICES

February 2017
Fredericton, New Brunswick

Suite 300, 346 Queen Street
Fredericton, New Brunswick E3B 1B2
Phone: 506.472.8440 Fax: 506.472.6250
www.parishgeomorphic.com

TABLE OF CONTENTS

LIST OF FIGURES

1 INTRODUCTION

In August 2016 PARISH Aquatic Services (Parish), A Division of Matrix Solutions Inc., conducted a Geomorphic Assessment and a detailed Topographic Survey on a 1.35 km reach of Mill Creek. During the assessment Parish identified several instream structures (failed digger logs, wing deflectors, gabion baskets, etc.) that were creating unstable geomorphic conditions and degrading aquatic habitat. Parish recommended to the Southeastern Anglers Association that these failed structures be removed as part of preliminary restoration efforts on Mill Creek.

In September 2016 Parish and members of the Southeast Anglers Association organized a work day with volunteers to remove the instream structures that were causing habitat degradation and unstable geomorphic conditions in Mill Creek. A total of eight structures were removed. In addition, refuse, such as tires, plastic bags, netting, metal re-bar and old signs were removed from the creek.

Several sections of creek had eroded banks and were over widened. Much of the reach included highly embedded substrate and infilled pools; characteristic of streams experiencing excessive amounts of sedimentation and bank erosion.

This report provides a brief description of the work completed and the structures removed by the Southeastern Anglers Association, Parish, and volunteers in September 2016.

Figure 1. Mill Creek project location

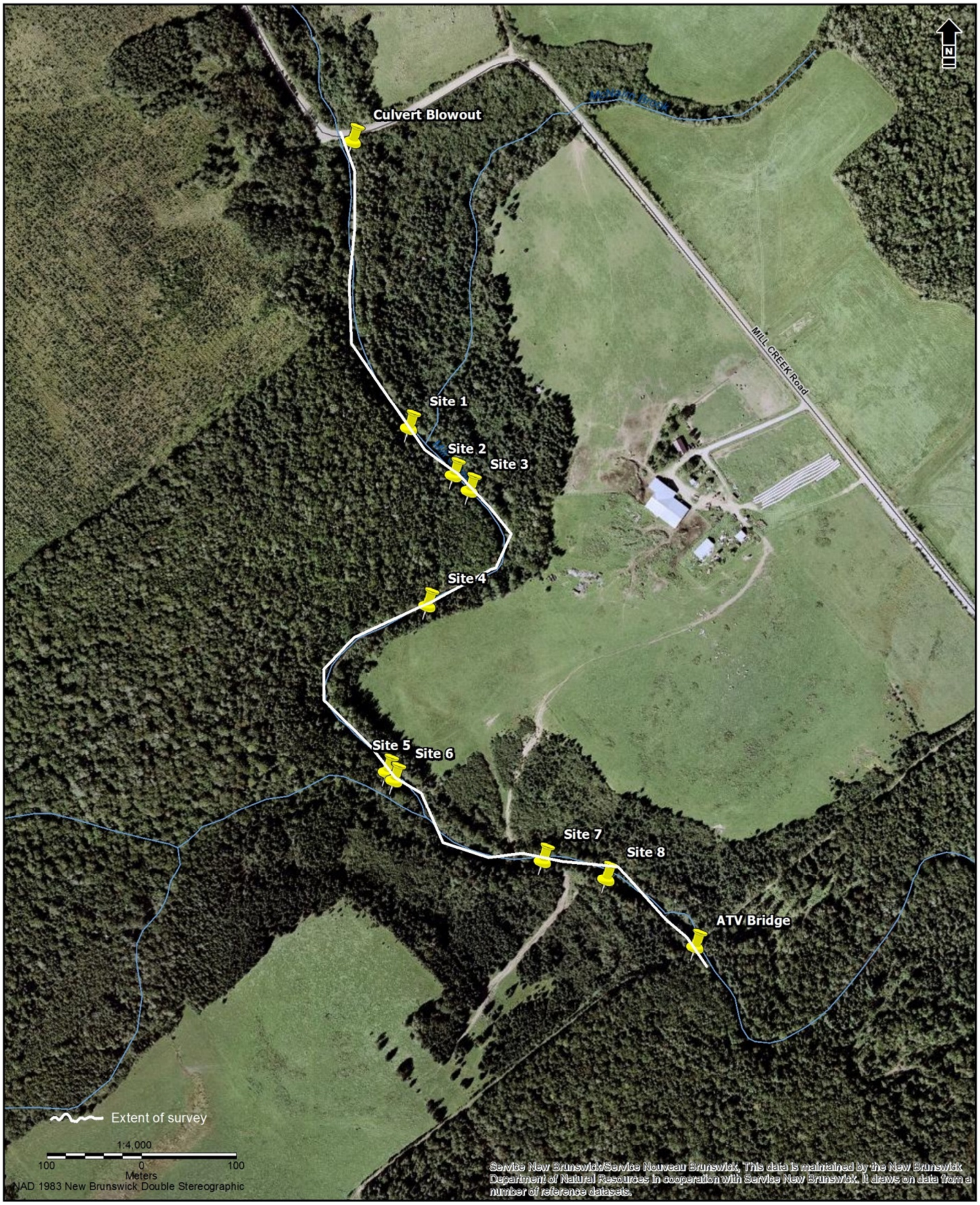

Figure 2. Mill Creek extent of survey and site locations

2 DESCRIPTION OF WORK COMPLETED

Figure 1 and Figure 2 show the location of Mill Creek and the Site locations along the 1.35 km reach. Several instream structures were present in this reach of Mill Creek. The structures identified to be causing, or have the potential to cause unstable channel conditions were removed and structures that posed little or no threat were left in place. The structures included: digger-logs, wing deflectors, gabion baskets and log-cribbing. The majority of the structures were constructed with logs and rocks, anchored to the creek bed with metal re-bar, nylon webbing and/or metal page wire fencing. Many of the structures were not properly tied into the bank and resulted in bank erosion and degradation of the floodplain.

The following sections provide details and photographs of the work completed at each site. All work was carried out in accordance with the Watercourse and Wetland Alteration Permit (ALT40869'16).

2.1 Site 1 - Digger Log

The digger log was anchored to the bed with metal re-bar and nylon netting. The banks were eroded at both ends of the structure. If not removed, further bank erosion and channel widening would have resulted.

Structure being removed. Banks were eroded around ends of structure.

Digger log after removal. Note metal re-bar anchors.

PARISH aquatic services

2.2 Site 2 – Wing Deflector

The wing deflector was located on the right bank. Banks were eroded around both ends of the structure and it was not tied into the bank. If left intact, it would have continued to cause degradation (bank erosion, channel widening and sedimentation to downstream areas).

Log wing deflector, anchored with re-bar and nylon netting.

Volunteers removing the structure. Note the bank erosion and evidence of channel widening.

2.3 Site 3 – Digger Log

The right bank was severely eroded around the digger log. The structure was contributing to loss of floodplain/bank erosion and an over-widened channel. Approximately 3 meters of the right bank had eroded around the structure. The eroded bank material was deposited downstream and had significantly altered channel morphology and associated habitat.

View of right bank, looking upstream at the digger log. Channel had widened by approximately 3 meters.

Workers removing structure. Note the re-bar anchors and nylon webbing. Viewing downstream.

2.4 Site 4 - Wing Deflector

The log wing deflector was located on the right bank. The structure had caused erosion of the downstream left bank and scour to the downstream right bank. The structure was anchored with re-bar and metal page wire fencing.

Failed wing deflector being removed by volunteers. September 2016

Bank erosion on opposite side of creek, caused by improperly placed wing deflector. September 2016

2.5 Site 5 – Digger Log / Cribbing

Log cribbing located at the tributary mouth was anchored with re-bar, metal page wire, and geotextile fabric. The structure had caused channel incision and head cutting at the tributary mouth. The structure altered the morphology of the tributary mouth and decreased the potential quality of the cold water habitat. The tributary was identified as a cold water source for Mill Creek.

Undermined digger log at mouth of cold water tributary. Structure altered the morphology of the mouth and hydraulics of the tributary. September 2016

Workers removing structure and geotextile material from tributary mouth. September 2016

2.6 Site 6 – Log Cribbing

Log cribbing located on the right bank approximately 30 meters downstream from site 5. Cribbing was anchored by metal re-bar and page wire. The structure had caused scour and bank erosion.

Failed crib log causing scour and bank erosion. Anchored by metal page wire and re-bar. September 2016

Workers removing structure. September 2016

2.7 Site 7 – Log Cribbing

Log cribbing on the right bank anchored by metal re-bar and nylon webbing. Cribbing had caused scour and bank erosion behind the structure.

Failed crib log causing scour and bank erosion. Anchored by metal page wire and re-bar. Looking downstream. September 2016

Volunteers removing structures. Looking upstream September 2016

2.8 Site 8 – Gabion Baskets

Gabion baskets located on the right bank and anchored with metal re-bar. The bank had eroded around the baskets. The baskets were no longer tied into the bank and the fill material had been removed.

Failed gabion baskets made of metal wire. Anchored by re-bar. September 2016

Workers removing metal wire and baskets. September 2016

3 CONCLUSION

This report described the removal of instream structures from a section of Mill Creek during September 2016. The structures were removed by members of the Southeastern Anglers Association, Parish Aquatic Services personnel and volunteers. Activities were conducted in accordance with Watercourse and Wetland Alteration permit (ALT40869'16) conditions of approval. The structures highlighted above were identified as causing channel instability and degradation of aquatic habitat. Removal of the failed structures at the eight sites will promote the return of natural fluvial geomorphic processes to the system and is an important step in the restoration process of Mill Creek.

The structures within this reach may have provided some benefit to aquatic habitat at some point; however, their eventual failure has promoted channel instability and degradation of habitat within the study reach. This highlights the importance of conducting fluvial geomorphic assessments and topographic surveys to inform the design and implementation of instream structures. Structures should also be periodically monitored post-installation to ensure that they are still meeting their intended purpose. This greatly increases the success of the stream restoration projects.

4 RECOMMENDATIONS

These recommendations are for moving forward with the 2017 field season and on through to 2019. With the washout of the culvert on McNarin Road, the road and bank material that washed downstream below the culvert has created a rapid change in the natural geomorphic characteristics of the Mill Creek in this reach. The creek has experienced changes in channel width, connectivity issues to floodplains, and changes in channel depth.

With the removal of the instream structures below the culvert at McNairn Road that were contributing to channel over widening, and bank erosion, the restoration of the channel to bring the channel back to a more natural width and depth can begin in 2017. It should be noted that there is still active bedload movement from the deposition of material that occurred when the culvert washed out at McNairn Road. As well the recent replacement and installation of the culvert and new channel alignment below the downstream invert of the culvert at McNairn Road may continue to contribute excess bedload and bank material, until the site stabilizes natural.

The recommendations proposed in this report are based on trying to re-establish a natural channel width of between 10 metres and 12 metres, reconnecting floodplains and gravel bars, and improving instream aquatic habitat to support salmonid species for the reach of Mill Creek between McNairn Road and the ATV bridge as shown in Figure 2.

Selected points for restoration will be selected during a walkthrough of this reach in spring 2017. The reason for this is that the channel is still going through an evolution of sorting the bedload and sediment deposition that occurred during the washout of the McNairn Road culvert. Predetermining sites for restoration on a channel that is under this type of geomorphic stress is difficult and would most likely result if failed efforts. As well, sites that are selected in 2017 for restoration projects and are not established with physical works by the end of 2017 will need to be reassessed in 2018 prior to commencing with the restoration program. Adjustments to the Mill Creek channel during the fall of 2017 and spring freshet of 2018 may result in channel adjustments that have benefited or hindered channel recovery due to natural changes or from the structures installed in the summer of 2017. It is critical to ensure that any instream structures are placed in the channel at locations to provide maximum effect and benefit and do not inhibit any restoration efforts.

The following restoration techniques are meant to assist the channel in achieving a more natural width to depth ratio while creating instream habitat for various aquatic species. Some of the structures were previously placed in Mill Creek and were removed during the summer of 2016 due to poor installation or location choice which resulted in channel over widening. The restoration techniques below are only a few examples of the many that may work as well in Mill Creek. Additional types of restoration structures or techniques may be added as the project moves forward into 2019.

4.1 Rock Vanes/Deflectors

Rock vanes are used to direct normal flows away from banks and create scour pools by constricting the channel and accelerating flows. These structures are composed of large stone partially embedded in the streambed such that they remain emerged during low flows. Rock sizing will depend on flow discharge and must be capable of resisting high flows. The vanes are oriented upstream with angles off the bank between 20 and 30 degrees. A single rock vein will span approximately one-third to one-half the channel width during base flow. Figure 3 outlines the design details of a typical rock vane structure.

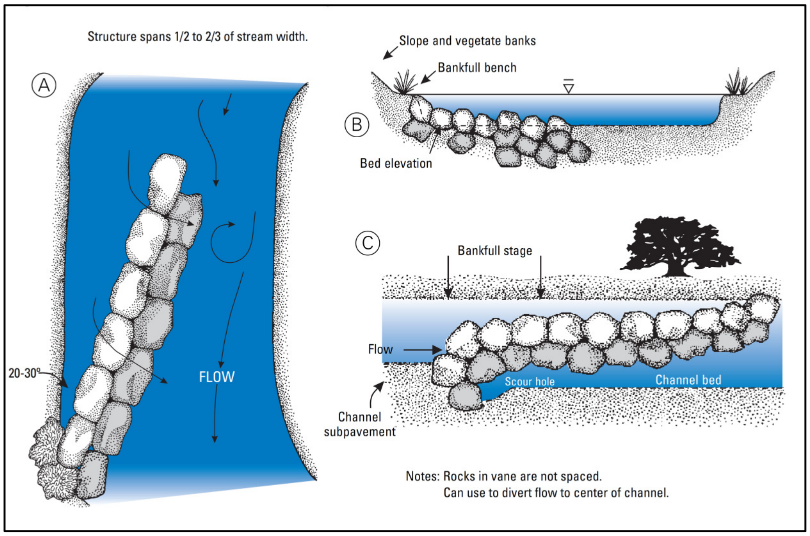

Figure 3. Rock vane structure

4.2 Upstream-V Log Weirs

Upstream-V log weirs are used to scour pools on the downstream side of the structure and accumulate gravel on the upstream side. They also direct flows away from the banks, narrow the stream channel, and can provide better access to the floodplain. Logs should be of appropriate size, determined by channel width, channel type, and bankfull discharge flows. An important design consideration for log weirs is that they do not become low-flow migration barriers. Log weirs are often placed in long, shallow riffles or runs. They may also be installed on straight reaches or meanders. Planview and cross section diagrams are illustrated in Figure 4.

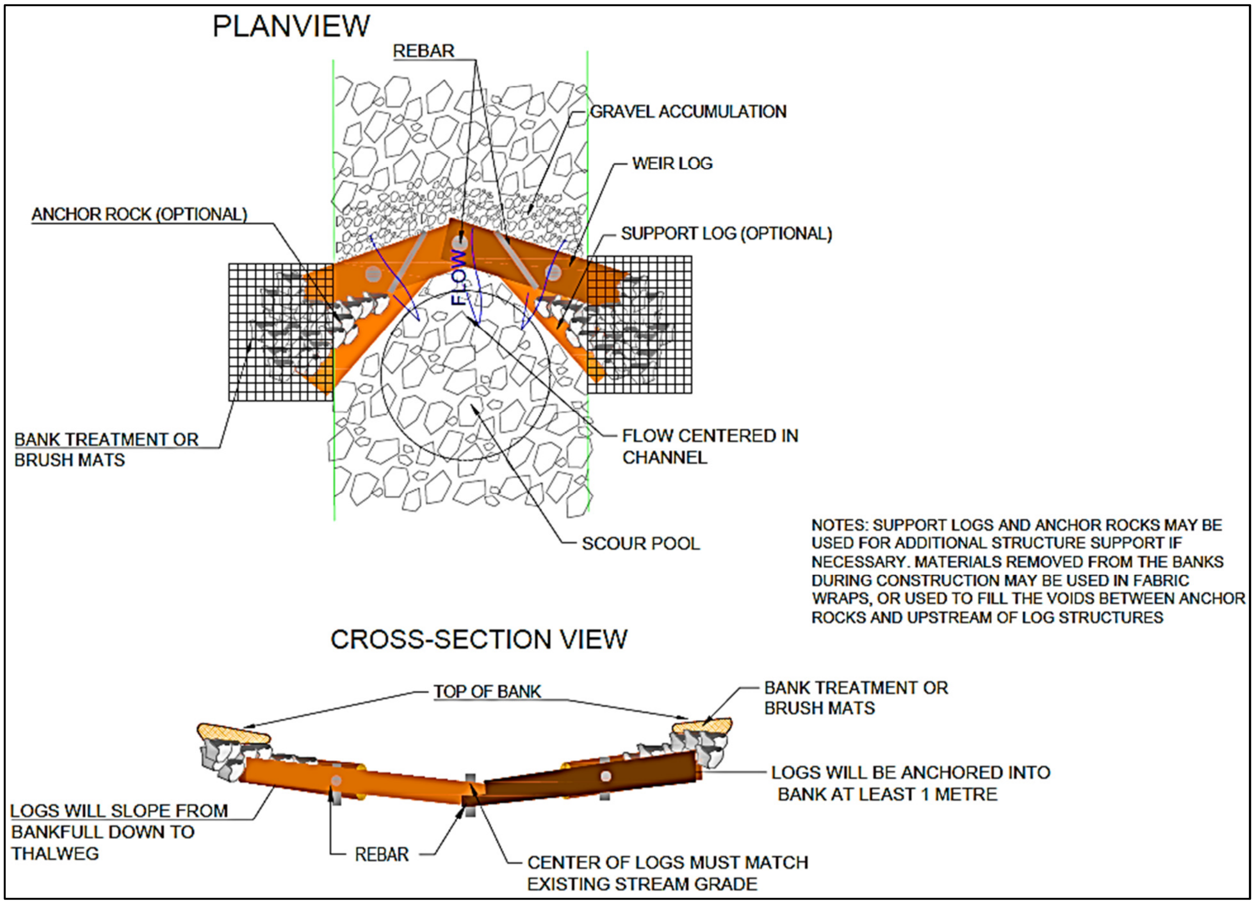

Figure 4. Upstream v-log weirs

4.3 Double Tree Deflector

Double tree deflectors are designed to narrow the channel and concentrate flows near the center to promote a scour pool downstream of the structure. Trees should be properly sized and installed so that peak flows carrying logs, ice and other debris can pass unimpeded. Evergreen trees should be used with the butt ends of tress facing upstream and secured to a stable structure on the bank. Details of a typical double tree deflector are provided in Figure 5.

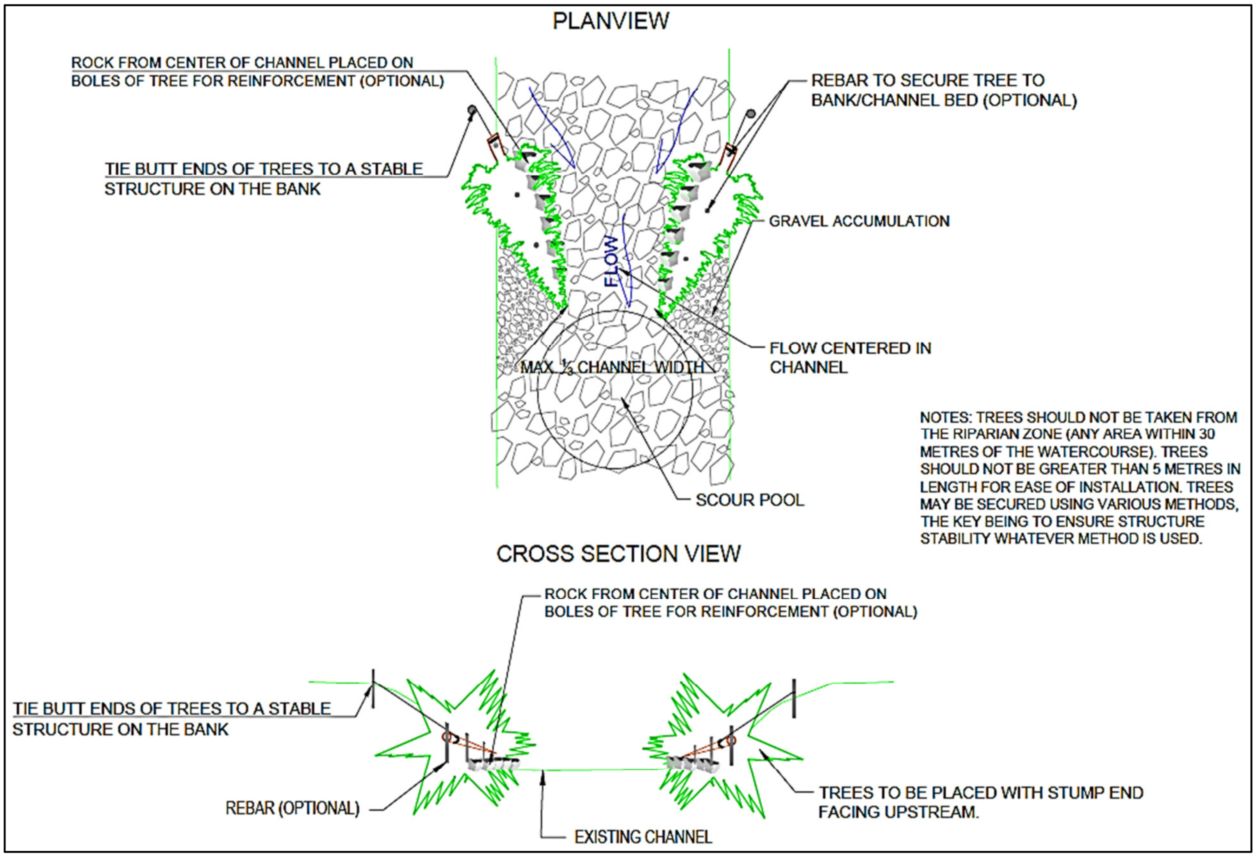

Figure 5. Planview and cross-section of double tree deflector

4.4 Brush Mattresses

Brush mattresses are a bank treatment which promotes sediment accumulation on point bars and help to narrow the channel by capturing sediment during high flows. These are most appropriate to use in smaller streams where banks are threatened by high flows. A brush matt is composed of evergreen tree branches (boughs) at least 1m in length that are placed in areas where sediment accumulation is desired. The boughs are installed parallel to the flow with the stump facing upstream. The boughs are laid on top of one another working from downstream to upstream and tied together. Stakes are inserted at the top of bank and the boughs are secured with a biodegradable twine.

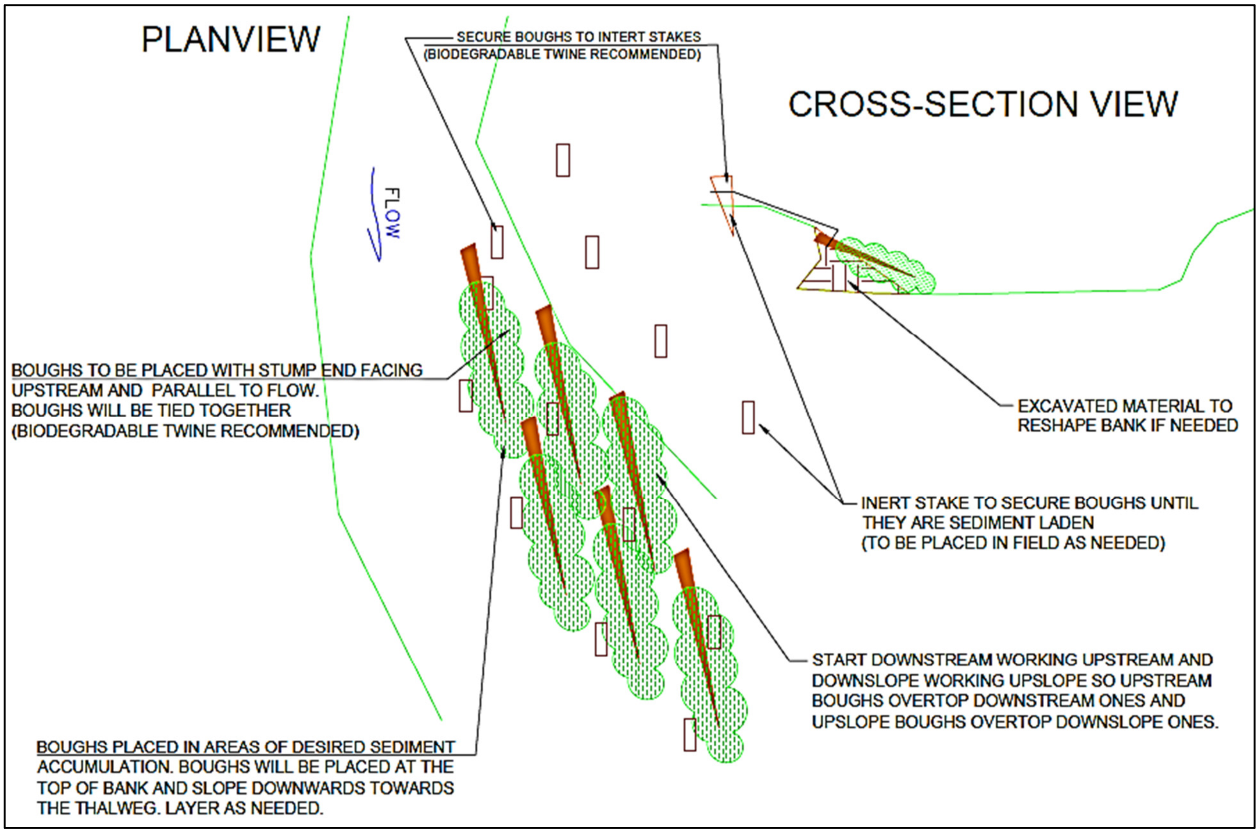

Figure 6. Brush mat option. Depiction of boughs can be interchanged with small evergreens.

4.5 Bank Treatment

Bank treatments consist of engineered, biodegradable fabric wraps that are secured in place with bank material (soil, gravel, cobble) and wooden stakes. Flood-tolerant species such as willow, dogwood, and alder are typically planted along the wraps to establish riparian vegetation. Bank treatments help to re-grade the floodplain and are intended to provide the foundation for long-term bank stability. Planview and cross section diagrams are illustrated in Figure 7.

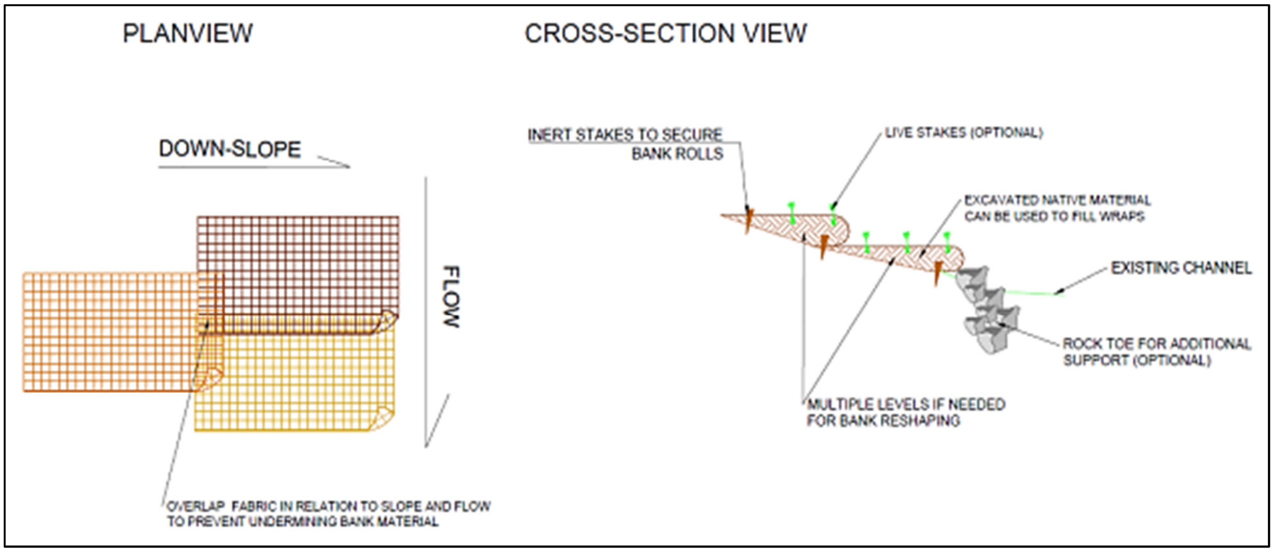

Figure 7. Bank treatments