MILL CREEK HABITAT RESTORATION AND BANK STABILIZATION, TOWN OF RICHMOND, ONTARIO COUNTY, NEW YORK: DESIGN REPORT

Prepared for:

Town of Richmond
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Prepared by:

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AND

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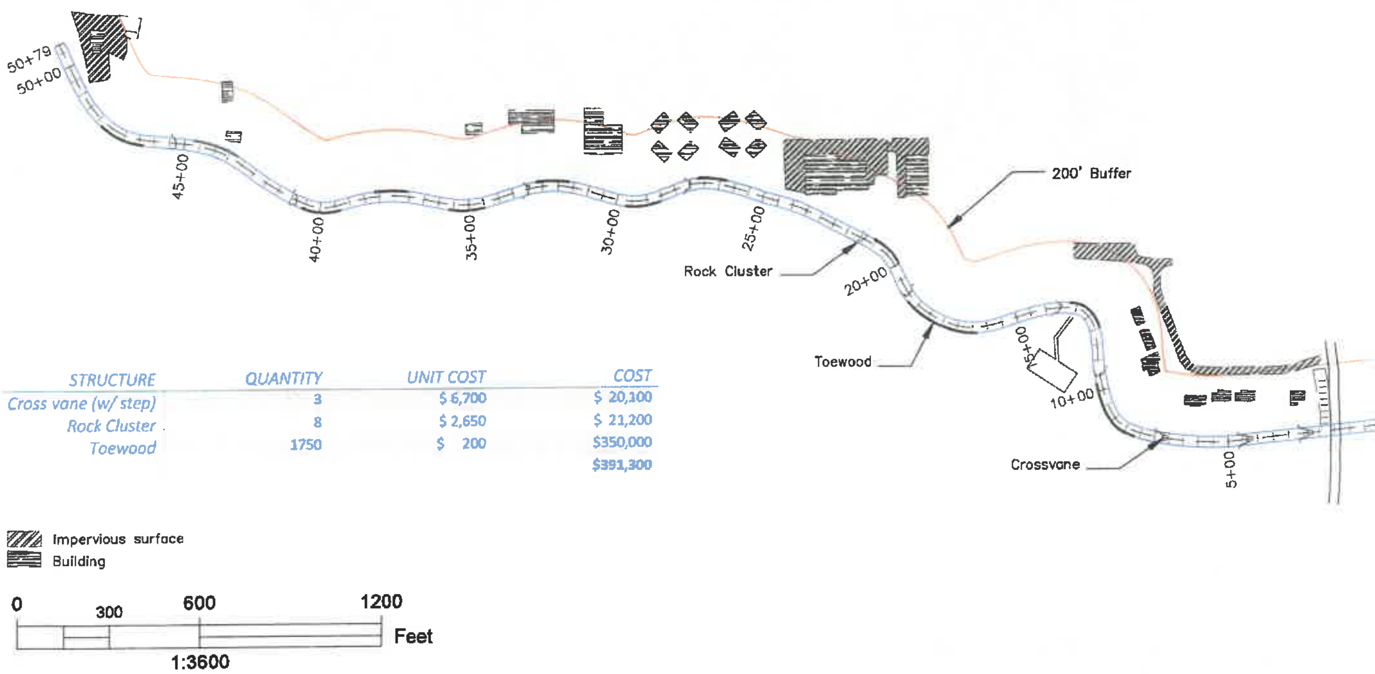
I. INTRODUCTION

October 2018



STRUCTURE	QUANTITY	UNIT COST	COST
Cross vane (w/ step)	3	$ 6,700	$ 20,100
Rock Cluster	8	$ 2,650	$ 21,200
Toewood	1750	$ 200	$350,000
			$391,300

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Mill Creek–Honeoye

DRAFT 20% DESIGN

SHEET 01

The Town of Richmond (Town) is working in partnership with the U.S. Fish and Wildlife Service (Service) and Ontario County Soil and Water Conservation District (District) to implement a stream restoration project along 4,500 linear feet of Mill Creek near the Sandy Bottom Park in the Town of Richmond, Ontario County, New York. The Town identified the project area as a primary source of sediment that is adversely affecting hydraulic capacity in the Honeoye Outlet at its confluence with Mill Creek. The residents along Mill Creek have taken an active role in attempting to manage the erosion occurring in Mill Creek. Restoration of Mill Creek downstream of the East Lake Road bridge to a stable channel form will significantly reduce sediment inputs, improve aquatic functions, and reduce the potential threats to private residential homes and public infrastructure.

The Service used the "Function-based Stream Restoration Project Process Guidelines" (Starr & Harman., 2016) in developing the most appropriate design approach for the proposed project, and conducted a reach level assessment. The stream-based assessment involved a visual assessment of stream characteristics and stability conditions upstream and downstream of the project area. The fluvial geomorphic conditions observed included channel dimensions, pattern, profile, substrate material, vertical and lateral stability, sediment supply potential, Rosgen stream type, and channel evolution. The reach level assessment was conducted to establish the existing functional condition, determine stressors, and identify constraints at the proposed project site.

The stated goals of this stream restoration project are to enhance stream habitat, reduce concentrations of sediment, detain and slow runoff, and provide stable conveyance of flows through the stream channel.

II. DESIGN DEVELOPMENT

This section presents the project constraints, design objectives, design criteria, and monitoring strategies involved in the Mill Creek Habitat Restoration and Streambank Stabilization Project.

A. CONSTRAINTS

Constraints are man-made features that limit the restoration potential of a stream restoration project. The main constraint within the project area is the location of private property in relation to degraded stream reaches within the project area. Many reaches on Mill Creek are located on private property so landowner cooperation would be needed to address stream issues related to stability on these properties.

B. DESIGN OBJECTIVES

The goals of this stream restoration project are to enhance stream habitat, reduce concentrations of sediment (bedload and suspended), detain and slow runoff, and provide stable conveyance of flows through the stream channel. The design objectives for this project were then developed to meet these goals.

C. DESIGN DEVELOPMENT

1. Proposed Design

Due to project constraints, there is limited opportunity to change stream planform through the reach. To provide

While the proper balance between plan form and in-stream structures is important for stable conditions, it is recognized that stability cannot be achieved without the proper riparian conditions. The proposed plan calls for riparian and upland plantings along the streambanks to quickly re-establish vegetation cover.

Design objectives of reducing sediment loads will be met primarily through bank stabilization. The proposed channel work has been designed to maximize avoidance of existing vegetation. Therefore, only minimal impacts will occur to existing vegetation and any vegetation impacted will be reused within the stream restoration project.

2. In-Stream Structures

Stream restoration projects are most vulnerable to erosive flows immediately after construction is completed. Vegetation roots need time to establish within the newly graded stream banks, and channel sub pavement and pavement layers need to form in order for long-term stability to be provided. Initial establishment of vegetation typically take 4 to 6 years in the central NY region. During this time, in-stream structures are needed to protect against erosive flows. For the Mill Creek restoration project, in-stream structures mainly consist of rock cross vane structures, converging rock cluster grade control structures, and toe wood structure. The design riffle pool sequence will provide a stable conveyance of stream flows, maintain streambed elevations, and protect existing infrastructure.

a. Rock Cross Vane

The cross-vane (Figure 1) will establish grade control in the proposed channel that will tie-in to the existing channel at the upstream end of the project. Cross vanes are in-stream structures used to reduce bank erosion, create a stable width/depth ratio, and maintain channel capacity, while maintaining sediment transport capacity and competence. The cross-vane is a stream habitat improvement structure that will: increase bank cover as a result of a differential raise of the water surface in the bank region; create holding and refuge cover during both high and low flow periods in the deep pool; develop feeding lanes in the flow separation zones (the interface between fast and slow water) due to the strong down welling and upwelling forces in the center of the channel; and, create spawning habitat in the tail-out or glide portion of the pool (Rosgen, D.L., 2001).

b. Toe Wood Structure

Toe wood structures will be used to provide lateral stability within the reach. Toe wood structures are used in certain stream types (Rosgen Bc,C & E) to reestablish stable lateral scour pools where rivers meander. The structure incorporates native woody material into a submerged undercut bank to replicate natural streambanks and add flow resistance for streambank protection. The majority of the wood is submerged to prevent deterioration. Incorporated into the structure is a bankfull bench to reduce bank height and improve the response of riparian vegetation (Rosgen, D.L., 2001).

c. Converging Rock Cluster

Converging Rock clusters will be used to provide grade control below constructed pools. Converging rock clusters provide grade control and dissipate energy at the head of riffles to keep the pool upstream of them flat and maintain riffle steepness. The structure helps to prevent down-cutting that can occur at the hydraulic grade control at the pool tailout. This down-cutting occurs in restored reaches because the pavement / subpavement layers of natural stream bed are disturbed during construction. In addition to providing hydraulic grade control converging rock clusters provide instream cover for fish, dissipate energy and create pocket water pools (Rosgen, D.L., 2001).

3. Vegetation Design

The proposed planting incorporates two zones of trees and shrubs to be planted. Riparian trees and shrubs will be planted between top of bank and five feet below the delineated top of bank. The proposed Zone 2 plantings will provide additional vegetation stabilization above areas that will be less frequently inundated. Riparian trees and shrubs will be installed at a density of 350 stems per acre. Before permanent vegetation is planted, a temporary herbaceous seed mix will be applied in areas disturbed by grading for temporary stabilization. The application of all seeding mixtures and planting of trees and shrubs will be conducted according to the planting plan specifications found in the 100% design plan set.

4. Impacts to Natural Resources

Installation of instream structures and channel modification will require in-stream work. Efforts will be made to minimize instream turbity by isolating work areas through the installation of temporary bypass channels. Methods vary based on type of structure being installed.

5. Monitoring

The New York State Department of Environmental Conservation (DEC) will do a fisheries inventory before project construction and then monitor the site periodically after restoration work has been completed.

III. Literature Cited

Starr, R. and W. Harman. (2016). Function-based Stream Restoration Project Process Guidelines. U.S. Fish and Wildlife Service – Chesapeake Bay Field Office. Annapolis, Maryland. CBFO-S16-03.

Rosgen, D. (2018). The Natural Channel Design Approach to River Restoration. Unpublished course material, Wildland Hydrology, 11210 N. County Road 19, Fort Collins, CO 80524

Mill Creek Streambank Stabilization Project
Town of Richmond, Ontario County NY

Figure 1. 7/6/16 View of Mill Creek streambank erosion facing upstream (southeast); eroded area is approximately 20ft in height at easternmost point. The Sandy Park Nature trail runs parallel to the stream, with an earthen berm currently blocking pedestrians from walking too close to eroded bank.

Figure 2. 7/20/18 View of Mill Creek streambank erosion facing upstream (southeast). Gravel berm placed along edge as seen in Figure 1 has begun to fall into creek bed.

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Figure 3. 7/6/16 View of Mill Creek streambank erosion facing downstream (northwest).

Figure 4. 7/6/16 View of Mill Creek streambank facing south showing 20ft eroding bank.

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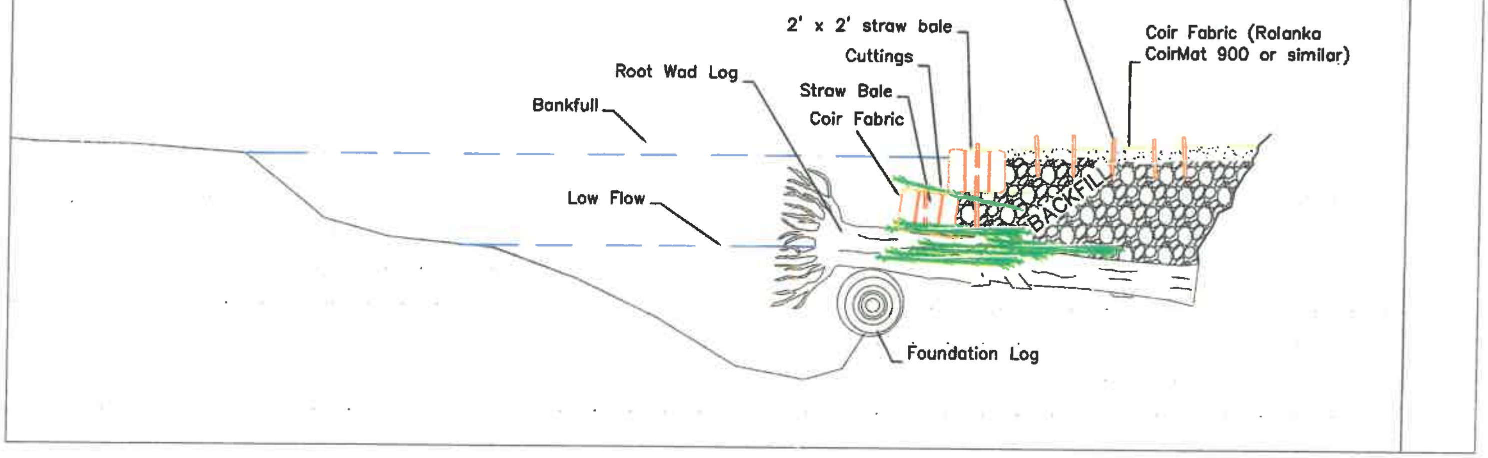
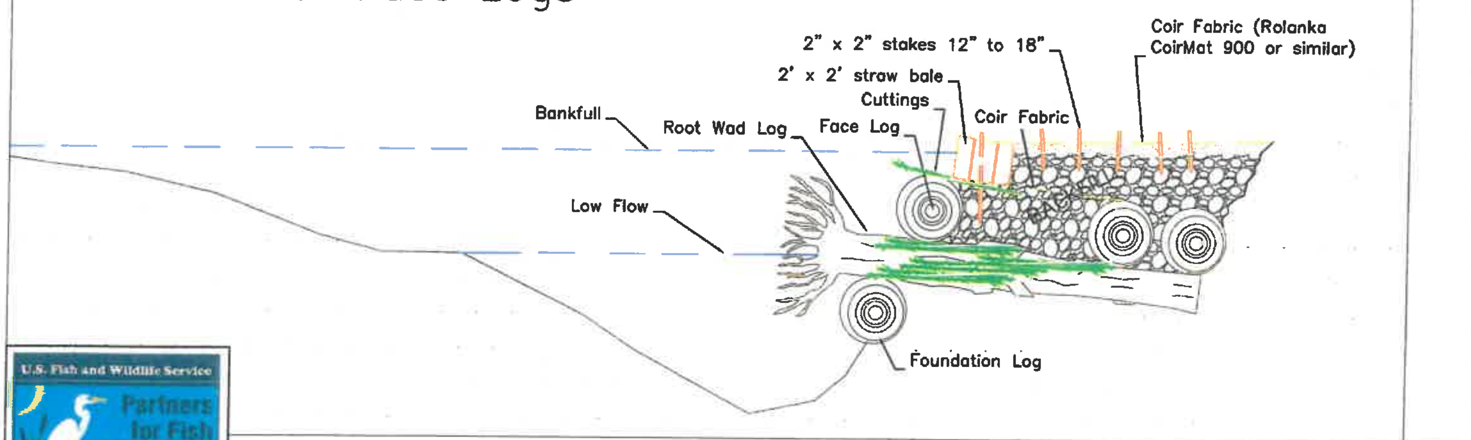
Figure 5. 7/6/16 View of Mill Creek streambank facing north showing 4-6ft eroding bank.

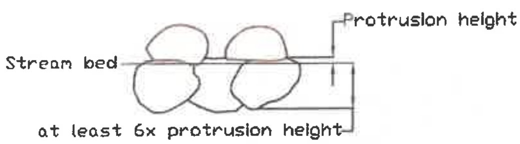
Toewood with Soil lifts



Toewood with Face Logs



Toewood Typical Cross Sections



Minimum rock size would be 3'x3'x3'. Cossvane would require approximately 40 cubic yds of rock.

Footer rocks need to be at least 6 times the protrusion height of the invert rock (i.e. if protusion height is 6" the footers need to be 3' deep).

Rock should be as flat as possible to ensure a tight build.