



**EEP Project Closeout Summary**

<b>Project ID &amp; Status</b>	
Project Name:	Trout Cove Branch and Tributary
EEP ID:	388
County:	Clay
Project Type:	Stream Restoration
Current Status:	5 years of monitoring complete

<b>Project Setting &amp; Classifications</b>	
Basin:	Hiwassee
Physiographic Region:	Blue Ridge & Mountains
Ecoregion:	Southern Crystalline Ridges
USGS Hydro Unit:	06020002090010
NCDWQ Subbasin:	04-05-01
Thermal Regime:	Cold
Trout Water:	No
Designer:	Arcadis G&M
Monitoring:	NCSU, SEC, Equinox

<b>Project Timeline</b>	
Milestone	Date
Construction Completed:	May 2002
As-Built Survey:	N/A
Monitoring Year - 1:	2005
Monitoring Year - 2:	Nov 2006
Monitoring Year - 3:	Nov 2007
Monitoring Year - 4:	Nov 2008
Monitoring Year - 5:	Nov 2009

**Table 1. Project Restoration Components and Mitigation Assets**

Stream	Drainage/Hydrology Component		Restoration Component		Asset Data								
					Asset Map#	Approach	Level	Ratio	Ratio Multip	Feet	SMU	Acres	WMU
	Trout Cove Branch		Segment 1		1	P2/P3	R	1.00	1.00	2928	2928	N/A	N/A
	Tributary		Segment 1		2	P2/P3	R	1.00	1.00	863	863	N/A	N/A
<b>Wetland</b>													
	NONE		N/A		N/A		N/A	N/A	N/A			N/A	N/A

<b>Watershed Data and Characteristics</b>						
P/I/E	Wetland Type	DA (SM)	Stream Order	% Imper	Land Use	303 (d)
P	N/A	0.453	2	<1	Agric.	No
P	N/A	0.094	1	1.3	Agric.	No
	N/A					

**Abbreviation Key:**

Approach:	Level:	Other:
P2 = Priority II Restoration	R= Restoration	SMU= Stream Mitigation Units
P3 = Priority III Restoration		WMU= Wetland Mitigation Units
		P/I/E= Perennial, Intermittent, Ephemeral
		N/A= Item does not apply

**Asset Summary:**

Level	Feet	SMU	Acres	WMU
R	3791	3791	0.0	0.0
E			0.0	0.0
EI	0.0	0.0		
EII	0.0	0.0		
C			0.0	0.0
P	0.0	0.0	0.0	0.0
<b>Total</b>	<b>3791</b>	<b>3791</b>	<b>0.0</b>	<b>0.0</b>

## **Background**

The Trout Cove restoration site is located in southwestern Clay County within the Hiwassee River Basin. The stream was designed and implemented under a North Carolina Clean Water Management Trust Fund (CWMTF) grant in June of 2002. Funds were transferred from the North Carolina Ecosystem Enhancement Program (NCEEP) to the CWMTF in 2004 and the project was first monitored by NCEEP in 2005 to service mitigation needs in the cataloging unit (CU). The project mainstem is 2,928 linear feet, which excludes the four crossings within the reach. The unnamed tributary excluding the crossing totals 863 linear feet, for an overall project total of 3,791 linear feet. Prior to restoration, both Trout Cove Branch and the unnamed tributary had been impacted by past land uses including grazing, mowing, channelization, and other maintenance activities. Stream reaches lacked riparian corridors and exhibited severe bank erosion with stream bank heights ranging from 1 to 6 feet and a mean bank height ratio of 1.8. The streams were classified as unstable B5 stream types progressing towards a G type. Soil loss for Trout Cove Branch was estimated at 170 tons per year prior to restoration.

## **Goals and Objectives**

- Improve stream and buffer conditions to limit lateral inputs of nutrients and sediments to the project reaches;
- Improve stream and buffer conditions to limit the loss of bank derived fines to the receiving watershed;
- Improve instream and riparian habitat cover;
- Improve conditions and opportunity for thermoregulation and oxygenation;
- Improve and maintain hydrologic function to include a floodplain connection appropriate to the stream type and to manage storm flows such that the channel improvements are sustainable;
- Transport bedload sediments in equilibrium;
- Exclude cattle through the fencing of a conservation easement;
- Install a native riparian buffer;
- Design and construct a sustainable step-pool stream reach with a reference appropriate dimension and profile to provide floodplain connection and extent appropriate to the stream type; and
- Install structures designed to provide grade control, bank protection, and habitat.

## Pre-Construction Site Photos

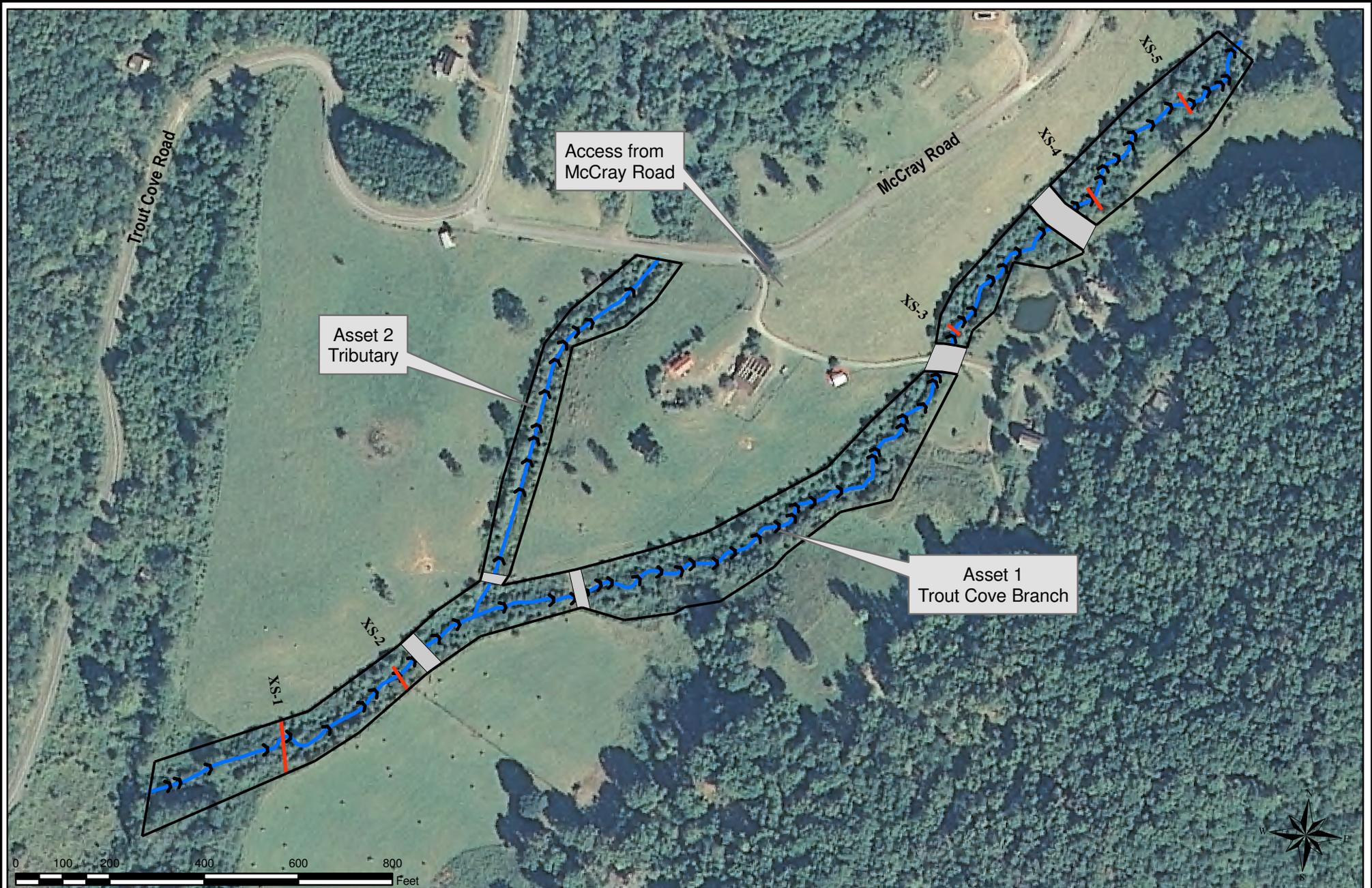


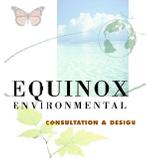
Photograph 3. Trout Cove Branch undercut and eroding bank. Bank height approximately 4 feet



Photograph 4. Trout Cove Branch eroding bank. Bank height approximately 5 feet.

Figure 1: Project Site Map



<p>Prepared for</p> 	<p>Trout Cove Branch &amp; Tributary Restoration Closeout Clay County, North Carolina</p> <p>NCEEP # 388</p> <p>Date September 2010</p>	<ul style="list-style-type: none"> <li> Easement Boundary</li> <li> As-Built Centerline</li> <li> Cross Sections</li> <li> Stream Crossing</li> <li> Structures</li> </ul>		<p>Prepared by</p> 
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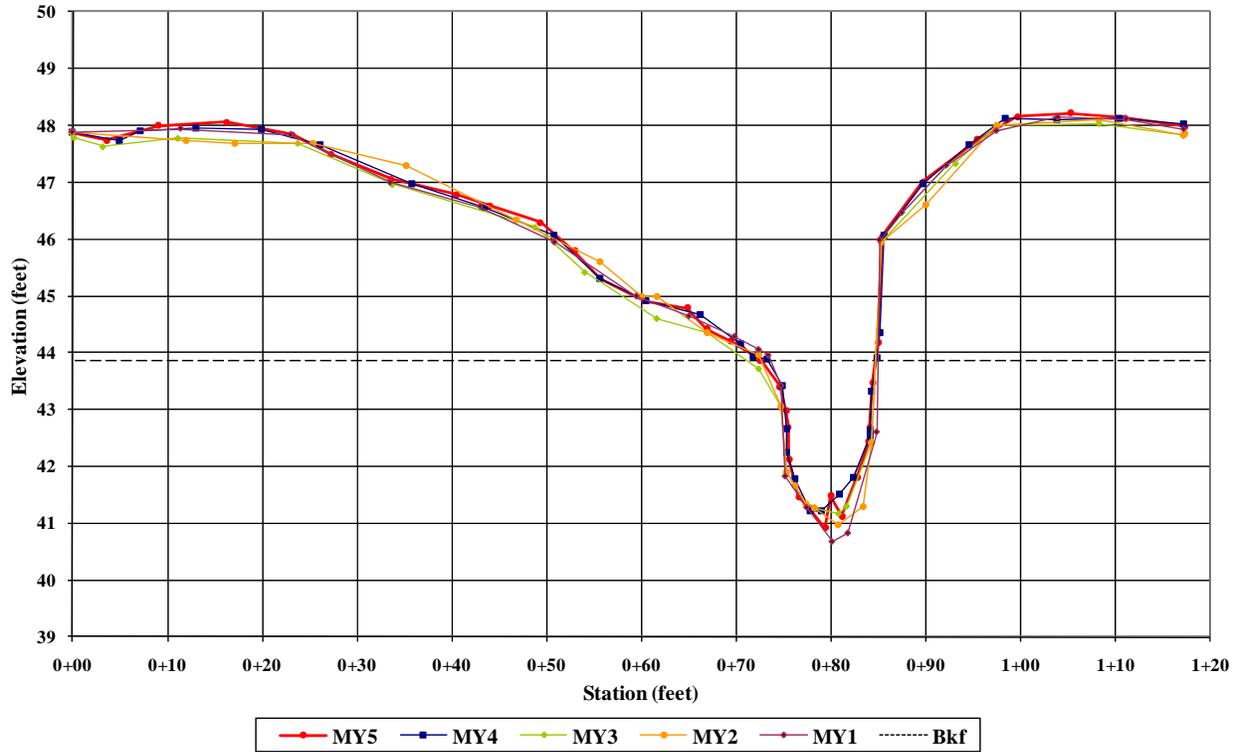
## Channel Stability

**Dimension:** Bankfull cross-sectional area values reported in Table 2 were calculated based on a set elevation established during monitoring year 4 in the proximity of the top of bank. Riffle cross-sectional values reported between monitoring years illustrate that the bed form has remained within the variability and sensitivity tolerances expected. The cross-sections have remained stable with a maximum vertical variation of about 0.3 feet and there was no down cutting indicated in the project profile. Cross-section 5 showed some earlier widening in dimension between monitoring years 1 and 2, but subsequently narrowed and only 4% of the projects banks exhibited instability during the monitoring period.

Table 2. Riffle Cross-Sectional Areas Calculated Based on Monitoring Year 4 Bankfull Elevations

<b>Riffle Cross-Sections</b>	<b>MY 1</b>	<b>MY 2</b>	<b>MY 3</b>	<b>MY 4</b>	<b>MY 5</b>
Cross-Section 3	3.5	4.2	2.7	3.6	3.9
Cross-Section 4	3.2	4.1	5.2	4.2	4.4
Cross-Section 5	1.8	4.0	3.3	3.9	2.7

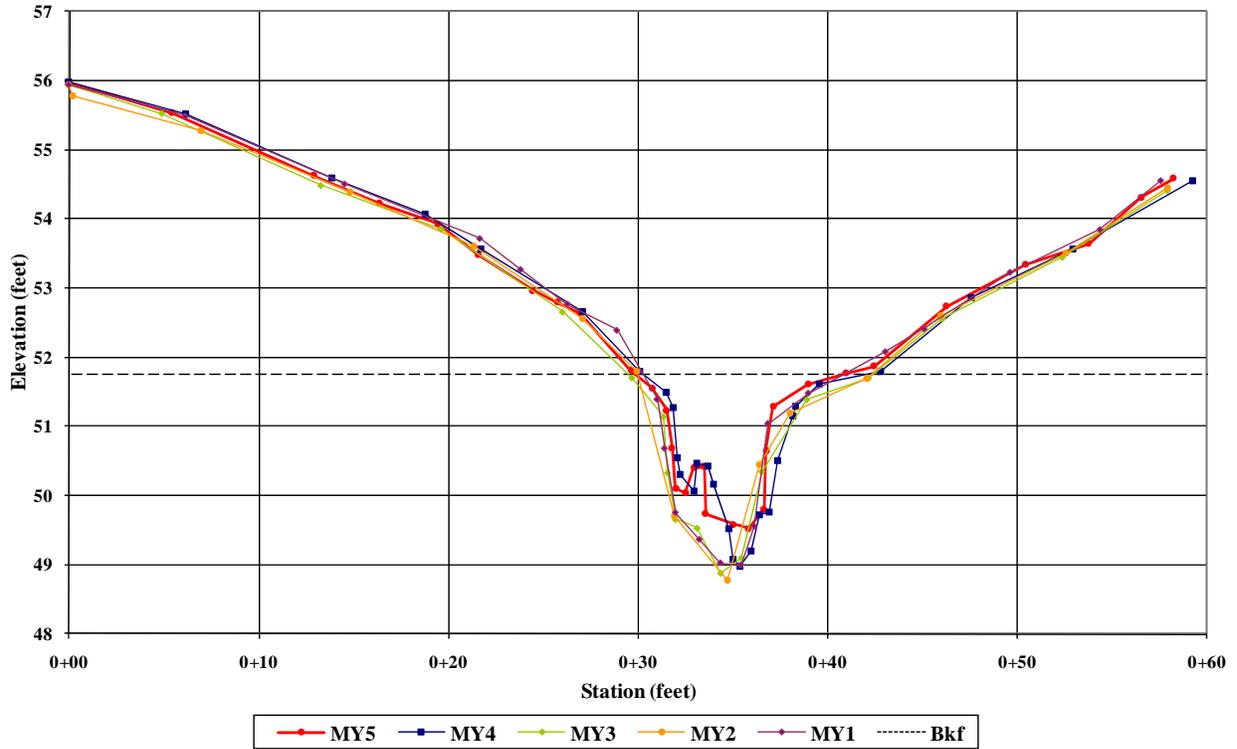
**Trout Cove Branch  
Cross-Section #1 - Pool  
April 9, 2009**



**Trout Cove Branch – Cross Section #1 – Monitoring Year 5**



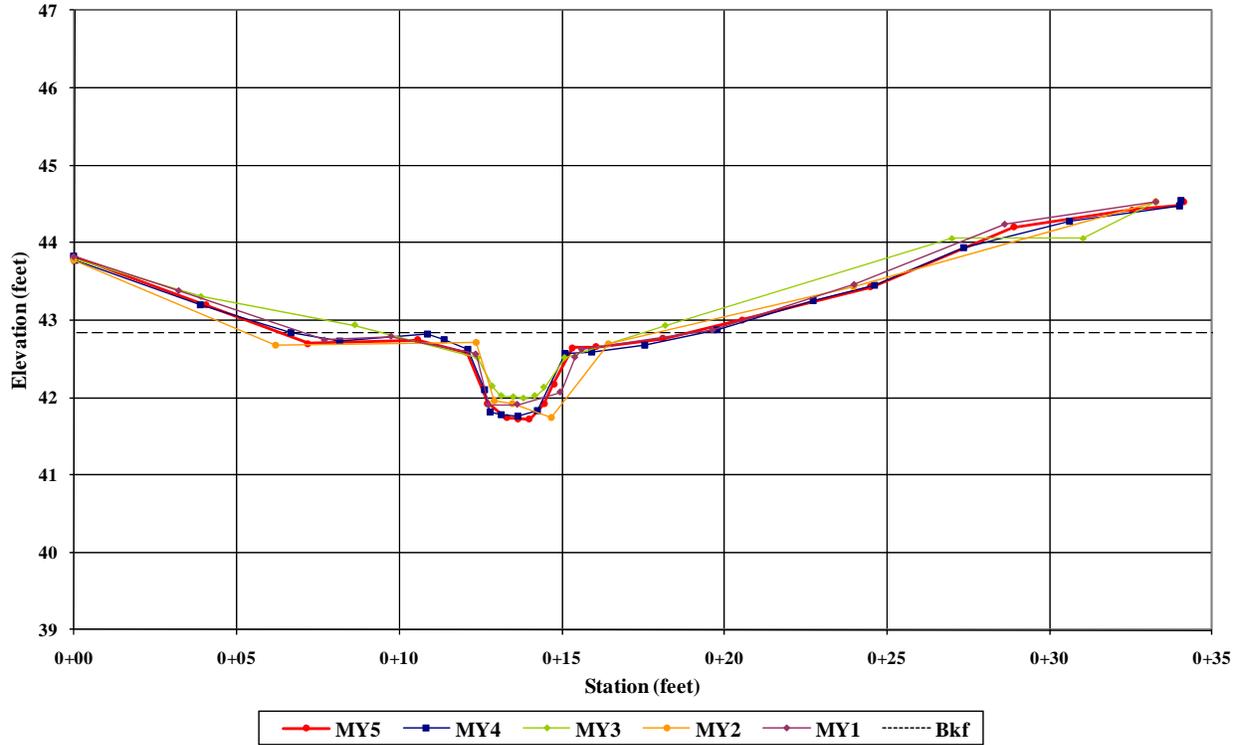
**Trout Cove Branch  
Cross-Section #2 - Pool  
April 9, 2009**



**Trout Cove Branch – Cross Section #2 – Monitoring Year 5**



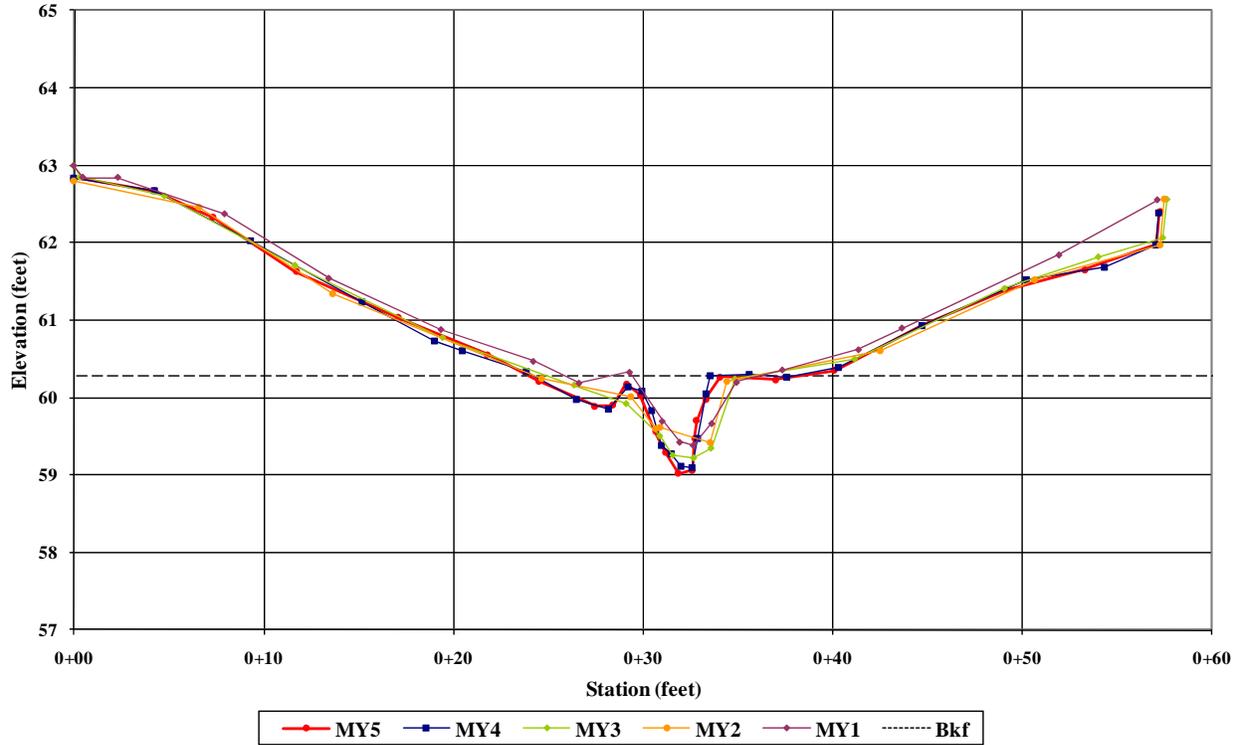
**Trout Cove Branch  
Cross-Section #3 - Riffle  
April 8, 2009**



**Trout Cove Branch – Cross Section #3 – Monitoring Year 5**



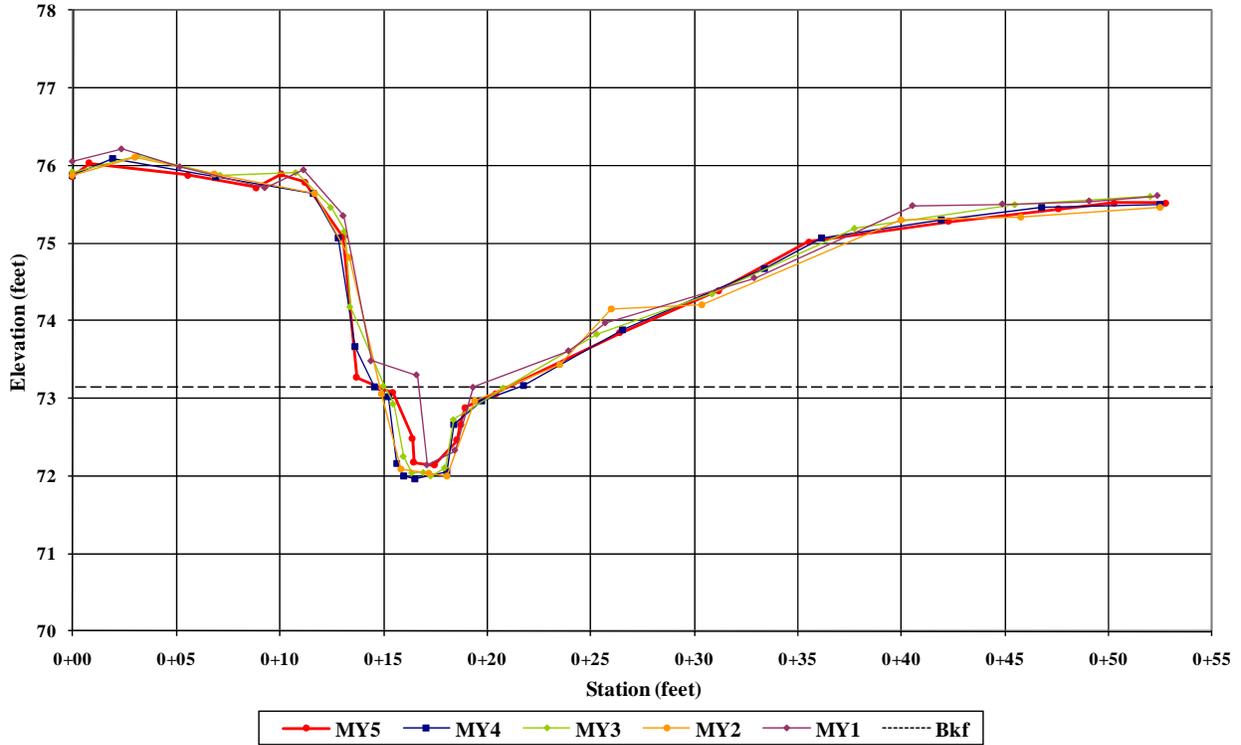
**Trout Cove Branch  
Cross-Section #4 - Riffle  
April 8, 2009**



**Trout Cove Branch – Cross Section #4 – Monitoring Year 5**



Trout Cove Branch  
 Cross-Section #5 - Riffle  
 April 8, 2009

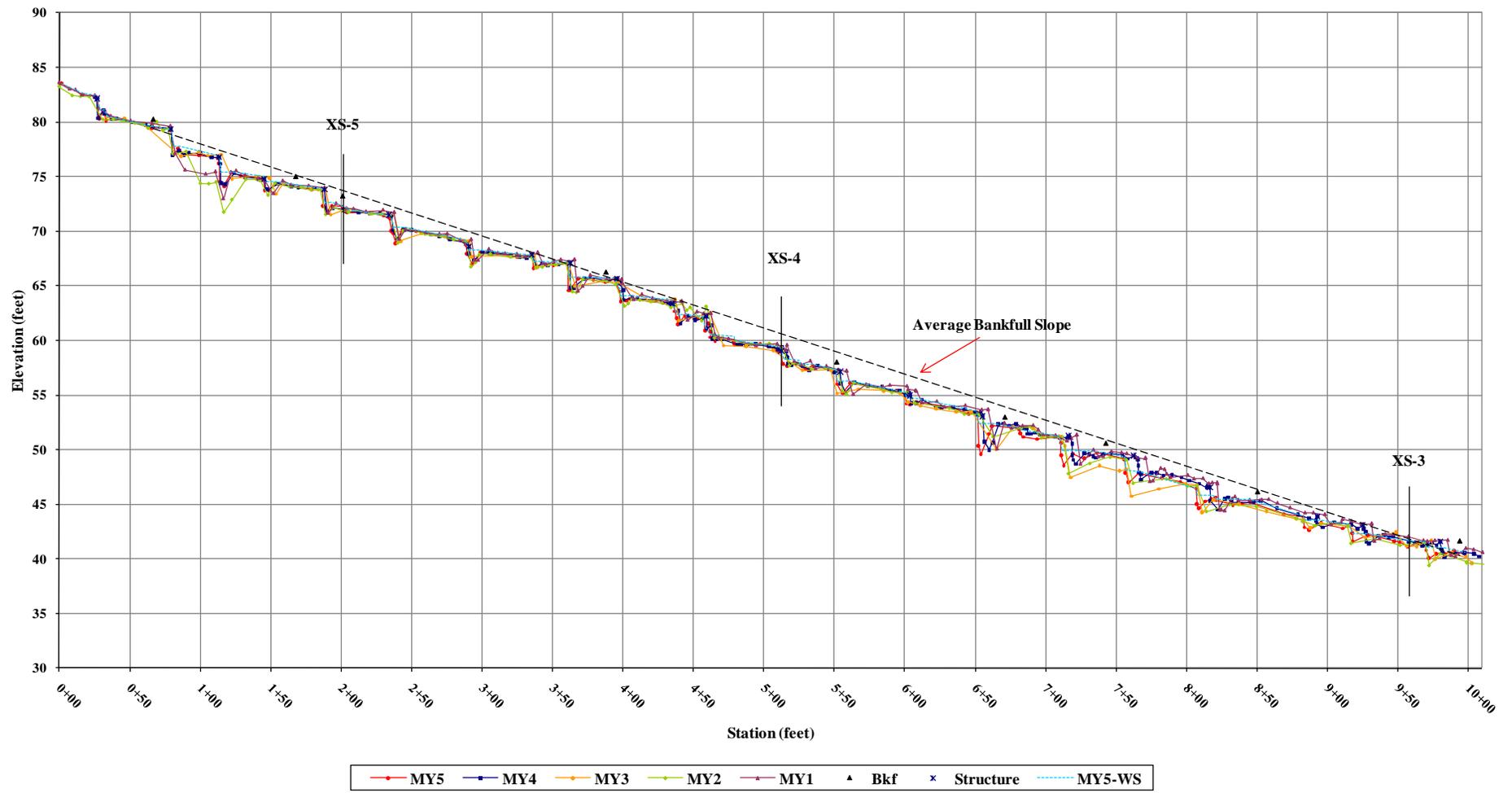


Trout Cove Branch – Cross Section #5 – Monitoring Year 5

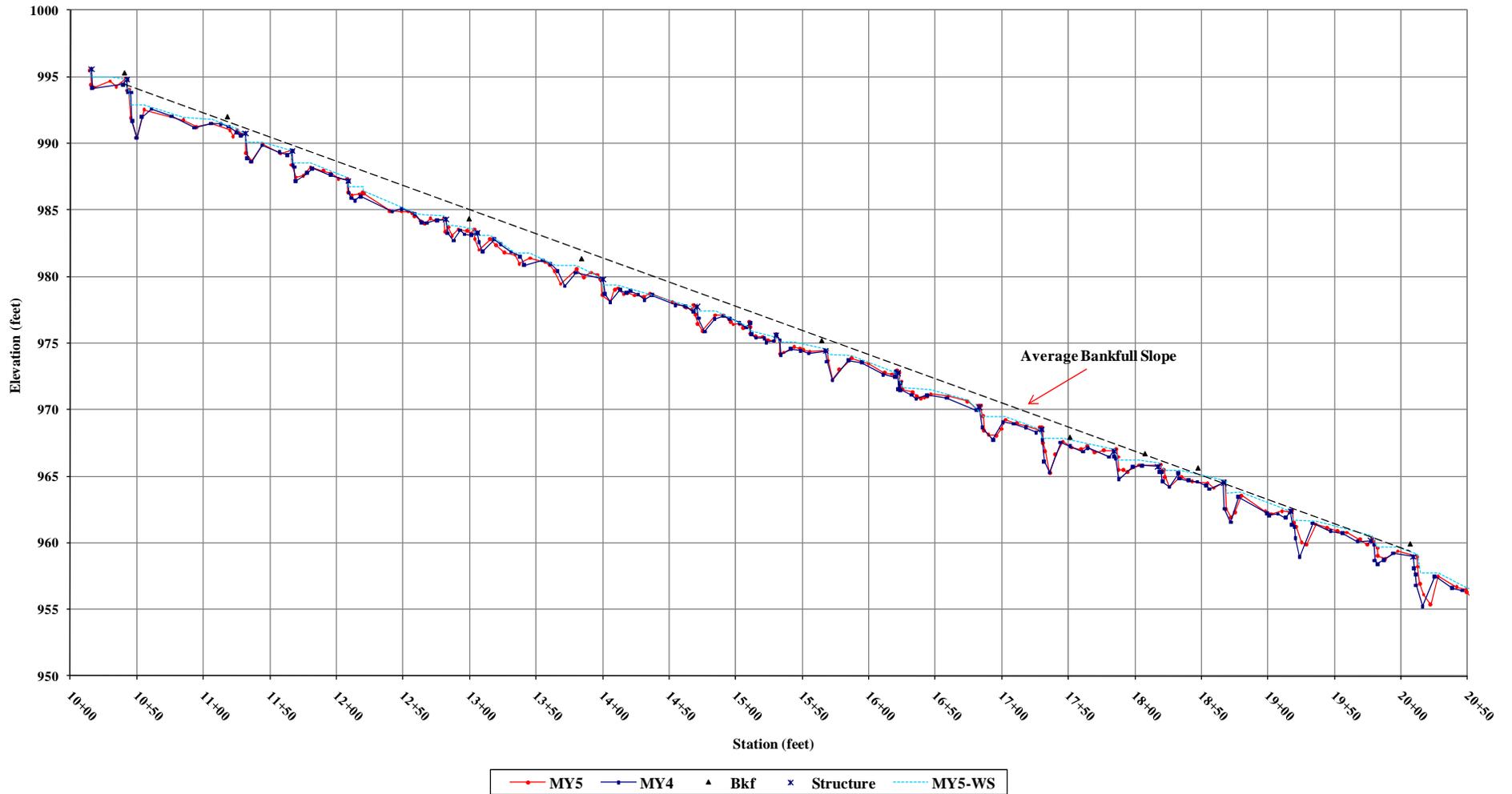


**Profile:** The stream profile has remained stable among monitoring years and indicates no significant or systemic loss of grade. The two main issues observed during monitoring year 5 and as seen in previous years were some pool aggradation and some level of piping through approximately half the structures. All other morphological metrics during monitoring year 5 indicated performance percentages averaging between 92 and 99%. The extent of pool aggradation observed during monitoring years 3 and 4 was primarily attributed to historic low flows preventing pool scour and sediment transport. While stream flows in monitoring year 5 appeared normal and included two bankfull events, pool aggradation was still common and was independent of structure condition. Limited upstream observations indicated poor land use activities which may be importing fines even at normal discharges that are accumulating in portions of some of the pools. Approximately half the structures surveyed in monitoring year 5 had some level of piping, but the visual observations and the profile plots indicate no significant or systemic loss of grade and the number of structures in the profile represents a very high level of grade control redundancy.

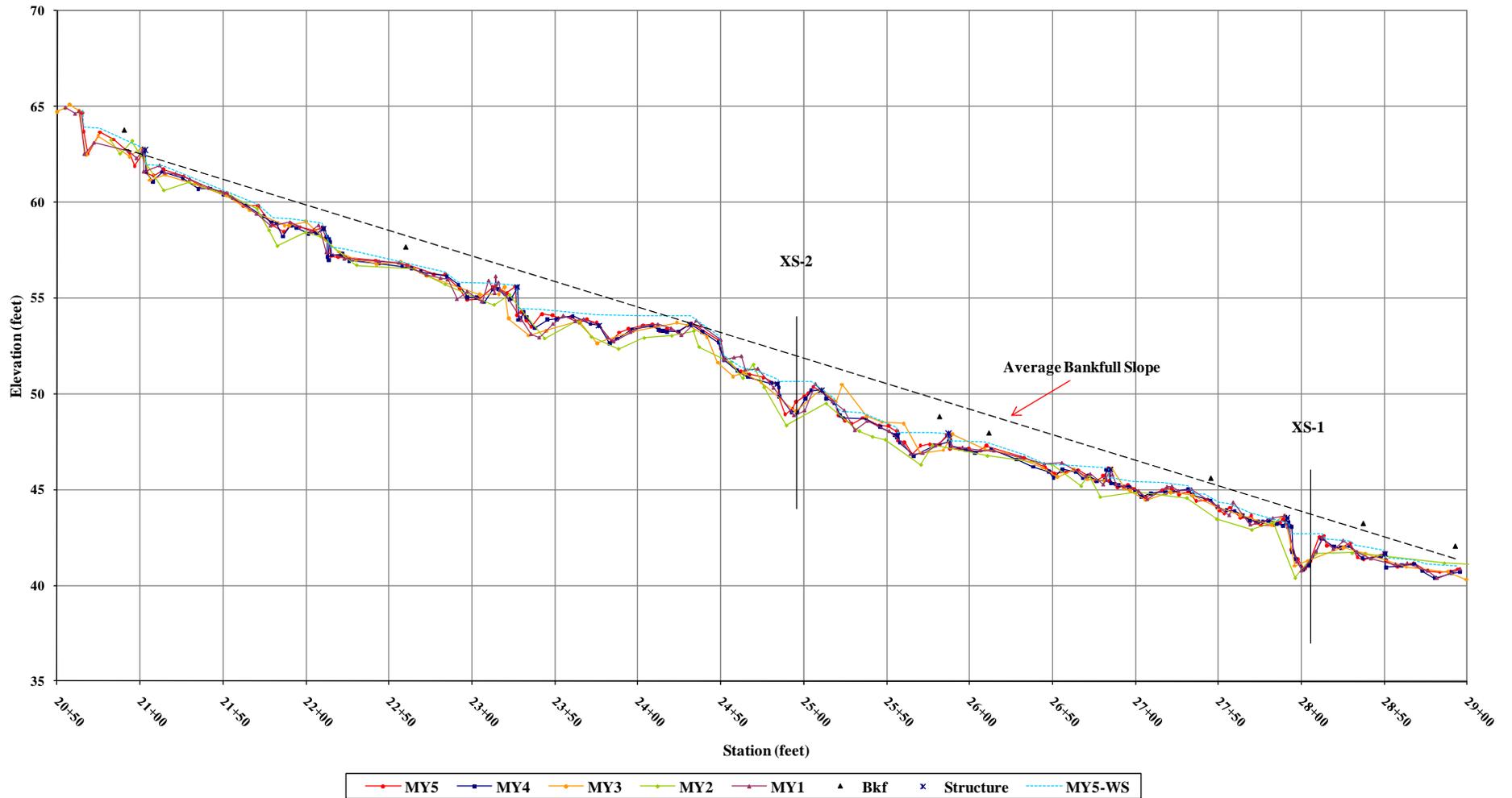
**Trout Cove Branch  
Longitudinal Profile - Upper Reach**



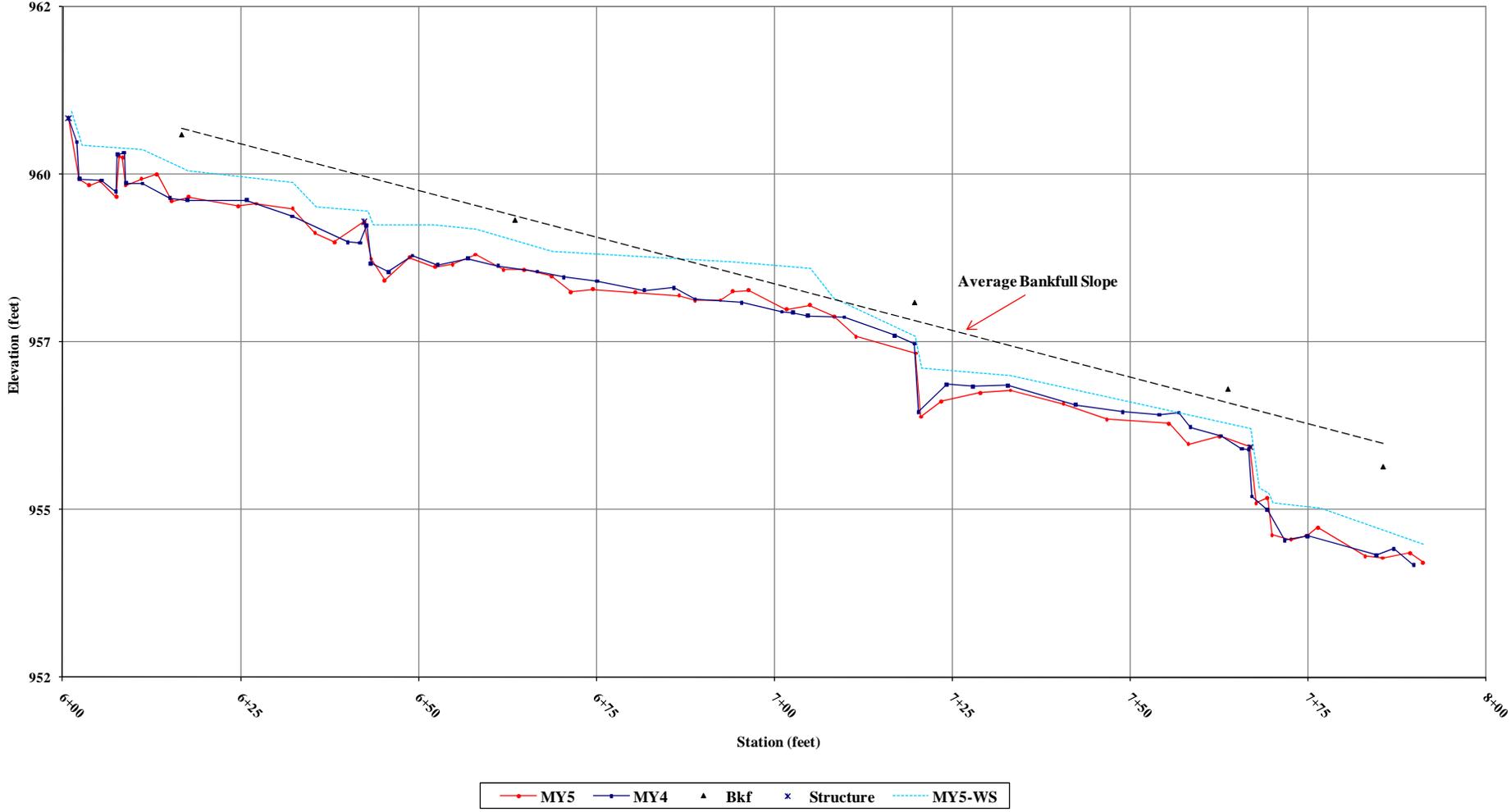
Trout Cove Branch  
Longitudinal Profile - Middle Reach



Trout Cove Branch  
 Longitudinal Profile - Lower Reach



**Trout Cove Branch  
Longitudinal Profile - Tributary Reach**



**Overbank Events:** Based on visual observations and crest gauge documentation, the Trout Cove Branch project has conveyed bankfull events in 2006, 2007, 2008, and 2009 (Table 3).

<b>Table 3. Verification of Bankfull Events Trout Cove Branch / Project No. 388</b>		
<b>Date of Data Collection</b>	<b>Date of Occurrence</b>	<b>Method</b>
2006	Unknown	Wrack lines, stained vegetation, displaced/flattened vegetation, and sediment deposition
2007	Unknown	Wrack lines, stained vegetation, displaced/flattened vegetation, and sediment deposition
6/27/08	Unknown	Crest gauge & wrack lines
4/9/09	Unknown	Crest gauge & wrack lines
11/6/09	Unknown	Crest gauge & wrack lines

**Stem Counts:** The monitoring year five vegetation plot data indicate that the project meets the established criterion for planted stem density, which is a minimum survival of 260 planted stems per acre at the end of the five year monitoring period. Average stem density for planted stems in monitoring year 5 was approximately 428 stems per acre. However, when the monitoring year 5 planted and natural stems were combined, the average stem density was 890 stems per acre, which is well above the minimum established criterion. Problems with vegetation consisted of small isolated bare bench and floodplain areas as well as approximately 10 currently isolated patches of high threat invasive plant species that span the project extent. An initial invasive treatment occurred in the summer of 2010 with a follow up treatment planned for the spring of 2011.





Vegetation Plot #1. Monitoring Year 5



Vegetation Plot #2. Monitoring Year 5



Vegetation Plot #3. Monitoring Year 5



Vegetation Plot #4. Monitoring Year 5



Vegetation Plot #5. Monitoring Year 5



Vegetation Plot #6. Monitoring Year 5



Vegetation Plot #7. Monitoring Year 5

**Project Goals, Outcomes and Conclusions:** The Trout Cove stream restoration project is meeting the monitoring criteria of geomorphic stability and vegetative success over the 5 year monitoring period. This project is successful and is submitted for regulatory closure.