Logan Creek Stream Restoration Project
Year 3 Monitoring Report

Jackson County, North Carolina

NCDMS Project ID No. 92515; Contract No. D06046-A

Savannah River Basin: 03060101-010020

DWR # 20080879 Ver. 2, SAW ID: 2008-01711

Project Info:	Monitoring Year: 3 of 5 Year of Data Collection: 2017 Year of Completed Construction: May 2015 Submission Date: December 2017
Submitted To:	NCDEQ – Division of Mitigation Services 5 Ravenscroft Drive, Suite 102 Asheville, NC 28801 NCDEQ Contract ID No. D06046-A

Michael Baker
INTERNATIONAL

Innovation Done Right...We Make a Difference

December 11, 2017

NCDENR - Division of Mitigation Services (DMS)
Attn: Mr. Paul Wiesner, Western Project Management Supervisor
5 Ravenscroft Drive, Suite 102
Asheville, NC 28801

Subject: Response to DMS comments on the Year 3 Monitoring Report Review for the Logan Creek Stream Restoration Project; Savannah River Basin - CU# 03060101; Jackson County, North Carolina; NCDMS Project # 92515; Contract No. D06046-A

Dear Mr. Wiesner,

Please find enclosed the final Logan Creek Year 3 Monitoring Report. We have addressed the comments that you submitted on the draft report and our responses to your comments are the following:

- The 2013 project mitigation plan proposed 4,249 SMUs and did not include UT 7 and UT8. The As-Built Baseline (MY0) report indicates 4,329 SMUs and the MY3 report indicates 4,327 SMUs. The IRT did not review the 2013 mitigation plan and most of the IRT members have not been to the project site. During MY2, DWR staff noted concerns about adding UT7 and UT8 after the mitigation plan stage. DMS recommends scheduling an IRT site visit to see the site in 2018 (MY4) and resolve any potential credit issues prior to project closeout. DMS can help facilitate this IRT site visit.
  The footage and SMUs for the As-built-MY0 and MY1 report were the same based on the post construction survey when we determined the actual footage. Last year in the MY2 report, we reduced these numbers slightly because the landowner installed a foot-bridge crossing that had been removed during construction, so MY2 and MY3 have consistent figures. We agree that a meeting with the IRT early in 2018 could be helpful in addressing any concerns that they may have about this project.

- Please be sure to describe the 2018 structure repair efforts in the MY4/ 2018 monitoring report.
  We will describe any repairs made in 2018 in the MY4 report.

- Please be sure the MY3 invoice for contract D06046-A matches the credits presented in the final MY3 report (4,327 SMUs).
  The invoice for Task 9 is based on 4,327 SMUs and the total fee requested reflects a credit applied for over-payment from previous years due to those invoices being based on a larger contract value.

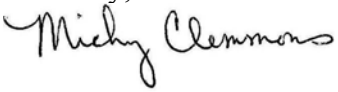
- Table 1 – Asterisks are shown for Logan Creek (Reach 1) and UT 5; however, no foot notes are included in the table. Please update the table with the appropriate footnotes.
  There should be no footnotes for this year and the asterisks were removed.

- Table 2 – The second footnote has three asterisks but should only have two based on the "End of Construction" row.
  The additional asterisk was removed.

- Table 10 – The MY3 column is mislabeled for UT6 & UT8. Please update accordingly.
  The mislabeled headers have been changed.

If you have any questions or find any issues that need to be addressed, please contact me directly at (828) 412-6100. I am submitting an invoice for this task to Ms. Debby Davis in the Raleigh DMS Office and will be providing you an email copy.

Sincerely,



Micky Clemmons,
Project Manager
Michael Baker Engineering, Inc.

Logan Creek Stream Restoration Project
Year 3 Monitoring Report

Jackson County, North Carolina

NCDMS Project ID Number – 92515

Report Prepared and Submitted by Michael Baker Engineering, Inc.
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NC Professional Engineering License # F-1084

TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY 3
2.0 METHODOLOGY 4
2.1 Vegetation Assessment 4
2.2 Stream Assessment 5
2.2.1 Morphologic Parameters and Channel Stability 5
2.2.2 Hydrology 6
2.2.3 Photographic Documentation 6
3.0 REFERENCES 7

APPENDICES

Appendix A *Project Vicinity Map and Background Tables*
Figure 1 Project Vicinity Map and Directions
Figure 2 Current Conditions Plan View – Overview Map, MY3
Figure 2A CCPV MY3, North Area
Figure 2B CCPV MY3, Middle Area
Figure 2C CCPV MY3, South Area

Appendix B *General Project Tables*
Table 1 Project Components and Mitigation Credits
Figure 3 Project Asset Map
Table 2 Project Activity and Reporting History
Table 3 Project Contacts
Table 4 Project Attributes

Appendix C *Vegetation Assessment Data*
Table 5 Vegetation Plot Mitigation Success Summary
Table 6 CVS Vegetation Metadata
Table 7 Stem Count Arranged by Plot and Species
Figure 4 Vegetation Monitoring Plot Photos

Appendix D *Stream Assessment Data*
Figure 5 Stream Photos by Channel and Station
Table 8 Visual Morphological Stability Assessment
Table 9 Verification of Bankfull Events
Figure 6 Cross-Sections with Annual Overlays
Figure 7 Longitudinal Profiles with Annual Overlays
Figure 8 Pebble Count Plots with Annual Overlays
Table 10 MY3 Stream Summary
Table 11 Morphology and Hydraulic Monitoring Summary

1.0 EXECUTIVE SUMMARY

Michael Baker Engineering, Inc. (Baker) restored, enhanced or preserved 5,110 linear feet (LF) of perennial stream channel along Logan Creek and eight unnamed tributaries (UT1,UT2, UT3, UT4, UT5, UT6, UT7 and UT8) in Jackson County, NC (Appendix A). The nearest town, Cashiers, is approximately five miles west of the Logan Creek Project site. The site lies in the Savannah River Basin within the Targeted Local Watershed 03060101-010020 (Horsepasture River) and within the North Carolina Division of Water Resources (NCDWR) sub-basin formerly known as 03-06-01-01 (Keowee River Subbasin). The Horsepasture River is a National Wild and Scenic River and a state-designated Natural and Scenic River. The project involved the restoration, enhancement, and preservation of a stable channel and a Montane Alluvial/Montane Oak-Hickory Forest system (NCWAM 2010, Schafale and Weakley 1990) from impairments within the project area due to past agricultural conversion including orchard development, trout hatchery development, mink farming and more recently single-family home development.

The project goals directly address stressors identified in the Savannah River Basin Restoration Priority Plan (RBRP) (DMS 2001 and updated 2008) such as habitat degradation, inadequate riparian buffer cover, channel modification, and excess nutrient and sediment loading. The primary restoration goals, as outlined in the approved mitigation plan, are described below:

- Create geomorphically stable stream channels within the Logan Creek project site.
- Protect stable areas as well as mature trees and other desirable vegetation.
- Improve water quality within the Logan Creek project area through reduction of bank erosion, improved nutrient and sediment removal, and stabilization of streambanks.
- Improve aquatic and terrestrial habitat.

To accomplish these goals, the following actions were taken:

- Restore the existing eroding or over-wide stream reaches by creating a stable channel that has access to its floodplain.
- Improve in-stream habitat by providing a more diverse bedform with riffles and pools, creating deeper pools, providing woody debris for habitat, moving sand deposits through the reach and reducing bank erosion.
- Establish native stream bank and floodplain vegetation to increase storm water runoff filtering capacity, improve bank stability, provide shading to decrease water temperature, provide cover, improve wildlife habitat and protect this area with a permanent conservation easement.
- Improve terrestrial habitat by increasing the density of tree species that root deeply, by thinning the thick stands of rhododendron within the easement area and planting a more diverse native plant community.

During Monitoring Year 3 (MY3), our monitoring activities indicated that the planted acreage was functioning well with most banks, benches and floodplain areas developing a diverse herbaceous community and having good growth of planted trees. There were no Vegetative Problem Areas identified during 2017. The Encroachment Area (EA-1) that was noted in 2016 is still mowed as a part of the nature trail, although no new trees in Vegetation Plot 3 have been affected since MY2. Despite the impacts to the trees in the plot, Veg Plot 3 still meets minimum success criteria for MY3.

The six channel problem areas noted in the MY2 report did not show further erosion and degradation during 2017. The sites were stabilized by sloping the banks, seeding, mulching, installing matting, and planting live stakes. These areas are now stable and if they remain stable through 2018 they will be removed from the monitoring report in MY4. Updated photos of these areas, labeled 2-1 through 2-6 on the MY3 CCPV, can be found in Appendix D.

There were two additional areas of erosion and three instances of piping log structures noted in MY3 (labeled 3-1 through 3-5). The erosion areas will be monitored in the coming year to see if they stabilize naturally, and the piping structures will be repaired.

As noted in the Baseline report, eight (8) vegetation monitoring plots were installed at this site, with seven (7) being installed along the restoration reach (Logan Creek, Reach 1) and one (1) being installed along the enhancement reach (Logan Creek, Reach 2). The location of these vegetation monitoring plots can be seen on Figures 2A-C. The average density of total planted stems following the MY3 growing season is 683 stems per acre (SPA). The average density of volunteer trees across all 8 vegetation plots was 304 SPA.

Stream geomorphological stability and performance during MY3 was assessed by surveying thirteen (13) cross-sections (8 on Logan Creek, 2 on UT3, 2 on UT6 and 1 on UT8) and a profile of Logan Creek, UT3, UT6 and UT8, evaluating the bed particle size with 3 riffle pebble counts and by observation and replicating channel location photographs. An additional cross-section was added on UT8 during MY2 surveying so that we have cross-sections on all restored tributaries. Cross-sections of all the channels indicated that there was very little change in the cross-sections during MY3. The particle size observed in MY3 pebble counts increased slightly in two of the pebble counts and remained the same in the third. No observed changes indicate any instability. The Visual Morphological Stability Assessment indicates that the Site is stable and performing well. All but three structures (CPA 3-1, 3-3, and 3-5), are functioning as designed during MY3. These structures are all instances of fabric tearing and allowing water and sediment to wash under the log structure over time (Table 14 in e-file data). These will be repaired in 2018. Overall, channel morphology is responding as designed and meeting project goals.

Summary information/data related to the Site and statistics related to performance of various project and monitoring elements can be found in the tables and figures in the report Appendices. Narrative background and supporting information formerly found in these reports can be found in the Baseline Monitoring Report and in the Mitigation Plan available on the NCDMS website. All raw data supporting the tables and figures in the appendices are available from NCDMS upon request.

2.0 METHODOLOGY

The monitoring plan for the Site includes criteria to evaluate the success of the stream and vegetation components of the project. The methodology and report template used to evaluate these components adheres to the NCDMS monitoring guidance document dated December 1, 2009 and other mitigation guidance (NCDMS 2009 and USACE 2003), which will continue to serve as the template for subsequent monitoring years. The specific locations of monitoring features: vegetation plots, permanent cross-sections and profiles, and the crest gauge location, are shown on the Current Conditions Plan View (CCPV) sheets found in Appendix A.

Vegetation monitoring plots, pebble counts and site photo points were monitored in September 2017. Site surveys for channel cross-sections, photos and profiles were conducted in October 2017.

2.1 Vegetation Assessment

To determine if success criteria are achieved, vegetation monitoring quadrants (veg plots) were installed and are monitored in accordance with the CVS-NCDMS Protocol for Recording Vegetation, Version 4.1 (CVS

2007 and Lee, Peet, Roberts and Wentworth 2007). The vegetation monitoring plots are a minimum of two percent of the planted portion of the Site with eight plots established randomly within the planted riparian buffer, per CVS Monitoring Level 2. No veg plots were established within the undisturbed forested areas along the northern part of the project or within the undisturbed forested areas along Reach II of Logan Creek and UT5. A small area was disturbed within this enhancement reach so that structures and channel repairs could be made during construction. Veg Plot 1 is located in this area where bare root trees and herbaceous vegetation were planted. The sizes of individual quadrants are 100 square meters for woody species and 1 square meter for herbaceous vegetation. Herbaceous vegetation quadrants were established in one corner of the larger woody vegetation plots and monitored by comparative photographs taken each year.

Trees surviving within vegetation monitoring plots were visually accessed during year three monitoring. We found that all vegetation was in good condition. All plots indicated that most trees were growing and in good to excellent condition and herbaceous vegetation was well established and growing well. The average density of total planted stems following the MY3 growing season is 683 stems per acre (SPA) with a range from 405 SPA to 931 SPA. The average density of volunteer trees was 304 SPA and the density ranged from 0 to 1,012 SPA. The overall SPA including both planted and volunteer stems was 986. With an average planted density of 683 stems per acre, the Site has met the minimum interim success criteria of 320 stems per acre by the end of MY3, and is on track to meet the final success criteria of 260 stems per acre by the end of MY5.

The invasive multiflora rose that was noted in MY2 was treated throughout the site in July 2017. As of MY3 monitoring (October 2017), the multiflora rose is largely under control across the site. Any new growth that is noted in the future will be treated as needed. No other areas of concern regarding the existing vegetation were noted along Logan Creek or any of the tributaries. Year 3 vegetation assessment information is provided in Appendix C.

2.2 Stream Assessment

The approach for the Logan Creek Site includes the restoration of channels to a stable morphology that allows for the transport of water and sediment through the Site and allows stream flows larger than bankfull flows to spread onto the floodplain. Stream monitoring efforts focus on visual observations, a crest gauge to document bankfull flooding events, surveying established stream cross-sections and channel profiles to assess channel stability and pebble counts to assess if proper sediment transport is taking place.

Stream survey data was collected to a minimum of Class C Vertical and Class A Horizontal Accuracy using Leica TS06 Total Station and was georeferenced to the NAD83 State Plane Coordinate System, FIPS3200 in US Survey Feet, which was derived from the As-built Survey.

2.2.1 Morphologic Parameters and Channel Stability

Cross-sections were classified using the Rosgen Stream Classification System (Rosgen 1994) and all cross-sections were evaluated to determine if they meet design expectations. Cross-sections were also compared to cross-section plots from previous monitoring years to evaluate changes in the cross sections. Morphological survey data is presented in Appendix D.

A longitudinal profile was surveyed for the entire length of Logan Creek, UT3 and UT6, and UT8 to document changes during year 3 of monitoring. The survey was tied to a permanent benchmark and measurements included thalweg, water surface (where flow was present), and top of low bank. Each of these measurements was taken at the head of each feature (e.g., riffle, pool) and at the maximum pool depth.

Stream geomorphological stability and performance during MY3 was assessed by surveying thirteen (13) cross-sections (8 on Logan Creek, 2 on UT3, 2 on UT6 and 1 on UT8) and a profile of these channels as described above. The bed particle size was evaluated with three riffle pebble counts and by observation and replicating channel location photographs. Cross-sections and profiles of all the channels indicated that there was very little change in the channel during MY3. Many of the surveyed

pools deepened slightly since MY2 and pools throughout the site seem to have returned to their design depth after the drought conditions of 2016. The Visual Morphological Stability Assessment indicates that the Site is stable and performing at 98 to 100 percent for all parameters. Three structures (two on Logan Creek Reach 1, one on UT8) were piping during MY3 (CPA 3-1, CPA 3-3, CPA 3-5). The fabric that should have sealed the upstream side of these structures had torn allowing water under the structure instead of over it. This issue will be repaired prior to the next growing season (Table 14 in e-file data). Overall, channel morphology is responding as designed and meeting project goals.

Pebble count data for MY3 indicates a shift to larger particle sizes as compared to the MY0 data. The channel had a mean D50 of 16.5 mm during baseline sampling, 36.9 mm during MY1, 22.2 mm in MY2, and 26.8 mm in MY3. This represents a general coarsening of particle size since baseline sampling.

2.2.2 Hydrology

A crest gauge was installed on the floodplain at the bankfull elevation along the right top of bank on Logan Creek at approximate Station 30+00. There were two major bankfull events recorded on the crest gauge during MY3. The crest gauge indicated a water depth on the floodplain of 2.17 feet during the first event and 1.45 feet during the second event. Rainfall data from the nearest CRONOS weather station (SASS) in Pickens, SC indicates that the first storm may have occurred on October 8, 2017 and the second event occurred on October 23, 2017. There were also physical indications of this flooding, such as large debris and wrack lines that indicated a flooding level that extended well beyond the top of bank (see photos with Table 9). Crest gauge readings are presented in Appendix D.

2.2.3 Photographic Documentation

Reference transects were photographed at each permanent cross-section. A survey tape is normally centered in the photograph when the tape is used to identify the transect. The water line was located in the lower area of the frame, and as much of the bank as possible included in each photograph. Photographs were taken at specific photo points established along each channel during Year 3 monitoring. Photographs from these points are replicated each year and used to document changes along the channel. Points were selected to include grade control structures as well as other structural components installed during construction. Annual photographs from the established photo points are shown in Appendix D.

2.2.4 Project Problem Areas

Project problem areas fall into three types: Vegetation Problem Areas (VPA), Encroachment Areas (EA), and Channel Problem Areas (CPA). All observed problem areas are shown on the CCPV maps. There were no VPAs identified during MY3. Vegetation was well established across the entire project site.

During MY3, three structures (CPA 3-1, 3-3, and 3-5) were noted that were experiencing piping. These structures are all instances of fabric tearing and allowing water and sediment to wash under the log structure over time. These structures will be repaired in 2018.

There were also two additional areas of erosion noted in MY3 (labeled CPA 3-2 and CPA 3-4). These areas both have sufficient vegetative cover, and will be monitored in the coming year to see if they stabilize naturally.

The Encroachment Area (EA-1) that was noted in 2016 is still regularly being mowed through Vegetation Plot 3, although no new trees in the plot have been affected since MY2. The mowed path through the plot is still approximately 10-12 feet wide. This issue will be addressed again with Lonesome Valley maintenance staff. Despite the impacts to the trees in the plot, Veg Plot 3 still meets minimum success criteria for MY3.

All issues discussed above reference the CCPV mapping and the Stream Problem Area table included in Appendix D and the e-File data with associated photos.

3.0 REFERENCES

Carolina Vegetation Survey (CVS) and NC Ecosystem Enhancement Program (NCEEP). 2007. CVS-NCEEP Data Entry Tool v. 2.3.1. University of North Carolina, Raleigh, NC.

Lee, M., Peet R., Roberts, S., Wentworth, T. 2007. CVS-NCEEP Protocol for Recording Vegetation, Version 4.1.

North Carolina Ecosystem Enhancement Program (NCEEP). 2009. Guidance and Content Requirements for EEP Monitoring Reports Version 1.2.1. December 1, 2009.

Rosgen, D. L. 1994. A Classification of Natural Rivers. Catena 22:169-199.

Schafale, M. P., and A. S. Weakley. 1990. Classification of the natural communities of North Carolina, third approximation. North Carolina Natural Heritage Program. Division of Parks and Recreation, NCDENR. Raleigh, NC.

United States Army Corps of Engineers (USACE). 1987. Corps of Engineers Wetlands Delineation Manual. Technical Report Y-87-1. Environmental Laboratory. US Army Engineer Waterways Experiment Station. Vicksburg, MS.

____. 1997. Corps of Engineers Wetlands Research Program. Technical Note VN-rs-4.1. Environmental Laboratory. U.S. Army Engineer Waterways Experiment Station. Vicksburg, MS.

____. 2005. "Technical Standard for Water-Table Monitoring of Potential Wetland Sites," WRAP Technical Notes Collection (ERDC TN-WRAP-05-2), U.S. Army Engineer Research and Development Center. Vicksburg, MS.

____. 2003. Stream Mitigation Guidelines, April 2003, U.S. Army Corps of Engineers. Wilmington District.

Appendix A

Project Vicinity Map and Background Tables

Includes:

Figure 1. Project Vicinity Map and Directions

Figure 2. Current Condition Plan View (CCPV) – Overview Map, MY3

Figure 2A. CCPV MY3, North Area

Figure 2B. CCPV MY3, Middle Area

Figure 2C. CCPV MY3, South Area

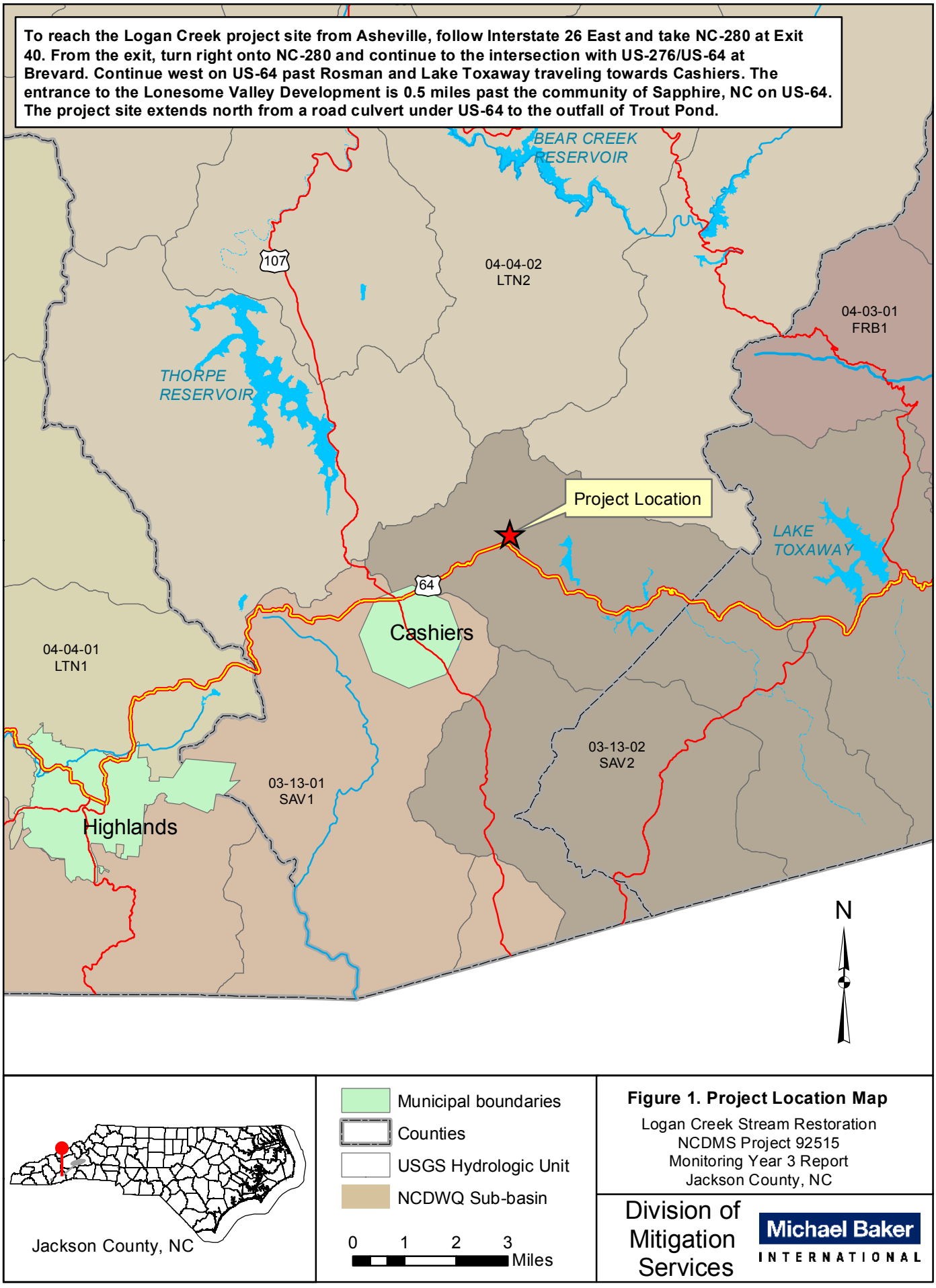

Figure 1. Project Location Map

Logan Creek Stream Restoration
NCDMS Project 92515
Monitoring Year 3 Report
Jackson County, NC

Division of Mitigation Services

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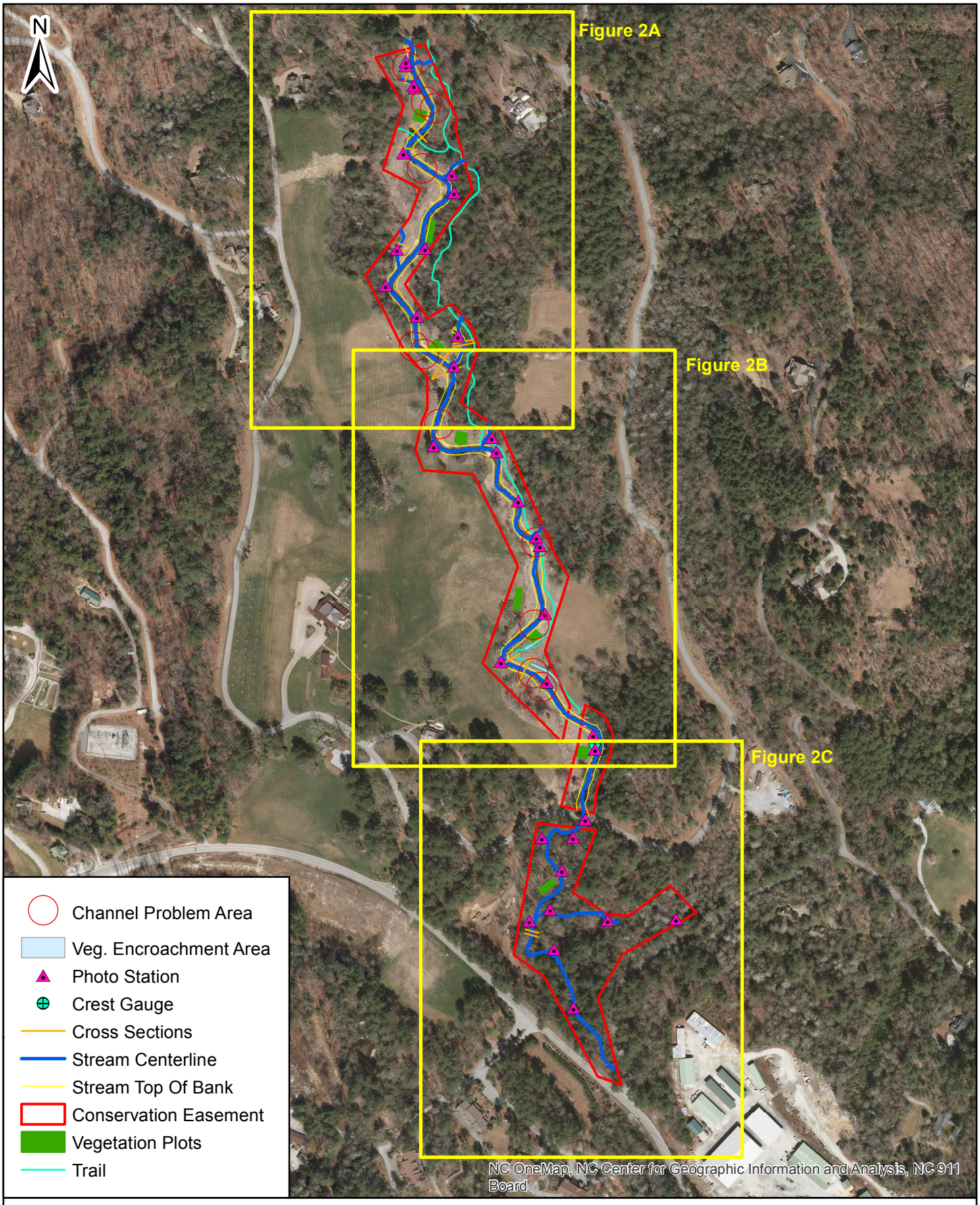

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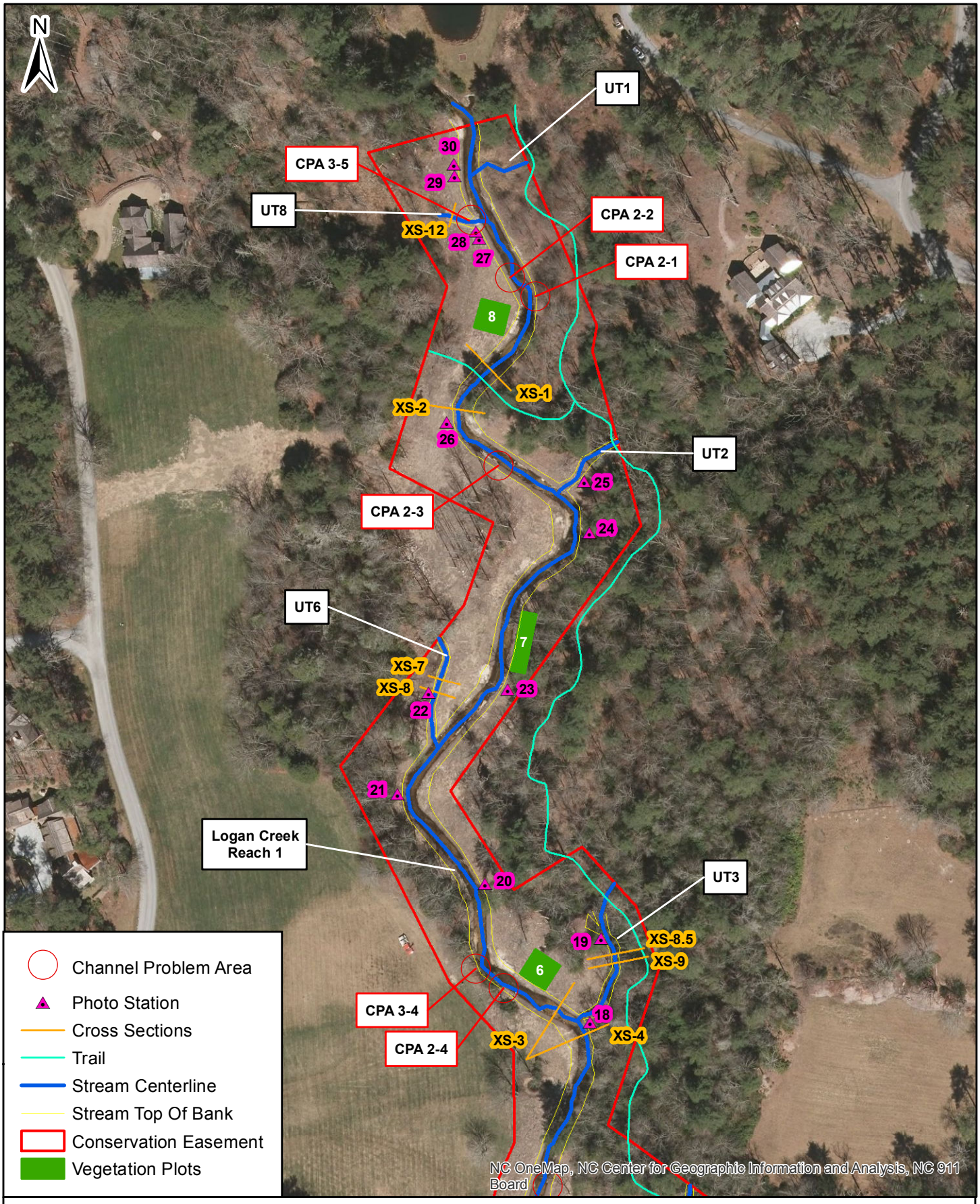
0 250 500 1,000 Feet

DMS Project # 92515

Figure 2 - Overview
Current Conditions Plan View
Monitoring Year 3
Logan Creek Site



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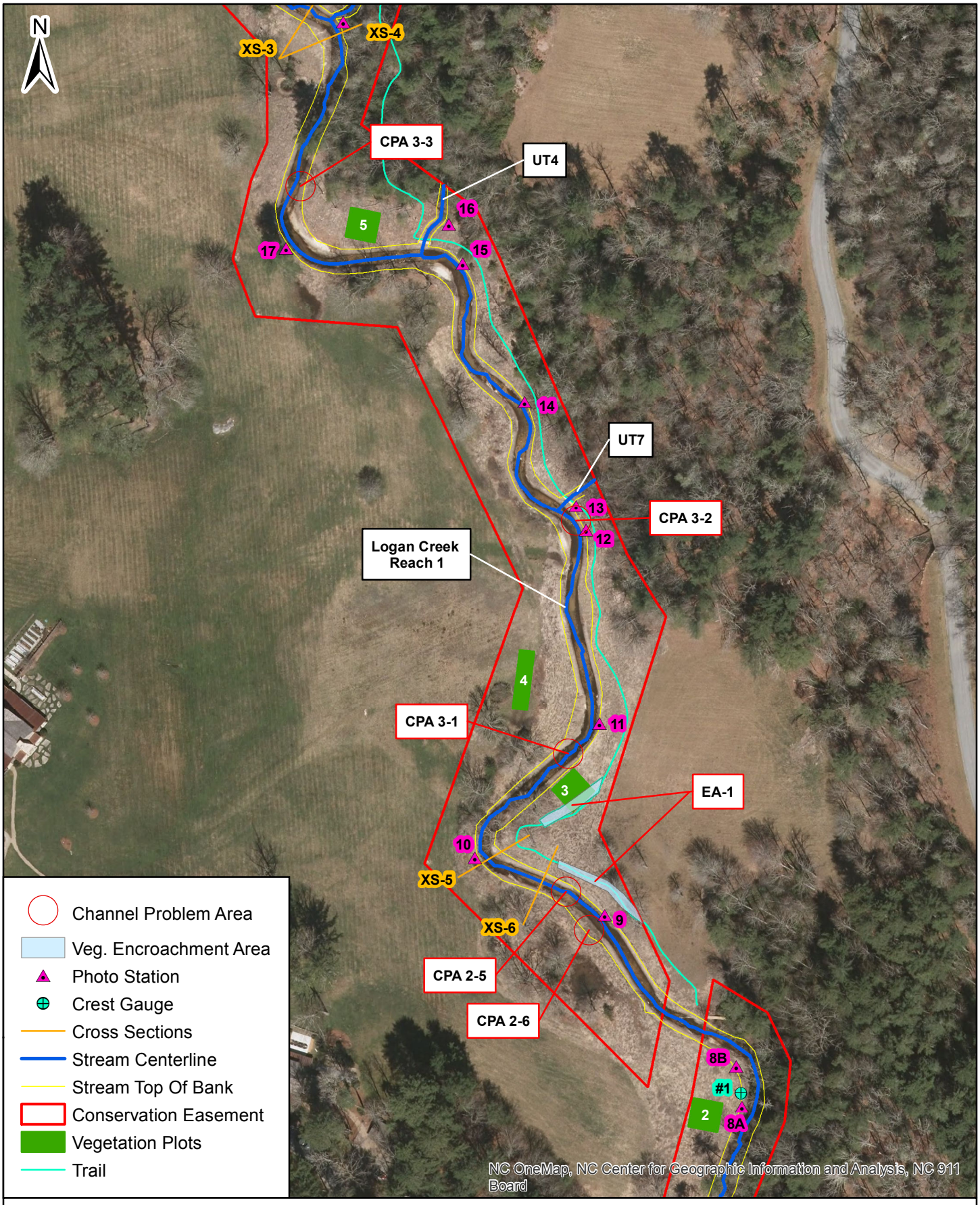
0 125 250 Feet

DMS Project # 92515

Figure 2A
Current Conditions Plan View
Monitoring Year 3
Logan Creek Site



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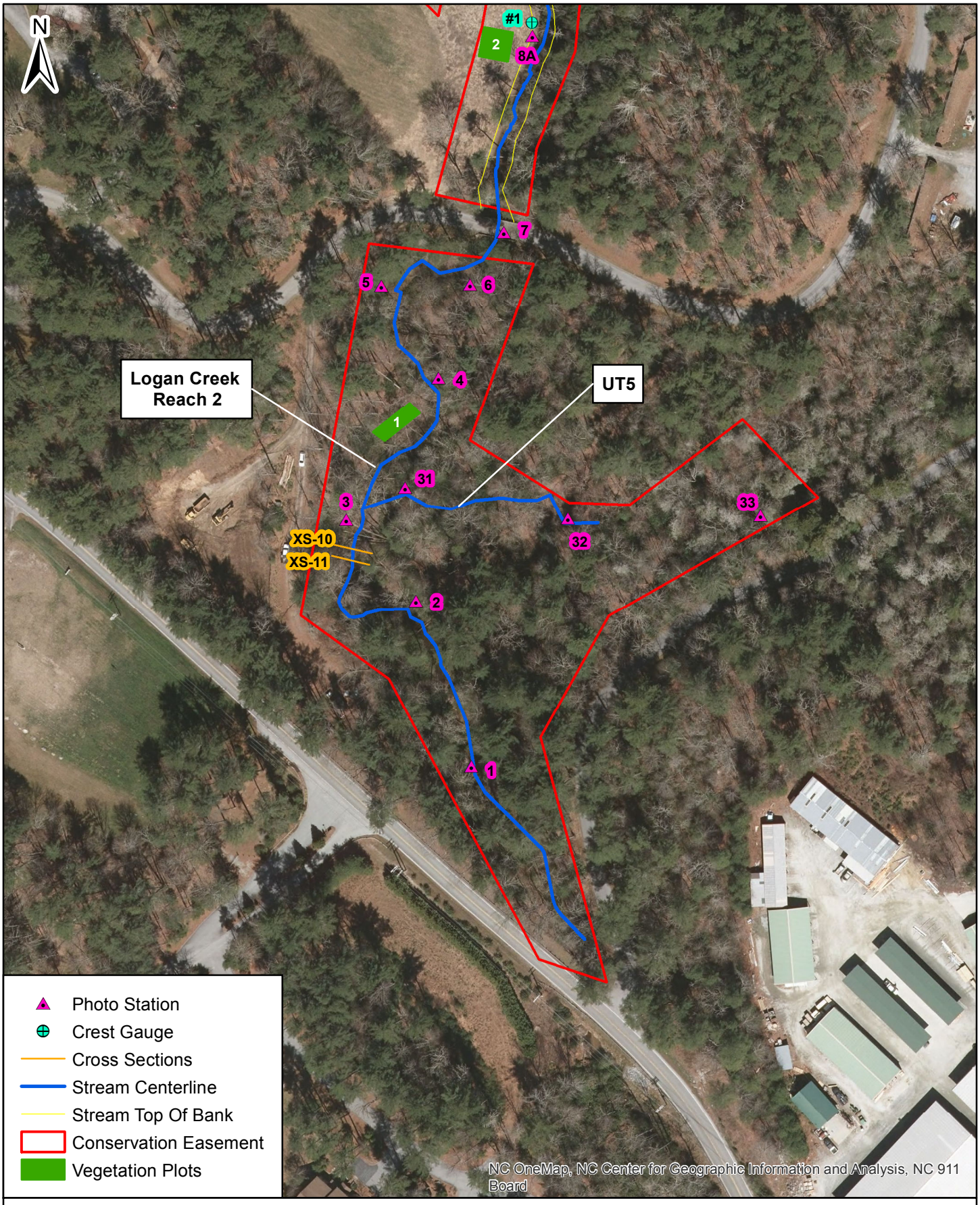
0 125 250 Feet

DMS Project # 92515

Figure 2B
Current Conditions Plan View
Monitoring Year 3
Logan Creek Site



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0 125 250 Feet

DMS Project # 92515

Figure 2C
Current Conditions Plan View
Monitoring Year 3
Logan Creek Site

Appendix B
General Project Tables

Includes:

Table 1. Project Components and Mitigation Credits
Figure 3. Project Asset Map
Table 2. Project Activity and Reporting History
Table 3. Project Contacts
Table 4. Project Attributes

Table 1. Project Components and Mitigation Credits

Logan Creek Restoration Project: DMS Project ID No. 92515

Mitigation Credits

	Stream				Riparian Wetland	Non-riparian Wetland	Buffer	Nitrogen Nutrient Offset	Phosphorus Nutrient Offset
Type	R	EI	EII	P					
Totals	3,441 SMU	692 SMU	136 SMU	58 SMU					

Project Components

Project Component or Reach ID	Stationing/ Location	Existing Footage/ Acreage	Approach	Restoration/ Restoration Equivalent	Restoration Footage or Acreage	Mitigation Ratio
STREAMS						
Logan Creek						
Reach 1	0+00 to 31+84	3134 LF	Restoration - PI	3,131 SMU	3,131 LF	1:1
Reach 2	32+43 to 42+81	1038 LF	Enhancement I	692 SMU	1,038 LF	1.5:1
UT1	0+00 to 0+71	71 LF	Enhancement II	28 SMU	71 LF	2.5:1
UT2	0+00 to 0+92	92 LF	Enhancement II	37 SMU	92 LF	2.5:1
UT3						
Reach 1	0+00 to 0+40	40 LF	Enhancement II	16 SMU	40 LF	2.5:1
Reach 2	0+40 to 1+78	138 LF	Restoration - PI	138 SMU	138 LF	1:1
UT4	0+00 to 0+84	84 LF	Enhancement II	34 SMU	84 LF	2.5:1
UT5	0+00 to 2+87	290 LF	Preservation	58 SMU	290 LF	5:1
UT6	0+00 to 1+27	127 LF	Restoration - PI	127 SMU	127 LF	1:1
UT7	0+00 to 0+54	54 LF	Enhancement II	21 SMU	54 LF	2.5:1
UT8	0+00 to 0+45	45 LF	Restoration - P1	45 SMU	45 LF	1:1

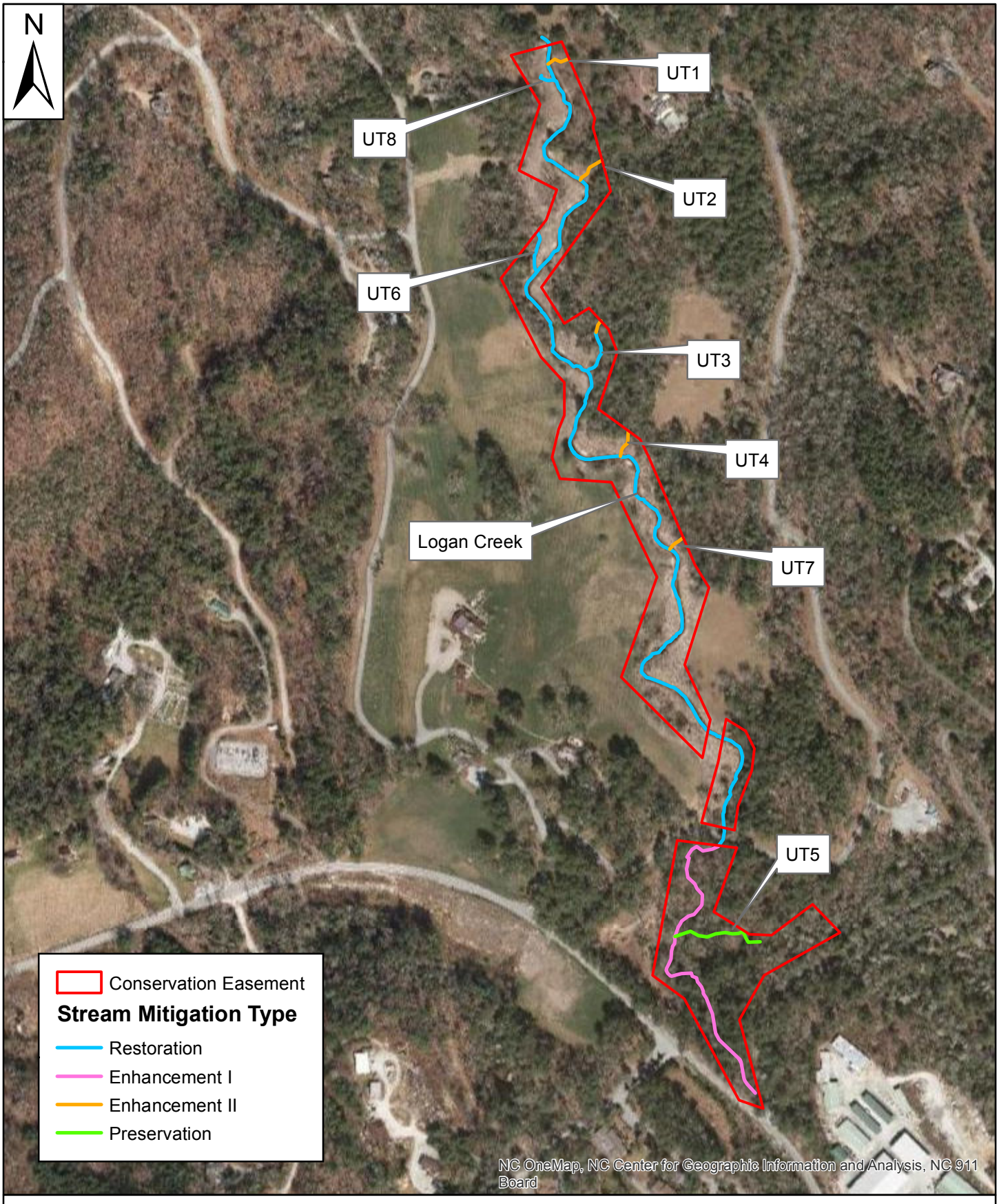
Component Summation

Restoration Level	Stream (LF)	Riparian Wetland (AC)		Non-riparian Wetland (AC)	Buffer (SF)	Upland (AC)
Restoration	3,441					
Enhancement I	1,038					
Enhancement II	341					
Creation						
Preservation	290					
High Quality Preservation						

BMP Elements

Element		Location	Purpose/Function	Notes

BMP Elements: BR= Bioretention Cell; SF= Sand Filter; SW= Stormwater Wetland; WDP= Wet Detention Pond; DDP= Dry Detention Pond; FS= Filter Strip; S= Grassed Swale; LS= Level Spreader; NI=Natural Infiltration Area



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0 200 400 600 800 1,000 Feet

DMS Project # 92515

Figure 3
Stream Asset Map
Monitoring Year 3
Logan Creek Site

Table 2. Project Activity and Reporting History
Logan Creek Restoration Project: DMS Project ID No. 92515

Activity or Report	Scheduled Completion	Data Collection Complete	Actual Completion or Delivery
Mitigation Plan Prepared	Jun-07	06-07	Apr-08
Mitigation Plan Amended	Apr-13	N/A	May-13
Mitigation Plan Approved	N/A	N/A	Jun-13
Final Design – (at least 90% complete)	N/A	N/A	May-13
Construction Begins	N/A	N/A	Jun-14
Temporary S&E mix applied to entire project area	N/A	N/A	Jan-15*
Permanent seed mix applied to entire project area	N/A	N/A	Jan-15*
Planting of bare root trees and live stakes	N/A	N/A	Jan-15*
End of Construction	N/A	N/A	May-15**
Survey of As-built conditions (Year 0 Monitoring-baseline)	N/A	Mar-15	Aug-15
As-Built Baseline Report	N/A	N/A	Nov-15
Year 1 Monitoring	N/A	N/A	Apr-16
Year 2 Monitoring	Dec-16	Nov-16	Dec-16
Year 3 Monitoring	Dec-17	Oct-17	Dec-17
Year 4 Monitoring	Dec-18	N/A	N/A
Year 5 Monitoring	Dec-19	N/A	N/A

* Began seeding with the start of construction June, 2014 and site was seeded multiple times with a final entire area overseeding at the time the bare root trees were planted.

** Construction of the majority of the site was completed by November 1, 2014 after a 2 week extension of the trout moratorium. The Enhancement Reach was done after April 15, 2015 (when Trout Moratorium ends) and was completed by May 12, 2015.

Table 3. Project Contacts	
Logan Creek Restoration Project: DMS Project ID No. 92515	
Designer	
Michael Baker Engineering, Inc.	797 Haywood Rd Suite 201 Asheville, NC 28806 Contact: Micky Clemmons, Tel. 828-412-6100
Construction Contractor	
River Works, Inc.	6105 Chapel Hill Road Raleigh, NC 27607 Contact: Bill Wright, Tel. 919-582-3575
Planting Contractor	
River Works, Inc.	6105 Chapel Hill Road Raleigh, NC 27607 Contact: Bill Wright Tel. 919-582-3575
Seeding Contractor	
River Works, Inc.	6105 Chapel Hill Road Raleigh, NC 27607 Contact: Bill Wright, Tel. 919-582-3575
Seed Mix Sources	Green Resources (seed), Tel. 336-855-6363
Nursery Stock Suppliers	ArborGen Inc. (trees), 843-528-3204 Dykes and Son (trees), 931-668-8833
Monitoring Performers	
Michael Baker Engineering, Inc.	797 Haywood Rd Suite 201 Asheville, NC 28806 Contact:
Stream and Vegetation Monitoring	Micky Clemmons, Tel. 828-412-6100
Monitoring Surveyor	Kee Mapping and Surveying P.O. Box 2566 Asheville, NC 28802 Contact: Brad Kee, License #C-3039; Phone: 828-575-9021

Table 4. Project Attributes			
Logan Creek Restoration Project: DMS Project ID No. 92515			
Project Information			
Project Name	Logan Creek Mitigation Project		
County	Jackson		
Project Area (acres)	12.71		
Project Coordinates (latitude and longitude)	Latitude 35.132803° Longitude -83.061046°		
Watershed Summary Information			
Physiographic Province	Blue Ridge		
River Basin	Savannah River Basin		
USGS Hydrologic Unit 8-digit and 14-digit	03060101 / 03060101010020		
DWR Sub-basin	Keowee River: 0306010101		
Project Drainage Area (AC)	Mainstem 1353.5 at beginning to 1714 at end, UT1, UT4, UT6, UT7 & UT8 <13, UT2 = 26; UT3 = 32, UT5 = 128.		
Project Drainage Area Percentage of Impervious Area	<2%		
USGA Land Use Classification	Deciduous Forest (76%)		
	Evergreen Forest (8%)		
	Pasture Land (4.6%)		
NCDMS Land Use Classification for this Hydrologic Unit	Forest (91%)	Shrub (1%)	
	Developed (6%)	Other (.5%)	
	Agriculture (1.5%)		
Stream Reach Summary Information			
Parameters	**Mainstem - Reach 1**	**Mainstem - Reach 2**	**UT3**
			R1 **R2**
Length of Reach (LF)	3,134	1,038	40 138
Valley Classification (Rosgen)	VIII	VIII	II
Drainage Area (AC)	1,557	1,714	32
NCDWR Stream Identification Score	52.5	52.5	41.5
NCDWR Water Quality Classification	C; TR: +HQW	C; TR: +HQW	C; TR: +HQW
Morphological Description (Rosgen stream	C-E	C-E	B
Evolutionary Trend	C→E	C→E	B
Underlying Mapped Soils	NkA	SaC	NkA, SaC
Drainage Class	Poorly drained to very poorly drained soils	Very deep, well drained, mod permeable soils	Somewhat poorly to well drained
Soil Hydric Status	Non-Hydric	Non-Hydric	Site-specific
Average Channel Slope (ft/ft)	0.004	0.007	0.012
FEMA Classification	Zone AE	Zone AE	None
Native Vegetation Community	Mixed Forested/Rhododendron and grassland	Mixed Forested/Rhododendron and grassland	Mixed Forested/Rhododendron and grassland
Percent Composition of Exotic/Invasive Vegetation[2]	<1%	<1%	<1%
Parameters	**UT3**	**UT6**	**6 other small UTs in R1**
	R1 **R2**		
Length of Reach (LF)	40 138	127	45 - 127
Valley Classification (Rosgen)	II	II	II
Drainage Area (AC)	32	32	.02 to .04
NCDWR Stream Identification Score	41.5	41.5	40.5 - 32.5
NCDWR Water Quality Classification	C; TR: +HQW	C; TR: +HQW	C; TR: +HQW
Morphological Description (Rosgen stream	B	B	E - B
Evolutionary Trend	B	B	B→C→E
Underlying Mapped Soils	NkA, SaC	NkA, SaC	NkA, SaC
Drainage Class	Somewhat poorly to well drained	Somewhat poorly to well drained	Somewhat poorly to well drained
Soil Hydric Status	Site-specific	Site-specific	Site-specific
Average Channel Slope (ft/ft)	0.012	0.012	0.0134 (UT6)
FEMA Classification	None	None	None
Native Vegetation Community	Mixed Forested/Rhododendron and grassland	Mixed Forested/Rhododendron and grassland	Mixed Forested/Rhododendron and grassland
Percent Composition of Exotic/Invasive Vegetation[2]	<1%	<1%	<1%
Regulatory Considerations			
Regulation	**Applicable**	**Resolved**	**Supporting Documentation**
Waters of the United States – Section 404	Yes	Yes	Permit: Action ID #2008-01711
Waters of the United States – Section 401	Yes	Yes	Permit: WQC #3885
Endangered Species Act	No	Yes	Categorical Exclusion
Historic Preservation Act	No	Yes	Categorical Exclusion
Coastal Zone Management Act (CZMA)/ Coastal Area Management Act (CAMA)	No	N/A	N/A
FEMA Floodplain Compliance	Yes	No-Rise	Certification, June 27, 2016
Essential Fisheries Habitat	No	N/A	N/A

Notes:
1. See Figure 2.5 of Mitigation Plan for key to soil series symbols.
3. USGS Land Use Data (2001) used rather than CGIA Land Use Classification data which is more dated (1996)

Appendix C

Vegetation Assessment Data

Includes:

Table 5. Vegetation Plot Mitigation Success Summary

Table 6. CVS Vegetation Metadata Table

Table 7. Stem Count Arranged by Plot and Species

Figure 4. Vegetation Monitoring Plot Photos

Table 8. Vegetative Problem Areas

Table 9. Vegetation Condition Assessment at Logan Creek

Table 5. Vegetation Plot Mitigation				
Success Summary (2017, MY3)				
Plot #	**Stream/ Wetland Stems[1]**	**Volunteers[2]**	**Total[3]**	**Success Criteria Met?**
1	809	0	809	Yes
2	405	607	1012	Yes
3	607	607	1214	Yes
4	647	202	850	Yes
5	850	0	850	Yes
6	688	1012	1700	Yes
7	931	0	931	Yes
8	526	0	526	Yes
Project Avg	**683**	**304**	**986**	**Yes**
Stem Class	**Characteristics**			
[1]Stream/ Wetland Stems	Native planted woody stems. Includes shrubs, does NOT include live stakes. No vines			
[2]Volunteers	Native woody stems. Not planted. No vines.			
[3]Total	Planted + volunteer native woody stems. Includes live stakes. Excl. exotics. Excl. vines.			
This color indicates that the number includes volunteer stems				
Indicates that the stems per acre exceeds requirements by 10%				
Indicates that the stems per acre exceeds requirements, but by less than 10%				

Table 6. Vegetation Metadata

Logan Creek Stream and Restoration Project - Project #92515

Report Prepared By	Russell Myers
Date Prepared	10/31/2017 9:24
database name	92515_MY3_Logan_cvs-eep-entrytool-v2.3.1.mdb
database location	L:\projects\109243 - Logan Creek\Monitoring\YR3 Monitoring\2.0 - Monitoring Data\App C - Vegetation\Veg Data
computer name	ASHELRMYERS
file size	46358528

DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
ALL Stems by Plot and spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.

PROJECT SUMMARY----------	
Project Code	92515
project Name	Logan Creek
Description	This Project will restore or enhance 4823 linear feet (LF) of stream along Logan Creek.
River Basin	Savannah
length(ft)	5110
stream-to-edge width (ft)	30
area (sq m)	28481.19
Required Plots (calculated)	8
Sampled Plots	8

Table 7. Stem Count Arranged by Plot
Project: Logan Creek, DMS Project 392515

			Current Plot Data (MY3 2017)																	
			92515-01-0001			92515-01-0002			92515-01-0003			92515-01-0004			92515-01-0005			92515-01-0006		
Scientific Name	Common Name	Species Type	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T
Alnus serrulata	hazel alder	Shrub				3	10	13	6	15	21	2		2	7		7	3		3
Betula nigra	river birch	Tree							1		1	3		3	3		3	1		1
Diospyros virginiana	common persimmon	Tree				1		1	1		1	2		2	4		4	2		2
Fraxinus pennsylvanica	green ash	Tree				1		1	2		2	4		4	2		2	8		8
Hamamelis virginiana	American witchhazel	Tree	7		7															
Leucothoe fontanesiana	highland doghobble	Shrub																		
Lindera benzoin	northern spicebush	Shrub	2		2															
Liriodendron tulipifera	tuliptree	Tree				1	5	6				2	5	7				1	25	26
Nyssa sylvatica	blackgum	Tree				1		1	2		2				2		2			
Oxydendrum arboreum	sourwood	Tree																		
Pinus strobus	eastern white pine	Tree																		
Quercus alba	white oak	Tree				3		3				2		2	2		2			
Quercus rubra	northern red oak	Tree							3		3	1		1	1		1	2		2
Robinia pseudoacacia	black locust	Tree																		
Sambucus canadensis	Common Elderberry	Shrub																		
Unknown		Shrub or Tree																		
Viburnum dentatum	southern arrowwood	Shrub	11		11															
		Stem count	20	0	20	10	15	25	15	15	30	16	5	21	21	0	21	17	25	42
		size (ares)	1			1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02		
		Species count	3	0	3	6	2	6	6	1	6	7	1	7	7	0	7	6	1	6
		Stems per ACRE	809	0	809	405	607	1012	607	607	1214	647	202	850	850	0	850	688	1012	1700

P = Planted — This color indicates that the number includes volunteer stems
V = Volunteer — Indicates that the stems per acre exceeds requirements by 10%
T = Total — Indicates that the stems per acre exceeds requirements, but by less than 10%

Table 7. Stem Count Arranged by Plot, continued
Project: Logan Creek, DMS Project 392515

			Current Plot Data (MY3 2017)						Annual Means											
			92515-01-0007			92515-01-0008			MY3 (2017)			MY2 (2016)			MY1 (2016)			MY0 (2015)		
Scientific Name	Common Name	Species Type	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T
Alnus serrulata	hazel alder	Shrub	6		6	5		5	32	25	57	32	30	62	32		32	33		33
Betula nigra	river birch	Tree	1		1	2		2	11		11	12		12	11		11	13		13
Diospyros virginiana	common persimmon	Tree	5		5	1		1	16		16	18		18	20		20	24		24
Fraxinus pennsylvanica	green ash	Tree	3		3	2		2	22		22	23		23	24		24	24		24
Hamamelis virginiana	American witchhazel	Tree							7		7	9		9	11		11			
Leucothoe fontanesiana	highland doghobble	Shrub	1		1				1		1	3		3	3		3	4		4
Lindera benzoin	northern spicebush	Shrub							2		2	2		2	2		2			
Liriodendron tulipifera	tuliptree	Tree	4		4	2		2	10	35	45	9	55	64	11		11	17		17
Nyssa sylvatica	blackgum	Tree	1		1	1		1	7		7	8		8	9		9	20		20
Oxydendrum arboreum	sourwood	Tree											2	2						
Pinus strobus	eastern white pine	Tree											14	14						
Quercus alba	white oak	Tree							7		7	7		7	6		6	6		6
Quercus rubra	northern red oak	Tree	2		2				9		9	10		10	12		12	13		13
Robinia pseudoacacia	black locust	Tree											1	1						
Sambucus canadensis	Common Elderberry	Shrub														1	1			
Unknown		Shrub or Tree																7		7
Viburnum dentatum	southern arrowwood	Shrub							11		11	11		11	11		11	9		9
		Stem count	23	0	23	13	0	13	135	60	195	144	102	246	152	1	153	170	0	170
		size (ares)	1			1			8			8			8			8		
		size (ACRES)	0.02			0.02			0.20			0.20			0.20			0.20		
		Species count	8	0	8	6	0	6	12	2	12	12	5	15	12	1	13	11	0	11
		Stems per ACRE	931	0	931	526	0	526	683	304	986	728	516	1244	769	5	774	860	0	860

P = Planted — This color indicates that the number includes volunteer stems
V = Volunteer — Indicates that the stems per acre exceeds requirements by 10%
T = Total — Indicates that the stems per acre exceeds requirements, but by less than 10%

Figure 4. Logan Creek Site – Monitoring Year 3 Vegetation Plot Photos, DMS Project #92515

Photo 1. Vegetation Plot 1 – Tree photo (October 2017).

Photo 2. Vegetation Plot 1 – Herbaceous photo (October 2017).

Photo 3. Vegetation Plot 2 – Tree photo (October 2017).

Photo 4. Vegetation Plot 2 – Herbaceous photo (October 2017).

Photo 5. Vegetation Plot 3 – Tree photo (October 2017).

Photo 6. Vegetation Plot 3 – Herbaceous photo (October 2017).

Logan Creek Site - Vegetation Plot Photos,
DMS Project #92515 - continued

Photo 7. Vegetation Plot 4 – Tree photo (October 2017).

Photo 8. Vegetation Plot 4 – Herbaceous photo (October 2017).

Photo 9. Vegetation Plot 5 – Tree photo (October 2017).

Photo 10, Vegetation Plot 5 – Herbaceous photo (October 2017).

Photo 11. Vegetation Plot 6 – Tree photo (October 2017).

Photo 12. Vegetation Plot 6 – Herbaceous photo (October 2017).

Logan Creek Site - Vegetation Plot Photos,
DMS Project #92515 - continued

Photo 13. Vegetation Plot 7 – Tree photo (October 2017).

Photo 14. Vegetation Plot 7 – Herbaceous photo (October 2017).

Photo 15. Vegetation Plot 8 – Tree photo (October 2017).

Photo 16. Vegetation Plot 8 – Herbaceous photo (October 2017).

Table 8. Vegetative Problem Areas MY3			
Feature Category	**Station #/Range**	**Probable Cause**	**Photo #**
Bare Bank	None		
Bare Bench	None		
Bare Flood Plain	None		
Invasive /Exotic Populations	None		

Table 9 Vegetation Condition Assessment at Logan Creek

Planted Acreage[1]	7.49					
Vegetation Category	**Definitions**	**Mapping Threshold**	**CCPV Depiction**	**Number of Polygons**	**Combined Acreage**	**% of Planted Acreage**
1. Bare Areas	None	0.1 acres	Pattern and Color	0	0.00	0.0%
2. Low Stem Density Areas	None	0.1 acres	Pattern and Color	0	0.00	0.0%
			Total	0	0.00	0.0%
3. Areas of Poor Growth Rates or Vigor	None	0.25 acres	Pattern and Color	0	0.00	0.0%
			Cumulative Total	0	0.00	0.0%
Easement Acreage[2]	**12.71**					
Vegetation Category	**Definitions**	**Mapping Threshold**	**CCPV Depiction**	**Number of Polygons**	**Combined Acreage**	**% of Easement Acreage**
4. Invasive Areas of Concern[4]	None	1000 SF	Pattern and Color	0	0.00	0.0%
5. Easement Encroachment Areas[3]	There was one Encroachment Area (EA-1) noted in 2016 along the nature trail, in the area of stations 23+00 to 28+00. A new maintenance staff person had the nature trail mowed; however, a wider area was mowed than we verbally agreed should be maintained. The width was 10-12 feet wide, while we had agreed to a width of 4-6 feet wide, which approximates the width of the previously existing nature trail. We discussed this with staff at Lonesome Valley and they agreed to address this issue with the trail maintenance staff, and to be sure they know the proper width for future maintenance. During MY3 monitoring, it was noted that the trail through Veg Plot 3 was still being mowed. This issue will be addressed with the trail maintenance staff again.	none	Light Blue	2	0.01	0.19%

1 = Enter the planted acreage within the easement. This number is calculated as the easement acreage minus any existing mature tree stands that were not subject to supplemental planting of the understory, the channel acreage, crossings or any other elements not directly planted as part of the project effort.

2 = The acreage within the easement boundaries.

3 = Encroachment may occur within or outside of planted areas and will therefore be calculated against the overall easement acreage. In the event a polygon is cataloged into items 1, 2 or 3 in the table and is the result of encroachment, the associated acreage should be tallied in the relevant item (i.e., item 1,2 or 3) as well as a parallel tally in item 5.

4 = Invasives may occur in or out of planted areas, but still within the easement and will therefore be calculated against the overall easement acreage. Invasives of concern/interest are listed below. The list of high concern species are those with the potential to directly outcompete native, young, woody stems in the short-term (e.g. monitoring period or shortly thereafter) or affect the community structure for existing, more established tree/shrub stands over timeframes that are slightly longer (e.g. 1-2 decades). The low/moderate concern group are those species that generally do not have this capacity over the timeframes discussed and therefore are not expected to be mapped with regularity, but can be mapped, if in the judgement of the observer their coverage, density or distribution is suppressing the viability, density, or growth of planted woody stems. Decisions as to whether remediation will be needed are based on the integration of risk factors by EEP such as species present, their coverage, distribution relative to native biomass, and the practicality of treatment. For example, even modest amounts of Kudzu or Japanese Knotweed early in the projects history will warrant control, but potentially large coverages of Microstegium in the herb layer will not likley trigger control because of the limited capacities to impact tree/shrub layers within the timeframes discussed and the potential impacts of treating extensive amounts of ground cover. Those species with the "watch list" designator in gray shade are of interest as well, but have yet to be observed across the state with any frequency. Those in *red italics* are of particular interest given their extreme risk/threat level for mapping as points where isolated specimens are found, particularly ealry in a projects monitoring history. However, areas of discreet, dense patches will of course be mapped as polygons. The symbology scheme below was one that was found to be helpful for symbolzing invasives polygons, particularly for situations where the conditon for an area is somewhere between isolated specimens and dense, discreet patches. In any case, the point or polygon/area feature can be symbolized to describe things like high or low concern and species can be listed as a map inset, in legend items if the number of species are limited or in the narrative section of the executive summary.

Appendix D

Stream Assessment Data

Includes:

Figure 5. Stream Photos by Channel and Station

Table 8. Visual Morphological Stability Assessment

Table 9. Verification of Bankfull or Greater than Bankfull Events

Figure 6. Cross-Sections with Annual Overlays

Figure 7. Longitudinal Profiles with Annual Overlays

Figure 8. Pebble Count Plots with Annual Overlays

Table 10. Monitoring Year 3 Stream Summary

Table 11. Morphology and Hydraulic Monitoring Summary

Figure 5. Logan Creek Stream Restoration project
Photo Points - Monitoring Year 3, (Stationing is approximate)

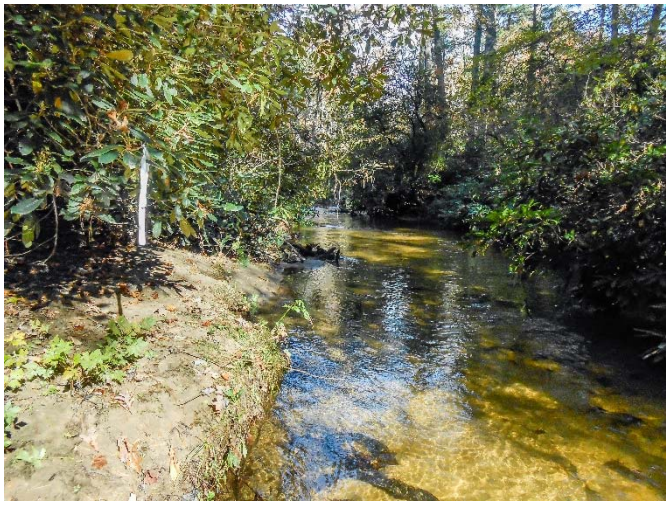


Photo 1. Logan Creek Photo Point 1 – Station 40+45 (October 2017) upstream view from right bank.

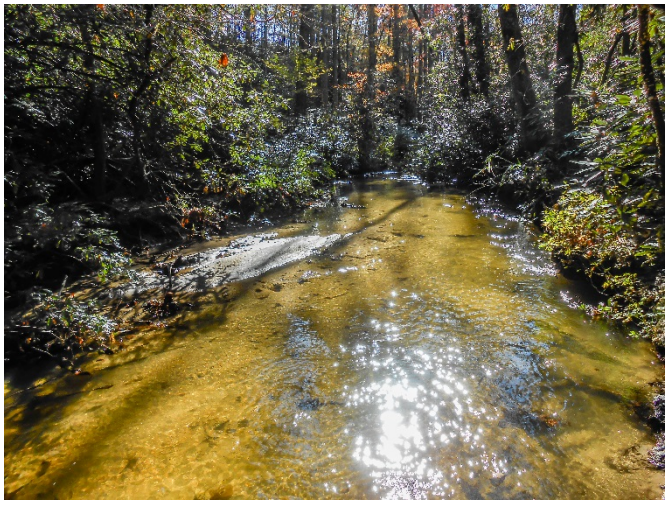


Photo 2. Logan Creek Photo Point 1 – Station 40+45 (October 2017) downstream view from right bank.

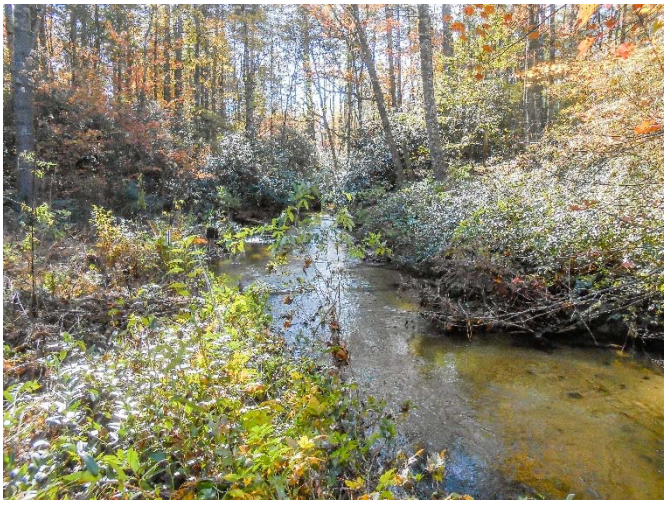


Photo 3. Logan Creek Photo Point 2 – Station 38+60 (October 2017) downstream view from left bank.

Photo 4. Logan Creek Photo Point 2 – Station 38+60 (October 2017) upstream view from left bank.

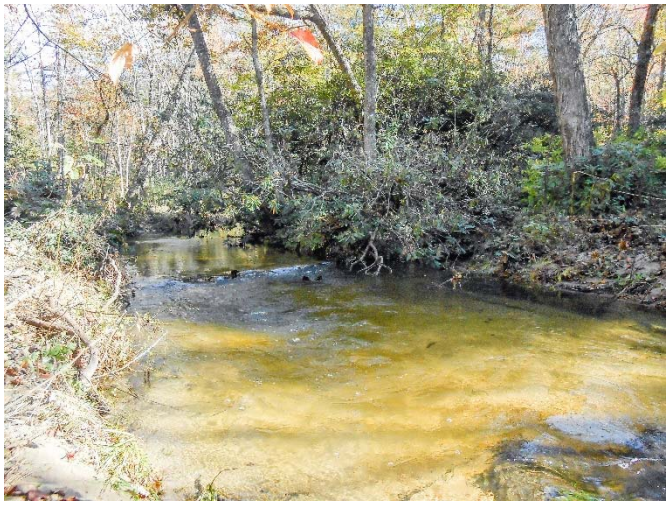


Photo 5. Logan Creek Photo Point 3 – Station 36+75 (October 2017) upstream view from right bank.

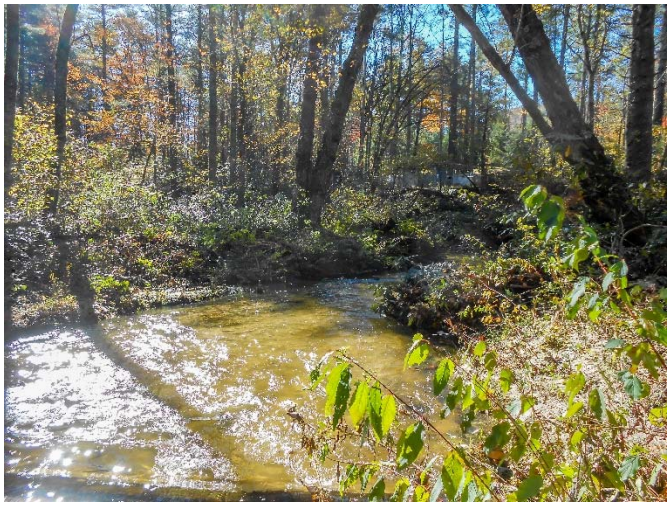


Photo 6. Logan Creek Photo Point 3 – Station 36+75 (October 2017) downstream view from right bank.

Photo 7. Logan Creek Photo Point 4 – Station 34+80 (October 2017) downstream from left bank.

Photo 8. Logan Creek Photo Point 4 – Station 34+80 (October 2017) upstream from left bank.

Photo 9. Logan Creek Photo Point 5 – Station 33+60 (October 2017) upstream from right bank.

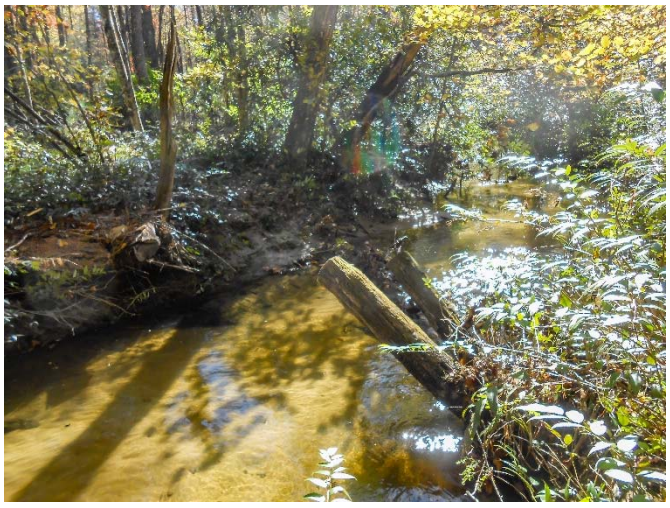


Photo 10. Logan Creek Photo Point 5 – Station 33+60 (October 2017) downstream from right bank.

Photo 11. Logan Creek Photo Point 6 – Station 32+70 (October 2017) downstream view from left bank.

Photo 12. Logan Creek Photo Point 6 – Station 32+70 (October 2017) upstream view from left bank.

Photo 13. Logan Creek Photo Point 7 – Station 32+15 (October 2017) downstream view from bridge.

Photo 14. Logan Creek Photo Point 7 – Station 32+00 (October 2017) upstream view from bridge.

Photo 15. Logan Creek Photo Point 8a – Station 29+75 (October 2017) downstream view from right bank.

Photo 16. Logan Creek Photo Point 8b – Station 29+25 (October 2017) upstream view from right bank.

Photo 17. Logan Creek Photo Point 9 – Station 26+75 (October 2017) downstream view from left bank.

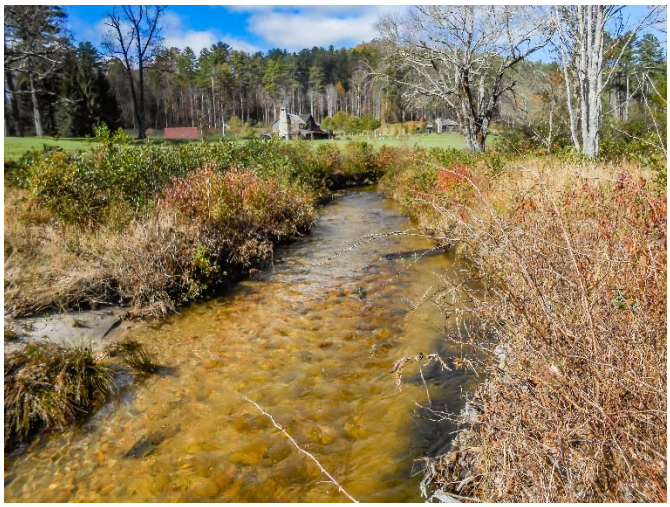


Photo 18. Logan Creek Photo Point 9 – Station 26+75 (October 2017) upstream view from left bank.

Photo 19. Logan Creek Photo Point 10 – Station 25+25 (October 2017) upstream view from right bank.

Photo 20. Logan Creek Photo Point 10 – Station 25+25 (October 2017) downstream view from right bank.

Photo 21. Logan Creek Photo Point 11 – Station 23+20 (October 2017) downstream view from left bank.

Photo 22. Logan Creek Photo Point 11 – Station 23+20 (October 2017) upstream view from left bank.

Photo 23. Logan Creek Photo Point 12 – Station 21+20 (October 2017) downstream view from left bank.

Photo 24. Logan Creek Photo Point 12 – Station 21+20 (October 2017) upstream view from left bank.

Photo 25. UT7 Photo Point 13 – (October 2017) upstream view from left bank.

Photo 26. UT7 Photo Point 13 – (October 2017) downstream view from left bank.

Photo 27. Logan Creek Photo Point 14 – Station 19+45 (October 2017) downstream view from left bank.

Photo 28. Logan Creek Photo Point 14 – Station 19+45 (October 2017) upstream view from left bank.

Photo 29. Logan Creek Photo Point 15 – Station 17+45 (October 2017) downstream view from left bank.

Photo 30. Logan Creek Photo Point 15 – Station 17+45 (October 2017) upstream view from left bank.

Photo 31. UT4 Photo Point 16 – Station 0+40 (October 2017) downstream view from left bank.

Photo 32. UT4 Photo Point 16 – Station 0+40 (October 2017) upstream view from left bank.

Photo 33. Logan Creek Photo Point 17 – Station 15+50 (October 2017) upstream view from right bank.

Photo 34. Logan Creek Photo Point 17 – Station 15+50 (October 2017) downstream view from right bank.

Photo 35. Logan Creek Photo Point 18 – Station 12+90 (October 2017) downstream view from left bank.

Photo 36. Logan Creek Photo Point 18 – Station 12+90 (October 2017) upstream view from left bank.

Photo 37. UT3 Photo Point 19 – Station 00+60 (October 2017) upstream from left bank.

Photo 38. UT3 Photo Point 19 – Station 00+60 (October 2017) downstream from left bank.

Photo 39. UT3 Photo Point 19 – Station 00+60 (October 2017) upstream from left bank to vernal pool.

Intentionally left blank.

Photo 40. Logan Creek Photo Point 20 – Station 10+60 (October 2017) downstream view from left bank.

Photo 41. Logan Creek Photo Point 20 – Station 10+60 (October 2017) upstream view from left bank.

Photo 42. Logan Creek Photo Point 21 – Station 9+40 (October 2017) upstream view from right bank.

Photo 43. Logan Creek Photo Point 21 – Station 9+40 (October 2017) downstream view from right bank.

Photo 44. UT6 Photo Point 22 – Station 0+75 (October 2017) upstream view from right bank.

Photo 45. UT6 Photo Point 22 – Station 0+75 (October 2017) downstream view from right bank.

Photo 46. Logan Creek Photo Point 23 – Station 7+70 (October 2017) downstream view from left bank.

Photo 47. Logan Creek Photo Point 23 – Station 7+70 (October 2017) upstream view from left bank.

Photo 48. Logan Creek, Photo Point 24 – Station 5+70 (October 2017) downstream view from left bank.

Photo 49. Logan Creek, Photo Point 24 – Station 5+70 (October 2017) upstream view from left bank.

Photo 50. UT2, Photo Point 25 – Station 0+65 (October 2017) upstream view from left bank.

Photo 51. UT2, Photo Point 25 – Station 0+65 (October 2017) downstream view from left bank.

Photo 52. Logan Creek, Photo Point 26 – Station 3+80 (October 2017) upstream view from right bank.

Photo 53. Logan Creek, Photo Point 26 – Station 3+80 (October 2017) downstream view from right bank.

Photo 54. Logan Creek, Photo Point 27 – Station 1+12 (October 2017) upstream view from right bank.

Photo 55. Logan Creek, Photo Point 27 – Station 1+12 (October 2017) downstream view from right bank.

Photo 56. UT8, Photo Point 28 – Station 1+10 (October 2017) upstream view from right bank and confluence.

Photo 57. UT1, Photo Point 29 – Station 0+50 (October 2017) view upstream and confluence.

Photo 58. Logan Creek, Photo Point 30 – Station 0+50 (October 2017) upstream view from right bank.

Photo 59. Logan Creek, Photo Point 30 – Station 0+50 (October 2017) downstream view from right bank.

Photo 60. UT5 - Preservation, Photo Point 31 – Station 1+80 (October 2017) downstream view from mid-channel to confluence.

Photo 61. UT5 - Preservation, Photo Point 31 – Station 1+80 (October 2017) upstream view from mid-channel to confluence.

Photo 62. UT5 - Preservation, Photo Point 32 – (October 2017) downstream view from right bank.

Photo 63. UT5 - Preservation, Photo Point 32 – (October 2017) upstream view from right bank.

Table 8. Visual Morphological Stability Assessment
Logan Creek Stream Restoration Project: DMS Project ID No. 92515

Logan Creek, Reach 1 (3,184 LF), Restoration Reach						
Feature Category	Metric (per As-Built and reference baselines)	(# Stable) Number Performing as Intended	Total number per As-Built	Total Number / feet in unstable state	% Performing in Stable Condition	Feature Perfomance Mean or Total
A. Riffles	1. Present?	18	18	0	100	
	2. Armor stable (e.g. no displacement)?	18	18	0	100	
	3. Facet grades appears stable?	18	18	0	100	
	4. Minimal evidence of embedding/fining?	18	18	0	100	
	5. Length appropriate?	18	18	0	100	**100%**
B. Pools	1. Present? (e.g. not subject to severe aggradation or migration?)	35	35	0	100	
	2. Sufficiently deep (Max Pool D:Mean Bkf >1.6?)	35	35	0	100	
	3. Length appropriate?	35	35	0	100	**100%**
C. Thalweg	1. Upstream of pool (structure) centering? (%)	100	100	0	100	
	2. Downstream of pool (structure) centering? (%)	100	100	0	100	**100%**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	17	19	0	89	
	2. Of those eroding, # w/concomitant point bar formation?	19	19	0	100	
	3. Apparent Rc within spec?	19	19	0	100	
	4. Sufficient floodplain access and relief?	19	19	0	100	**97%**
E. Bed General	1. General channel bed aggradation areas (bar formation)	3,184	3,184	0	100	
	2. Channel bed degradation - areas of increasing down-cutting or head cutting?	3,184	3,184	0	100	**100%**
F. Vanes, Rock/Log Drop Structures*	1. Free of back or arm scour?	24	24	0	100	
	2. Height appropriate?	24	24	0	100	
	3. Angle and geometry appear appropriate?	24	24	0	100	
	4. Free of piping or other structural failures?	22	24	0	92	**98%**
G. Wads/ Boulders	1. Free of scour?	24	24	0	100	
	2. Footing stable?	24	24	0	100	**100%**

Logan Creek, Reach 2 (1,038 LF), Enhancement Reach						
Feature Category	Metric (per As-Built and reference baselines)	(# Stable) Number Performing as Intended	Total number per As-Built	Total Number / feet in unstable state	% Performing in Stable Condition	Feature Perfomance Mean or Total
A. Riffles	1. Present?	10	10	0	100	
	2. Armor stable (e.g. no displacement)?	10	10	0	100	
	3. Facet grades appears stable?	10	10	0	100	
	4. Minimal evidence of embedding/fining?	10	10	0	100	
	5. Length appropriate?	10	10	0	100	**100%**
B. Pools	1. Present? (e.g. not subject to severe aggradation or migration?)	13	13	0	100	
	2. Sufficiently deep (Max Pool D:Mean Bkf >1.6?)	13	13	0	100	
	3. Length appropriate?	13	13	0	100	**100%**
C. Thalweg	1. Upstream of pool (structure) centering? (%)	100	100	0	100	
	2. Downstream of pool (structure) centering? (%)	100	100	0	100	**100%**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	5	5	0	100	
	2. Of those eroding, # w/concomitant point bar formation?	5	5	0	100	
	3. Apparent Rc within spec?	5	5	0	100	
	4. Sufficient floodplain access and relief?	5	5	0	100	**100%**
E. Bed General	1. General channel bed aggradation areas (bar formation)	1,038	1,038	0	100	
	2. Channel bed degradation - areas of increasing down-cutting or head cutting?	1,038	1,038	0	100	**100%**
F. Vanes, Rock/Log Drop Structures*	1. Free of back or arm scour?	11	11	0	100	
	2. Height appropriate?	11	11	0	100	
	3. Angle and geometry appear appropriate?	11	11	0	100	
	4. Free of piping or other structural failures?	11	11	0	100	**100%**
G. Wads/ Boulders	1. Free of scour?	0	0	0		
	2. Footing stable?	0	0	0		

* Note: Due to very low water levels some piping is occurring, only one structure may need to be repaired to fix the issue. Most structures in Reach 2 were designed to have water go under them during low water, in order to move sand through the reach.

Table 8. Visual Morphological Stability Assessment - Continued
Logan Creek Stream Restoration Project: DMS Project ID No. 92515

UT3 (178 LF)

Feature Category	Metric (per As-Built and reference baselines)	(# Stable) Number Performing as Intended	Total number per As-Built	Total Number / feet in unstable state	% Performing in Stable Condition	Feature Perfomance Mean or Total
A. Riffles	1. Present?	3	3	0	100	
	2. Armor stable (e.g. no displacement)?	3	3	0	100	
	3. Facet grades appears stable?	3	3	0	100	
	4. Minimal evidence of embedding/fining?	3	3	0	100	
	5. Length appropriate?	3	3	0	100	**100%**
B. Pools	1. Present? (e.g. not subject to severe aggradation or migration?)	3	3	0	100	
	2. Sufficiently deep (Max Pool D:Mean Bkf >1.6?)	3	3	0	100	
	3. Length appropriate?	3	3	0	100	**100%**
C. Thalweg[1]	1. Upstream of pool (structure) centering? (%)	100	100	0	100	
	2. Downstream of pool (structure) centering? (%)	100	100	0	100	**100%**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	0	0			
	2. Of those eroding, # w/concomitant point bar formation?	0	0			
	3. Apparent Rc within spec?	0	0			
	4. Sufficient floodplain access and relief?	0	0			
E. Bed General	1. General channel bed aggradation areas (bar formation)	178	178	0	100	
	2. Channel bed degradation - areas of increasing down-cutting or head cutting?	178	178	0	100	**100%**
F. Vanes, Rock/Log Drop Structures	1. Free of back or arm scour?	4	4	0	100	
	2. Height appropriate?	4	4	0	100	
	3. Angle and geometry appear appropriate?	4	4	0	100	
	4. Free of piping or other structural failures?	4	4	0	100	**100%**
G. Wads/ Boulders	1. Free of scour?	0	0			
	2. Footing stable?	0	0			

UT6, (127 LF)

Feature Category	Metric (per As-Built and reference baselines)	(# Stable) Number Performing as Intended	Total number per As-Built	Total Number / feet in unstable state	% Performing in Stable Condition	Feature Perfomance Mean or Total
A. Riffles	1. Present?	3	3	0	100	
	2. Armor stable (e.g. no displacement)?	3	3	0	100	
	3. Facet grades appears stable?	3	3	0	100	
	4. Minimal evidence of embedding/fining?	3	3	0	100	
	5. Length appropriate?	3	3	0	100	**100%**
B. Pools	1. Present? (e.g. not subject to severe aggradation or migration?)	2	2	0	100	
	2. Sufficiently deep (Max Pool D:Mean Bkf >1.6?)	2	2	0	100	
	3. Length appropriate?	2	2	0	100	**100%**
C. Thalweg	1. Upstream of pool (structure) centering? (%)	100	100	0	100	
	2. Downstream of pool (structure) centering? (%)	100	100	0	100	**100%**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	N/A	N/A	N/A	100	
	2. Of those eroding, # w/concomitant point bar formation?	N/A	N/A	N/A	100	
	3. Apparent Rc within spec?	N/A	N/A	N/A	100	
	4. Sufficient floodplain access and relief?	N/A	N/A	N/A	100	**100%**
E. Bed General	1. General channel bed aggradation areas (bar formation)	127	127	0	100	
	2. Channel bed degradation - areas of increasing down-cutting or head cutting?	127	127	0	100	**100%**
F. Vanes, Rock/Log Drop Structures	1. Free of back or arm scour?	2	2	0	100	
	2. Height appropriate?	2	2	0	100	
	3. Angle and geometry appear appropriate?	2	2	0	100	
	4. Free of piping or other structural failures?	2	2	0	100	**100%**
G. Wads/ Boulders	1. Free of scour?	N/A	N/A	N/A	N/A	
	2. Footing stable?	N/A	N/A	N/A	N/A	**N/A**

Table 8. Visual Morphological Stability Assessment - Continued
Logan Creek Stream Restoration Project: DMS Project ID No. 92515

UT8, (45 LF)						
Feature Category	Metric (per As-Built and reference baselines)	(# Stable) Number Performing as Intended	Total number per As-Built	Total Number / feet in unstable state	% Performing in Stable Condition	Feature Perfomance Mean or Total
A. Riffles	1. Present?	1	1	0	100	
	2. Armor stable (e.g. no displacement)?	1	1	0	100	
	3. Facet grades appears stable?	1	1	0	100	
	4. Minimal evidence of embedding/fining?	1	1	0	100	
	5. Length appropriate?	1	1	0	100	**100%**
B. Pools	1. Present? (e.g. not subject to severe aggradation or migration?)	0	0	0		
	2. Sufficiently deep (Max Pool D:Mean Bkf >1.6?)	0	0	0		
	3. Length appropriate?	0	0	0		
C. Thalweg	1. Upstream of pool (structure) centering? (%)	100	100	0	100	
	2. Downstream of pool (structure) centering? (%)	100	100	0	100	**100%**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	N/A	N/A	N/A	100	
	2. Of those eroding, # w/concomitant point bar formation?	N/A	N/A	N/A	100	
	3. Apparent Rc within spec?	N/A	N/A	N/A	100	
	4. Sufficient floodplain access and relief?	N/A	N/A	N/A	100	**100%**
E. Bed General	1. General channel bed aggradation areas (bar formation)	45	45	0	100	
	2. Channel bed degradation - areas of increasing down-cutting or head cutting?	45	45	0	100	**100%**
F. Vanes, Rock/Log Drop Structures	1. Free of back or arm scour?	1	1	0	100	
	2. Height appropriate?	1	1	0	100	
	3. Angle and geometry appear appropriate?	1	1	0	100	
	4. Free of piping or other structural failures?	0	1	0	0	**75%**
G. Wads/ Boulders	1. Free of scour?	N/A	N/A	N/A	N/A	
	2. Footing stable?	N/A	N/A	N/A	N/A	**N/A**

Table 9. Verification of Bankfull or Greater than Bankfull Events
Logan Creek Stream Restoration Project: DMS Project ID No. 92515

	Date of Data Collection	Date of Event	Method of Data Collection	Gauge Watermark Height (inches)*
				Logan Creek Station 30+00
MY2	3/18/2016	2 events: 1 in Dec-15 and 1 in Jan-16.	Crest Gauge	25.75 inches
	8/17/2016	undetermined	Crest Gauge	1.56 inches
MY3	10/26/2017	Between 7/26/2017 and 10/26/2017	Crest Gauge, Photographs	26.04 inches
	10/26/2017	10/23/2017	Crest Gauge, Photographs	17.40 inches

* height indicates the highest position of cork shavings on the dowel.

Crest Gauge reading taken on 10/26/2017 shows two distinct high flow events, the lower of which likely occurred on 10/23/2017.

Crest Gauge reading taken on 10/26/2017 shows two distinct high flow events, the lower of which likely occurred on 10/23/2017.

Wrack lines well back from the stream, indicating wide flooding of the floodplain during the storms in October.

Large amounts of debris scattered across the floodplain indicating significant flooding in October.

MY3 Stream Problem Areas and Photos Logan Creek Stream Restoration Project, Number #92515			
Feature Issue	**Station**	**Suspected Cause**	**Photo #**
Aggradation/Bar Formation	None	None	None
Bank Scour	Station 21+00	Bank slump (approx. 6 ft.) along left bank of main stem. Will be monitored to see if the bank stabilizes in MY4 (CPA 3-2 on CCPV)	14
	Station 11+50	Bank slump (approx. 8 ft.) along right bank of main stem. Will be monitored to see if the bank stabilizes in MY4 (CPA 3-4 on CCPV)	16
	Station 2+10	Flooding during December and January caused a small area of bank scour at this location. (CPA 2-1 on CCPV)	1, 2
	Station 4+60	Flooding during December and January caused a small area of bank scour at this location. (CPA 2-3 on CCPV)	5,6
	Station 11+70	Flooding during December and January caused a small area of bank scour at this location. (CPA 2-4 on CCPV)	7,8
	Station 26+60	Flooding during December and January caused a small area of bank scour at this location. (CPA 2-5 on CCPV)	9,10
	Station 27+00	Flooding during December and January caused a small area of bank scour at this location. (CPA 2-6 on CCPV)	11,12
Engineered Structures	Station 23+75	Piping of log structure after the fabric sealing this structure tore (CPA 3-1 on CCPV)	13
	Station 14+75	Piping of log structure after the fabric sealing this structure tore (CPA 3-3 on CCPV)	15
	UT8 Station 00+40	Piping of log structure on UT-8 near the confluence of UT-8 and Logan Creek (CPA 3-5 on CCPV)	17
	2+00	Piping of log structure after the fabric sealing this structure tore during flooding of December and January. (CPA 2-2 on CCPV) *Will be removed from list in MY4*	3,4
Encroachments	Station (approximately) 23+00 to 28+00	New maintenance workers mowed the nature trail (an allowance in the easement); however, they mowed a wider width than was agreed to. We discussed this with staff at Lonesome Valley and they were going to discuss this with a new trails manager. (EA-1 on CCPV)	18,19
New Problem Areas for MY3			
Existing/Old Problem areas from MY2			

Logan Creek Stream Restoration Project – Monitoring Year 3 Stream Problem Area Photos

Photo 1. CPA 2-1 – Station 2+10, small area of bank scour caused by flooding of December and January.

Photo 2. CPA 2-1 – Station 2+10, same area as shown in photo 1 during October 2017 with vegetation stabilizing site. Bank was graded, matting was reinstalled, and live stakes were added during October 2017.

Photo 3. CPA 2-2 – Station 2+00, Piping of log structure after the fabric sealing this structure tore during flooding of December and January.

Photo 4. CPA 2-2 – Station 2+00, Piping structure was repaired in May 2017. Fabric was replaced and substrate was replaced upstream of log structure.

Photo 5. CPA 2-3 – Station 4+60, small area of bank scour caused by flooding of December and January 2016.

Photo 6. CPA 2-3 – Station 4+60, bank scour area was regraded, matting was reinstalled, and herbaceous vegetation was transplanted in May 2017. Livestakes were installed in October 2017.

Photo 7. CPA 2-4 – Station 11+70, small area of bank scour caused by flooding of December and January 2016.

Photo 8. CPA 2-4 – Station 11+70, scour area noted in MY2 has stabilized for the most part. Livestakes were planted in the scour area as well as the bank downstream of the problem area in October 2017.

Photo 9. CPA 2-5 – Station 26+60, small area of bank scour caused by flooding of December and January 2016.

Photo 10. CPA 2-5 – Station 26+60, bank scour area was regraded, matting was reinstalled, and herbaceous vegetation was transplanted in May 2017. Livestakes were installed in October 2017.

Photo 11. CPA 2-6 – Station 27+00, small area of bank scour caused by flooding of December and January 2016.

Photo 12. CPA 2-6 – Station 27+00, bank scour area was regraded, matting was reinstalled, and herbaceous vegetation was transplanted in May 2017. Livestakes were installed in October 2017.

Photo 13. CPA 3-1 – Station 23+75, piping of log structure after the fabric sealing this structure tore in 2017. This structure will be repaired in 2018.

Photo 14. CPA 3-2 – Station 21+00, small bank slump area (approx. 6 ft.) along left bank of main stem. Will be monitored to see if the bank stabilizes in MY4

Photo 15. CPA 3-3 – Station 14+75, piping of log structure after the fabric sealing this structure tore in 2017. This structure will be repaired in 2018.

Photo 16. CPA 3-4 – Station 11+50, small bank slump (approx. 8 ft.) along right bank of main stem. Will be monitored to see if the bank stabilizes in MY4

Photo 17. CPA 3-5 – Station UT8 00+40, piping of log structure on UT-8 near the confluence of UT-8 and Logan Creek

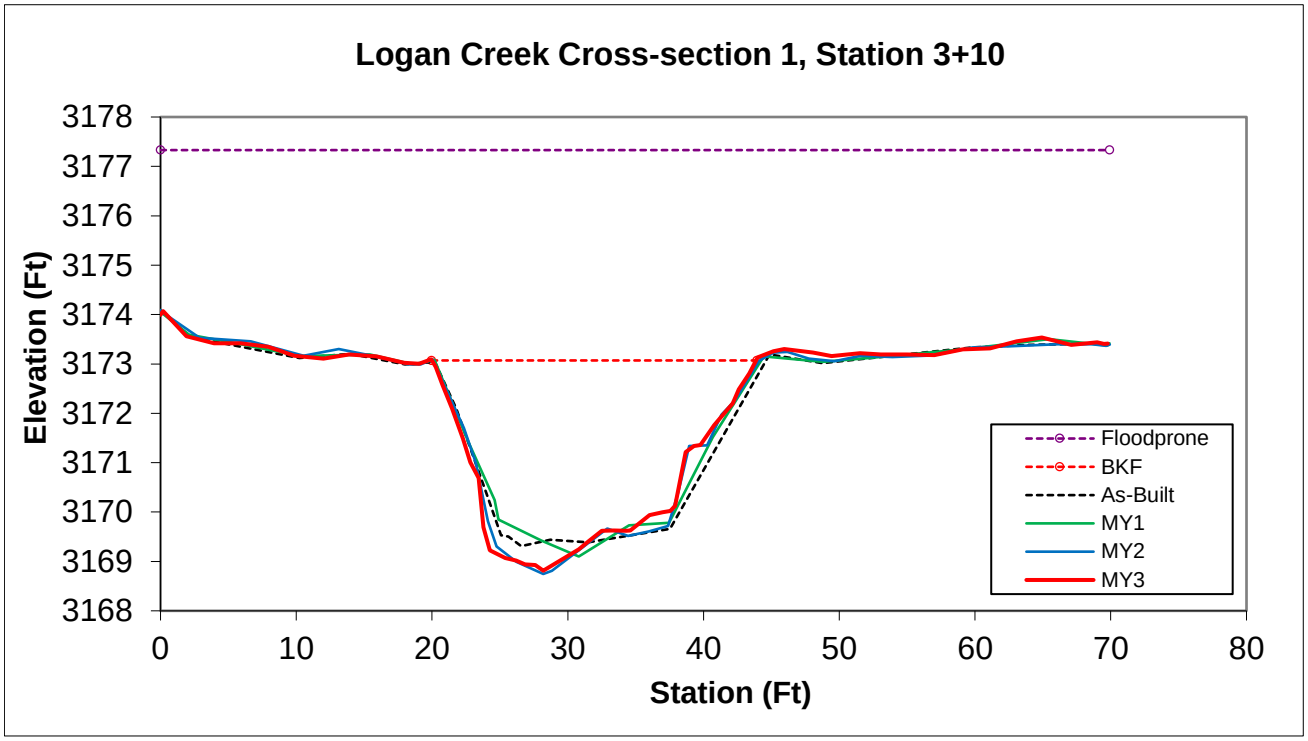
Encroachments

Photo 18. EA 2-1 – Maintenance workers mowed the nature trail wider than the 4-6 feet that had been agreed to earlier, near stationing 23+00 to 28+00.

Photo 19. EA 2-1 – In July of 2017, the path was still being mowed wide through Veg Plot 3.

Permanent Cross-Section 1
(MY3 Data - collected October, 2017)

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	E	64.69	23.95	2.70	4.26	8.87	1.00	2.91	3173.07	3173.07

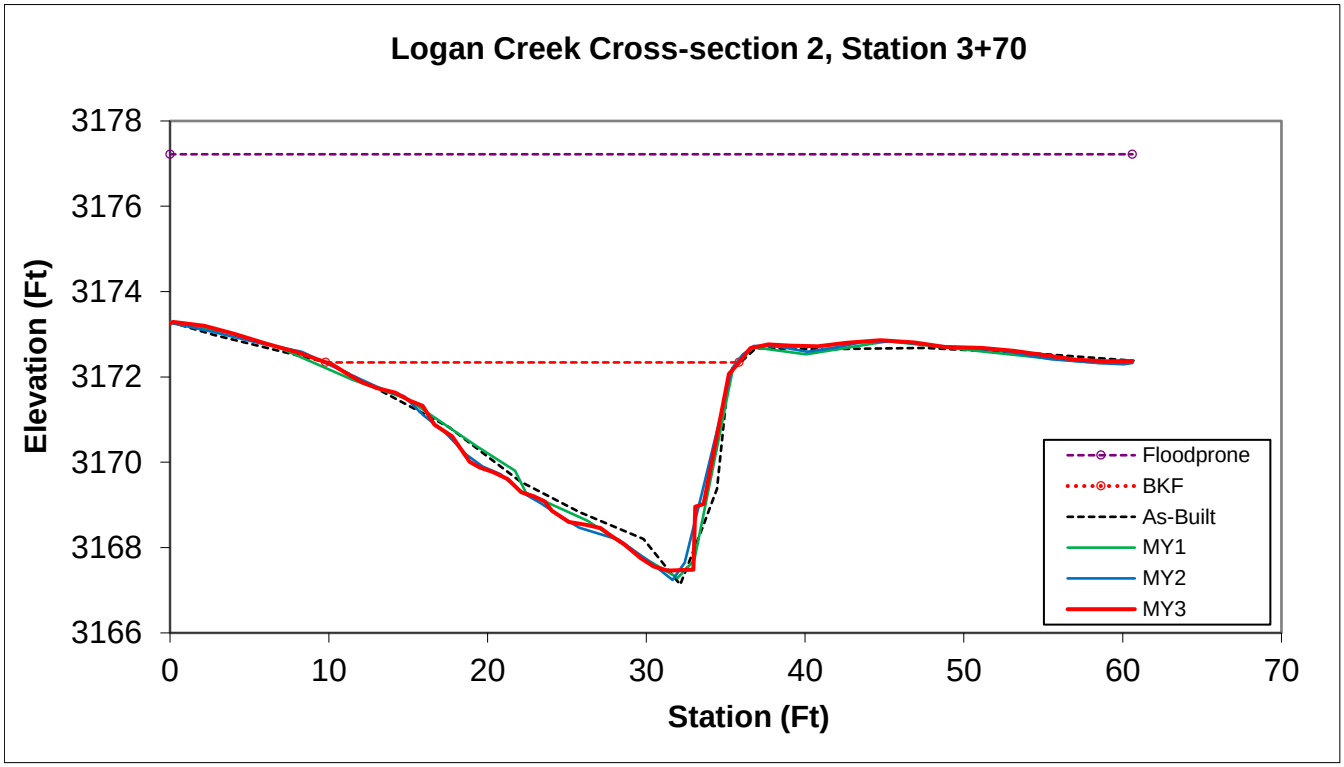


Looking at the Left Bank

Looking at the Right Bank

Permanent Cross-Section 2
(MY3 Data - collected October, 2017)

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool	-	66.22	25.98	2.55	4.88	10.19	1.06	2.33	3172.34	3172.66

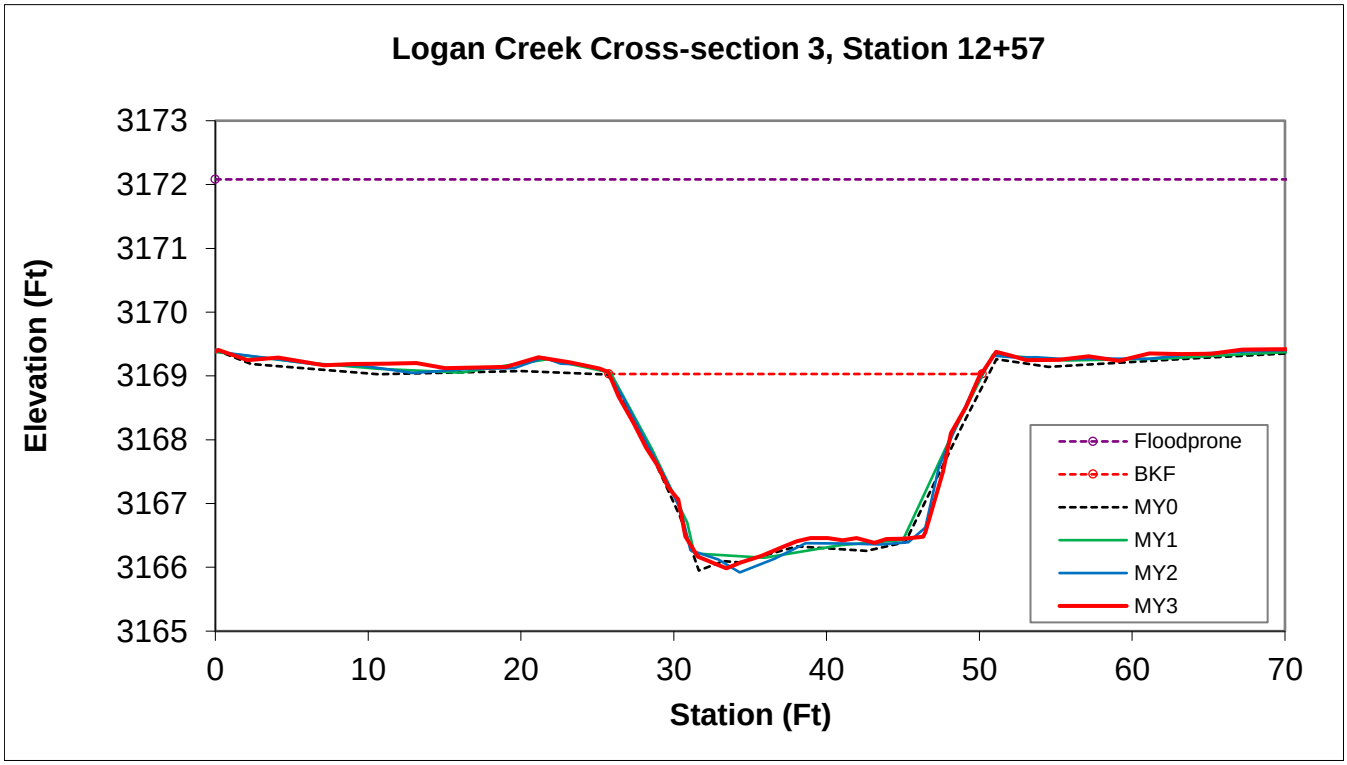


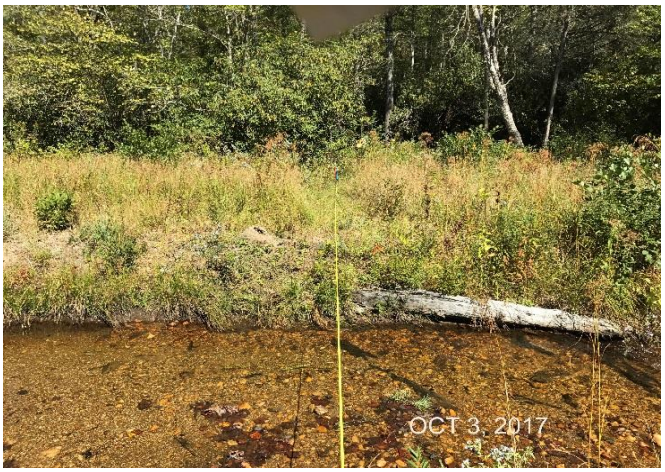
Looking at the Left Bank

Looking at the Right Bank

Permanent Cross-Section 3
(MY3 Data - collected October, 2017)

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	E	52.30	24.29	2.15	3.05	11.30	1.03	4.08	3169.03	3969.11



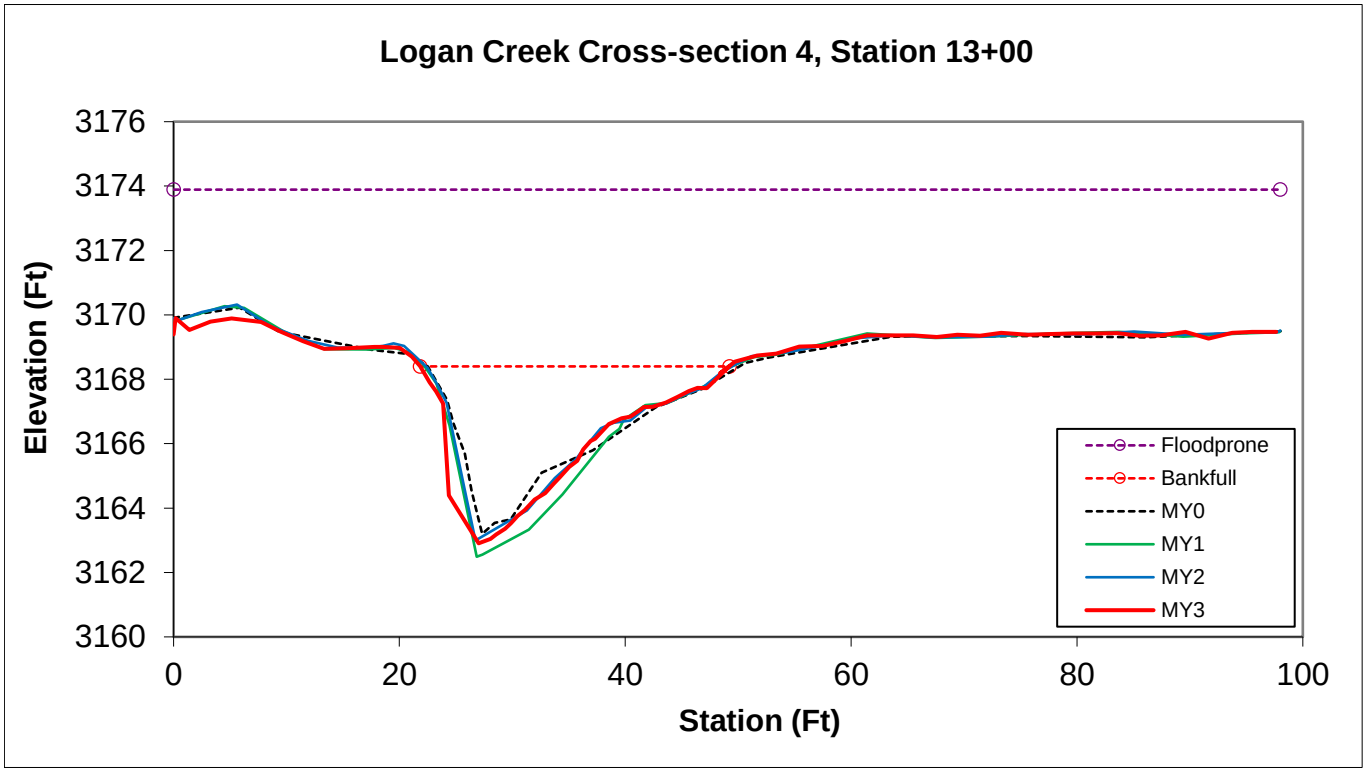


Looking at the Left Bank

Looking at the Right Bank

Permanent Cross-Section 4
(MY3 Data - collected October, 2017)

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool	-	70.16	27.38	2.56	5.49	10.70	1.02	3.57	3168.40	3168.54

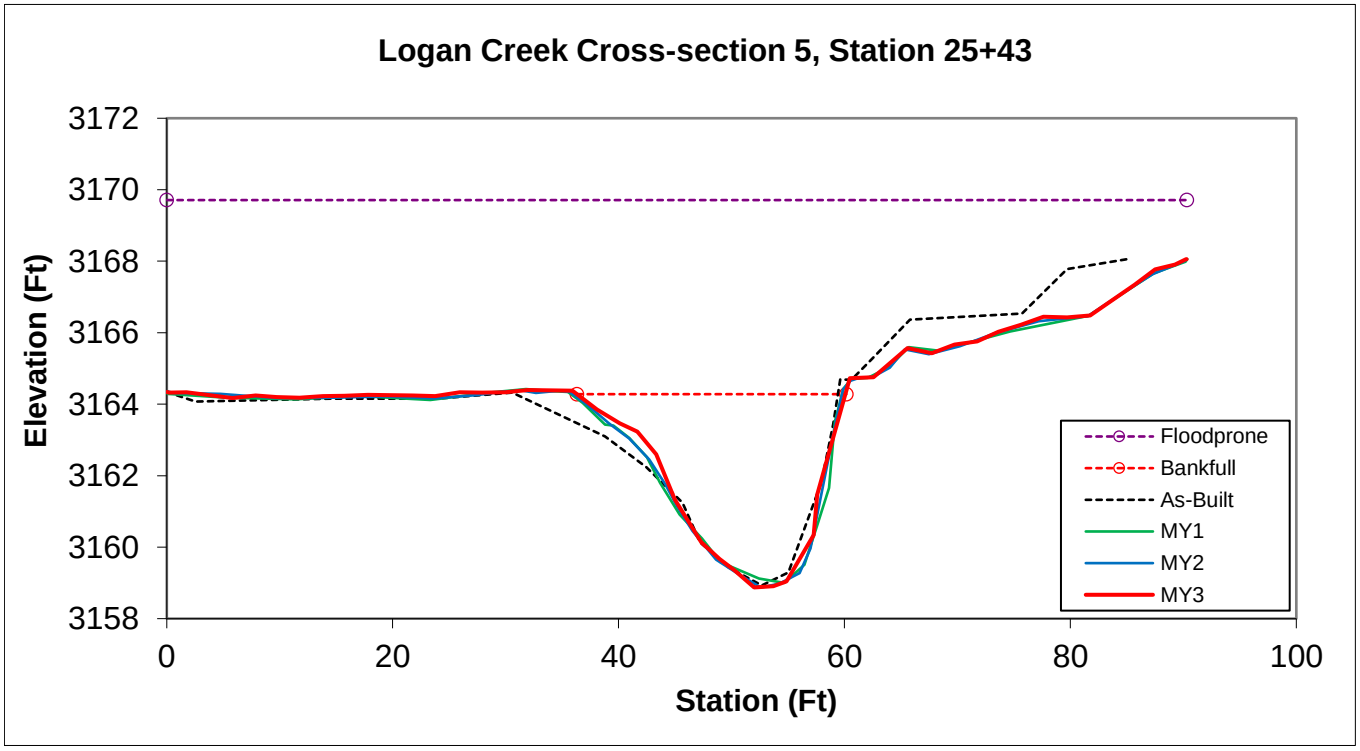


Looking at the Left Bank

Looking at the Right Bank

Permanent Cross-Section 5
(MY3 Data - collected October, 2017)

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool	-	71.03	23.77	2.99	5.42	7.95	1.01	3.80	3164.28	3164.37

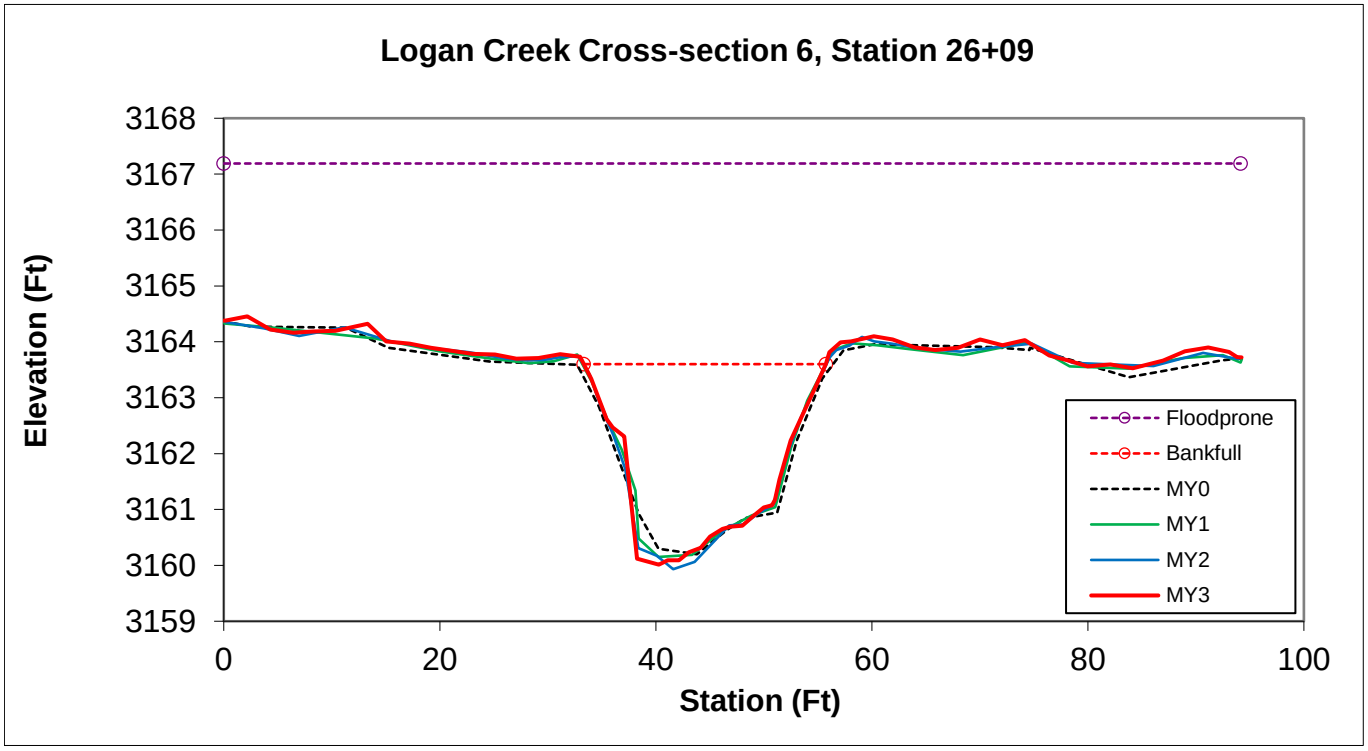


Looking at the Left Bank

Looking at the Right Bank

Permanent Cross-Section 6
(MY3 Data - collected October, 2017)

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	E	50.79	22.40	2.27	3.59	9.87	1.04	4.21	3163.60	3163.73

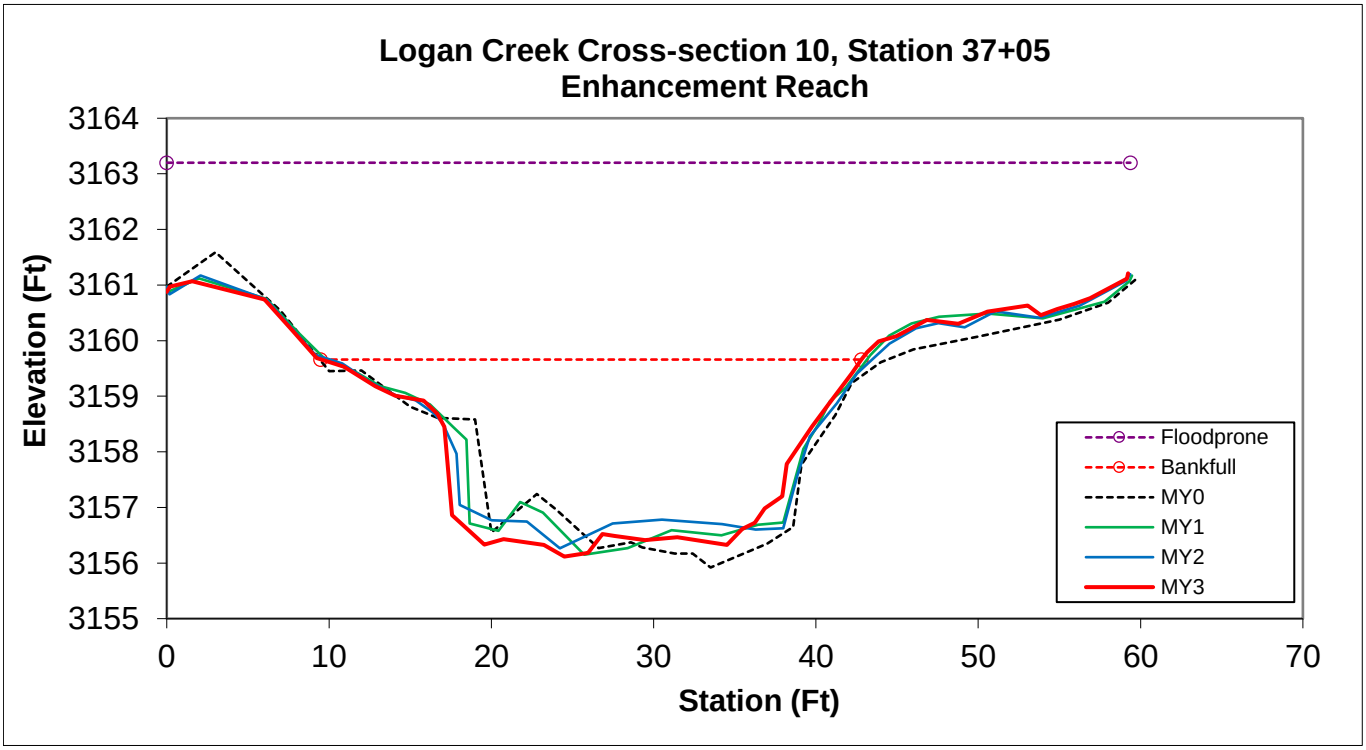


Looking at the Left Bank

Looking at the Right Bank

Permanent Cross-section 10
(MY3 Data - collected October, 2017)

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool	-	74.72	33.28	2.25	3.54	14.79	1.01	1.78	3159.66	3159.80

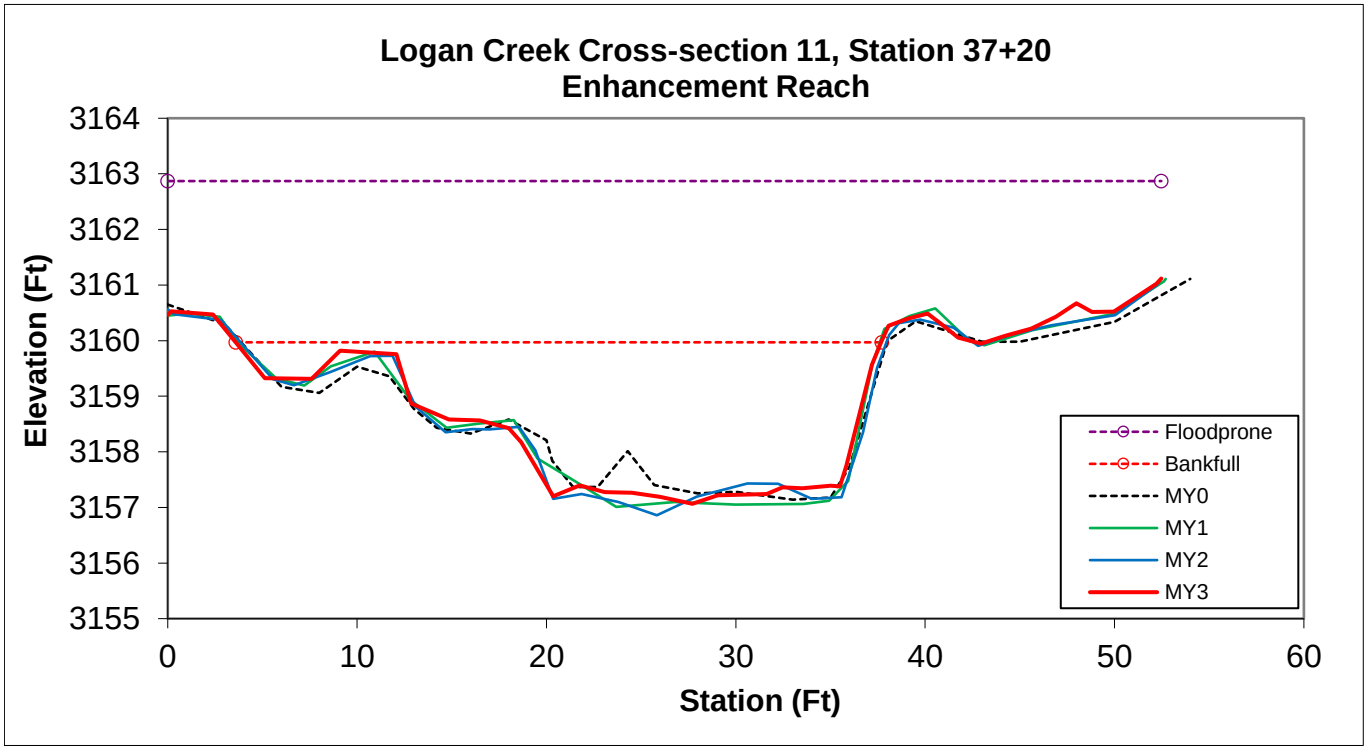


Looking at the Left Bank

Looking at the Right Bank

Permanent Cross-section 11
(MY3 Data - collected October, 2017)

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	B	59.43	34.08	1.74	2.90	19.59	1.11	1.54	3159.97	3160.26

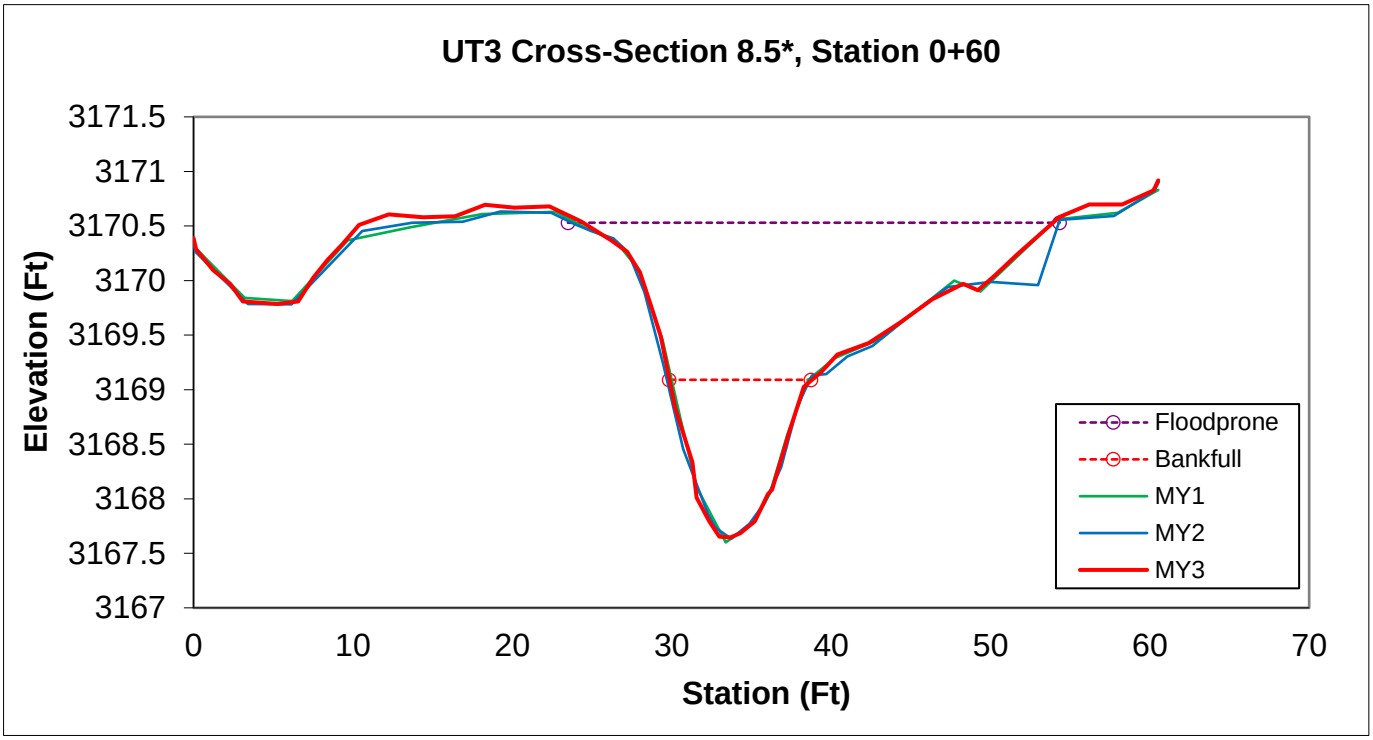


Looking at the Left Bank

Looking at the Right Bank

Permanent Cross-section 8.5
(MY3 Data - collected October, 2017)

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool	-	8.05	8.93	0.90	1.44	9.92	1.07	4.52	3169.09	3169.17



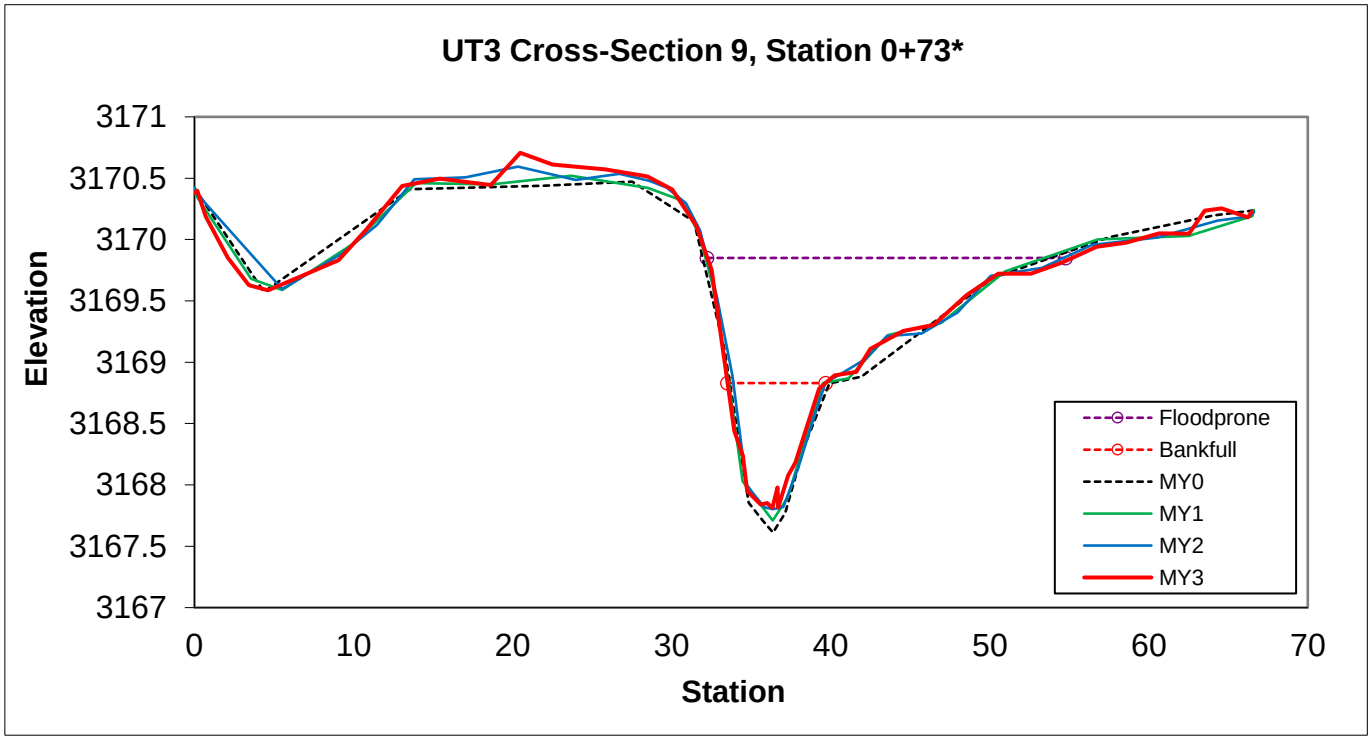
Looking at the Left Bank

Looking at the Right Bank

* This Pool cross-section was not taken for the baseline but was added during MY1 survey and will be continued each year going forward.

Permanent Cross-section 9
(MY3 Data - collected October, 2017)

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	E	3.81	6.16	0.62	1.02	9.94	1.06	4.86	3168.83	3168.90



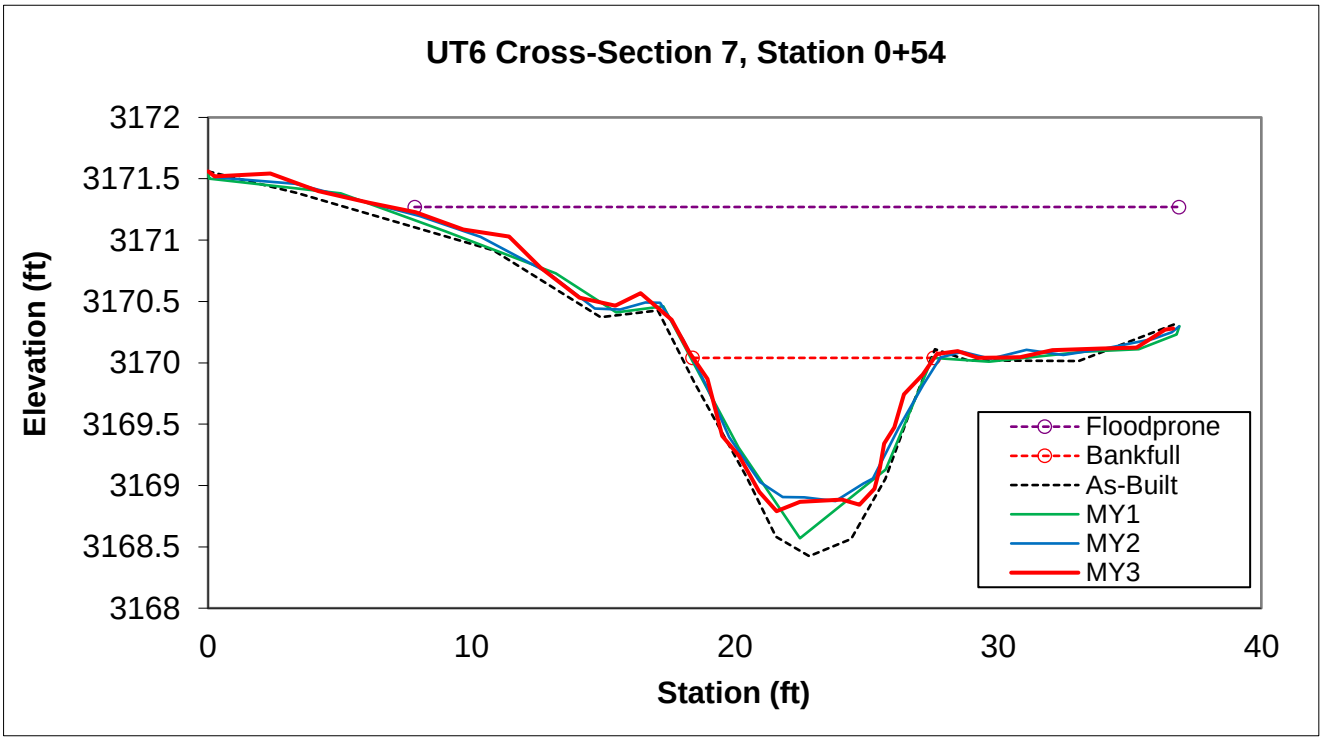
Looking at the Left Bank

Looking at the Right Bank

* The stationing shown on this cross section plot has been changed to correct an error shown in the MY0 plots.

Permanent Cross-section 7
(MY3 Data - collected October, 2017)

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool	-	7.41	9.70	0.81	1.24	11.23	1.08	3.27	3170.04	3170.09

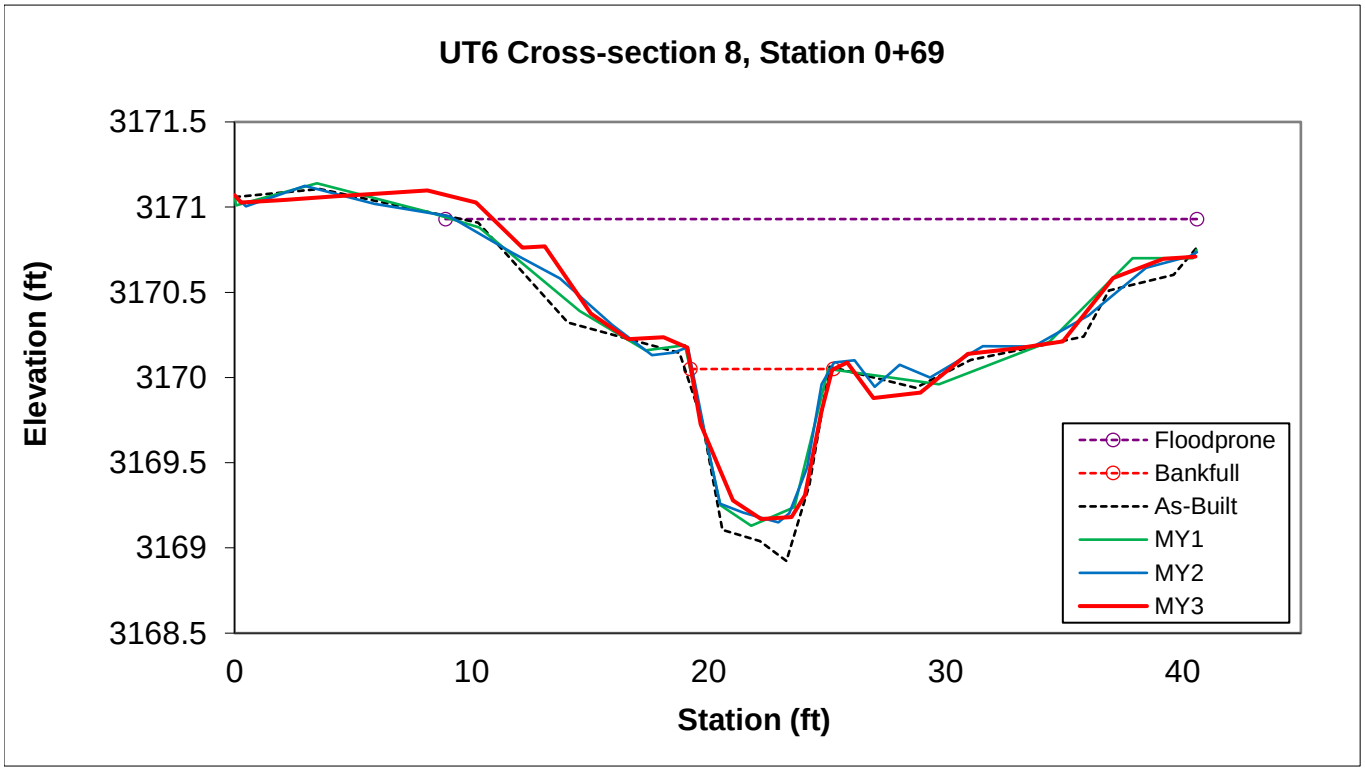


Looking at the Left Bank

Looking at the Right Bank

Permanent Cross-section 8
(MY3 Data - collected October, 2017)

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	E	3.78	6.01	0.63	0.88	9.54	1.05	4.93	3170.05	3170.09

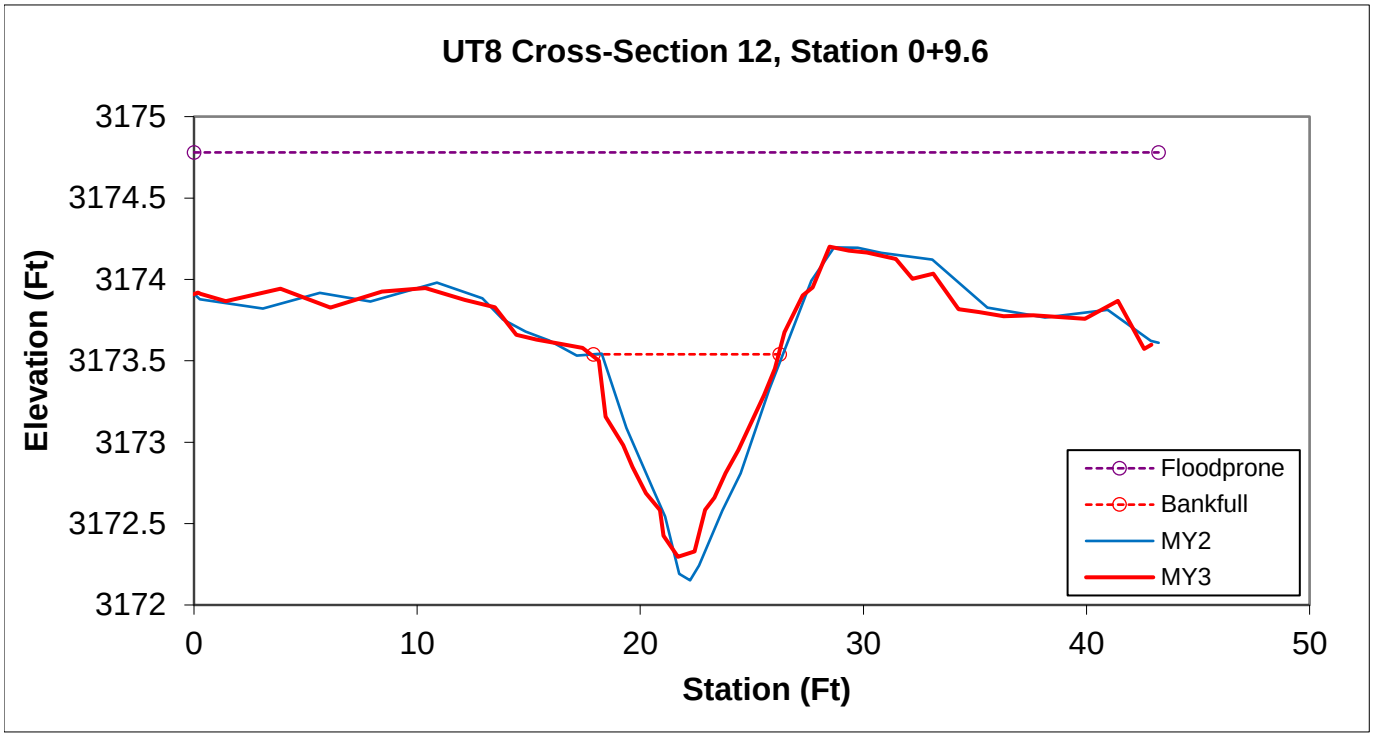


Looking at the Left Bank

Looking at the Right Bank

Permanent Cross-section 12
(MY3 Data - collected October, 2017)

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	E	5.83	8.43	0.69	1.24	12.22	1.00	5.09	3173.54	3173.54

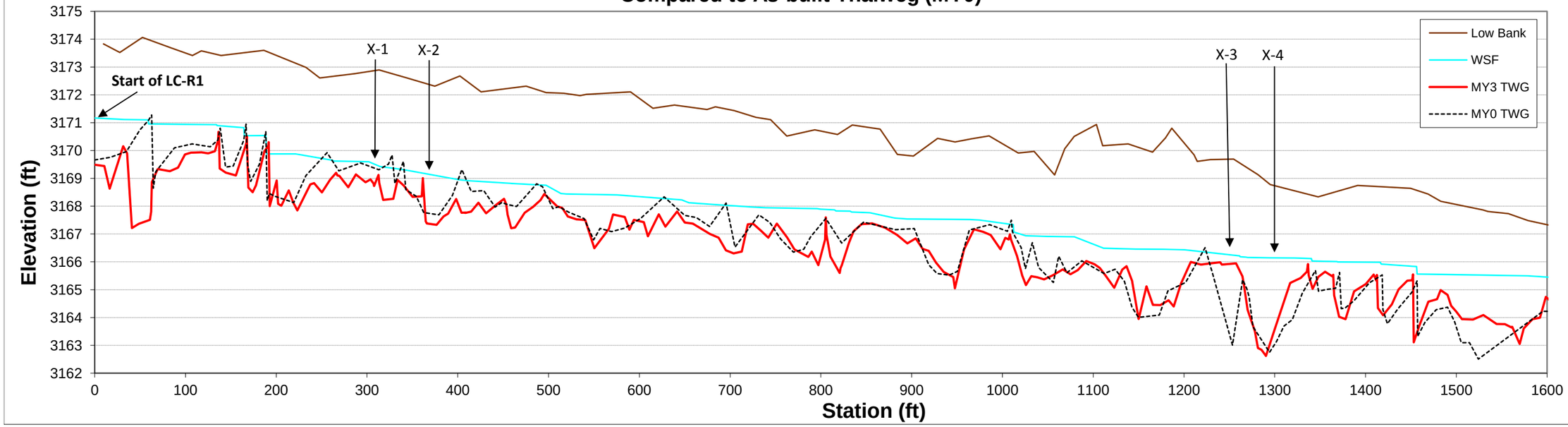


Looking at the Left Bank

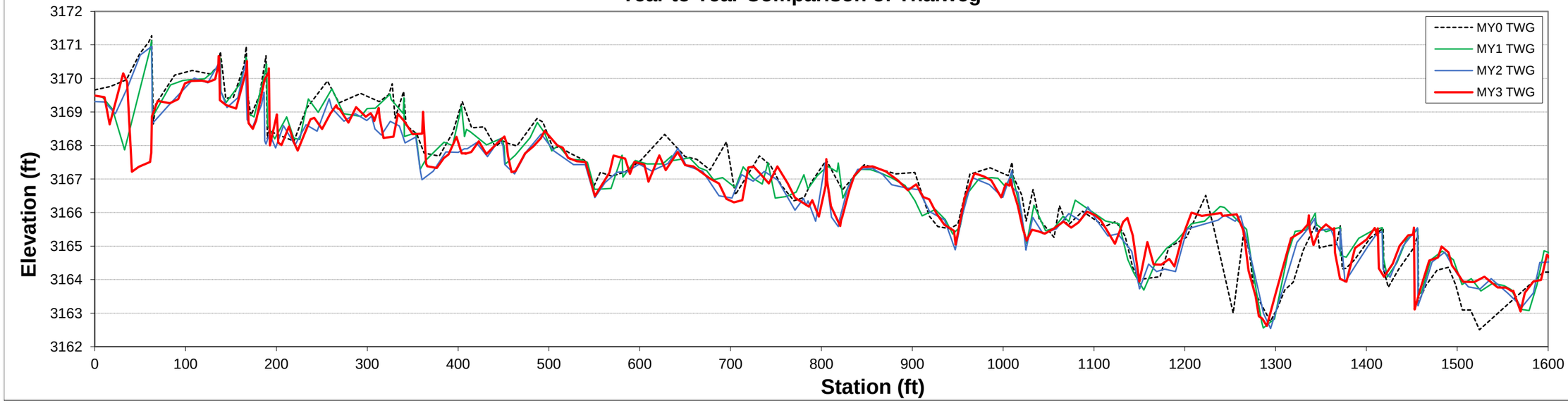
Looking at the Right Bank

This Riffle cross-section was not taken during AB or MY1 surveys but was added in MY2 and will be continued each year going forward.

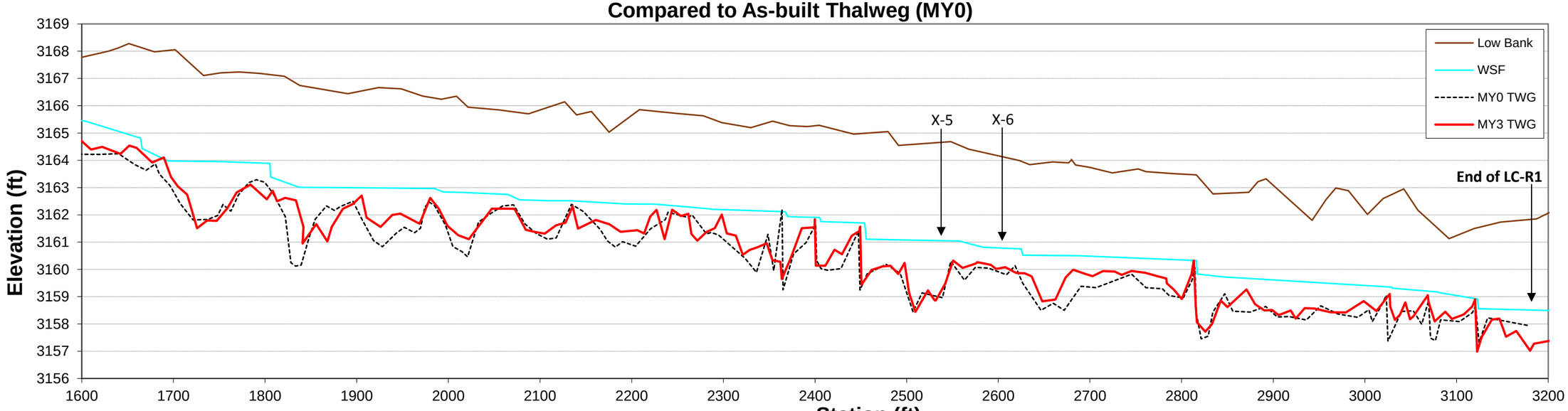
Profile of Logan Creek, Station 0+00 to 16+00, Compared to As-built Thalweg (MY0)



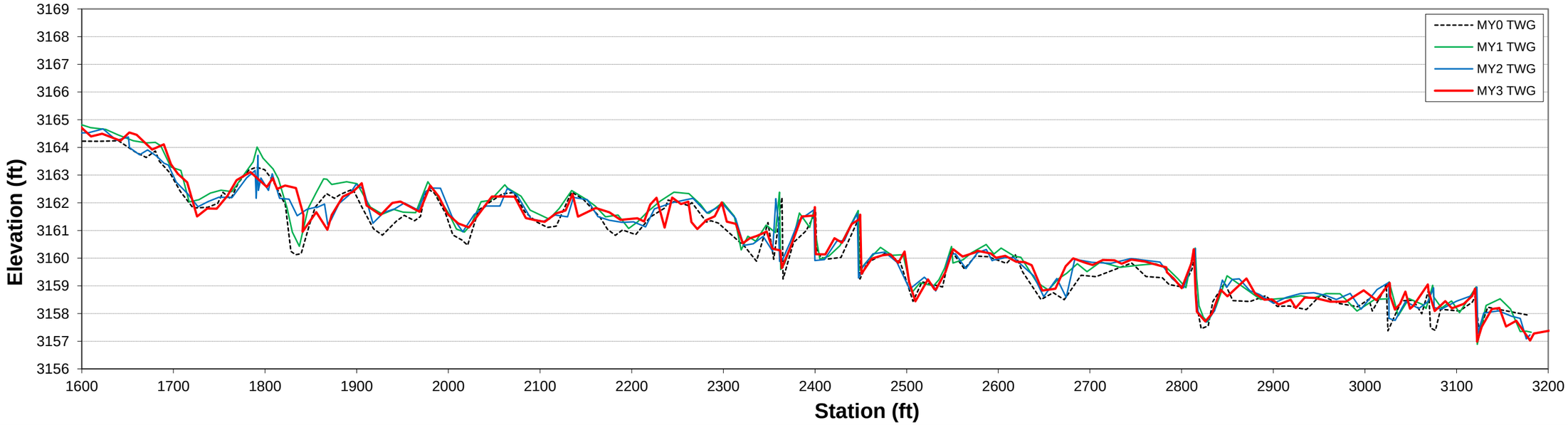
Profile of Logan Creek Thalweg, Station 0+00 to 16+00, Year to Year Comparison of Thalweg

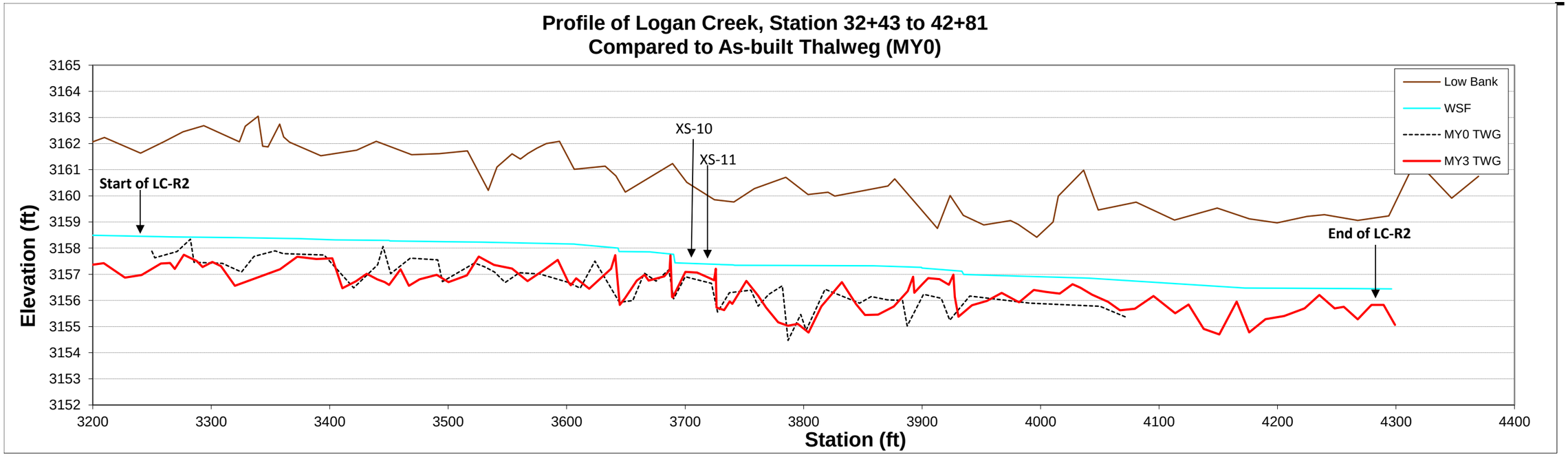


Profile of Logan Creek, Station 16+00 to 32+00
Compared to As-built Thalweg (MY0)

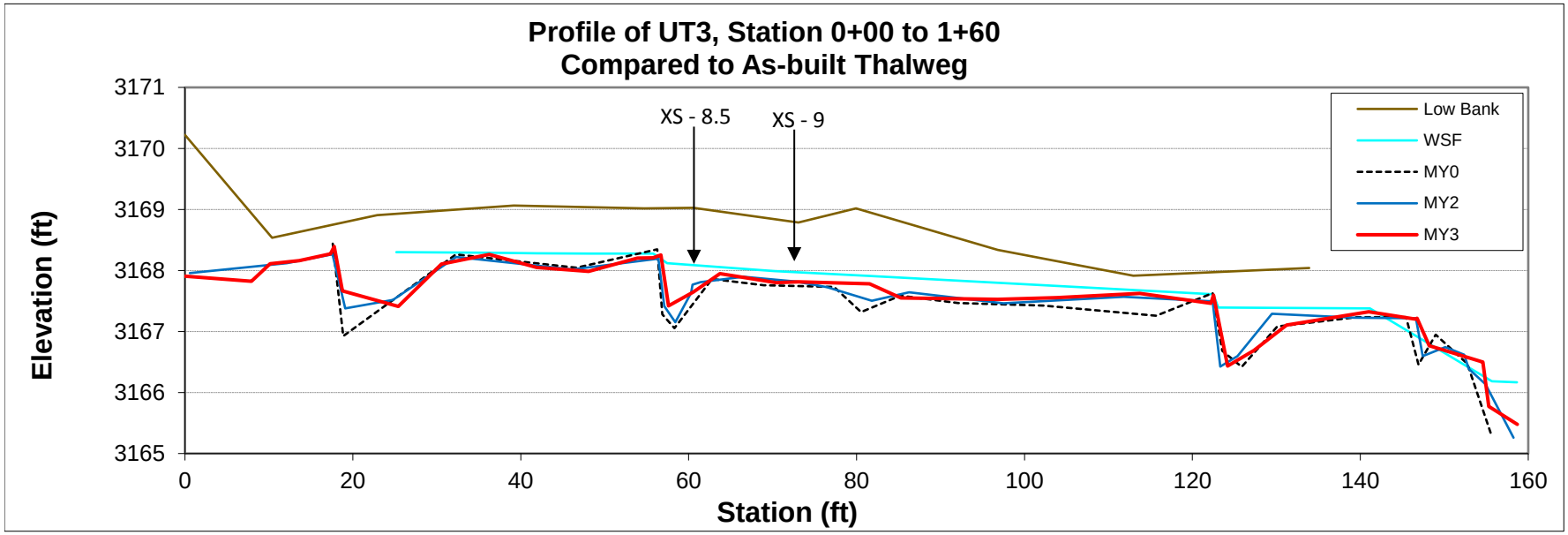


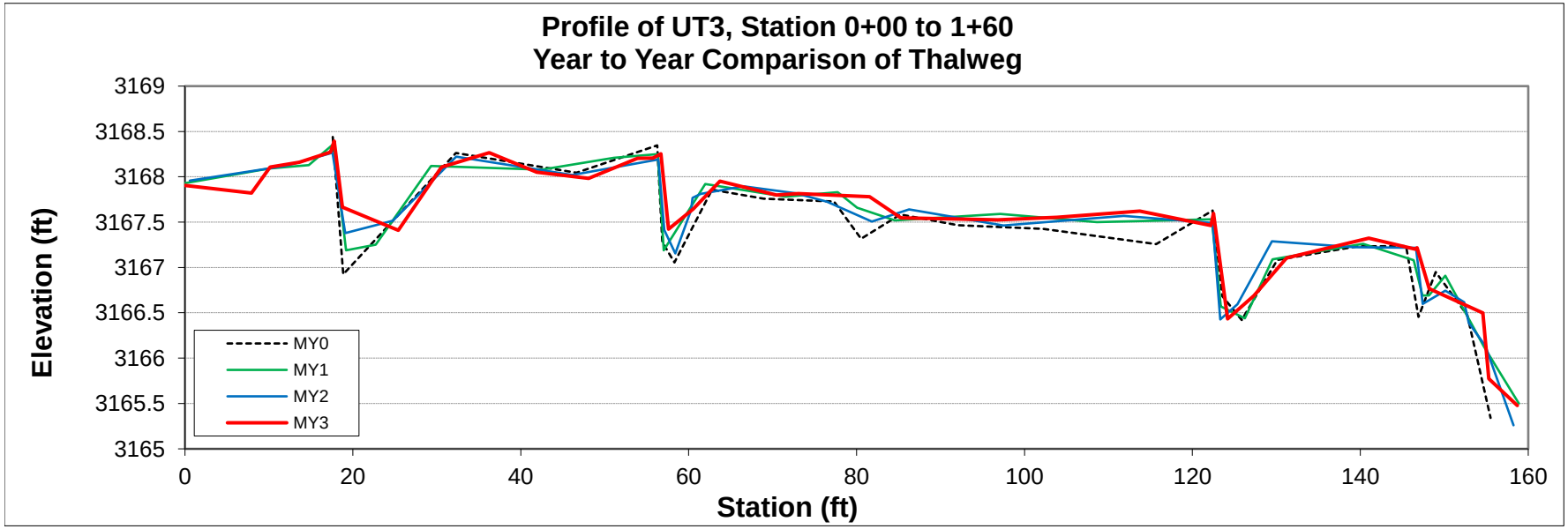
Profile of Logan Creek Thalweg, Station 16+00 to 32+00
Year to Year Comparison of Thalweg

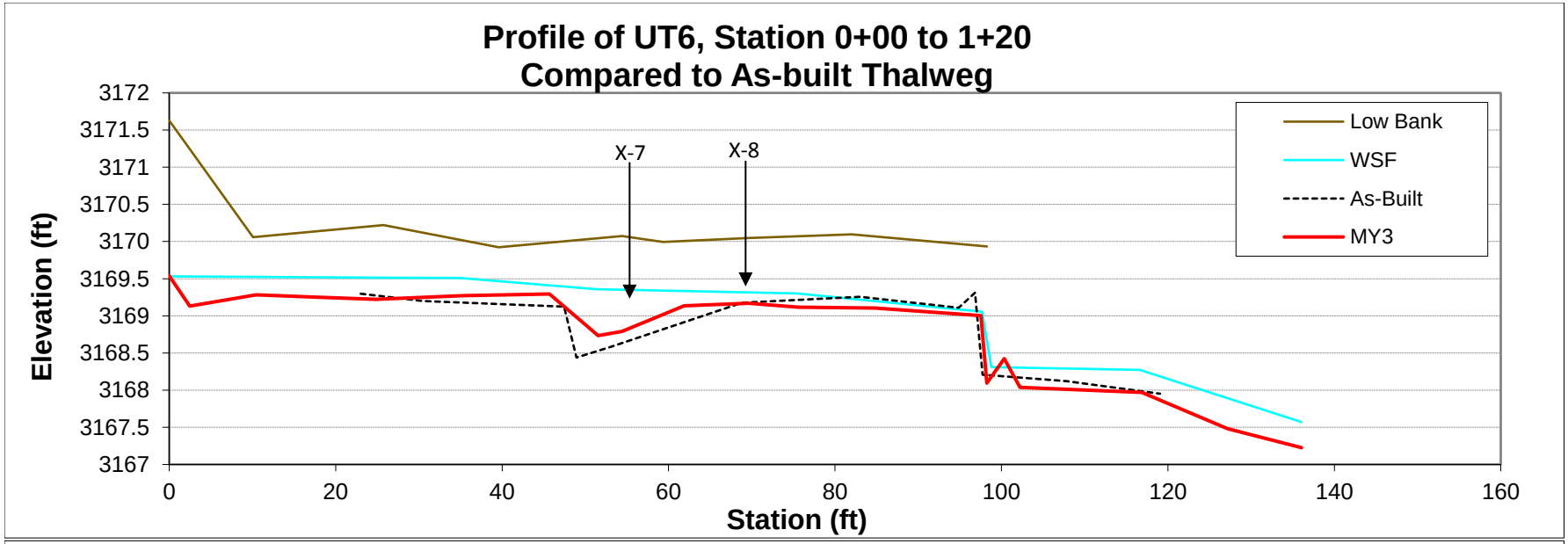


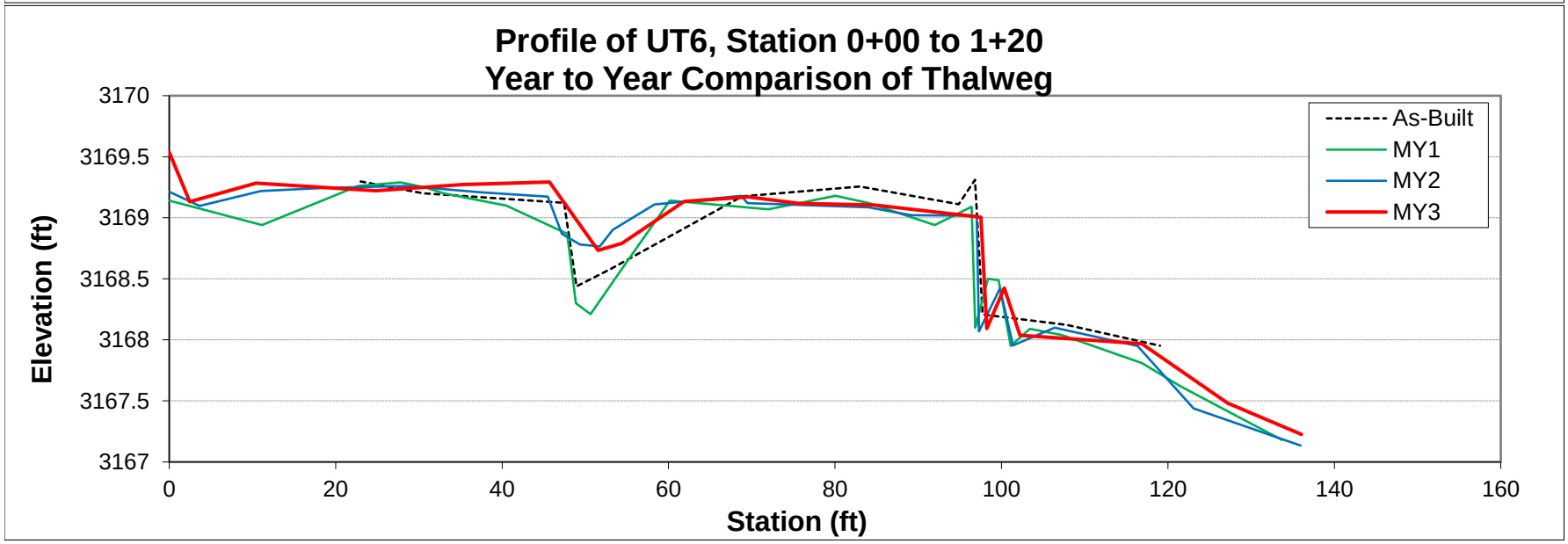

Profile of Logan Creek, Station 32+43 to 42+81
Compared to As-built Thalweg (MY0)
Elevation (ft)
Station (ft)
Start of LC-R2
XS-10
XS-11
End of LC-R2
Low Bank
WSF
MY0 TWG
MY3 TWG
3165
3164
3163
3162
3161
3160
3159
3158
3157
3156
3155
3154
3153
3152
3200
3300
3400
3500
3600
3700
3800
3900
4000
4100
4200
4300
4400

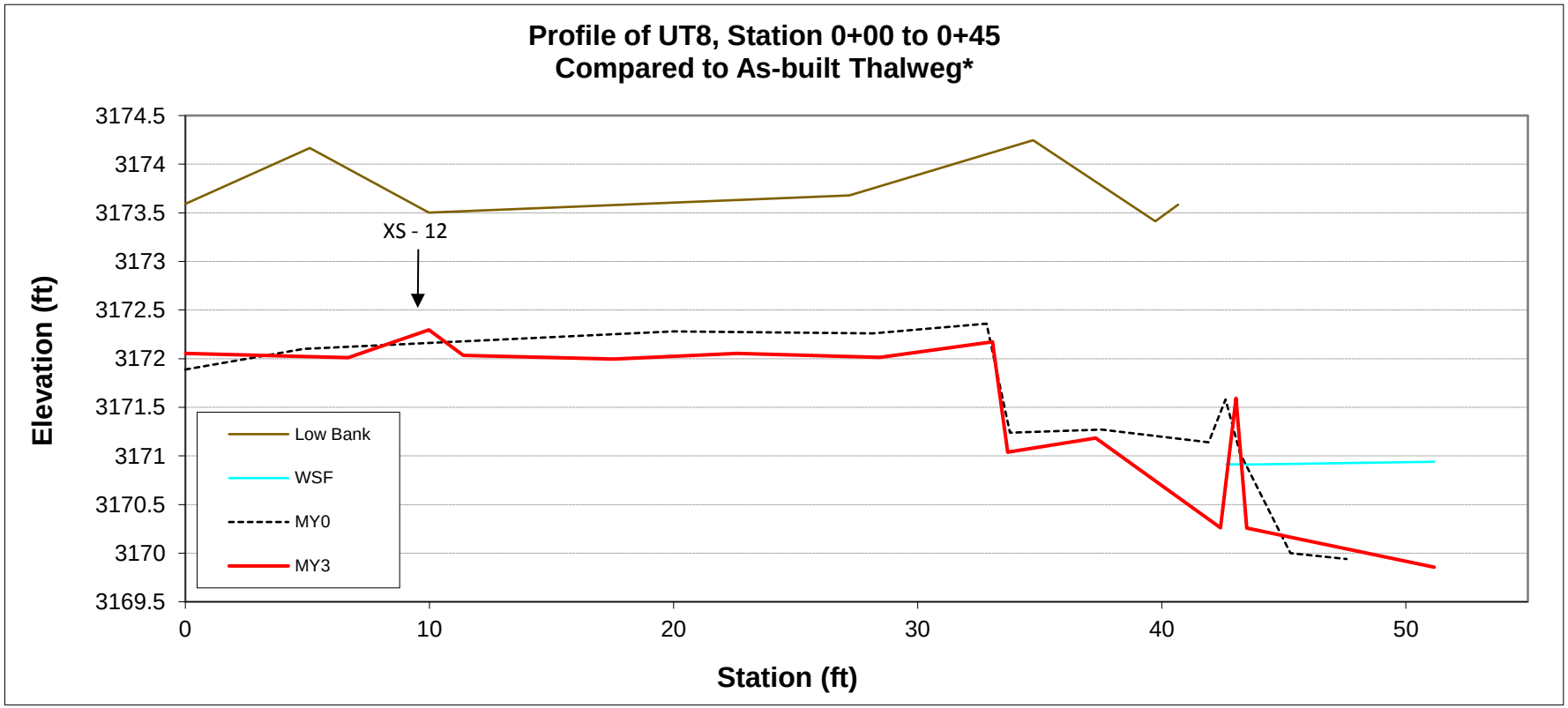
Profile of Logan Creek Thalweg, Station 32+43 to 42+81
Year to Year Comparison of Thalweg
Elevation (ft)
Station (ft)
MY0 TWG
MY1 TWG
MY2 TWG
MY3 TWG
3165
3164
3163
3162
3161
3160
3159
3158
3157
3156
3155
3154
3153
3152
3200
3300
3400
3500
3600
3700
3800
3900
4000
4100
4200
4300
4400


Profile of UT3, Station 0+00 to 1+60
Compared to As-built Thalweg
Elevation (ft)
Station (ft)
XS - 8.5
XS - 9
Low Bank
WSF
MY0
MY2
MY3
3171
3170
3169
3168
3167
3166
3165
0
20
40
60
80
100
120
140
160


Profile of UT3, Station 0+00 to 1+60
Year to Year Comparison of Thalweg
Elevation (ft)
Station (ft)
MY0
MY1
MY2
MY3
3169
3168.5
3168
3167.5
3167
3166.5
3166
3165.5
3165
0
20
40
60
80
100
120
140
160


Profile of UT6, Station 0+00 to 1+20
Compared to As-built Thalweg
Elevation (ft)
Station (ft)
X-7
X-8
Low Bank
WSF
As-Built
MY3
3172
3171.5
3171
3170.5
3170
3169.5
3169
3168.5
3168
3167.5
3167
0
20
40
60
80
100
120
140
160


Profile of UT6, Station 0+00 to 1+20
Year to Year Comparison of Thalweg
Elevation (ft)
Station (ft)
As-Built
MY1
MY2
MY3
3170
3169.5
3169
3168.5
3168
3167.5
3167
0
20
40
60
80
100
120
140
160



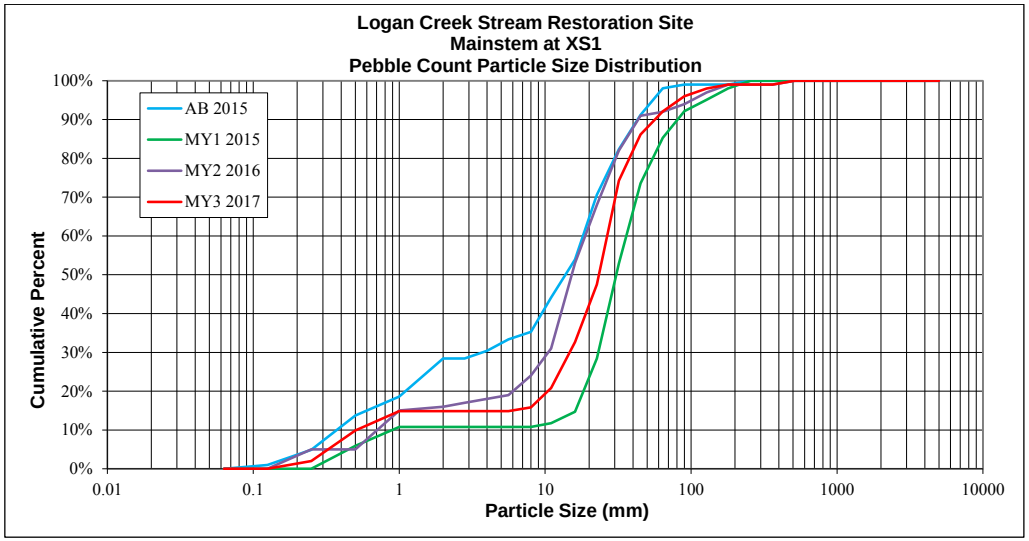
* Note: This profile was added in MY1 because restoration credit is being requested for this reach. However, the profile on this reach was not surveyed and included in the MY0 report.

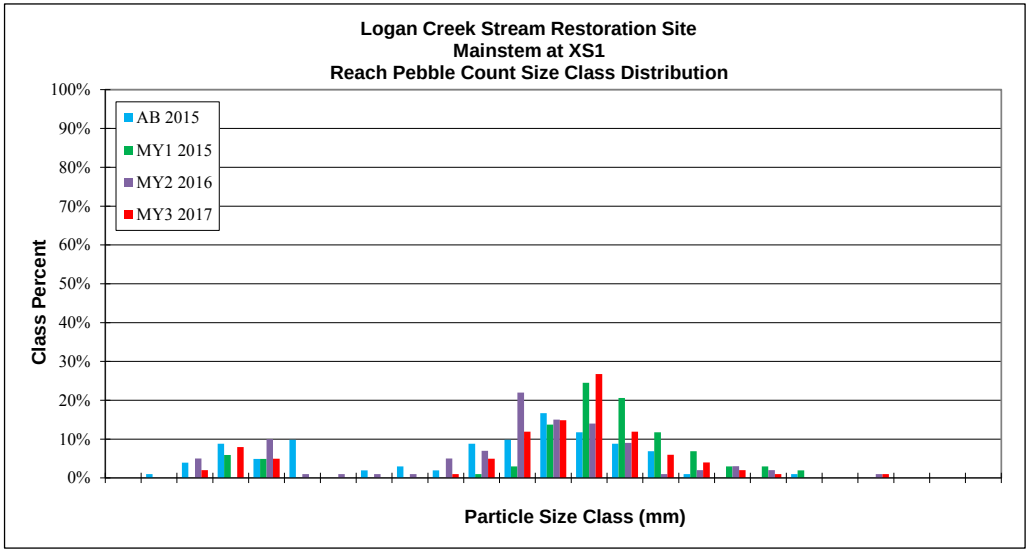
Cross-Section Pebble Count; Monitoring Year 3
Logan Creek Mitigation Project, DMS #92515

SITE OR PROJECT:	Logan Cr
REACH/LOCATION:	Riffle at XS1
FEATURE:	Riffle
DATE:	26-Oct-17

			MY3 2017			Distribution
MATERIAL	**PARTICLE**	**SIZE (mm)**	**Total**	**Class %**	**% Cum**	**Plot Size (mm)**
Silt/Clay	Silt / Clay	< .063			0%	0.063
Sand	Very Fine	.063 - .125			0%	0.125
	Fine	.125 - .25	2	2%	2%	0.25
	Medium	.25 - .50	8	8%	10%	0.50
	Coarse	.50 - 1.0	5	5%	15%	1.0
	Very Coarse	1.0 - 2.0			15%	2.0
Gravel	Very Fine	2.0 - 2.8			15%	2.8
	Very Fine	2.8 - 4.0			15%	4.0
	Fine	4.0 - 5.6			15%	5.6
	Fine	5.6 - 8.0	1	1%	16%	8.0
	Medium	8.0 - 11.0	5	5%	21%	11.0
	Medium	11.0 - 16.0	12	12%	33%	16.0
	Coarse	16 - 22.6	15	15%	48%	22.6
	Coarse	22.6 - 32	27	27%	74%	32
	Very Coarse	32 - 45	12	12%	86%	45
	Very Coarse	45 - 64	6	6%	92%	64
Cobble	Small	64 - 90	4	4%	96%	90
	Small	90 - 128	2	2%	98%	128
	Large	128 - 180	1	1%	99%	180
	Large	180 - 256			99%	256
Boulder	Small	256 - 362			99%	362
	Small	362 - 512	1	1%	100%	512
	Medium	512 - 1024			100%	1024
	Large-Very Large	1024 - 2048			100%	2048
Bedrock	Bedrock	> 2048			100%	5000
Total % of whole count			101	100%		

Summary Data			
Channel materials			
D16 =	8.1	D84 =	42.3
D35 =	16.9	D95 =	82.3
D50 =	23.3	D100 =	362 - 512



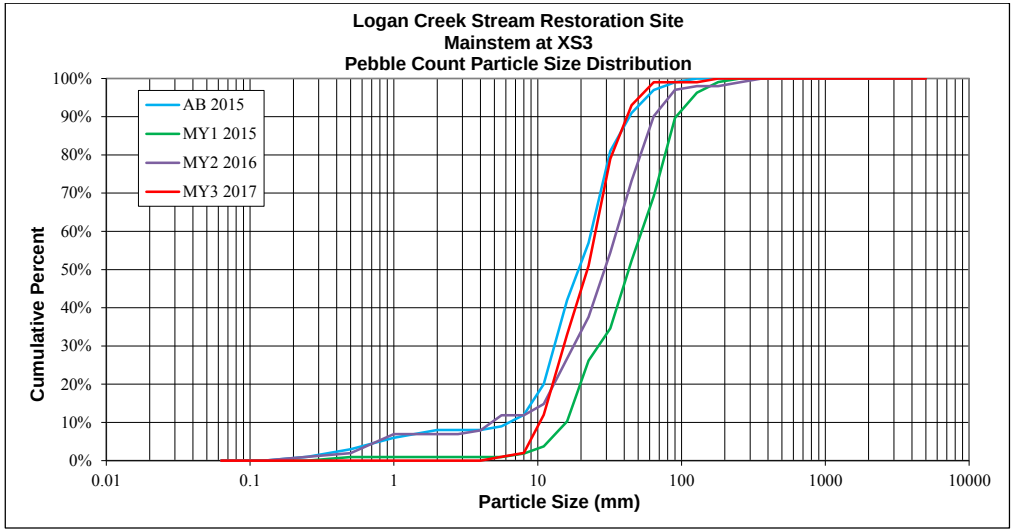


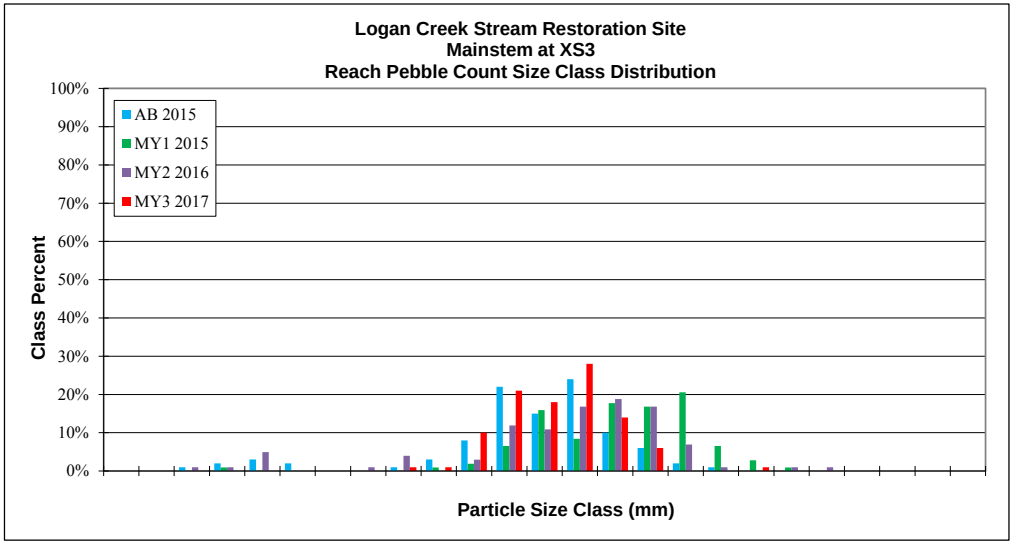
Cross-Section Pebble Count; Monitoring Year 3
Logan Creek Mitigation Project, DMS #92515

SITE OR PROJECT:	Logan Cr
REACH/LOCATION:	Riffle at XS3
FEATURE:	Riffle
DATE:	26-Oct-17

			MY3 2017			Distribution
MATERIAL	**PARTICLE**	**SIZE (mm)**	**Total**	**Class %**	**% Cum**	**Plot Size (mm)**
Silt/Clay	Silt / Clay	< .063			0%	0.063
Sand	Very Fine	.063 - .125			0%	0.125
	Fine	.125 - .25			0%	0.25
	Medium	.25 - .50			0%	0.50
	Coarse	.50 - 1.0			0%	1.0
	Very Coarse	1.0 - 2.0			0%	2.0
Gravel	Very Fine	2.0 - 2.8			0%	2.8
	Very Fine	2.8 - 4.0			0%	4.0
	Fine	4.0 - 5.6	1	1%	1%	5.6
	Fine	5.6 - 8.0	1	1%	2%	8.0
	Medium	8.0 - 11.0	10	10%	12%	11.0
	Medium	11.0 - 16.0	21	21%	33%	16.0
	Coarse	16 - 22.6	18	18%	51%	22.6
	Coarse	22.6 - 32	28	28%	79%	32
	Very Coarse	32 - 45	14	14%	93%	45
	Very Coarse	45 - 64	6	6%	99%	64
Cobble	Small	64 - 90			99%	90
	Small	90 - 128			99%	128
	Large	128 - 180	1	1%	100%	180
	Large	180 - 256			100%	256
Boulder	Small	256 - 362			100%	362
	Small	362 - 512			100%	512
	Medium	512 - 1024			100%	1024
	Large-Very Large	1024 - 2048			100%	2048
Bedrock	Bedrock	> 2048			100%	5000
Total % of whole count			100	100%		

Summary Data			
Channel materials			
D16 =	11.8	D84 =	36.1
D35 =	16.6	D95 =	50.6
D50 =	22.2	D100 =	128 - 180



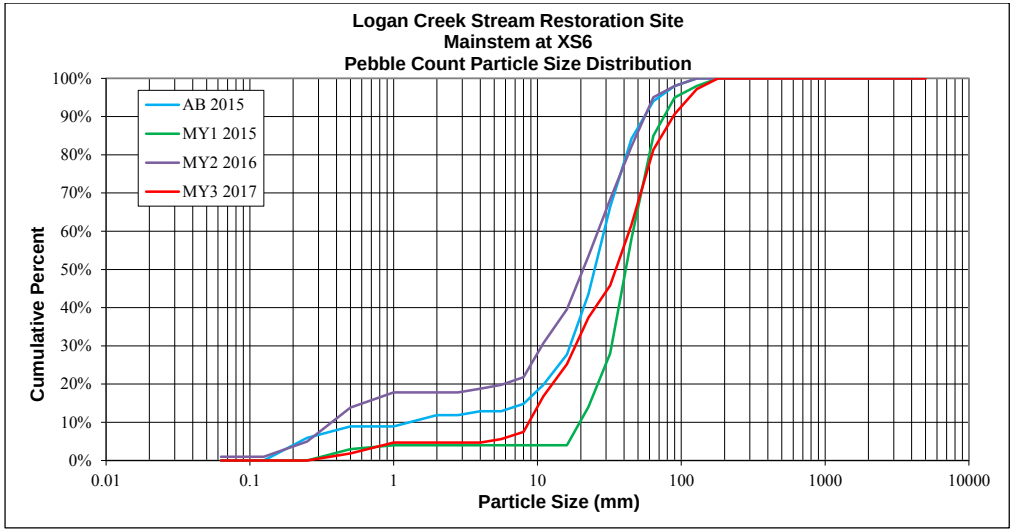


Cross-Section Pebble Count; Monitoring Year 3
Logan Creek Mitigation Project, DMS #92515

SITE OR PROJECT:	Logan Cr
REACH/LOCATION:	Riffle at XS6
FEATURE:	Riffle
DATE:	26-Oct-17

			MY3 2017			Distribution
MATERIAL	PARTICLE	SIZE (mm)	Total	Class %	% Cum	Plot Size (mm)
Silt/Clay	Silt / Clay	< .063			0%	0.063
Sand	Very Fine	.063 - .125			0%	0.125
	Fine	.125 - .25			0%	0.25
	Medium	.25 - .50	2	2%	2%	0.50
	Coarse	.50 - 1.0	3	3%	5%	1.0
	Very Coarse	1.0 - 2.0			5%	2.0
Gravel	Very Fine	2.0 - 2.8			5%	2.8
	Very Fine	2.8 - 4.0			5%	4.0
	Fine	4.0 - 5.6	1	1%	6%	5.6
	Fine	5.6 - 8.0	2	2%	7%	8.0
	Medium	8.0 - 11.0	10	9%	17%	11.0
	Medium	11.0 - 16.0	9	8%	25%	16.0
	Coarse	16 - 22.6	13	12%	37%	22.6
	Coarse	22.6 - 32	9	8%	46%	32
	Very Coarse	32 - 45	17	16%	62%	45
	Very Coarse	45 - 64	21	20%	81%	64
Cobble	Small	64 - 90	10	9%	91%	90
	Small	90 - 128	7	7%	97%	128
	Large	128 - 180	3	3%	100%	180
	Large	180 - 256			100%	256
Boulder	Small	256 - 362			100%	362
	Small	362 - 512			100%	512
	Medium	512 - 1024			100%	1024
	Large-Very Large	1024 - 2048			100%	2048
Bedrock	Bedrock	> 2048			100%	5000
Total % of whole count			107	100%		

Summary Data			
Channel materials			
D16 =	10.7	D84 =	70.6
D35 =	21.1	D95 =	113.7
D50 =	35.0	D100 =	128 - 180



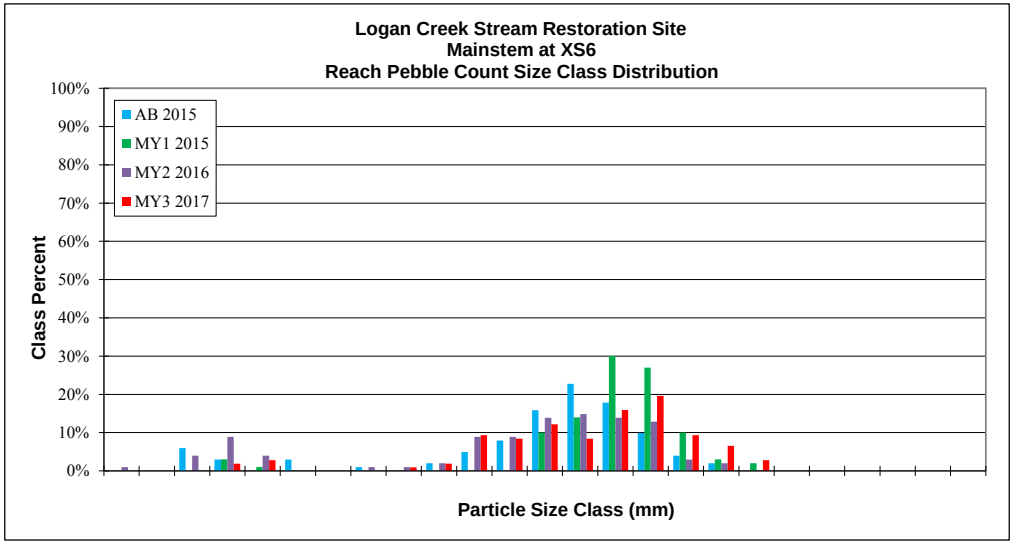


Table 10. Monitoring Year 3 Stream Summary

Logan Creek Restoration Project; DMS Project ID No. 94645

Logan Creek Mainstem

Parameter	USGS Gauge	Regional Curve Interval [1]			Pre-Existing Condition [1]						Reference Reach Data: Right Prong Logan Creek						Design						As-built						MY1						MY2						MY3					
Dimension and Substrate - Riffle		NC Mtn. Regional Curve			Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
BF Width (ft)	-	26.4	28.3	-	22.9	27.3	23.8	38.7	6.6	4	-	16.7	-	-	-	-	-	26.0	-	-	-	-	23.6	24.3	24.1	25.2	0.67	3	22.6	23.7	24.0	24.3	0.77	3	22.5	26.2	24.3	33.9	4.50	4	22.4	26.2	24.1	34.1	4.62	4
Floodprone Width (ft)	-	-	-	-	-	-	-	-	-	-	-	35.0	-	-	-	-	-	150.00	-	-	-	-	-	>150	-	-	-	3	-	>150	-	-	-	3	>54	>80		>100		4	>54	>80	-	>100	-	4
BF Mean Depth (ft)	-	1.4	1.5	-	1.50	2.2	2.4	2.60	0.4	4	-	1.06	-	-	-	-	-	2.3	-	-	-	-	2.1	2.3	2.2	2.6	0.22	3	2.1	2.3	2.2	2.6	0.21	3	1.8	2.2	2.2	2.7	0.32	4	1.7	2.2	2.2	2.7	0.34	4
BF Max Depth (ft)	-	-	-	-	3.4	3.6	3.5	3.8	0.2	4	-	1.54	-	-	-	-	-	4.0	-	-	-	-	3.1	3.4	3.4	3.7	0.24	3	2.9	3.4	3.5	4.0	0.45	3	3.0	3.5	3.4	4.3	0.53	4	2.9	3.5	3.3	4.3	0.53	4
BF Cross-sectional Area (ft^2)	-	37.5	42.7	-	55.8	58.0	58.4	59.5	1.36	4	-	17.7	-	-	-	-	-	58.5	-	-	-	-	51.7	56.0	53.2	63.0	5.01	3	50.2	54.6	51.2	62.4	5.53	3	51.4	57.7	57.3	64.8	5.74	4	50.8	56.8	55.9	64.7	5.60	4
Width/Depth Ratio	-	-	-	-	8.9	13.6	9.8	25.7	7.01	4	-	15.8	-	-	-	-	-	12	-	-	-	-	9.2	10.7	10.8	12.0	1.12	3	9.3	10.3	10.1	11.6	0.96	3	8.9	12.2	10.6	18.6	3.81	4	8.9	12.4	10.6	19.6	4.24	4
Entrenchment Ratio	-	-	-	-	3.4	11.3	12.0	17.8	5.83	4	-	2.0	-	-	-	-	-	5.8	-	-	-	-	2.9	3.6	3.9	4.0	0.50	3	2.9	3.7	4.0	4.1	0.54	3	1.6	3.2	3.5	4.2	1.06	4	1.5	3.2	3.5	4.2	1.08	4
Bank Height Ratio	-	-	-	-	1	1.2	1.1	1.5	0.2	4	-	1.2	-	-	-	-	-	1.0	-	-	-	-	1.0	1.00	1.00	1.0	0.00	3	1.0	1.0	1.0	1.1	0.05	3	1.0	1.1	1.0	1.2	0.09	4	1.0	1.0	1.0	1.1	0.04	4
d50 (mm)	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	12.4	-	-	-	-	12.4	12.4	12.4	12.4	0.00	1	30.7	38.3	41.1	43.0	5.41	3	15.2	21.7	20.7	29.2	5.8	3	22.2	26.8	23.3	35.0	5.8	3
Pattern																																														
Channel Beltwidth (ft)	-	-	-	-	194	216	217	252	18.13	7	-	80	-	-	-	-	65	-	-	140	-	-	130.0	193.2	190.0	258.0	41.45	6	130.0	193.2	190.0	258.0	41.5	6	130.0	193.2	190.0	258.0	41.5	6	130.0	193.2	190.0	258.0	41.5	6
Radius of Curvature (ft)	-	-	-	-	23	32	30	46	8.6	5	-	23	-	-	-	-	28	-	-	75	-	-	44.0	63.9	66.1	104.0	17.17	9	44.0	63.9	66.1	104.0	17.2	9	44.0	63.9	66.1	104.0	17.2	9	44.0	63.9	66.1	104.0	17.2	9
Rc:Bankfull width (ft/ft)	-	-	-	-	0.85	1.19	1.11	1.7	0.32	5	-	1.38	-	-	-	-	1.1	-	-	2.9	-	-	1.80	2.60	2.70	4.30	0.71	9	1.80	2.60	2.70	4.30	0.71	9	1.80	2.60	2.70	4.30	0.71	9	1.80	2.60	2.70	4.30	0.71	9
Meander Wavelength (ft)	-	-	-	-	120	177	197	239	46.75	5	-	150	-	-	-	-	118	-	-	236	-	-	145.0	236.7	244.5	321.0	48.10	12	145.0	236.7	244.5	321.0	48.1	12	145.0	236.7	244.5	321.0	48.1	12	145.0	236.7	244.5	321.0	48.1	12
Meander Width Ratio	-	-	-	-	4.44	6.56	7.3	8.85	1.73	5	-	4.8	-	-	-	-	2.5	-	-	5.4	-	-	6.0	9.7	10.1	13.2	1.98	12	6.0	9.7	10.1	13.2	2.0	12	6.0	9.7	10.1	13.2	2.0	12	6.0	9.7	10.1	13.2	2.0	12
Profile																																														
Riffle Length (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25.7	68.1	65.3	149.8	31.6	16	18.6	90.5	93.5	162.3	47.4	9	40.6	105.7	90.6	238.8	61.8	9
Riffle Slope (ft/ft)	-	-	-	-	-	-	-	-	-	-	-	0.019	-	-	-	-	0.003	-	-	0.007	-	-	-	-	-	-	-	-	0.0009	0.0079	0.0049	0.0218	0.0065	16	0.0025	0.0076	0.0075	0.0162	0.0042	9	0.0060	0.0046	0.0034	0.0118	0.0036	9
Pool Length (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	31.0	66.4	64.5	112.2	25.4	19	48.1	89.2	82.2	150.6	29.1	14	24.19	89.2	82.2	150.6	29.1	14
Pool Spacing (ft)	-	-	-	-	-	-	-	-	-	-	-	75	-	-	-	-	94	-	-	165	-	-	-	-	-	-	-	-	86.6	148.6	143.5	292.6	51.9	20	50	127.4	119.8	264	46.3	24	38	152.3	126.5	524	109.0	24
Pool Max Depth (ft)	-	-	-	-	2.9	3.8	4.0	4.5	0.64	3	-	2.28	-	-	-	-	-	6.00	-	-	-	-	5.2	5.3	5.2	5.4	0.1	3	5.1	5.4	5.3	5.9	0.36	3	5	5.3	5.4	5.4	0.15	3	3	3.3	3.3	3.9	0.40	4
Pool Volume (ft^3)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Substrate and Transport Parameters																																													
Ri% / Ru% / P% / G% / S%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SC% / Sa% / G% / B% / Be%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
d16 / d35 / d50 / d84 / d95	-	-	-	-	0.8 / 5.8 / 12.4 / 35.4 / 169.6						-	-	-	-	-	-	-	-	-	-	-	-	mean 5.1 / 10.9 / 16.5 / 34.8 / 55.9						mean 17.3/ 28.6 / 36.9 / 71.8 / 123.1						mean 6.7/ 16.3 / 22.2 / 45.4 / 91.4						mean 10.2/ 18.2 / 26.8 / 49.7 / 82.2					
Reach Shear Stress (competency) lb/ft^2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stream Power (transport capacity) W/m^2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Additional Reach Parameters																																													
Drainage Area (SM)	-	2.1 to 2.67			2.1 at upper end of project to 2.67 towads end of project						-	0.83	-	-	-	-	2.1 at upper end of project to 2.67 towads end of project						2.1 at upper end of project to 2.67 towads end of project						2.1 at upper end of project to 2.67 towads end of project						2.1 at upper end of project to 2.67 towads end of project						2.1 at upper end of project to 2.67 towads end of project					
Impervious cover estimate (%)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.67	-	-	-	-	-	2.67	-	-	-	-	-	2.67	-	-	-	-	-	2.67	-	-	-	-	-	2.67	-	-	-	-
Rosgen Classification	-	-	-	-	-	C4 to E4	-	-	-	-	-	C4	-	-	-	-	-	C4	-	-	-	-	-	C4	-	-	-	-	-	C4	-	-	-	-	-	C4	-	-	-	-	-	C4	-	-	-	-
BF Velocity (fps)	-	-	-	-	-	-	-	-	-	-	-	3.55	-	-	-	-	-	4.31	-	-	-	-	-	4.33	-	-	-	-	-	4.20	-	-	-	-	-	4.20	-	-	-	-	-	4.20	-	-	-	-
BF Discharge (cfs)	-	205.7	237.0		-	-	-	-	-	-	-	98	-	-	-	-	-	271.5	-	-	-	-	-	242.6	-	-	-	-	-	264.8	-	-	-	-	-	264.8	-	-	-	-	-	264.8	-	-	-	-
35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Channel length (ft)	-	-	-	-	-	4,700	-	-	-	-	-	-	-	-	-	-	-	4,101	-	-	-	-	-	4,172	-	-	-	-	-	4,172	-	-	-	-	-	4,172	-	-	-	-	-	4,172	-	-	-	-
Sinuosity	-	-	-	-	-	-	-	-	-	-	-	2.01	-	-	-	-	-	1.3	-	-	-	-	-	1.31	-	-	-	-	-	1.34	-	-	-	-	-	1.34	-	-	-	-	-	1.34	-	-	-	-
Water Surface Slope (Channel) (ft/ft)	-	-	-	-	-	-	-	-	-	-	-	0.0079	-	-	-	-	-	0.0035	-	-	-	-	-	0.0039	-	-	-	-	-	0.0033	-	-	-	-	-	0.0033	-	-	-	-	-	0.0033	-	-	-	-
BF slope (ft/ft)	-	-	-	-	-	-	-	-	-	-	-	0.016	-	-	-	-	-	0.0047	-	-	-	-	-	0.0052	-	-	-	-	-	0.0044	-	-	-	-	-	0.0044	-	-	-	-	-	0.0044	-	-	-	-
Bankfull Floodplain Area (acres)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BEHI VL% / L% / M% / H% / VH% / E%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Channel Stability or Habitat Metric	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Biological or Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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UT3

Parameter	USGS Gauge	Regional Curve Interval [1]			Pre-Existing Condition [1]						Reference Reach Data: Morgan Creek						Design						As-built						MY1						MY2						MY3					
Dimension and Substrate - Riffle		NC Mtn./NC Pied. Rural			Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
BF Width (ft)	-	5.3	4.1	-	-	-	-	-	-	-	-	16.7	-	-	-	-	-	6.0	-	-	-	-	6.1	6.2	6.2	6.3	0.06	2	-	5.9	-	-	-	1	-	5.8	-	-	-	1	-	6.2	-	-	-	1
Floodprone Width (ft)	-	-	-	-	-	-	-	-	-	-	-	35.0	-	-	-	-	-	-	-	-	-	-	-	>27	-	-	-	-	-	28.1	-	-	-	1	-	22.6	-	-	-	1	-	22.6	-	-	-	1
BF Mean Depth (ft)	-	0.4	0.5	-	-	-	-	-	-	-	-	1.06	-	-	-	-	-	0.7	-	-	-	-	0.70	0.70	0.70	0.80	0.02	2.00	-	0.70	-	-	-	1	-	0.70	-	-	-	1	-	0.60	-	-	-	1
BF Max Depth (ft)	-	-	-	-	-	-	-	-	-	-	-	1.54	-	-	-	-	-	-	-	-	-	-	1.1	1.2	1.2	1.2	0.0	2	-	1.1	-	-	-	1	-	1.0	-	-	-	1	-	1.0	-	-	-	1
BF Cross-sectional Area (ft^2)	-	1.9	4.1	-	-	-	-	-	-	-	-	17.7	-	-	-	-	-	4.2	-	-	-	-	4.5	4.6	4.6	4.6	0.1	2	-	4.1	-	-	-	1	-	4.0	-	-	-	1	-	3.8	-	-	-	1
Width/Depth Ratio	-	-	-	-	-	-	-	-	-	-	-	15.8	-	-	-	-	-	-	-	-	-	-	8.1	8.4	8.4	8.7	0.3	2	-	8.5	-	-	-	1	-	8.4	-	-	-	1	-	9.9	-	-	-	1
Entrenchment Ratio	-	-	-	-	-	-	-	-	-	-	-	2.0	-	-	-	-	-	-	-	-	-	-	4.3	5.5	5.5	6.6	1.2	2	-	4.0	-	-	-	1	-	3.9	-	-	-	1	-	4.9	-	-	-	1
Bank Height Ratio	-	-	-	-	-	-	-	-	-	-	-	1.2	-	-	-	-	-	-	-	-	-	-	1.0	1.0	1.0	1.0	0.0	2	-	1.0	-	-	-	1	-	1.0	-	-	-	1	-	1.1	-	-	-	1
d50 (mm)	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pattern																																														
Channel Beltwidth (ft)	-	-	-	-	-	-	-	-	-	-	-	80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Radius of Curvature (ft)	-	-	-	-	-	-	-	-	-	-	-	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rc:Bankfull width (ft/ft)	-	-	-	-	-	-	-	-	-	-	-	1.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Meander Wavelength (ft)	-	-	-	-	-	-	-	-	-	-	-	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Meander Width Ratio	-	-	-	-	-	-	-	-	-	-	-	4.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Profile																																														
Riffle Length (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12.0	31.8	19.0	77.0	26.3	4	14.3	18.7	14.9	30.5	6.9	4	27.1	43.8	43.8	60.51	16.7	2	24.1	42.8	39.3	64.9	16.8	3	15.33	31.5	20.34	58.68	19.4	3
Riffle Slope (ft/ft)	-	-	-	-	-	-	-	-	-	-	-	0.019	-	-	-	-	0.0052	0.0107	0.0106	0.017	0.0041	4	0.0000	0.0078	0.0118	0.0140	0.0084	4	0.0000	0.0032	0.0032	0.0064	0.0032	2	0.0072	0.0092	0.0084	0.0121	0.0021	3	0.0049	0.0061	0.0065	0.0068	0.0008	3
Pool Length (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.0	-	-	0	4	6.5	11.6	7.9	21.4	5.7	5	5.68	11.56	11.70	17.29	4.70	3	7.50	10.90	10.20	15.00	3.10	3	6.99	9.42	8.58	12.68	2.40	3
Pool Spacing (ft)	-	-	-	-	-	-	-	-	-	-	-	75	-	-	-	-	18.0	22.7	24.0	26.0	3.4	3	22.2	39.0	42.4	48.8	10.2	4	21.23	42.9	38.02	69.37	20	3	24.1	42.8	39.3	64.9	16.8	3	32.2	44.4	34.6	66.5	15.6	3
Pool Max Depth (ft)	-	-	-	-	-	-	-	-	-	-	-	2.28	-	-	-	-	-	1.2	-	-	-	-	1.7	-	-	-	-	1	-	1.5	-	-	-	-	-	1.5	-	-	-	-	-	1.0	-	-	-	-
Pool Volume (ft^3)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Substrate and Transport Parameters																																														
Ri% / Ru% / P% / G% / S%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SC% / Sa% / G% / B% / Be%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
d16 / d35 / d50 / d84 / d95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Reach Shear Stress (competency) lb/ft^2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stream Power (transport capacity) W/m^2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Additional Reach Parameters																																													
Drainage Area (SM)	-	0.05			0.05						-	0.83	-	-	-	-	-	-	-	-	-	-	-	0.05		-	-	-	0.05		-	-	-	0.05		-	-	-	0.05		-	-	-
Impervious cover estimate (%)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<5%	-	-	-	-	-	<5%	-	-	-	-	-	<5%	-	-	-	-	-	<5%	-	-	-	-	-	<5%	-	-	-	-
Rosgen Classification	-	-	-	-	-	-	-	-	-	-	-	C4	-	-	-	-	-	-	-	-	-	-	-	C	-	-	-	-	-	E	-	-	-	-	-	E	-	-	-	-	-	E	-	-	-	-
BF Velocity (fps)	-	-	-	7	-	-	-	-	-	-	-	3.55	-	-	-	-	-	-	-	-	-	-	-	4.27	-	-	-	-	-	4.81	-	-	-	-	-	4.81	-	-	-	-	-	4.81	-	-	-	-
BF Discharge (cfs)	-	7.8	18.3		-	-	-	-	-	-	-	98	-	-	-	-	-	-	-	-	-	-	-	212.2	-	-	-	-	-	22.1	-	-	-	-	-	22.1	-	-	-	-	-	22.1	-	-	-	-
35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Channel length (ft)	-	-	-	-	-	75	-	-	-	-	-	-	-	-	-	-	-	311.0	-	-	-	-	-	350	-	-	-	-	-	153	-	-	-	-	-	153	-	-	-	-	-	153	-	-	-	-
Sinuosity	-	-	-	-	-	-	-	-	-	-	-	2.01	-	-	-	-	-	-	-	-	-	-	-	1.5	-	-	-	-	-	1.17	-	-	-	-	-	1.17	-	-	-	-	-	1.17	-	-	-	-
Water Surface Slope (Channel) (ft/ft)	-	-	-	-	-	-	-	-	-	-	-	0.0079	-	-	-	-	-	-	-	-	-	-	-	0.0043	-	-	-	-	-	0.0225	-	-	-	-	-	0.0225	-	-	-	-	-	0.0225	-	-	-	-
BF slope (ft/ft)	-	-	-	-	-	-	-	-	-	-	-	0.016	-	-	-	-	-	-	-	-	-	-	-	0.004	-	-	-	-	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bankfull Floodplain Area (acres)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BEHI VL% / L% / M% / H% / VH% / E%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Channel Stability or Habitat Metric	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Biological or Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

1. Harman, W.A., D.E Wise, M.A. Walker, R. Morris, MA Cantrell, M. Clemmons, G.D. Jennings, D.R. Clinton, J.M. Patterson. 2000. Bankfull Regional Curves for North Carolina Mountain Streams. In: AWRA Conference Proceedings, D.L. Kane, editor. American Water Resources Specialty Conference on Water Resources in Extreme Environments. Anchorage, Alaska.

Table 10. Monitoring Year 3 Stream Summary

Logan Creek Restoration Project; DMS Project ID No. 94645

UT6

Parameter	USGS Gauge	Regional Curve Interval [1]			Pre-Existing Condition [1]						Reference Reach Data – Morgan Creek						Design						As-built						MY1						MY2						MY3					
		NC Mtn./NC Pied.	Rural		Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Dimension and Substrate - Riffle																																													
BF Width (ft)	-	5.3	4.1	-	-	-	-	-	-	-	-	16.7	-	-	-	-	-	6.0	-	-	-	-	6.1	6.2	6.2	6.3	0.06	2	-	5.8	-	-	-	1	-	5.8	-	-	-	1	-	6.0	-	-	-	1
Floodprone Width (ft)	-	-	-	-	-	-	-	-	-	-	-	35.0	-	-	-	-	-	-	-	-	-	-	-	>27	-	-	-	-	-	32.4	-	-	-	1	-	>35	-	-	-	1	-	>35	-	-	-	1
BF Mean Depth (ft)	-	0.4	0.5	-	-	-	-	-	-	-	-	1.06	-	-	-	-	-	0.7	-	-	-	-	0.70	0.70	0.70	0.80	0.02	2.00	-	0.70	-	-	-	1	-	0.60	-	-	-	1	-	0.60	-	-	-	1
BF Max Depth (ft)	-	-	-	-	-	-	-	-	-	-	-	1.54	-	-	-	-	-	-	-	-	-	-	1.1	1.2	1.2	1.2	0.0	2	-	0.9	-	-	-	1	-	0.9	-	-	-	1	-	0.9	-	-	-	1
BF Cross-sectional Area (ft^2)	-	1.9	4.1	-	-	-	-	-	-	-	-	17.7	-	-	-	-	-	4.2	-	-	-	-	4.5	4.6	4.6	4.6	0.1	2	-	3.8	-	-	-	1	-	3.7	-	-	-	1	-	3.8	-	-	-	1
Width/Depth Ratio	-	-	-	-	-	-	-	-	-	-	-	15.8	-	-	-	-	-	-	-	-	-	-	8.1	8.4	8.4	8.7	0.3	2	-	9.0	-	-	-	1	-	9.1	-	-	-	1	-	9.5	-	-	-	1
Entrenchment Ratio	-	-	-	-	-	-	-	-	-	-	-	2.0	-	-	-	-	-	-	-	-	-	-	4.3	5.5	5.5	6.6	1.2	2	-	5.6	-	-	-	1	-	5.4	-	-	-	1	-	4.9	-	-	-	1
Bank Height Ratio	-	-	-	-	-	-	-	-	-	-	-	1.2	-	-	-	-	-	-	-	-	-	-	1.0	1.0	1.0	1.0	0.0	2	-	1.0	-	-	-	1	-	1.0	-	-	-	1	-	1.1	-	-	-	1
d50 (mm)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	-	-	-	-	-	1
Pattern																																													
Channel Beltwidth (ft)	-	-	-	-	-	-	-	-	-	-	-	80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Radius of Curvature (ft)	-	-	-	-	-	-	-	-	-	-	-	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rc:Bankfull width (ft/ft)	-	-	-	-	-	-	-	-	-	-	-	1.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Meander Wavelength (ft)	-	-	-	-	-	-	-	-	-	-	-	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Meander Width Ratio	-	-	-	-	-	-	-	-	-	-	-	4.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Profile																																													
Riffle Length (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12.0	31.8	19.0	77.0	26.3	4	14.3	18.7	14.9	30.5	6.9	4	17.81	27.00	27.03	36.25	9.2	2	27.5	31	31	34.5	3.5	2	35.17	35.4	35.38	35.58	0.2	2
Riffle Slope (ft/ft)	-	-	-	-	-	-	-	-	-	-	-	0.019	-	-	-	-	0.0052	0.0107	0.0106	0.017	0.0041	4	0.0000	0.0078	0.0118	0.0140	0.0084	4	0.0014	0.0052	0.0052	0.0090	0.0038	2	0.0029	0.0033	0.0033	0.0036	0.0004	2	0.0014	0.0021	0.0021	0.0028	0.0007	2
Pool Length (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.0	-	-	0	4	6.5	11.6	7.9	21.4	5.7	5	19.75	26.73	26.73	33.70	7.0	2	9.40	16.30	16.30	23.20	6.9	2	2.76	9.51	9.51	16.26	6.8	2
Pool Spacing (ft)	-	-	-	-	-	-	-	-	-	-	-	75	-	-	-	-	18.0	22.7	24.0	26.0	3.4	3	22.2	39.0	42.4	48.8	10.2	4	39.46	42.9	42.9	46.34	3.4	2	45.6	46.85	46.85	48.1	1.25	2	46.87	47.9	47.91	48.94	1	2
Pool Max Depth (ft)	-	-	-	-	-	-	-	-	-	-	-	2.28	-	-	-	-	-	1.2	-	-	-	-	1.7	-	-	-	-	1	-	1.5	-	-	-	-	-	1.17	-	-	-	-	-	0.735	-	-	-	-
Pool Volume (ft^3)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Substrate and Transport Parameters																																													
Ri% / Ru% / P% / G% / S%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SC% / Sa% / G% / B% / Be%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
d16 / d35 / d50 / d84 / d95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Reach Shear Stress (competency) lb/f	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BF Mean Depth (ft)	-	0.4	0.5	-	-	-	-	-	-	-	-	1.06	-	-	-	-	-	0.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.70	-	-	-	1	-	0.70	-	-	-	1
BF Max Depth (ft)	-	-	-	-	-	-	-	-	-	-	-	1.54	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.4	-	-	-	1	-	1.2	-	-	-	1
BF Cross-sectional Area (ft^2)	-	1.9	0.02	-	-	-	0.02	-	-	-	-	17.7	-	-	-	-	-	4.2	-	-	-	-	-	-	0.02	-	-	-	-	-	0.02	-	-	-	1	-	6.0	0.02	-	-	-	1	-	5.8	0.02	-	-	-	1
Width/Depth Ratio	-	-	-	-	-	-	-	-	-	-	-	15.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<5%	-	-	-	1	-	11.0	<5%	-	-	-	1	-	12.2	<5%	-	-	-	1
Entrenchment Ratio	-	-	-	-	-	-	-	-	-	-	-	2.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	E	-	-	-	1	-	5.3	E	-	-	-	1	-	5.1	E	-	-	-	1
Bank Height Ratio	-	-	-	-	-	-	-	-	-	-	-	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.32	-	-	-	1	-	1.0	3.32	-	-	-	1	-	1.0	3.32	-	-	-	1
d50 (mm)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15.2	-	-	-	-	-	-	15.2	-	-	-	-	-	-	15.2	-	-	-	-	-
Pattern: reach is to short for this data.																																													
Channel Beltwidth (ft)	-	-	-	-	-	-	-	-	-	-	-	80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	104	-	-	-	-	-	-	104	-	-	-	-	-	-	104	-	-	-	-	-
Radius of Curvature (ft)	-	-	-	-	-	-	-	-	-	-	-	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.04	-	-	-	-	-	-	1.04	-	-	-	-	-	-	1.04	-	-	-	-	-
Rc:Bankfull width (ft/ft)	-	-	-	-	-	-	-	-	-	-	-	1.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0114	-	-	-	-	-	-	0.0114	-	-	-	-	-	-	0.0114	-	-	-	-	-
Meander Wavelength (ft)	-	-	-	-	-	-	-	-	-	-	-	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Meander Width Ratio	-	-	-	-	-	-	-	-	-	-	-	4.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Profile: reach is to short for this data.																																													
Riffle Length (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12.0	31.8	19.0	77.0	26.3	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Riffle Slope (ft/ft)	-	-	-	-	-	-	-	-	-	-	-	0.019	-	-	-	-	0.0052	0.0107	0.0106	0.017	0.0041	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pool Length (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pool Spacing (ft)	-	-	-	-	-	-	-	-	-	-	-	75	-	-	-	-	18.0	22.7	24.0	26.0	3.4	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pool Max Depth (ft)	-	-	-	-	-	-	-	-	-	-	-	2.28	-	-	-	-	-	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pool Volume (ft^3)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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Substrate and Transport Parameters	USGS Gagge	Regional Curve Interval [1]			Pre-Existing Condition [1]						Reference Reach Data – Morgan Creek						Design						As-built						MY1						MY2						MY3					
Ri% / Ru% / P% / G% / S%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SC% / Sa% / G% / B% / Be%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
d16 / d35 / d50 / d84 / d95	-	NC Mtn./NC Pied.	Rural		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Reach Shear Stress (competency) lb/f	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stream Power (transport capacity) W/m²	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Additional Reach Parameters																																													
Drainage Area (SM)	-										-	0.83	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Impervious cover estimate (%)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rosgen Classification	-	-	-	-	-	-	-	-	-	-	-	C4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BF Velocity (fps)	-	-	-	-	-	-	-	-	-	7	-	3.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BF Discharge (cfs)	-	7.8	18.3	-	-	-	-	-	-	-	-	98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Channel length (ft)	-	-	-	-	-	75	-	-	-	-	-	-	-	-	-	-	-	311.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sinuosity	-	-	-	-	-	-	-	-	-	-	-	2.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Water Surface Slope (Channel) (ft/ft)	-	-	-	-	-	-	-	-	-	-	-	0.0079	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BF slope (ft/ft)	-	-	-	-	-	-	-	-	-	-	-	0.016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bankfull Floodplain Area (acres)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BEHI VL% / L% / M% / H% / VH% / E%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Channel Stability or Habitat Metric	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Biological or Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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Table 11. Morphology and Hydraulic Monitoring Summary
Logan Creek Restoration Project: DMS Project ID No. 92515

Logan Creek (4,172 LF)

	Cross-section X-1, Station 3+10 (Riffle), Restoration Reach							Cross-section X-2, Station 3+70 (Pool), Restoration Reach							Cross-section X-3, Station 12+57 (Riffle), Restoration Reach							Cross-section X-4, Station 13+00 (Pool)						
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation																												
BF Width (ft)	24.1	24.0	24.1	24.0	-	-	-	25.9	26.8	26.0	26.0	-	-	-	25.2	24.3	24.46	24.3	-	-	-	27.6	27.1	27.1	27.4	-	-	-
BF Mean Depth (ft)	2.6	2.6	2.7	2.7	-	-	-	2.5	2.4	2.5	2.6	-	-	-	2.1	2.1	2.15	2.2	-	-	-	2.3	2.7	2.4	2.6	-	-	-
Width/Depth Ratio	9.2	9.3	8.9	8.9	-	-	-	10.5	11.0	10.3	10.2	-	-	-	12.0	11.6	11.36	11.3	-	-	-	12.1	10.0	11.2	10.7	-	-	-
BF Cross-sectional Area (ft^2)	63.0	62.4	64.8	64.7	-	-	-	63.9	65.2	65.5	66.2	-	-	-	53.2	51.2	52.7	52.3	-	-	-	62.8	73.8	65.4	70.2	-	-	-
BF Max Depth (ft)	3.7	4.0	4.3	4.3	-	-	-	5.2	5.1	5.1	4.9	-	-	-	3.1	2.9	3.11	3.1	-	-	-	5.2	5.9	5.4	5.5	-	-	-
Width of Floodprone Area (ft)	>70	>70	>70	>70	-	-	-	>60	>60	>60	>60	-	-	-	>100	>100	>100	>100	-	-	-	>100	>100	>100	>100	-	-	-
Entrenchment Ratio	2.9	2.9	2.9	2.9	-	-	-	2.3	2.3	2.3	2.3	-	-	-	3.9	4.1	4.1	4.1	-	-	-	3.6	3.6	3.6	3.6	-	-	-
Bank Height Ratio	1.0	1.0	1.0	1.0	-	-	-	1.1	1.1	1.0	1.1	-	-	-	1.0	1.1	1.0	1.0	-	-	-	1.0	1.0	1.1	1.0	-	-	-
Wetted Perimeter (ft)	29.3	29.3	29.5	29.4	-	-	-	30.9	31.7	31.0	31.1	-	-	-	29.5	28.6	28.8	28.6	-	-	-	32.2	32.6	31.9	32.5	-	-	-
Hydraulic Radius (ft)	2.1	2.1	2.2	2.2	-	-	-	2.1	2.1	2.1	2.1	-	-	-	1.8	1.8	1.8	1.8	-	-	-	2.0	2.3	2.0	2.2	-	-	-
Based on current/developing bankfull feature																												
BF Width (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BF Mean Depth (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Width/Depth Ratio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BF Cross-sectional Area (ft^2)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BF Max Depth (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Width of Floodprone Area (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Entrenchment Ratio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bank Height Ratio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wetted Perimeter (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hydraulic Radius (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cross Sectional Area between end pins (ft^2)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
d50 (mm)	13.8	30.7	15.2	23.3	-	-	-	-	-	-	-	-	-	-	19.2	43	29.2	22.2	-	-	-	-	-	-	-	-	-	-

	Cross-section X-5, Station 25+43 (Pool), Restoration Reach							Cross-section X-6, Station 26+09 (Riffle), Restoration Reach							Cross-section 10, Station 37+05 (Pool), Enhancement Reach							Cross-section 11, Station 37+20 (Riffle), Enhancement Reach						
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation																												
BF Width (ft)	21.3	24.0	23.9	23.8	-	-	-	23.6	22.6	22.5	22.4	-	-	-	31.0	33.4	33.4	33.3	-	-	-	29.2	33.9	33.9	34.1	-	-	-
BF Mean Depth (ft)	3.0	3.1	3.1	3.0	-	-	-	2.2	2.2	2.3	2.3	-	-	-	2.1	2.1	2.1	2.3	-	-	-	2.1	1.8	1.8	1.7	-	-	-
Width/Depth Ratio	7.1	7.8	7.8	8.0	-	-	-	10.8	10.1	9.9	9.9	-	-	-	14.4	15.6	15.9	14.8	-	-	-	14.0	18.6	18.6	19.6	-	-	-
BF Cross-sectional Area (ft^2)	63.9	74.3	73.3	71.0	-	-	-	51.7	50.2	51.4	50.8	-	-	-	66.6	71.2	70.3	74.7	-	-	-	60.7	61.8	61.8	59.4	-	-	-
BF Max Depth (ft)	5.4	5.3	5.4	5.4	-	-	-	3.4	3.5	3.7	3.6	-	-	-	3.5	3.5	3.4	3.5	-	-	-	2.9	3.0	3.0	2.9	-	-	-
Width of Floodprone Area (ft)	>80	>90	>90	>90	-	-	-	>95	>95	>95	>95	-	-	-	>60	>60	>60	>60	-	-	-	>54	>54	>54	>54	-	-	-
Entrenchment Ratio	4.4	4.4	3.8	3.8	-	-	-	4.0	4.0	4.2	4.2	-	-	-	4.2	1.8	1.8	1.8	-	-	-	4.5	1.6	1.6	1.5	-	-	-
Bank Height Ratio	1.0	1.0	1.0	1.0	-	-	-	1.0	1.0	1.0	1.0	-	-	-	1.0	1.1	1.0	1.0	-	-	-	1.1	1.2	1.2	1.1	-	-	-
Wetted Perimeter (ft)	27.3	30.2	30.0	29.8	-	-	-	28.0	27.0	27.1	26.9	-	-	-	35.2	37.6	37.6	37.8	-	-	-	33.4	37.6	37.6	37.6	-	-	-
Hydraulic Radius (ft)	2.3	2.5	2.4	2.4	-	-	-	1.8	1.9	1.9	1.9	-	-	-	1.9	1.9	1.9	2.0	-	-	-	1.8	1.6	1.6	1.6	-	-	-
Based on current/developing bankfull feature																												
BF Width (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BF Mean Depth (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Width/Depth Ratio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BF Cross-sectional Area (ft^2)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BF Max Depth (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Width of Floodprone Area (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Entrenchment Ratio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bank Height Ratio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wetted Perimeter (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hydraulic Radius (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cross Sectional Area between end pins (ft^2)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
d50 (mm)	-	-	-	-	-	-	-	24.9	41.1	20.7	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 11. Morphology and Hydraulic Monitoring Summary
Logan Creek Restoration Project: DMS Project ID No. 92515

UT3 (178 LF)

	Cross-section X-8.5, Station 0+60* (Pool)							Cross-section X-9, Station 0+73* (Riffle)																							
Dimension and substrate	Base*	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+				
Based on fixed baseline bankfull elevation																															
BF Width (ft)	-	8.6	8.2	8.9	-	-	-	6.3	5.9	5.8	6.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BF Mean Depth (ft)	-	0.9	0.9	0.9	-	-	-	0.7	0.7	0.7	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Width/Depth Ratio	-	9.4	9.9	9.9	-	-	-	8.7	8.5	8.4	9.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BF Cross-sectional Area (ft²)	-	7.9	8.2	8.1	-	-	-	4.5	4.1	4.0	3.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BF Max Depth (ft)	-	1.5	1.5	1.4	-	-	-	1.2	1.1	1.0	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Width of Floodprone Area (ft)	-	32.0	30.9	30.9	-	-	-	26.8	23.8	22.6	22.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Entrenchment Ratio	-	3.7	3.4	4.5	-	-	-	4.3	4.0	3.9	4.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bank Height Ratio	-	1.1	1.0	1.1	-	-	-	1.0	1.0	1.0	1.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wetted Perimeter (ft)	-	10.4	10.0	10.7	-	-	-	7.7	7.3	7.2	7.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hydraulic Radius (ft)	-	0.8	0.8	0.8	-	-	-	0.6	0.6	0.6	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Based on current/developing bankfull feature																															
BF Width (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BF Mean Depth (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Width/Depth Ratio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BF Cross-sectional Area (ft²)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BF Max Depth (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Width of Floodprone Area (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Entrenchment Ratio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bank Height Ratio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wetted Perimeter (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hydraulic Radius (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cross Sectional Area between end pins (ft²)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
d50 (mm)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

*Stationing is corrected in this report.

UT6 (127 LF)

	Cross-section X-7, Station 0+54 (Pool)							Cross-section X-8, Station 0+69 (Riffle)																							
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+				
Based on fixed baseline bankfull elevation																															
BF Width (ft)	9.8	9.2	9.4	9.7	-	-	-	6.1	5.8	5.8	6.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BF Mean Depth (ft)	1.0	0.9	0.8	0.8	-	-	-	0.8	0.7	0.6	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Width/Depth Ratio	9.5	10.7	12.1	11.2	-	-	-	8.1	9.0	9.1	9.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BF Cross-sectional Area (ft²)	10.1	7.9	7.4	7.4	-	-	-	4.6	3.8	3.7	3.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BF Max Depth (ft)	1.7	1.5	1.2	1.2	-	-	-	1.1	0.9	0.9	0.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Width of Floodprone Area (ft)	> 50	> 50	> 50	> 50	-	-	-	> 35	> 35	> 35	> 35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Entrenchment Ratio	3.8	4.0	3.1	3.3	-	-	-	6.6	5.6	5.4	4.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bank Height Ratio	1.0	1.0	1.0	1.1	-	-	-	1.0	1.0	1.0	1.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wetted Perimeter (ft)	11.8	10.9	11.0	11.3	-	-	-	7.7	7.1	7.1	7.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hydraulic Radius (ft)	0.9	0.7	0.7	0.7	-	-	-	0.6	0.5	0.5	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Based on current/developing bankfull feature																															
BF Width (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BF Mean Depth (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Width/Depth Ratio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BF Cross-sectional Area (ft²)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BF Max Depth (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Width of Floodprone Area (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Entrenchment Ratio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bank Height Ratio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wetted Perimeter (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hydraulic Radius (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cross Sectional Area between end pins (ft²)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
d50 (mm)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 11. Morphology and Hydraulic Monitoring Summary
Logan Creek Restoration Project: DMS Project ID No. 92515

UT8 (45 LF)																														
	Cross-section X-12, Station 0+9.6 (Riffle)																													
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+		
Based on fixed baseline bankfull elevation																														
BF Width (ft)	-	-	8.1	8.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
BF Mean Depth (ft)	-	-	0.7	0.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Width/Depth Ratio	-	-	11.0	12.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
BF Cross-sectional Area (ft^2)	-	-	6.0	5.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
BF Max Depth (ft)	-	-	1.4	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Width of Floodprone Area (ft)	-	-	> 50	> 50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Entrenchment Ratio	-	-	5.3	5.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Bank Height Ratio	-	-	1.0	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Wetted Perimeter (ft)	-	-	9.6	9.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Hydraulic Radius (ft)	-	-	0.6	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Based on current/developing bankfull feature																														
BF Width (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
BF Mean Depth (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Width/Depth Ratio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
BF Cross-sectional Area (ft^2)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
BF Max Depth (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Width of Floodprone Area (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Entrenchment Ratio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Bank Height Ratio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Wetted Perimeter (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Hydraulic Radius (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Cross Sectional Area between end pins (ft^2)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
d50 (mm)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		