

# **UT to Clarke Creek Annual Final Monitoring Report**

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DWR Project # 11-0409  
SCO # 09-07763-01  
DLR (Land Quality) Project # MECK-2012-034

Monitoring Report Year 2 of 5  
Mecklenburg County, North Carolina



Submitted to:

NC Department of Environmental Quality  
Division of Mitigation Services  
1652 Mail Service Center  
Raleigh, NC 27699-1652

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Submitted by:



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UT to Clarke Creek Stream and Wetland Restoration  
DMS Project #92500

Monitoring Report Year 2 of 5  
Mecklenburg County, North Carolina

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## **EXECUTIVE SUMMARY**

The UT Clarke Creek is located in Mecklenburg County, North Carolina near the Town of Huntersville. The property parcel is owned by Mecklenburg County and is referred to as Clark's Creek Nature Preserve. The project consisted of approximately 4,594 linear feet of existing streams on the site within the USGS cataloging unit Yadkin 03040105. The project site was assessed in the Upper Rocky River Local Watershed Plan (LWP) that was prepared for DMS by MACTEC in 2004. The LWP identified the major stressors in the watershed: stream bank erosion, lack of adequate forested buffer, stream channelization, agricultural impacts, land use changes, sedimentation, point source in-stream impacts, nutrients, and fecal coliform bacteria.

Restoration goals for this project include:

- Reduce sediment stressors caused by stream bank erosion and shear stress along the reach
- Improve stream bank stability and sediment transport efficiency
- Provide for uplift in water quality functions and nutrient filtration
- Provide for greater overall stream and wetland habitat complexity and quality
- Improve and maintain riparian buffer habitat

The project objectives include:

- Implement a sustainable, reference-based, rehabilitation of the project reaches' dimension to support sediment transport equilibrium.
- Provide a sustainable and functional bankfull floodplain feature and reslope banks at a more stable slope.
- Strategically install stream structures and plantings designed to maintain lateral stability and habitat to the stream channel.
- Install, augment, and maintain appropriate vegetative riparian buffer and riverine wetland community types with sufficient density and vigor to support native vegetation. The buffer should have a minimum width of 50 feet (ft) on each side of project streams and consist of a mix of native species representative of a bottomland hardwood forest.
- Restore and/or enhance the natural hydrology, vegetation, and soil composition in adjacent wetlands.

This report documents the completion of the restoration construction activities and presents year 2 monitoring data for the post-construction monitoring period. Table 1 (Appendix A) summarizes site conditions before and after restoration, as well as the conditions predicted in the previously approved Mitigation Plan.

## **1.0 PROJECT SUMMARY**

### **1.1 Project Setting and Background**

The UT Clarke Creek stream and wetland restoration project is located in Mecklenburg County, North Carolina, in the Yadkin-Pee Dee River Basin (USGS cataloging unit 03040105), DWR Subbasin 30711 (Figure 1). The project lies within Clark's Creek Nature Preserve, a 57.2 acre property owned by Mecklenburg County. The project restored 3,155 linear feet of stream and preserved 1,051 linear feet of stream and restored or preserved 1.457 acres of wetlands (Table 1). Prior to construction, the project site had problems with channelization, bank instability, and a limited riparian buffer zone. Areas of mass wasting, bank slumping, incision, and sediment deposition were evident in all reaches. Backwater effects from beaver dams also caused aggradation and habitat loss. The project aimed to reduce the major stressors identified in the Upper Rocky River Local Watershed Plan (LWP) which include stream bank erosion, lack of adequate forested buffer, stream channelization, and sedimentation.

### **1.2 Project Goals and Objectives**

The goals and objectives of this project focus on improving water quality and restoring physical habitat. These goals and objectives are stated in the UT Clarke Creek Mitigation Plan (2011).

#### Goals:

1. Reduce sediment stressors caused by stream bank erosion and shear stress along the reach
2. Improve stream bank stability and sediment transport efficiency
3. Provide for uplift in water quality functions and nutrient filtration
4. Provide for greater overall stream and wetland habitat complexity and quality
5. Improve and maintain riparian buffer habitat

#### Objectives:

1. Implement a sustainable, reference-based, rehabilitation of the project reaches' dimension to support sediment transport equilibrium
2. Provide a sustainable and functional bankfull floodplain feature and reslope banks at a more stable slope
3. Strategically install stream structures and plantings designed to maintain lateral stability and habitat to the stream channel
4. Install, augment, and maintain appropriate vegetative riparian buffer and riverine wetland community types with sufficient density and vigor to support native vegetation. The buffer should have a minimum width of 50 feet on each side of project streams and consist of a mix of native species representative of a bottomland hardwood forest.
5. Restore and/or enhance the natural hydrology, vegetation, and soil composition in adjacent wetlands

### 1.3 Success Criteria

The following success criteria are provided from the NCEEP *Mitigation Plan Document Guidance* and the Army Corps of Engineers (ACOE) (2003).

#### 1.3.1 Stream Morphology and Channel Stability

Restored or enhanced streams should demonstrate morphological stability to be considered successful. Any deviations will be evaluated to determine whether changes are indicative of instability. Stability will be based on permanent cross sections, longitudinal profile, substrate analysis, sediment transport, and evidence of bankfull events.

Both reaches' profiles and cross sections adjusted minimally from the monitoring year 1 conditions. The channels access the floodplain and evidence of bankfull events were observed during Year 2 monitoring. This evidence includes the presence of wracklines, sediment deposits, a field visit during a bankfull event, and a crest gauge reading of 20" above bankfull on UT1 and 19" above bankfull on UT to Clarke Creek.

On UT to Clarke Creek, one area of notable bare bank was noted between Stations 4+90 and 5+29. This area was lacking significant woody vegetation along the stream bank. Vegetation was also found growing in the channel between Station 1+78 and 2+41. Particle size increased in cross section 9, while cross section 1A saw a decrease in particle size compared to monitoring year 1 data.

Reach UT1 had one area of bare bank between Stations 4+78 to 5+37. This area was lacking significant woody and herbaceous vegetation. Two instances of vegetation in the channel were noted between Stations 1+12 to 1+41 and 2+74 to 2+92. This vegetation trapped smaller particles in cross sections 4 and 5 leading to smaller particle sizes collected for the pebble counts. Particle size in cross section 8 increased from baseline data, while cross section 6 had a decrease in particle size.

#### 1.3.2 Wetlands

Wetland hydrology attainment will be monitored in accordance to the ACOE (2003) standards. The target wetland hydrological success criterion is saturation or inundation for at least 12.5 percent of the growing season in the lower landscape (floodplain) positions. To achieve the hydrologic success criterion, groundwater levels must be within 12 inches of the ground surface for 29 consecutive days, which is 12.5 percent of the March 22 to November 11 (232 days) growing season. Eight Ecotone Water Level Loggers were established within the wetland restoration, creation, and preservation areas to monitor groundwater levels during the growing season. Three more loggers were placed during the 2015 growing season. Wells 3, 5, 6, 8, 9, 10, and 11 were placed within the wetland boundaries to provide hydrologic data for the restored and enhanced wetland areas. Wells 2, 4, and 7 were placed outside the wetland boundaries to confirm

the upland boundaries of the same wetlands. Well 1 was placed within the wetland preservation to provide reference conditions for the restored and enhanced wetlands in the project.

Wells 1 and 7 met the hydrology success criteria for monitoring year 2. Wells 2, 3, and 4 did not meet the success criteria. Wells 5, 6, and 8 malfunctioned and do not have data during the growing season. According to rainfall data for the area, less than 1 inch of rain fell for each month from March to August. This could explain why the majority of the wells placed in wetland areas did not meet the success criteria.

### 1.3.3 Vegetation

Planted vegetation will be monitored for five years in accordance with the guidelines and procedures developed by the Carolina Vegetation Survey-NCDMS Level 2 Protocol (Lee et al., 2006). To achieve vegetative success criteria, the average number of planted stems per acre must exceed or meet 320 stems/acre after the third year of monitoring, 288 stems/acre after four years, and 260 stems/acre after the fifth year of project monitoring. The monitoring year 2 stem counts are located in Tables 7 and 9 in Appendix C. Currently, only plot 8 is not meeting the interim measures of success. However, when including volunteer stems, plot 8 exceeds to interim stem count (688 total stems/acre). Vegetation throughout the reach appears to be growing at acceptable rates. Carolina Silvics completed a supplemental planting effort in the 2014-2015 dormant season throughout the project site. Carolina Silvics will also complete a supplemental planting effort in the 2015-2016 dormant season.

Summary information/data related to the occurrence of items such as beaver or encroachment 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 documentation formerly found in these reports can be found in the Baseline Monitoring Report (formerly Mitigation Plan) and in the Mitigation Plan (formerly the Restoration Plan) documents available on DMS's website. All raw data supporting the tables and figures in the appendices is available from DMS upon request.

## 1.4 Project History, Contacts, and Attribute Data

The UT to Clarke Creek Stream and Wetland Restoration site was designed by JJG, North State Environmental constructed the site, and it will be monitored by SEPI Engineering & Construction. Tables 2, 3, and 4 in Appendix A provide detailed information regarding the Project Activity and Reporting History, Project Contacts, and Project Baseline Information and Attributes.

### 1.4.1 Construction Deviations

The as-built plan sheets/record drawings depict several engineered instream structures that were not located during baseline monitoring. It was determined the structures were not installed due to

constraints that arose during construction, and the record drawings were not updated with that information.

## **2.0 METHODOLOGY**

The following methods were utilized during the year 2 monitoring for data collection and post-processing:

- Geomorphic topographic data collections were performed in the field using a survey grade GPS such that each survey point has three-dimensional coordinates, and is georeferenced (NAD83-State Plane Feet – FIPS3200).
- Longitudinal stationing was developed using the as-built survey thalweg as a baseline.
- The Modified-Wolman pebble count particle size distribution protocol was utilized.
- The CVS Level 2 methodology was utilized for the vegetation plot data collection.

### 3.0 REFERENCES

Jordan, Jones, and Goulding, Inc. Mitigation Plan: UT Clarke Creek Stream and Wetland Restoration, 2011.

Mactec Engineering and Consulting, Inc. November 30, 2004. *Watershed Management Plan and Recommendations, Lower Yadkin/Upper Rocky River Basin, Local Watershed Planning (Phase II), Cabarrus, Iredell, Rowan and Mecklenburg Counties, North Carolina*. Prepared for North Carolina Ecosystem Enhancement Program.

NCDWQ. 2008B. *Yadkin – Pee Dee River Basin Plan*. 553 pages.

NC Ecosystem Enhancement Program. As-built Baseline Monitoring Report Format, Data Requirements, and Content Guidance, 2014.

Radford, Albert. 1968. *Manual of Vascular Flora of the Carolinas*. The University of North Carolina Press, Chapel Hill. 596 p.

Rosgen, D L. 1996. *Applied River Morphology*. Wildland Hydrology Books, Pagosa Springs, CO.

U. S. Army Corps of Engineers. 1987. *Wetland Delineation Manual* (Technical Report Y-87-1), Washington, DC.

U. S. Army Corps of Engineers. 2003. *Stream Mitigation Guidelines*. USACOE, USEPA, NCWRC, NCDENR-DWQ.

Appendix A  
Background Tables

**Table 1a. Project Components  
UT Clarke Creek/DMS Project #92500**

Project Component or Reach ID	Existing Feet/Acres	Restoration Level	Approach	Footage or Acreage	Stationing	Mitigation Ratio	Mitigation Units	BMP Elements	Comment
UT Clarke Creek	1507 lf	E1	P 2/3	1507 lf	00+00 – 15+87	1.5:1	1004.7		Creating bankfull bench, regrading bank slopes, installing structures, planting native vegetation
UT1	723 lf	E1	P 2/3	741 lf	00+00 – 07+48, 07+65 – 07+78	1.5:1	494.0		Creating bankfull bench, regrading bank slopes, installing structures, planting native vegetation
UT1	17 lf	E1	P 2/3	17 lf	07+48 – 07+65	3:1	5.7		Creating bankfull bench, regrading bank slopes, installing structures, planting native vegetation in sewer easement
UT2	308 lf	E2	P 4	308 lf	04+22 – 05+99, 07+16 – 08+47	2.5:1	123.2		Planting of native vegetation, removal of invasive species
UT3	100 lf	E1	P 2/3	84 lf	00+00 – 00+56, 00+72 – 01+03	1.5:1	56.0		Creating bankfull bench, regrading bank slopes, installing structures, planting native vegetation
UT3	16 lf	E1	P 2/3	16 lf	00+56 – 00+72	3:1	5.3		Creating bankfull bench, regrading bank slopes, installing structures, planting native vegetation in sewer easement
UT4	373 lf	E1	P 2/3	363 lf	01+92 – 05+65	1.5:1	242		Creating bankfull bench, regrading bank slopes, installing structures, planting native vegetation
UT5	119 lf	E1	P 2/3	119 lf	03+56 – 04+75	1.5:1	79.3		Creating bankfull bench, regrading bank slopes, installing structures, planting native vegetation
UT6*	1464 lf	P	-	1051 lf	00+00 – 14+64	5:1	210.2		Designated as Preservation
Wetland A**	0.085 ac	R		0.0*		0	0		Restoring aerial extent of riparian wetland adjacent to stream
Wetland B	0.134 ac	P		0.134 ac		5:1	0.027		Designated as Preservation
Wetland C	0.057 ac	E		0.057 ac		2:1	0.029		Includes improving hydrology and vegetation to enhance the riparian wetland adjacent to stream
Wetland D	0.070 ac	R		1.020 ac		1:1	1.02		Restoring aerial extent of riparian wetland adjacent to stream
Wetland E	0.109 ac	E		0.109 ac		2:1	0.055		Includes improving hydrology and vegetation to enhance the riparian wetland adjacent to stream
Wetland E	0.109 ac	C		0.137 ac		3:1	0.046		Includes improving hydrology and vegetation to enhance the riparian wetland adjacent to stream

\*DMS cannot receive mitigation credits for streams with conservation easements on only one side of a project stream. A portion of UT6 is ineligible for credits resulting in 413 LF difference between existing and final credit length.

\*\*One segment of WL A will be incorporated into the enhancement of UT2. The remainder of WL A will be incorporated into the restoration of WL D

**Table 1b. Component Summations  
UT Clarke Creek/DMS Project #92500**

Restoration Level	Stream (lf)	Riparian Wetland (Ac)		Non-Ripar (Ac)	Upland (Ac)	Buffer (Ac)	BMP
		Riverine	Non-Riverine				
Restoration		1.02					
Enhancement		0.166					
Enhancement I	2,847						
Enhancement II	308						
Creation		0.137					
Preservation	1,051	0.134					
HQ Preservation							
		1.457	0				
<b>Totals (Feet/Acres)</b>	<b>4,206</b>	<b>1.457</b>					
<b>MU Totals</b>	<b>2,220</b>	<b>1.18</b>					

 Non-Applicable

**Table 2. Project Activity and Reporting History  
UT Clarke Creek/DMS Project #92500**

**Elapsed Time Since grading complete: 2 years 4 months**  
**Elapsed Time Since planting complete: 1 year 9 months**  
**Number of reporting Years: 2**

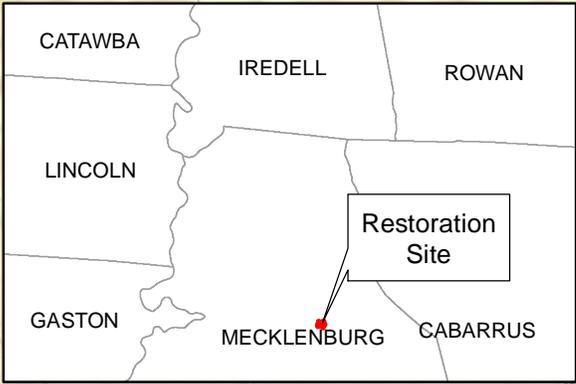
<b>Activity or Deliverable</b>	<b>Data Collection Complete</b>	<b>Completion or Delivery</b>
Institution Date	NA	Sept-2008
404 permit date	NA	Jan-2012
Restoration Plan	Sept-2010	Feb-2011
Final Design – Construction Plans	NA	July-2012
Construction	NA	July-2013
Containerized, bare root and B&B plantings	NA	Feb-2014
Mitigation Plan / As-built (Year 0 Monitoring – baseline)	Mar-2014	June-2014
Year 1 Monitoring	Sept-2014	Nov-2014
Year 2 Monitoring	Sept-Oct-2015	Jan-2016
Year 3 Monitoring		
Year 4 Monitoring		
Year 5 Monitoring		

**Table 3. Project Contacts Table  
UT to Clarke Creek/DMS Project #92500**

<b>Designer</b>	Jordan, Jones, and Goulding, Inc. 309 E. Morehead Street, Suite 110, Charlotte, NC 28202
Primary project design POC	Matthew M. Clabaugh, PE
<b>Construction Contractor</b>	North State Environmental 2889 Lowery Street, Winston-Salem, NC 27101
Construction contractor POC	Michael Anderson, (336) 245-1253
<b>Survey Contractor</b>	NorthState Environmental 2889 Lowery Street, Winston-Salem, NC 27101
Survey contractor POC	David Keith Alley, PLS
<b>Planting Contractor</b>	Carolina Silvics 908 Indian Trail Road, Edenton, NC 27932
Planting contractor POC	
<b>Seeding Contractor</b>	Canady's Landscaping & Erosion 256 Fairview Acres Road, Lexington, NC 27295
Contractor point of contact	Craig Canady, (336) 236-1182
<b>Seed Mix Sources</b>	
<b>Nursery Stock Suppliers</b>	
<b>Monitoring Performers</b>	SEPI Engineering & Construction 1025 Wade Avenue, Raleigh, NC 27605
Stream Monitoring POC	Philip Beach, PWS (919) 789-9977
Vegetation Monitoring POC	Kim Hamlin (919) 789-9977
Wetland Monitoring POC	Philip Beach, PWS (919) 789-9977

<b>Table 4. Project Attribute Table</b>			
<b>UT to Clarke Creek/DMS Project #92500</b>			
Project County	Mecklenburg		
Physiographic Region	Piedmont		
Ecoregion	Southern Outer Piedmont belt		
Project River Basin	Yadkin-Pee Dee		
USGS HUC for Project (14 digit)	03040105010040		
NCDWQ Sub-basin for Project	03-07-11		
Within extent of EEP Watershed Plan?	Upper Rocky River LWP		
WRC Hab Class (Warm, Cool, Cold)	Warm		
% of project easement fenced or demarcated	100%		
Beaver activity observed during design phase?	Yes		
<b>Restoration Component Attribute Table</b>			
	<b>UT Clarke Creek</b>	<b>UT1</b>	
Drainage area	1.08	0.46	
Stream order	2	1	
Restored length (feet)	1507	758	
Perennial or Intermittent	Perennial	Perennial	
Watershed type (Rural, Urban, Developing etc.)	Rural		
Watershed LULC Distribution (e.g.)			
Residential	94.60%		
Ag-Row Crop	-		
Ag-Livestock	-		
Forested	-		
Etc.	5.40%		
Watershed impervious cover (%)	16.50%		
NCDWQ AU/Index number	13-17-5-2		
NCDWQ classification	C		
303d listed?	No		
Upstream of a 303d listed segment?	Yes		
Reasons for 303d listing or stressor	5, Ecological/biological integrity		
Total acreage of easement	57.2		
Total vegetated acreage within the easement	57.2		
Total planted acreage as part of the restoration	57.2		
Rosgen classification of pre-existing	E4	B4c	B4c
Rosgen classification of As-built	N/A		
Valley type	VIII		
Valley slope	-		
Valley side slope range (e.g. 2-3.%)	-		
Valley toe slope range (e.g. 2-3.%)	-		
Cowardin classification	N/A		
Trout waters designation	No		
Species of concern, endangered etc.? (Y/N)	No		
Dominant soil series and characteristics	Mo, MeD, EnD		
Series	Monacan, Mecklenburg, Enon		
Depth	-		
Clay%	-		
K	-		
T	-		

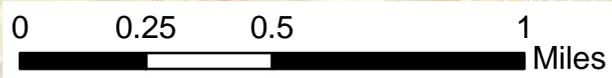
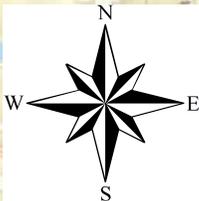
Appendix B  
Visual Assessment Data



Directions to the Site: Take I-40 to I-85 S. Take exit 45B to W WT Harris Blvd and continue for 2.4 miles. Then turn right onto David Cox Rd, right onto W Sugar Creek Rd which turns into Browne Rd. Turn left at the light onto Hucks Rd and continue for a little over one mile. The access to the site is a gravel road on the right.

**Restoration Site**

**Gravel Road Entrance**

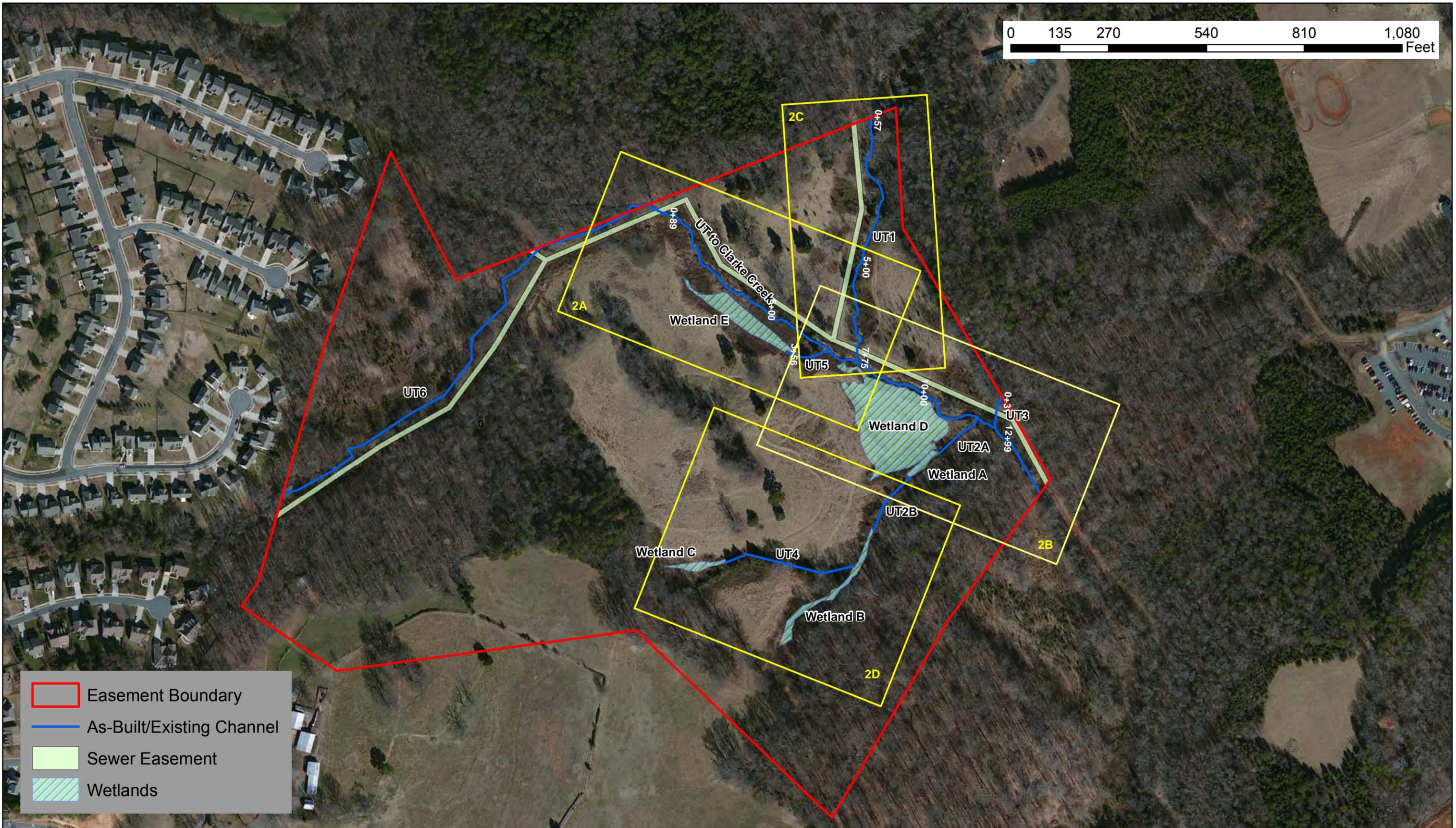
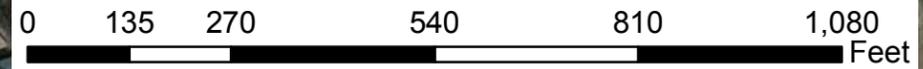


# Restoration Site Vicinity

UT to Clarke Creek  
 Monitoring Year 2 Mecklenburg County, NC  
 January 2016 Project # 92500 Figure 1

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- Easement Boundary
- As-Built/Existing Channel
- Sewer Easement
- Wetlands

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 NC Department of  
 Environmental Quality  
 Division of Mitigation Services

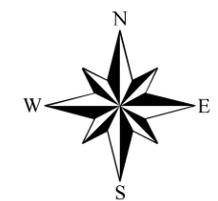
# UT to Clarke Creek Monitoring Year 2

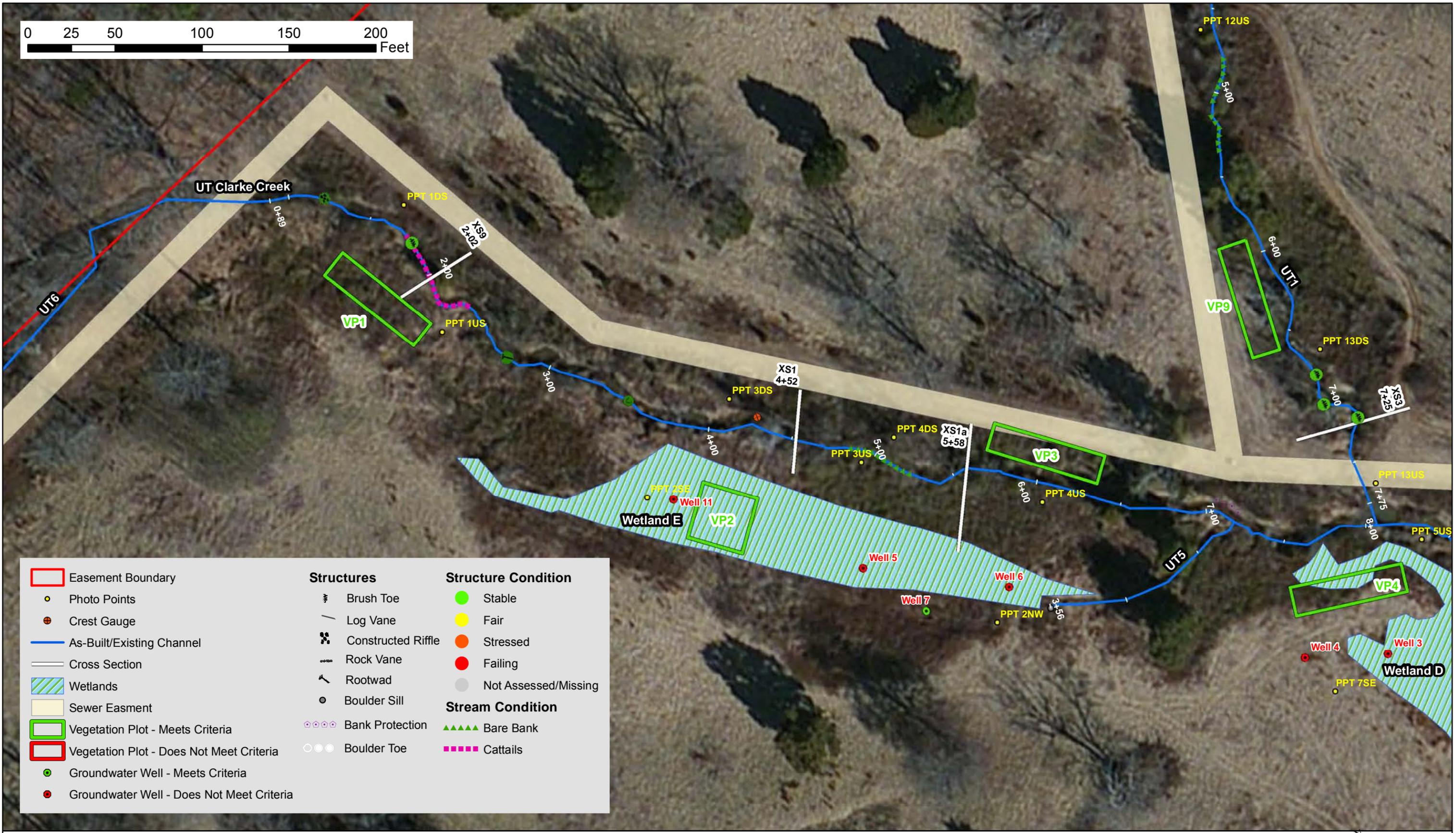
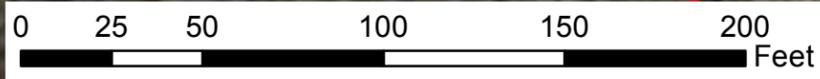
## Current Conditions Plan View - Index Map

January 2016      Project # 92500      Figure 2      Mecklenburg County, NC

Prepared By

**SEPI**  
 ENGINEERING &  
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Easement Boundary	<b>Structures</b>	<b>Structure Condition</b>
Photo Points	Brush Toe	Stable
Crest Gauge	Log Vane	Fair
As-Built/Existing Channel	Constructed Riffle	Stressed
Cross Section	Rock Vane	Failing
Wetlands	Rootwad	Not Assessed/Missing
Sewer Easement	Boulder Sill	<b>Stream Condition</b>
Vegetation Plot - Meets Criteria	Bank Protection	Bare Bank
Vegetation Plot - Does Not Meet Criteria	Boulder Toe	Cattails
Groundwater Well - Meets Criteria		
Groundwater Well - Does Not Meet Criteria		

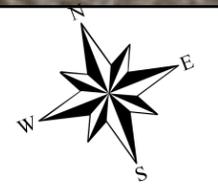
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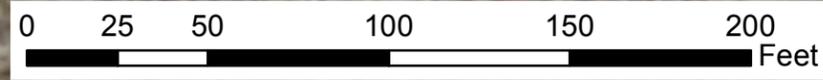
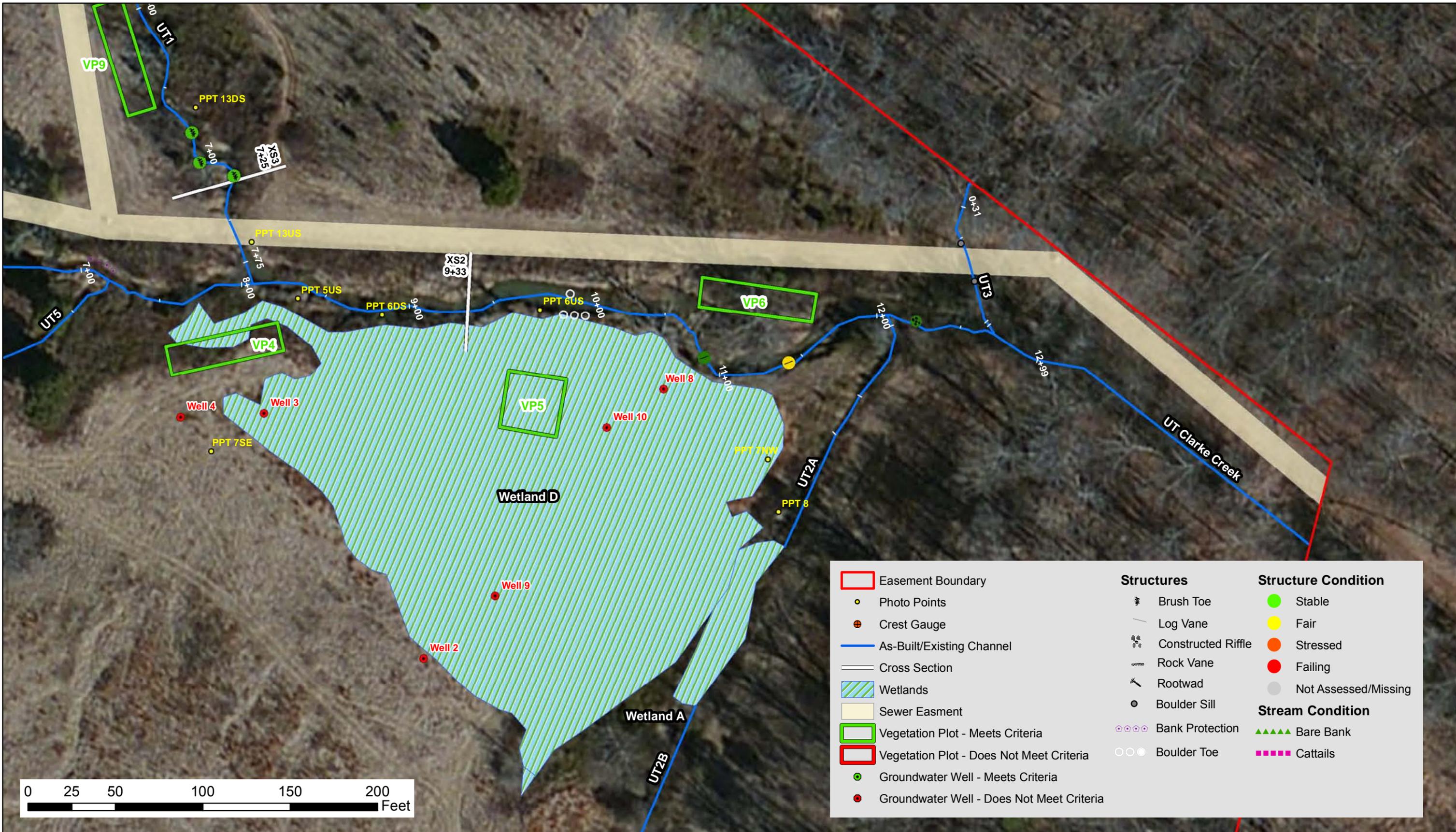
# UT to Clarke Creek Monitoring Year 2

## Current Conditions Plan View - UT Clarke Creek above Confluence

January 2016    Project # 92500    Figure 2A    Mecklenburg County, NC

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 ENGINEERING &  
 CONSTRUCTION





Easement Boundary	Photo Points	Brush Toe	Stable
Crest Gauge	As-Built/Existing Channel	Log Vane	Fair
Cross Section	Wetlands	Constructed Riffle	Stressed
Sewer Easement	Vegetation Plot - Meets Criteria	Rock Vane	Failing
Vegetation Plot - Does Not Meet Criteria	Groundwater Well - Meets Criteria	Rootwad	Not Assessed/Missing
Groundwater Well - Does Not Meet Criteria		Boulder Sill	<b>Stream Condition</b>
		Bank Protection	Bare Bank
		Boulder Toe	Cattails

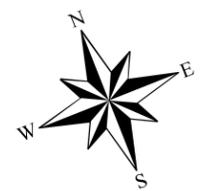
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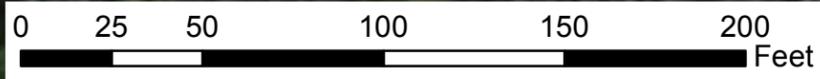
# UT to Clarke Creek Monitoring Year 2

## Current Conditions Plan View - UT to Clarke Creek below Confluence

January 2016    Project # 92500    Figure 2B    Mecklenburg County, NC

Prepared By  
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 ENGINEERING &  
 CONSTRUCTION





Easement Boundary	<b>Structures</b>	<b>Structure Condition</b>
Photo Points	Brush Toe	Stable
Crest Gauge	Log Vane	Fair
As-Built/Existing Channel	Constructed Riffle	Stressed
Cross Section	Rock Vane	Failing
Wetlands	Rootwad	Not Assessed/Missing
Sewer Easement	Boulder Sill	<b>Stream Condition</b>
Vegetation Plot - Meets Criteria	Bank Protection	Bare Bank
Vegetation Plot - Does Not Meet Criteria	Boulder Toe	Cattails
Groundwater Well - Meets Criteria		
Groundwater Well - Does Not Meet Criteria		

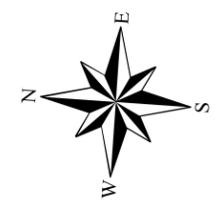
# UT to Clarke Creek Monitoring Year 2

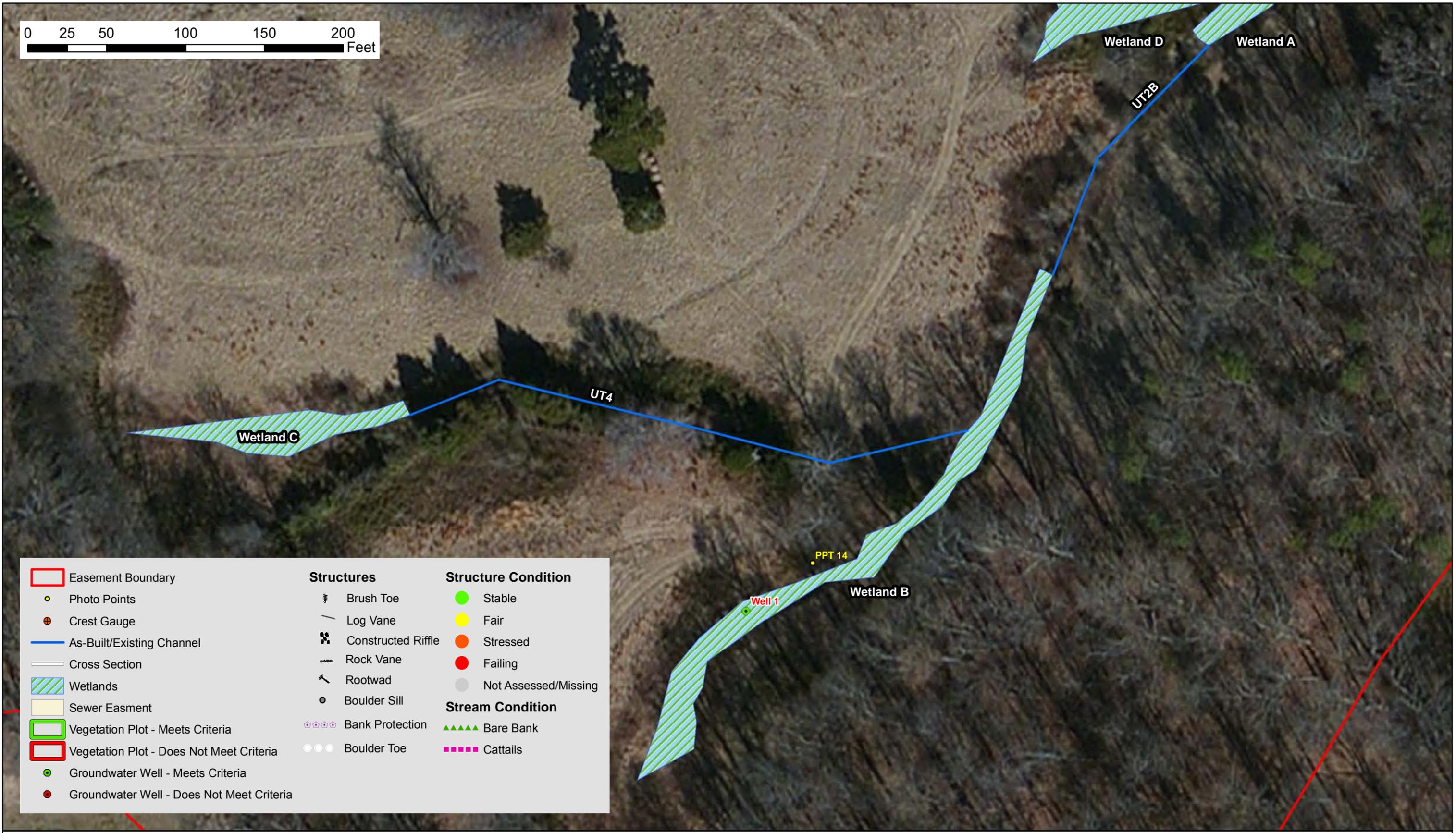
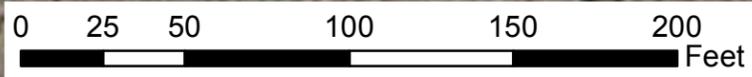
## Current Conditions Plan View - UT 1

January 2016      Project # 92500      Figure 2C      Mecklenburg County, NC

Prepared for:  
NC Department of  
Environmental Quality  
Division of Mitigation Services

Prepared By  
**SEPI**  
ENGINEERING &  
CONSTRUCTION





Easement Boundary	<b>Structures</b>	<b>Structure Condition</b>
Photo Points	Brush Toe	Stable
Crest Gauge	Log Vane	Fair
As-Built/Existing Channel	Constructed Riffle	Stressed
Cross Section	Rock Vane	Failing
Wetlands	Rootwad	Not Assessed/Missing
Sewer Easement	Boulder Sill	<b>Stream Condition</b>
Vegetation Plot - Meets Criteria	Bank Protection	Bare Bank
Vegetation Plot - Does Not Meet Criteria	Boulder Toe	Cattails
Groundwater Well - Meets Criteria		
Groundwater Well - Does Not Meet Criteria		

Prepared for:  
 NC Department of  
 Environmental Quality  
 Division of Mitigation Services

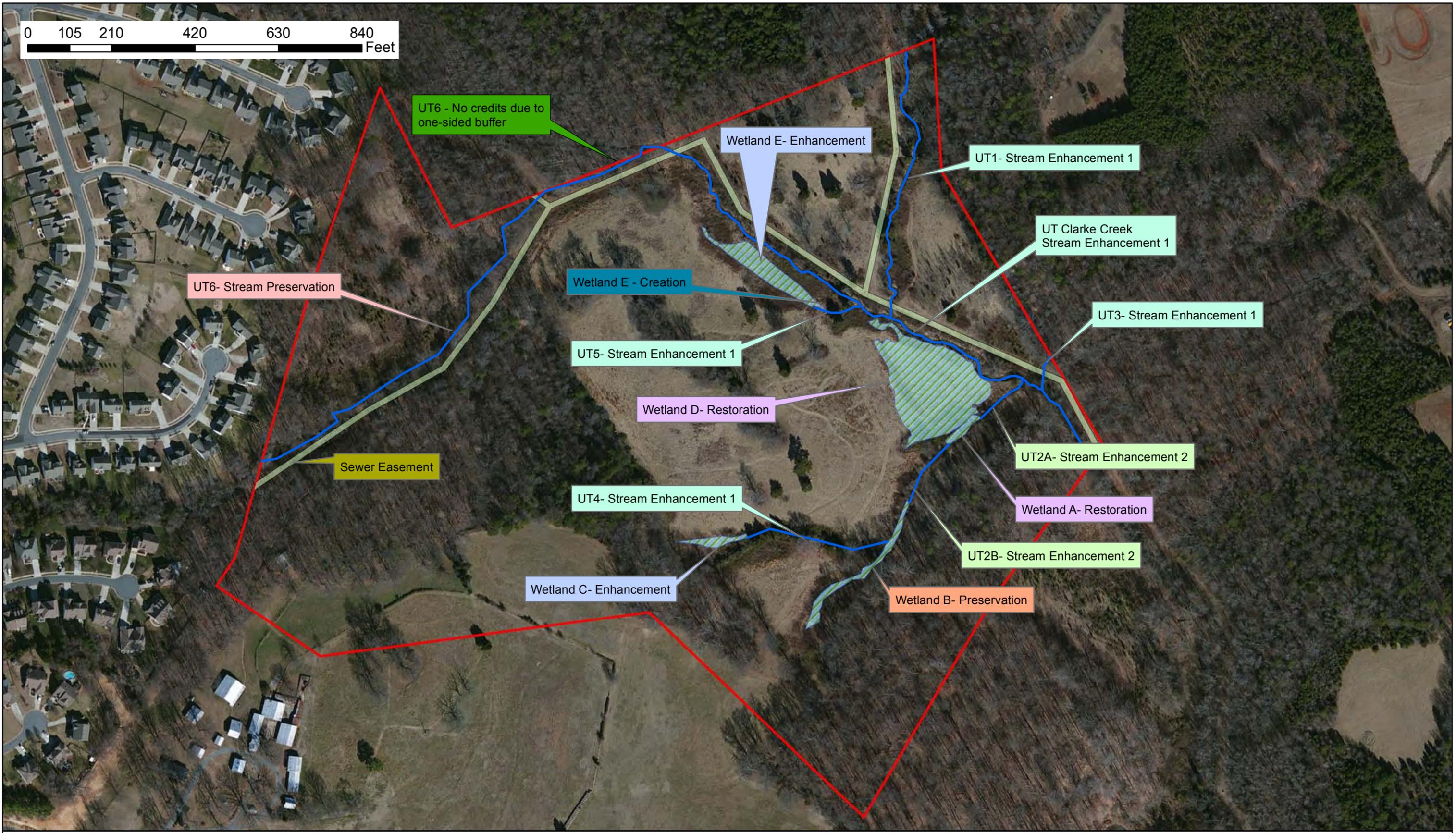
# UT to Clarke Creek Monitoring Year 2

## Current Conditions Plan View - UT 4

January 2016      Project # 92500      Figure 2D      Mecklenburg County, NC

Prepared By





Prepared for:  
NC Department of  
Environmental Quality  
Division of Mitigation Services

# UT to Clarke Creek Monitoring Year 2 Components Map

January 2016

Project # 92500

Figure 3

Mecklenburg County, NC

Prepared By



Table 5a  
 Reach ID  
 Assessed Length

**Visual Stream Morphology Stability Assessment**  
 UT to Clarke Creek  
 1507

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	1. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%			
		2. <u>Degradation</u> - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate	8	10			80%			
		3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth $\geq$ 1.6)	10	10					
	2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)		10	10			100%			
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	10	10			100%			
		2. Thalweg centering at downstream of meander (Glide)	10	10			100%			
<b>Totals</b>										
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			1	39	99%	1	39	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
<b>Totals</b>										
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	7	7			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	1	1			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	8	8			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. (See guidance for this table in EEP monitoring guidance document)	7	8			88%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio $\geq$ 1.6 Rootwads/logs providing some cover at base-flow.	2	2			100%			

Table 5b  
 Reach ID  
 Assessed Length

**Visual Stream Morphology Stability Assessment**  
 UT1  
 758

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	1. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%			
		2. <u>Degradation</u> - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate	3	5			60%			
		3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth $\geq$ 1.6)	5	6					
	2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)		6	6			100%			
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	6	6			100%			
		2. Thalweg centering at downstream of meander (Glide)	6	6			100%			
<b>Totals</b>										
2. Bank	1. <u>Scoured/Eroding</u>	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			2	52	97%	0	0	97%
	2. <u>Undercut</u>	Banks undercut/overhanging to the extent that mass wasting appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. <u>Mass Wasting</u>	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
<b>Totals</b>										
3. Engineered Structures	1. <u>Overall Integrity</u>	Structures physically intact with no dislodged boulders or logs.	7	7			100%			
	2. <u>Grade Control</u>	Grade control structures exhibiting maintenance of grade across the sill.	1	1			100%			
	2a. <u>Piping</u>	Structures lacking any substantial flow underneath sills or arms.	8	8			100%			
	3. <u>Bank Protection</u>	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. (See guidance for this table in EEP monitoring guidance document)	8	8			100%			
	4. <u>Habitat</u>	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio $\geq$ 1.6 Rootwads/logs providing some cover at base-flow.	2	2			100%			

**Table 6** **Vegetation Condition Assessment**

Planted Acreage<sup>1</sup>

13

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	Pattern and Color	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	Pattern and Color	0	0.00	0.0%
<b>Total</b>				0	0.00	0.0%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	Pattern and Color	0	0.00	0.0%
<b>Cumulative Total</b>				0	0.00	0.0%

Easement Acreage<sup>2</sup>

57.2

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern <sup>4</sup>	Areas or points (if too small to render as polygons at map scale).	1000 SF	Pattern and Color	0	0.00	0.0%
5. Easement Encroachment Areas <sup>3</sup>	Areas or points (if too small to render as polygons at map scale).	none	Pattern and Color	0	0.00	0.0%



Photo Station 1 Downstream-XS9 (MY2 – 10/22/2015)



Photo Station 1 Upstream-XS 9 (MY2 – 10/22/2015)



Photo Station 2 Northeast-Wetland E (MY2 – 10/22/2015)



Photo Station 2 Southeast-Wetland E (MY2 – 10/22/2015)



Photo Station 3 Downstream-XS1 (MY2 – 10/22/2015)



Photo Station 3 Upstream-XS1 (MY2 – 10/22/2015)



Photo Station 4 Downstream-XS1A (MY2 – 10/22/2015)



Photo Station 4 Upstream-XS1A (MY2 – 10/22/2015)



Photo Station 5 Upstream-Confluence (MY2 – 10/22/2015)



Photo Station 6 Downstream-XS2 (MY2 – 10/22/2015)



Photo Station 6 Upstream-XS2 (MY2 – 10/22/2015)



Photo Station 7 Northwest- Wetland D (MY2 – 10/22/2015)



Photo Station 7 Southeast-Wetland D (MY2 – 10/22/2015)



Photo Station 8 Downstream-UT2 (MY2 – 10/22/2015)



Photo Station 8 South-Wetland A (MY2 – 10/22/2015)



Photo Station 9 Downstream-XS4 (MY2 – 10/22/2015)



Photo Station 9 Upstream-XS4 (MY2 – 10/22/2015)



Photo Station 10 Downstream-XS5 (MY2 – 10/22/2015)



Photo Station 10 Upstream-XS5 (MY2 – 10/22/2015)



Photo Station 11 Downstream-XS6 (MY2 – 10/22/2015)



Photo Station 11 Upstream-XS6 (MY2 – 10/22/2015)



Photo Station 12 Downstream-XS8 (MY2 – 10/22/2015)



Photo Station 12 Upstream-XS8 (MY2 – 10/22/2015)



Photo Station 13 Downstream-XS3 (MY2 – 10/22/2015)



Photo Station 13 Upstream-XS3 (MY2 – 10/22/2015)

Photo Station 14 was not captured during this monitoring year.



Vegetation Plot 1 – 5m x 20m (MY2 – 10/22/2015)



Vegetation Plot 2 – 10m x 10m (MY2 – 10/22/2015)



Vegetation Plot 3 – 5m x 20m (MY2 – 10/22/2015)



Vegetation Plot 4 – 5m x 20m (MY2 – 10/21/2015)



Vegetation Plot 5 – 5m x 20m (MY2 – 10/21/2015)



Vegetation Plot 6 – 5m x 20m (MY2 – 10/21/2015)



Vegetation Plot 7 – 10m x 10m (MY2 – 10/22/2015)



Vegetation Plot 8 – 5m x 20m (MY2 – 10/22/2015)



Vegetation Plot 9 – 5m x 20m (MY2 – 10/22/2015)

Appendix C  
Vegetation Plot Data

Table 7. Vegetation Plot Mitigation Success Summary  
 UT to Clarke Creek / DMS Project #92500  
 Year 2 of 5

Plot #	Stems/Acre	Success Criteria Met?
1	364.2	Yes
2	323.7	Yes
3	688	Yes
4	364.2	Yes
5	445.2	Yes
6	607	Yes
7	566.6	Yes
8	242.8	No
9	526.1	Yes

Table 8 - CVS Vegetation Metadata  
 UT Clarke Creek / DMS Project #92500

<b>Report Prepared By</b>	Kim Hamlin
<b>Date Prepared</b>	10/27/2015 13:38
<b>database name</b>	UTClarkeCr_92500_MY2_2015_CVS_Database.mdb
<b>database location</b>	G:\Environmental\NCEEP Ut Clark Creek WMS\MY02\AnnualReport\UTClarkeCr_92500_MY2_2015_DRAFT\Support Files\3 - Vegetation Plot Data
<b>computer name</b>	W93
<b>file size</b>	66662400

**DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT-----**

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

<b>Project Code</b>	92500
<b>project Name</b>	UT Clarke Creek
<b>Description</b>	Stream and Wetland Restoration
<b>River Basin</b>	Yadkin-Pee Dee
<b>length(ft)</b>	3,106 lf restored, 1,464 lf preserved
<b>stream-to-edge width (ft)</b>	
<b>area (sq m)</b>	52609.1
<b>Required Plots (calculated)</b>	9
<b>Sampled Plots</b>	9



Appendix D  
Stream Survey Data

Station	Elevation
0.19	748.63
0.26	748.66
3.69	748.26
6.89	748.19
11.13	747.92
15.47	747.70
18.71	747.51
21.87	747.33
23.63	747.18
24.78	746.37
25.53	746.23
28.92	746.63
30.38	746.63
31.33	746.99
32.91	747.05
34.21	747.52
39.2	747.99
44.9	748.02
47.45	748.97

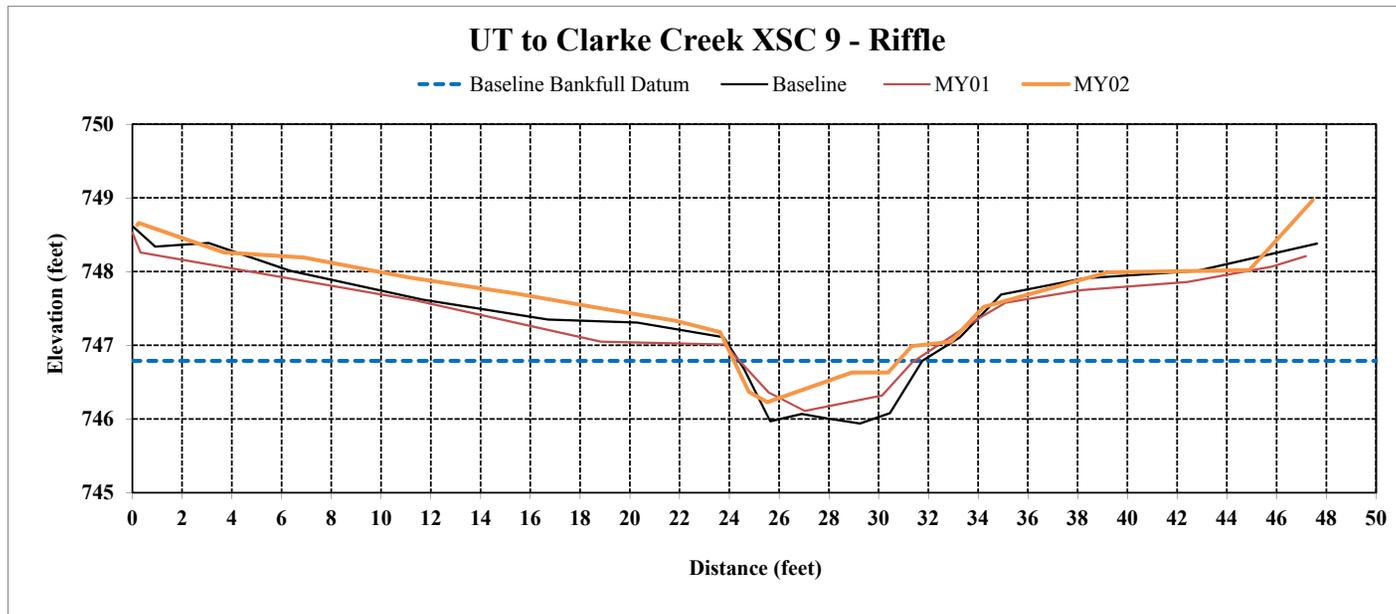
<b>Reach</b>	UT to Clarke Creek
<b>River Basin</b>	Yadkin/Pee Dee
<b>Cross Section ID</b>	XSC-9, Riffle, 2+02
<b>Drainage Area (Sq Mi)</b>	1.08
<b>Date</b>	10/22/2015
<b>Observers</b>	P. Beach, K. Hamlin, C. Flowers

SUMMARY DATA	
<b>Baseline Bankfull Datum, ft</b>	746.79
<b>Bankfull Cross Sectional Area, ft<sup>2</sup></b>	3.47
<b>Bankfull Width, ft</b>	7.7
<b>Max Depth at Bankfull, ft</b>	0.56
<b>Mean Depth at Bankfull, ft</b>	0.45
<b>Width/Depth Ratio</b>	17.09
<b>Flood Prone Width, ft</b>	12.13
<b>Flood Prone Area Elevation</b>	747.35
<b>Entrenchment Ratio</b>	1.58
<b>Bank Height Ratio</b>	1.36



Stream Type E4

Sta. 2+02 Looking Downstream



Station	Elevation
0.16	746.22
0.34	746.19
3.17	745.91
8.59	745.4
13.59	744.88
19.17	744.69
21.7	744.86
23.73	744.47
25.72	744.13
25.83	744.03
26.15	744
27.26	743.11
28.89	743.06
31.54	743.09
33.42	744.73
35.08	745.03
39.98	745.35
45.04	745.76
48.21	746.76

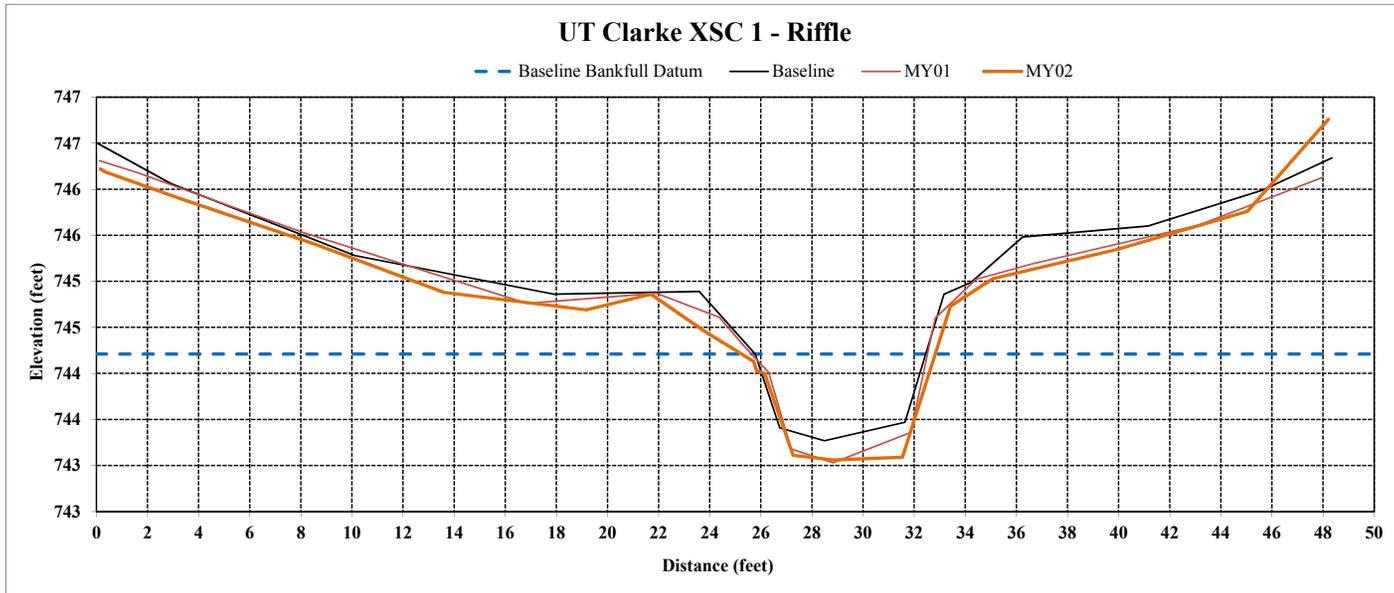
Reach	UT to Clarke Creek
River Basin	Yadkin/Pee Dee
Cross Section ID	XSC-1, Riffle, 4+52
Drainage Area (Sq Mi)	1.08
Date	10/22/2015
Observers	P. Beach, K. Hamlin, C. Flowers

SUMMARY DATA	
Baseline Bankfull Datum, ft	744.21
Bankfull Cross Sectional Area, ft <sup>2</sup>	6.15
Bankfull Width, ft	7.08
Max Depth at Bankfull, ft	1.15
Mean Depth at Bankfull, ft	0.87
Width/Depth Ratio	8.15
Flood Prone Width, ft	30.98
Flood Prone Area Elevation	745.36
Entrenchment Ratio	4.38
Bank Height Ratio	0.93



Stream Type E4

Sta. 4+52 Looking Downstream



Station	Elevation
0.94	745.84
2.18	745.56
6.17	744.59
12.23	743.87
18.63	743.33
19.55	743.31
21.81	743.06
22.9	742.72
23.47	742.29
23.83	740.93
25.73	740.59
25.75	741.49
29.62	741.04
30.47	742.65
31.1	742.81
32.72	742.99
34.8	743.05
37.05	743.29
37.79	743.63
43.9	743.98
51.13	744.28
52.71	744.52
66.48	745.56
69.53	745.79
75.18	745.84

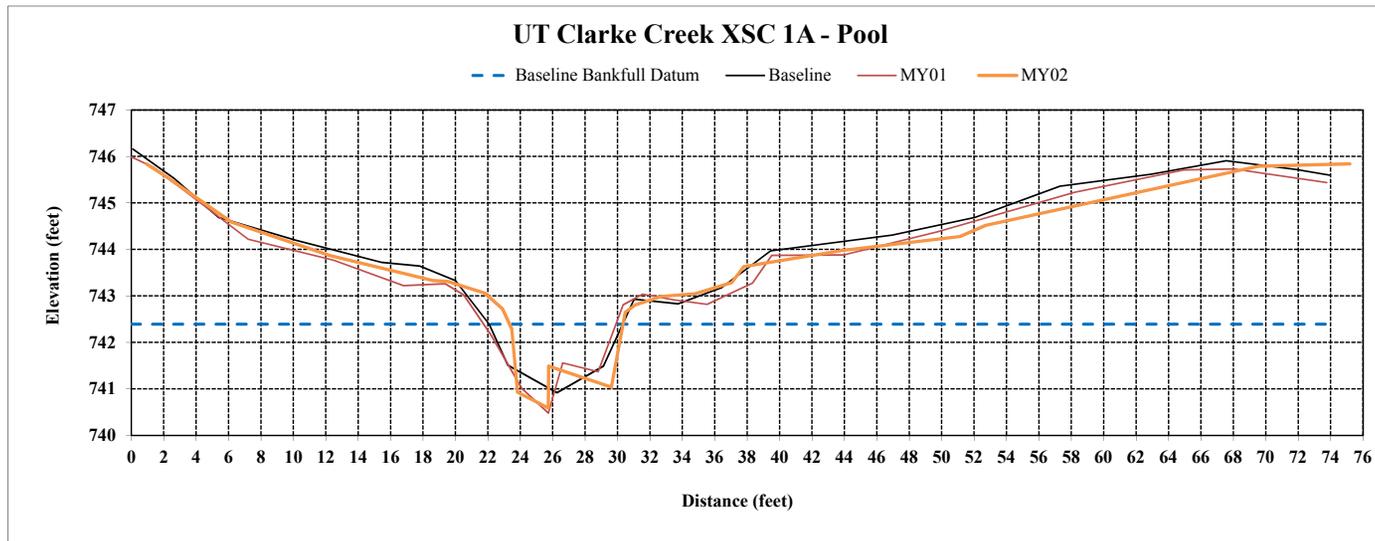
<b>Reach</b>	UT to Clarke Creek
<b>River Basin</b>	Yadkin/Pee Dee
<b>Cross Section ID</b>	XSC-1A, Pool, 5+58
<b>Drainage Area (Sq Mi)</b>	1.08
<b>Date</b>	10/22/2015
<b>Observers</b>	P. Beach, K. Hamlin, C. Flowers

SUMMARY DATA	
<b>Baseline Bankfull Datum, ft</b>	742.39
<b>Bankfull Cross Sectional Area, ft<sup>2</sup></b>	7.67
<b>Bankfull Width, ft</b>	7.00
<b>Max Depth at Bankfull, ft</b>	1.80
<b>Mean Depth at Bankfull, ft</b>	1.10
<b>Width/Depth Ratio</b>	6.39
<b>Flood Prone Width, ft</b>	38.00
<b>Flood Prone Area Elevation</b>	744.19
<b>Entrenchment Ratio</b>	5.43
<b>Bank Height Ratio</b>	0.94



Stream Type E4

Sta. 5+58 Looking Downstream



Station	Elevation
0.1	743.64
4.14	742.69
6.15	741.83
9.4	741.24
11.36	740.91
17.58	740.19
26.83	739.92
28.41	739.59
29.07	739.04
30.29	737.17
31.16	737.29
32.19	737.19
33.07	737.10
35.28	737.49
36.88	737.77
37.79	737.99
38.26	739.83
39.72	740.04
41.7	740.07
44.35	740.09
48.3	740.41
48.99	740.7
49.24	741
52.14	741.45
53.51	742.27
56.78	743.6

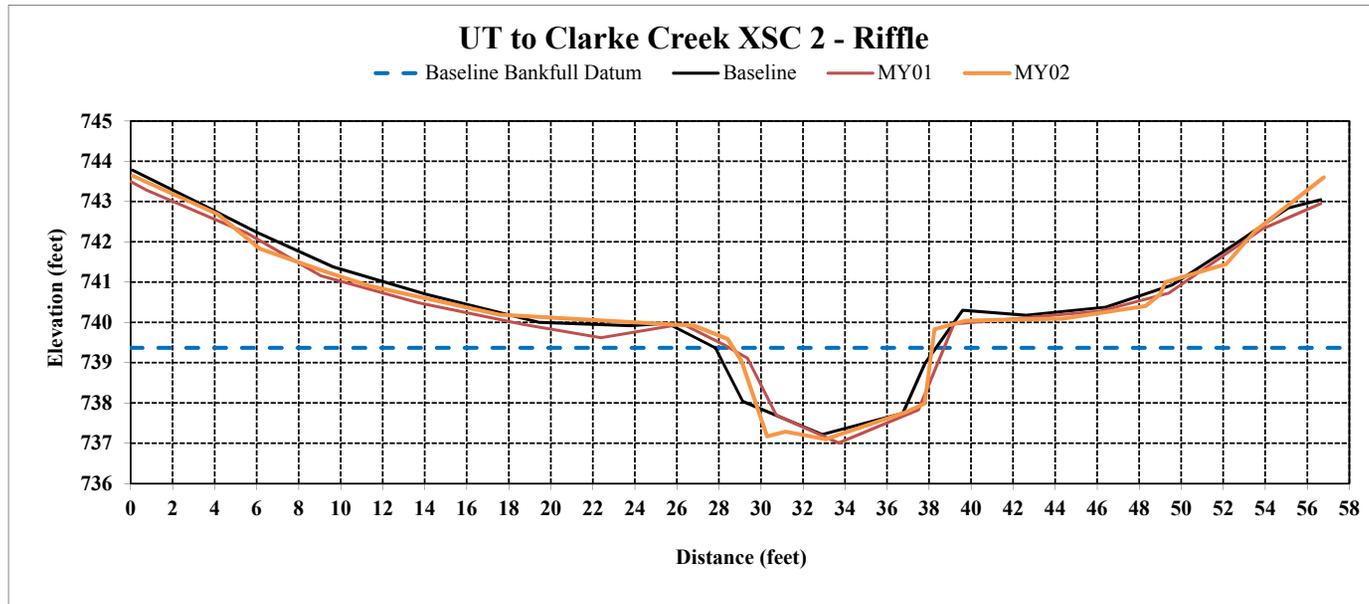
<b>Reach</b>	UT to Clarke Creek
<b>River Basin</b>	Yadkin/Pee Dee
<b>Cross Section ID</b>	XSC-2, Riffle, 9+33
<b>Drainage Area (Sq Mi)</b>	1.08
<b>Date</b>	10/22/2015
<b>Observers</b>	P. Beach, K. Hamlin, C. Flowers

SUMMARY DATA	
<b>Baseline Bankfull Datum, ft</b>	739.37
<b>Bankfull Cross Sectional Area, ft<sup>2</sup></b>	18.70
<b>Bankfull Width, ft</b>	9.85
<b>Max Depth at Bankfull, ft</b>	2.27
<b>Mean Depth at Bankfull, ft</b>	1.90
<b>Width/Depth Ratio</b>	5.19
<b>Flood Prone Width, ft</b>	45.14
<b>Flood Prone Area Elevation</b>	741.64
<b>Entrenchment Ratio</b>	4.58
<b>Bank Height Ratio</b>	1.10



Stream Type E4

Sta. 9+33 Looking Downstream



Station	Elevation
0	749.13
0.02	748.64
0.07	748.65
6.33	748.50
12.04	747.94
17.51	747.13
22.73	746.67
26.48	746.40
28.3	746.08
28.94	745.82
30.48	745.45
32.79	745.23
34.37	745.36
36.7	746.22
37.55	746.18
39.25	745.94
42.85	745.91
52.28	746.88
62.34	748.36
63.76	748.91
70.66	749.41
76.44	749.73

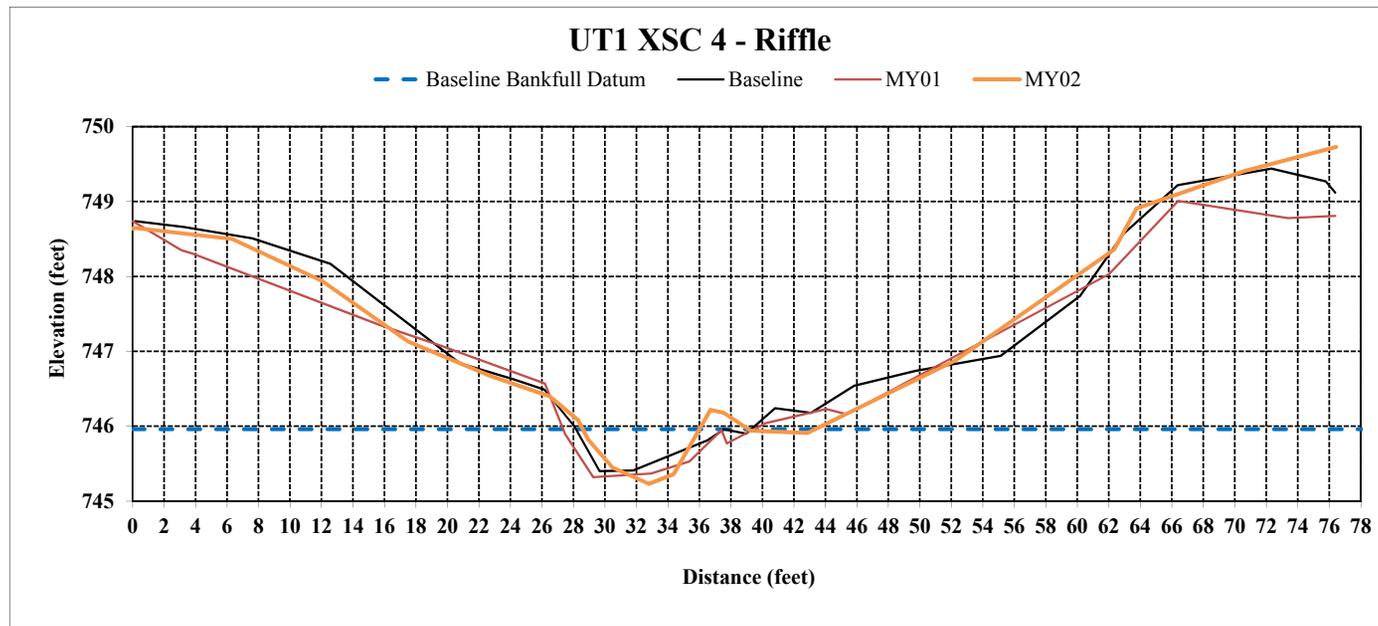
<b>Reach</b>	UT1
<b>River Basin</b>	Yadkin/Pee Dee
<b>Cross Section ID</b>	XSC-4, Riffle, 1+26
<b>Drainage Area (Sq Mi)</b>	0.46
<b>Date</b>	10/22/2015
<b>Observers</b>	P. Beach, K. Hamlin, C. Flowers

SUMMARY DATA	
<b>Baseline Bankfull Datum, ft</b>	745.96
<b>Bankfull Cross Sectional Area, ft<sup>2</sup></b>	4.55
<b>Bankfull Width, ft</b>	8.4
<b>Max Depth at Bankfull, ft</b>	0.73
<b>Mean Depth at Bankfull, ft</b>	0.54
<b>Width/Depth Ratio</b>	15.51
<b>Flood Prone Width, ft</b>	28.5
<b>Flood Prone Area Elevation</b>	746.69
<b>Entrenchment Ratio</b>	3.39
<b>Bank Height Ratio</b>	1.16



Stream Type B4c

Sta. 1+26 Looking Downstream



Station	Elevation
0	750.72
3.44	749.33
4.36	749.08
8.05	747.68
11.16	746.83
19.1	746.50
23.54	745.40
25.82	745.03
26.77	744.90
28.01	744.10
29.71	743.35
31.46	744.19
33.89	744.81
35.89	745.24
37.79	745.73
45.31	745.79
57.28	746.49
71.83	747.73

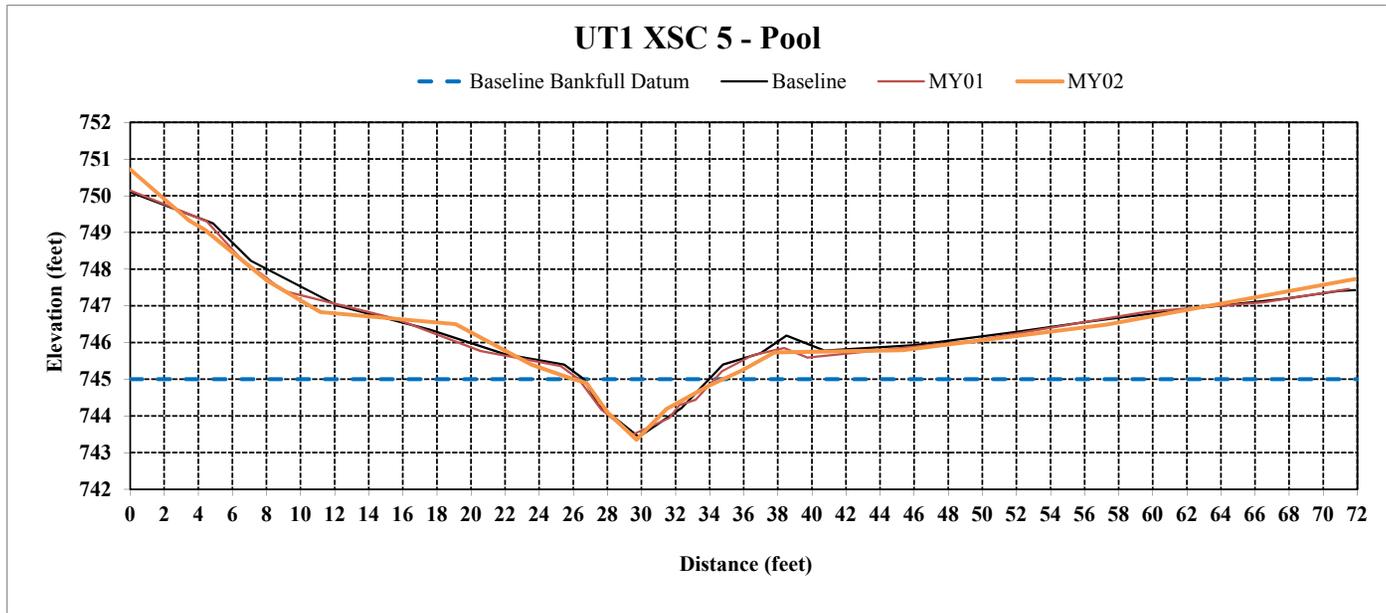
Reach	UT1
River Basin	Yadkin/Pee Dee
Cross Section ID	XSC-5, Pool, 2+66
Drainage Area (Sq Mi)	0.46
Date	10/22/2015
Observers	P. Beach, K. Hamlin, C. Flowers

SUMMARY DATA	
Baseline Bankfull Datum, ft	745.90
Bankfull Cross Sectional Area, ft <sup>2</sup>	4.86
Bankfull Width, ft	7.12
Max Depth at Bankfull, ft	1.65
Mean Depth at Bankfull, ft	0.68
Width/Depth Ratio	10.43
Flood Prone Width, ft	44
Flood Prone Area Elevation	746.65
Entrenchment Ratio	6.18
Bank Height Ratio	0.88



Stream Type B4c

Sta. 2+66 Looking Downstream



Station	Elevation
0	750.67
1.89	749.61
3.1	749.42
7.46	747.85
16.95	746.61
24.16	746.11
29.13	745.70
30.65	745.20
32.18	744.99
33.83	743.96
34.89	743.82
36.13	744.12
37.16	744.78
39.42	745.11
43.23	745.57
48.96	746.02
54.04	746.62
59.47	747.07
70.7	747.45

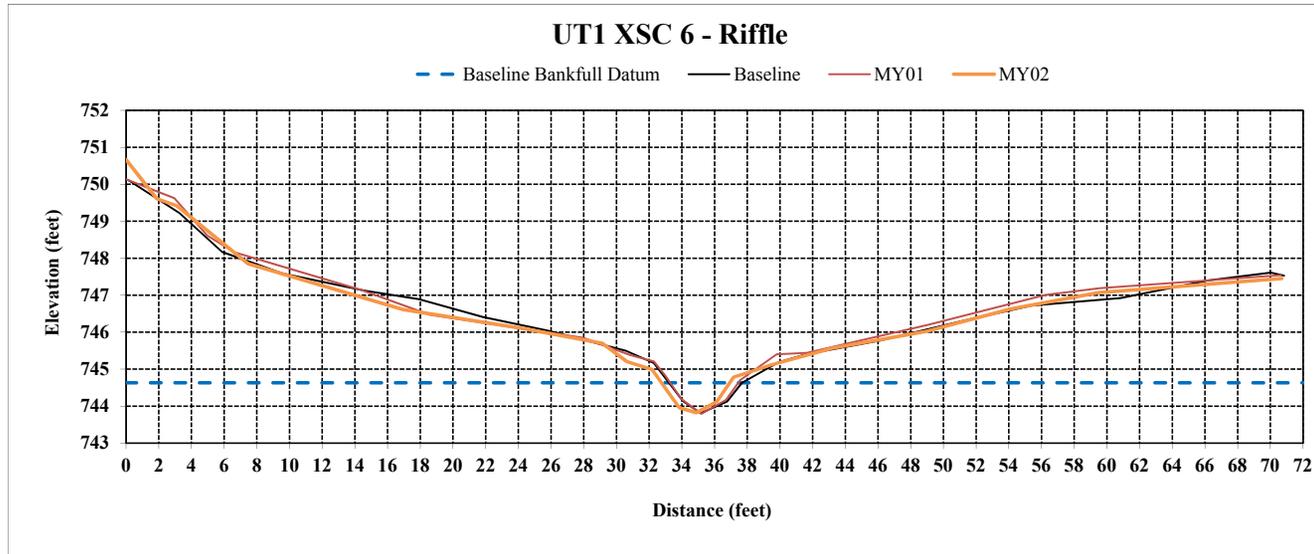
Reach	UT1
River Basin	Yadkin/Pee Dee
Cross Section ID	XSC-6, Riffle, 3+33
Drainage Area (Sq Mi)	0.46
Date	10/22/2015
Observers	P. Beach, K. Hamlin, C. Flowers

SUMMARY DATA	
Baseline Bankfull Datum, ft	744.63
Bankfull Cross Sectional Area, ft <sup>2</sup>	2.96
Bankfull Width, ft	5.42
Max Depth at Bankfull, ft	0.81
Mean Depth at Bankfull, ft	0.55
Width/Depth Ratio	9.92
Flood Prone Width, ft	12
Flood Prone Area Elevation	745.44
Entrenchment Ratio	2.21
Bank Height Ratio	1.19



Stream Type B4c

Sta. 3+33 Looking Downstream



Station	Elevation
0.27	750.20
1.97	749.75
3.42	748.84
5.2	748.09
14.27	746.74
20.94	746.00
26.36	745.07
27.51	744.91
27.84	744.75
28.71	743.98
32.04	743.55
35.23	743.50
36.96	744.72
37.92	744.92
44.29	745.42
50.44	745.89
57.18	747.2

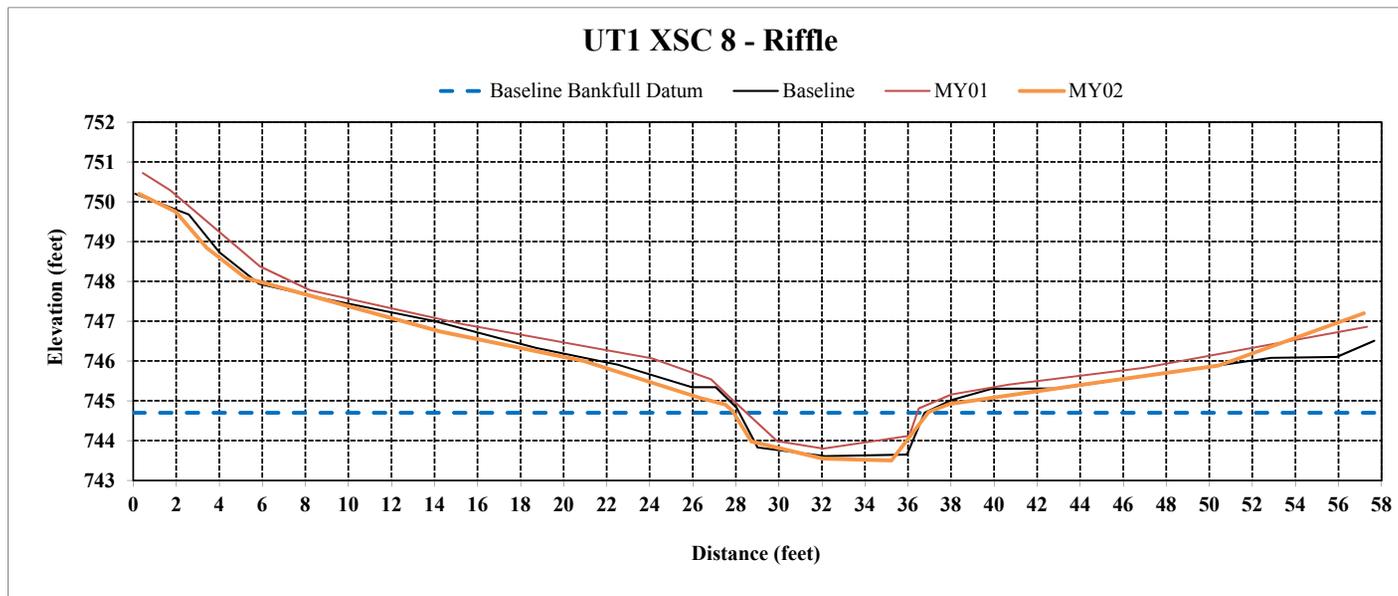
Reach	UT1
River Basin	Yadkin/Pee Dee
Cross Section ID	XSC-8, Riffle, 4+14
Drainage Area (Sq Mi)	0.46
Date	10/22/2015
Observers	P. Beach, K. Hamlin, C. Flowers

SUMMARY DATA	
Baseline Bankfull Datum, ft	744.70
Bankfull Cross Sectional Area, ft <sup>2</sup>	8.37
Bankfull Width, ft	9.12
Max Depth at Bankfull, ft	1.20
Mean Depth at Bankfull, ft	0.92
Width/Depth Ratio	9.94
Flood Prone Width, ft	28.94
Flood Prone Area Elevation	745.9
Entrenchment Ratio	2.02
Bank Height Ratio	1.02



Stream Type B4c

Sta. 4+14 Looking Downstream



Station	Elevation
0	745.15
4.71	742.89
7.32	742.46
12.33	741.97
18.5	741.72
24.22	741.53
24.7	741.43
25.47	740.95
26.28	739.71
27.97	739.01
30.38	738.40
32.22	738.70
33.57	739.49
34.43	739.85
35.39	740.99
36.88	741.26
39.66	741.48
44.43	741.67
53.11	741.76
59.16	742.34
67.55	744.05

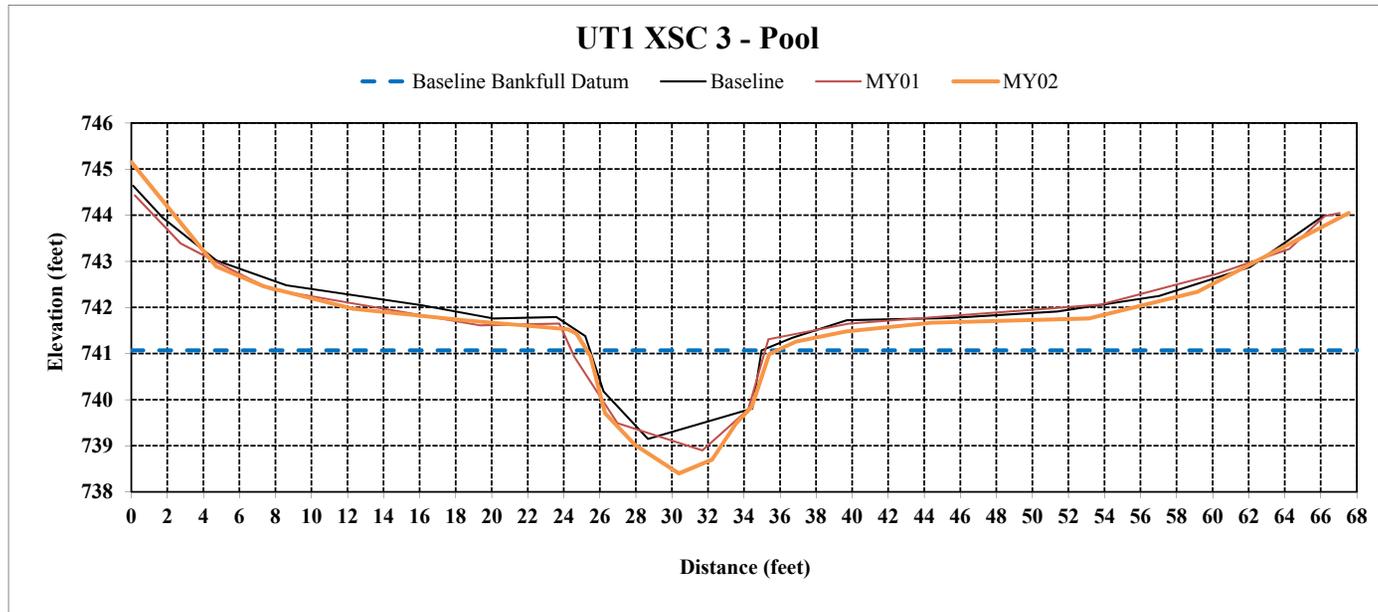
<b>Reach</b>	UT1
<b>River Basin</b>	Yadkin/Pee Dee
<b>Cross Section ID</b>	XSC-3, Pool, 7+25
<b>Drainage Area (Sq Mi)</b>	0.46
<b>Date</b>	10/22/2015
<b>Observers</b>	P. Beach, K. Hamlin, C. Flowers

SUMMARY DATA	
<b>Baseline Bankfull Datum, ft</b>	741.07
<b>Bankfull Cross Sectional Area, ft<sup>2</sup></b>	17.54
<b>Bankfull Width, ft</b>	10.81
<b>Max Depth at Bankfull, ft</b>	2.67
<b>Mean Depth at Bankfull, ft</b>	1.62
<b>Width/Depth Ratio</b>	6.66
<b>Flood Prone Width, ft</b>	63.00
<b>Flood Prone Area Elevation</b>	743.74
<b>Entrenchment Ratio</b>	5.83
<b>Bank Height Ratio</b>	0.97



Stream Type B4c

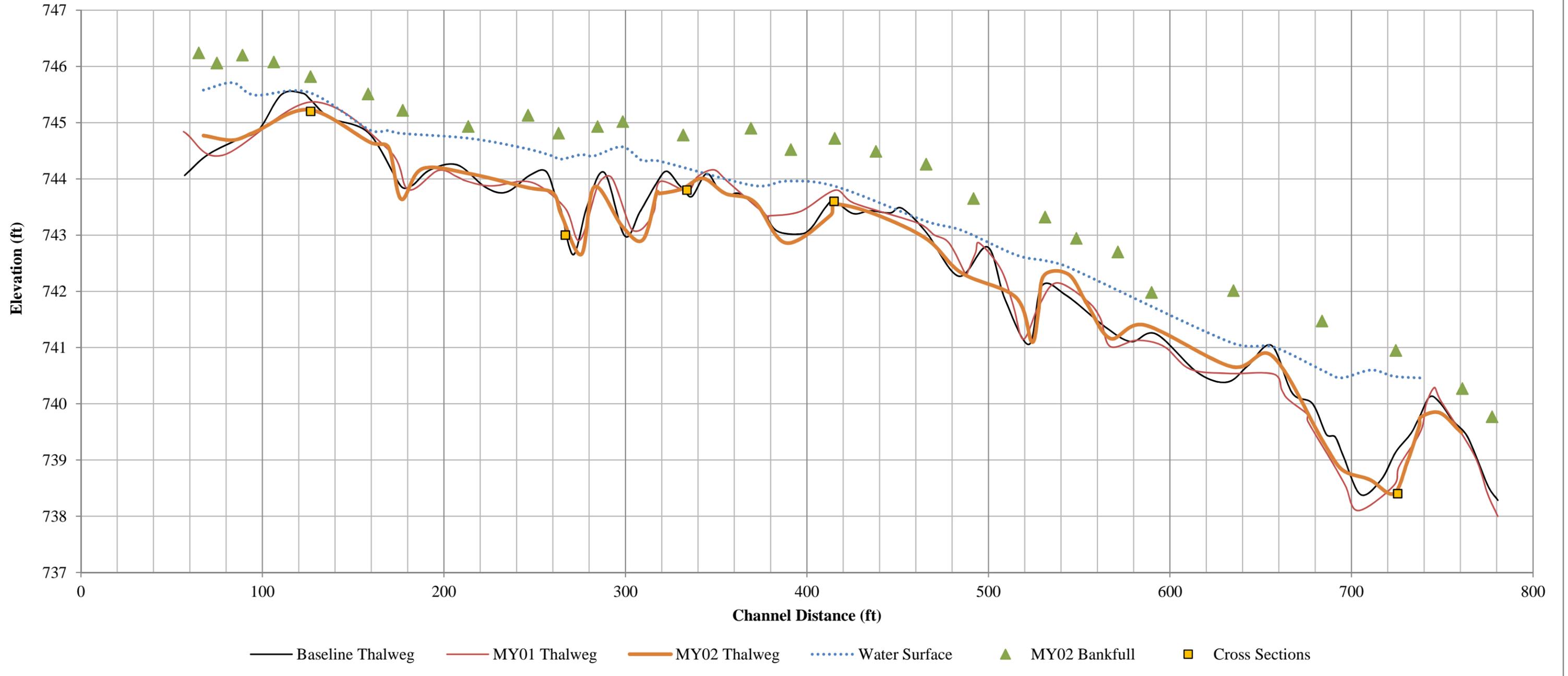
Sta. 7+25 Looking Downstream



### Longitudinal Profile - UT to Clarke Creek



# Longitudinal Profile - UT 1



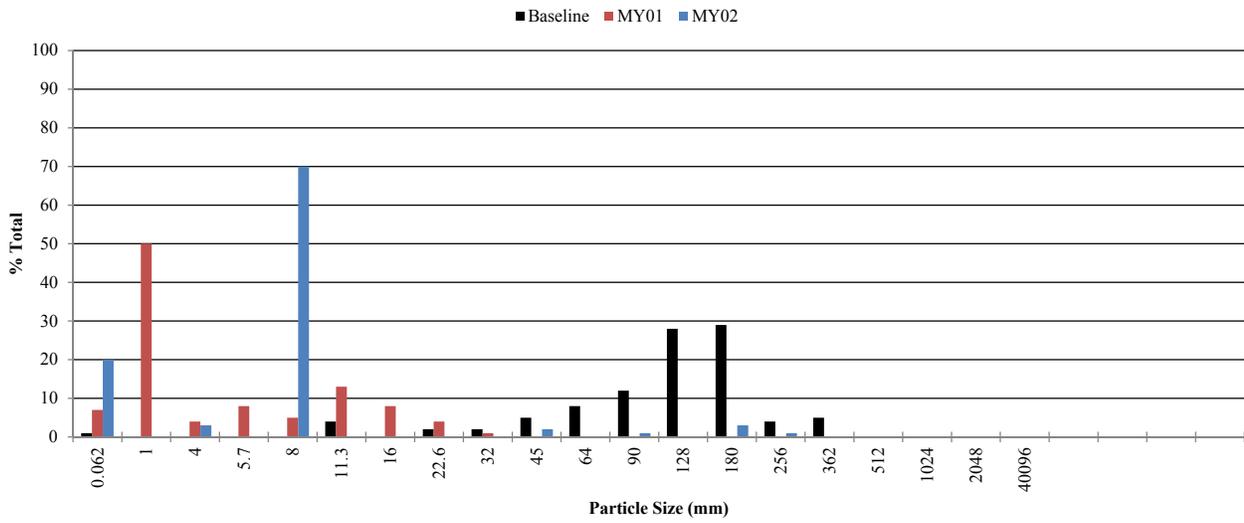
UT to Clarke Creek - US of XS9 - Riffle Pebble Count

Location: STA 2+02

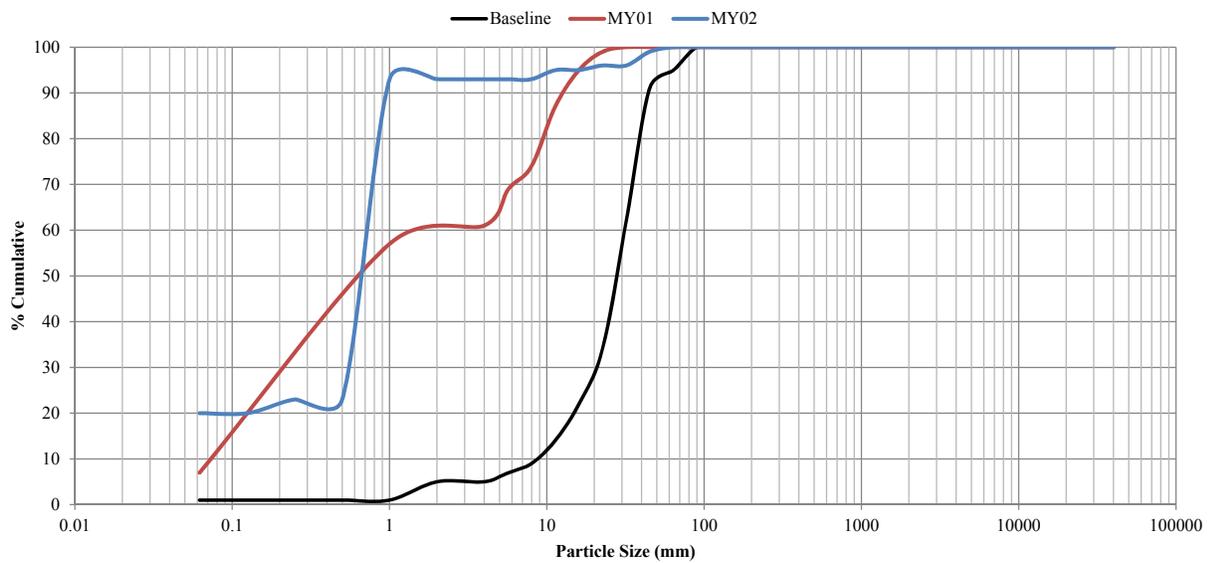
Inches	Particle	Millimeters		Count	% Total	% Cum.
	Silt/Clay	<0.062	S A N D	20	20	20
	Very Fine	0.062-0.125		0	0	20
	Fine	0.125-0.25		3	3	23
	Medium	0.25-0.50		0	0	23
	Coarse	0.50-1.0		70	70	93
0.04-0.08	Very Coarse	1.0-2		0	0	93
0.08-0.16	Very Fine	2-4	G R A V E L	0	0	93
0.16-0.22	Fine	4-5.7		0	0	93
0.22-0.31	Fine	5.7-8		0	0	93
0.31-0.44	Medium	8-11.3		2	2	95
0.44-0.63	Medium	11.3-16		0	0	95
0.63-0.89	Coarse	16-22.6		1	1	96
0.89-1.26	Coarse	22.6-32		0	0	96
1.26-1.77	Very Coarse	32-45		3	3	99
1.77-2.5	Very Coarse	45-64		1	1	100
2.5-3.5	Small	64-90		C O B B L E	0	0
3.5-5.0	Small	90-128	0		0	100
5.0-7.1	Medium	128-180	0		0	100
7.1-10.1	Large	180-256	0		0	100
10.1-14.3	Small	256-362	B O U L D E R	0	0	100
14.3-20	Small	362-512		0	0	100
20-40	Medium	512-1024		0	0	100
40-80	Large	1024-2048		0	0	100
	Bedrock	Bedrock	Bedrock	0	0	100
<b>Total Counted</b>				100		

Summary Data	
D50	0.7
D84	0.9
D95	1

**Individual Class Percent  
Pebble Count - US of XSC9 - Riffle**



**Cumulative Percent  
Pebble Count - US of XSC9 - Riffle**



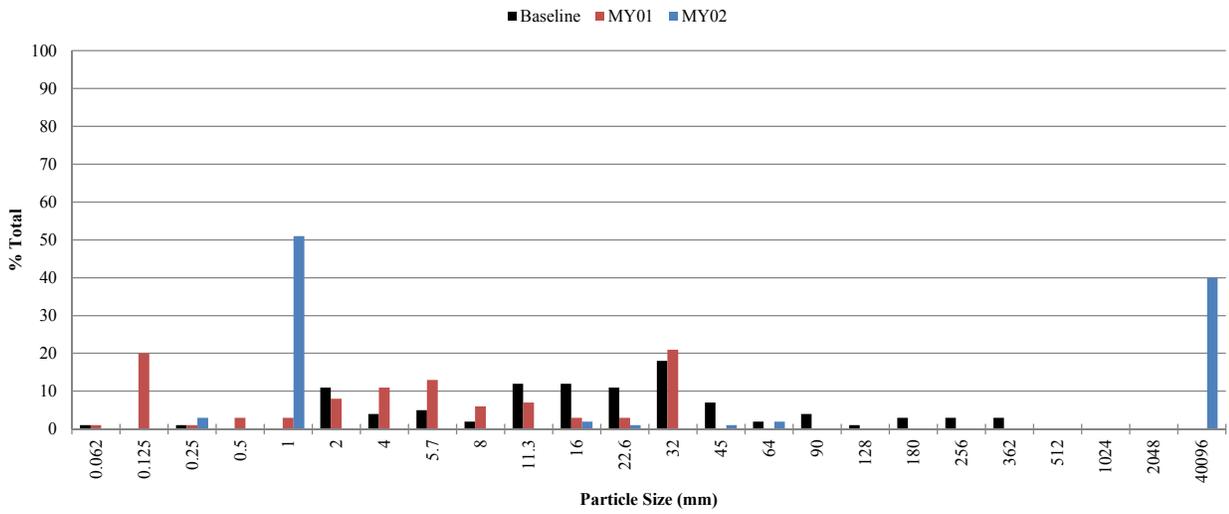
UT to Clarke Creek - XS1A - Riffle Pebble Count

Location: STA 5+58

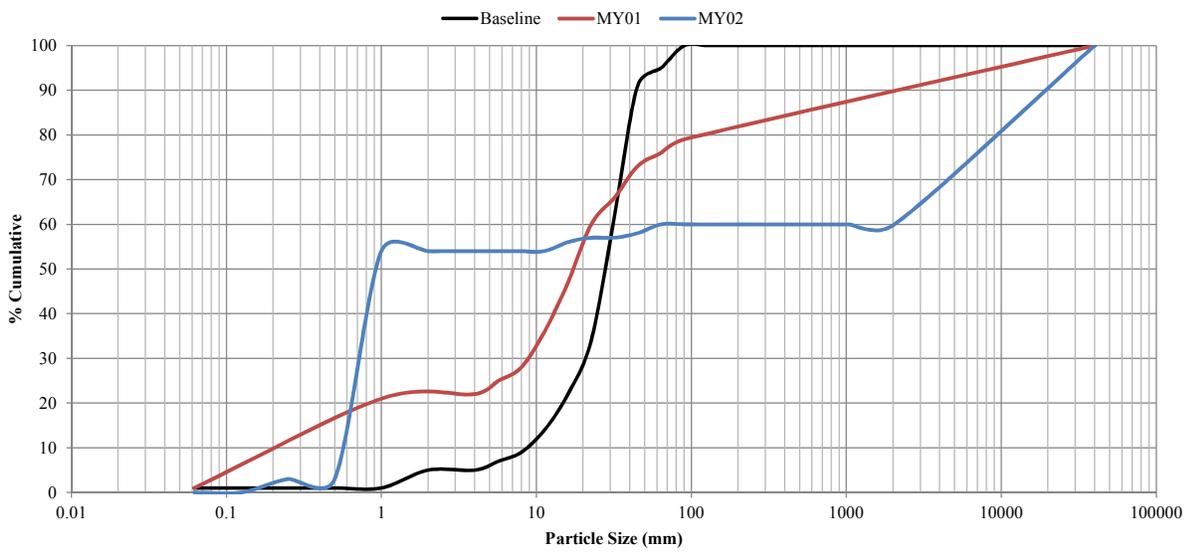
Inches	Particle	Millimeters		Count	% Total	% Cum.
	Silt/Clay	<0.062	S A N D	0	0	0
	Very Fine	0.062-0.125		0	0	0
	Fine	0.125-0.25		3	3	3
	Medium	0.25-0.50		0	0	3
	Coarse	0.50-1.0		51	51	54
0.04-0.08	Very Coarse	1.0-2		0	0	54
0.08-0.16	Very Fine	2-4	G R A V E L	0	0	54
0.16-0.22	Fine	4-5.7		0	0	54
0.22-0.31	Fine	5.7-8		0	0	54
0.31-0.44	Medium	8-11.3		0	0	54
0.44-0.63	Medium	11.3-16		2	2	56
0.63-0.89	Coarse	16-22.6		1	1	57
0.89-1.26	Coarse	22.6-32		0	0	57
1.26-1.77	Very Coarse	32-45		1	1	58
1.77-2.5	Very Coarse	45-64		2	2	60
2.5-3.5	Small	64-90	C O B B L E	0	0	60
3.5-5.0	Small	90-128		0	0	60
5.0-7.1	Medium	128-180		0	0	60
7.1-10.1	Large	180-256		0	0	60
10.1-14.3	Small	256-362	B O U L D E R	0	0	60
14.3-20	Small	362-512		0	0	60
20-40	Medium	512-1024		0	0	60
40-80	Large	1024-2048		0	0	60
	Bedrock	Bedrock	Bedrock	40	40	100
<b>Total Counted</b>				100		

Summary Data	
D50	0.9
D84	15,000
D95	25,000

**Individual Class Percent  
Pebble Count - XSC1A - Riffle**



**Cumulative Percent  
Pebble Count - XSC1A - Riffle**



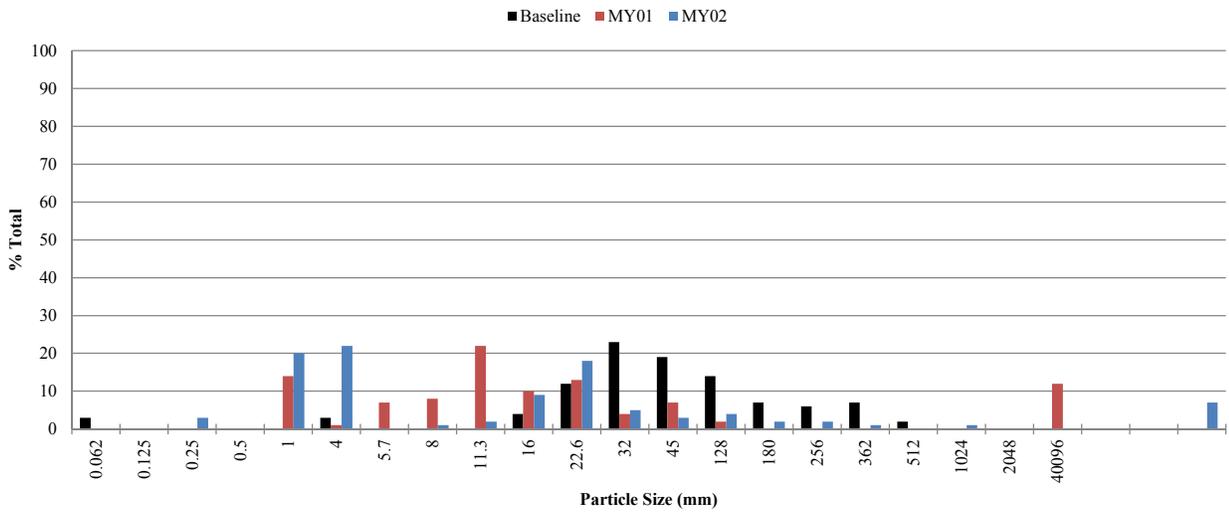
UT to Clarke Creek - US of Confluence with UT1 - Riffle Pebble Count

Location: STA 7+50

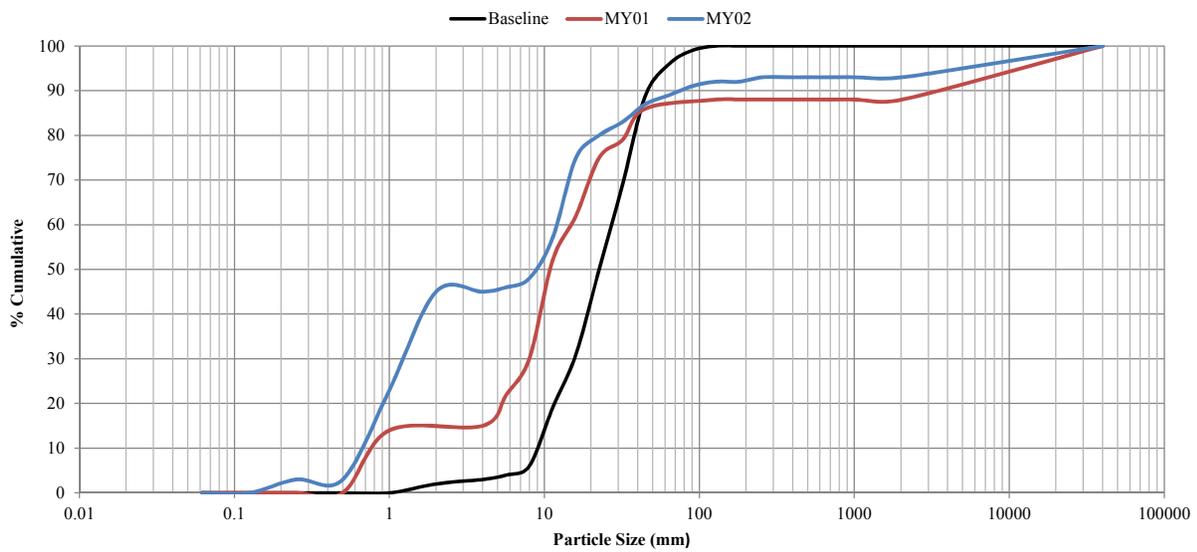
Inches	Particle	Millimeters		Count	% Total	% Cum.
	Silt/Clay	<0.062	S A N D	0	0	0
	Very Fine	0.062-0.125		0	0	0
	Fine	0.125-0.25		3	3	3
	Medium	0.25-0.50		0	0	3
	Coarse	0.50-1.0		20	20	23
0.04-0.08	Very Coarse	1.0-2		22	22	45
0.08-0.16	Very Fine	2-4	G R A V E L	0	0	45
0.16-0.22	Fine	4-5.7		1	1	46
0.22-0.31	Fine	5.7-8		2	2	48
0.31-0.44	Medium	8-11.3		9	9	57
0.44-0.63	Medium	11.3-16		18	18	75
0.63-0.89	Coarse	16-22.6		5	5	80
0.89-1.26	Coarse	22.6-32		3	3	83
1.26-1.77	Very Coarse	32-45		4	4	87
1.77-2.5	Very Coarse	45-64		2	2	89
2.5-3.5	Small	64-90	C O B B L E	2	2	91
3.5-5.0	Small	90-128		1	1	92
5.0-7.1	Medium	128-180		0	0	92
7.1-10.1	Large	180-256		1	1	93
10.1-14.3	Small	256-362	B O U L D E R	0	0	93
14.3-20	Small	362-512		0	0	93
20-40	Medium	512-1024		0	0	93
40-80	Large	1024-2048		0	0	93
	Bedrock	Bedrock	Bedrock	7	7	100
<b>Total Counted</b>				100		

Summary Data	
D50	9
D84	32
D95	3000

**Individual Class Percent  
Pebble Count - US of Confluence with UT1 - Riffle**



**Cumulative Percent  
Pebble Count - US of Confluence with UT1 - Riffle**



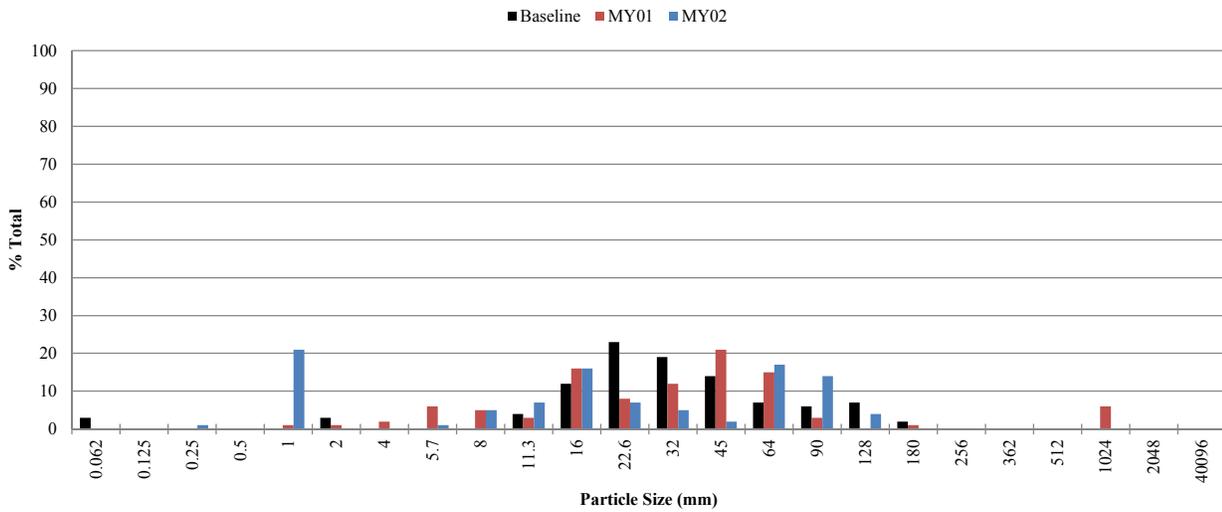
UT to Clarke Creek - DS of Confluence with 2B - Riffle Pebble Count

Location: STA 12+00

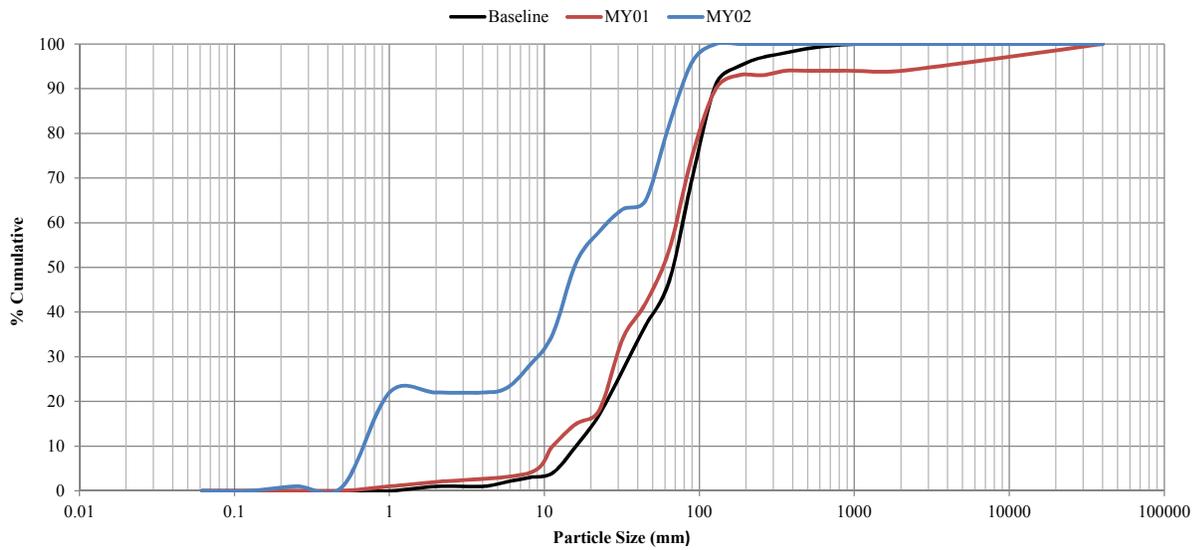
Inches	Particle	Millimeters		Count	% Total	% Cum.
	Silt/Clay	<0.062	S A N D	0	0	0
	Very Fine	0.062-0.125		0	0	0
	Fine	0.125-0.25		1	1	1
	Medium	0.25-0.50		0	0	1
	Coarse	0.50-1.0		21	21	22
0.04-0.08	Very Coarse	1.0-2		0	0	22
0.08-0.16	Very Fine	2-4	G R A V E L	0	0	22
0.16-0.22	Fine	4-5.7		1	1	23
0.22-0.31	Fine	5.7-8		5	5	28
0.31-0.44	Medium	8-11.3		7	7	35
0.44-0.63	Medium	11.3-16		16	16	51
0.63-0.89	Coarse	16-22.6		7	7	58
0.89-1.26	Coarse	22.6-32		5	5	63
1.26-1.77	Very Coarse	32-45		2	2	65
1.77-2.5	Very Coarse	45-64		17	17	82
2.5-3.5	Small	64-90	C O B B L E	14	14	96
3.5-5.0	Small	90-128		4	4	100
5.0-7.1	Medium	128-180		0	0	100
7.1-10.1	Large	180-256		0	0	100
10.1-14.3	Small	256-362	B O U L D E R	0	0	100
14.3-20	Small	362-512		0	0	100
20-40	Medium	512-1024		0	0	100
40-80	Large	1024-2048		0	0	100
	Bedrock	Bedrock	Bedrock	0	0	100
<b>Total Counted</b>				100		

Summary Data	
D50	16
D84	70
D95	90

**Individual Class Percent  
Pebble Count - DS of Confluence with 2B - Riffle**



**Cumulative Percent  
Pebble Count - DS of Confluence with 2B - Riffle**

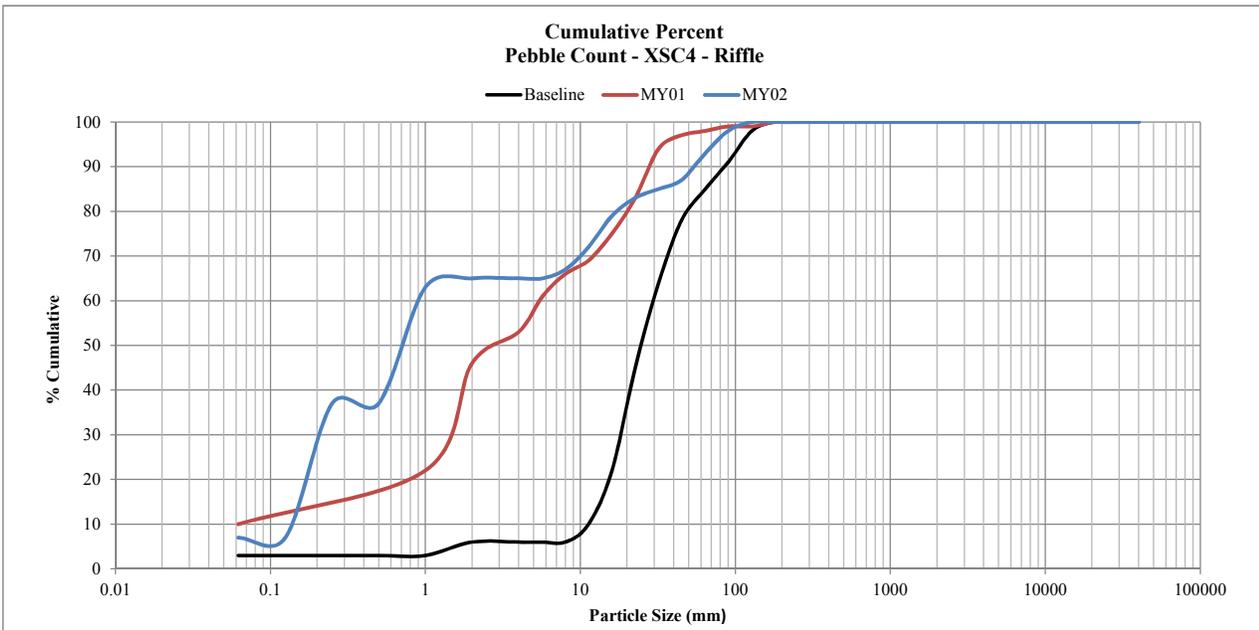
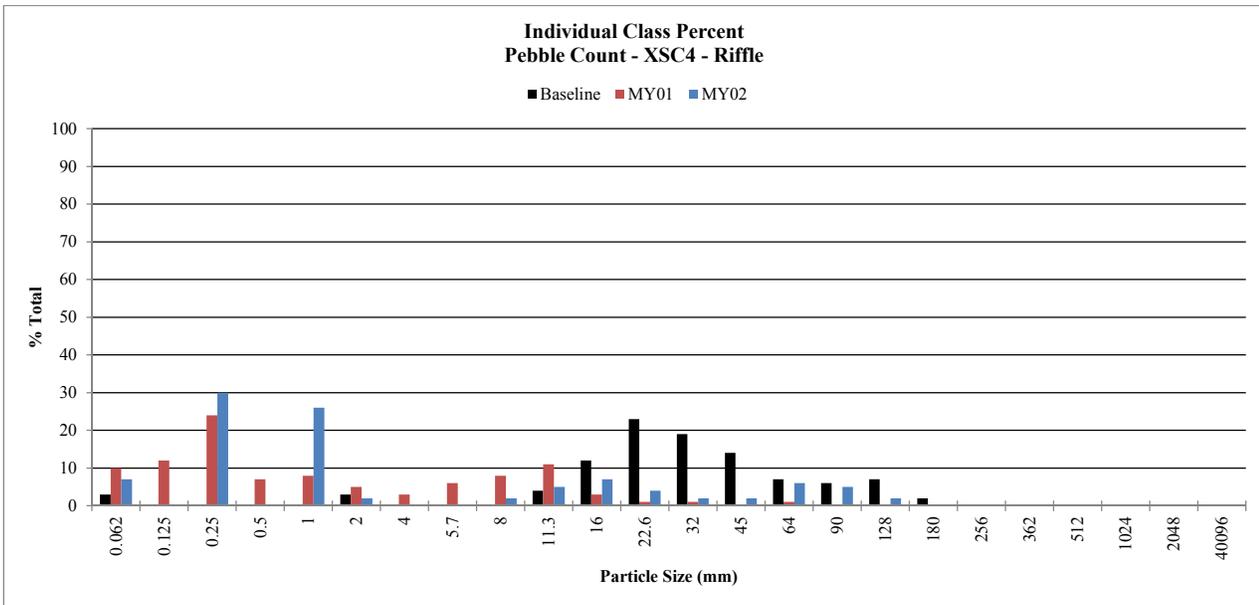


UT to Clarke Creek - Reach: UT1 - XS4 - Riffle Pebble Count

Location: STA 1+29

Inches	Particle	Millimeters		Count	% Total	% Cum.
	Silt/Clay	<0.062	S A N D	7	7	7
	Very Fine	0.062-0.125		0	0	7
	Fine	0.125-0.25		30	30	37
	Medium	0.25-0.50		0	0	37
	Coarse	0.50-1.0		26	26	63
0.04-0.08	Very Coarse	1.0-2		2	2	65
0.08-0.16	Very Fine	2-4	G R A V E L	0	0	65
0.16-0.22	Fine	4-5.7		0	0	65
0.22-0.31	Fine	5.7-8		2	2	67
0.31-0.44	Medium	8-11.3		5	5	72
0.44-0.63	Medium	11.3-16		7	7	79
0.63-0.89	Coarse	16-22.6		4	4	83
0.89-1.26	Coarse	22.6-32		2	2	85
1.26-1.77	Very Coarse	32-45		2	2	87
1.77-2.5	Very Coarse	45-64		6	6	93
2.5-3.5	Small	64-90		C O B B L E	5	5
3.5-5.0	Small	90-128	2		2	100
5.0-7.1	Medium	128-180	0		0	100
7.1-10.1	Large	180-256	0		0	100
10.1-14.3	Small	256-362	B O U L D E R	0	0	100
14.3-20	Small	362-512		0	0	100
20-40	Medium	512-1024		0	0	100
40-80	Large	1024-2048		0	0	100
	Bedrock	Bedrock	Bedrock	0	0	100
<b>Total Counted</b>				100		

Summary Data	
D50	0.7
D84	30
D95	70

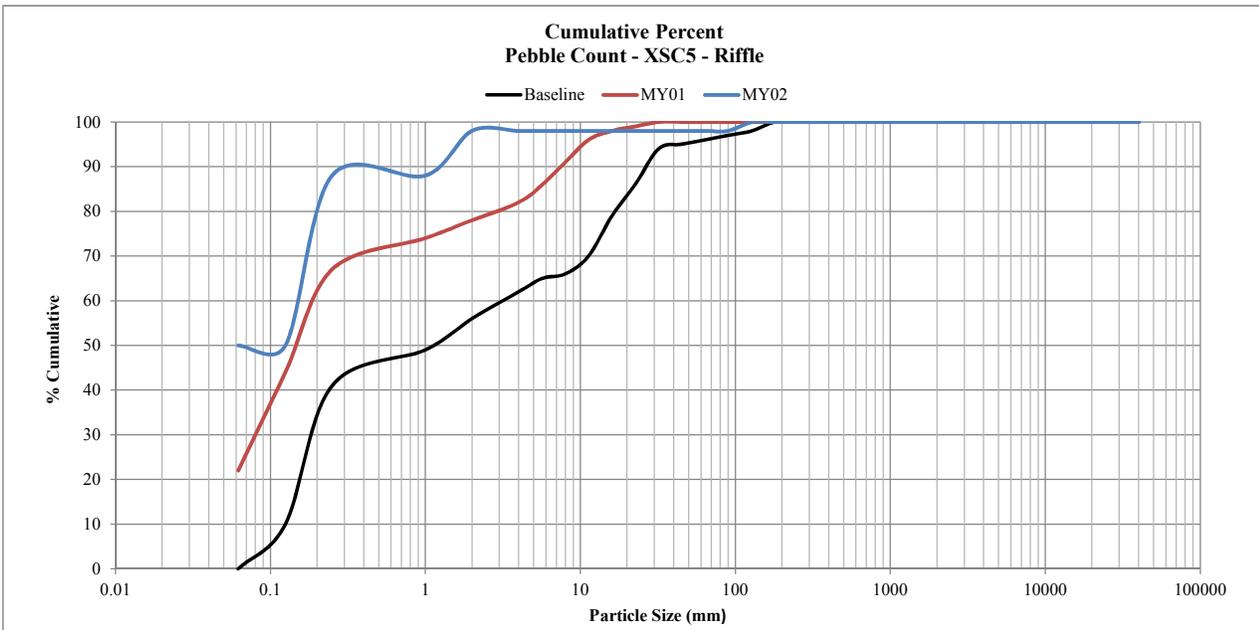
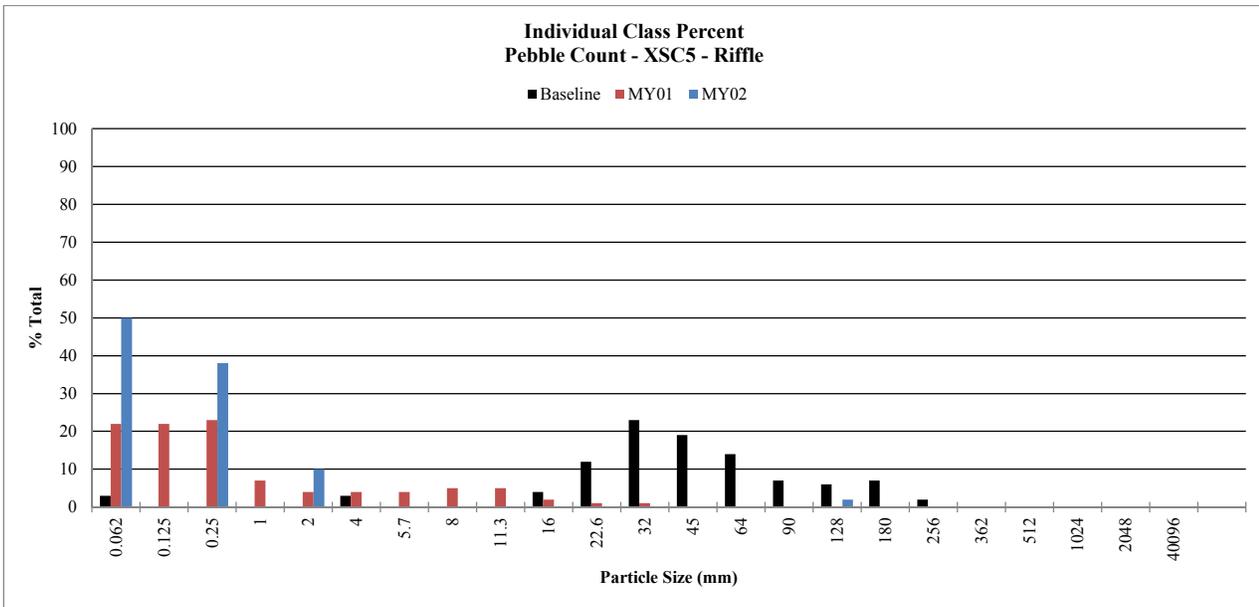


UT to Clarke Creek - Reach: UT1 - XS5 - Riffle Pebble Count

Location: STA 2+69

Inches	Particle	Millimeters		Count	% Total	% Cum.
	Silt/Clay	<0.062	S A N D	50	50	50
	Very Fine	0.062-0.125		0	0	50
	Fine	0.125-0.25		38	38	88
	Medium	0.25-0.50		0	0	88
	Coarse	0.50-1.0		10	10	98
0.04-0.08	Very Coarse	1.0-2		0	0	98
0.08-0.16	Very Fine	2-4	G R A V E L	0	0	98
0.16-0.22	Fine	4-5.7		0	0	98
0.22-0.31	Fine	5.7-8		0	0	98
0.31-0.44	Medium	8-11.3		0	0	98
0.44-0.63	Medium	11.3-16		0	0	98
0.63-0.89	Coarse	16-22.6		0	0	98
0.89-1.26	Coarse	22.6-32		0	0	98
1.26-1.77	Very Coarse	32-45		0	0	98
1.77-2.5	Very Coarse	45-64		0	0	98
2.5-3.5	Small	64-90		C O B B L E	2	2
3.5-5.0	Small	90-128	0		0	100
5.0-7.1	Medium	128-180	0		0	100
7.1-10.1	Large	180-256	0		0	100
10.1-14.3	Small	256-362	B O U L D E R	0	0	100
14.3-20	Small	362-512		0	0	100
20-40	Medium	512-1024		0	0	100
40-80	Large	1024-2048		0	0	100
	Bedrock	Bedrock	Bedrock	0	0	100
<b>Total Counted</b>				100		

Summary Data	
D50	0.062
D84	0.25
D95	1



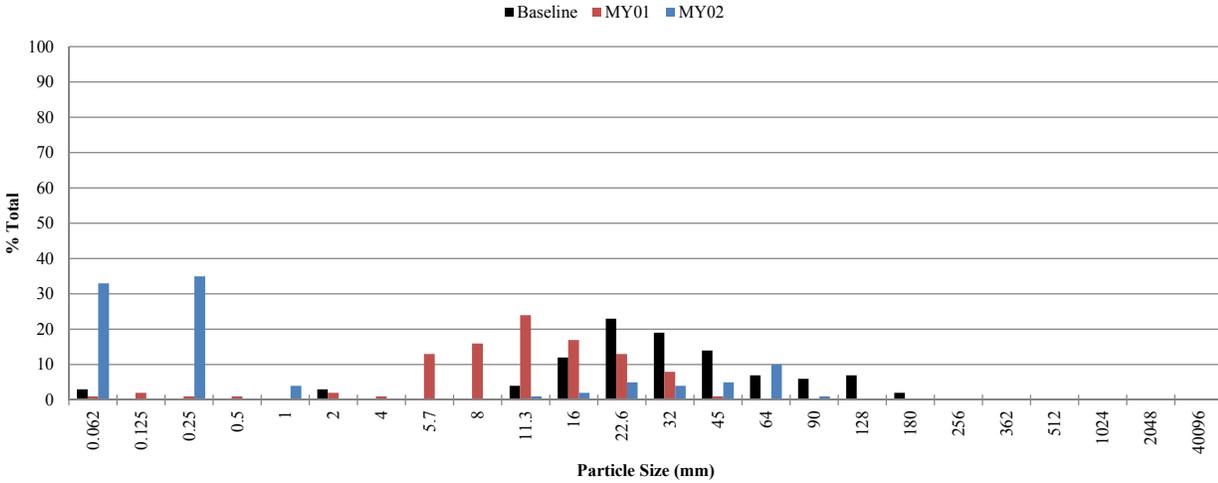
UT to Clarke Creek - Reach: UT1 - DS of XS6 - Riffle Pebble Count

Location: STA 3+34

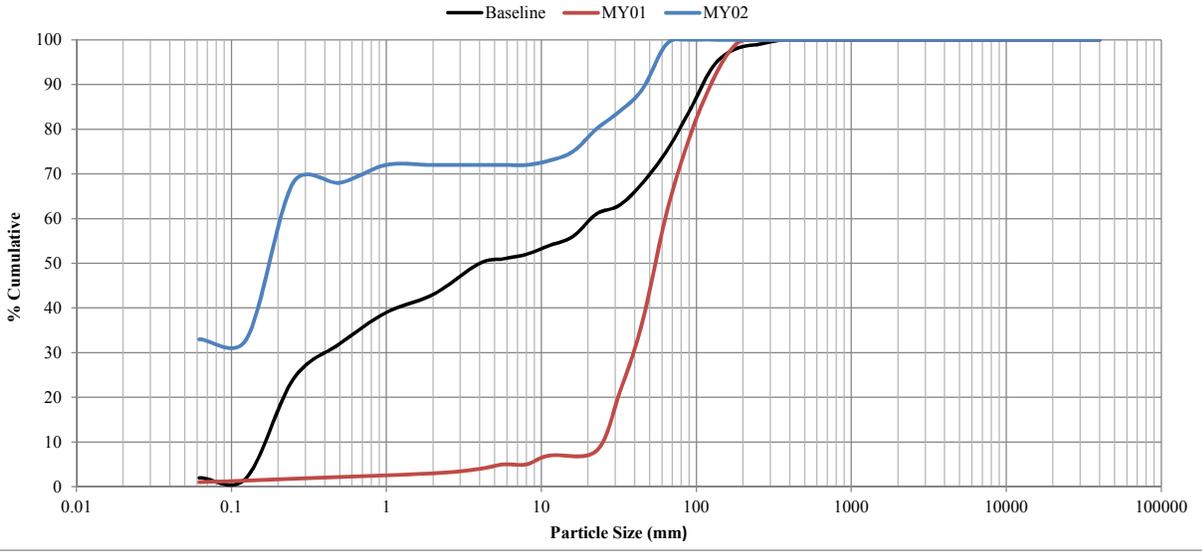
Inches	Particle	Millimeters		Count	% Total	% Cum.
	Silt/Clay	<0.062	S A N D	33	33	33
	Very Fine	0.062-0.125		0	0	33
	Fine	0.125-0.25		35	35	68
	Medium	0.25-0.50		0	0	68
	Coarse	0.50-1.0		4	4	72
0.04-0.08	Very Coarse	1.0-2		0	0	72
0.08-0.16	Very Fine	2-4	G R A V E L	0	0	72
0.16-0.22	Fine	4-5.7		0	0	72
0.22-0.31	Fine	5.7-8		0	0	72
0.31-0.44	Medium	8-11.3		1	1	73
0.44-0.63	Medium	11.3-16		2	2	75
0.63-0.89	Coarse	16-22.6		5	5	80
0.89-1.26	Coarse	22.6-32		4	4	84
1.26-1.77	Very Coarse	32-45		5	5	89
1.77-2.5	Very Coarse	45-64		10	10	99
2.5-3.5	Small	64-90	C O B B L E	1	1	100
3.5-5.0	Small	90-128		0	0	100
5.0-7.1	Medium	128-180		0	0	100
7.1-10.1	Large	180-256		0	0	100
10.1-14.3	Small	256-362	B O U L D E R	0	0	100
14.3-20	Small	362-512		0	0	100
20-40	Medium	512-1024		0	0	100
40-80	Large	1024-2048		0	0	100
	Bedrock	Bedrock	Bedrock	0	0	100
<b>Total Counted</b>				100		

Summary Data	
D50	0.2
D84	40
D95	55

**Individual Class Percent  
Pebble Count - DS of XSC6 - Riffle**



**Cumulative Percent  
Pebble Count - DS of XSC6 - Riffle**

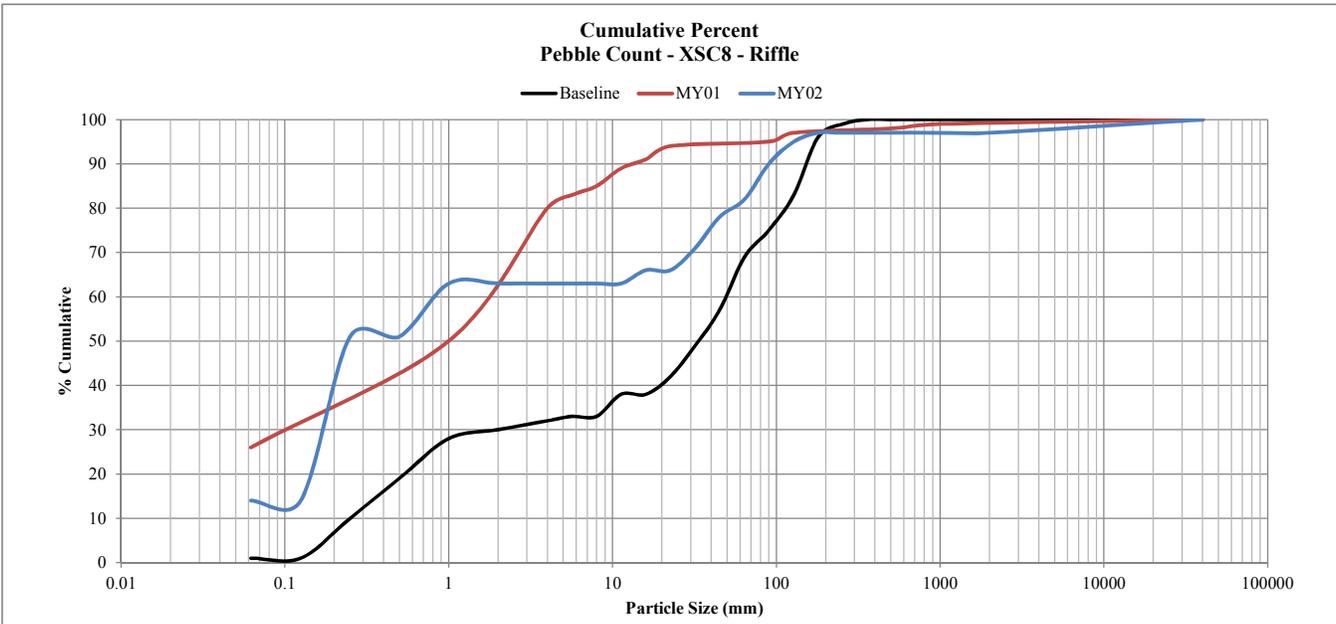
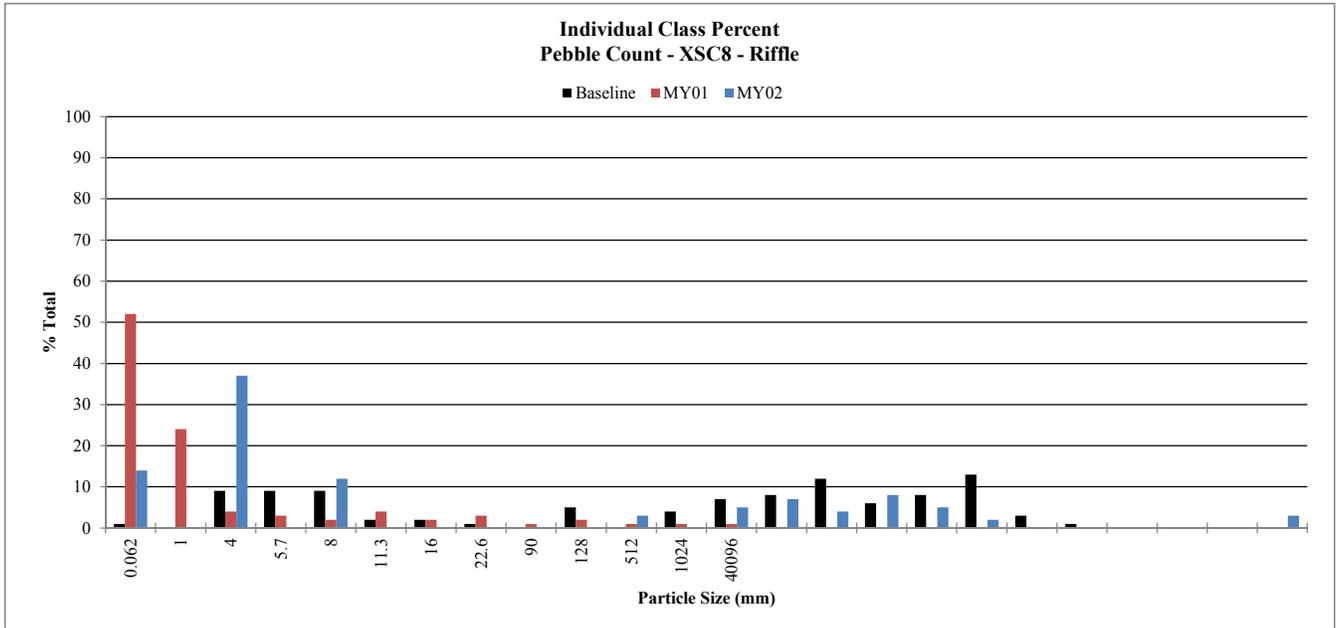


UT to Clarke Creek - Reach: UT1 - XS8 - Riffle Pebble Count

Location: STA 4+14

Inches	Particle	Millimeters		Count	% Total	% Cum.
	Silt/Clay	<0.062	S A N D	14	14	14
	Very Fine	0.062-0.125		0	0	14
	Fine	0.125-0.25		37	37	51
	Medium	0.25-0.50		0	0	51
	Coarse	0.50-1.0		12	12	63
0.04-0.08	Very Coarse	1.0-2		0	0	63
0.08-0.16	Very Fine	2-4	G R A V E L	0	0	63
0.16-0.22	Fine	4-5.7		0	0	63
0.22-0.31	Fine	5.7-8		0	0	63
0.31-0.44	Medium	8-11.3		0	0	63
0.44-0.63	Medium	11.3-16		3	3	66
0.63-0.89	Coarse	16-22.6		0	0	66
0.89-1.26	Coarse	22.6-32		5	5	71
1.26-1.77	Very Coarse	32-45		7	7	78
1.77-2.5	Very Coarse	45-64		4	4	82
2.5-3.5	Small	64-90	C O B B L E	8	8	90
3.5-5.0	Small	90-128		5	5	95
5.0-7.1	Medium	128-180		2	2	97
7.1-10.1	Large	180-256		0	0	97
10.1-14.3	Small	256-362	B O U L D E R	0	0	97
14.3-20	Small	362-512		0	0	97
20-40	Medium	512-1024		0	0	97
40-80	Large	1024-2048		0	0	97
	Bedrock	Bedrock	Bedrock	3	3	100
<b>Total Counted</b>				100		

Summary Data	
D50	0.25
D84	70
D95	128



**Table 10a. Baseline Stream Data Summary**  
 UT to Clarke Creek/DMS #92500 - UT Clarke Creek (1507 feet)

Parameter	Gauge <sup>2</sup>	Regional Curve			Pre-Existing Condition					Reference Reach(es) Data					Design			Monitoring Baseline							
		LL	UL	Eq.	Min	Mean	Med	Max	SD <sup>5</sup>	n	Min	Mean	Med	Max	SD <sup>5</sup>	n	Min	Med	Max	Min	Mean	Med	Max	SD <sup>5</sup>	n
<b>Dimension and Substrate - Riffle Only</b>																									
Bankfull Width (ft)		7	30	3	11.38			12.62			8.26			10.93			10.57		12.2	6.72	7.95	7.17	9.97	-	3
Floodprone Width (ft)					36.14			49.08			11.69			19.17			54.63		63.43	18.7	25.23	22.4	34.6	-	3
Bankfull Mean Depth (ft)		1	2.5	1.17	1.77			1.83			1.02			1.98			1.22		1.46	0.39	0.9	0.76	1.55	-	3
<sup>1</sup> Bankfull Max Depth (ft)											1.57			2.05			1.89		2.21	0.85	1.313	0.94	2.15	-	3
Bankfull Cross Sectional Area (ft <sup>2</sup> )		5	40	8.47	20.88			22.29			8.42			17.17			12.89		17.86	2.8	7.803	5.11	15.5	-	3
Width/Depth Ratio					6.22			7.13			6.96			8.1			8.36		8.66	6.41	11.2	8.84	18.36	-	3
Entrenchment Ratio					2.86			4.31			1.41			1.86			5.17		5.2	2.61	3.137	3.33	3.47	-	3
<sup>1</sup> Bank Height Ratio					1.43			1.48			1.86			2.22			1		1	0.82	0.897	0.87	1	-	3
<b>Profile</b>																									
Riffle Length (ft)																				8.89	19.21	13.85	54.02	13.73	10
Riffle Slope (ft/ft)																				0.008	0.026	0.021	0.073	0.019	10
Pool Length (ft)																				14.37	42.2	34.77	84.52	26.2	10
Pool Max depth (ft)																				0.698	2.027	2.141	3.445	0.793	10
Pool Spacing (ft)																				34.82	82.81	83.19	151.6	36.88	9
<b>Pattern</b>																									
Channel Beltwidth (ft)																				14	14.8	14.5	15.9	-	3
Radius of Curvature (ft)																				10.4	16.17	16.9	21.2	-	3
Rc:Bankfull width (ft/ft)																				1.5	2	2	2.5	-	3
Meander Wavelength (ft)																				67.3	80.1	70	103	-	3
Meander Width Ratio																				1.9	4.6	2.0	9.8	-	3
<b>Transport parameters</b>																									
Reach Shear Stress (competency) lb/ft <sup>2</sup>								0.74												0.74					
Max part size (mm) mobilized at bankfull								1												0.41					
Stream Power (transport capacity) W/m <sup>2</sup>								-												-					
<b>Additional Reach Parameters</b>																									
Rosgen Classification								E4					B4c						E4					E4	
Bankfull Velocity (fps)		-	-	-				5.03												4.4-4.9				-	
Bankfull Discharge (cfs)		25	300	26.78				110.8						28						54.6-63.4					
Valley length (ft)								1612					200											1612	
Channel Thalweg length (ft)								1507					-							-				1507	
Sinuosity (ft)								1.07					-							-				1.07	
Water Surface Slope (Channel) (ft/ft)								0.0075					-							0.0083				0.0089	
BF slope (ft/ft)								0.0083					-							-				0.0092	
<sup>3</sup> Bankfull Floodplain Area (acres)								-					-							-				-	
<sup>4</sup> % of Reach with Eroding Banks								-					-							-				-	
Channel Stability or Habitat Metric								-					-							-				-	
Biological or Other								-					-							-				-	

**Table 10b. Baseline Stream Data Summary**  
 UT to Clarke Creek/DMS #92500 - UT 1 (758 feet)

Parameter	Gauge <sup>2</sup>	Regional Curve			Pre-Existing Condition					Reference Reach(es) Data					Design			Monitoring Baseline							
		LL	UL	Eq.	Min	Mean	Med	Max	SD <sup>5</sup>	n	Min	Mean	Med	Max	SD <sup>5</sup>	n	Min	Med	Max	Min	Mean	Med	Max	SD <sup>5</sup>	n
<b>Dimension and Substrate - Riffle Only</b>																									
Bankfull Width (ft)		6	11	2.07	9.08			11.26			7.09			11.96			10.6		10.77	7.18	8.44	8.60	9.40	0.93	4
Floodprone Width (ft)					19.5			20.02			13.18			39.46			49.4		93.72	11.30	25.48	16.40	57.80	21.83	4
Bankfull Mean Depth (ft)		6	11	0.89	1.51			1.7			0.78			1.33			1.1		1.28	0.37	0.87	0.84	1.43	0.46	4
<sup>1</sup> Bankfull Max Depth (ft)					1.83			2.45			1.11			1.82			1.6		2.14	0.56	1.10	0.96	1.92	0.59	4
Bankfull Cross Sectional Area (ft <sup>2</sup> )		6	12	4.73	15.46			17.01			8.69			13.75			11.84		13.54	3.14	7.57	6.84	13.45	4.67	4
Width/Depth Ratio					5.34			7.46			5.81			15.33			8.28		9.79	6.57	12.23	9.83	22.69	7.23	4
Entrenchment Ratio					1.73			2.2			1.85			3.8			4.59		8.84	1.57	2.88	1.90	6.15	2.20	4
<sup>1</sup> Bank Height Ratio					1.34			1.56			1.53			1.6			1		1	0.73	0.93	1.00	1.00	0.14	4
<b>Profile</b>																									
Riffle Length (ft)																				4.82	9.83	8.81	18.46	5.27	5
Riffle Slope (ft/ft)																				0.008	0.023	0.025	0.036	0.011	5
Pool Length (ft)																				22.7	29.14	27.48	39.29	7.208	5
Pool Max depth (ft)																				0.944	1.956	1.857	3.012	0.777	5
Pool Spacing (ft)																				73.48	108.4	116.9	126.4	24.56	4
<b>Pattern</b>																									
Channel Beltwidth (ft)																				13.7	15.7	13.8	19.8	-	3
Radius of Curvature (ft)																				21.9	32.6	34.7	41.1	-	3
Rc:Bankfull width (ft/ft)																				2.5	3.9	3.6	5.6	-	3
Meander Wavelength (ft)																				41.5	64.1	46	105	-	3
Meander Width Ratio																				1.46	1.78	1.59	2.3	-	3
<b>Transport parameters</b>																									
Reach Shear Stress (competency) lb/ft <sup>2</sup>								0.88											0.59						
Max part size (mm) mobilized at bankfull								0.75											4.27						
Stream Power (transport capacity) W/m <sup>2</sup>								-											-						
<b>Additional Reach Parameters</b>																									
Rosgen Classification								B4c					B4c						B4c					B4c	
Bankfull Velocity (fps)		-	-	-				4.11											3.6-4.0					-	
Bankfull Discharge (cfs)		10	200	14.48				64											42.2-53.4						
Valley length (ft)								657					150											657	
Channel Thalweg length (ft)								723					-						-					758	
Sinuosity (ft)								1.1				-							-					1.15	
Water Surface Slope (Channel) (ft/ft)								0.009				-							0.0077					0.0089	
BF slope (ft/ft)								0.009				-							0.009					0.0083	
<sup>3</sup> Bankfull Floodplain Area (acres)								-				-							-					-	
<sup>4</sup> % of Reach with Eroding Banks								-				-							-					-	
Channel Stability or Habitat Metric								-				-							-					-	
Biological or Other								-				-							-					-	

**Table 11a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)**  
 UT to Clarke Creek/DMS #92500 Segment/Reach: UT to Clarke Creek (1507', XS1, 1A, 2, 9) and UT1 (758', XS 3, 4, 5, 6, 8)

Based on fixed baseline bankfull elevation <sup>1</sup>	Cross Section 1 (Riffle)							Cross Section 1A (Pool)							Cross Section 2 (Riffle)							Cross Section 9 (Riffle)													
	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+							
Record elevation (datum) used	744.2	744.2	744.2					742.4	742.4	742.4					739.37	739.4	739.4					746.7	746.7	746.7											
Bankfull Width (ft)	6.7	6.9	7.08					9.02	8	7					9.97	10.7	9.85					7.17	6.35	7.7											
Floodprone Width (ft)	22.4	29.5	30.98					25.6	41.79	38					34.6	45	45.14					18.7	21.5	12.13											
Bankfull Mean Depth (ft)	0.76	0.67	0.87					0.2	0.75	1.1					1.55	1.28	1.9					0.39	0.39	0.45											
Bankfull Max Depth (ft)	0.94	1.17	1.15					1.47	1.91	1.8					2.15	2.36	2.27					0.85	0.68	0.56											
Bankfull Cross Sectional Area (ft <sup>2</sup> )	5.11	4.59	6.15					1.78	5.96	7.67					15.5	13.66	18.7					2.8	2.48	3.47											
Bankfull Width/Depth Ratio	8.84	10.37	8.15					45.71	10.74	6.39					6.41	8.38	5.19					18.36	16.26	17.09											
Bankfull Entrenchment Ratio	3.33	4.28	4.38					2.84	5.22	5.43					3.47	4.21	4.58					2.61	3.39	1.58											
Bankfull Bank Height Ratio	1	0.84	0.93					1	1.22	0.94					0.82	0.89	1.1					0.87	0.97	1.36											
Cross Sectional Area between end pins (ft <sup>2</sup> )	65.6	60.5	60.6					145.9	142.8	132.2					187.2	179	178.9					52.1	52.4	46.4											
d50 (mm)	-	-	-					17	18	0.9					-	-	-					28	0.6	0.7											
	Cross Section 3 (Pool)							Cross Section 4 (Riffle)							Cross Section 5 (Pool)							Cross Section 6 (Pool)							Cross Section 8 (Riffle)						
Based on fixed baseline bankfull elevation <sup>1</sup>	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+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used	741.1	741.1	741.1					745.8	745.8	745.8					745.9	745.9	745.9					744.6	744.6	744.6					744.7	744.7	744.7				
Bankfull Width (ft)	9.78	10.42	10.81					8.4	9.93	8.4					8.18	7.88	7.12					7.18	5.29	5.42					8.75	8	9.12				
Floodprone Width (ft)	57.8	60.8	63					13.3	22.81	28.5					40	40	44					11.3	11.3	12					19.5	16.15	28.94				
Bankfull Mean Depth (ft)	1.66	1.4	1.62					0.37	0.4	0.54					0.84	0.76	0.68					0.64	0.47	0.55					1.04	0.8	0.92				
Bankfull Max Depth (ft)	1.92	2.17	2.67					0.56	0.64	0.73					1.57	1.51	1.65					0.82	0.84	0.81					1.09	0.9	1.2				
Bankfull Cross Sectional Area (ft <sup>2</sup> )	16.24	14.57	17.54					3.14	3.95	4.55					6.9	5.98	4.86					4.59	2.48	2.96					9.09	6.4	8.37				
Bankfull Width/Depth Ratio	5.89	7.45	6.66					22.69	24.96	15.51					9.7	10.38	10.43					11.23	11.28	9.92					8.42	10	9.94				
Bankfull Entrenchment Ratio	5.91	5.83	5.83					1.58	2.3	3.39					4.89	5.08	6.18					1.57	2.14	2.21					2.22	2.02	2.02				
Bankfull Bank Height Ratio	1	1.11	0.97					0.73	0.98	1.16					1	1	0.88					1	1.09	1.19					1	1.12	1.02				
Cross Sectional Area between end pins (ft <sup>2</sup> )	170.9	174	157.5					100.5	115.9	98					258.1	258.8	285.7					247.5	230.5	271.5					231.5	229.9	226.7				
d50 (mm)	-	-	-					24	2.5	0.7					0.5	0.15	0.062					4	55	0.2					24	0.125	0.25				

**Exhibit Table 11b. Monitoring Data - Stream Reach Data Summary**  
 UT to Clarke Creek/DMS #92500 - UT to Clarke Creek (1507 lf)

Parameter	Baseline						MY-1						MY-2						MY-3						MY-4						MY-5					
	Min	Mean	Med	Max	SD <sup>4</sup>	n	Min	Mean	Med	Max	SD <sup>4</sup>	n	Min	Mean	Med	Max	SD <sup>4</sup>	n	Min	Mean	Med	Max	SD <sup>4</sup>	n	Min	Mean	Med	Max	SD <sup>4</sup>	n	Min	Mean	Med	Max	SD <sup>4</sup>	n
<b>Dimension and Substrate - Riffle only</b>																																				
Bankfull Width (ft)	6.72	7.953	7.17	9.97	-	3	6.35	7.98	6.9	10.7	-	3	7.08	8.21	7.7	9.85	1.45	3																		
Floodprone Width (ft)	18.7	25.23	22.4	34.6	-	3	21.5	32	29.5	45	-	3	12.13	29.42	30.98	45.14	16.56	3																		
Bankfull Mean Depth (ft)	0.39	0.9	0.76	1.55	-	3	0.39	0.78	0.67	1.28	-	3	0.45	1.07	0.87	1.9	0.75	3																		
<sup>1</sup> Bankfull Max Depth (ft)	0.85	1.313	0.94	2.15	-	3	0.68	1.40	1.17	2.36	-	3	0.56	1.33	1.15	2.27	0.87	3																		
Bankfull Cross Sectional Area (ft <sup>2</sup> )	2.8	7.803	5.11	15.5	-	3	2.48	6.91	4.59	13.66	-	3	3.47	9.44	6.15	18.7	8.13	3																		
Width/Depth Ratio	6.41	11.2	8.84	18.36	-	3	8.38	11.67	10.37	16.26	-	3	5.19	10.14	8.15	17.09	6.2	3																		
Entrenchment Ratio	2.61	3.137	3.33	3.47	-	3	3.39	3.96	4.21	4.28	-	3	1.58	3.51	4.38	4.58	1.68	3																		
<sup>1</sup> Bank Height Ratio	0.82	0.897	0.87	1	-	3	0.84	0.90	0.89	0.97	-	3	0.93	1.13	1.1	1.36	0.22	3																		
<b>Profile</b>																																				
Riffle Length (ft)	4.82	9.826	8.81	18.46	5.272	5	26.31	57.23	65.37	82.74	24.05	5	14.48	23.41	21.86	37.21	8.65	5																		
Riffle Slope (ft/ft)	0.008	0.023	0.025	0.036	0.011	5	0.003	0.02	0.01	0.049	0.02	5	0.012	0.04	0.035	0.066	0.02	5																		
Pool Length (ft)	22.7	29.14	27.48	39.29	7.208	5	15.31	38.0	41.1	55.2	14.79	5	22.87	31.86	34.57	37.04	6.06	5																		
Pool Max depth (ft)	0.944	1.956	1.857	3.012	0.777	5	2.58	3.1	2.98	3.78	0.49	5	1.72	2.62	2.38	3.81	0.9	5																		
Pool Spacing (ft)	73.48	108.4	116.9	126.4	24.56	4	94.9	165.4	174.2	218.3	56.67	4	37.47	76.75	83.33	102.9	30.28	4																		
<b>Pattern</b>																																				
Channel Beltwidth (ft)	14	14.8	14.5	15.9	-	3																														
Radius of Curvature (ft)	10.4	16.17	16.9	21.2	-	3																														
Rc:Bankfull width (ft/ft)	1.5	2	2	2.5	-	3																														
Meander Wavelength (ft)	67.3	80.1	70	103	-	3																														
Meander Width Ratio	1.9	4.6	2.0	9.8	-	3																														
<b>Additional Reach Parameters</b>																																				
Rosgen Classification			E4						E4						E4																					
Channel Thalweg length (ft)			1507						1507						1507																					
Sinuosity (ft)			1.07						1.07						1.07																					
Water Surface Slope (Channel) (ft/ft)			0.0089						0.0091						0.0092																					
BF slope (ft/ft)			0.0092						0.009						0.0092																					
<sup>3</sup> Ri% / Ru% / P% / G% / S%	-	-	-	-	-		-	-	-	-	-		-	-	-	-	-																			
<sup>3</sup> SC% / Sa% / G% / C% / B% / Be%																																				
<sup>3</sup> d16 / d35 / d50 / d84 / d95 /																																				
<sup>2</sup> % of Reach with Eroding Banks			-						-						-																					
Channel Stability or Habitat Metric			-						-						-																					
Biological or Other			-						-						-																					

Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

**Exhibit Table 11c. Monitoring Data - Stream Reach Data Summary**  
 UT to Clarke Creek/DMS #92500 - UT1 (758 lf)

Parameter	Baseline						MY-1						MY-2						MY-3						MY-4						MY-5					
	Min	Mean	Med	Max	SD <sup>1</sup>	n	Min	Mean	Med	Max	SD <sup>1</sup>	n	Min	Mean	Med	Max	SD <sup>1</sup>	n	Min	Mean	Med	Max	SD <sup>1</sup>	n	Min	Mean	Med	Max	SD <sup>1</sup>	n	Min	Mean	Med	Max	SD <sup>1</sup>	n
<b>Dimension and Substrate - Riffle only</b>																																				
Bankfull Width (ft)	7.18	8.443	8.595	9.4	0.932	4	8	8.965	8.965	9.93	-	2	8.4	8.76	8.76	9.12	-	2																		
Floodprone Width (ft)	11.3	25.48	16.4	57.8	21.83	4	16.15	19.48	19.48	22.81	-	2	28.94	50.97	50.97	73	-	2																		
Bankfull Mean Depth (ft)	0.37	0.87	0.84	1.43	0.464	4	0.4	0.6	0.6	0.8	-	2	0.54	0.73	0.73	0.92	-	2																		
<sup>1</sup> Bankfull Max Depth (ft)	0.56	1.098	0.955	1.92	0.589	4	0.64	0.77	0.77	0.9	-	2	0.73	0.965	0.965	1.2	-	2																		
Bankfull Cross Sectional Area (ft <sup>2</sup> )	3.14	7.568	6.84	13.45	4.669	4	3.95	5.175	5.175	6.4	-	2	4.55	6.46	6.46	8.37	-	2																		
Width/Depth Ratio	6.57	12.23	9.825	22.69	7.233	4	10	17.48	17.48	24.96	-	2	9.94	12.73	12.73	15.51	-	2																		
Entrenchment Ratio	1.57	2.88	1.9	6.15	2.201	4	2.02	2.16	2.16	2.3	-	2	2.02	5.355	5.355	8.69	-	2																		
<sup>1</sup> Bank Height Ratio	0.73	0.933	1	1	0.135	4	0.98	1.05	1.05	1.12	-	2	1.02	1.09	1.09	1.16	-	2																		
<b>Profile</b>																																				
Riffle Length (ft)	4.82	9.826	8.81	18.46	5.272	5	16.49	44.86	42	78.79	22.87	5	12.43	33.85	33.74	47.95	14.26	5																		
Riffle Slope (ft/ft)	0.008	0.023	0.025	0.036	0.011	5	0.004	0.01	0.013	0.02	0.01	5	0.0075	0.016	0.016	0.022	0.005	5																		
Pool Length (ft)	22.7	29.14	27.48	39.29	7.208	5	14.39	32.24	20.83	59	20.07	5	15.37	48.01	48.01	80.66	46.17	2																		
Pool Max depth (ft)	0.944	1.956	1.857	3.012	0.777	5	1.01	2.01	2.03	3.57	1.02	5	1.1522	2.047	2.068	2.934	0.648	5																		
Pool Spacing (ft)	73.48	108.4	116.9	126.4	24.56	4	31.28	107.2	106.5	184.4	62.5	4	43.39	80.66	89.2	99.37	22.12	5																		
<b>Pattern</b>																																				
Channel Beltwidth (ft)	13.7	15.7	13.8	19.8	-	3																														
Radius of Curvature (ft)	21.9	32.6	34.7	41.1	-	3																														
Rc:Bankfull width (ft/ft)	2.5	3.9	3.6	5.6	-	3																														
Meander Wavelength (ft)	41.5	64.1	46	105	-	3																														
Meander Width Ratio	1.46	1.78	1.59	2.3	-	3																														
<b>Additional Reach Parameters</b>																																				
Rosgen Classification				B4c						B4c						B4c																				
Channel Thalweg length (ft)				758						758						758																				
Sinuosity (ft)				1.15						1.15						1.15																				
Water Surface Slope (Channel) (ft/ft)				0.0089						0.0095						0.0081																				
BF slope (ft/ft)				0.0083						0.0082						0.008																				
<sup>3</sup> Ri% / Ru% / P% / G% / S%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-																		
<sup>3</sup> SC% / Sa% / G% / C% / B% / Be%																																				
<sup>3</sup> d16 / d35 / d50 / d84 / d95 /																																				
<sup>2</sup> % of Reach with Eroding Banks				-						-						-																				
Channel Stability or Habitat Metric				-						-						-																				
Biological or Other				-						-						-																				

Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

Appendix E  
Hydrologic Data

Table 12. Verification of Bankfull Events UT to Clarke Creek - DMS Project #92500			
Date of Data Collection	Date of Occurrence	Method	Photo
2/19/2014	2/19/2014	Visual observation of wrack lines	See photo from Baseline Monitoring Report
9/18/2014	Between 2/19/2014 and 9/18/2014	Crest Gauge Reading*: 20" above bankfull (UT1) and 15.5" above bankfull (UT Clarke Creek); Visual observation of wrack lines	See photo from MY01 Annual Monitoring Report
9/18/2014	Between 2/19/2014 and 9/18/2014	Crest Gauge Reading*: 20" above bankfull (UT1) and 15.5" above bankfull (UT Clarke Creek); Visual observation of wrack lines	See photo from MY02 Annual Monitoring Report
4/15/2015	Between 9/18/2014 and 4/15/2015	Crest Gauge Reading: 7" above bankfull (UT1) and 8.5" above bankfull (UT Clarke Creek); Visual observation of bankfull event and wracklines	See photo 1 below
10/22/2015	Between 4/15/2015 and 10/22/2015	Crest Gauge Reading*: 20" above bankfull (UT1) and 19" above bankfull (UT Clarke Creek); Visual observation of wrack lines	See photo 2 below

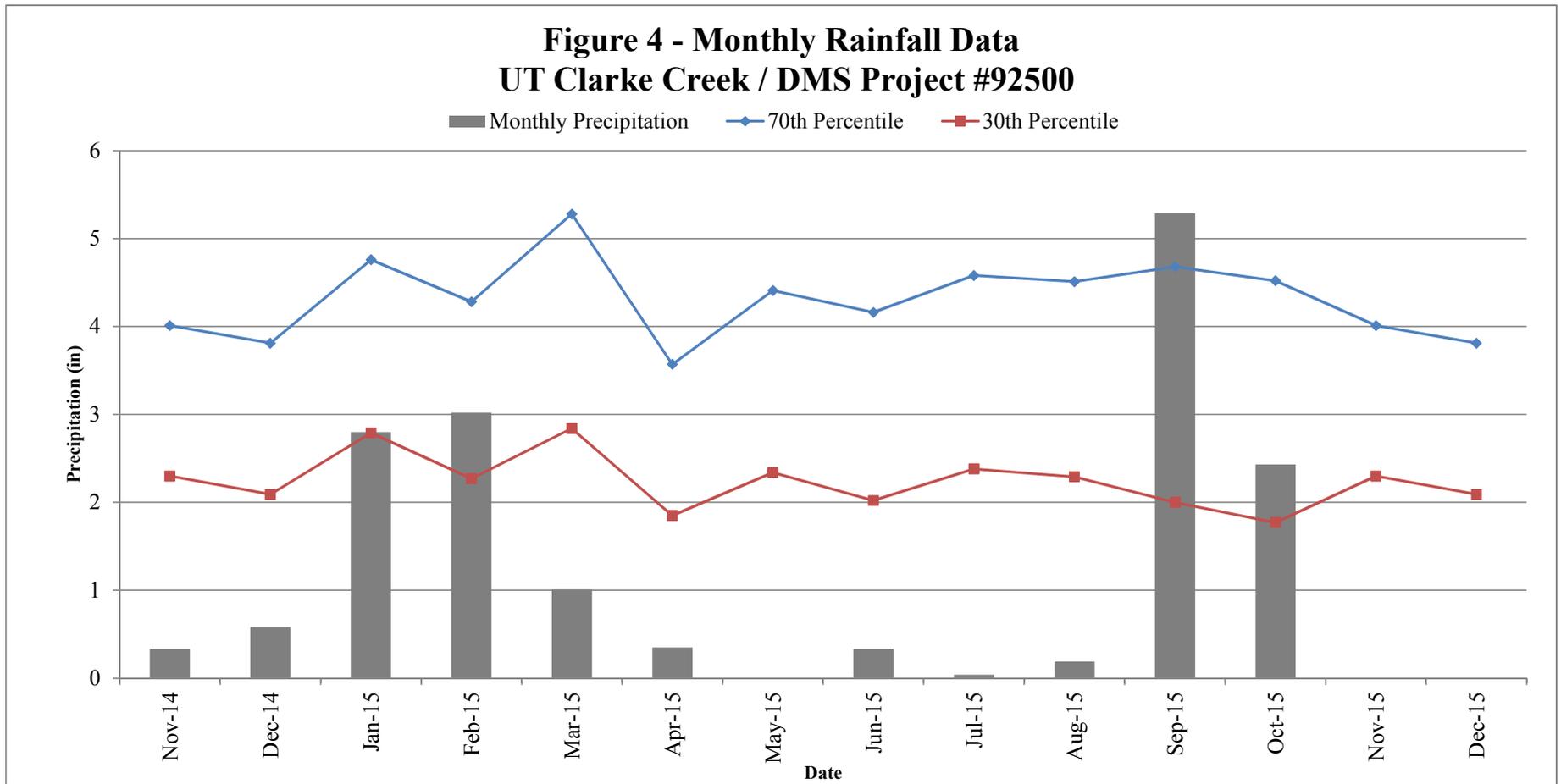


Photo 1: 04/15/2015- Bankfull event - downstream section of UT to Clarke Creek

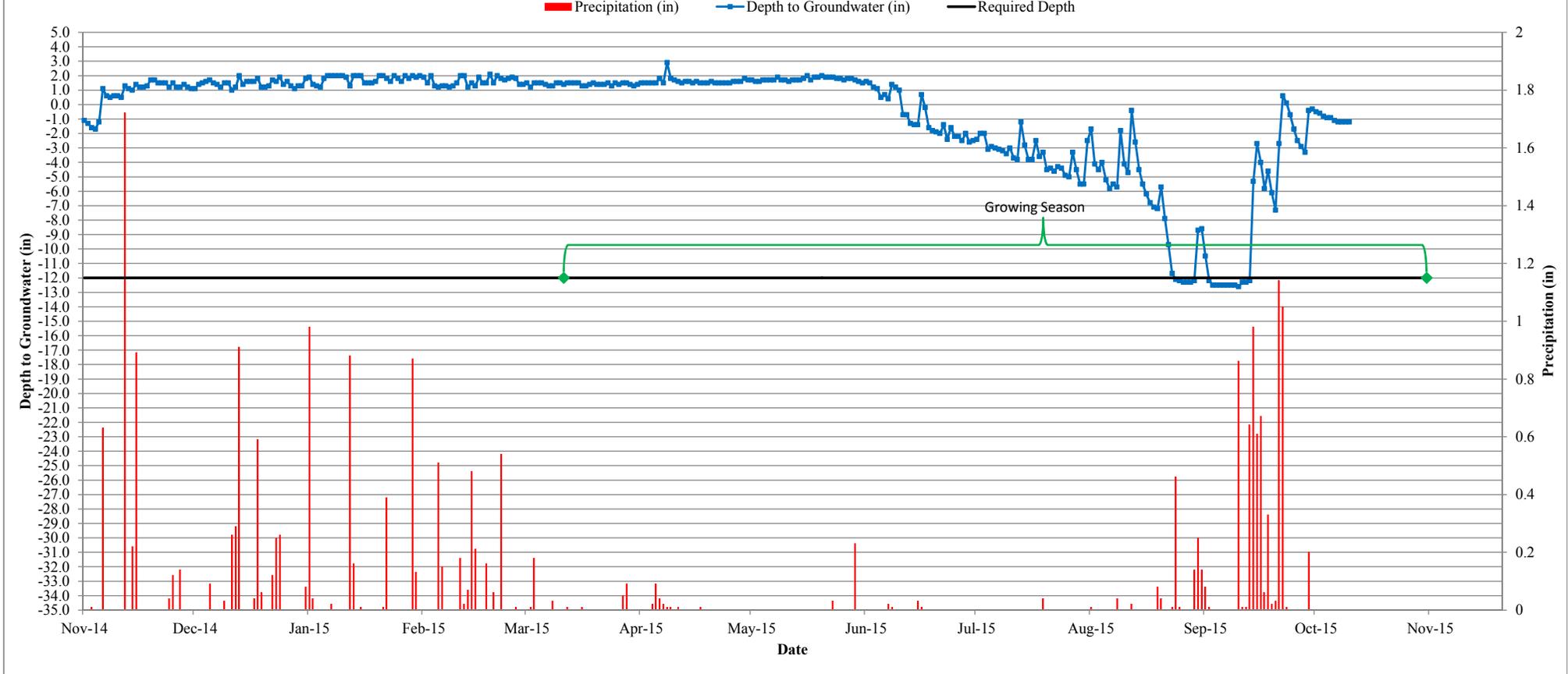


Photo 2: 10/22/2015- Crest Gauge Reading on UT to Clarke Creek

**Figure 4 - Monthly Rainfall Data  
UT Clarke Creek / DMS Project #92500**



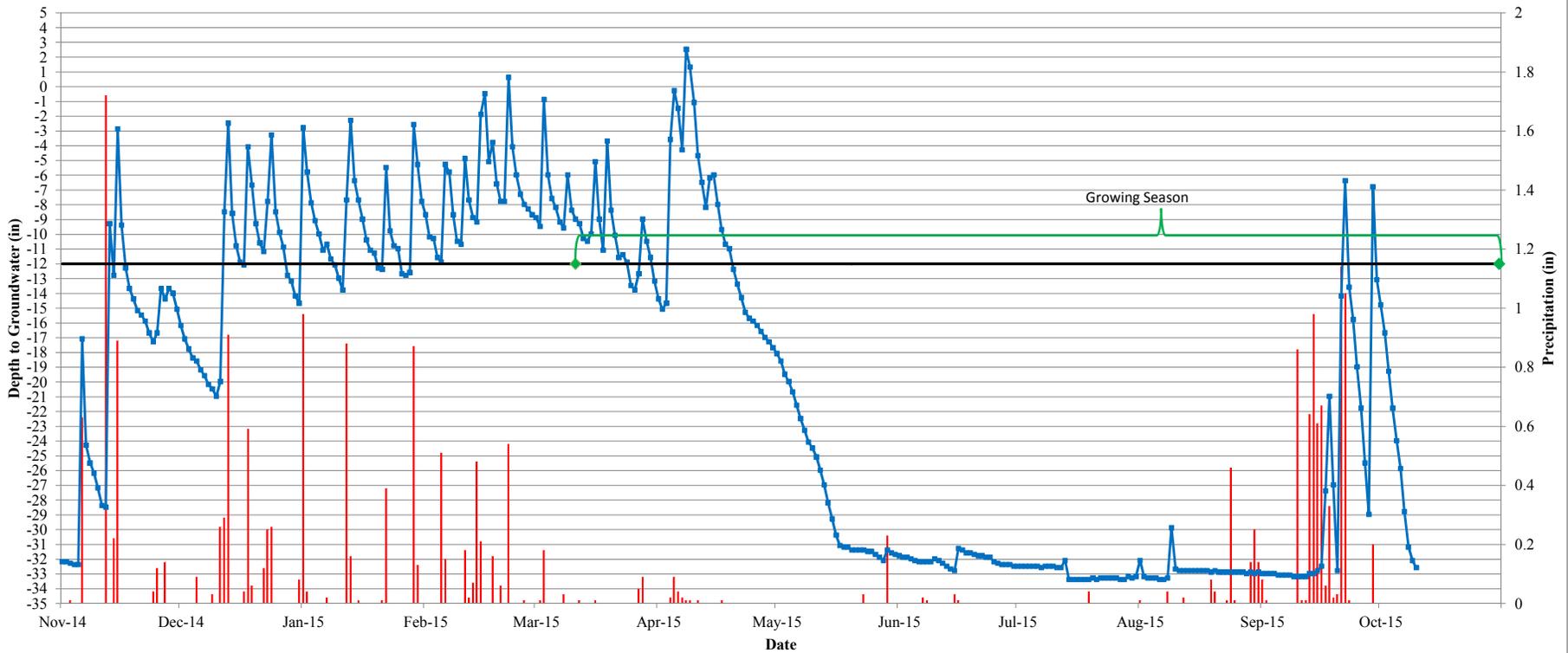
**Figure 5**  
**UT to Clarke Creek Hydrology Monitoring**  
**Groundwater Gauge 1 - 2015**  
**WM0000136A5C22**



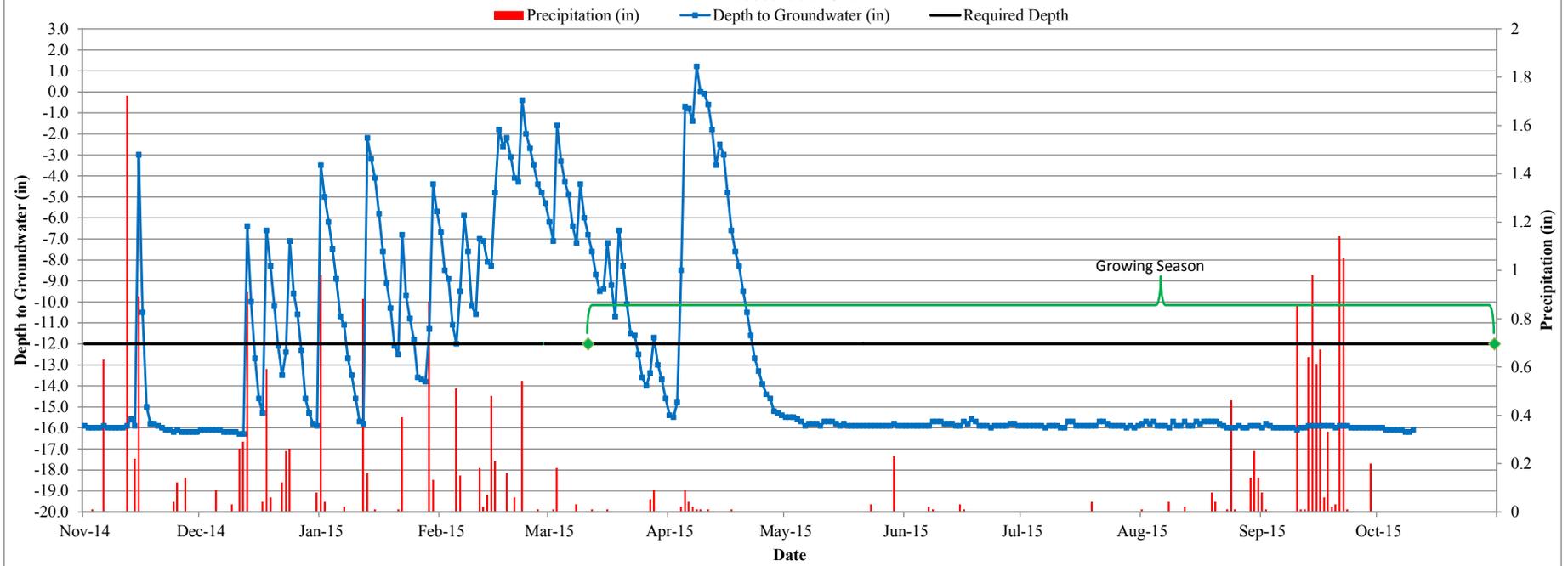
**Figure 6**  
**UT to Clarke Creek Hydrology Monitoring**  
**Groundwater Gauge 2 - 2015**

WM00001130F789

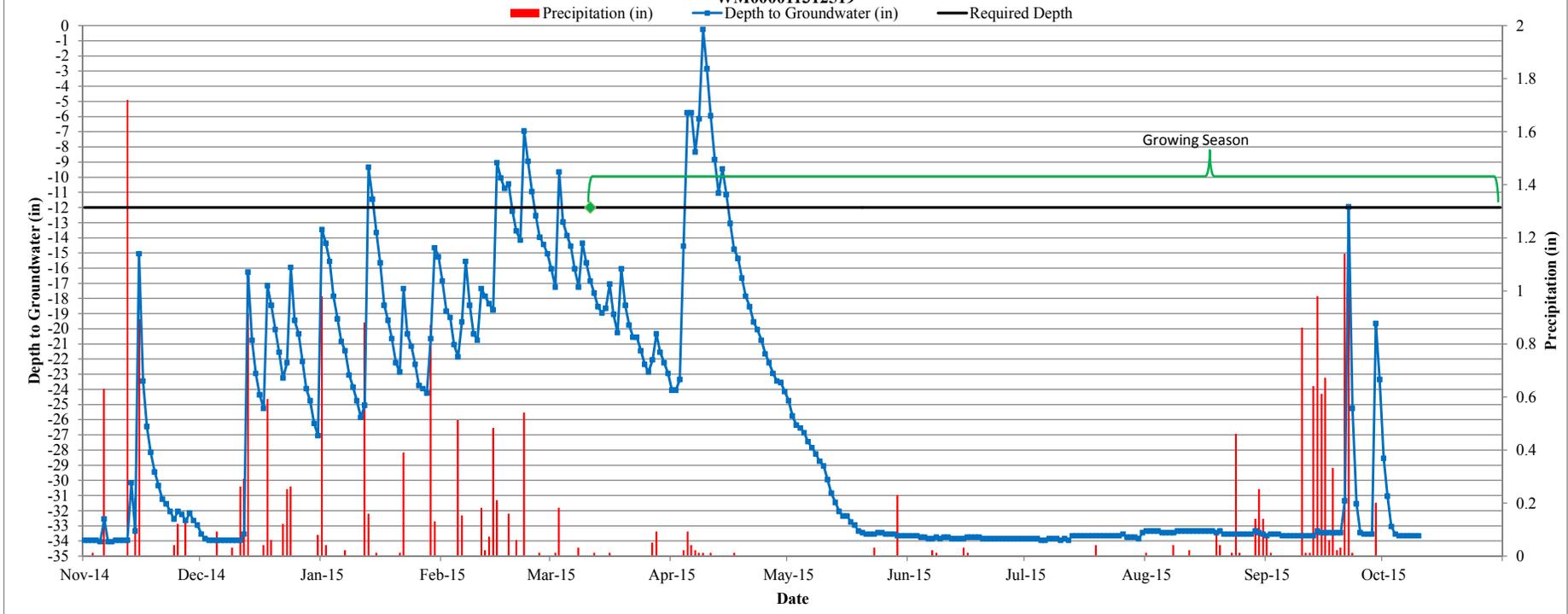
Precipitation (in)    Depth to Groundwater (in)    Required Depth



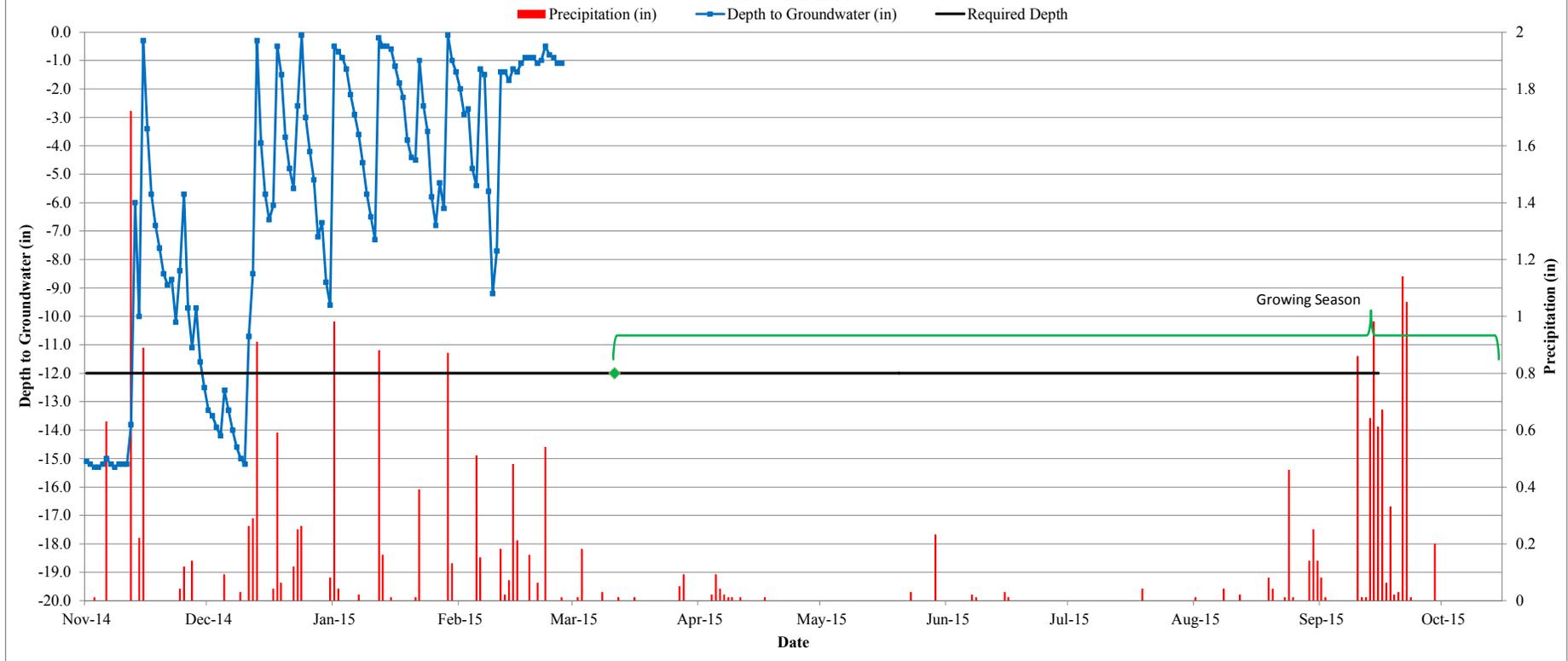
**Figure 7**  
**UT to Clarke Creek Hydrology Monitoring**  
**Groundwater Gauge 3 - 2015**  
**WM0000136B1C42**



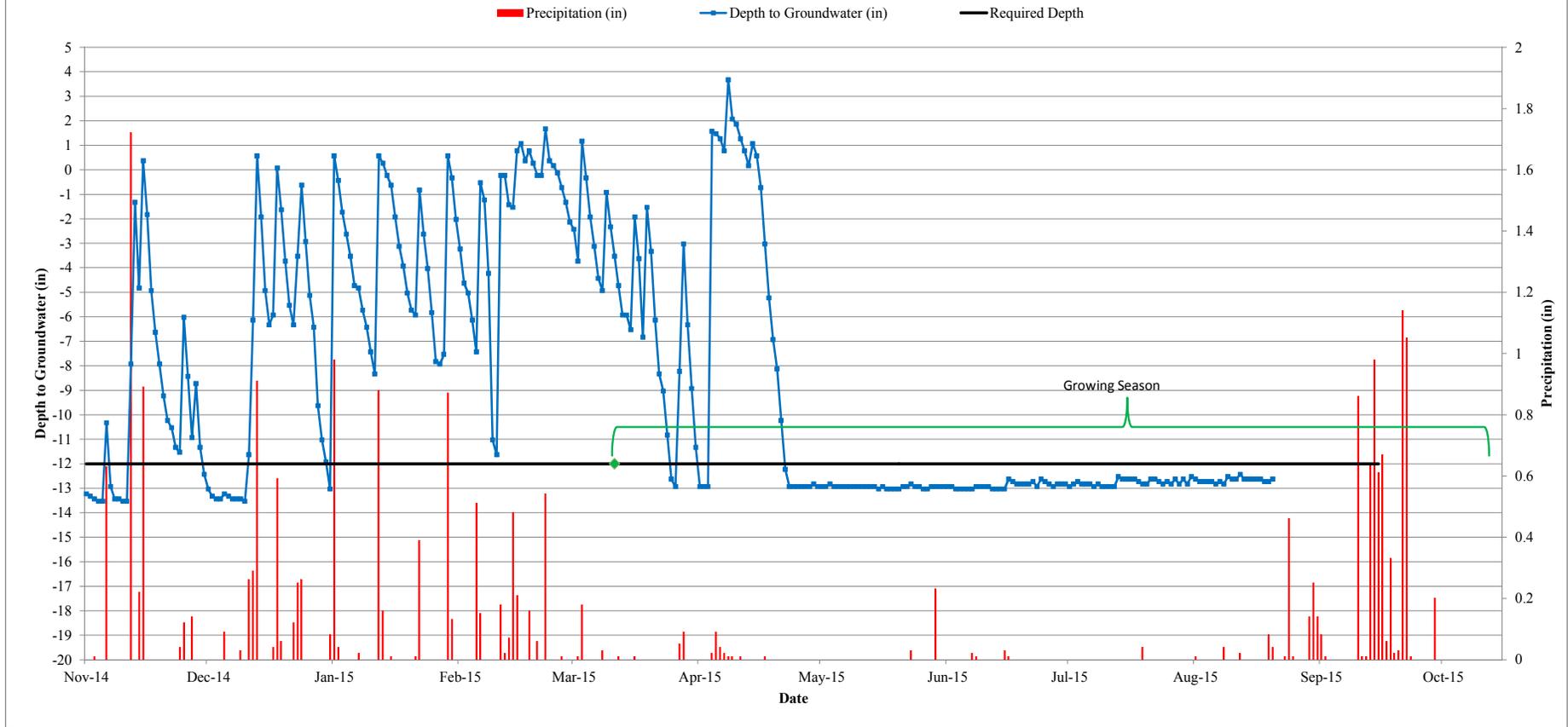
**Figure 8**  
**UT to Clarke Creek Hydrology Monitoring**  
**Groundwater Gauge 4 - 2015**  
**WM000011312519**



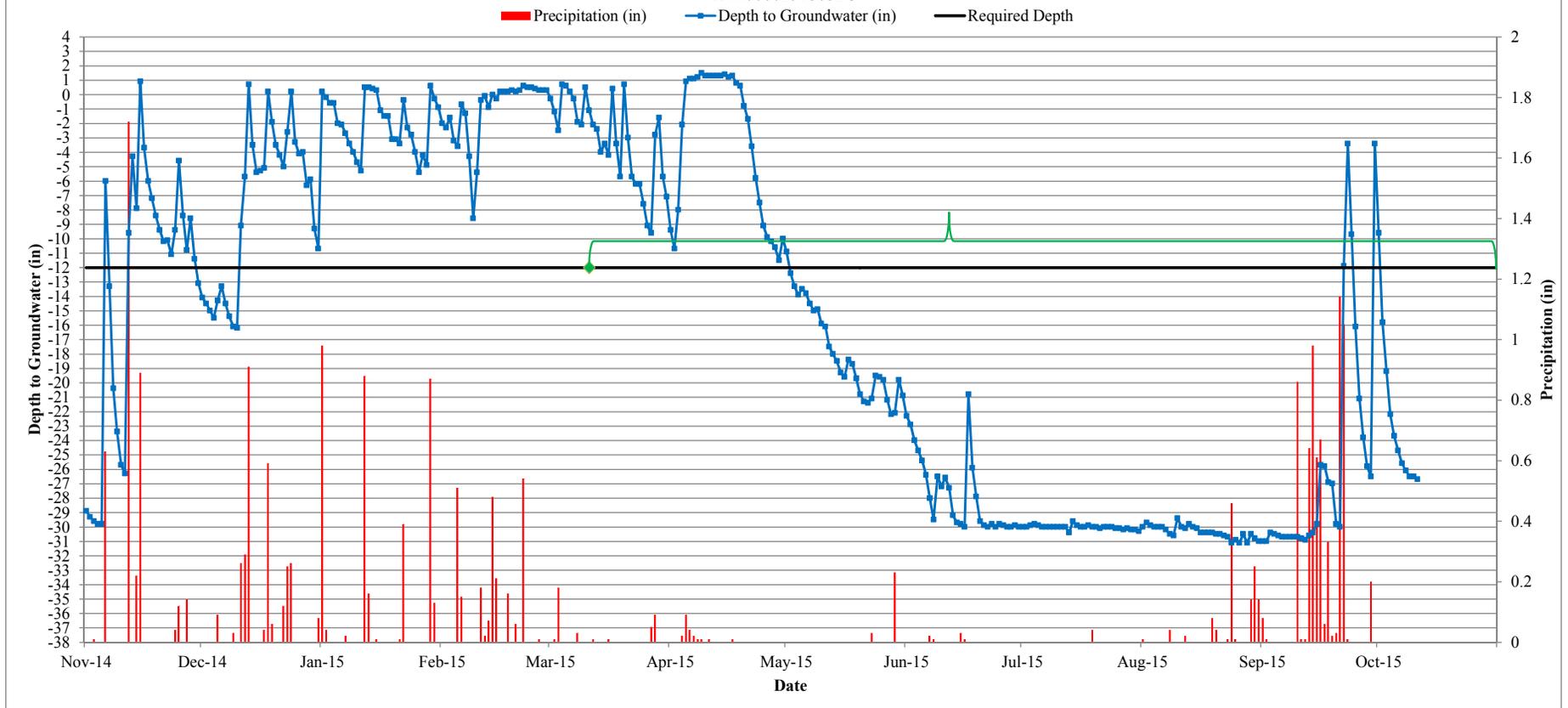
**Figure 9**  
**UT to Clarke Creek Hydrology Monitoring**  
**Groundwater Gauge 5 - 2015**  
**WM000013D4D149**



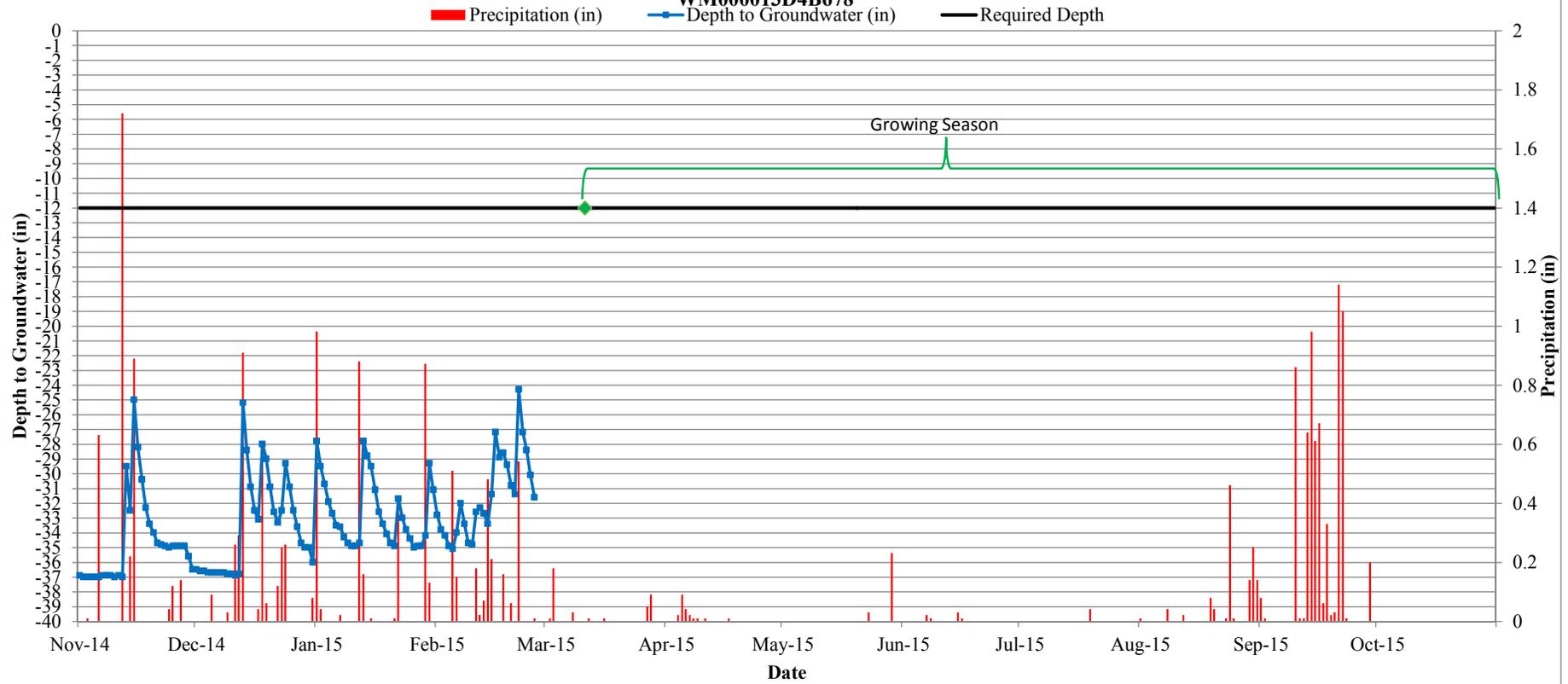
**Figure 10**  
**UT to Clarke Creek Hydrology Monitoring**  
**Groundwater Gauge 6 - 2015**  
**WM0000138B838E**



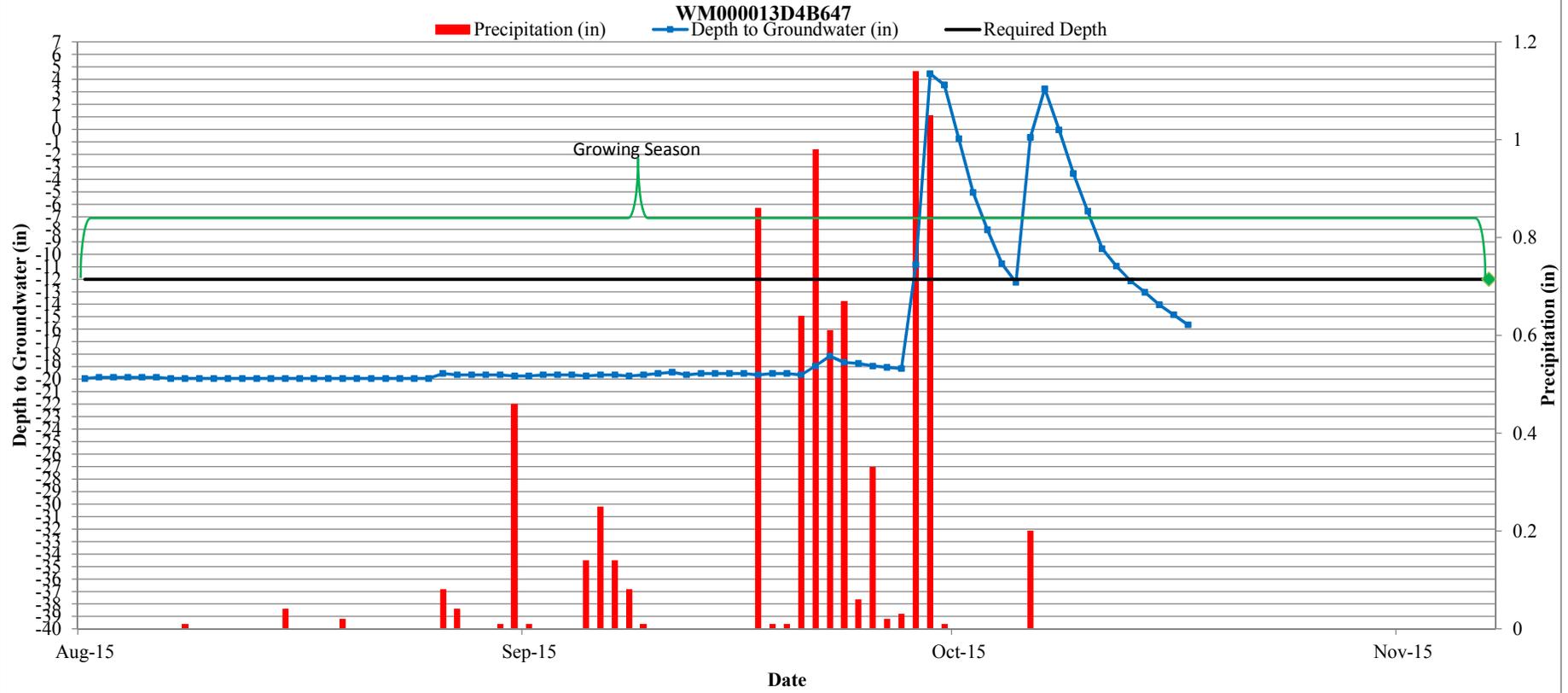
**Figure 11**  
**UT to Clarke Creek Hydrology Monitoring**  
**Groundwater Gauge 7 - 2015**  
**WM00001315052C**



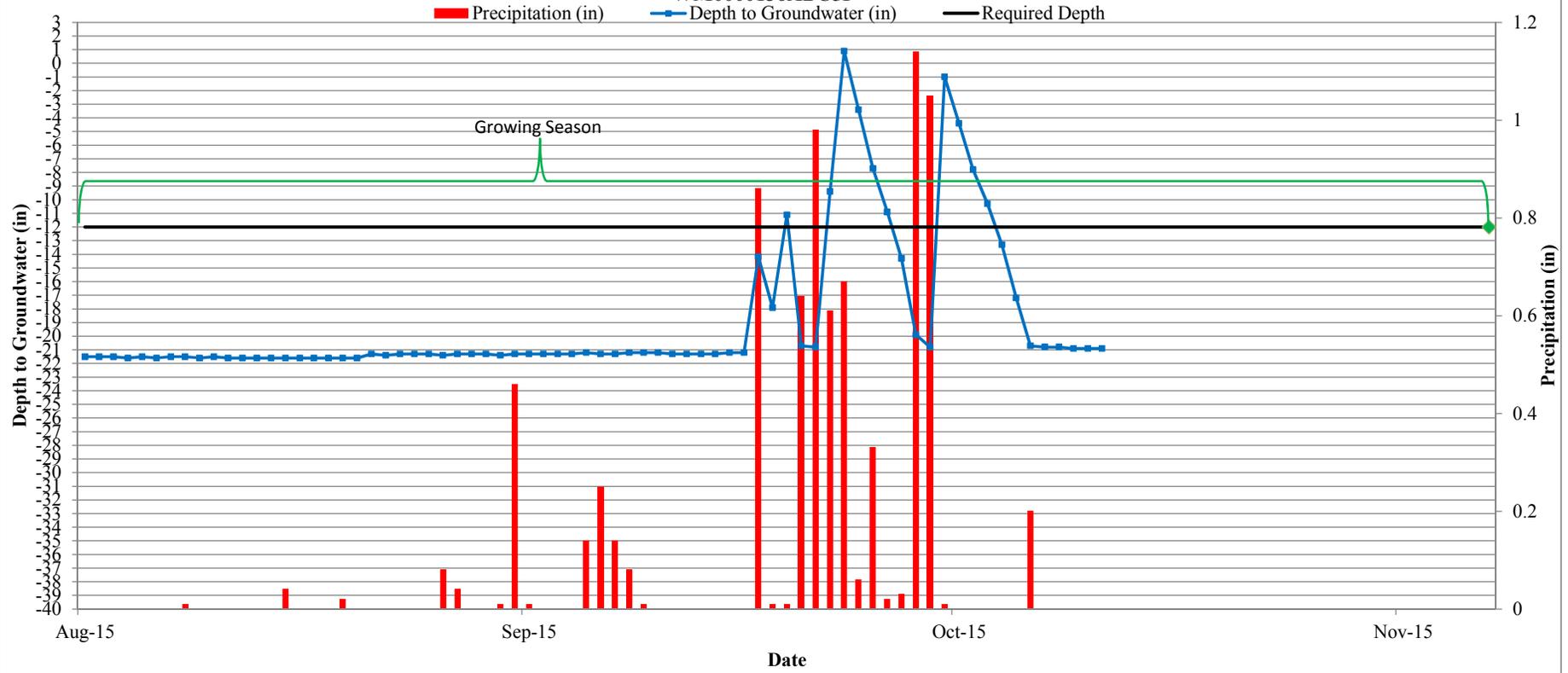
**Figure 12**  
**UT to Clarke Creek Hydrology Monitoring**  
**Groundwater Gauge 8 - 2015**  
**WM000013D4B678**



**Figure 13**  
**UT to Clarke Creek Hydrology Monitoring**  
**Groundwater Gauge 9 - 2015**



**Figure 14**  
**UT to Clarke Creek Hydrology Monitoring**  
**Groundwater Gauge 10 - 2015**  
**WM0000136ABC5F**



**Figure 15**  
**UT to Clarke Creek Hydrology Monitoring**  
**Groundwater Gauge 11 - 2015**  
**WM00001315322D**

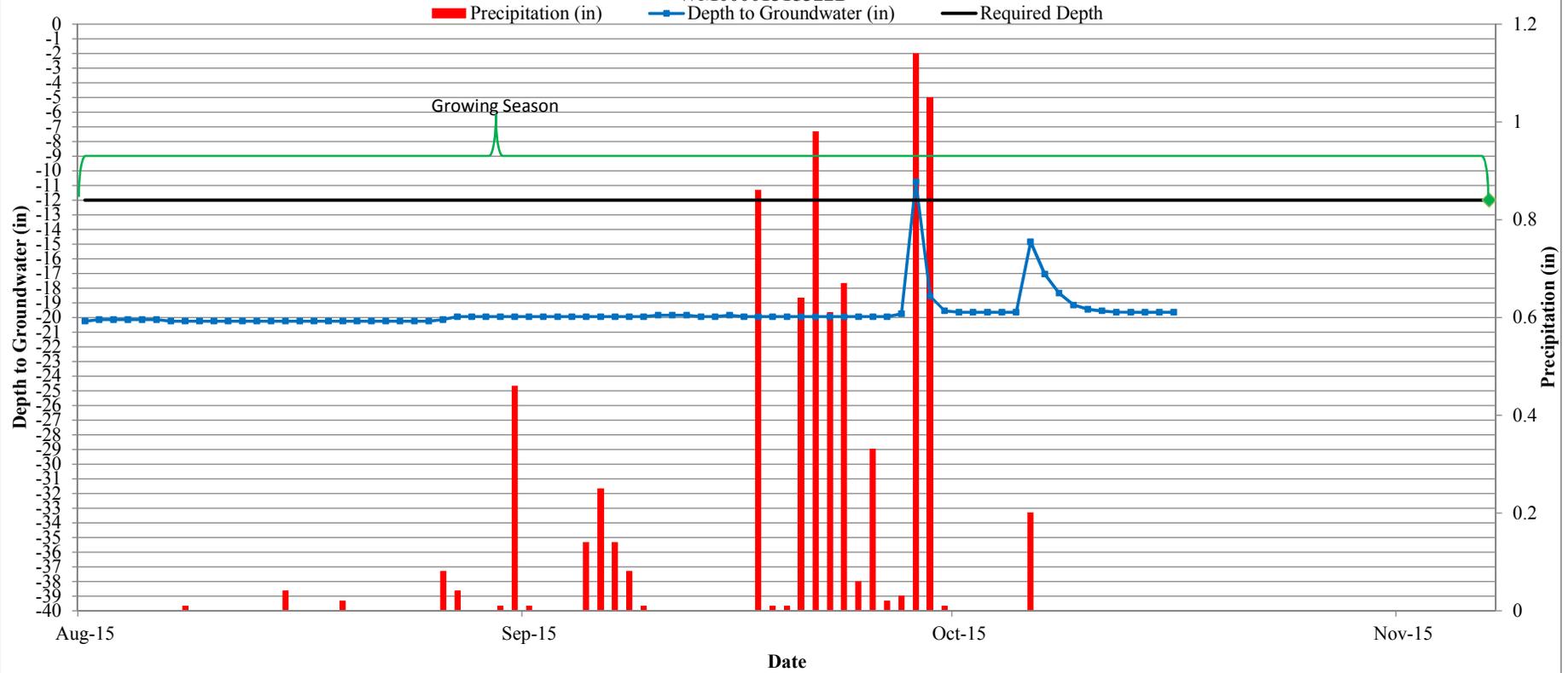


Table 13. Wetland Gauge Attainment Data					
Gauge	Success Criteria Achieved/Max Consecutive Days During Growing Season (Percentage)				
	Year 1 (2014)	Year 2 (2015)	Year 3 (2016)	Year 4 (2017)	Year 5 (2018)
1	Yes/236 days (99%)	Yes/177 days (74%)			
2	No/23 days (10%)	No/25 days (10%)			
3	Yes/45 days (19%)	No/24 days (10%)			
4	No/12 days (5%)	No/11 days (5%)			
5	Yes/47 days (20%)	No Data <sup>b</sup>			
6	Yes/45 days (19%)	No Data <sup>b</sup>			
7	Yes/64 days (27%)	Yes/63 days (26%)			
8	No/0 days (0%)	No Data <sup>b</sup>			
9 <sup>a</sup>	No Data	No/7 days (10% of days with data)			
10 <sup>a</sup>	No Data	No/6 days (8% of days with data)			
11 <sup>a</sup>	No Data	No/1 day (1% of days with data)			

<sup>a</sup>Well installed after start of 2015 growing season; therefore, gauge data not available

<sup>b</sup>Well malfunction - no data during growing season