UT to Clarke Creek Stream and Wetland Restoration Site
Annual Final Monitoring Report

DMS # 92500
DENR Contract # 005363
USACE Action ID # SAW-2010-00471
DWR Project # 11-0409
SCO # 09-07763-01
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Monitoring Report Year 3 of 5
Mecklenburg County, North Carolina

Submitted to:

NC Department of Environmental Quality
Division of Mitigation Services
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UT to Clarke Creek Stream and Wetland Restoration
DMS Project #92500

Monitoring Report Year 3 of 5
Mecklenburg County, North Carolina

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INTRODUCTION

The UT Clarke Creek Stream and Wetland Restoration Project (Site) 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, and
- 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, and
- 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 3 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 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, and
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, and

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 bankful 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 3 monitoring. This evidence includes the presence of wracklines and a crest gauge reading of 12.5" above bankfull on UT1 and 24" above bankfull on UT to Clarke Creek.

On UT to Clarke Creek areas of channel widening which were observed during the May 2016 Site Assessment at Stations 1+00, 3+75, 6+50 are still present. Vegetation observed in the channel between Station 1+78 and 2+41 is now absent. The area of bare bank from Stations 2+85 to 3+00, 4+90 to 5+29, and 11+00 to 11+30 is also still present. One area of bare floodplain was observed between Stations 10+68 and 10+88. Cross Sections 1A and 9 showed an increase in D50 compared to MY02 (but less than baseline) while Station 7+50 showed a decrease in D50 compared to MY02. The increase in particle size at Cross Section 9 may be attributed to the loss of vegetation in the channel and subsequent fine sediment removal at Station 1+78 and 2+41. The particle size increase at Cross Section 1A may be attributed to the channel widening at Station 6+50.

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 bare floodplain were observed between Stations 7+65 to 7+87 and 6+97 to 7+37. Cross Section 4 showed an increase in particle size for this monitoring year compared to the previous year but still less than baseline condition.

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.

Only Well 1 met the hydrology success criteria for monitoring year 3. Wells 2 through 8 did not meet the success criteria. Wells 9 through 11 malfunctioned but do have data during the growing season. According to rainfall data for the area, in the months of March, April, June and August less than 2 inches of rain fell for each month during this time period. This may provide an explanation of 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 3 stem counts are located in Tables 7 and 9 in Appendix C. Currently, plots 3,4,6,7, and 9 are meeting the interim measure of success. However, when including volunteer stems, plots 1, 5 and 8 exceed the interim stem count. Plot 2 did not meet the interim requirement even with volunteers included. Vegetation throughout the reach appears to be growing at acceptable rates. Carolina Silvics completed a supplemental planting effort in the 2015 - 2016 dormant season throughout the project site. In February 2016, Carolina Silvics replanted 1,300 stems in areas where stem densities were still not meeting the vegetative success criteria. These stems were as follows:

Riparian Areas: 300 Betula nigra, 200 Nyssa sylvatica, 200 Quercus coccinea, 150 Quercus micahauxii, 150 Quercus nigra, and 200 Quercus rubra. Wetland Areas: 50 Quercus michauxii and 50 Quercus nigra.

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 3 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.

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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
Weltand 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 inelligible 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				
Totals (Feet/Acres)	**4,206**	**1.457**					
MU Totals	**2,220**	**1.176**					

Non-Applicable

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

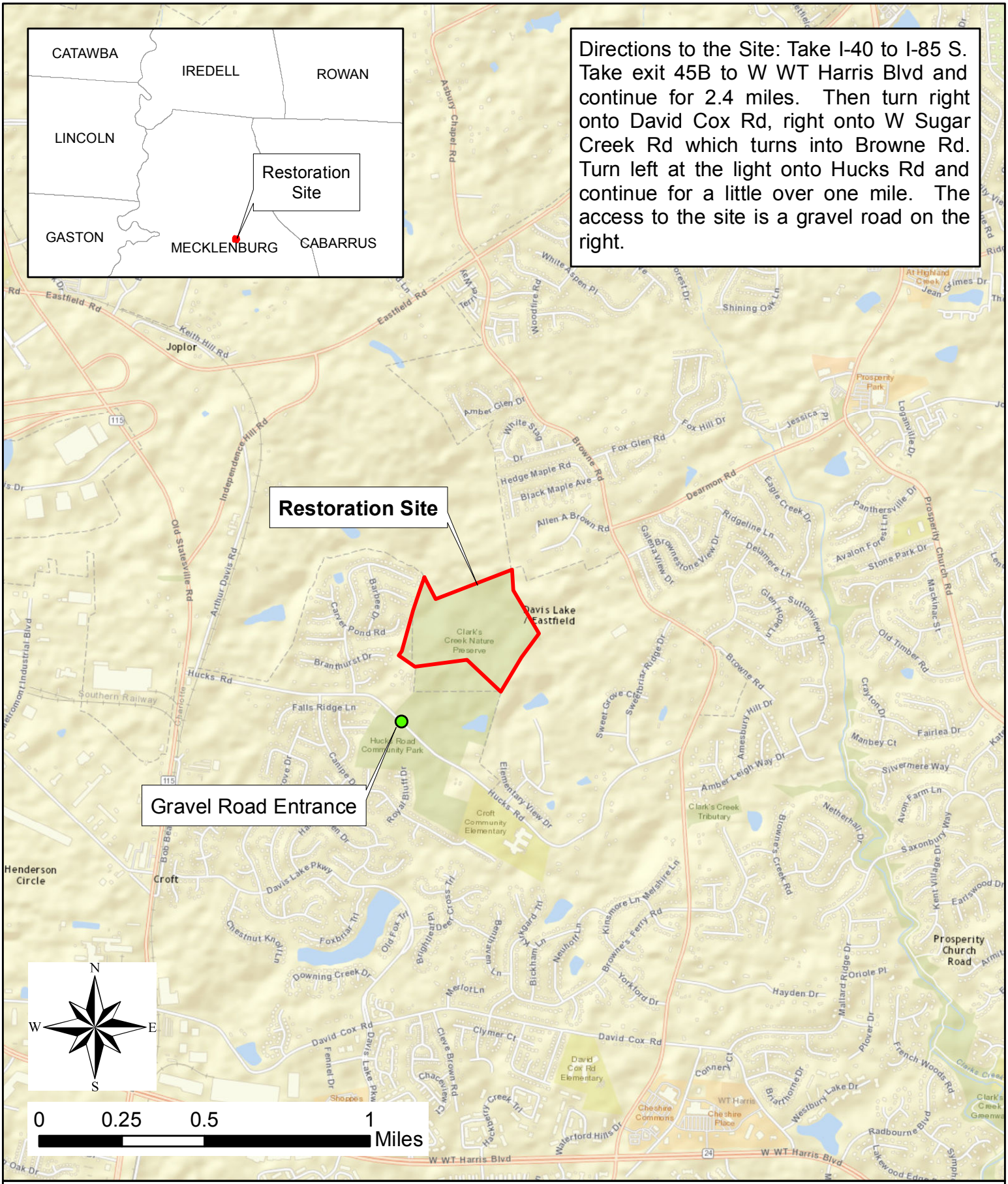
Elapsed Time Since grading complete: 3 years 4 months
Elapsed Time Since planting complete: 2 year 9 months
Number of reporting Years: 3

Activity or Deliverable	Data Collection Complete	Completion or Delivery
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	Oct - 2016	Dec - 2016
Year 4 Monitoring		
Year 5 Monitoring		

Table 3. Project Contacts Table UT to Clarke Creek/DMS Project #92500	
Designer Primary project design POC	Jordan, Jones, and Goulding, Inc. 309 E. Morehead Street, Suite 110, Charlotte, NC 28202 Matthew M. Clabaugh, PE
Construction Contractor Construction contractor POC	North State Environmental 2889 Lowery Street, Winston-Salem, NC 27101 Michael Anderson, (336) 245-1253
Survey Contractor Survey contractor POC	NorthState Environmental 2889 Lowery Street, Winston-Salem, NC 27101 David Keith Alley, PLS
Planting Contractor Planting contractor POC	Carolina Silvics 908 Indian Trail Road, Edenton, NC 27932
Seeding Contractor Contractor point of contact	Canady's Landscaping & Erosion 256 Fairview Acres Road, Lexington, NC 27295 Craig Canady, (336) 236-1182
Seed Mix Sources	
Nursery Stock Suppliers	
Monitoring Performers	SEPI Engineering & Construction 1025 Wade Avenue, Raleigh, NC 27605
Stream Monitoring POC	Philip Beach, PWS (919) 789-9977
Vegetation Monitoring POC	Jason Hales, PWS (919) 789-9977
Wetland Monitoring POC	Philip Beach, PWS (919) 789-9977

Table 4. Project Attribute Table UT to Clarke Creek/DMS Project #92500			
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		
Restoration Component Attribute Table			
	UT Clarke Creek	**UT1**	
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



Restoration Site Vicinity

UT to Clarke Creek

Monitoring Year 3 Mecklenburg County, NC

January 2017 Project # 92500 Figure 1

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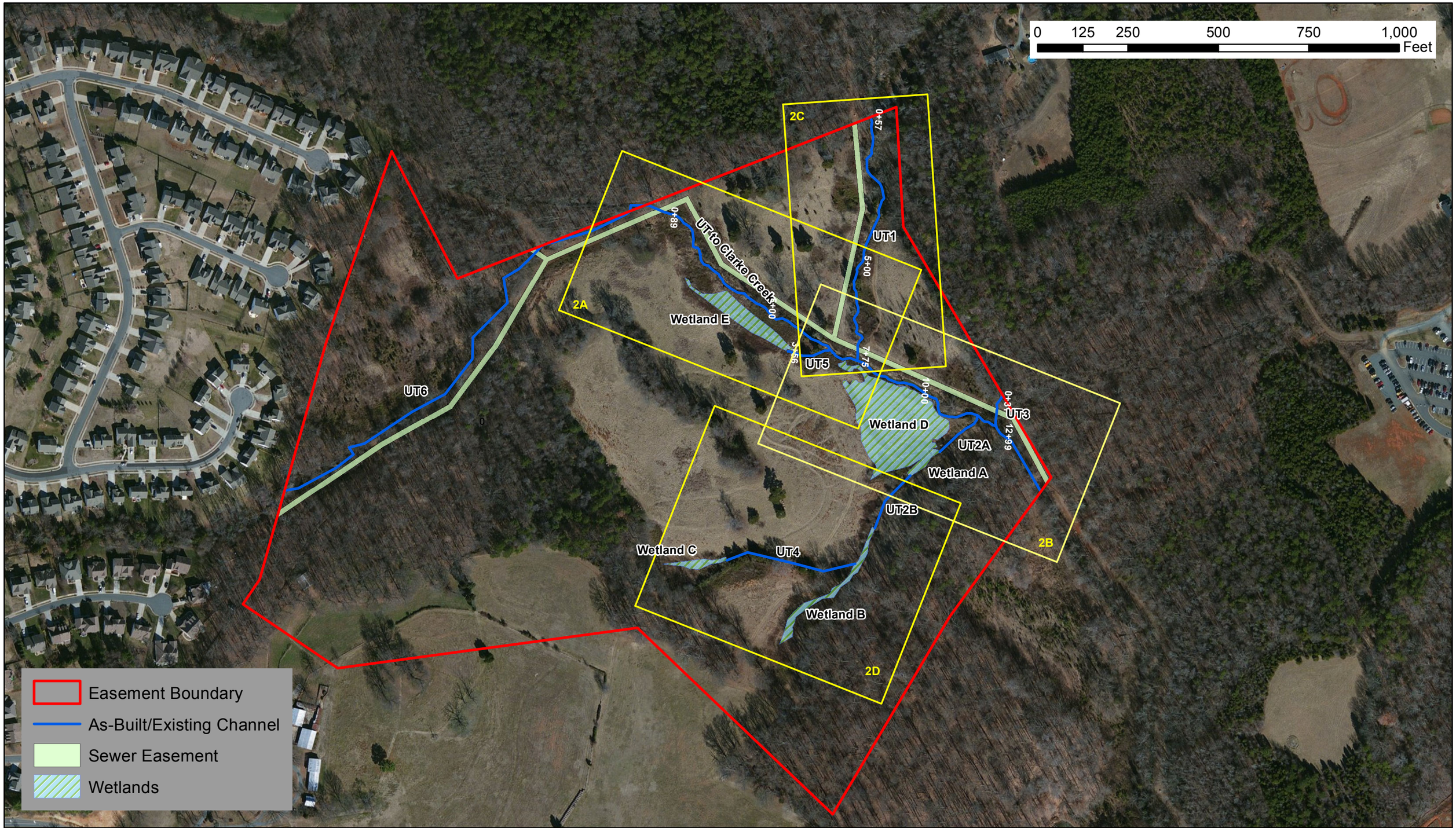

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UT to Clarke Creek Monitoring Year 3

Current Conditions Plan View - Index Map

January 2017 Project # 92500 Figure 2 Mecklenburg County, NC

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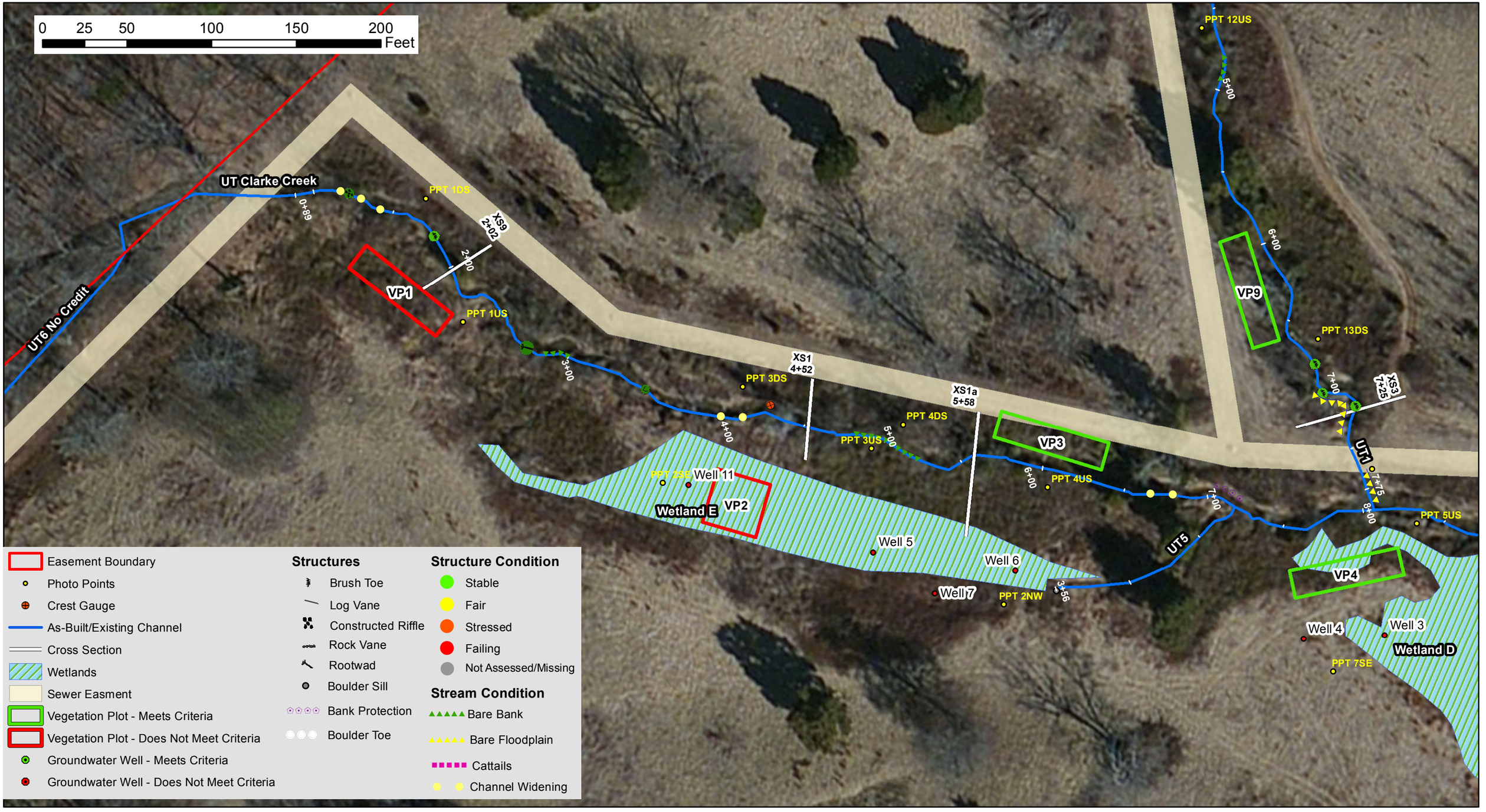

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UT to Clarke Creek Monitoring Year 3

Current Conditions Plan View - UT Clarke Creek above Confluence

January 2017 Project # 92500 Figure 2A Mecklenburg County, NC

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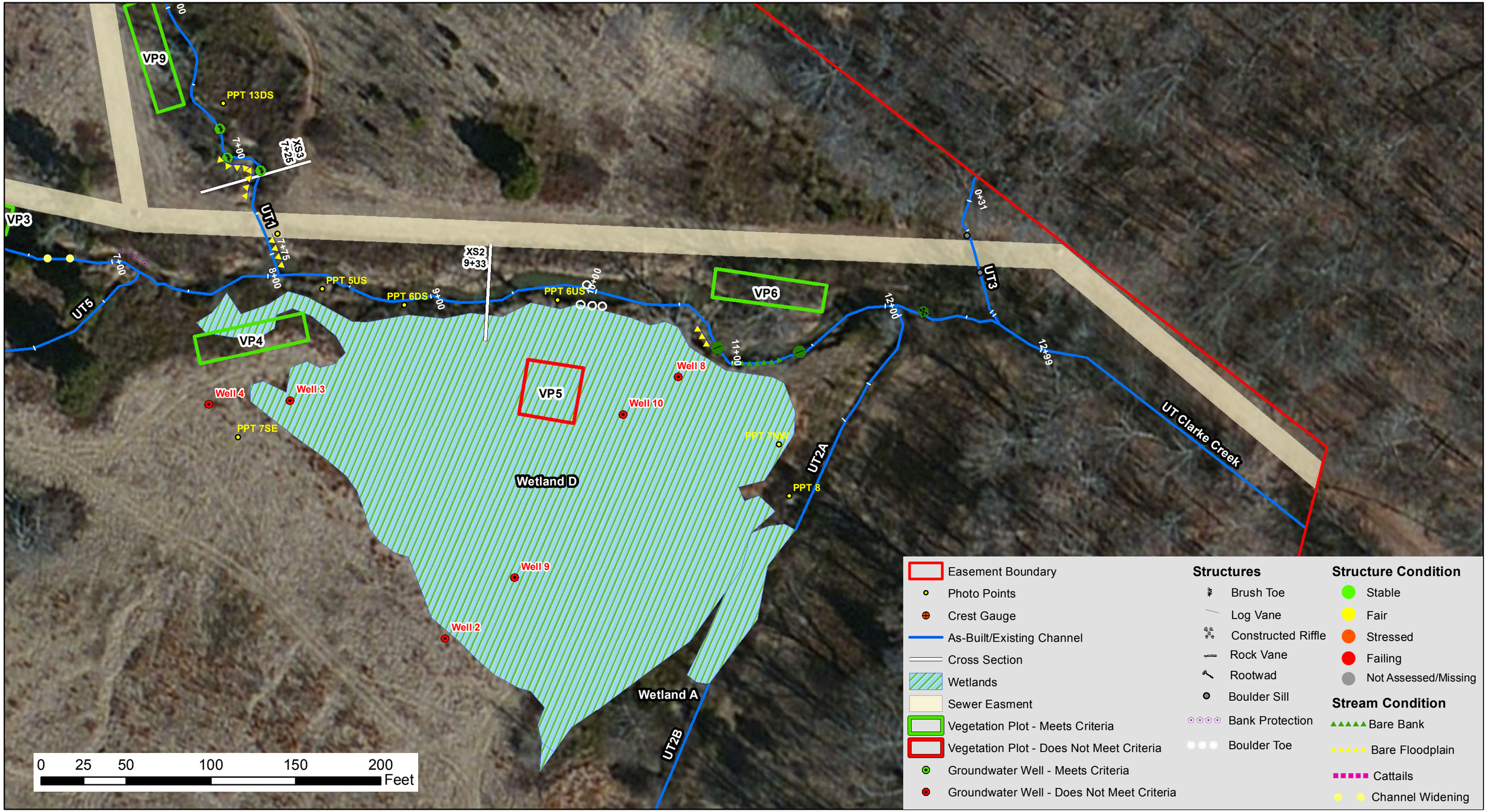

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UT to Clarke Creek Monitoring Year 3

Current Conditions Plan View - UT Clarke Creek below Confluence

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0 25 50 100 150 200 Feet

XS4 1+26
XS5 2+66
XS6 3+33
XS8 4+14
XS3 7+25
XS2 9+33
XS1a 5+58

VP7
VP8
VP9
VP4
VP3

PPT 9DS
PPT 10DS
PPT 11DS
PPT 10US
PPT 12DS
PPT 11US
PPT 12US
PPT 13DS
PPT 13US
PPT 5US
PPT 6US
PPT 6DS
PPT 7SE
PPT 4US
PPT 4DS
PPT 2NW

0+57
1+00
2+00
3+00
4+00
5+00
6+00
7+00
7+75
8+00
9+00
10+
3+56

UT1
UT5
UT Clarke Creek

Wetland D
Wetland E

Well 3
Well 4
Well 6

- Easement Boundary
- Photo Points
- Crest Gauge
- As-Built/Existing Channel
- Cross Section
- Wetlands
- Sewer Easment
- Vegetation Plot - Meets Criteria
- Vegetation Plot - Does Not Meet Criteria
- Groundwater Well - Meets Criteria
- Groundwater Well - Does Not Meet Criteria

Structures

- Brush Toe
- Log Vane
- Constructed Riffle
- Rock Vane
- Rootwad
- Boulder Sill
- Bank Protection
- Boulder Toe

Structure Condition

- Stable
- Fair
- Stressed
- Failing
- Not Assessed/Missing

Stream Condition

- Bare Bank
- Bare Floodplain
- Cattails
- Channel Widening

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UT to Clarke Creek Monitoring Year 3

Current Conditions Plan View - UT 1

January 2017 Project # 92500 Figure 2C Mecklenburg County, NC

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N E S W

Easement Boundary
Photo Points
Crest Gauge
As-Built/Existing Channel
Cross Section
Wetlands
Sewer Easment
Vegetation Plot - Meets Criteria
Vegetation Plot - Does Not Meet Criteria
Groundwater Well - Meets Criteria
Groundwater Well - Does Not Meet Criteria

Structures

Brush Toe
Log Vane
Constructed Riffle
Rock Vane
Rootwad
Boulder Sill
Bank Protection
Boulder Toe

Structure Condition

Stable
Fair
Stressed
Failing
Not Assessed/Missing

Stream Condition

Bare Bank
Bare Floodplain
Cattails
Channel Widening

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UT to Clarke Creek Monitoring Year 3

Current Conditions Plan View - UT 4

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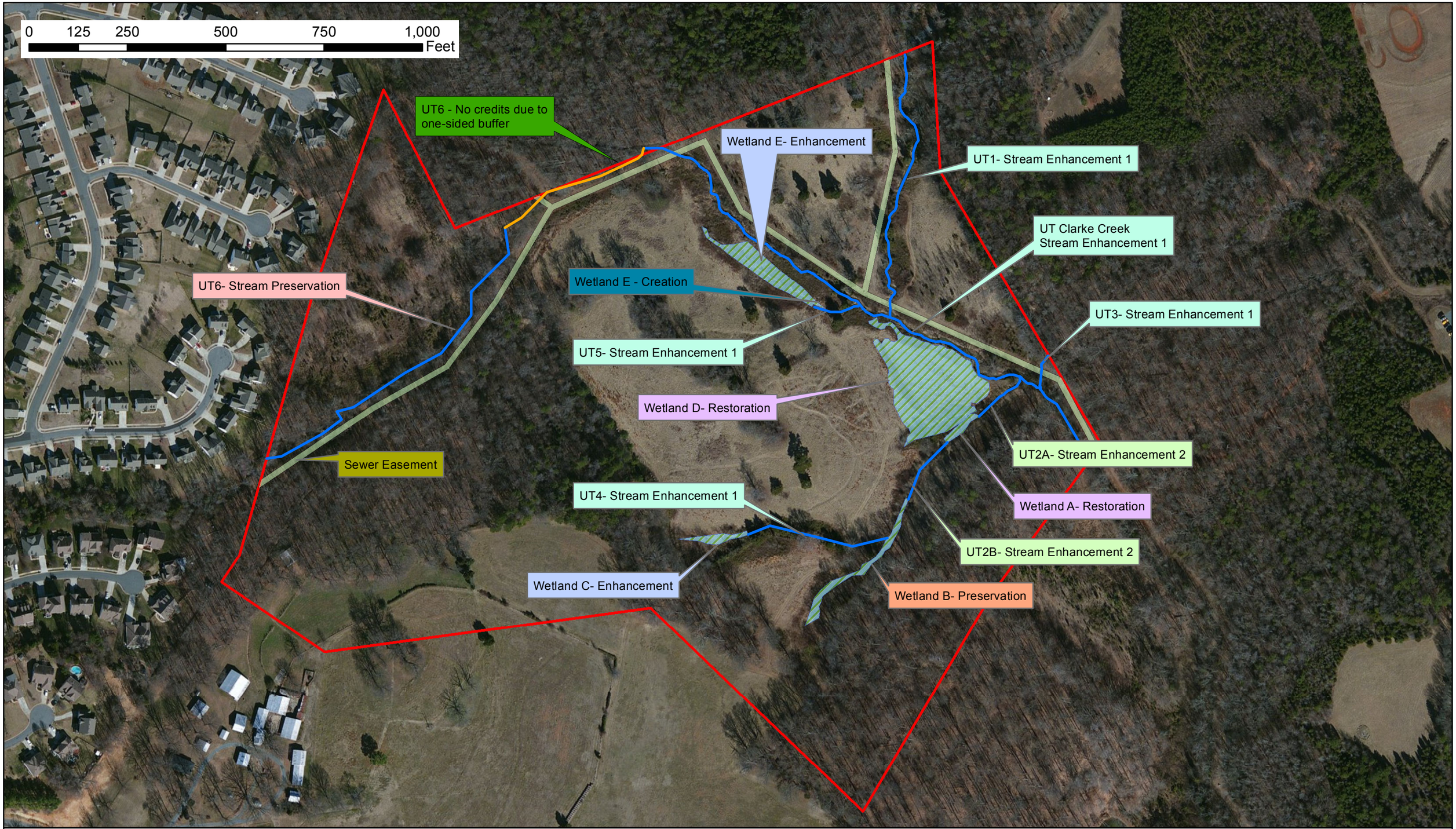
N W E S



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UT to Clarke Creek Monitoring Year 2

Components Map

January 2017 Project # 92500 Figure 3 Mecklenburg County, NC

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N W E S

Table 5a **Visual Stream Morphology Stability Assessment**
Reach ID **UT to Clarke Creek**
Assessed Length **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. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%			
		2. Degradation - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	10	10			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	9	10			90%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem 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%			
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 NOT 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%
				Totals	1	39	99%	1	39	100%
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 not 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 ≥ 1.6 Rootwads/logs providing some cover at base-flow.	2	2			100%			

Table 5b **Visual Stream Morphology Stability Assessment**
Reach ID **UT1**
Assessed Length **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. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%			
		2. Degradation - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	5	5			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	4	6			67%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem 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%			
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			2	52	97%	0	0	97%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT 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%
				Totals	2	52	97%	0	0	97%
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 not 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 ≥ 1.6 Rootwads/logs providing some cover at base-flow.	2	2			100%			

Table 6 Vegetation Condition Assessment

Planted Acreage[1] **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	7	0.01	0.1%
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%
			Total	7	0.01	0.1%
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%
			Cumulative Total	7	0.01	0.1%

Easement Acreage[2] **57.2**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern[4]	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[3]	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 (MY3 – 10/21/2016)

Photo Station 1 Upstream-XS9 (MY3 – 10/21/2016)

Photo Station 2 Northeast-Wetland E (MY3 – 12/02/2016)

Photo Station 2 Southeast-Wetland E (MY3 – 10/20/2016)

Photo Station 3 Downstream-XS1 (MY3 – 11/09/2016)

Photo Station 3 Upstream-XS1 (MY3 – 11/09/2016)

Photo Station 4 Downstream-XS1A (MY3 – 10/20/2016)

Photo Station 4 Upstream-XS1A (MY3 – 10/21/2016)

Photo Station 5 Upstream-Confluence (MY3 – 12/02/2016)

Photo Station 6 Downstream-XS2 (MY3 – 10/20/2016)

Photo Station 6 Upstream-XS2 (MY3 – 10/20/2016)

Photo Station 7 Northwest- Wetland D (MY3 – 10/20/2016)

Photo Station 7 Southeast-Wetland D (MY3 – 10/20/2016)

Photo Station 8 Downstream-UT2 (MY3 – 10/20/2016)

Photo Station 8 South-Wetland A (MY3 – 10/20/2016)

Photo Station 9 Downstream-XS4 (MY3 – 10/20/2016)

Photo Station 9 Upstream-XS4 (MY3 – 10/20/2016)

Photo Station 10 Downstream-XS5 (MY3 – 10/20/2016)

Photo Station 10 Upstream-XS5 (MY3 – 10/20/2016)

Photo Station 11 Downstream-XS6 (MY3 – 10/21/2016)

Photo Station 11 Upstream-XS6 (MY3 – 10/21/2016)

Photo Station 12 Downstream-XS8 (MY3 – 10/20/2016)

Photo Station 12 Upstream-XS8 (MY3 – 10/20/2016)

Photo Station 13 Downstream-XS3 (MY3 – 10/21/2016)

Photo Station 13 Upstream-XS3 (MY3 – 10/21/2016)

Photo Station 14 North-Wetland B (MY3 – 12/02/2016)

Photo Station 14 South-Wetland B (MY3 – 12/02/2016)

Vegetation Plot 1 – 5m x 20m (MY2 – 10/20/2016)

Vegetation Plot 2 – 10m x 10m (MY2 – 12/2/2016)

Vegetation Plot 3 – 5m x 20m (MY2 – 10/20/2016)

Vegetation Plot 4 – 5m x 20m (MY2 – 10/20/2016)

Vegetation Plot 5 – 5m x 20m (MY2 – 12/2/2016)

Vegetation Plot 6 – 5m x 20m (MY2 – 12/2/2016)

Vegetation Plot 7 – 10m x 10m (MY2 – 12/2/2016)

Vegetation Plot 8 – 5m x 20m (MY2 – 12/2/2016)

Vegetation Plot 9 – 5m x 20m (MY2 – 12/2/2016)

Appendix C
Vegetation Plot Data

Table 7. Vegetation Plot Mitigation Success Sumary UT to Clarke Creek / DMS Project #92500 Year 3 of 5		
Plot #	Stems/Acre	Success Criteria Met?
1	121.4	No
2	121.4	No
3	323.7	Yes
4	323.7	Yes
5	283.3	No
6	485.6	Yes
7	445.2	Yes
8	80.9	No
9	404.7	Yes

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

Report Prepared By	Philip Beach
Date Prepared	11/29/2016 14:33
database name	UTClarkeCr_92500_MY3_2016_CVS_Database.mdb
database location	G:\Environmental\NCEEP Ut Clark Creek WMS\MY03\AnnualReport\UTClarkeCr_92500_MY3_2016_DRAFT\Support Files\3 - Vegetation Plot Data
computer name	W69
file size	66662400
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	92500
project Name	UT Clarke Creek
Description	Stream and Wetland Restoration
River Basin	Yadkin-Pee Dee
length(ft)	
stream-to-edge width (ft)	
area (sq m)	
Required Plots (calculated)	
Sampled Plots	9

Table 9 - CVS Planted and Total Stem Counts (Stems and Species by Plot with Annual Means
DMS Project Code 92500. Project Name: UT Clarke Creek

			Current Plot Data (MY3 2016)																							Annual Means											
			92500-01-0001			92500-01-0002			92500-01-0003			92500-01-0004			92500-01-0005			92500-01-0006			92500-01-0007			92500-01-0008			92500-01-0009			MY3 (2016)			MY2 (2015)			MY1 (2014)			MY0 (2014)		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Alnus serrulata	hazel alder	Shrub									1							1	1	1										1	1	2	1	1	11			3			1
Amelanchier arborea	common serviceberry	Tree										1	1	1	1	1	1									1	1	1	3	3	3	3	3	3	1	1	2	1	1	1
Asimina triloba	pawpaw	Tree																																			1			
Baccharis halimifolia	eastern baccharis	Shrub																																			1			
Betula nigra	river birch	Tree	1	1	1	1	1	1	3	3	3	1	1	1				4	4	4	3	3	3	1	1	1	3	3	3	17	17	17	20	20	21	6	6	6	8	8	8
Carpinus caroliniana	American hornbeam	Tree																																	2	2	2	2	2	2
Carya glabra	pignut hickory	Tree																																				1	1	1
Chionanthus virginicus	white fringetree	Shrub Tree							1	1	1																		1	1	1	3	3	3						
Cornus amomum	silky dogwood	Shrub								2	2							1	1	1								2	2	1	5	5	1	5	6		3	3		6	6
Diospyros virginiana	common persimmon	Tree																																			3			
Fraxinus pennsylvanica	green ash	Tree										4	4	4			1	2	2	5	1	1	3			2	1	1	3	8	8	18	15	15	18	11	11	12	15	15	15
Ilex verticillata	common winterberry	Shrub																																				1	1	1
Juglans	walnut	Tree																																						1
Juglans nigra	black walnut	Tree																																						
Liquidambar styraciflua	sweetgum	Tree			1																					1					2			10			7			4
Liriodendron tulipifera	tuliptree	Tree																															3	3	3	5	5	5	12	12	12
Nyssa sylvatica	blackgum	Tree																			2	2	2				1	1	1	3	3	3	3	3	3						
Pinus taeda	loblolly pine	Tree									1												4			5					10			9						
Platanus occidentalis	American sycamore	Tree							2	2	2							1	1	1	2	2	2	1	1	1	2	2	2	8	8	8	15	15	15	4	4	4	7	7	7
Populus deltoides	eastern cottonwood	Tree			1									1			1						3						3			9			21			13			
Quercus falcata	southern red oak	Tree	1	1	1	2	2	2				2	2	2	2	2	2	2	2	2	2	2	2							11	11	11	19	19	19	13	13	13	26	26	26
Quercus michauxii	swamp chestnut oak	Tree	1	1	1				2	2	2				2	2	2									2	1	1	1	6	6	8	11	11	11						
Quercus nigra	water oak	Tree																1	1	1										1	1	1	3	3	3	4	4	4	8	8	8
Quercus phellos	willow oak	Tree																			1	1	1							1	1	1	2	2	2	1	1	1			
Quercus rubra	northern red oak	Tree													1	1	1			1						4	1	1	1	2	2	7	3	3	3	1	1	1	1	1	1
Salix nigra	black willow	Tree			30			4		4	4			3	1	1	8			1						2			11	1	5	63		4	120		2	73		5	98
Sambucus canadensis	Common Elderberry	Shrub																																						
Stem count			3	3	35	3	3	7	8	14	16	8	8	12	7	7	16	12	12	17	11	11	20	2	2	18	10	12	28	64	72	169	102	110	286	48	53	154	82	93	192
size (ares)			1			1			1			1			1			1			1			1			1			9			9			9			9		
size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.22			0.22			0.22			0.22		
Species count			3	3	6	2	2	3	4	6	8	4	4	6	5	5	7	7	7	9	6	6	8	2	2	8	7	8	10	14	14	17	14	15	21	10	12	18	11	13	16
Stems per ACRE			121.4	121.4	1416	121.4	121.4	283.3	323.7	566.6	647.5	323.7	323.7	485.6	283.3	283.3	647.5	485.6	485.6	688	445.2	445.2	809.4	80.94	80.94	728.4	404.7	485.6	1133	287.8	323.7	759.9	458.6	494.6	1286	215.8	238.3	692.5	368.7136	418.1752	863.3294

Appendix D
Stream Survey Data

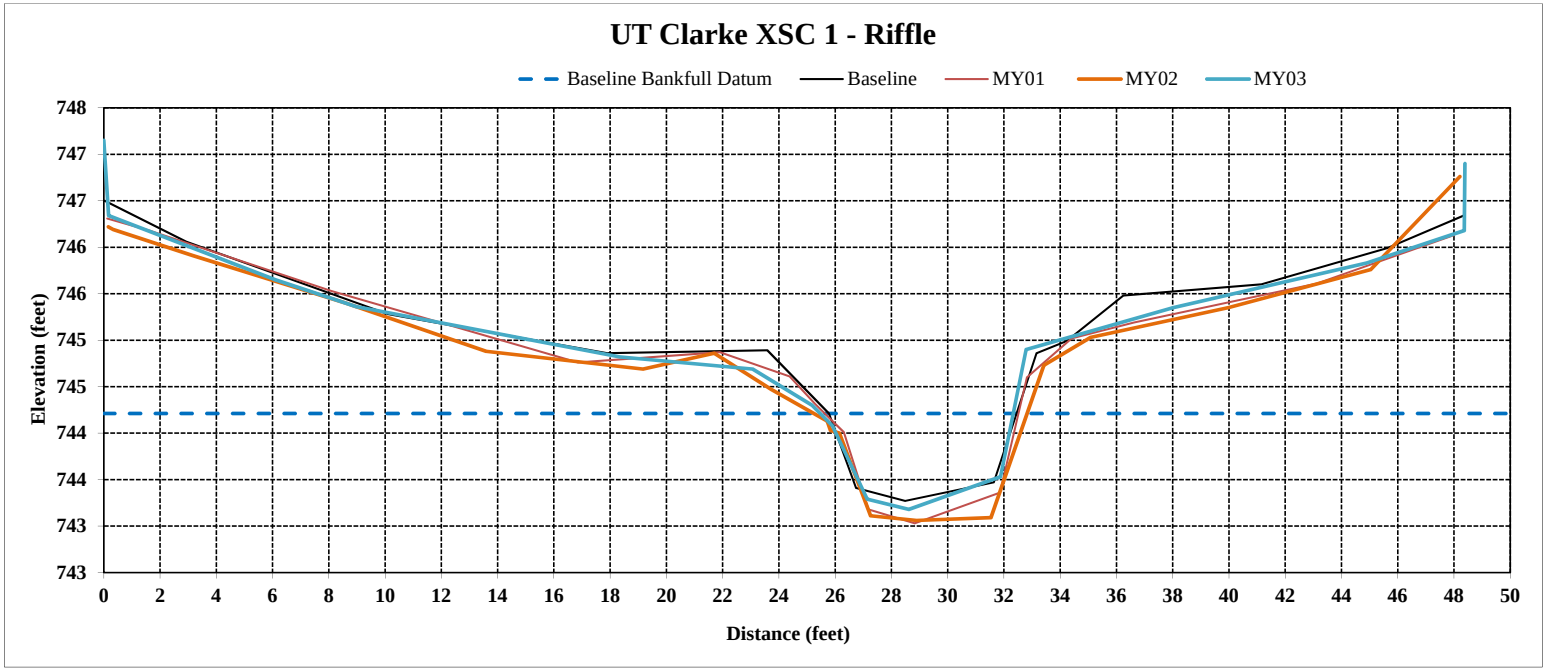
Station	Elevation
0	747.15
0.17	746.34
6.1	745.65
8.98	745.36
18.34	744.82
23.07	744.69
25.18	744.3
25.9	744.08
27.14	743.29
28.62	743.18
31.88	743.53
32.79	744.9
38.02	745.35
44.9	745.83
48.37	746.18
48.39	746.9

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	10/21/2016
Observers	P. Beach, E. Webster

SUMMARY DATA	
Baseline Bankfull Datum, ft	744.21
Bankfull Cross Sectional Area, ft^2	4.35
Bankfull Width, ft	6.89
Max Depth at Bankfull, ft	1.03
Mean Depth at Bankfull, ft	0.63
Width/Depth Ratio	10.90
Flood Prone Width, ft	21.00
Flood Prone Area Elevation	745.24
Entrenchment Ratio	3.05
Bank Height Ratio	1.09

Stream Type	E4

Sta. 4+52 Looking Downstream



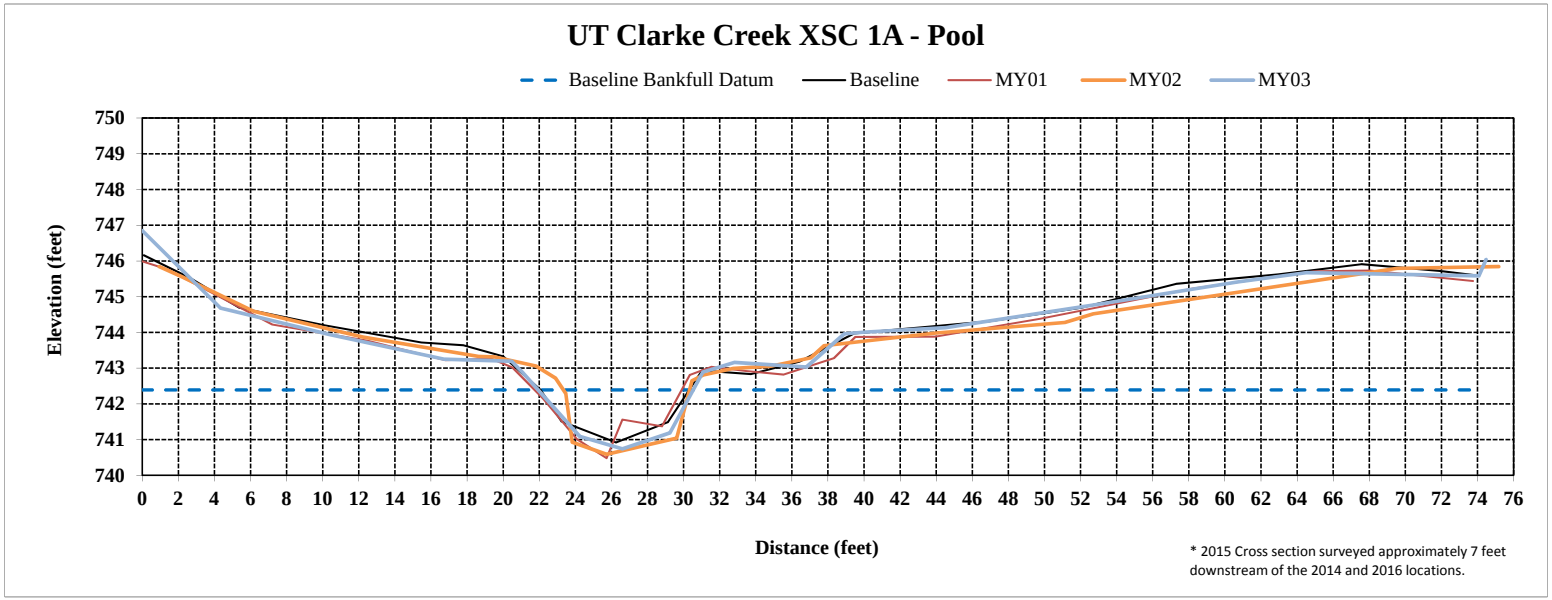
Station	Elevation
0	746.85
4.34	744.68
10.4	743.94
16.75	743.25
20.47	743.19
21.08	742.88
22.36	742.15
24.24	741.09
26.61	740.74
29.24	741.19
31.07	742.89
32.81	743.16
36.8	743.03
38.91	743.96
40.07	744.01
44.51	744.13
53.11	744.8
60.69	745.41
64.5	745.67
74.08	745.58
74.48	746.04

Reach	UT to Clarke Creek
River Basin	Yadkin/Pee Dee
Cross Section ID	XSC-1A, Pool, 5+58
Drainage Area (Sq Mi)	1.08
Date	10/21/2016
Observers	P. Beach, E. Webster

SUMMARY DATA	
Baseline Bankfull Datum, ft	742.39
Bankfull Cross Sectional Area, ft^2	7.92
Bankfull Width, ft	8.71
Max Depth at Bankfull, ft	1.65
Mean Depth at Bankfull, ft	0.91
Width/Depth Ratio	9.58
Flood Prone Width, ft	29.00
Flood Prone Area Elevation	744.04
Entrenchment Ratio	3.33
Bank Height Ratio	1.47

Stream Type	E4

Sta. 5+58 Looking Downstream



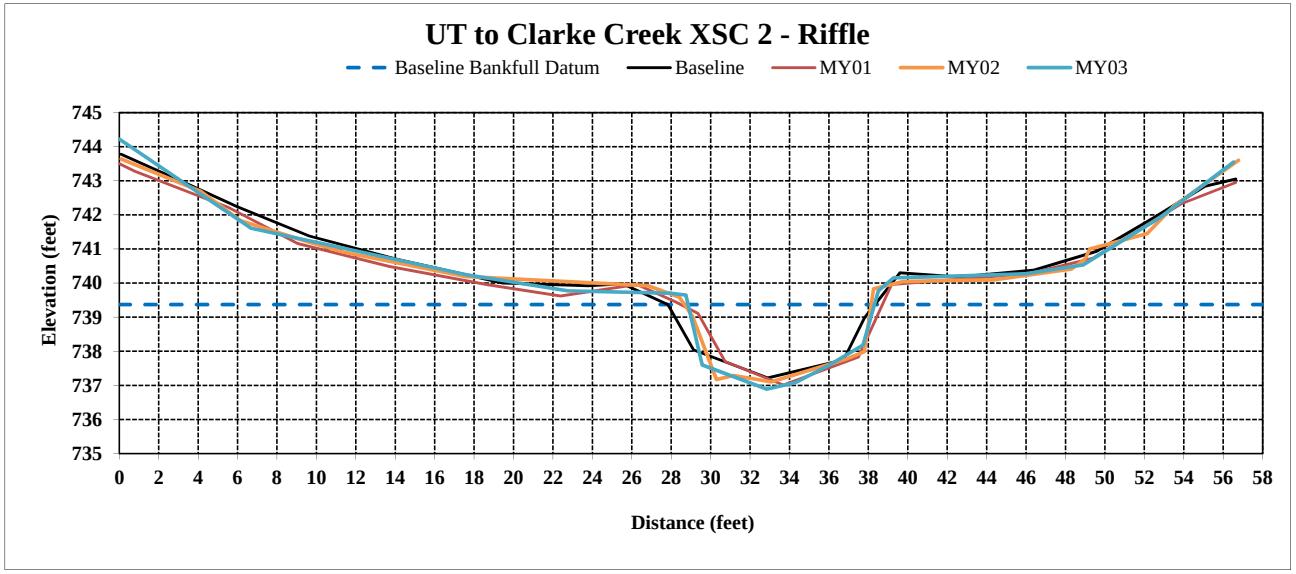
Station	Elevation
0	744.22
6.67	741.61
17.56	740.25
22.77	739.77
27.92	739.7
28.74	739.65
29.57	737.6
32.85	736.89
34.31	737.08
36.02	737.6
37.73	738.18
38.51	739.77
39.28	740.15
41.1	740.18
45.94	740.27
48.89	740.53
52.82	741.93
56.53	743.55

Reach	UT to Clarke Creek
River Basin	Yadkin/Pee Dee
Cross Section ID	XSC-2, Riffle, 9+33
Drainage Area (Sq Mi)	1.08
Date	10/21/2016
Observers	P. Beach, E. Webster

SUMMARY DATA	
Baseline Bankfull Datum, ft	739.37
Bankfull Cross Sectional Area, ft^2	20.16
Bankfull Width, ft	9.77
Max Depth at Bankfull, ft	2.48
Mean Depth at Bankfull, ft	2.06
Width/Depth Ratio	4.73
Flood Prone Width, ft	47.25
Flood Prone Area Elevation	741.85
Entrenchment Ratio	4.84
Bank Height Ratio	1.09

Stream Type	E4

Sta. 9+33 Looking Downstream



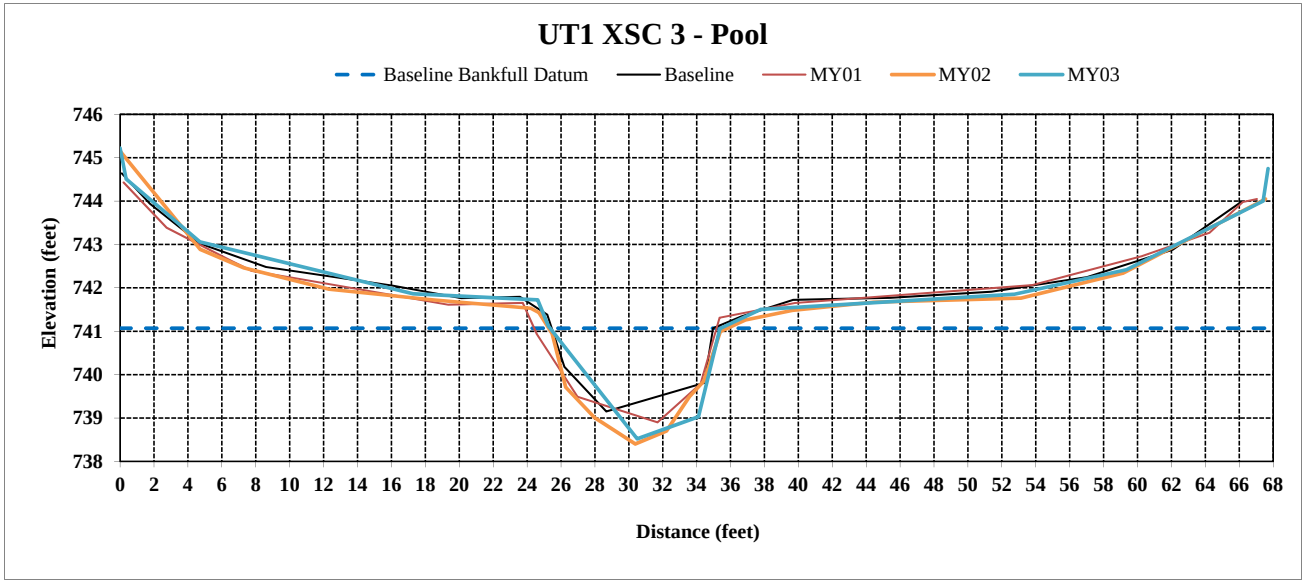
Station	Elevation
0	745.22
0.35	744.51
4.7	743.06
17.3	741.86
24.62	741.72
25.26	741.12
26.67	740.41
30.49	738.52
34.11	739.03
35.37	741.06
37.76	741.50
52.71	741.85
59.35	742.42
67.41	744.00
67.7	744.75

Reach	UT1
River Basin	Yadkin/Pee Dee
Cross Section ID	XSC-3, Pool, 7+25
Drainage Area (Sq Mi)	0.46
Date	10/21/2016
Observers	P. Beach, E. Webster

SUMMARY DATA	
Baseline Bankfull Datum, ft	741.07
Bankfull Cross Sectional Area, ft^2	19.48
Bankfull Width, ft	10.11
Max Depth at Bankfull, ft	2.55
Mean Depth at Bankfull, ft	1.93
Width/Depth Ratio	5.25
Flood Prone Width, ft	62.00
Flood Prone Area Elevation	743.62
Entrenchment Ratio	6.13
Bank Height Ratio	1.17

Stream Type	B4c

Sta. 7+25 Looking Downstream



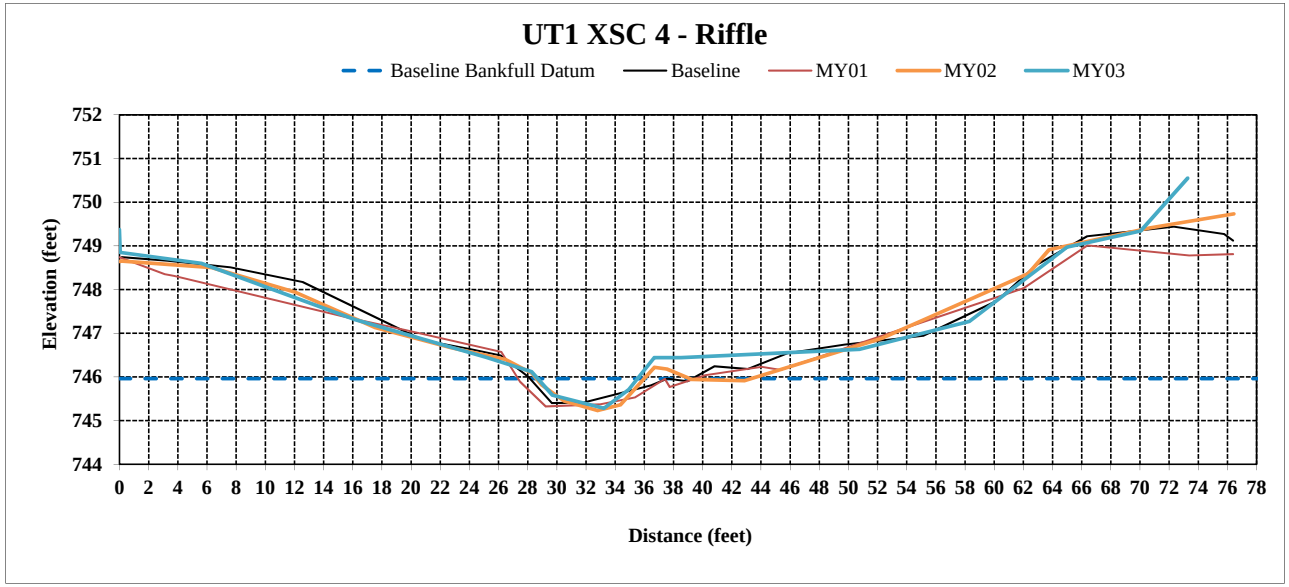
Station	Elevation
0	749.37
0.05	748.85
5.6	748.6
16.16	747.31
25.13	746.45
28.26	746.12
29.7	745.58
33.23	745.28
34.93	745.71
36.67	746.44
38.52	746.44
50.74	746.63
58.3	747.27
64.99	748.97
70.04	749.34
73.27	750.55

Reach	UT1
River Basin	Yadkin/Pee Dee
Cross Section ID	XSC-4, Riffle, 1+26
Drainage Area (Sq Mi)	0.46
Date	10/21/2016
Observers	P. Beach, E. Webster

SUMMARY DATA	
Baseline Bankfull Datum, ft	745.96
Bankfull Cross Sectional Area, ft^2	4.24
Bankfull Width, ft	8.41
Max Depth at Bankfull, ft	0.68
Mean Depth at Bankfull, ft	0.50
Width/Depth Ratio	16.67
Flood Prone Width, ft	26
Flood Prone Area Elevation	746.64
Entrenchment Ratio	3.09
Bank Height Ratio	1.99

Stream Type	B4c

Sta. 1+26 Looking Downstream



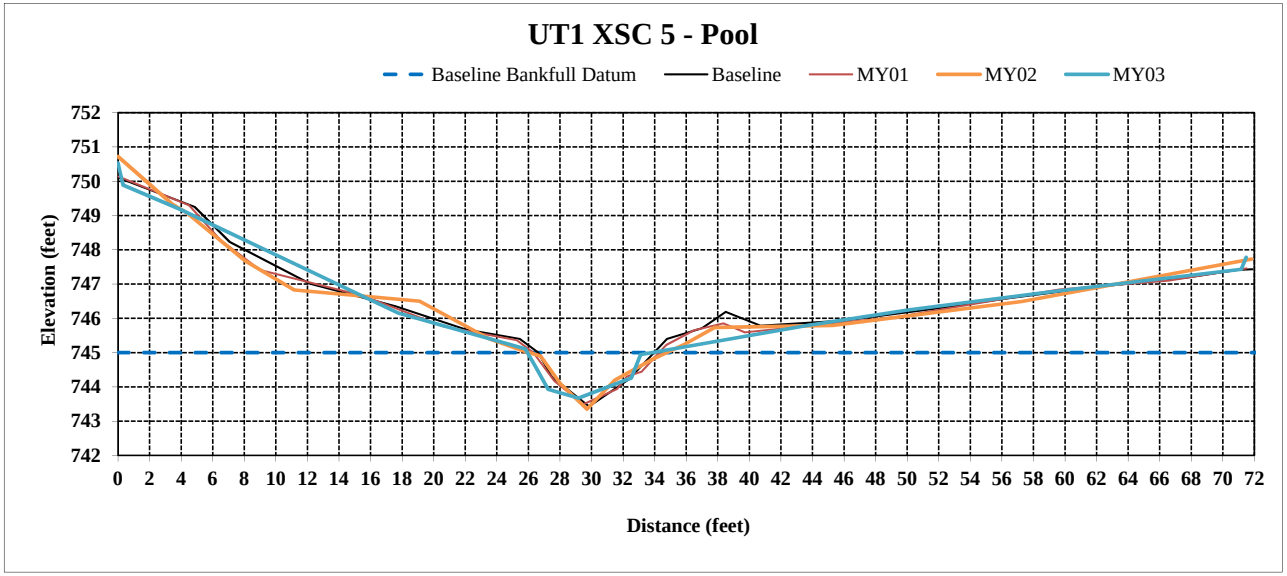
Station	Elevation
0	750.53
0.31	749.89
3.89	749.19
17.72	746.16
25.8	745.11
26.44	744.6
27.25	743.93
29.18	743.67
32.52	744.26
33.11	744.94
43.66	745.79
50.14	746.25
58.65	746.75
71.17	747.43
71.48	747.78

Reach	UT1
River Basin	Yadkin/Pee Dee
Cross Section ID	XSC-5, Pool, 2+66
Drainage Area (Sq Mi)	0.46
Date	10/21/2016
Observers	P. Beach, E. Webster

SUMMARY DATA	
Baseline Bankfull Datum, ft	745.90
Bankfull Cross Sectional Area, ft^2	6.20
Bankfull Width, ft	7.31
Max Depth at Bankfull, ft	1.33
Mean Depth at Bankfull, ft	0.85
Width/Depth Ratio	8.61
Flood Prone Width, ft	34
Flood Prone Area Elevation	746.33
Entrenchment Ratio	4.65
Bank Height Ratio	1.59

Stream Type	B4c

Sta. 2+66 Looking Downstream



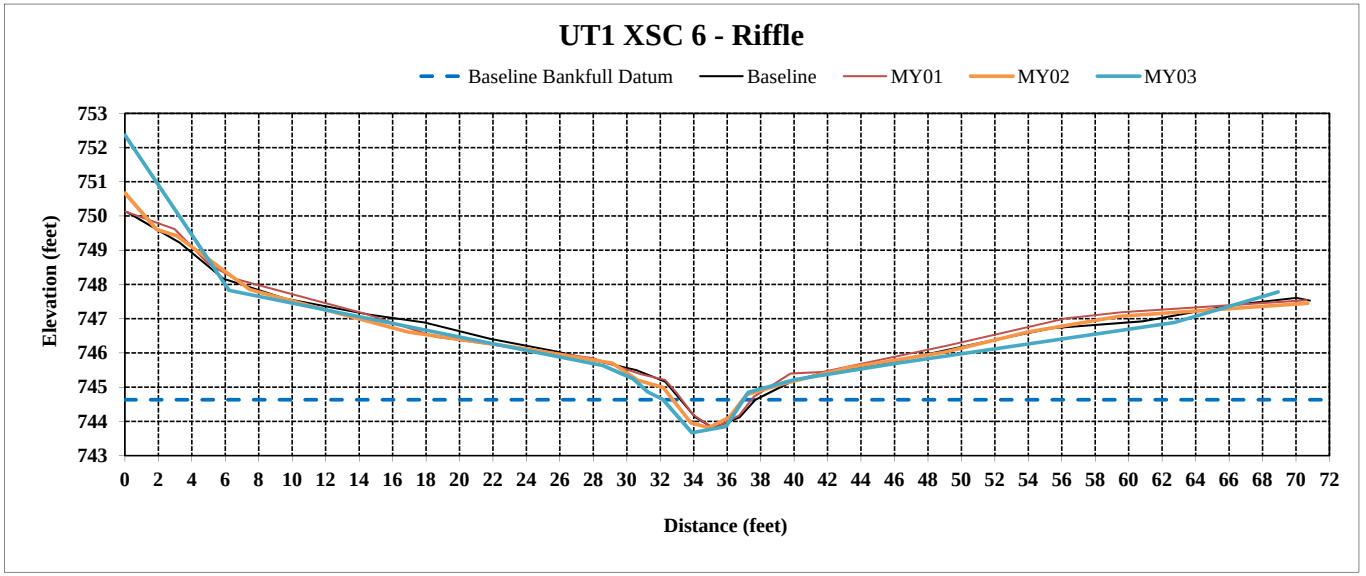
Station	Elevation
0	752.36
6.23	747.83
22.92	746.18
28.58	745.63
30.37	745.25
31.26	744.86
32.16	744.64
33.9	743.67
35.93	743.85
37.26	744.85
40.04	745.22
46.18	745.7
62.73	746.89
68.93	747.78

Reach	UT1
River Basin	Yadkin/Pee Dee
Cross Section ID	XSC-6, Riffle, 3+33
Drainage Area (Sq Mi)	0.46
Date	10/21/2016
Observers	P. Beach, E. Webster

SUMMARY DATA	
Baseline Bankfull Datum, ft	744.63
Bankfull Cross Sectional Area, ft^2	4.23
Bankfull Width, ft	6
Max Depth at Bankfull, ft	0.96
Mean Depth at Bankfull, ft	0.71
Width/Depth Ratio	8.51
Flood Prone Width, ft	16
Flood Prone Area Elevation	745.59
Entrenchment Ratio	2.67
Bank Height Ratio	1.61

Stream Type	B4c

Sta. 3+33 Looking Downstream



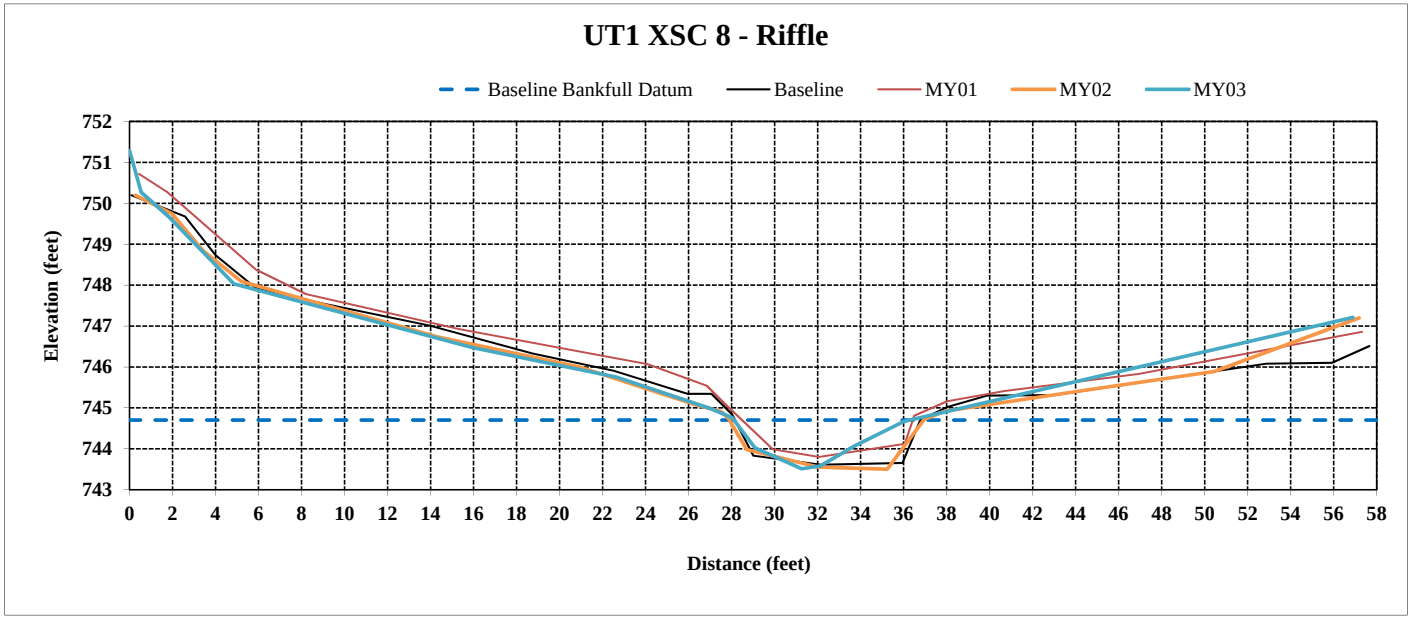
Station	Elevation
0	751.29
0.54	750.27
1.83	749.67
4.85	748.03
15.97	746.47
22.65	745.75
27.03	744.98
28.03	744.76
29.09	744.02
31.25	743.51
32.13	743.58
33.72	744.07
36.01	744.67
56.89	747.21

Reach	UT1
River Basin	Yadkin/Pee Dee
Cross Section ID	XSC-8, Riffle, 4+14
Drainage Area (Sq Mi)	0.46
Date	10/21/2016
Observers	P. Beach, E. Webster

SUMMARY DATA	
Baseline Bankfull Datum, ft	744.70
Bankfull Cross Sectional Area, ft^2	5.68
Bankfull Width, ft	5.69
Max Depth at Bankfull, ft	1.19
Mean Depth at Bankfull, ft	1.00
Width/Depth Ratio	5.70
Flood Prone Width, ft	24
Flood Prone Area Elevation	745.89
Entrenchment Ratio	4.22
Bank Height Ratio	1.24

Stream Type	B4c

Sta. 4+14 Looking Downstream



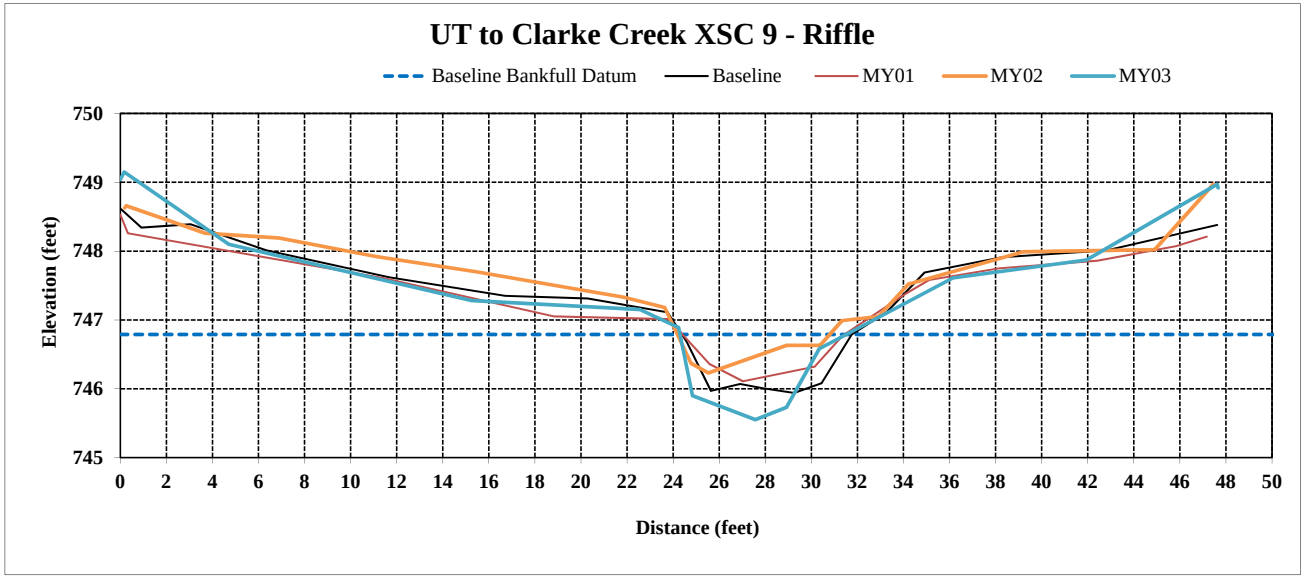
Station	Elevation
0	749.04
0.17	749.15
4.71	748.1
15.26	747.28
22.56	747.15
24.24	746.89
24.84	745.9
27.57	745.55
28.92	745.73
30.34	746.58
36.15	747.61
41.94	747.87
47.62	748.97
47.66	748.92

Reach	UT to Clarke Creek
River Basin	Yadkin/Pee Dee
Cross Section ID	XSC-9, Riffle, 2+02
Drainage Area (Sq Mi)	1.08
Date	10/21/2016
Observers	P. Beach, E. Webster

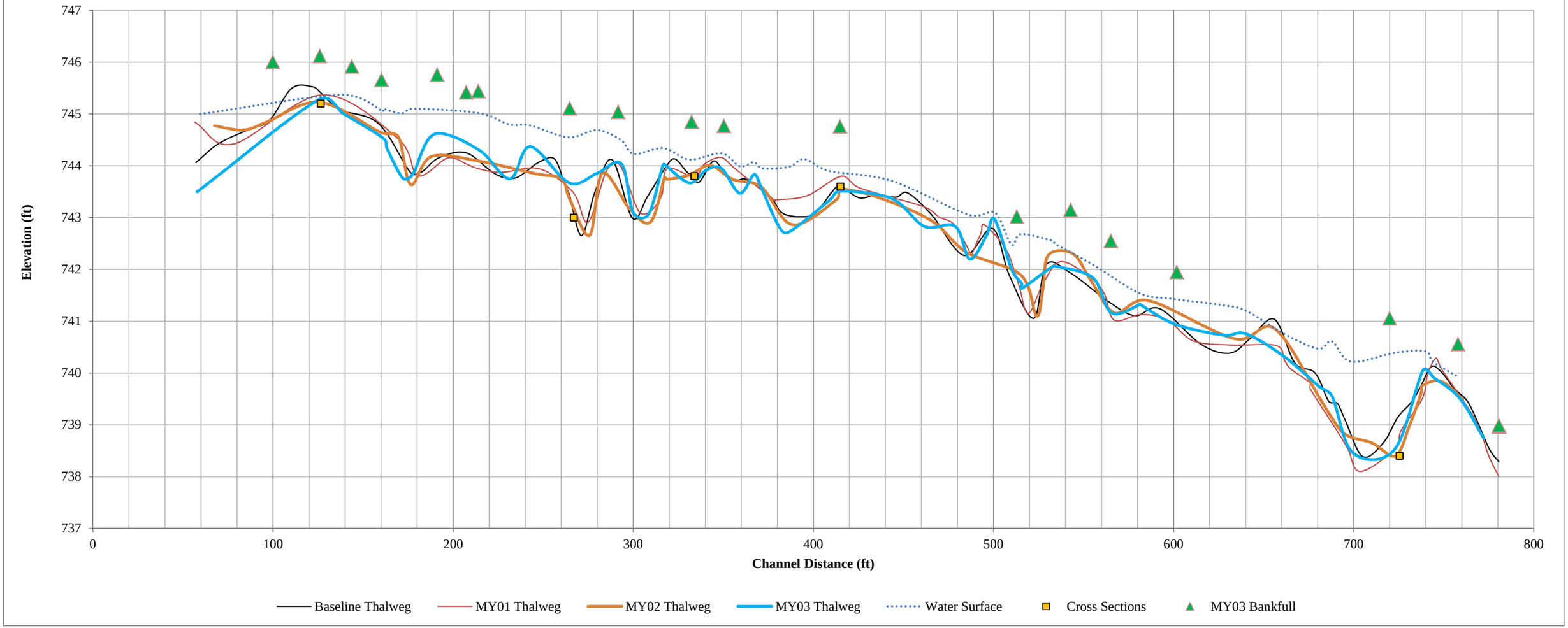
SUMMARY DATA	
Baseline Bankfull Datum, ft	746.79
Bankfull Cross Sectional Area, ft^2	4.41
Bankfull Width, ft	6.1
Max Depth at Bankfull, ft	1.24
Mean Depth at Bankfull, ft	0.72
Width/Depth Ratio	8.44
Flood Prone Width, ft	38
Flood Prone Area Elevation	748.03
Entrenchment Ratio	6.23
Bank Height Ratio	1.29

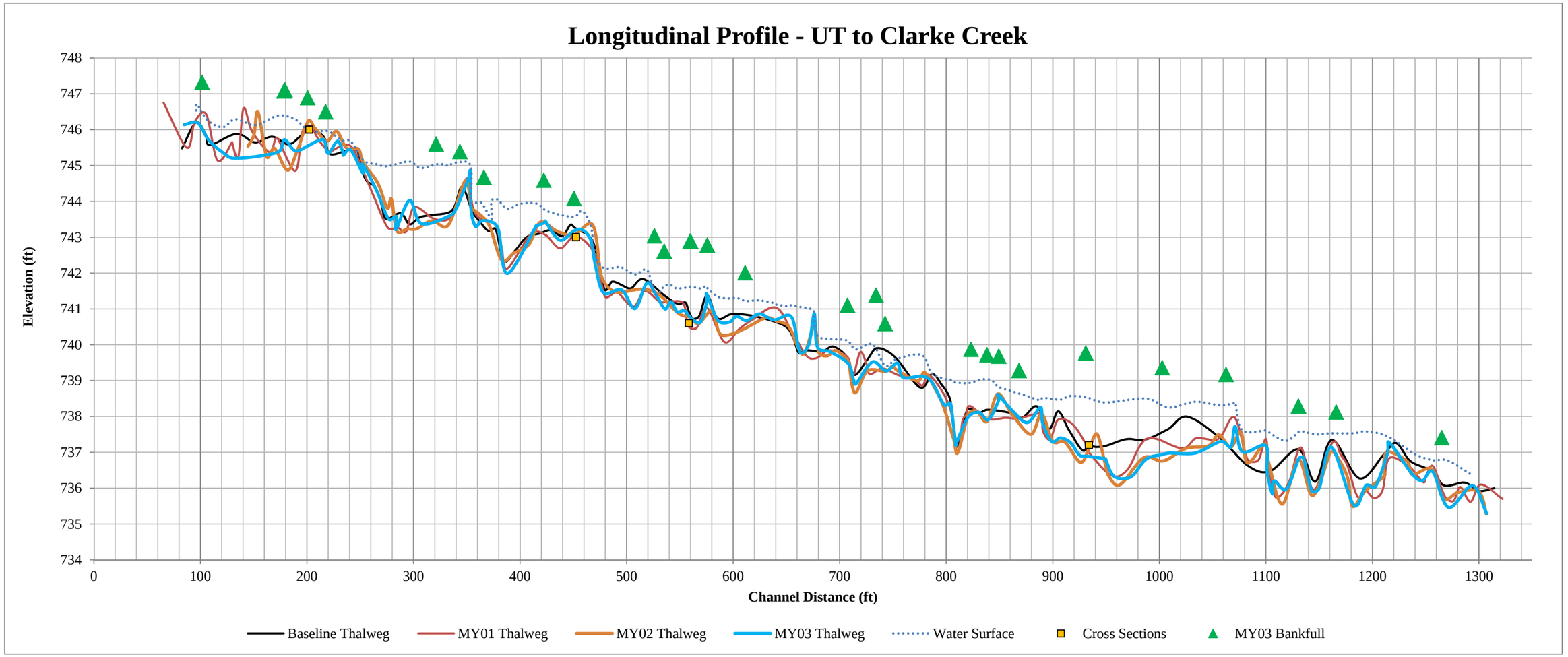
Stream Type	E4

Sta. 2+02 Looking Downstream



Longitudinal Profile - UT 1



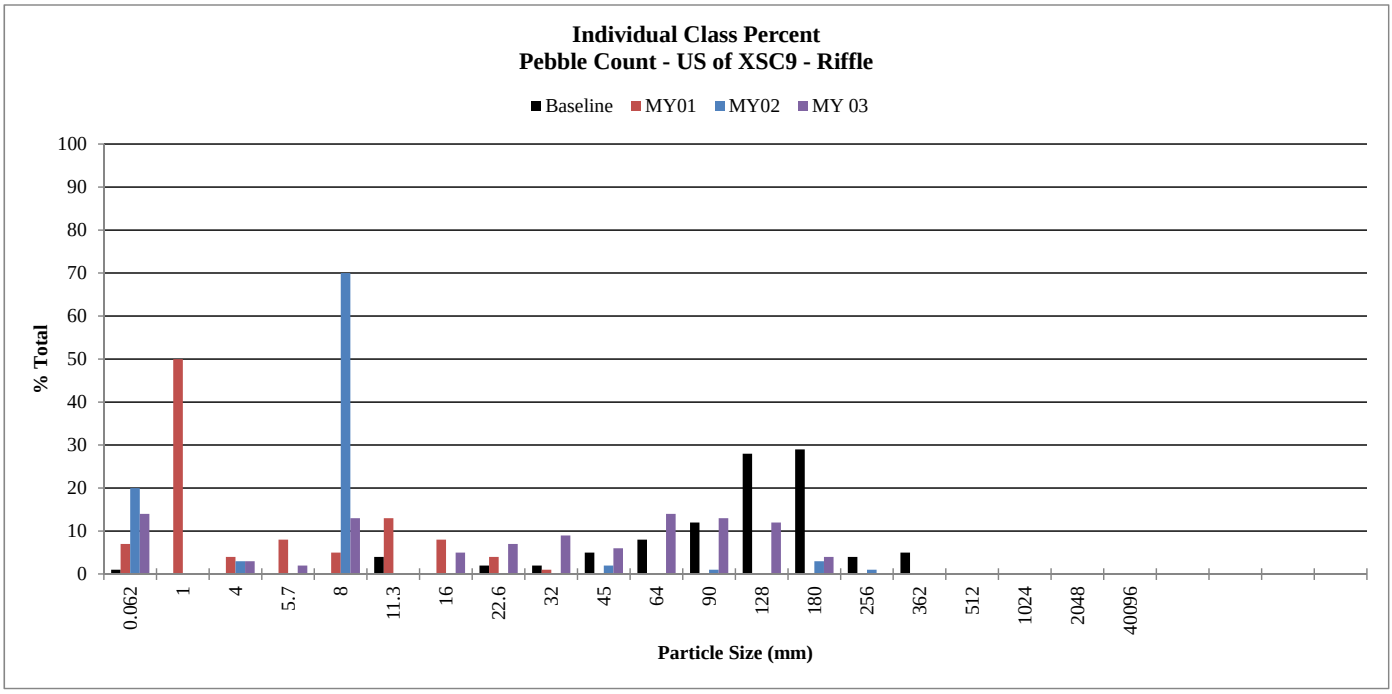

Longitudinal Profile - UT to Clarke Creek
Elevation (ft)
748
747
746
745
744
743
742
741
740
739
738
737
736
735
734
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
Channel Distance (ft)
Baseline Thalweg
MY01 Thalweg
MY02 Thalweg
MY03 Thalweg
Water Surface
Cross Sections
MY03 Bankfull

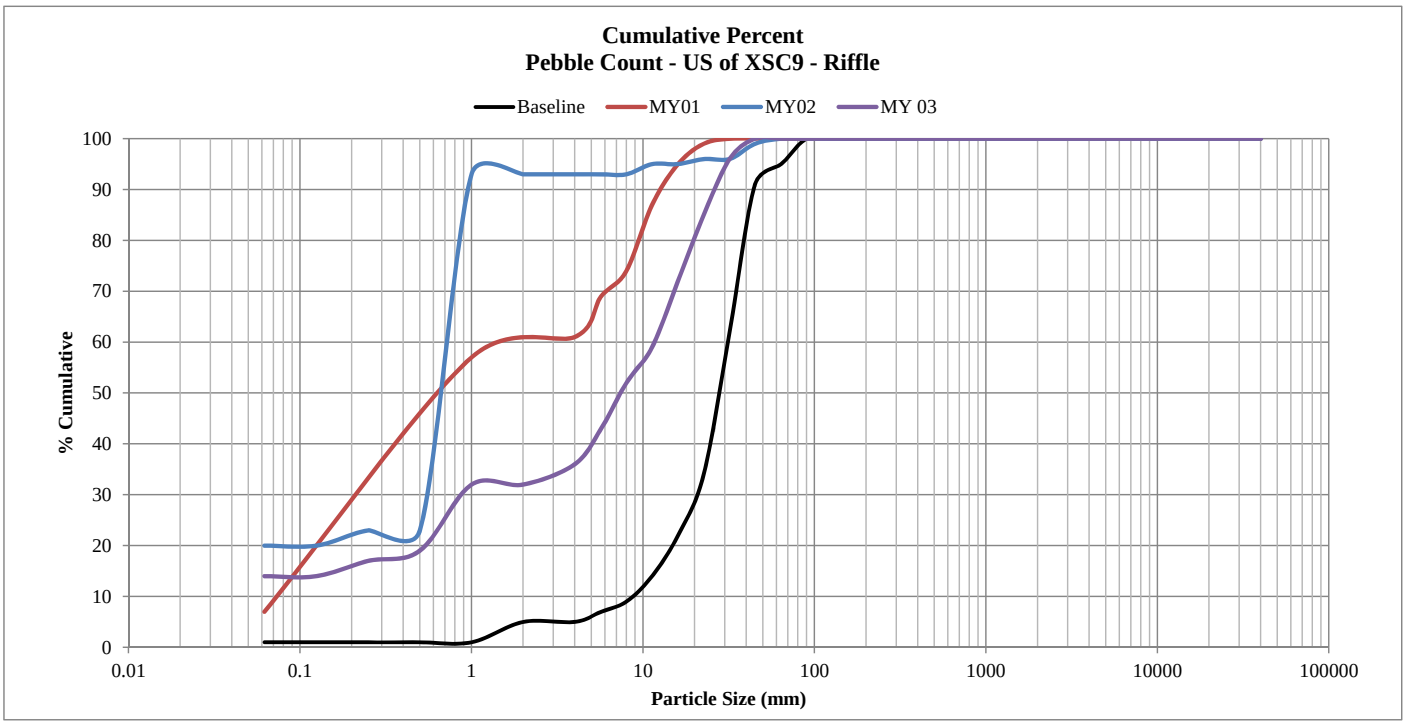
UT to Clarke Creek - US of XS9 - Riffle Pebble Count

Location: STA 2+02

Inches	Particle	Millimeters		Count	% Total	% Cum.
	Silt/Clay	<0.062		16	14	14
	Very Fine	0.062-0.125	S	0	0	14
	Fine	0.125-0.25	A	3	3	17
	Medium	0.25-0.50	N	2	2	19
	Coarse	0.50-1.0	D	14	13	32
0.04-0.08	Very Coarse	1.0-2		0	0	32
0.08-0.16	Very Fine	2-4		5	5	36
0.16-0.22	Fine	4-5.7		8	7	43
0.22-0.31	Fine	5.7-8	G	10	9	52
0.31-0.44	Medium	8-11.3	R	7	6	59
0.44-0.63	Medium	11.3-16	A	15	14	72
0.63-0.89	Coarse	16-22.6	V	14	13	85
0.89-1.26	Coarse	22.6-32	E	13	12	96
1.26-1.77	Very Coarse	32-45	L	4	4	100
1.77-2.5	Very Coarse	45-64		0	0	100
2.5-3.5	Small	64-90		0	0	100
3.5-5.0	Small	90-128	C	0	0	100
5.0-7.1	Medium	128-180	O	0	0	100
7.1-10.1	Large	180-256	B	0	0	100
10.1-14.3	Small	256-362	B	0	0	100
14.3-20	Small	362-512	L	0	0	100
20-40	Medium	512-1024	E	0	0	100
40-80	Large	1024-2048		0	0	100
	Bedrock	Bedrock	Bedrock	0	0	100
			Total Counted	111		

Summary Data	
D50	7.5
D84	22
D95	31


Individual Class Percent
Pebble Count - US of XSC9 - Riffle
Baseline
MY01
MY02
MY 03
% Total
100
90
80
70
60
50
40
30
20
10
0
0.062
1
4
5.7
8
11.3
16
22.6
32
45
64
90
128
180
256
362
512
1024
2048
40096
Particle Size (mm)

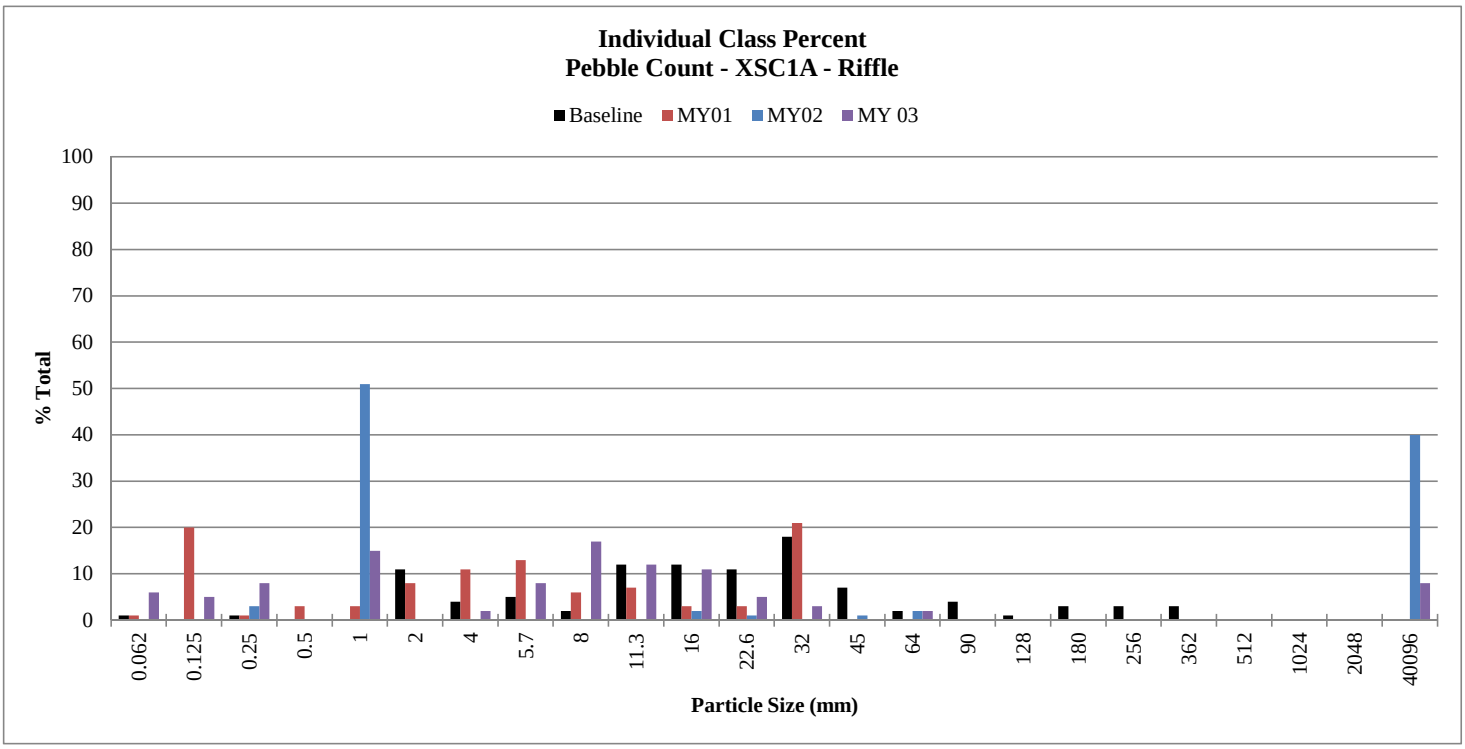

Cumulative Percent
Pebble Count - US of XSC9 - Riffle
Baseline
MY01
MY02
MY 03
% Cumulative
100
90
80
70
60
50
40
30
20
10
0
0.01
0.1
1
10
100
1000
10000
100000
Particle Size (mm)

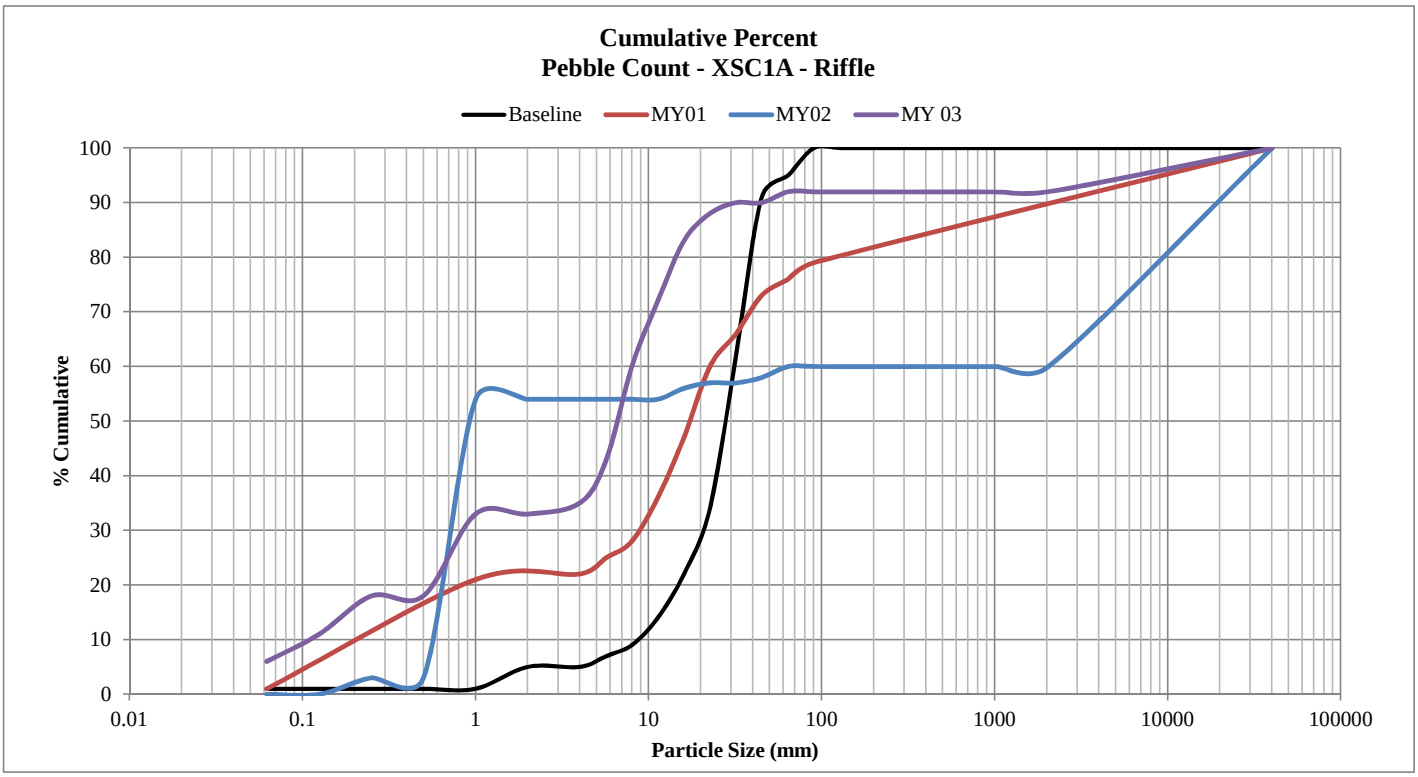
UT to Clarke Creek - XS1A - Riffle Pebble Count

Location: STA 5+58

Inches	Particle	Millimeters		Count	% Total	% Cum.
	Silt/Clay	<0.062	SAND	7	6	6
	Very Fine	0.062-0.125		6	5	11
	Fine	0.125-0.25		9	8	18
	Medium	0.25-0.50		0	0	18
	Coarse	0.50-1.0		18	15	33
0.04-0.08	Very Coarse	1.0-2		0	0	33
0.08-0.16	Very Fine	2-4	GRAVEL	2	2	35
0.16-0.22	Fine	4-5.7		10	8	43
0.22-0.31	Fine	5.7-8		20	17	60
0.31-0.44	Medium	8-11.3		14	12	72
0.44-0.63	Medium	11.3-16		13	11	83
0.63-0.89	Coarse	16-22.6		6	5	88
0.89-1.26	Coarse	22.6-32		3	3	90
1.26-1.77	Very Coarse	32-45		0	0	90
1.77-2.5	Very Coarse	45-64		2	2	92
2.5-3.5	Small	64-90	COBBLE	0	0	92
3.5-5.0	Small	90-128		0	0	92
5.0-7.1	Medium	128-180		0	0	92
7.1-10.1	Large	180-256		0	0	92
10.1-14.3	Small	256-362	BOULDER	0	0	92
14.3-20	Small	362-512		0	0	92
20-40	Medium	512-1024		0	0	92
40-80	Large	1024-2048		0	0	92
	Bedrock	Bedrock	Bedrock	10	8	100
			Total Counted	120		

Summary Data	
D50	6.75
D84	18
D95	3,000


Individual Class Percent
Pebble Count - XSC1A - Riffle
Baseline
MY01
MY02
MY 03
% Total
100
90
80
70
60
50
40
30
20
10
0
0.062
0.125
0.25
0.5
1
2
4
5.7
8
11.3
16
22.6
32
45
64
90
128
180
256
362
512
1024
2048
40096
Particle Size (mm)

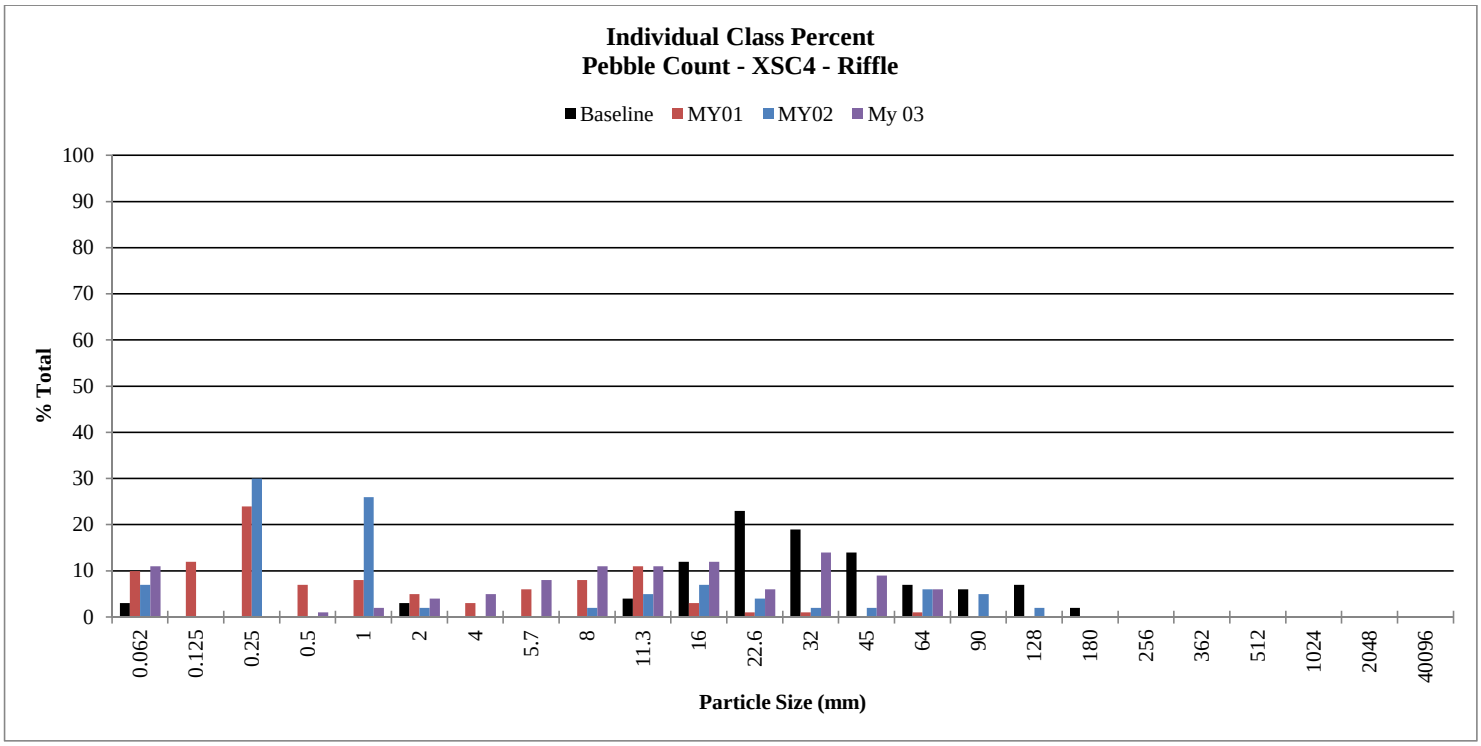

Cumulative Percent
Pebble Count - XSC1A - Riffle
Baseline
MY01
MY02
MY 03
% Cumulative
100
90
80
70
60
50
40
30
20
10
0
0.01
0.1
1
10
100
1000
10000
100000
Particle Size (mm)

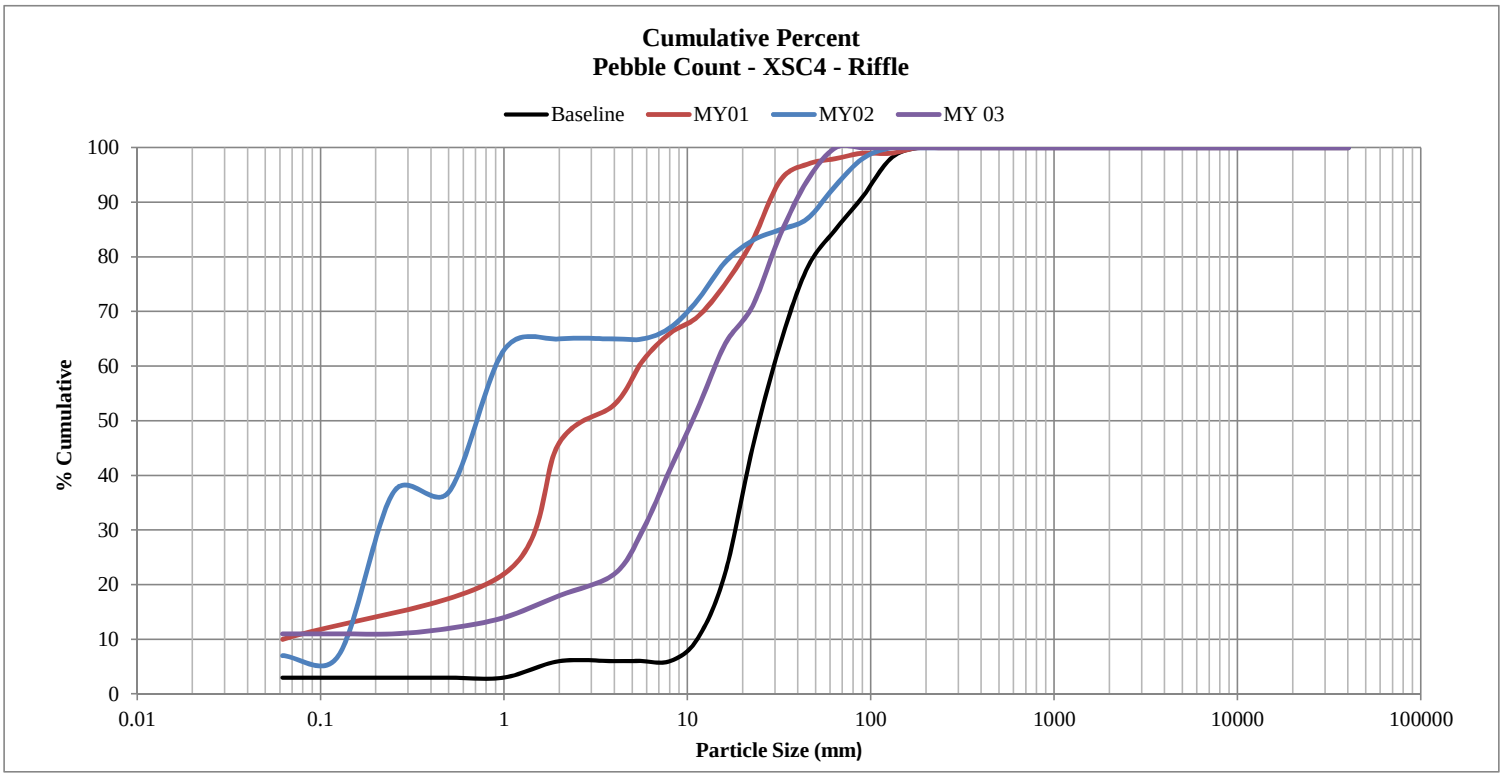
UT to Clarke Creek - Reach: UT1 - XS4 - Riffle Pebble Count

Location: STA 1+29

Inches	Particle	Millimeters		Count	% Total	% Cum.
	Silt/Clay	<0.062		14	11	11
	Very Fine	0.062-0.125	S	0	0	11
	Fine	0.125-0.25	A	0	0	11
	Medium	0.25-0.50	N	1	1	12
	Coarse	0.50-1.0	D	3	2	14
0.04-0.08	Very Coarse	1.0-2		5	4	18
0.08-0.16	Very Fine	2-4		6	5	22
0.16-0.22	Fine	4-5.7		10	8	30
0.22-0.31	Fine	5.7-8	G	14	11	41
0.31-0.44	Medium	8-11.3	R	14	11	52
0.44-0.63	Medium	11.3-16	A	16	12	64
0.63-0.89	Coarse	16-22.6	V	8	6	71
0.89-1.26	Coarse	22.6-32	E	18	14	84
1.26-1.77	Very Coarse	32-45	L	12	9	94
1.77-2.5	Very Coarse	45-64		8	6	100
2.5-3.5	Small	64-90	C	0	0	100
3.5-5.0	Small	90-128	O	0	0	100
5.0-7.1	Medium	128-180	B	0	0	100
7.1-10.1	Large	180-256	B L E	0	0	100
10.1-14.3	Small	256-362	B	0	0	100
14.3-20	Small	362-512	O	0	0	100
20-40	Medium	512-1024	U L D	0	0	100
40-80	Large	1024-2048	E R	0	0	100
	Bedrock	Bedrock	Bedrock	0	0	100
			Total Counted	129		

Summary Data	
D50	10.5
D84	32
D95	46


Individual Class Percent
Pebble Count - XSC4 - Riffle
Baseline
MY01
MY02
My 03
% Total
100
90
80
70
60
50
40
30
20
10
0
0.062
0.125
0.25
0.5
1
2
4
5.7
8
11.3
16
22.6
32
45
64
90
128
180
256
362
512
1024
2048
40096
Particle Size (mm)

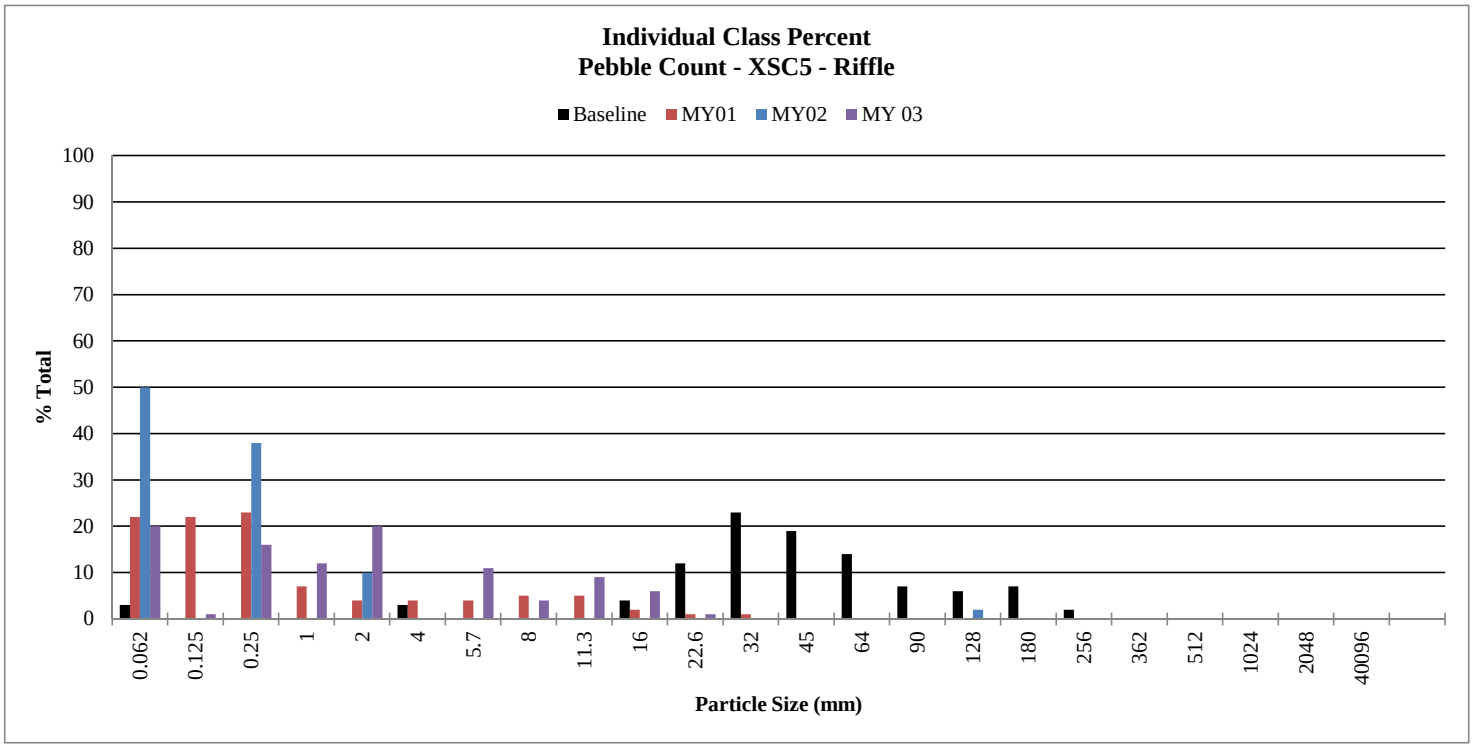

Cumulative Percent
Pebble Count - XSC4 - Riffle
Baseline
MY01
MY02
MY 03
% Cumulative
100
90
80
70
60
50
40
30
20
10
0
0.01
0.1
1
10
100
1000
10000
100000
Particle Size (mm)

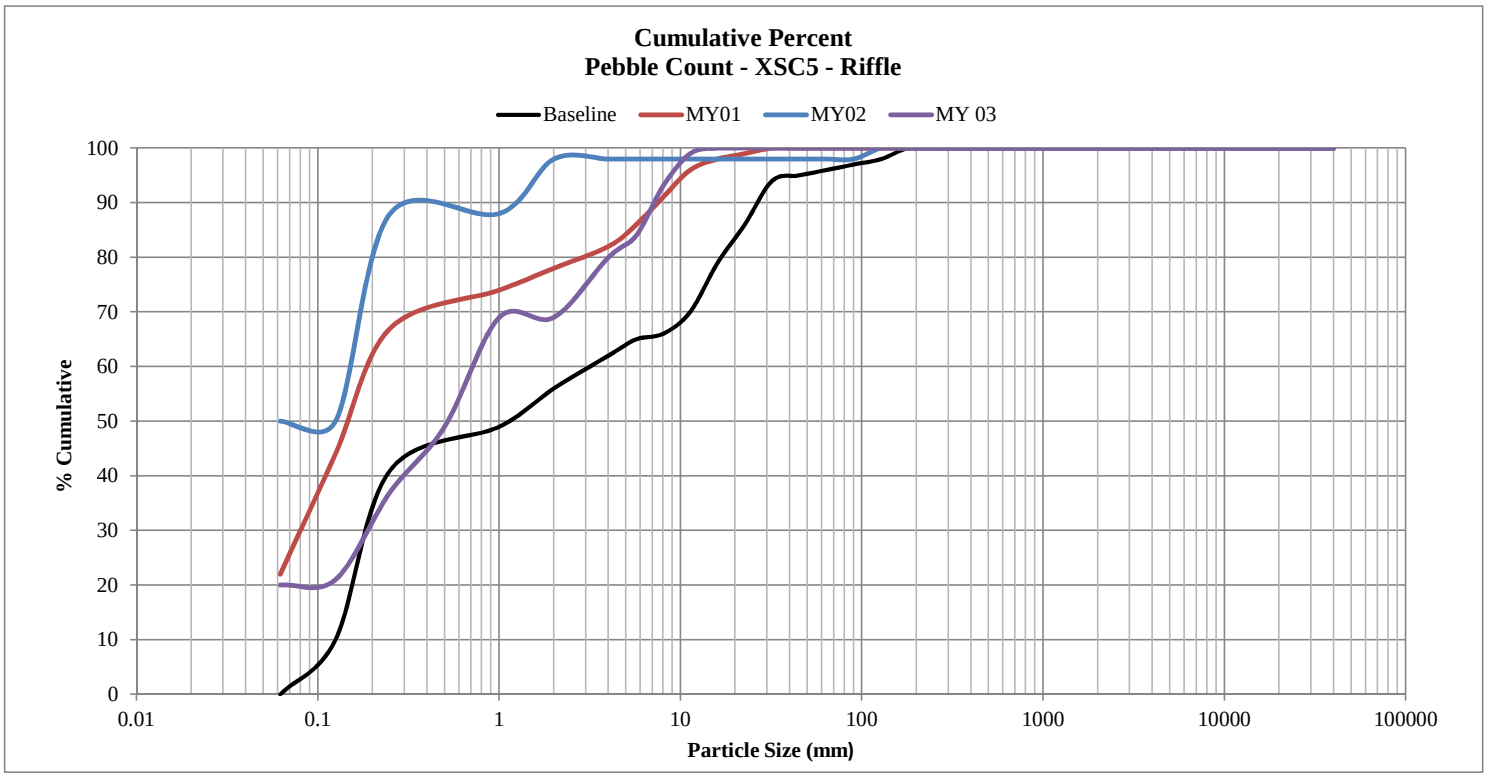
UT to Clarke Creek - Reach: UT1 - XS5 - Riffle Pebble Count

Location: STA 2+69

Inches	Particle	Millimeters		Count	% Total	% Cum.
	Silt/Clay	<0.062		20	20	20
	Very Fine	0.062-0.125	S	1	1	21
	Fine	0.125-0.25	A	16	16	37
	Medium	0.25-0.50	N	12	12	49
	Coarse	0.50-1.0	D	20	20	69
0.04-0.08	Very Coarse	1.0-2		0	0	69
0.08-0.16	Very Fine	2-4		11	11	80
0.16-0.22	Fine	4-5.7		4	4	84
0.22-0.31	Fine	5.7-8	G	9	9	93
0.31-0.44	Medium	8-11.3	R	6	6	99
0.44-0.63	Medium	11.3-16	A	1	1	100
0.63-0.89	Coarse	16-22.6	V	0	0	100
0.89-1.26	Coarse	22.6-32	E	0	0	100
1.26-1.77	Very Coarse	32-45	L	0	0	100
1.77-2.5	Very Coarse	45-64		0	0	100
2.5-3.5	Small	64-90		0	0	100
3.5-5.0	Small	90-128	C	0	0	100
5.0-7.1	Medium	128-180	O	0	0	100
7.1-10.1	Large	180-256	B	0	0	100
10.1-14.3	Small	256-362	B	0	0	100
14.3-20	Small	362-512	L	0	0	100
20-40	Medium	512-1024	E	0	0	100
40-80	Large	1024-2048		0	0	100
	Bedrock	Bedrock	Bedrock	0	0	100
			Total Counted	100		

Summary Data	
D50	0.55
D84	5.7
D95	8.5


Individual Class Percent
Pebble Count - XSC5 - Riffle
Baseline
MY01
MY02
MY 03
% Total
100
90
80
70
60
50
40
30
20
10
0
0.062
0.125
0.25
1
2
4
5.7
8
11.3
16
22.6
32
45
64
90
128
180
256
362
512
1024
2048
40096
Particle Size (mm)

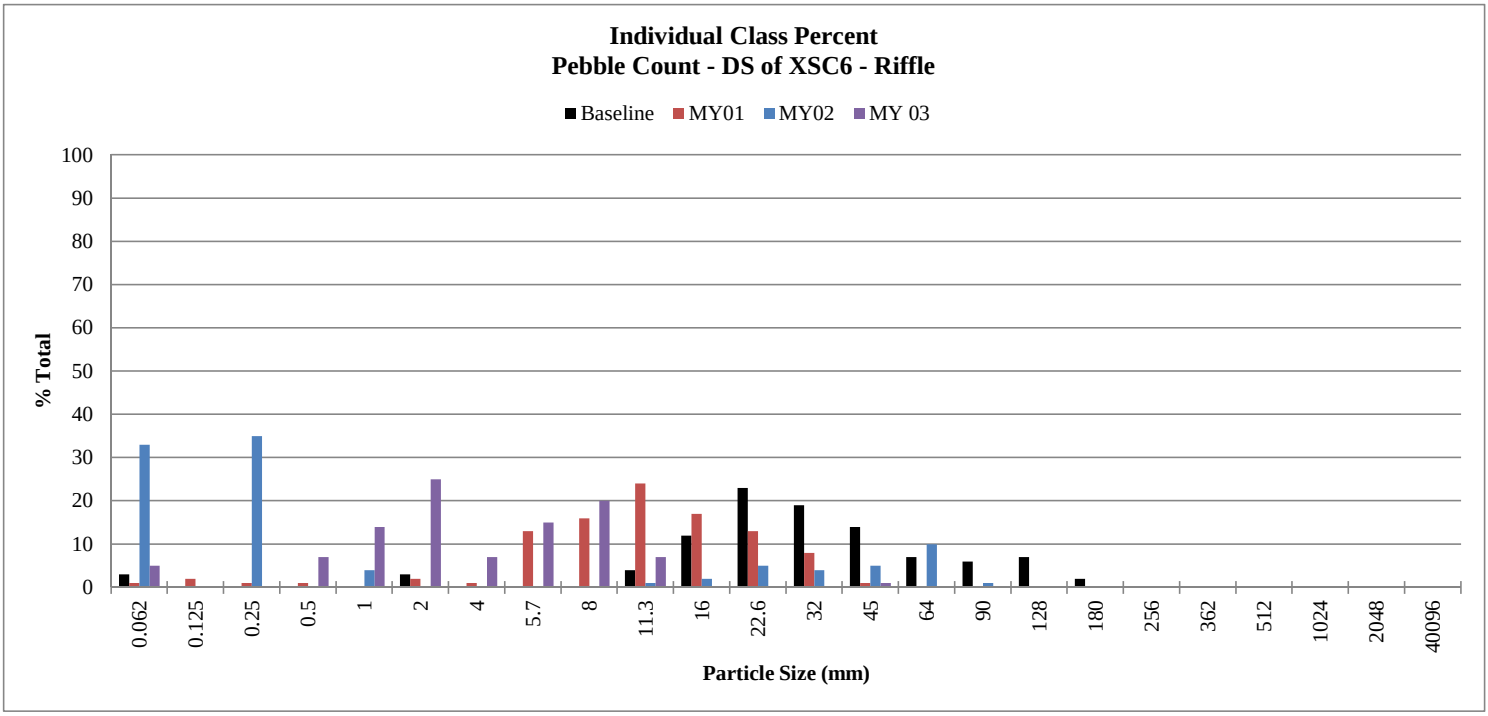

Cumulative Percent
Pebble Count - XSC5 - Riffle
Baseline
MY01
MY02
MY 03
% Cumulative
100
90
80
70
60
50
40
30
20
10
0
0.01
0.1
1
10
100
1000
10000
100000
Particle Size (mm)

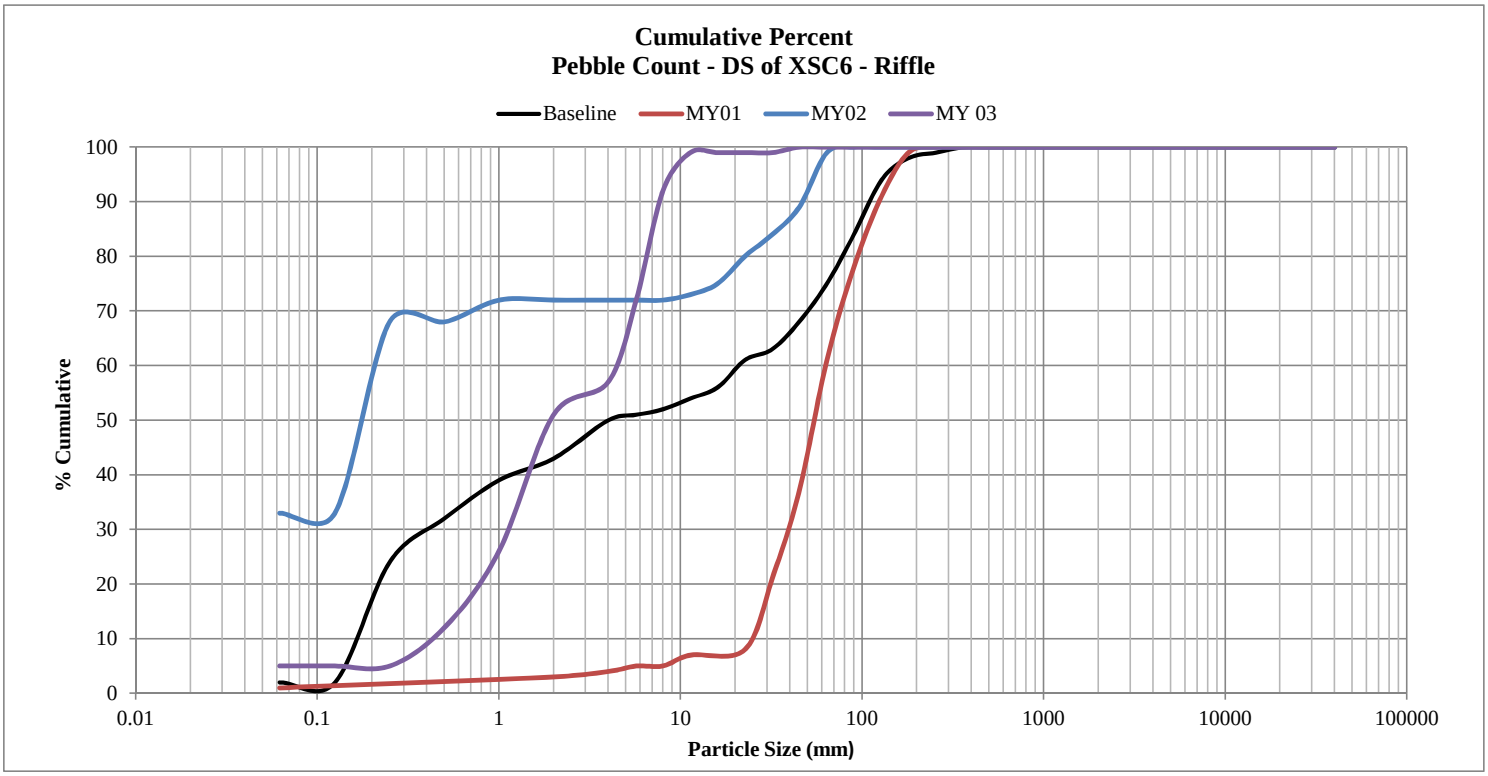
UT to Clarke Creek - Reach: UT1 - DS of XS6 - Riffle Pebble Count

Location: STA 3+34

Inches	Particle	Millimeters		Count	% Total	% Cum.
	Silt/Clay	<0.062		7	5	5
	Very Fine	0.062-0.125	S	0	0	5
	Fine	0.125-0.25	A	0	0	5
	Medium	0.25-0.50	N	9	7	12
	Coarse	0.50-1.0	D	19	14	26
0.04-0.08	Very Coarse	1.0-2		34	25	51
0.08-0.16	Very Fine	2-4		9	7	57
0.16-0.22	Fine	4-5.7		20	15	72
0.22-0.31	Fine	5.7-8	G	27	20	92
0.31-0.44	Medium	8-11.3	R	10	7	99
0.44-0.63	Medium	11.3-16	A	0	0	99
0.63-0.89	Coarse	16-22.6	V	0	0	99
0.89-1.26	Coarse	22.6-32	E	0	0	99
1.26-1.77	Very Coarse	32-45	L	1	1	100
1.77-2.5	Very Coarse	45-64		0	0	100
2.5-3.5	Small	64-90		0	0	100
3.5-5.0	Small	90-128	C	0	0	100
5.0-7.1	Medium	128-180	O	0	0	100
7.1-10.1	Large	180-256	B	0	0	100
10.1-14.3	Small	256-362	B	0	0	100
14.3-20	Small	362-512	L	0	0	100
20-40	Medium	512-1024	E	0	0	100
40-80	Large	1024-2048		0	0	100
	Bedrock	Bedrock	Bedrock	0	0	100
			Total Counted	136		

Summary Data	
D50	1.9
D84	7
D95	9


Individual Class Percent
Pebble Count - DS of XSC6 - Riffle
Baseline
MY01
MY02
MY 03
% Total
100
90
80
70
60
50
40
30
20
10
0
0.062
0.125
0.25
0.5
1
2
4
5.7
8
11.3
16
22.6
32
45
64
90
128
180
256
362
512
1024
2048
4096
Particle Size (mm)

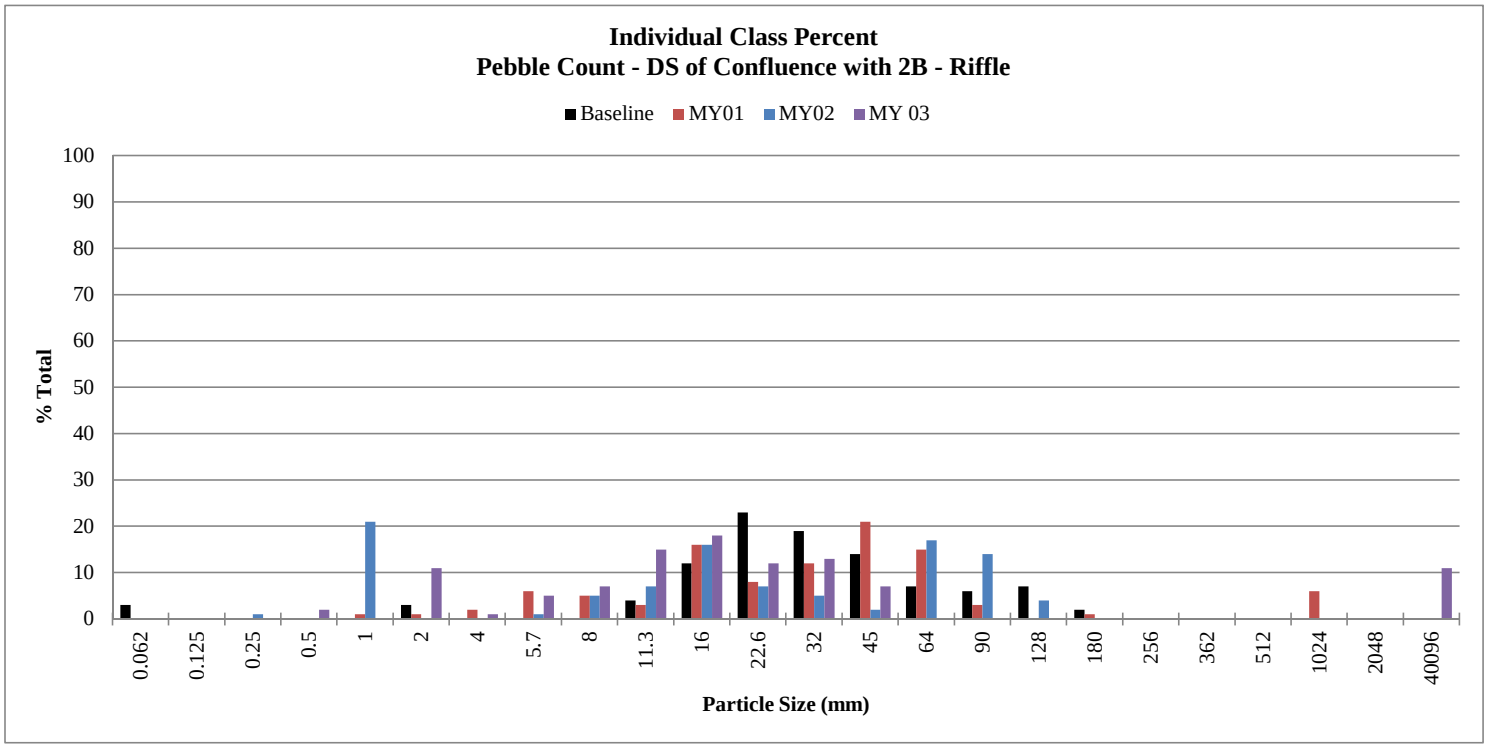

Cumulative Percent
Pebble Count - DS of XSC6 - Riffle
Baseline
MY01
MY02
MY 03
% Cumulative
100
90
80
70
60
50
40
30
20
10
0
0.01
0.1
1
10
100
1000
10000
100000
Particle Size (mm)

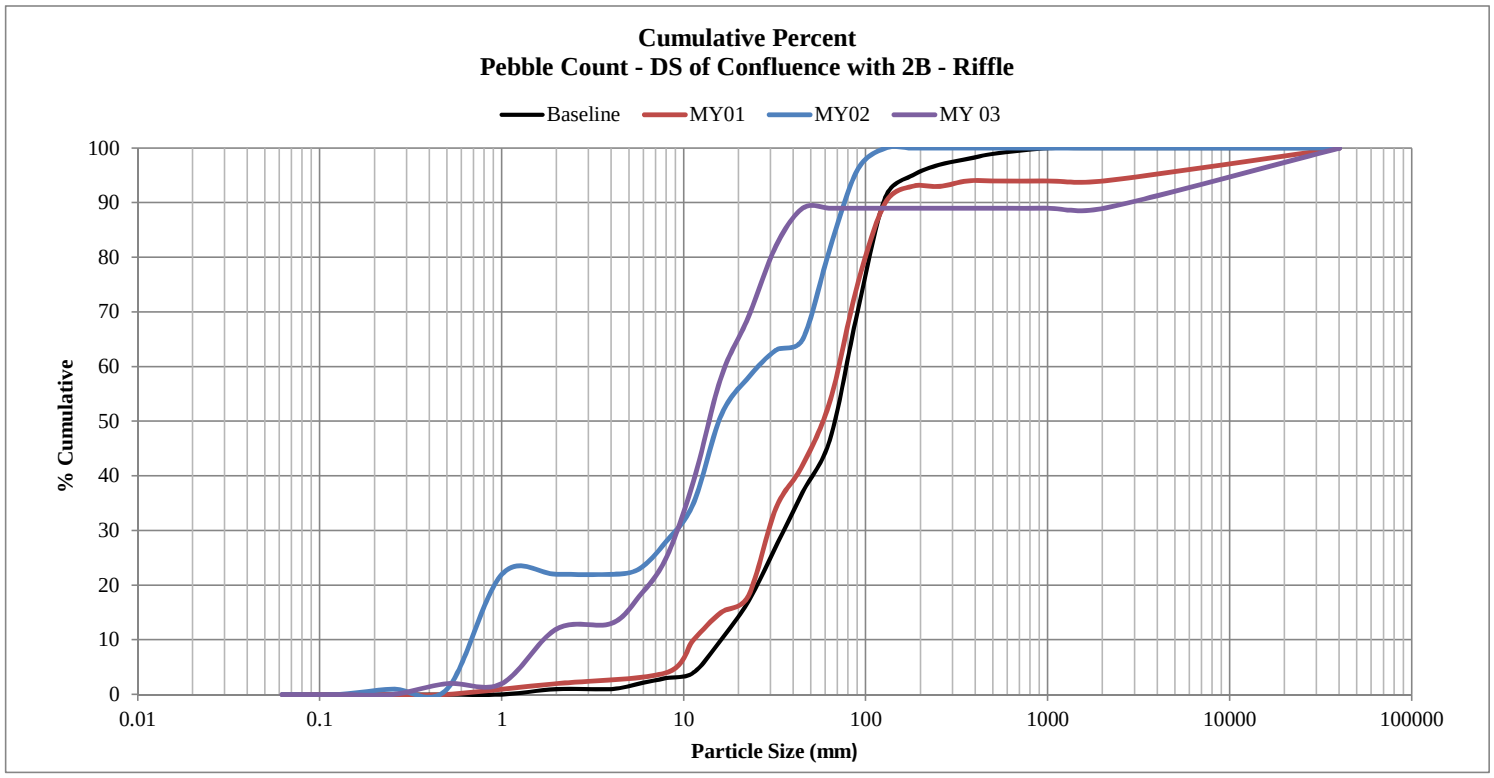
UT to Clarke Creek - DS of Confluence with 2B - Riffle Pebble Count

Location: STA 12+00

Inches	Particle	Millimeters		Count	% Total	% Cum.
	Silt/Clay	<0.062		0	0	0
	Very Fine	0.062-0.125	S	0	0	0
	Fine	0.125-0.25	A	0	0	0
	Medium	0.25-0.50	N	2	2	2
	Coarse	0.50-1.0	D	0	0	2
0.04-0.08	Very Coarse	1.0-2		14	11	12
0.08-0.16	Very Fine	2-4		1	1	13
0.16-0.22	Fine	4-5.7		6	5	18
0.22-0.31	Fine	5.7-8	G	9	7	25
0.31-0.44	Medium	8-11.3	R	19	15	39
0.44-0.63	Medium	11.3-16	A	24	18	58
0.63-0.89	Coarse	16-22.6	V	15	12	69
0.89-1.26	Coarse	22.6-32	E	17	13	82
1.26-1.77	Very Coarse	32-45	L	9	7	89
1.77-2.5	Very Coarse	45-64		0	0	89
2.5-3.5	Small	64-90	C	0	0	89
3.5-5.0	Small	90-128	O	0	0	89
5.0-7.1	Medium	128-180	B	0	0	89
7.1-10.1	Large	180-256	B L E	0	0	89
10.1-14.3	Small	256-362	B	0	0	89
14.3-20	Small	362-512	O	0	0	89
20-40	Medium	512-1024	U L D E R	0	0	89
40-80	Large	1024-2048		0	0	89
	Bedrock	Bedrock	Bedrock	14	11	100
			Total Counted	130		

Summary Data	
D50	15
D84	35
D95	10000


Individual Class Percent
Pebble Count - DS of Confluence with 2B - Riffle
Baseline
MY01
MY02
MY 03
% Total
100
90
80
70
60
50
40
30
20
10
0
0.062
0.125
0.25
0.5
1
2
4
5.7
8
11.3
16
22.6
32
45
64
90
128
180
256
362
512
1024
2048
40096
Particle Size (mm)

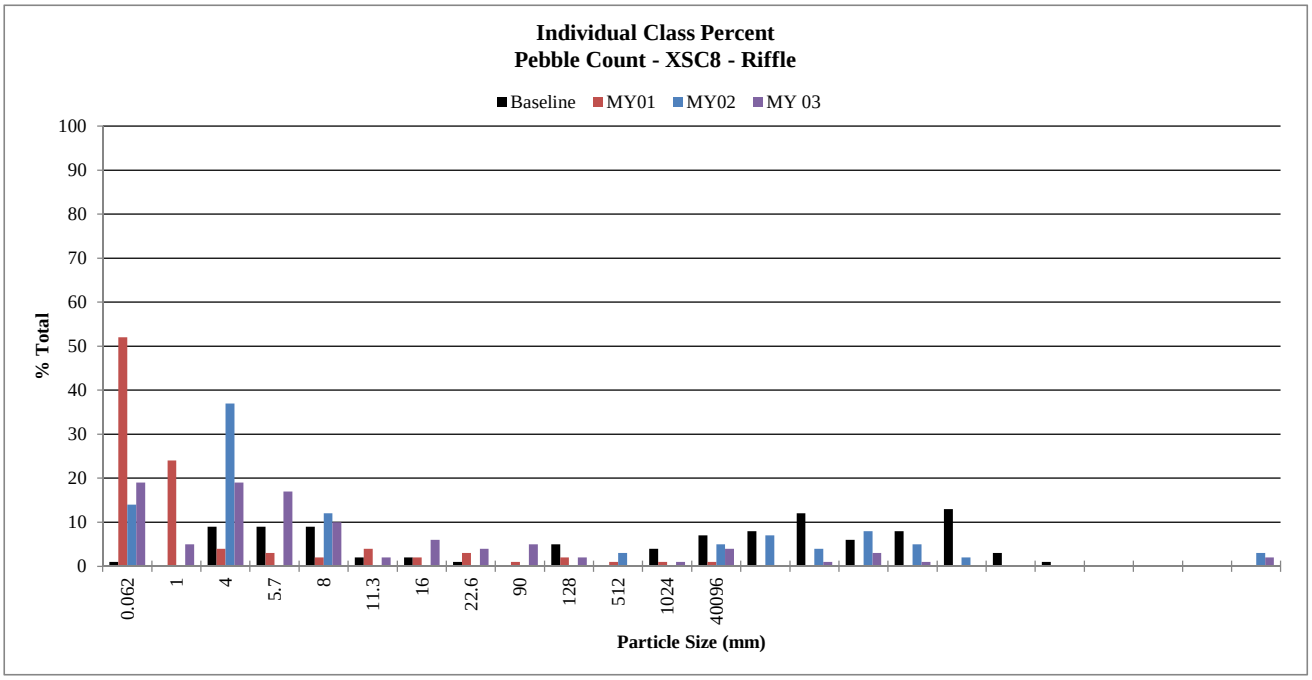

Cumulative Percent
Pebble Count - DS of Confluence with 2B - Riffle
Baseline
MY01
MY02
MY 03
% Cumulative
100
90
80
70
60
50
40
30
20
10
0
0.01
0.1
1
10
100
1000
10000
100000
Particle Size (mm)

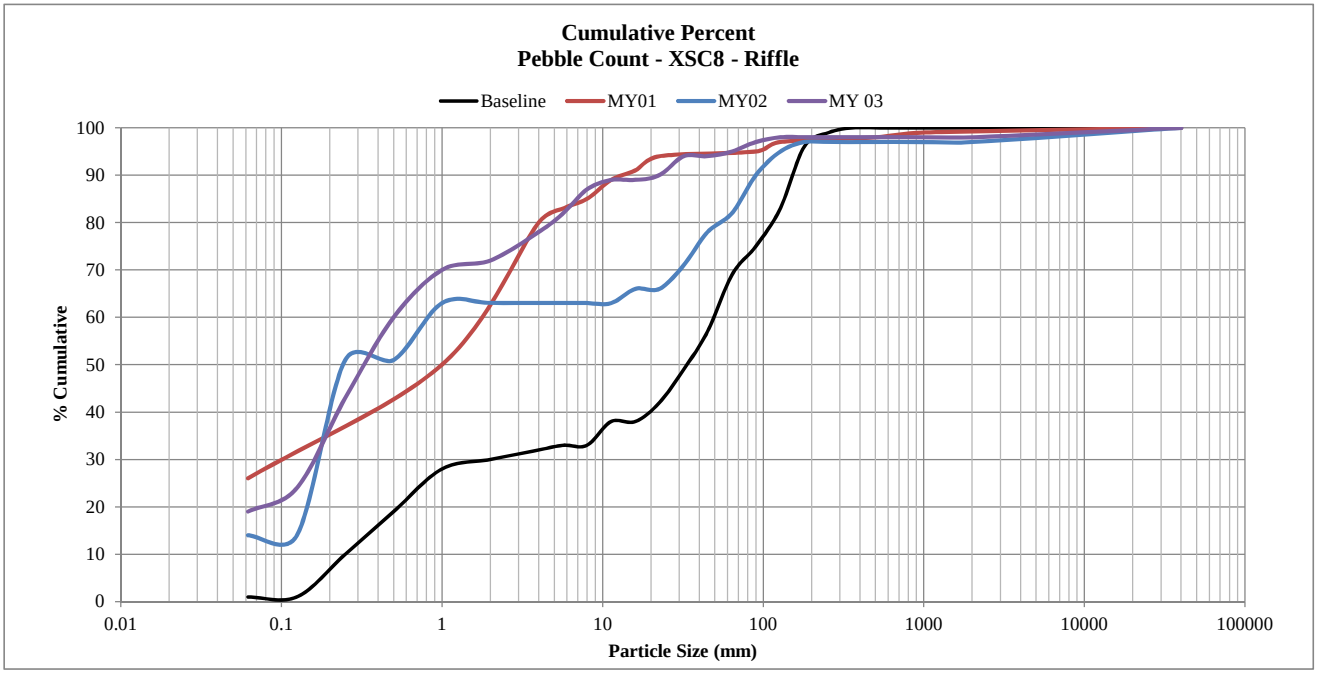
UT to Clarke Creek - Reach: UT1 - XS8 - Riffle Pebble Count

Location: STA 4+14

Inches	Particle	Millimeters		Count	% Total	% Cum.
	Silt/Clay	<0.062	SAND	22	19	19
	Very Fine	0.062-0.125		6	5	24
	Fine	0.125-0.25		23	19	43
	Medium	0.25-0.50		20	17	60
	Coarse	0.50-1.0		12	10	70
0.04-0.08	Very Coarse	1.0-2		2	2	72
0.08-0.16	Very Fine	2-4	GRAVEL	7	6	78
0.16-0.22	Fine	4-5.7		5	4	82
0.22-0.31	Fine	5.7-8		6	5	87
0.31-0.44	Medium	8-11.3		2	2	89
0.44-0.63	Medium	11.3-16		0	0	89
0.63-0.89	Coarse	16-22.6		1	1	90
0.89-1.26	Coarse	22.6-32		5	4	94
1.26-1.77	Very Coarse	32-45		0	0	94
1.77-2.5	Very Coarse	45-64		1	1	95
2.5-3.5	Small	64-90	COBBLE	3	3	97
3.5-5.0	Small	90-128		1	1	98
5.0-7.1	Medium	128-180		0	0	98
7.1-10.1	Large	180-256		0	0	98
10.1-14.3	Small	256-362	BOULDER	0	0	98
14.3-20	Small	362-512		0	0	98
20-40	Medium	512-1024		0	0	98
40-80	Large	1024-2048		0	0	98
	Bedrock	Bedrock	Bedrock	2	2	100
			Total Counted	118		

Summary Data	
D50	0.2
D84	7
D95	30


Individual Class Percent
Pebble Count - XSC8 - Riffle
Baseline
MY01
MY02
MY 03
% Total
100
90
80
70
60
50
40
30
20
10
0
0.062
1
4
5.7
8
11.3
16
22.6
90
128
512
1024
40096
Particle Size (mm)

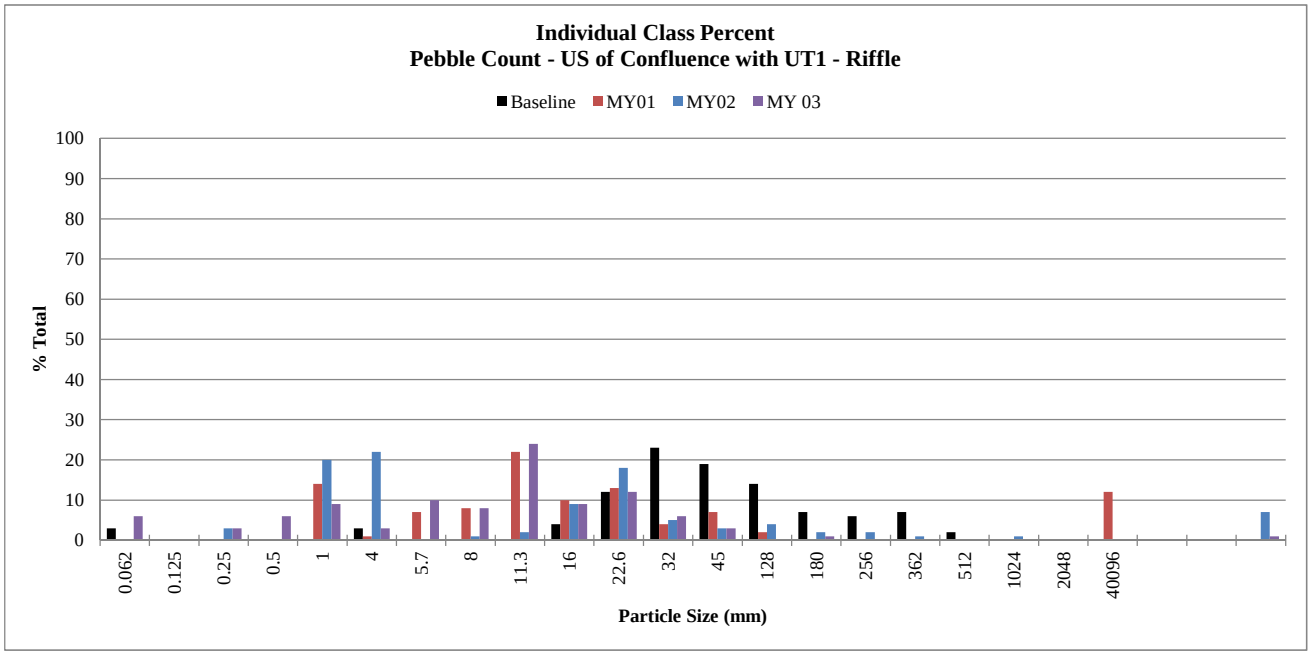

Cumulative Percent
Pebble Count - XSC8 - Riffle
Baseline
MY01
MY02
MY 03
% Cumulative
100
90
80
70
60
50
40
30
20
10
0
0.01
0.1
1
10
100
1000
10000
100000
Particle Size (mm)

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		6	6	6
	Very Fine	0.062-0.125	S	0	0	6
	Fine	0.125-0.25	A	3	3	9
	Medium	0.25-0.50	N	6	6	15
	Coarse	0.50-1.0	D	9	9	24
0.04-0.08	Very Coarse	1.0-2		3	3	27
0.08-0.16	Very Fine	2-4		10	10	37
0.16-0.22	Fine	4-5.7		8	8	45
0.22-0.31	Fine	5.7-8	G	24	24	68
0.31-0.44	Medium	8-11.3	R	9	9	77
0.44-0.63	Medium	11.3-16	A	12	12	89
0.63-0.89	Coarse	16-22.6	V	6	6	95
0.89-1.26	Coarse	22.6-32	E	3	3	98
1.26-1.77	Very Coarse	32-45	L	0	0	98
1.77-2.5	Very Coarse	45-64		1	1	99
2.5-3.5	Small	64-90	C	0	0	99
3.5-5.0	Small	90-128	O	0	0	99
5.0-7.1	Medium	128-180	B	0	0	99
7.1-10.1	Large	180-256	B L E	0	0	99
10.1-14.3	Small	256-362	B	0	0	99
14.3-20	Small	362-512	O	0	0	99
20-40	Medium	512-1024	U L D E R	0	0	99
40-80	Large	1024-2048		0	0	99
	Bedrock	Bedrock	Bedrock	1	1	100
			Total Counted	101		

Summary Data	
D50	5
D84	15
D95	22


Individual Class Percent
Pebble Count - US of Confluence with UT1 - Riffle
Baseline
MY01
MY02
MY 03
% Total
100
90
80
70
60
50
40
30
20
10
0
0.062
0.125
0.25
0.5
1
4
5.7
8
11.3
16
22.6
32
45
128
180
256
362
512
1024
2048
40096
Particle Size (mm)

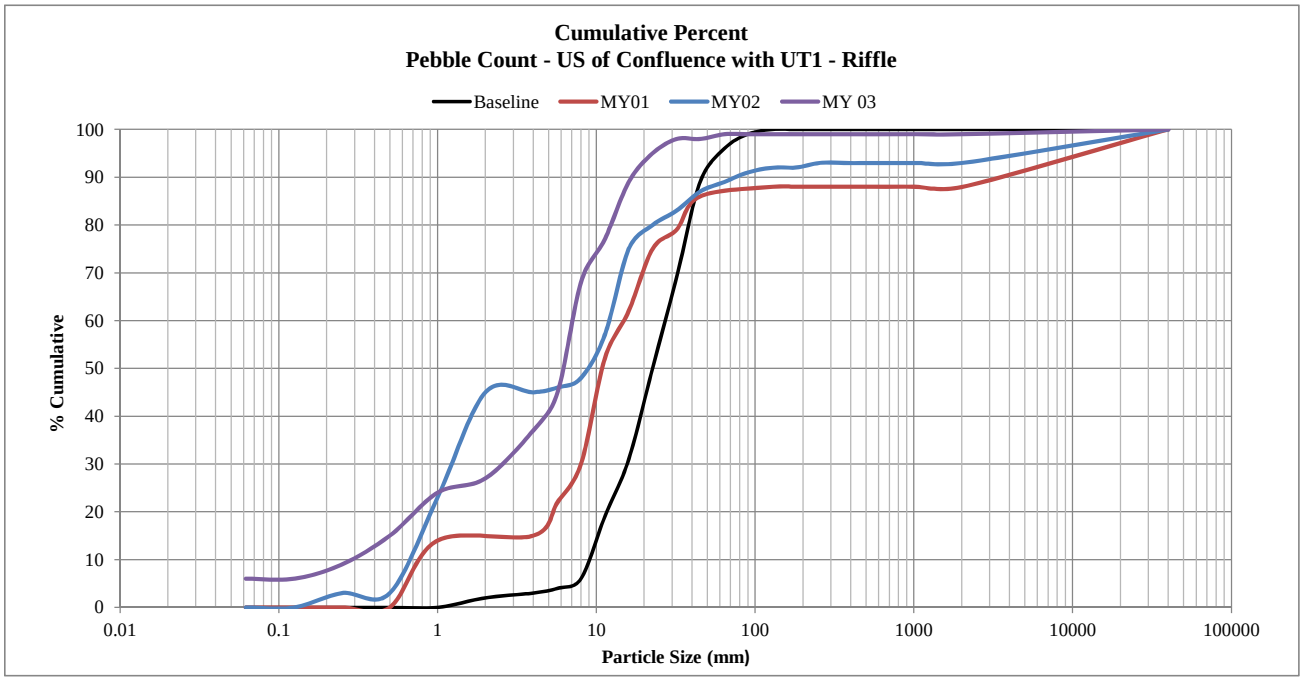

Cumulative Percent
Pebble Count - US of Confluence with UT1 - Riffle
Baseline
MY01
MY02
MY 03
% Cumulative
100
90
80
70
60
50
40
30
20
10
0
0.01
0.1
1
10
100
1000
10000
100000
Particle Size (mm)

Table 10a. Baseline Stream Data Summary

UT to Clarke Creek/EEP #92500 - UT Clarke Creek (1507 feet)

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
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
[1]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^2)		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
[1]Bank Height Ratio					1.43			1.48			1.86			2.22			1		1	0.82	0.897	0.87	1	-	3
Profile																									
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
Pattern																									
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
Transport parameters																									
Reach Shear Stress (competency) lb/f^2					0.74												0.74			-					
Max part size (mm) mobilized at bankfull					1												0.41			-					
Stream Power (transport capacity) W/m^2					-												-			-					
Additional Reach Parameters																									
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					
[3]Bankfull Floodplain Area (acres)					-						-						-			-					
[4]% of Reach with Eroding Banks					-						-														
Channel Stability or Habitat Metric					-						-														
Biological or Other					-						-														

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section surveys and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing survey data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 10b. Baseline Stream Data Summary

UT to Clarke Creek/EEP #92500 - UT 1 (758 feet)

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
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
[1]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^2)		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
[1]Bank Height Ratio					1.34			1.56			1.53			1.6			1		1	0.73	0.93	1.00	1.00	0.14	4
Profile																									
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
Pattern																									
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
Transport parameters																									
Reach Shear Stress (competency) lb/ft^2					0.88												0.59			-					
Max part size (mm) mobilized at bankfull					0.75												4.27			-					
Stream Power (transport capacity) W/m^2					-												-			-					
Additional Reach Parameters																									
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					
[3]Bankfull Floodplain Area (acres)					-						-						-			-					
[4]% of Reach with Eroding Banks					-						-														
Channel Stability or Habitat Metric					-						-														
Biological or Other					-						-														

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section surveys and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing survey data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

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)

	Cross Section 1 (Riffle)							Cross Section 1A (Pool)							Cross Section 2 (Riffle)							Cross Section 9 (Riffle)													
Based on fixed baseline bankfull elevation[1]	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	744.2	744.2	744.2	744.2				742.4	742.4	742.4	742.4				739.37	739.4	739.4	739.4				746.7	746.7	746.7	746.7										
Bankfull Width (ft)	6.7	6.9	7.08	6.89				9.02	8	7	8.71				9.97	10.7	9.85	9.77				7.17	6.35	7.7	6.1										
Floodprone Width (ft)	22.4	29.5	30.98	21				25.6	41.79	38	29				34.6	45	45.14	47.25				18.7	21.5	12.13	38										
Bankfull Mean Depth (ft)	0.76	0.67	0.87	0.63				0.2	0.75	1.1	0.91				1.55	1.28	1.9	2.06				0.39	0.39	0.45	0.72										
Bankfull Max Depth (ft)	0.94	1.17	1.15	1.03				1.47	1.91	1.8	1.65				2.15	2.36	2.27	2.48				0.85	0.68	0.56	1.24										
Bankfull Cross Sectional Area (ft^2)	5.11	4.59	6.15	4.35				1.78	5.96	7.67	7.92				15.5	13.66	18.7	20.16				2.8	2.48	3.47	4.41										
Bankfull Width/Depth Ratio	8.84	10.37	8.15	10.9				45.71	10.74	6.39	9.58				6.41	8.38	5.19	4.73				18.36	16.26	17.09	8.44										
Bankfull Entrenchment Ratio	3.33	4.28	4.38	3.05				2.84	5.22	5.43	3.33				3.47	4.21	4.58	4.84				2.61	3.39	1.58	6.23										
Bankfull Bank Height Ratio	1	0.84	0.93	1.09				1	1.22	0.94	1.47				0.82	0.89	1.1	1.09				0.87	0.97	1.36	1.29										
Cross Sectional Area between end pins (ft^2)	65.6	60.5	60.6	61.32				145.9	142.8	132.2	113.9				187.2	179	178.9	174.7				52.1	52.4	46.4	71.17										
d50 (mm)	-	-	-	-				17	18	0.9	6.75				-	-	-	-				28	0.6	0.7	7.5										

	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[1]	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	741.1				745.8	745.8	745.8	745.8				745.9	745.9	745.9	745.9				744.6	744.6	744.6	744.6				744.7	744.7	744.7	744.7			
Bankfull Width (ft)	9.78	10.42	10.81	10.11				8.4	9.93	8.4	8.41				8.18	7.88	7.12	7.31				7.18	5.29	5.42	6				8.75	8	9.12	5.69			
Floodprone Width (ft)	57.8	60.8	63	62				13.3	22.81	28.5	26				40	40	44	34				11.3	11.3	12	16				19.5	16.15	28.94	24			
Bankfull Mean Depth (ft)	1.66	1.4	1.62	1.93				0.37	0.4	0.54	0.5				0.84	0.76	0.68	0.85				0.64	0.47	0.55	0.71				1.04	0.8	0.92	1			
Bankfull Max Depth (ft)	1.92	2.17	2.67	2.55				0.56	0.64	0.73	0.68				1.57	1.51	1.65	1.33				0.82	0.84	0.81	0.96				1.09	0.9	1.2	1.19			
Bankfull Cross Sectional Area (ft^2)	16.24	14.57	17.54	19.48				3.14	3.95	4.55	4.24				6.9	5.98	4.86	6.2				4.59	2.48	2.96	4.23				9.09	6.4	8.37	5.68			
Bankfull Width/Depth Ratio	5.89	7.45	6.66	5.25				22.69	24.96	15.51	16.67				9.7	10.38	10.43	8.61				11.23	11.28	9.92	8.51				8.42	10	9.94	5.7			
Bankfull Entrenchment Ratio	5.91	5.83	5.83	6.13				1.58	2.3	3.39	3.09				4.89	5.08	6.18	4.65				1.57	2.14	2.21	2.67				2.22	2.02	2.02	4.22			
Bankfull Bank Height Ratio	1	1.11	0.97	1.17				0.73	0.98	1.16	1.99				1	1	0.88	1.59				1	1.09	1.19	1.61				1	1.12	1.02	1.24			
Cross Sectional Area between end pins (ft^2)	170.9	174	157.5	140.4				100.5	115.9	98	112.4				258.1	258.8	285.7	291.4				247.5	230.5	271.5	388.2				231.5	229.9	226.7	248.5			
d50 (mm)	-	-	-	-				24	2.5	0.7	10.5				0.5	0.15	0.062	0.55				4	55	0.2	1.9				24	0.125	0.25	0.2			

1 = Widths and depths for monitoring resurvey will be based on the baseline bankfull datum regardless of dimensional/depositional development. Input the elevation used as the datum, which should be consistent and based on the baseline datum established. If the performer has inherited the project and cannot acquire the datum used for prior years this must be discussed with EEP. If this cannot be resolved in time for a given years report submission a footnote in this should be included that states: "It is uncertain if the monitoring datum has been consistent over the monitoring history, which may influence calculated values. Additional data from a prior performer is being acquired to provide confirmation. Values will be recalculated in a future submission based on a consistent datum if determined to be necessary."

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					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
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	6.1	7.587	6.89	9.77	1.93	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	21	35.42	38	47.25	13.31	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	0.63	1.137	0.72	2.06	0.80	3												
[1]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	1.03	1.583	1.24	2.48	0.78	3												
Bankfull Cross Sectional Area (ft^2)	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	4.35	9.64	4.41	20.16	9.11	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	4.73	8.023	8.44	10.9	3.11	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	3.05	4.707	4.84	6.23	1.59	3												
[1]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	1.09	1.157	1.09	1.29	0.12	3												
Profile																																				
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	13.39	27.55	23.27	50.39	14.07	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	0.003	0.037	0.038	0.087	0.03	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	20.94	33.61	36.44	54.1	11.99	7												
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	1.6	2.344	2.25	3.05	0.47	7												
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	61.44	107.8	93.69	164.1	36.98	7												
Pattern																																				
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																														

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

Additional Reach Parameters																																				
[5]Rosgen Classification	E4						E4						E4						E4																	
[5]Channel Thalweg length (ft)	1507						1507						1507						1507																	
[5]Sinuosity (ft)	1.07						1.07						1.07						1.07																	
Water Surface Slope (Channel) (ft/ft)	0.0089						0.0091						0.0092						0.009																	
BF slope (ft/ft)	0.0092						0.009						0.0092						0.0093																	
[3]Ri% / Ru% / P% / G% / S%	-	-	-	-	-		-	-	-	-	-		-	-	-	-	-																			
[3]SC% / Sa% / G% / C% / B% / Be%																																				
[3]d16 / d35 / d50 / d84 / d95 /																																				
[2]% of Reach with Eroding Banks	-						-						-																							
Channel Stability or Habitat Metric	-						-						-																							
Biological or Other	-						-						-																							

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section surveys and the longitudinal profile.
2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table
3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
4 = Of value/needed only if the n exceeds 3
5 = Reflects baseline monitoring values

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					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
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	5.69	6.7	6	8.41	1.49	3												
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	16	22	24	26	5.29	3												
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	0.5	0.737	0.71	1	0.25	3												
[1]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	0.68	0.943	0.96	1.19	0.26	3												
Bankfull Cross Sectional Area (ft^2)	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	4.23	4.717	4.24	5.68	0.83	3												
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	5.7	10.29	8.51	16.67	5.70	3												
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	2.67	3.327	3.09	4.22	0.80	3												
[1]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	1.24	1.613	1.61	1.99	0.38	**3**												
Profile																																				
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	18.56	34.4	35.79	46.62	12.67	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	0.012	0.017	0.015	0.024	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	22.65	36.02	28.29	57.56	15.77	5												
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	1.29	1.948	1.97	2.54	0.446	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	77.75	137.6	132.9	207	53.12	4												
Pattern																																				
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																														

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

Additional Reach Parameters																																				
[5]Rosgen Classification	B4c						B4c						B4c						B4c																	
[5]Channel Thalweg length (ft)	758						758						758						758																	
[5]Sinuosity (ft)	1.15						1.15						1.15						1.15																	
Water Surface Slope (Channel) (ft/ft)	0.0089						0.0095						0.0081						0.0086																	
BF slope (ft/ft)	0.0083						0.0082						0.008						0.0093																	
[3]Ri% / Ru% / P% / G% / S%	-	-	-	-	-		-	-	-	-	-		-	-	-	-	-																			
[3]SC% / Sa% / G% / C% / B% / Be%																																				
[3]d16 / d35 / d50 / d84 / d95 /																																				
[2]% of Reach with Eroding Banks	-						-						-																							
Channel Stability or Habitat Metric	-						-						-																							
Biological or Other	-						-						-																							

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section surveys and the longitudinal profile.
2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table
3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
4. = Of value/needed only if the n exceeds 3
5 = Reflects baseline monitoring values

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 from MY02 Annual Monitoring Report
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 from MY02 Annual Monitoring Report
5/18/2016	Between 10/22/2015 and 5/18/2016	Crest Gauge Reading* 12.5" above bankfull (UT1) and 24" above bankfull (UT Clarke Creek); visual observation of wrack lines	No wrack line photos captured during this monitoring period. See below for crest gauge photo.
10/21/2016	Between 5/18/2016 and 10/21/2016	Crest Gauge Reading* 13" above bankfull (UT1) and 11" above bankfull (UT Clarke Creek)	No wrack line photos captured during this monitoring period. See below for crest gauge photo.

Photo 1: 05/18/16 - Crest gauge indication of bankfull event.

Photo 2: 10/21/16 - Crest gauge indication of bankfull event.

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

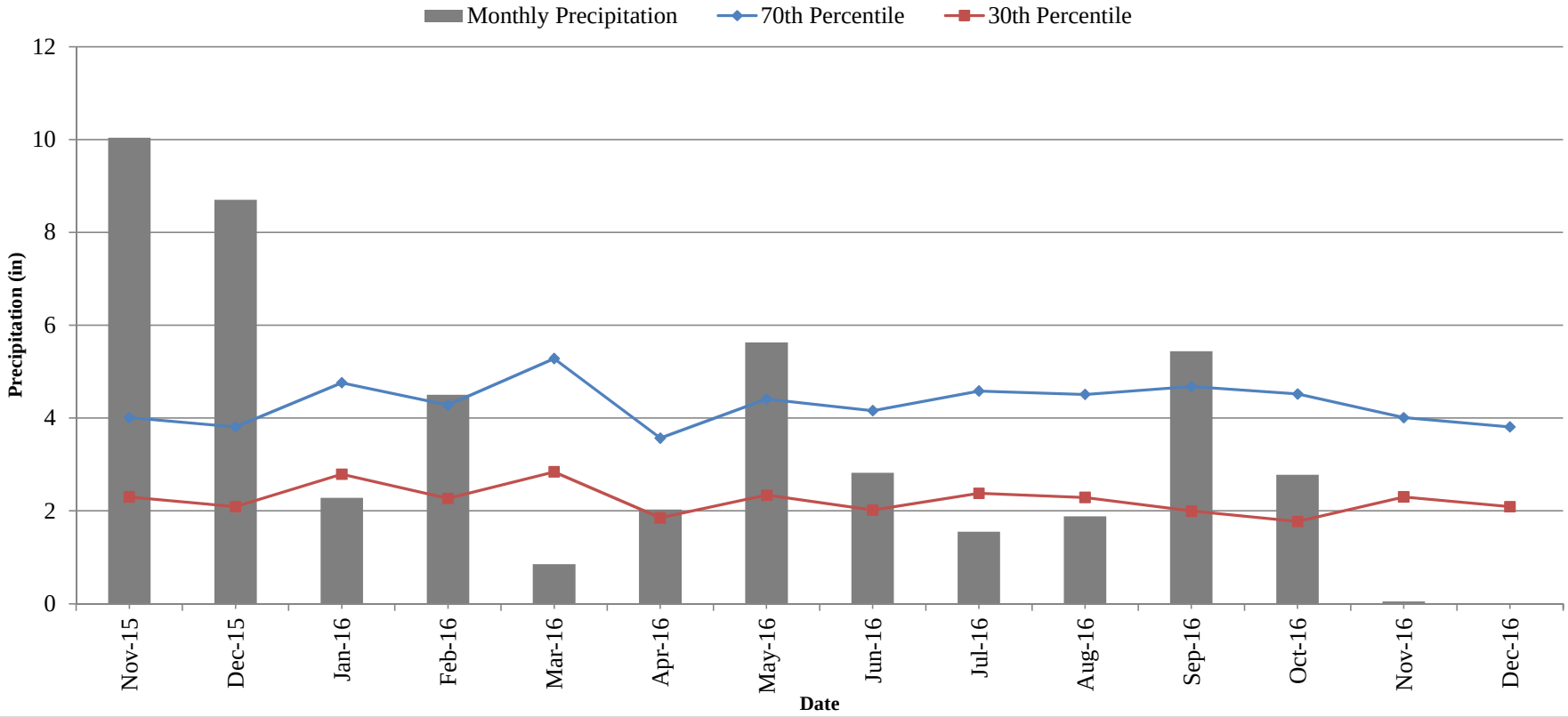


Table 13. Wetland Gauge Attainment Data					
Gauge	Success Criteria Achieved/Max Consecutive Days During Growing Season (Percentage)				
	Year 1 (2014)	Year 2 (2015)	Year 3 (2016)	Year 4 (2017)	Year 5 (2018)
1	Yes/236 days (99%)	Yes/177 days (74%)	Yes/213 days (92%)		
2	No/23 days (10%)	No/25 days (10%)	No/4 days (2%)		
3	Yes/45 days (19%)	No/24 days (10%)	No/4 days (2%)		
4	No/12 days (5%)	No/11 days (5%)	No/1 day (0%)		
5	Yes/47 days (20%)	No Data[b]	No/6 days (3%)		
6	Yes/45 days (19%)	No Data[b]	No/6 days (3%)		
7	Yes/64 days (27%)	Yes/63 days (26%)	No/9 days (4%)		
8	No/0 days (0%)	No Data[b]	No/6 days (3%)		
9[a]	No Data	No/7 days (10% of days with data)	No/19 days (8%)		
10[a]	No Data	No/6 days (8% of days with data)	No/9 days (4%)		
11[a]	No Data	No/1 day (1% of days with data)	No/15 days (6%)		

[a]Well installed after start of 2015 growing season; therefore, gauge data not available

[b]Well malfunction - no data during growing season

Figure 5
UT to Clarke Creek Hydrology Monitoring
Groundwater Gauge 1 - 2016
WM0000136A5C22

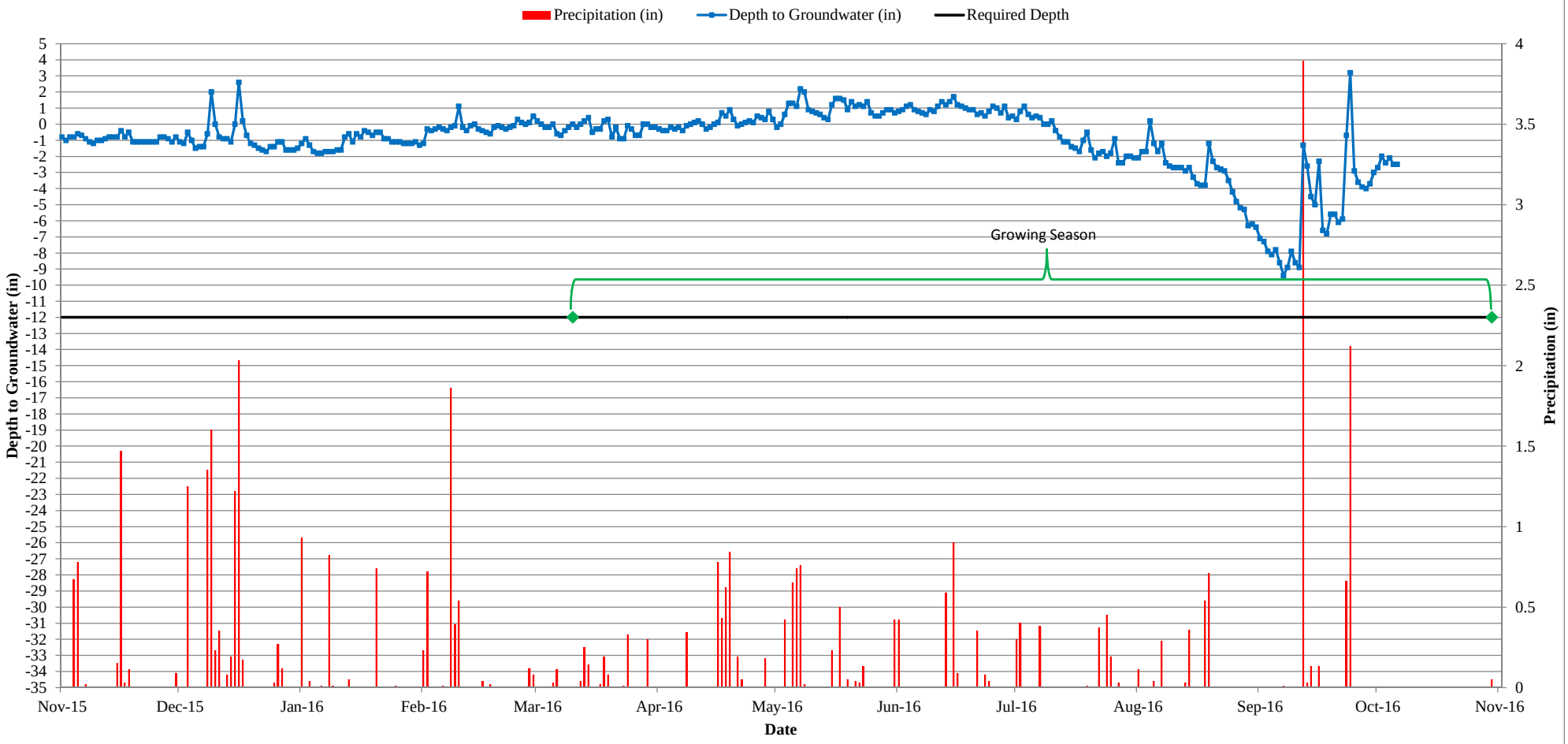


Figure 6
UT to Clarke Creek Hydrology Monitoring
Groundwater Gauge 2 - 2016
WM00001130F789

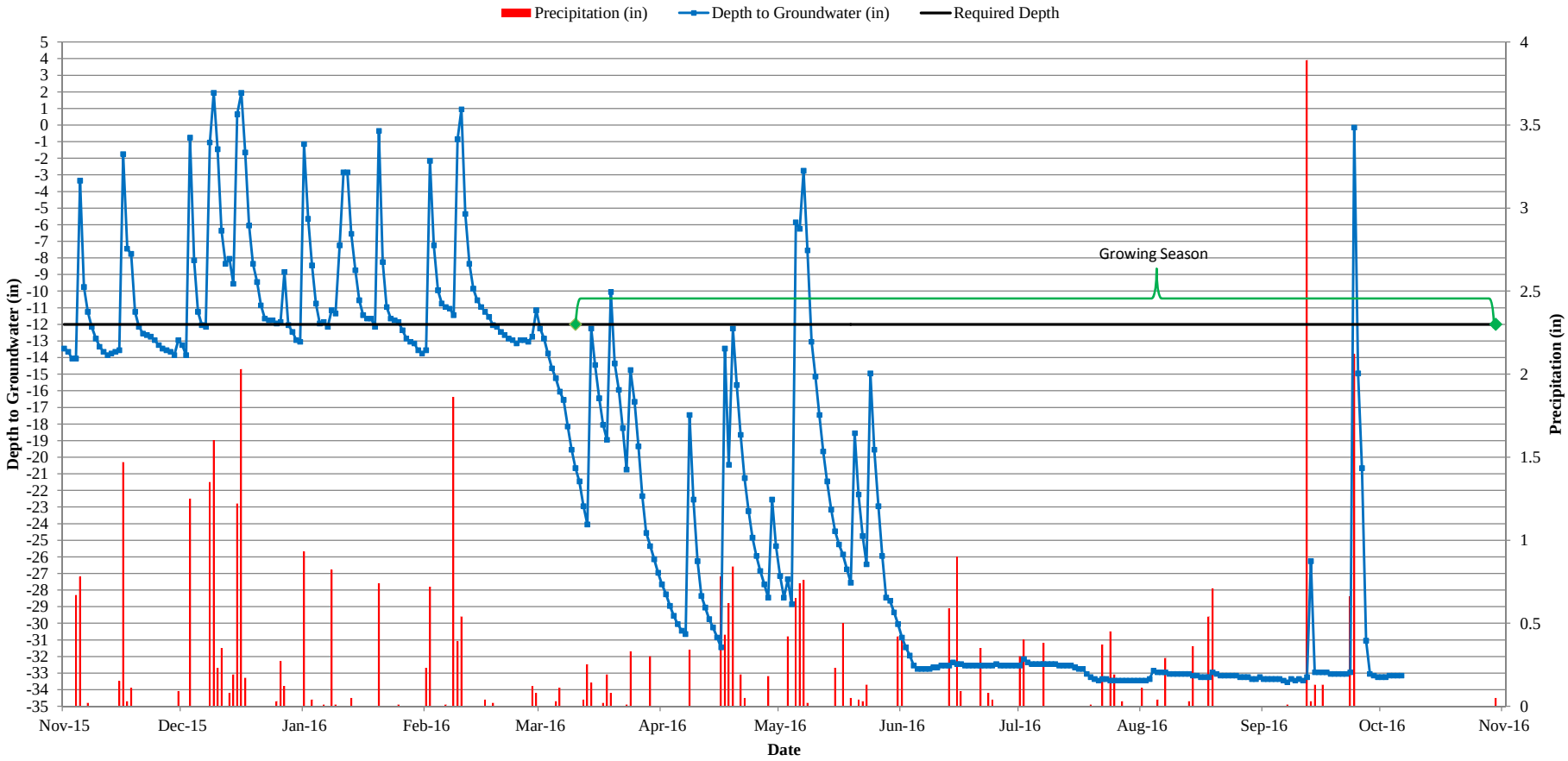


Figure 7
UT to Clarke Creek Hydrology Monitoring
Groundwater Gauge 3 - 2016
WM0000136B1C42

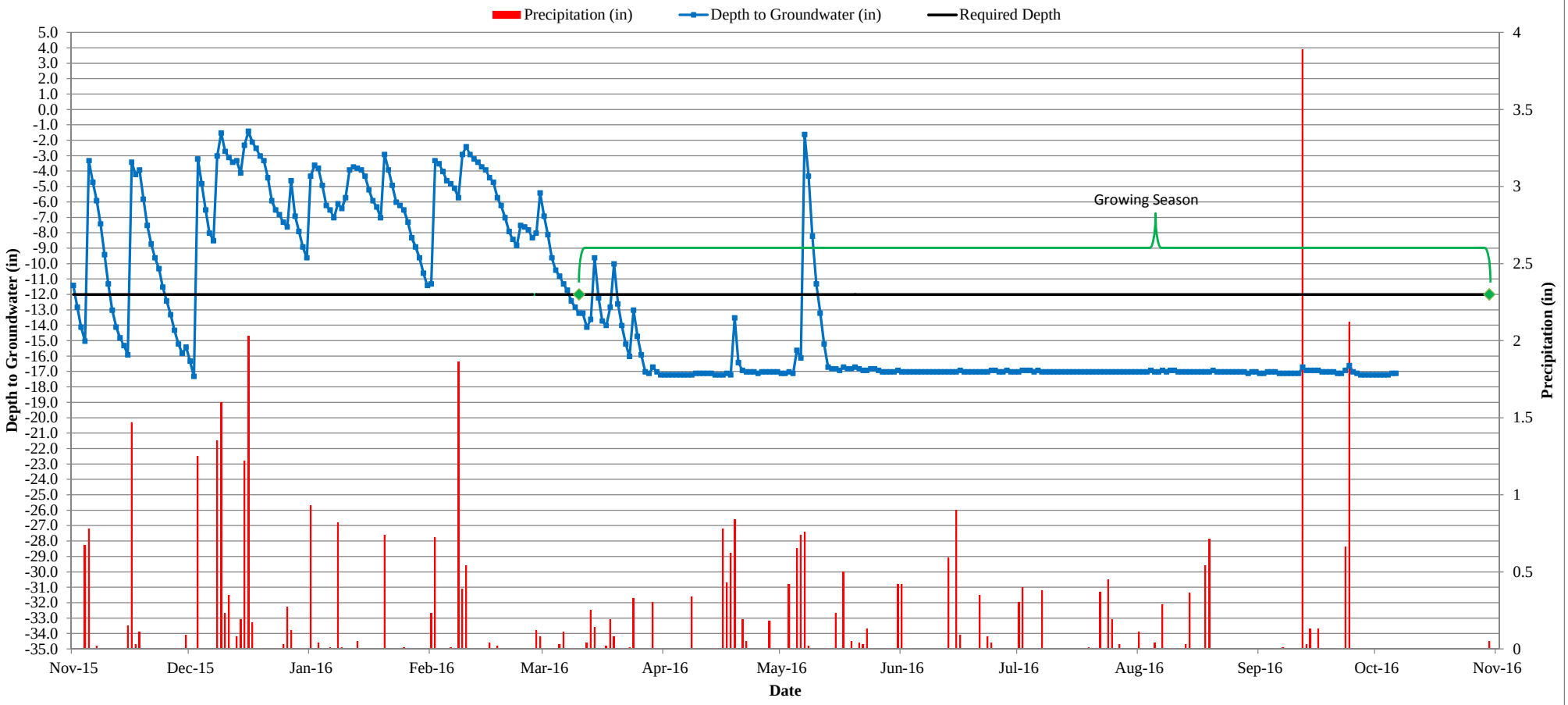


Figure 8
UT to Clarke Creek Hydrology Monitoring
Groundwater Gauge 4 - 2016
WM000011312519

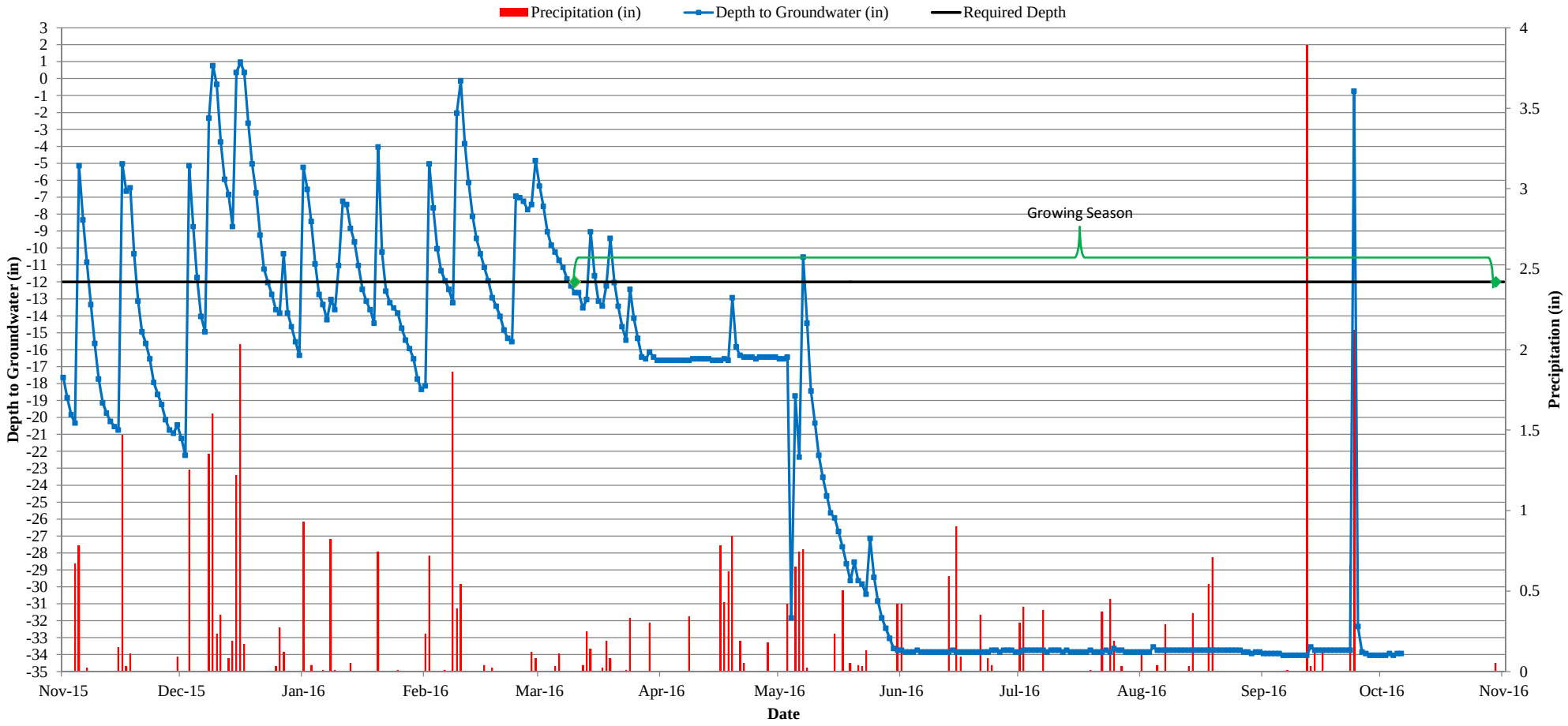


Figure 9
UT to Clarke Creek Hydrology Monitoring
Groundwater Gauge 5 - 2016
WM0000B651C12 (formerly WM000013D4D149)

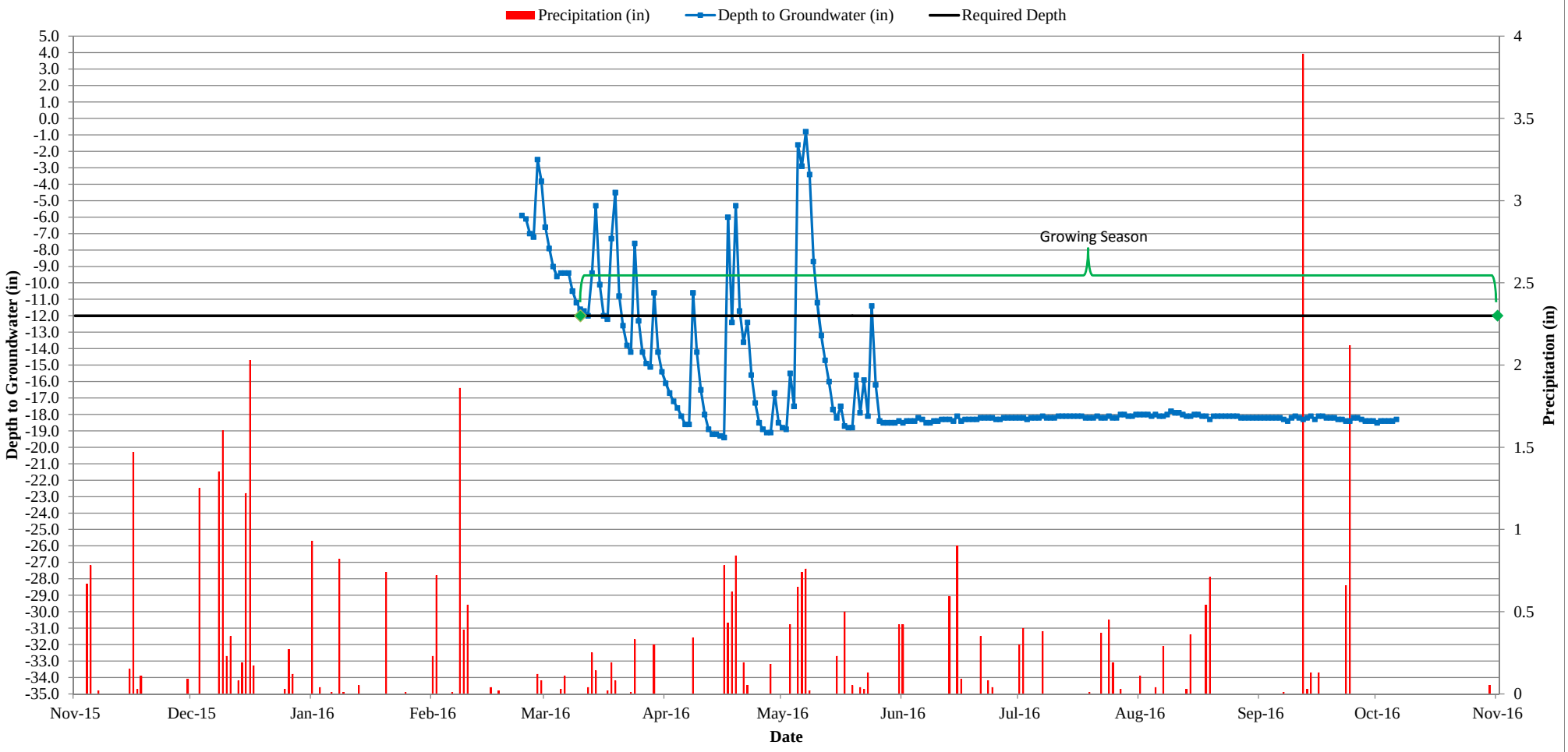


Figure 10
UT to Clarke Creek Hydrology Monitoring
Groundwater Gauge 6 - 2016
WM0000138B838E (formerly WM000013D482C8)

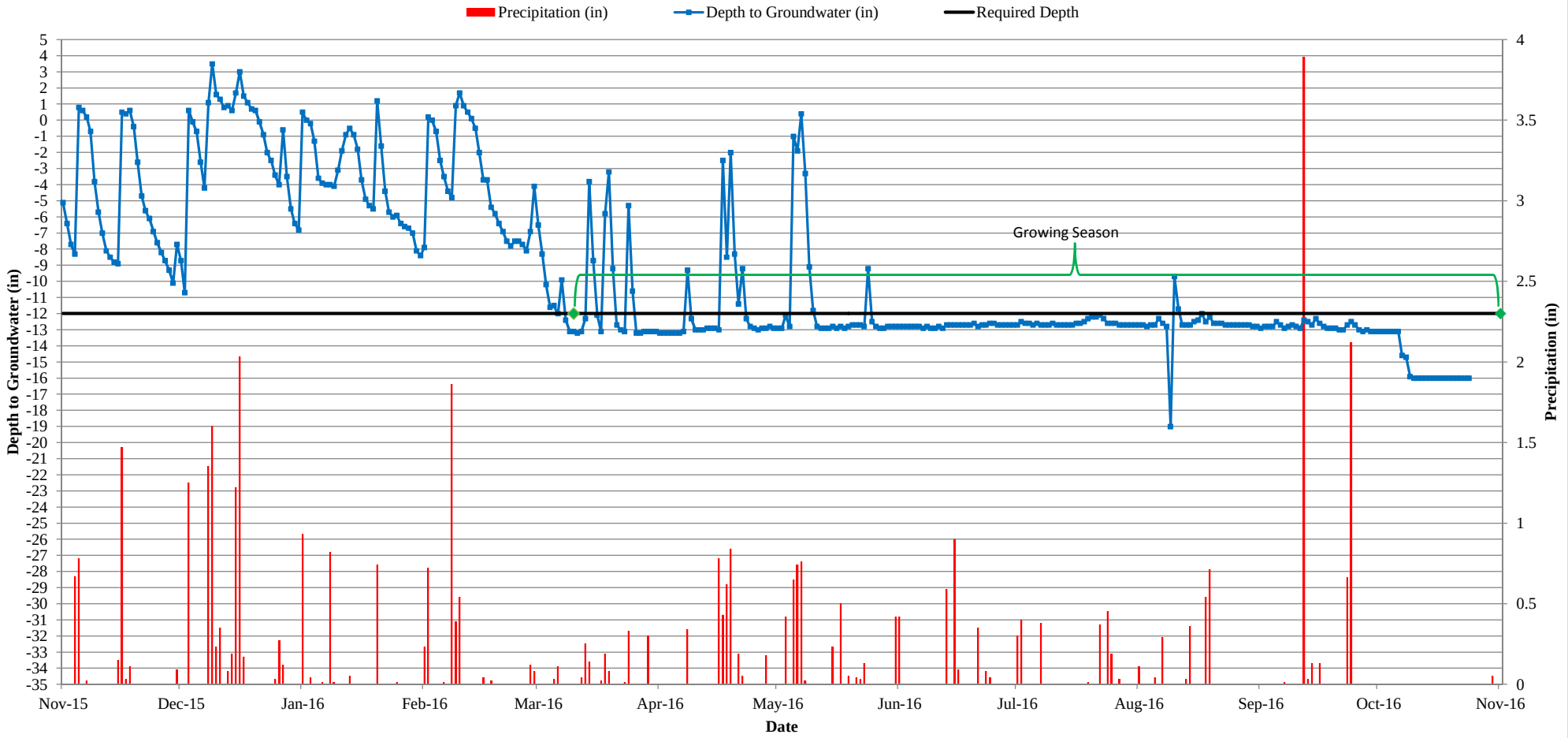


Figure 11
UT to Clarke Creek Hydrology Monitoring
Groundwater Gauge 7 - 2016
WM00001315052C

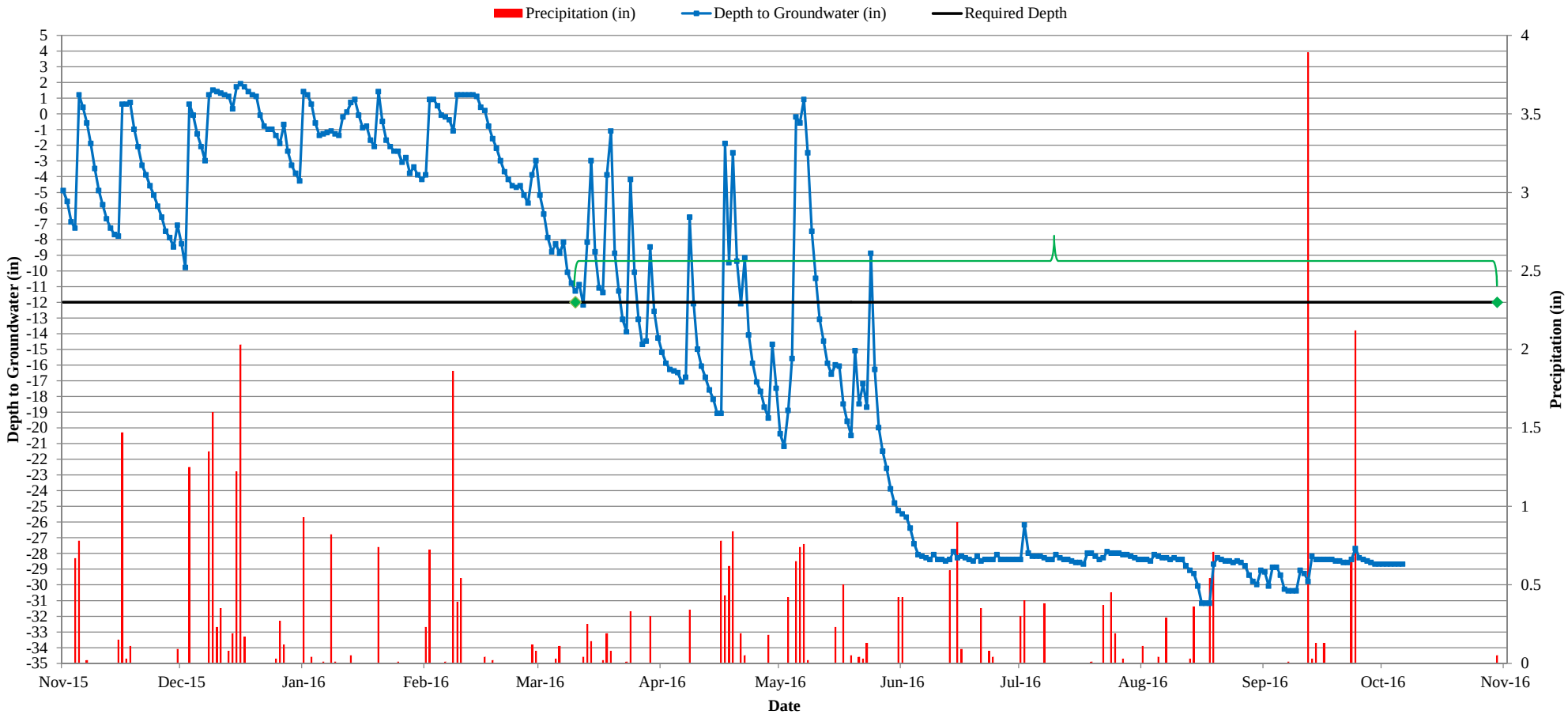


Figure 12
UT to Clarke Creek Hydrology Monitoring
Groundwater Gauge 8 - 2016
WM000013D482C8 (formerly WM000013D4B678)

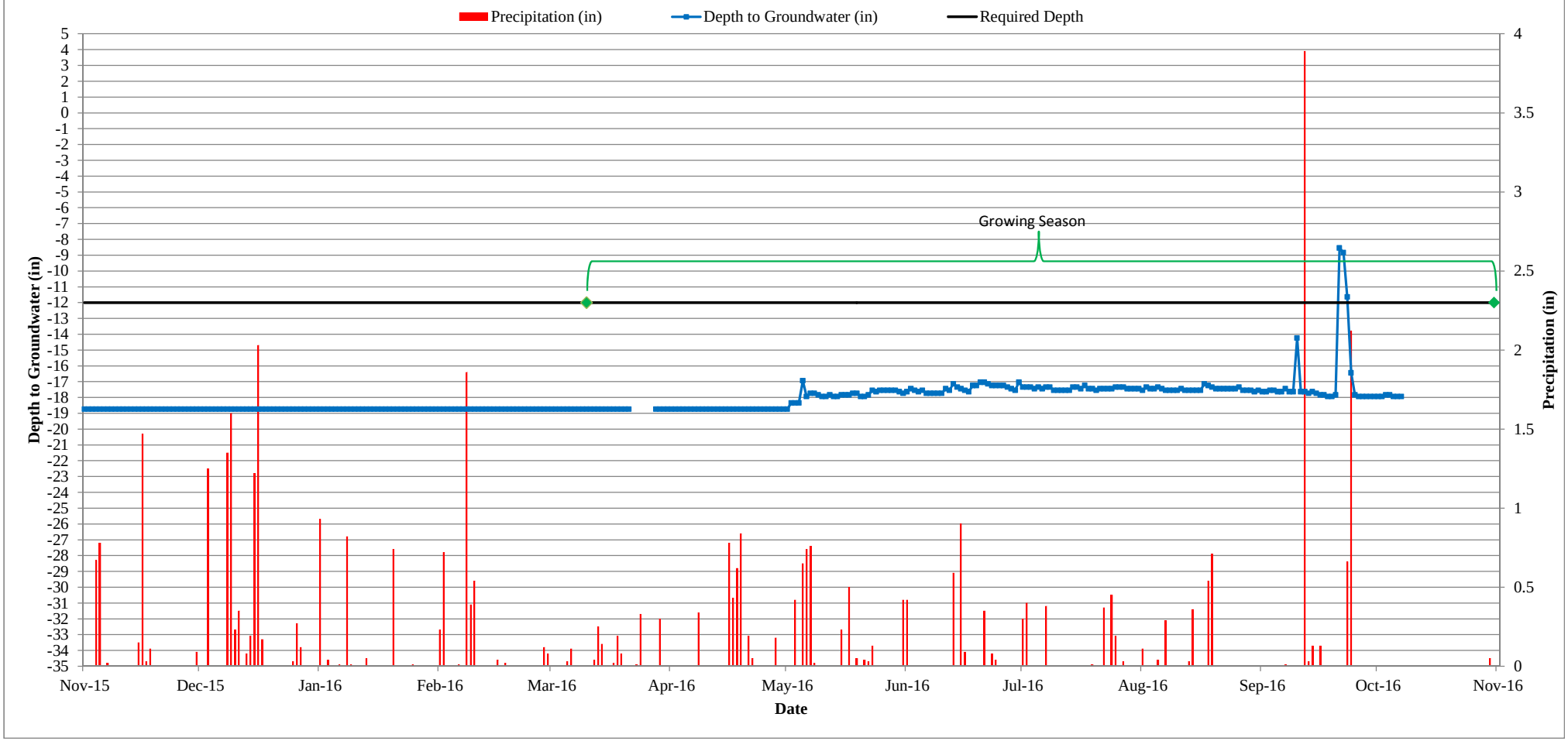


Figure 13
UT to Clarke Creek Hydrology Monitoring
Groundwater Gauge 9 - 2016
WM000009DE4B47 (formerly WM000013D4B647)

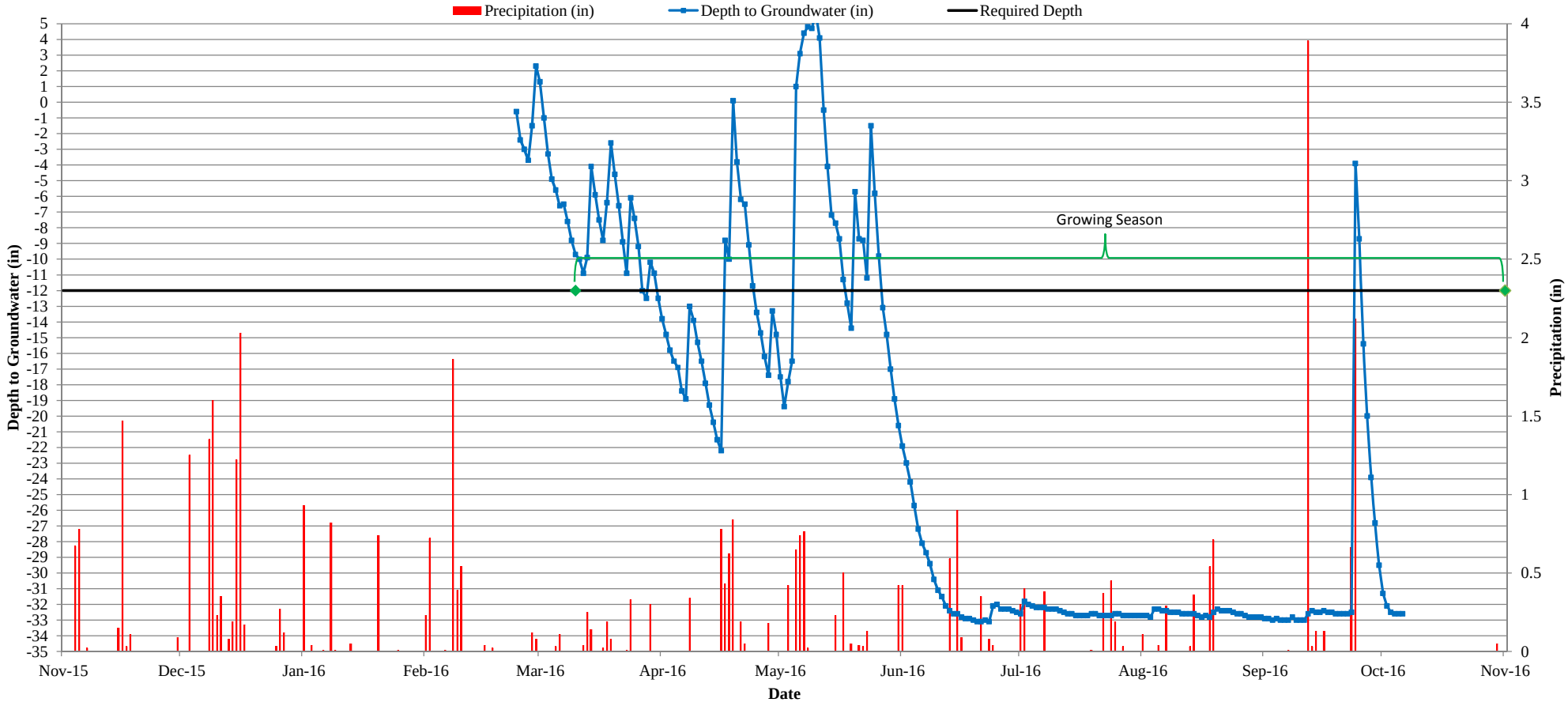


Figure 14
UT to Clarke Creek Hydrology Monitoring
Groundwater Gauge 10 - 2016
WM 000000EBD27A5 (formerly WM0000136ABC5F)

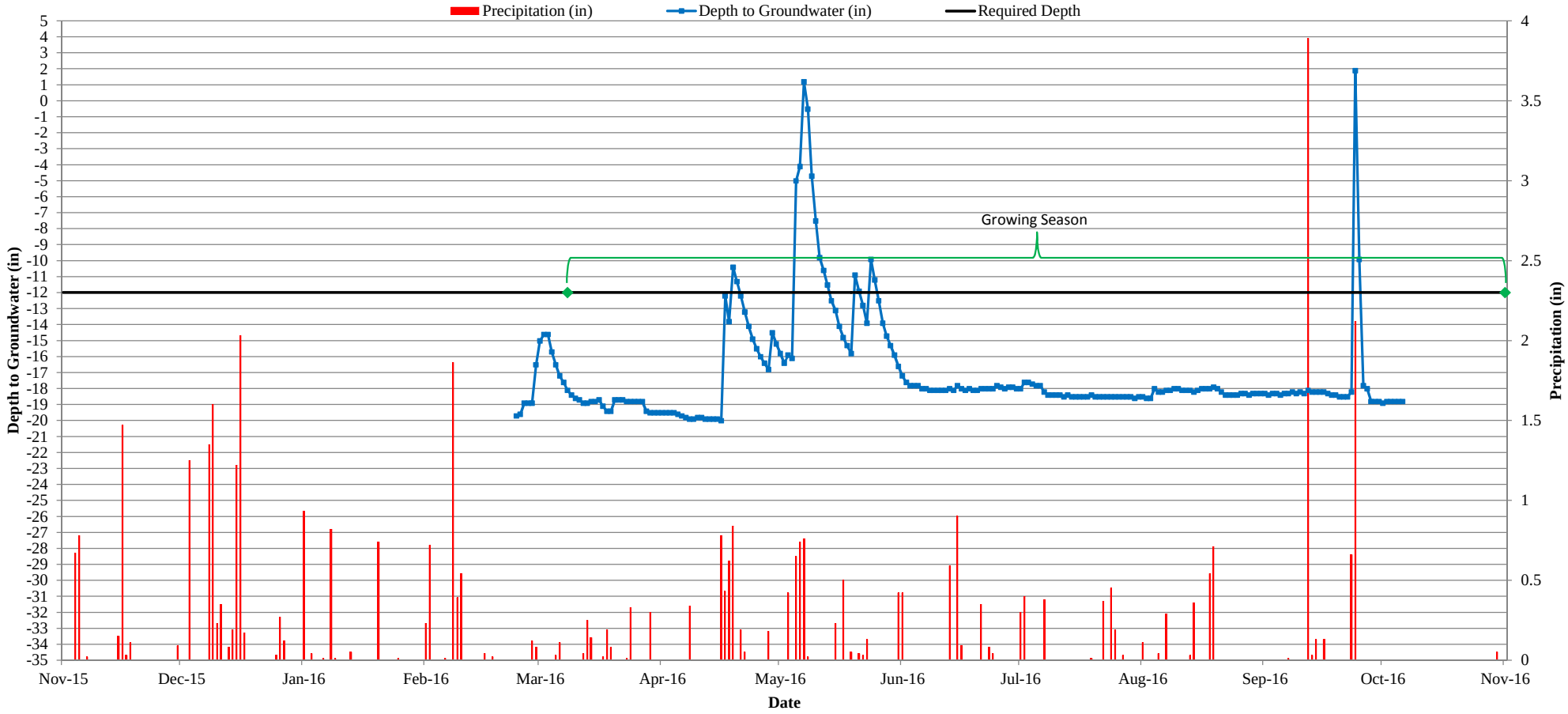


Figure 15
UT to Clarke Creek Hydrology Monitoring
Groundwater Gauge 11 - 2016
WM00001315322D