Unnamed Tributary to Crab Creek Stream and Wetland Restoration

NCEEP Project Number: 857
Monitoring Contract Number: 004495
Monitoring Year 5
2014 Report

Submitted to
North Carolina Ecosystem Enhancement Program
North Carolina Department of Environment and Natural Resources
January 2015

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Raleigh, NC 27699

Monitoring Firm

EQUINOX

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Unnamed Tributary to Crab Creek Stream and Wetland Restoration
2014 Monitoring Report (MY 5)

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1.0 EXECUTIVE SUMMARY / PROJECT ABSTRACT

The goals and objectives stated in the Unnamed Tributary to Crab Creek Restoration Plan (NCEEP 2007) are as follows:

Project Goals:

- Reduce bank sediment export and nutrient inputs to the receiving watershed of Crab Creek, a Class C Trout Water;
- Enhance and preserve riparian buffers of a headwater trout stream;
- Enhance aquatic and terrestrial habitat along an intact stream corridor;
- Improve wetland functions by connecting and expanding the following wetland communities: Swamp Forest-Bog Complex, Southern Appalachian Bog, and Montane Alluvial Forest and;
- Improve and expand Southern Appalachian Bog wetland habitat for the Bog Turtle *Clemmys muhlenburgii*.

Project Objectives:

- Restore 4,026 linear feet of stream channel with appropriate pattern, profile, and dimension to support a gravel transport system;
- Re-establish the natural stream features (bed heterogeneity) to restore aquatic habitat;
- Improve aquatic organism passage and habitat corridor continuity by replacing the culvert; and
- Convert existing croplands into Swamp Forest-Bog Complex and Southern Appalachian Bog communities.

Project Performance:

Vegetation data were collected during August 2014. Based on the planted totals for plots within the 30 foot buffer surrounding the restored channel, 6 of the 9 vegetation plots fell short of the 260 stems per acre criterion for monitoring year 5. The planted mean was 243 stems per acre with a range of 121 to 566. However, the inclusion of natural recruits results in a mean of approximately 700 stems per acre with a range of 243 to 1700. A different methodology was used to sample the Southern Appalachian Bog wetland features surrounding the mainstem and lower portion of the tributary due to the early successional planting plan associated with this community type (See sheet 15 of the planting plan in the approved mitigation plan). In keeping with an early successional reference for this community type, the planting plan consisted of a low density shrub assemblage with various sedges and rush species making for an herbaceous dominated system. These bog systems are characterized by a mosaic of patchy shrub assemblages and meadows. Therefore the woody density of this community type is lower than those of typical mitigation (50 stems per acre - see sheet 15 of the planting plan and section 7.4 in the approved mitigation plan for zones D and F). Random circular plots were sampled during monitoring years two and five within the five year monitoring period. In these bog areas the woody stem density ranged from 61to 627 stems per acre (with a mean of 323 stems per acre) in year 5 and is accompanied by a dense herbaceous layer. Therefore the bog features on the site possess the distribution of strata and densities that meet or exceed those targeted in the planting plan. Due in large part to the project elevations resulting in shorter growing seasons, the size of

the woody stems are generally smaller than that observed at many sites after 5 years of monitoring.

There are also approximately 20 isolated patches of high threat invasive plants that are distributed throughout the project area. Four percent of the easement acreage is comprised of these invasive plants. The one percent increase in invasive coverage is due to two new areas added during MY5. One of these areas is associated with the powerline right-of-way at the downstream end of the easement. The dominant species is multiflora rose *Rosa multiflora*; other species present include oriental bittersweet *Celastrus orbiculatus*, privet *Ligustrum sp.*, and Japanese honeysuckle *Lonicera japonica*. There also are two areas with low stem densities that are associated with the streambank erosion areas as noted below.

All cross sections have remained stable through MY5. All cross sections show no signs of erosion or deterioration. Stream reach geomorphological data indicates the stream channels have remained very stable since construction. Stream channel problems observed during MY5 were minimal and consisted of seven small problems areas, 2 areas of aggradation and 5 areas of degradation, throughout all assessed reaches. Particle-size distributions remain stable, with no significant trends towards coarser or finer materials. This indicates that the channel is transporting sediment as designed.

Data from the eight groundwater monitoring stations indicated that all stations, with the exception of MW-1, met the soil saturation criterion of groundwater being within 12 inches of the soil surfaces for at least five percent of the hydroperiod during the MY5 growing season. The on-site rain gauge documented above normal precipitation during May-July. During normal rainfall years all groundwater gauges are expected to meet the minimum criteria. One bankfull event was documented during a November 2014 field visit (Table 12). This is the fifth documented bankfull event since construction was completed, meeting the criterion of two bankfull events since completion of construction.

In October 2013, wetland boundary delineations were performed to confirm the boundary of wetland features on the project site. A total of 21.8 acres of wetland were delineated within the project site. This included 10.9 acres of restoration, 3.1 acres of enhancement, 0.1 acres of creation, and 7.7 acres of preservation. The total acreage showed a 5.1 acre increase in total wetland area compared to the original baseline delineation of 16.7 acres, resulting from a 2.9 acre and a 2.2 acre increase in restoration and preservation acreage, respectively. The increase in wetland acreage increased primarily as a result of including wetlands within the beltwidth of the stream that were excluded during the initial delineation. Two areas within Wetlands 1 and 2 that were included in the original wetland delineation failed to meet all three indicators for wetland jurisdiction. The failing area in Wetland 2 was located in the restoration area around Monitoring Well 1, which has failed to meet the hydrologic success criteria three out of four monitoring years. Additionally, this area failed to meet the hydric soil indicator. The failing area in Wetland 3, consisting of both restoration and creation, failed to meet the hydric soil indicator; which, was due to a large deposit of sand burying hydric soil. The origin of the sand layer is likely from the adjacent agricultural field. These areas have been excluded from the wetland acreages included in Table 1a and 1b.

During a May field visit, mountain redbelly dace (*Phoxinus oreas*) were observed spawning over creek chub beds along the mainstem within the restoration area. Mountain redbelly dace are important indicators of stream health because they thrive in soft, unpolluted, clear water. The evidence of this spawning taking place illustrates the success of the UT-Crab Creek project in providing aquatic habitat and enhancing overall water quality within the watershed. Follow the link below to watch a video of mountain redbelly dace (http://portal.ncdenr.org/web/eep/eep-news/-/blogs/video-of-redbelly-dace-spawning-at-eep-project-site?_33_redirect=%2Fweb%2Feep%2Feep-news).

Summary information and data related to the occurrence of items such as beaver or easement 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 information formerly found in these reports can be found in the mitigation and restoration plan documents available on NCEEP's website. All raw data supporting tables and figures in the appendices are available from NCEEP upon request.

2.0 Methodology

The stream monitoring methodologies utilized in MY4 replicate those employed during the previous monitoring years and are based on standard guidance and procedures documents (Rosgen 1996; USACE 2003).

Vegetation plot monitoring data were collected following the standard CVS-EEP Protocol for Recording Vegetation, Level II, Version 4.2 (Lee et al. 2008).

Wetland hydrology was considered established if groundwater monitoring data indicated saturated soils within 12 inches of the soil surface for 5% of the Hydro period. Due to the Alleghany County data set being based on a site with elevations approximately 1,000 feet different from the project site, the growing season for the site was based on the Natural Resource Conservation Service (NRCS) data set for Ashe County (NRCS 2009). During October 2013, a wetland boundary delineation was performed to confirm the presence of wetland features on the project site. The delineation utilized the Level II Routine Wetland Determination method as defined in the 1987 USACE Wetlands Delineation Manual and the 2010 USACE Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region.

3.0 References

Lee, M.T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2008. CVS-EEP Protocol for Recording Vegetation. Version 4.2. The University of North Carolina at Chapel Hill, Department of Biology.

NCEEP (North Carolina Ecosystem Enhancement Program). 2007. UT to Crab Creek Restoration Site. Alleghany County, North Carolina. Restoration Plan. Raleigh.

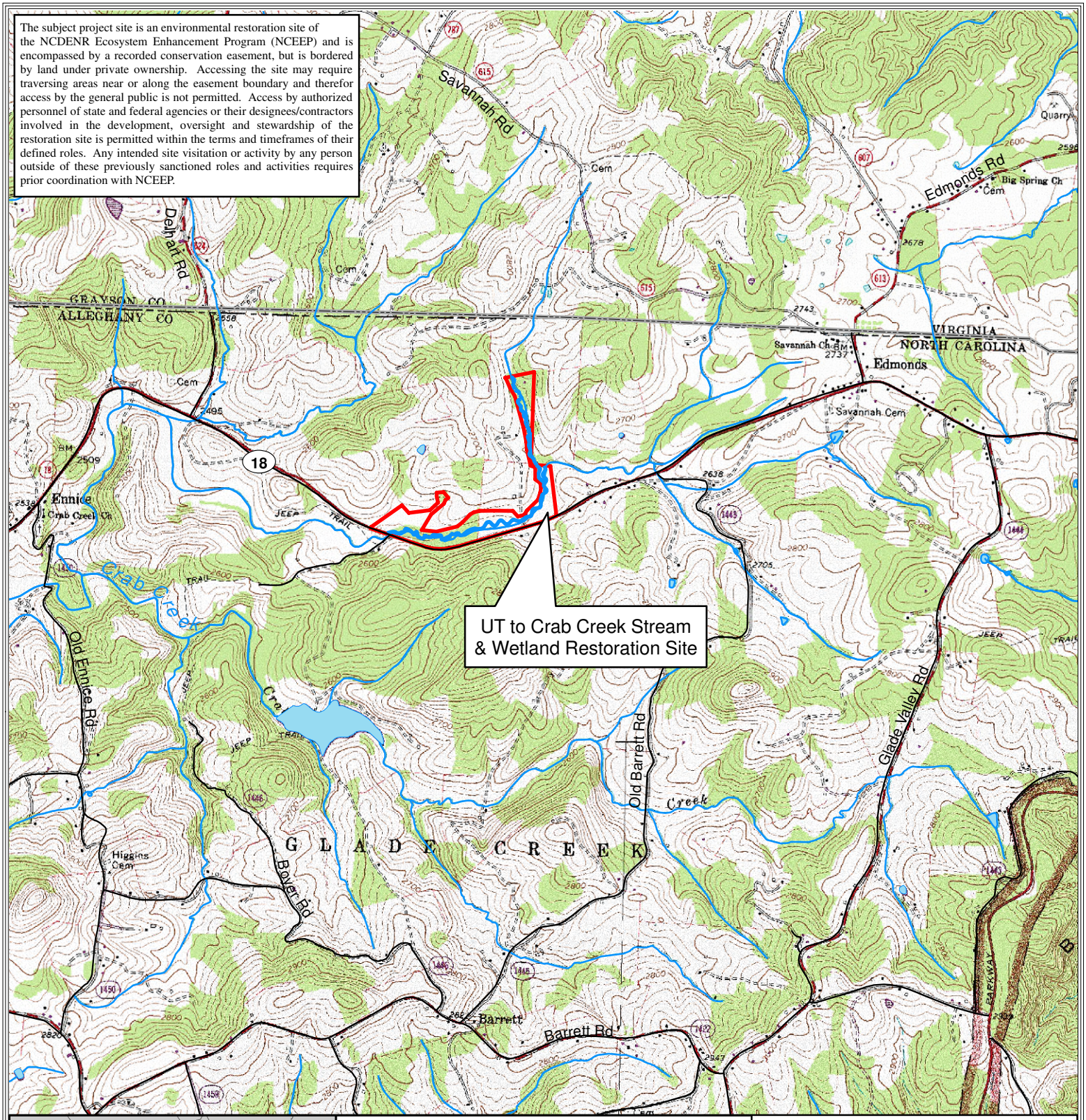
NRCS (Natural Resources Conservation Service). Undated. Climate Analysis for Wetlands by County. http://www.wcc.nrcs.usda.gov/climate/wetlands.html; accessed November 2012.

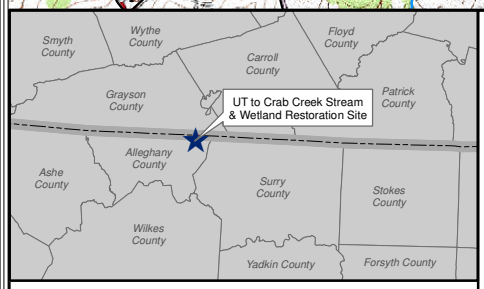
Rosgen, D.L. 1996. Applied River Morphology. Wildland Hydrology Books. Pagosa Springs, Colorado.

USACE (U.S. Army Corps of Engineers). 2003. Stream Mitigation Guidelines. U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, North Carolina Wildlife Resources Commission, North Carolina Department of Environment and Natural Resources-Division of Water Quality. Wilmington District.

Appendix A
Project Vicinity Map and Background Tables

The subject project site is an environmental restoration site of the NCDENR Ecosystem Enhancement Program (NCEEP) and is encompassed by a recorded conservation easement, but is bordered by land under private ownership. Accessing the site may require traversing areas near or along the easement boundary and therefor access by the general public is not permitted. Access by authorized personnel of state and federal agencies or their designees/contractors involved in the development, oversight and stewardship of the restoration site is permitted within the terms and timeframes of their defined roles. Any intended site visitation or activity by any person outside of these previously sanctioned roles and activities requires prior coordination with NCEEP.





Directions: From Raleigh, proceed west on I-40 towards Winston Salem. Take Exit 193 B (NC-8N/US-52N) towards Mount Airy. Proceed on US-52N to I-74W towards Wytheville, VA. Take Exit 5 (I-77S) and proceed to Exit 100 (Mount Airy/Galax/NC-89). Turn left and proceed west on NC-89. Turn left at NC-18 and go approximately 6 miles to the project site. The site is located on the north side of NC-18.

Figure 1 - Vicinity Map

UT to Crab Creek Stream & Wetland Restoration Site

Project No. 857

Alleghany County, North Carolina

N

EQUINOX ENVIRONMENTAL CONSULTATION & DESIGN

Ecosystem Enhancement PROGRAM

0 1,250 2,500 5,000 Feet

7.5 Minute Series Cumberland Knob Quadrangle

Table 1a. Project Components
UT Crab Creek Stream & Wetland / Project No. 857

Project Component or Reach ID	Existing Feet/Acres	Restoration Level	Approach	Footage or Acreage[1]	Stationing	Creditable Footage or Acreage[2]	Ratio	Credits	BMP Elements	Comment
UT1	2,313 lf	R	P3	1,775	100+00 - 101+71 103+00 - 104+35 105+34 - 112+29 113+51 - 116+88 120+26 - 124+65	1,775	1.0	1,775	Existing culvert and crossing removed.	Stream channel stabilized with in-stream structures, including step pools and riffle grade control.
		E	EII	496	101+71 - 103+00 104+35 - 105+34 112+29 - 113+51 116+88 - 118+34	496	2.5	198		Included revegetation and stream bank stabilization.
UTCC-US	2,086 lf	R	P2	2,485	10+00 - 34+85	2,423	1.0	2,423	Existing culvert and crossing replaced with open bottom arch culvert.	Stream channel stabilized with in-stream structures, including step pools and riffle grade control.
UTCC-DS	2,172 lf	P		2,172	34+85 - 56+57	2,067	5.0	413		
Montane Alluvial Forest (Enhancement)	3.00	E		3.01		2.90	2	1.45		Ditch filled and existing fill, debris, and culvert drain removed. Existing seep heads developed and additional hardwood trees planted to restore and enhance Montane Alluvial Forest.
Montane Alluvial Forest (Restoration)	0.90	R		0.83		0.82	1	0.82		
Southern Appalachain Bog (Preservation)	2.70	P		2.23		2.17	5	0.43		Preservation of Southern Appalachian Bog Community.
Southern Appalachain Bog (Creation)	0.00	C		0.08		0.08	3	0.03		Overfill cropland soil removed, groundwater springs exposed, and bog wetland species planted to restore and create Southern Appalachian Bog Community hydrology.
Southern Appalachain Bog (Restoration)	6.70	R		9.57		9.29	1	9.29		
Swamp Forest Bog Complex (Preservation)	5.81	P		5.81		5.72	5	1.14		Preservation of Swamp Forest-Bog Complex along UTCC-DS reach.

=Non-Applicable

[1]Acreage updated based on MY4 wetland boundary delineation

[2] Creditable amounts account for removal of any crossings and 50% asset reduction for utility crossovers

Table 1b. Component Summations
UT Crab Creek Stream & Wetland / Project No. 857

Restoration Level	Stream (lf)	Riparian Wetland (Ac)[1]		Non-Riparian (Ac)	Upland (Ac)	Buffer (Ac)	BMP
		Riverine	Non-Riverine				
Restoration	4,198		10.1				
Enhancement			2.9				
Enhancement I	0						
Enhancement II	496						
Creation			0.08				
Preservation	2,172		7.89				
HQ Preservation	0		0				
		0.0	0.0				
Totals	**6,866**	**20.98**		**0**	**0**	**0**	**0**

=Non-Applicable

[1]Acreage updated based on MY4 wetland boundary delineation

Table 2. Project Activity & Reporting History UT Crab Creek Stream & Wetland / Project No. 857		
Activity or Report	**Data Collection Complete**	**Actual Completion or Delivery**
Land Acquisition	N/A	May 2006
Environmental Resource Technical Report	2006	May 2007
Restoration Plan	2007	Dec 2007
Permit Date	N/A	April 2008
Final Design - Construction Plans	N/A	Aug 2008
Construction	N/A	April 2010
Temporary S&E mix applied	N/A	2009 - 2010
Permanent seed mix applied	N/A	April 2010
Planting	N/A	April 2010
Initial Wetland Monitoring Gauges & Rain Gauge Installed	N/A	April 2010
Morphological Data Collection	June 2010	N/A
Mitigation Plan / As-built (Year 0 Monitoring - Baseline)	June 2010	Feb 2011
Year 1 Monitoring	March 2011	Oct 2011
Year 2 Monitoring	Oct 2011	Dec 2011
Year 3 Monitoring	Nov 2012	Jan 2013
Year 4 Monitoring	Nov 2013	Jan 2014
Year 5 Monitoring	Nov 2014	Nov 2014

N/A - Item does not apply.

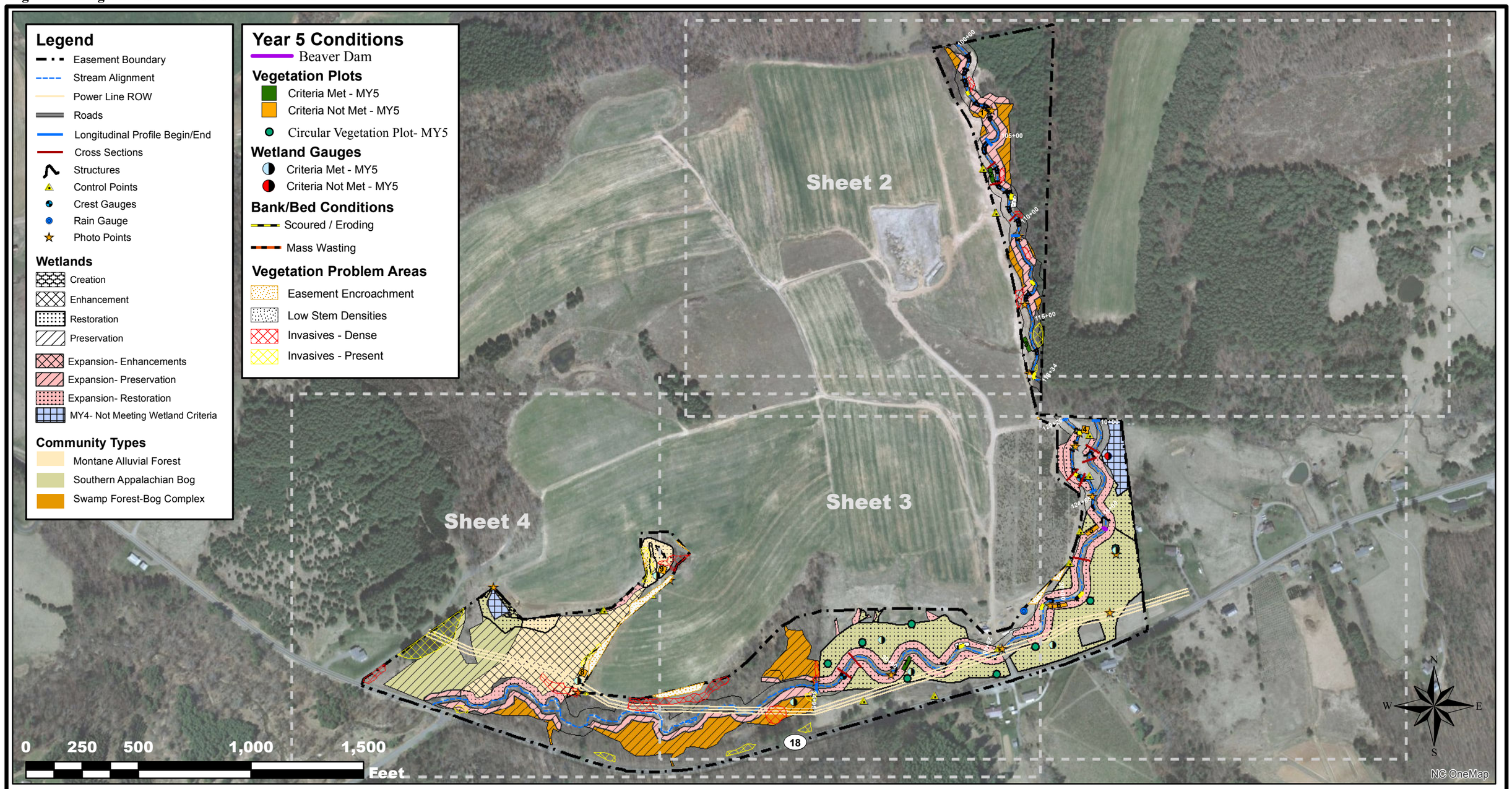
Table 3. Project Contacts UT Crab Creek Stream & Wetland / Project No. 857	
Designer Primary Project Design POC	KCI Associates of North Carolina Landmark Center II, Suite 220 4601 Six Forks Road Raleigh, NC 27609 April Davis (919) 783-9214
Construction Contractor Construction Contractor POC	Carolina Environmental Contracting Inc. P.O. Box 1905 Mount Airy, NC 27030 Stephen James (336) 320-3849
Planting Contractor Planting Contractor POC	Carolina Environmental Contracting Inc. P.O. Box 1905 Mount Airy, NC 27030 Stephen James (336) 320-3849
Seeding Contractor Seeding Contractor POC	Carolina Environmental Contracting Inc. P.O. Box 1905 Mount Airy, NC 27030 Stephen James (336) 320-3849
Seed Mix Sources	Green Resources
Nursery Stock Suppliers	Mellow Marsh Farm (919) 742-1200
Monitoring Performers (Y0) - 2009	Equinox Environmental Consultation & Design, Inc. 37 Haywood Street, Suite 100 Asheville, North Carolina 28801
Stream Monitoring POC	Win Taylor (828) 253-6856
Vegetation Monitoring POC	Win Taylor (828) 253-6856
Wetland Monitoring POC	Win Taylor (828) 253-6856
Monitoring Performers (Y1) - 2010	Equinox Environmental Consultation & Design, Inc. 37 Haywood Street, Suite 100 Asheville, North Carolina 28801
Stream Monitoring POC	Win Taylor (828) 253-6856
Vegetation Monitoring POC	Win Taylor (828) 253-6856
Wetland Monitoring POC	Win Taylor (828) 253-6856
Monitoring Performers (Y2) - 2011	Equinox Environmental Consultation & Design, Inc. 37 Haywood Street, Suite 100 Asheville, North Carolina 28801
Stream Monitoring POC	Win Taylor (828) 253-6856
Vegetation Monitoring POC	Win Taylor (828) 253-6856
Wetland Monitoring POC	Win Taylor (828) 253-6856
Monitoring Performers (Y3)- 2012	Equinox Environmental Consultation & Design, Inc. 37 Haywood Street, Suite 100 Asheville, North Carolina 28801
Stream Monitoring POC	Kevin Mitchell (828) 253-6856
Vegetation Monitoring POC	Kevin Mitchell (828) 253-6856
Wetland Monitoring POC	Kevin Mitchell (828) 253-6856
Monitoring Performers (Y4)- 2013	Equinox Environmental Consultation & Design, Inc. 37 Haywood Street, Suite 100 Asheville, North Carolina 28801
Stream Monitoring POC	Hunter Terrell (828) 253-6856
Vegetation Monitoring POC	Hunter Terrell (828) 253-6856
Wetland Monitoring POC	Hunter Terrell (828) 253-6856
Monitoring Performers (Y5)- 2014	Equinox Environmental Consultation & Design, Inc. 37 Haywood Street, Suite 100 Asheville, North Carolina 28801
Stream Monitoring POC	Hunter Terrell (828) 253-6856
Vegetation Monitoring POC	Hunter Terrell (828) 253-6856
Wetland Monitoring POC	Hunter Terrell (828) 253-6856

Table 4. Project Attributes UT Crab Creek Stream & Wetland / Project No. 857			
Project County	Alleghany		
Physiographic Region	Blue Ridge		
Ecoregion	New River Plateau		
River Basin	Little River		
USGS HUC	05050001030020		
NCDWQ Sub-Basin	05-07-03		
Within Extent of EEP Watershed Plan	Little River and Laurel Branch Local Watershed Plans		
WRC Class	Cold		
% of Project Easement Fenced or Demarcated	100%		
Beaver Activity Observed During Design Phase	No		
Restoration Component Attributes			
	UT1	**UTCC-US**	**UTCC-DS**
Drainage Area (sq.mi.)	0.53	1.65	2.64
Stream Order	First	Second	Second
Restored Length (feet)	1,775	2,485	N/A
Perennial or Intermittent	Perennial	Perennial	Perennial
Watershed Type	Rural		
Watershed LULC Distribution			
Forest/Wetland	53%		
Pasture/Managed Herbaceous	45%		
Other	2%		
Watershed Impervious Cover	-	-	-
NCDWQ AU/Index Number	10-9-12	10-9-12	10-9-12
NCDWQ Classification	C; Tr	C; Tr	C; Tr
303d Listed	No	No	No
Upstream of 303d Listed Segment	No	No	No
Reasons for 303d Listing or Stressor	N/A	N/A	N/A
Total Acreage of Easement	47.8		
Total Vegetated Acreage within Easement	9.0	10.6	19.7
Total Planted Acreage as Part of Restoration	3.3	10.6	1.5
Rosgen Classification of Pre-Existing	G4/C4	C4	E4
Rosgen Classification of As-Built	Cb/C	C	N/A
Valley Type	-	-	-
Valley Slope	0.025	0.010	-
Valley Side Slope Range	-	-	-
Valley Toe Slope Range	-	-	-
Cowardin Classification	N/A	N/A	N/A
Trout Waters Designation	Yes	Yes	Yes
Species of Concern, Endangered, Etc.	Bog Turtle, American Speedwell, and Canadian Burnet		
Dominant Soil Series and Characteristics			
Series	Nikwasi		
Depth	-	-	-
Clay%	-	-	-
K	-	-	-
T	-	-	-

- Information unavailable.
N/A - Item does not apply.

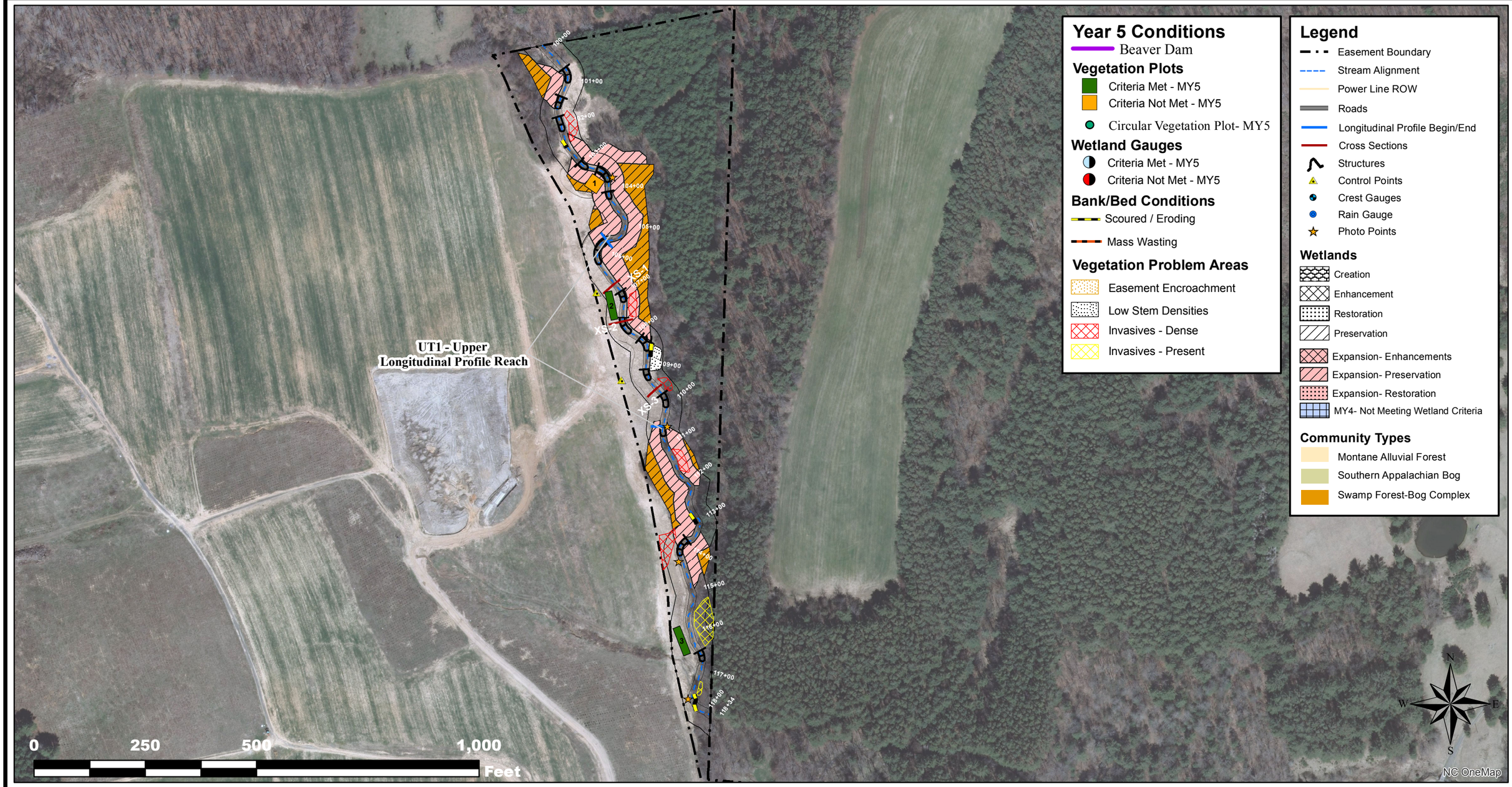
Appendix B
Visual Assessment Data

Figure 2. Integrated Current Condition Plan View



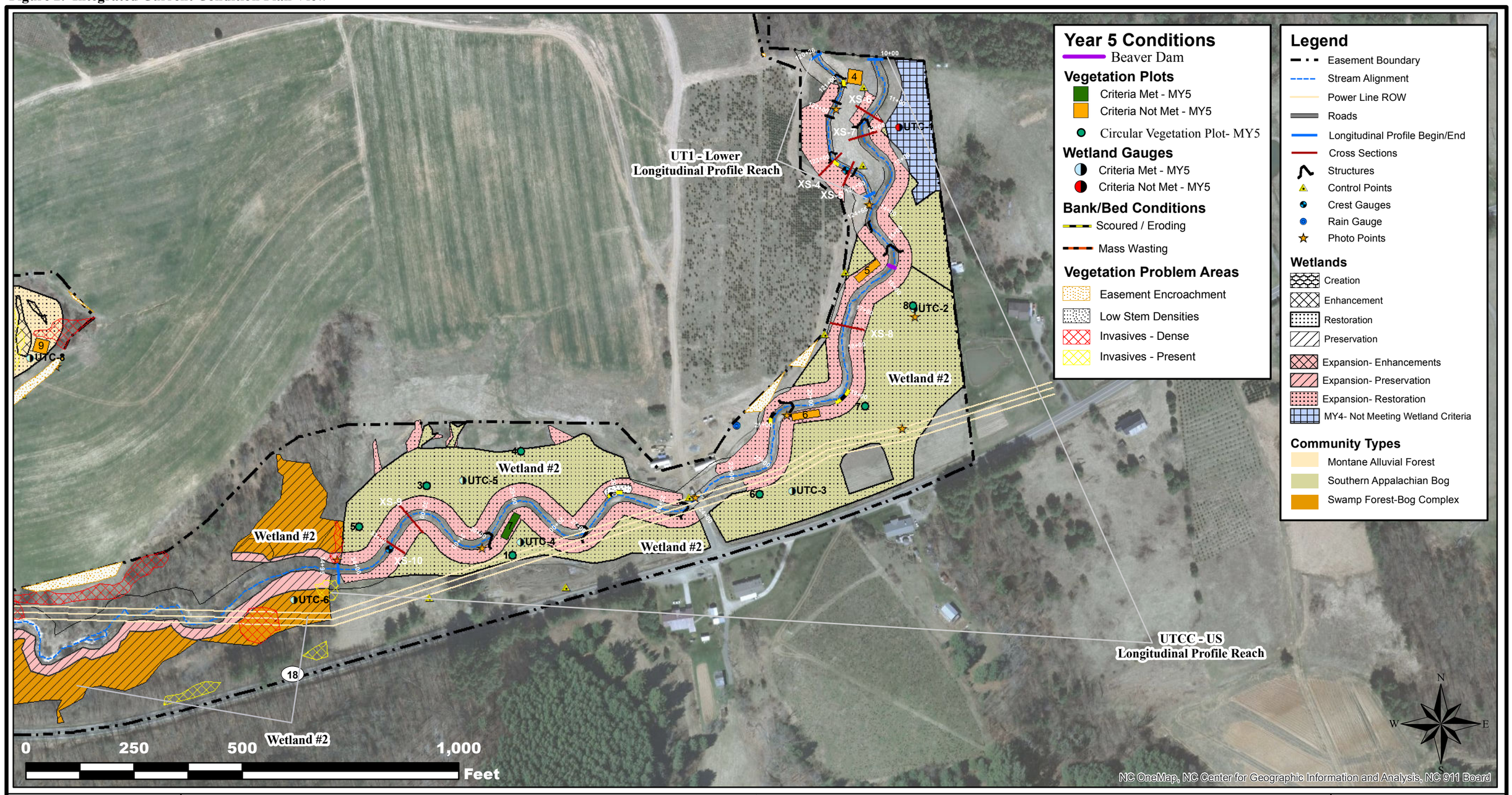
Prepared for	Project:	Notes:	Prepared by
Ecosystem Enhancement Program	UT to Crab Creek Stream and Wetland Restoration Year 5 Monitoring Alleghany County, North Carolina	1) Base Map from CAD file "Crab_base_final" Provided by KCI Associates of NC P.A. 2) NC OneMap 2010 Aerial Photo 3) Wetland boundaries updated using MY4 Wetland Boundary Delineation data	EQUINOX
	Sheet 1 of 4		
	Date	Project Number	
	November 2014	NCEEP # 857	

Figure 2. Integrated Current Condition Plan View



Prepared for Ecosystem Enhancement Program	**Project:** UT to Crab Creek Stream and Wetland Restoration Year 5 Monitoring Alleghany County, North Carolina	Notes: 1) Base Map from CAD file "Crab_base_final" Provided by KCI Associates of NC P.A. 2) NC OneMap 2010 Aerial Photo 3) Wetland boundaries updated using MY4 Wetland Boundary Delineation data	Prepared by EQUINOX
	Sheet 2 of 4		
	Date November 2014	Project Number NCEEP # 857	

Figure 2. Integrated Current Condition Plan View



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	Sheet 3 of 4		
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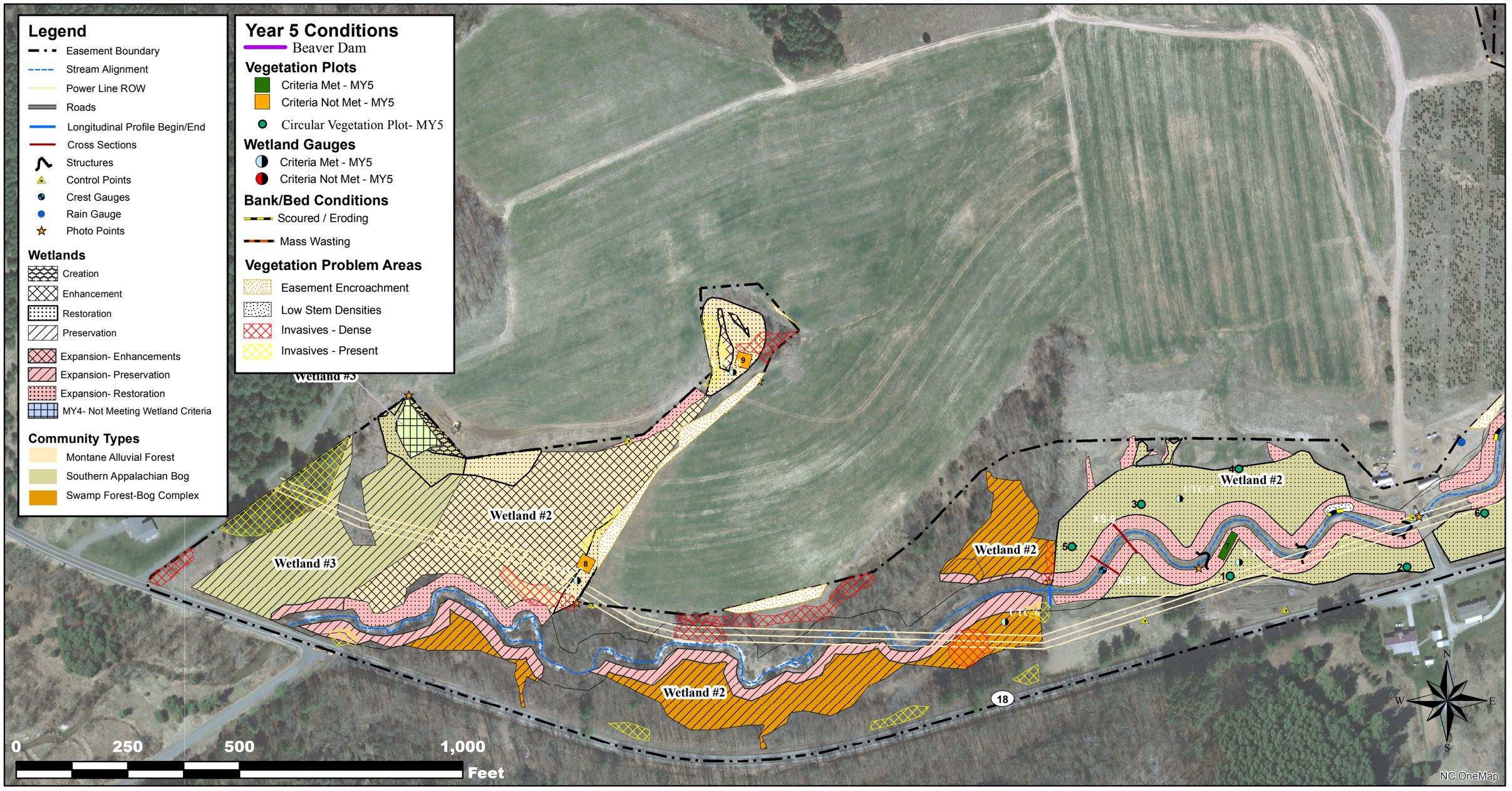


Prepared for	Project:	Notes:	Prepared by
Ecosystem Enhancement Program	UT to Crab Creek Stream and Wetland Restoration Year 5 Monitoring Alleghany County, North Carolina	1) Base Map from CAD file "Crab_base_final" Provided by KCI Associates of NC P.A. 2) NC OneMap2010 Aerial Photo 3) Wetland boundaries updated using MY4 Wetland Boundary Delineation data	EQUINOX
	Sheet 4 of 4		
	Date	Project Number	
	November 2014	NCEEP # 857	

Table 5. Visual Stream Morphology Stability Assessment
UT Crab Creek Stream & Wetland / Project No. 857 - UT1 - Upper
Assessed Length 1,832 feet

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.	17	17			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6).	20	20			100%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle).	20	20			100%			
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run).	20	20			100%			
		2. Thalweg centering at downstream of meander bend (Glide).	19	20			95%			
2. Bank	1. Scoured / Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			4	117	97%	3	45	98%
	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	4	117	97%	3	45	98%
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	15	15			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	15	15			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	15	15			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does NOT exceed 15%.	15	15			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth Ratio ≥ 1.6. Rootwads/logs providing some cover at base-flow.	15	15			100%			

N/A - Item does not apply.

Table 5. Visual Stream Morphology Stability Assessment
UT Crab Creek Stream & Wetland / Project No. 857 - UT1 - Lower
Assessed Length 438 feet

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	4			100%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle).	4	4			100%			
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run).	4	4			100%			
		2. Thalweg centering at downstream of meander bend (Glide).	4	4			100%			
2. Bank	1. Scoured / Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			2	33	96%	1	15	98%
	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	33	96%	0	0	96%
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	5	5			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	5	5			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	5	5			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does NOT exceed 15%.	5	5			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth Ratio ≥ 1.6. Rootwads/logs providing some cover at base-flow.	5	5			100%			

N/A - Item does not apply.

Table 5. Visual Stream Morphology Stability Assessment
UT Crab Creek Stream & Wetland / Project No. 857 - UTCC - US
Assessed Length 2,485 feet

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.	17	17			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6).	15	15			100%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle).	15	15			100%			
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run).	15	15			100%			
		2. Thalweg centering at downstream of meander bend (Glide).	15	15			100%			
2. Bank	1. Scoured / Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			3	110	98%	2	25	98%
	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.			1	21	100%	1	21	100%
				Totals	4	131	97%	3	46	98%
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.	7	7			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	7	7			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does NOT exceed 15%.	7	7			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth Ratio ≥ 1.6. Rootwads/logs providing some cover at base-flow.	7	7			100%			

N/A - Item does not apply.

Table 6. Vegetation Condition Assessment UT Crab Creek Stream & Wetland / Project No. 857 Planted Acreage 15.4					
Vegetation Category	**Definitions**	**CCPV Depiction**	**Number of Polygons**	**Combined Acreage**	**% of Planted Acreage**
1. Bare Areas	Very limited cover of both woody and herbaceous material.	N/A	0	0.00	0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	Stipple Black Dots White Background	2	0.06	<1%
		Totals	2	0.06	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.	N/A	0	0.00	0%
		Cumulative Totals	2	0.06	0%
Easement Acreage 47.8					
Vegetation Category	**Definitions**	**CCPV Depiction**	**Number of Polygons**	**Combined Acreage**	**% of Easement Acreage**
4. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale).	Cross Hatch (Red - Dense/Yellow - Present)	20	1.90	4%
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale).	Stipple Orange Dots White Background & ATV Trail	7	0.47	<1%

N/A - Item does not apply.

Unnamed Tributary 1 – Permanent Photo Station 1
Upstream

Unnamed Tributary 1 – Permanent Photo Station 2
Upstream

Unnamed Tributary 1 – Permanent Photo Station 3
Upstream

Unnamed Tributary 1 – Permanent Photo Station 3
Downstream

Unnamed Tributary 1 – Permanent Photo Station 4
Upstream

Unnamed Tributary 1 – Permanent Photo Station 5
Upstream

Unnamed Tributary 1 – Permanent Photo Station 6
Upstream

Unnamed Tributary 1 – Permanent Photo Station 7
Upstream

Unnamed Tributary Crab Creek Upper – Permanent Photo Station 7
Upstream

Unnamed Tributary Crab Creek Upper – Permanent Photo Station 7
Downstream

Wetland Area 2 – Permanent Photo Station 8
North

Wetland Area 2 – Permanent Photo Station 8
Southwest

Wetland Area 2 – Permanent Photo Station 9
North

Wetland Area 2 – Permanent Photo Station 9
West

Unnamed Tributary Crab Creek Upper – Permanent Photo Station 10 Upstream

Unnamed Tributary Crab Creek Upper – Permanent Photo Station 11 Upstream

Unnamed Tributary Crab Creek Upper – Permanent Photo Station 11
Downstream

Unnamed Tributary Crab Creek Upper – Permanent Photo Station 12
Upstream

Unnamed Tributary Crab Creek Upper – Permanent Photo Station 13
Upstream

Wetland Area 2 – Permanent Photo Station 14
West

Wetland Area 2 – Permanent Photo Station 15
Southwest

Wetland Area 3 – Permanent Photo Station 16
South

Appendix C
Vegetation Plot Data

Table 7. Vegetation Plot Criteria Attainment UT Crab Creek / Project No. 857		
Vegetation Plot ID	**Vegetation Survival Threshold Met?**	**Tract Mean**
1	No	33%
2	Yes	
3	Yes	
4	No	
5	No	
6	No	
7	Yes	
8	No	
9	No	

Vegetation Monitoring Plot 1
Monitoring Year 5 – Aug 28, 2014

Vegetation Monitoring Plot 2
Monitoring Year 5 – Aug 28, 2014

Vegetation Monitoring Plot 3
Monitoring Year 5 – Aug 28, 2014

Vegetation Monitoring Plot 4
Monitoring Year 5 – Aug 28, 2014

Vegetation Monitoring Plot 5
Monitoring Year 5 – Aug 28, 2014

Vegetation Monitoring Plot 6
Monitoring Year 5 – Aug 28, 2014

Vegetation Monitoring Plot 7
Monitoring Year 5 – Aug 28, 2014

Vegetation Monitoring Plot 8
Monitoring Year 5 – Aug 28, 2014

Vegetation Monitoring Plot 9
Monitoring Year 5 – Aug 28, 2014

Table 8. CVS Vegetation Plot Metadata UT Crab Creek - 857	
Report Prepared By	Owen Carson
Date Prepared	8/29/2014 9:44
Database Name	Equinox-2014-A-UTCrab-MY5.mdb
Database Location	Z:\ES\NRI&M\EEP Monitoring\UT Crab Creek\UTC-MY5-2014\Data\Veg
Computer Name	FIELDTECH3-PC
File Size	36388864
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	857
Project Name	UT-Crab Creek Stream & Wetland Restoration
Description	
River Basin	New
Length(ft)	
Stream-to-Edge Width (ft)	
Area (sq m)	
Required Plots (calculated)	
Sampled Plots	9

Table 9. Planted and Total Stem Counts (Species by Plot with Annual Means)
UT Crab Creek Stream & Wetland / Project No. 857

			Current Plot Data (MY5 2014)																										Annual Means																	
			857-01-0001			857-01-0002			857-01-0003			857-01-0004			857-01-0005			857-01-0006			857-01-0007			857-01-0008			857-01-0009			MY5 (2014)			MY4 (2013)			MY3 (2012)			MY2 (2011)			MY1 (2010)			MY0 (2010)		
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	PnoLS	P-all	T	PnoLS	P-all	T
Acer rubrum	red maple	Tree																																			4			3					
Alnus serrulata	hazel alder	Shrub	1	1	4	7	7	7	8	8	8	2	2	2	2	2	35	4	4	22	1	1	18	3	3	3	4	4	4	32	32	103	35	35	119	35	35	133	32	32	89	21	21	50	11	11	11
Aronia arbutifolia	Red Chokeberry	Shrub										1	1	1							6	6	6							7	7	7	7	7	7	8	8	8	8	8	8	8	8	8	6	6	6
Aronia prunifolia																																					1								
Betula lenta var. lenta	sweet birch	Tree																																	1	1	1	9	9	9	9	9	9	15	15	15
Betula nigra	river birch	Tree																									2	2	2	2	2	2	5	5	5	5	5	5									
Carpinus caroliniana var. virginiana		Tree																																				4	4	8	15	15	15	25	25	25
Cornus amomum	silky dogwood	Shrub												5			4															9			31			43			2			1			
Ilex verticillata	common winterberry	Shrub				3	3	3				1	1	1	1	1	1	1	1	1										6	6	6	6	6	6	6	6	6	11	11	11	12	12	12	7	7	7
Lindera benzoin var. benz	northern spicebush	Shrub							1	1	1																			1	1	1	1	1	1	4	4	5	7	7	7	11	11	11	23	23	23
Nyssa sylvatica	blackgum	Tree				4	4	4																						4	4	4	5	5	5	5	5	5									
Physocarpus opulifolius v	common ninebark	Shrub															2															2															
Prunus serotina	black cherry	Tree																																						1						
Robinia pseudoacacia	black locust	Tree																																							1					
Rosa palustris	swamp rose	Shrub												13																		13			10			9									
Salix nigra	black willow	Tree									2																					2						3			1					
Sambucus canadensis	Common Elderberry	Shrub																								5						5			4			7			2			2		
Unknown		Shrub or Tree																																										5	5	5
Viburnum nudum	possumhaw	Shrub	2	2	2																									2	2	2	2	2	2	2	2	2	2	2	2	8	8	8	8	8	8
Stem count			3	3	6	14	14	14	9	9	11	4	4	22	3	3	42	5	5	23	7	7	24	3	3	8	6	6	6	54	54	156	61	61	190	66	66	232	73	73	143	84	84	117	100	100	100
size (ares)			1			1			1			1			1			1			1			1			1			9			9			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			0.22			0.22		
Species count			2	2	2	3	3	3	2	2	3	3	3	5	2	2	4	2	2	2	2	2	2	1	1	2	2	2	2	7	7	12	7	7	10	8	8	14	7	7	12	7	7	10	8	8	8
Stems per ACRE			121.4	121.4	242.8	566.6	566.6	566.6	364.2	364.2	445.2	161.9	161.9	890.3	121.4	121.4	1700	202.3	202.3	930.8	283.3	283.3	971.2	121.4	121.4	323.7	242.8	242.8	242.8	242.8	242.8	701.5	274.3	274.3	854.3	296.8	296.8	1043	328.2	328.2	643	377.7	377.7	526.1	449.7	449.7	449.7

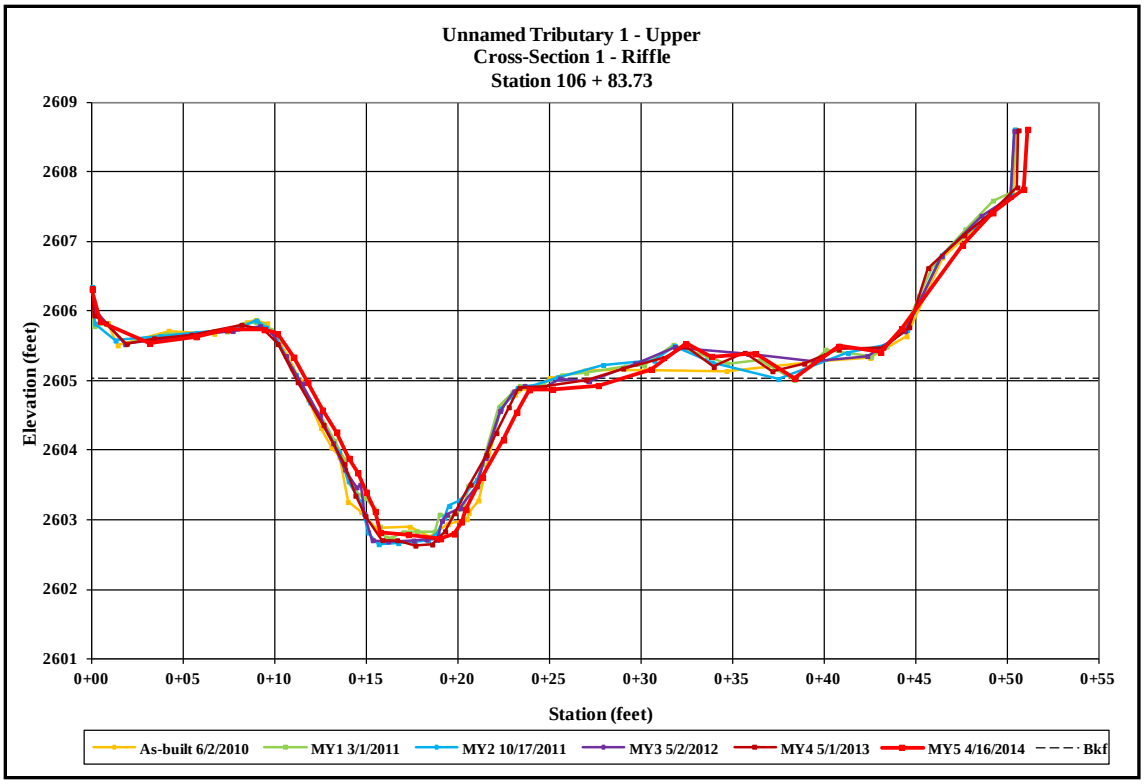
Exceeds requirements by 10%
Exceeds requirements, but by less than 10%
Fails to meet requirements, by less than 10%
Fails to meet requirements by more than 10%

Table 9a. Random Circular Vegetation Plot Stem Counts
UT Crab Creek Stream & Wetland/Project No. 857

Species	Plot								
	1	2	3	4	5	6	7	8	Total Stems
Alnus serrulata	3	9	5	22	23		4	7	**73**
Aronia arbutifolia								3	**3**
Cornus amomum	1	3			4	3	7	14	**32**
Pinus strobus	1								**1**
Pinus virginiana				6					**6**
Rosa palustris			2				3	5	**10**
Salix nigra			2		4				**6**
Total Stems	**5**	**12**	**9**	**28**	**31**	**3**	**14**	**29**	**131**
Stems Per Acre	**101**	**243**	**182**	**567**	**627**	**61**	**283**	**587**	

Average Stem Density- 332 Stems Per Acre

Appendix D
Stream Survey Data

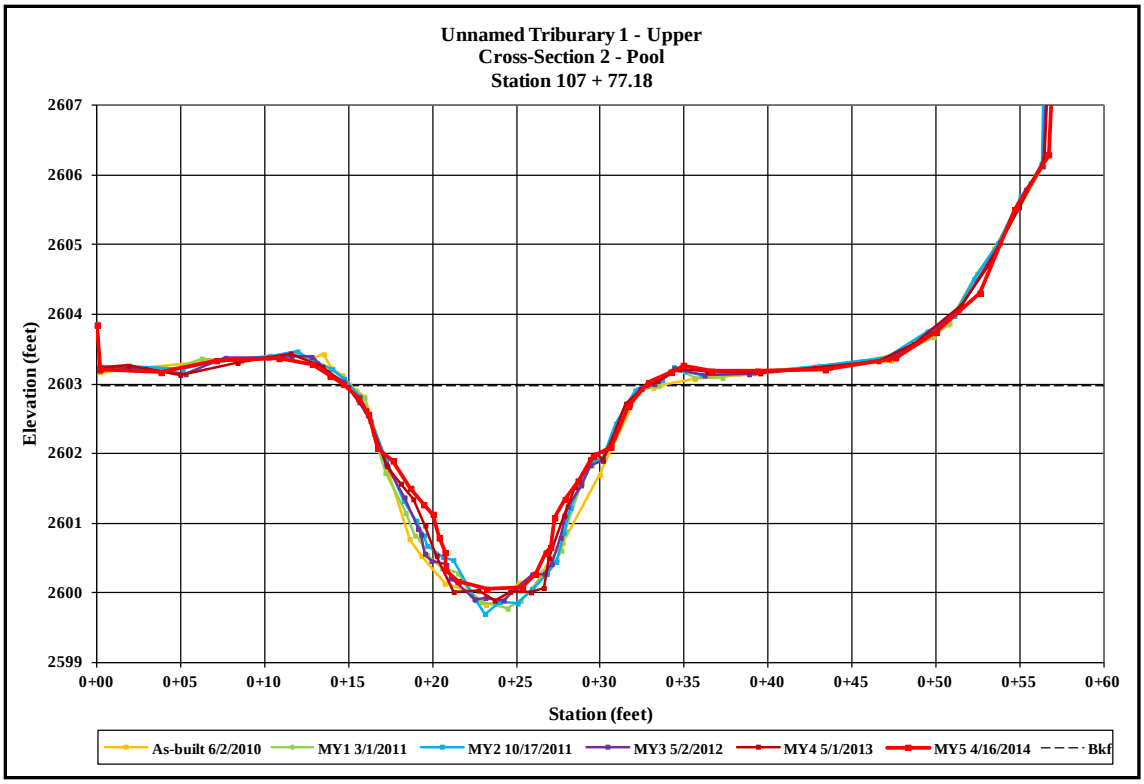


Left Descending Bank

Right Descending Bank

Upstream

Downstream

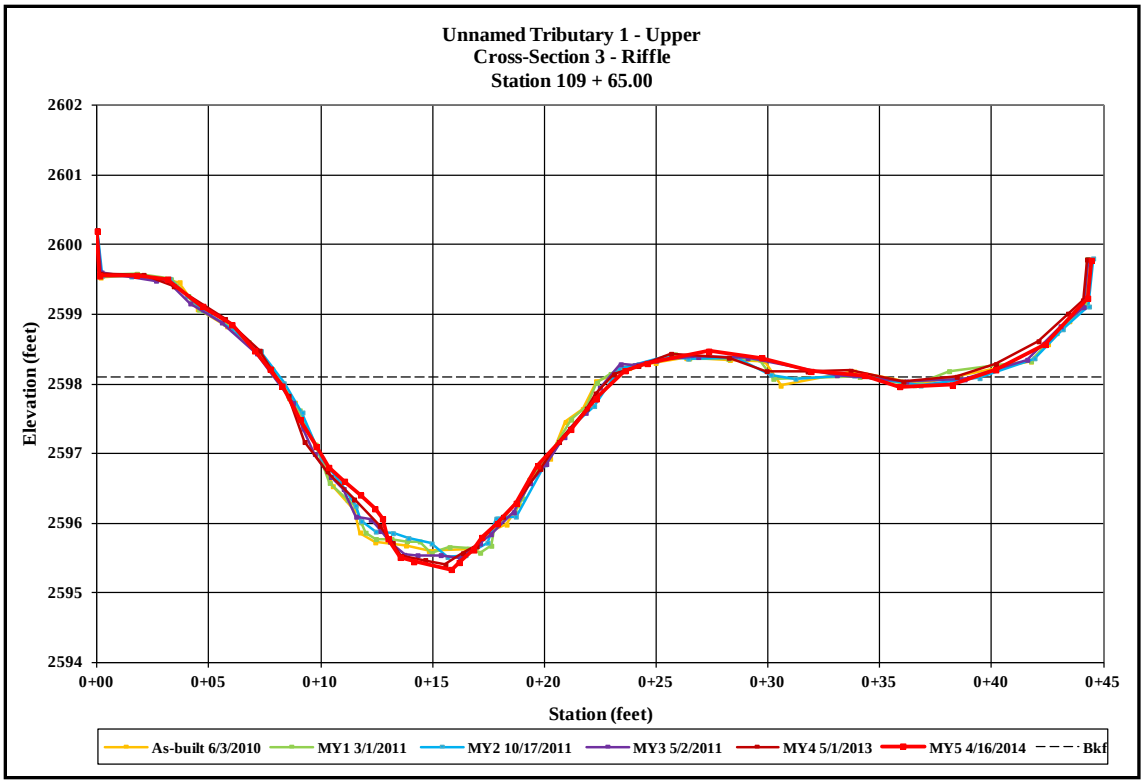


Left Descending Bank

Right Descending Bank

Upstream

Downstream

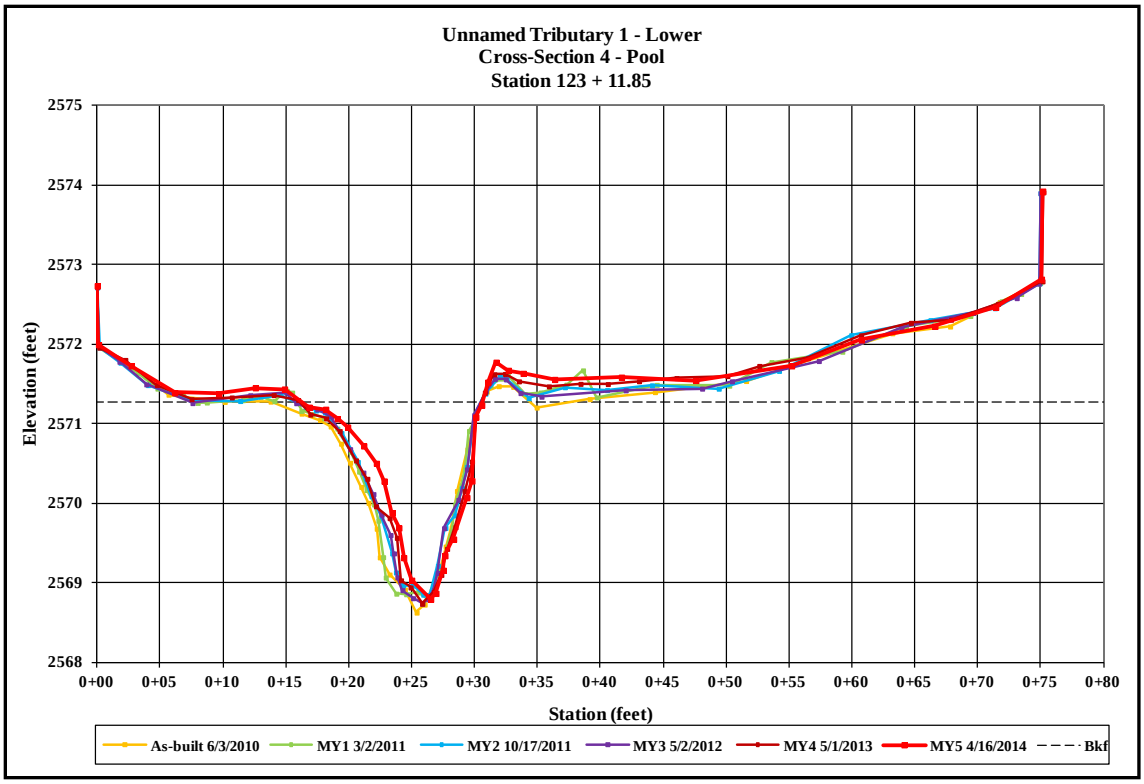


Left Descending Bank

Right Descending Bank

Upstream

Downstream

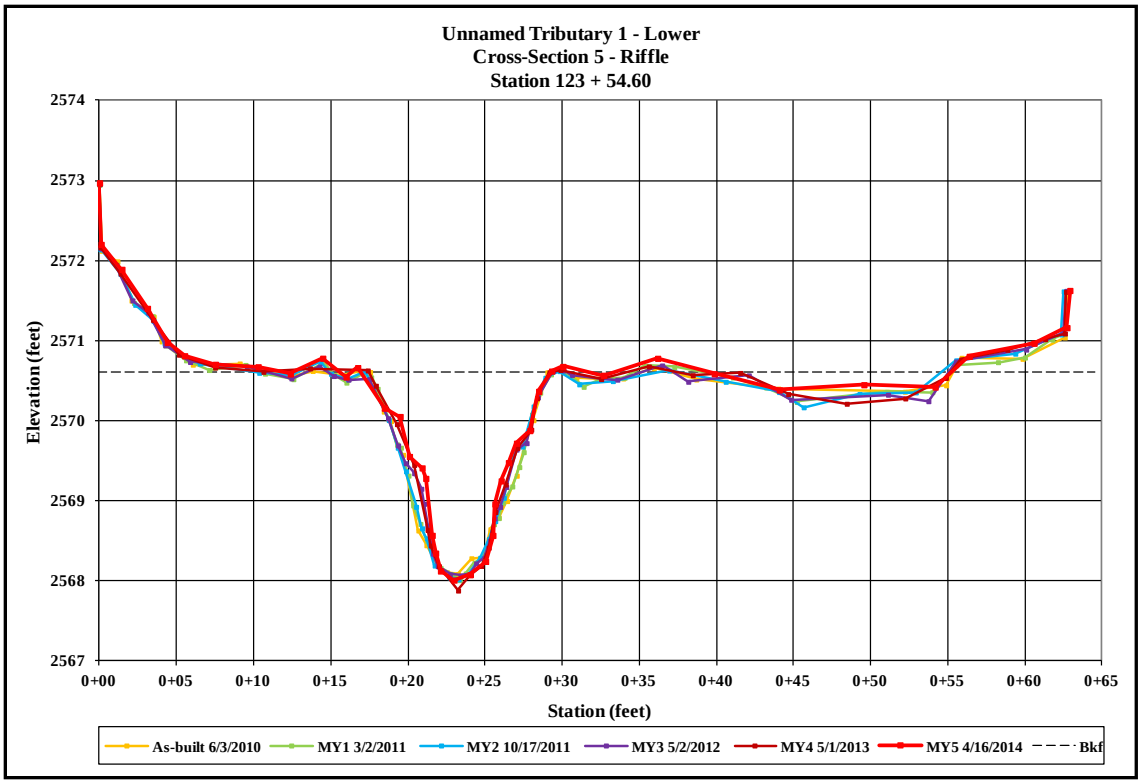


Left Descending Bank

Right Descending Bank

Upstream

Downstream

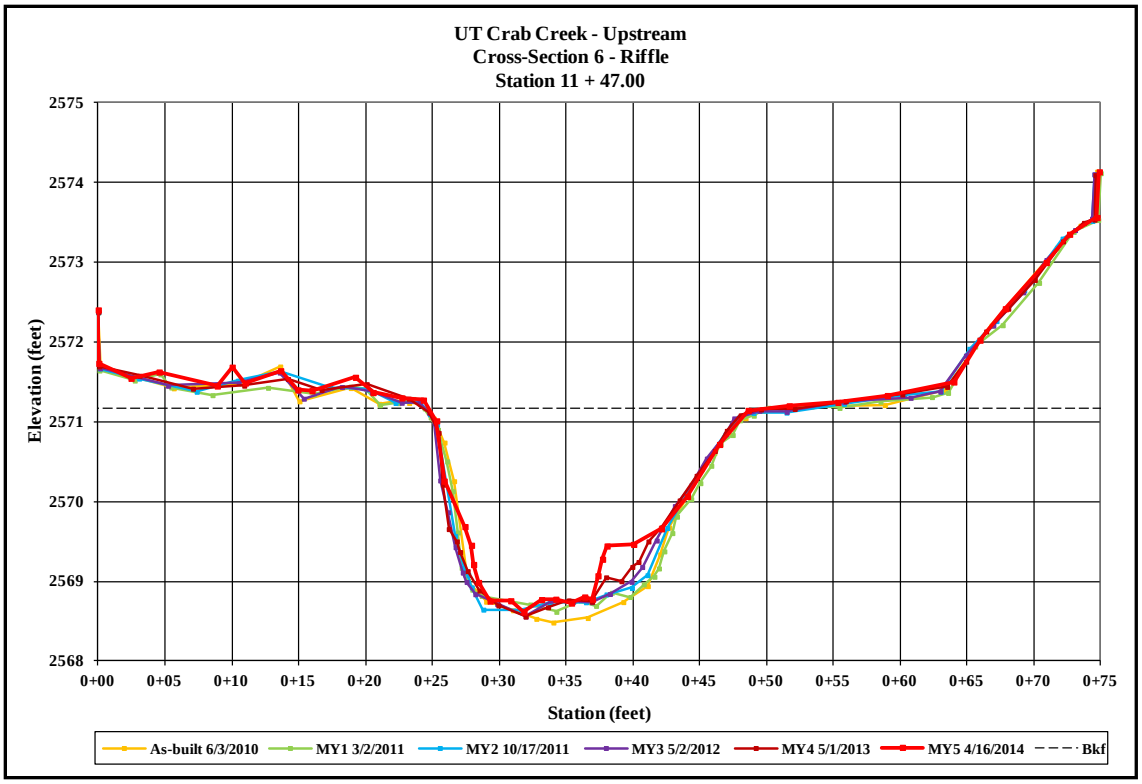


Left Descending Bank

Right Descending Bank

Upstream

Downstream

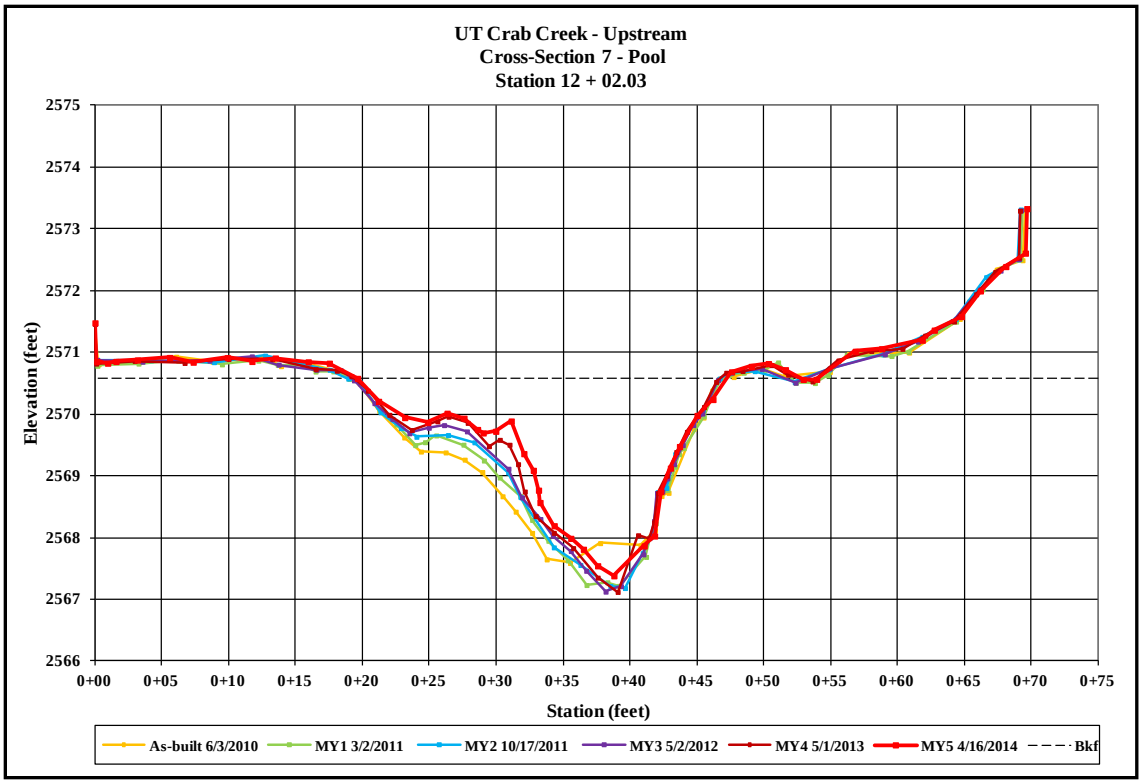


Left Descending Bank

Right Descending Bank

Upstream

Downstream

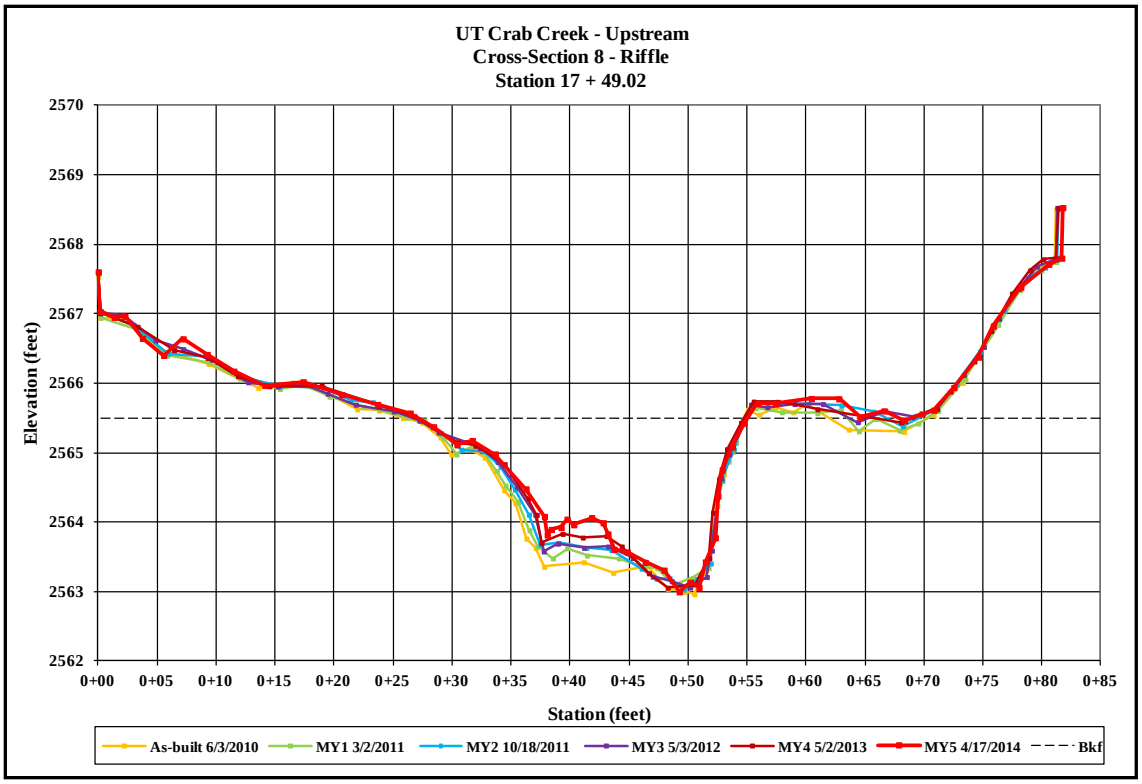


Left Descending Bank

Right Descending Bank

Upstream

Downstream

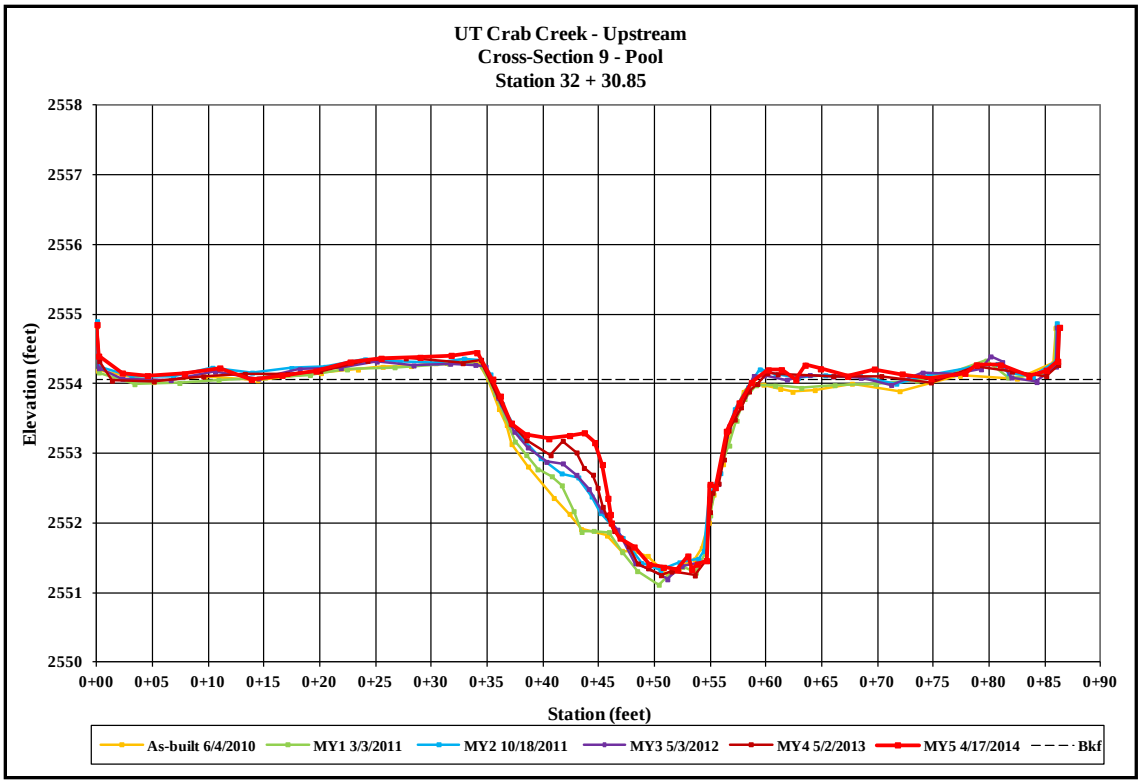


Left Descending Bank

Right Descending Bank

Upstream

Downstream

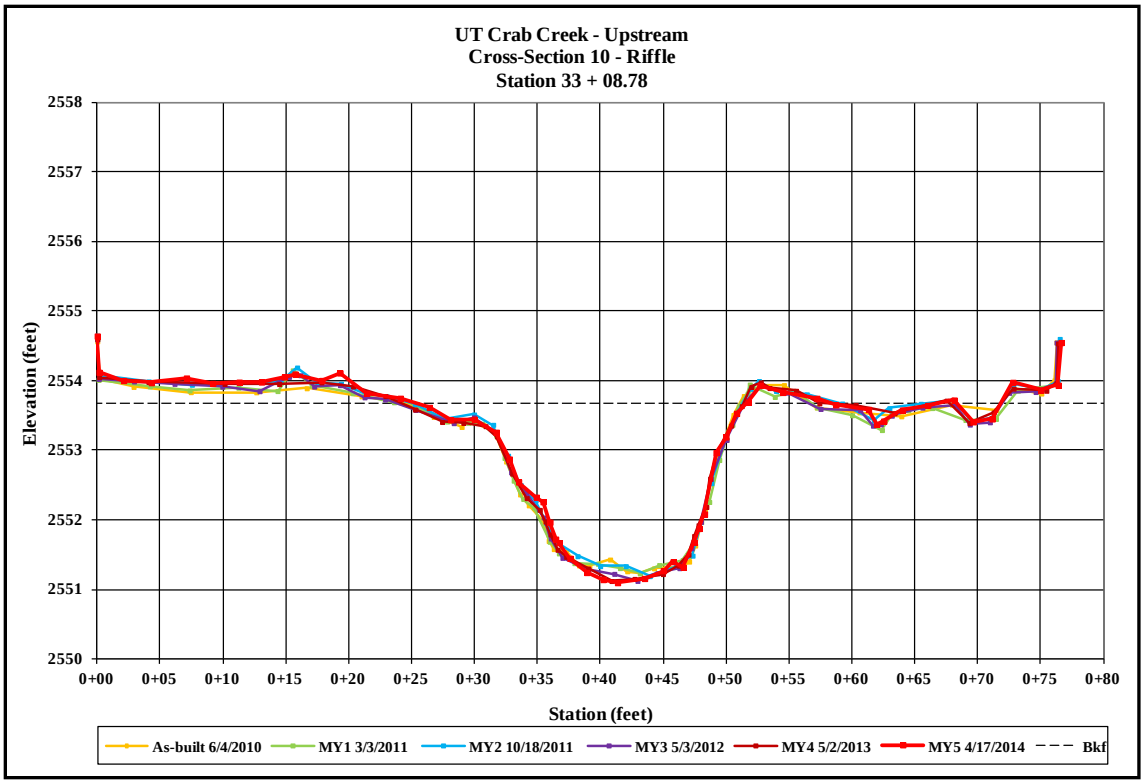


Left Descending Bank

Right Descending Bank

Upstream

Downstream



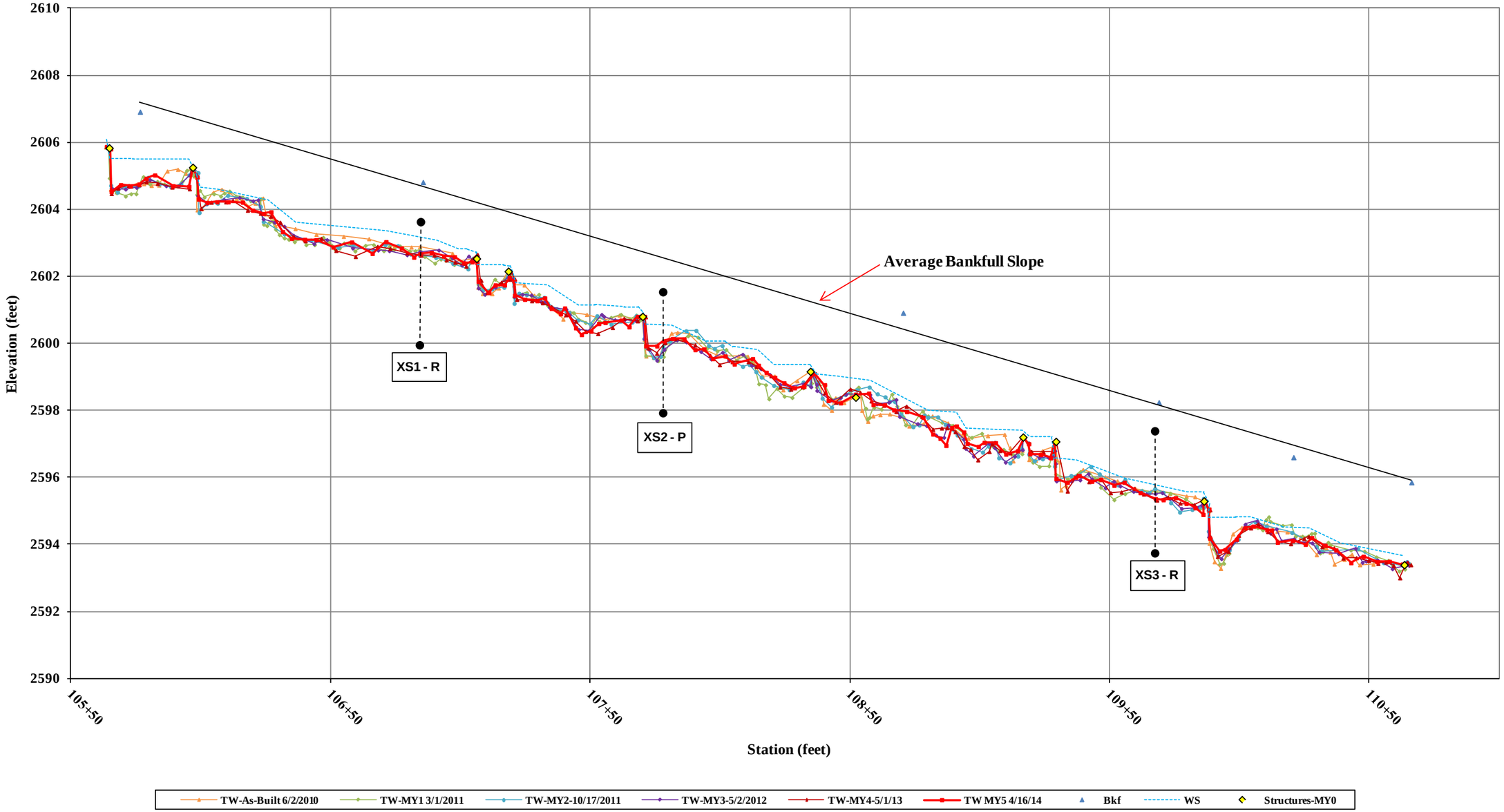
Left Descending Bank

Right Descending Bank

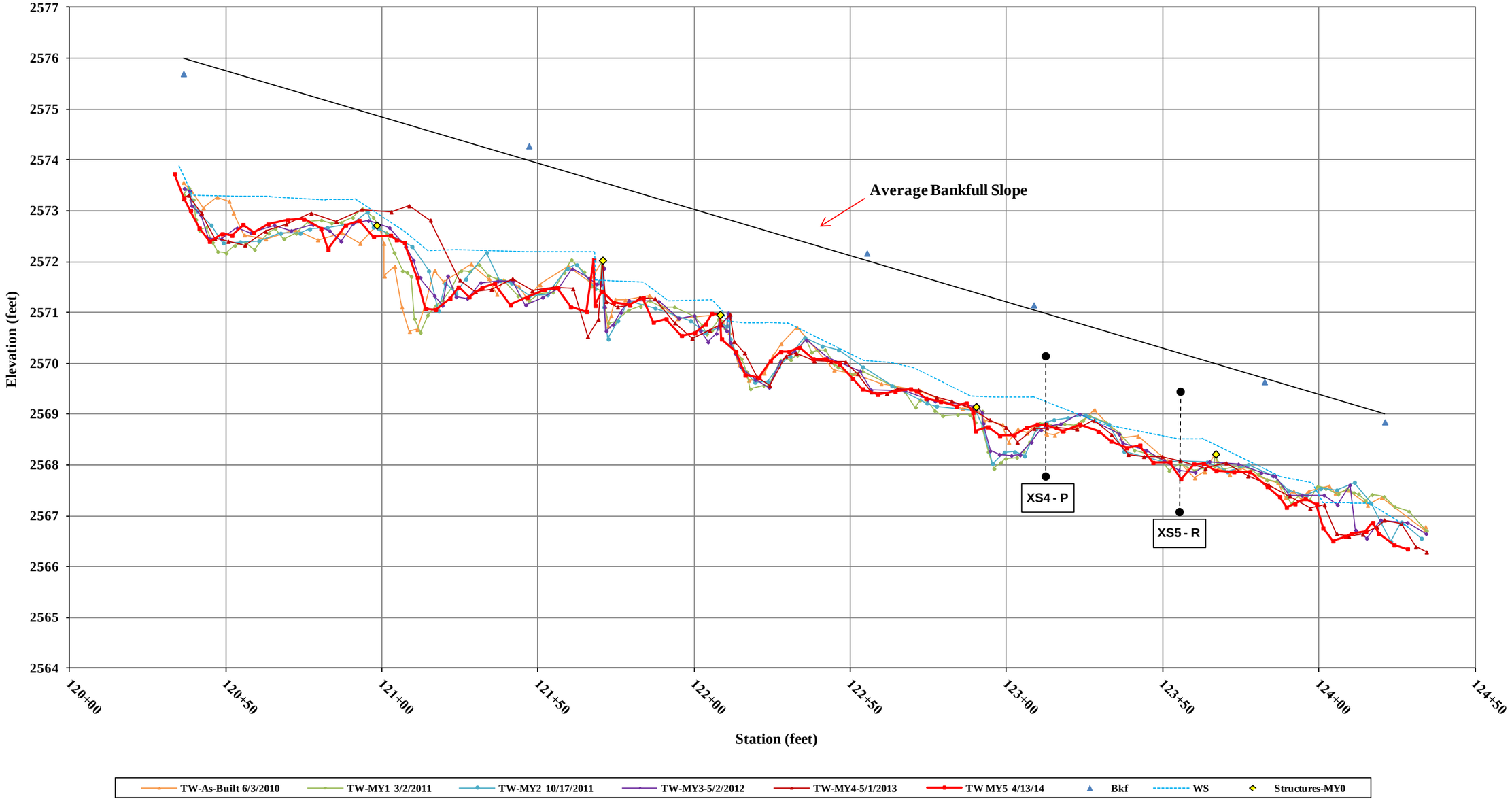
Upstream

Downstream

UT to Crab Creek - Upper
Longitudinal Profile
Stationing 105+63 - 110+63



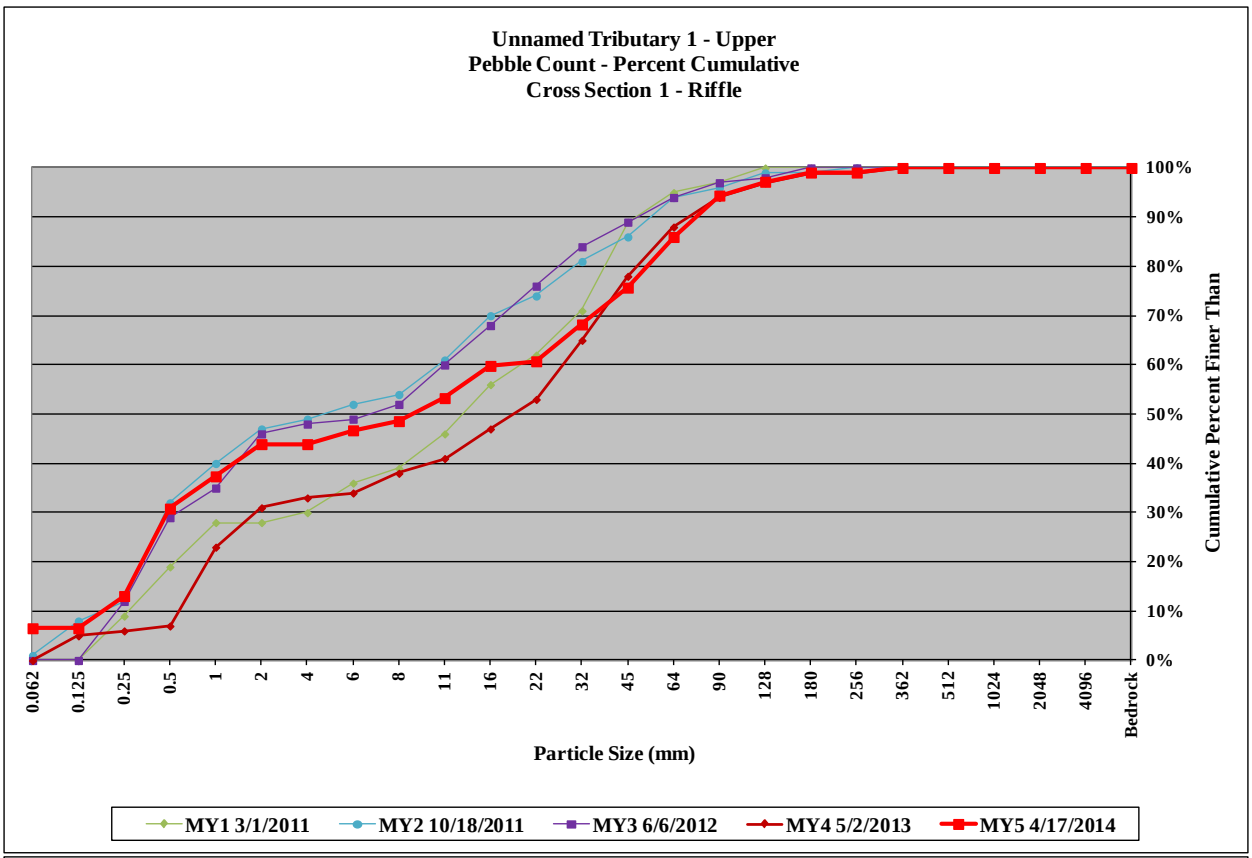
UT to Crab Creek- Lower
Longitudinal Profile
Stationing 120+36 - 124+33

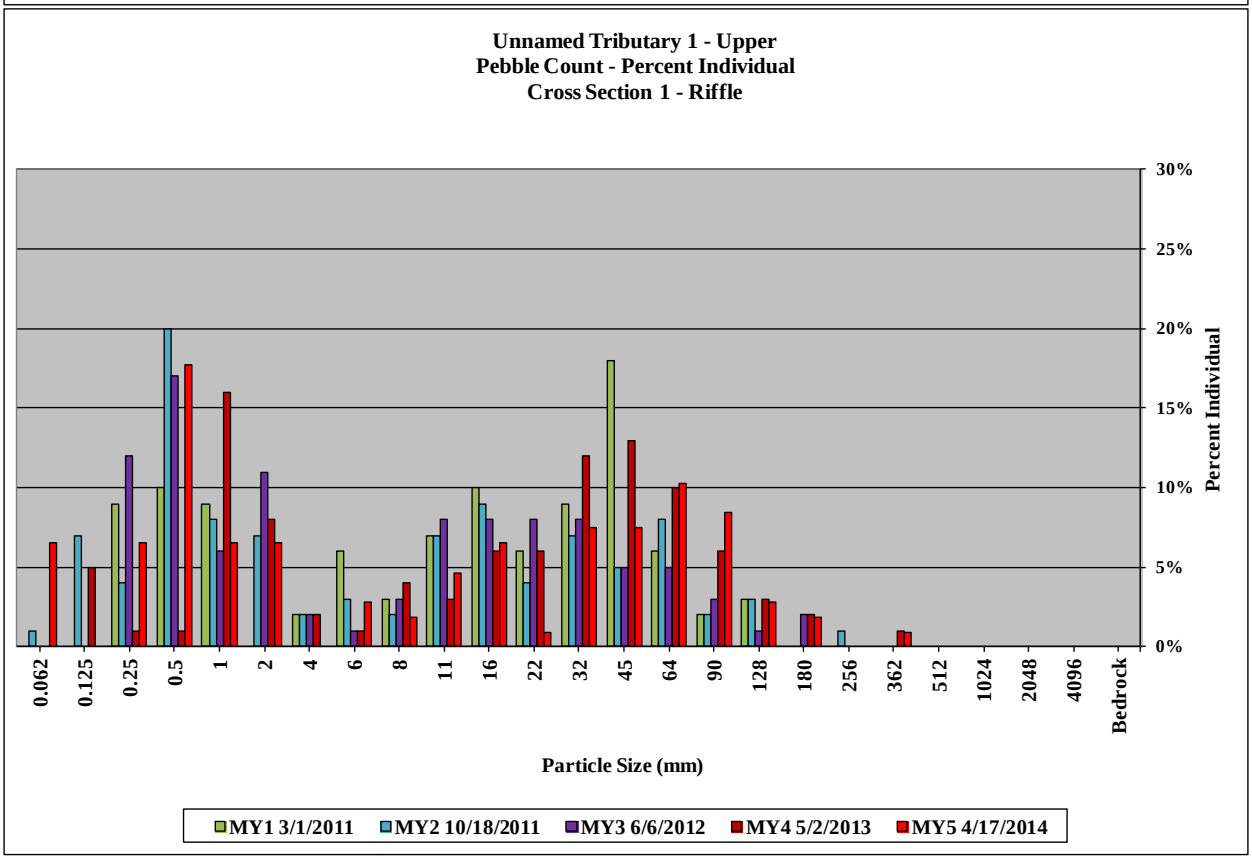


UT to Crab Creek- Upstream
Longitudinal Profile
Stationing 10+02 - 34+57

UT Crab Creek Stream & Wetland / Project No. 857 UT1 - Upper - Cross-Section 1 - Riffle Pebble Count Summary					
			Monitoring Year 5		
Description	**Material**	**Size (mm)**	**Total #**	**Item %**	**Cum %**
Silt/Clay	silt/clay	0.062	7	7%	7%
Sand	very fine sand	0.125	0	0%	7%
	fine sand	0.25	7	7%	13%
	medium sand	0.50	19	18%	31%
	coarse sand	1.00	7	7%	37%
	very coarse sand	2.00	7	7%	44%
Gravel	very fine gravel	4.0	0	0%	44%
	fine gravel	5.7	3	3%	47%
	fine gravel	8.0	2	2%	49%
	medium gravel	11.3	5	5%	53%
	medium gravel	16.0	7	7%	60%
	coarse gravel	22.3	1	1%	61%
	coarse gravel	32	8	7%	68%
	very coarse gravel	45	8	7%	76%
	very coarse gravel	64	11	10%	86%
Cobble	small cobble	90	9	8%	94%
	medium cobble	128	3	3%	97%
	large cobble	180	2	2%	99%
	very large cobble	256	0	0%	99%
Boulder	small boulder	362	1	1%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
	very large boulder	4096	0	0%	100%
Bedrock	bedrock	>4096	0	0%	100%
TOTALS			107	100%	100%

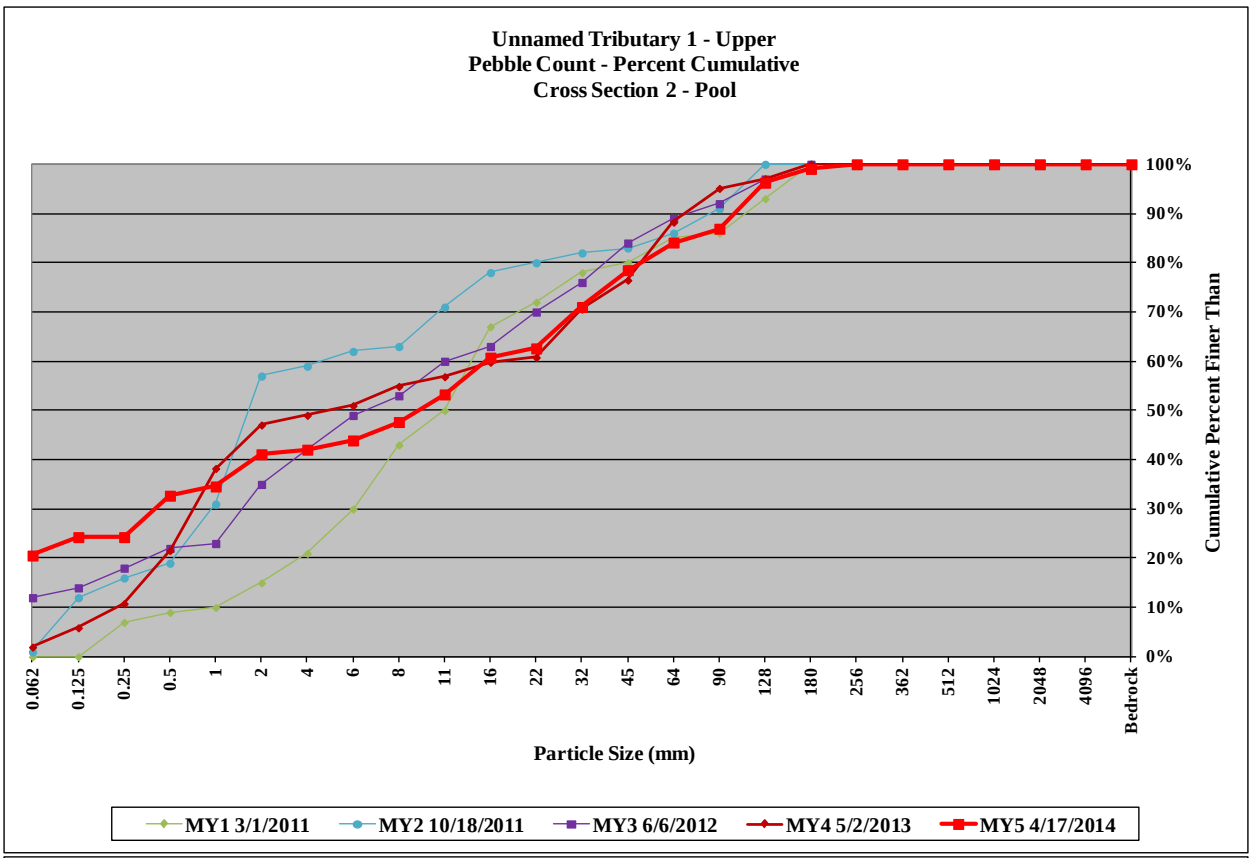
Summary Data	
D50	8.8
D84	60
D95	97

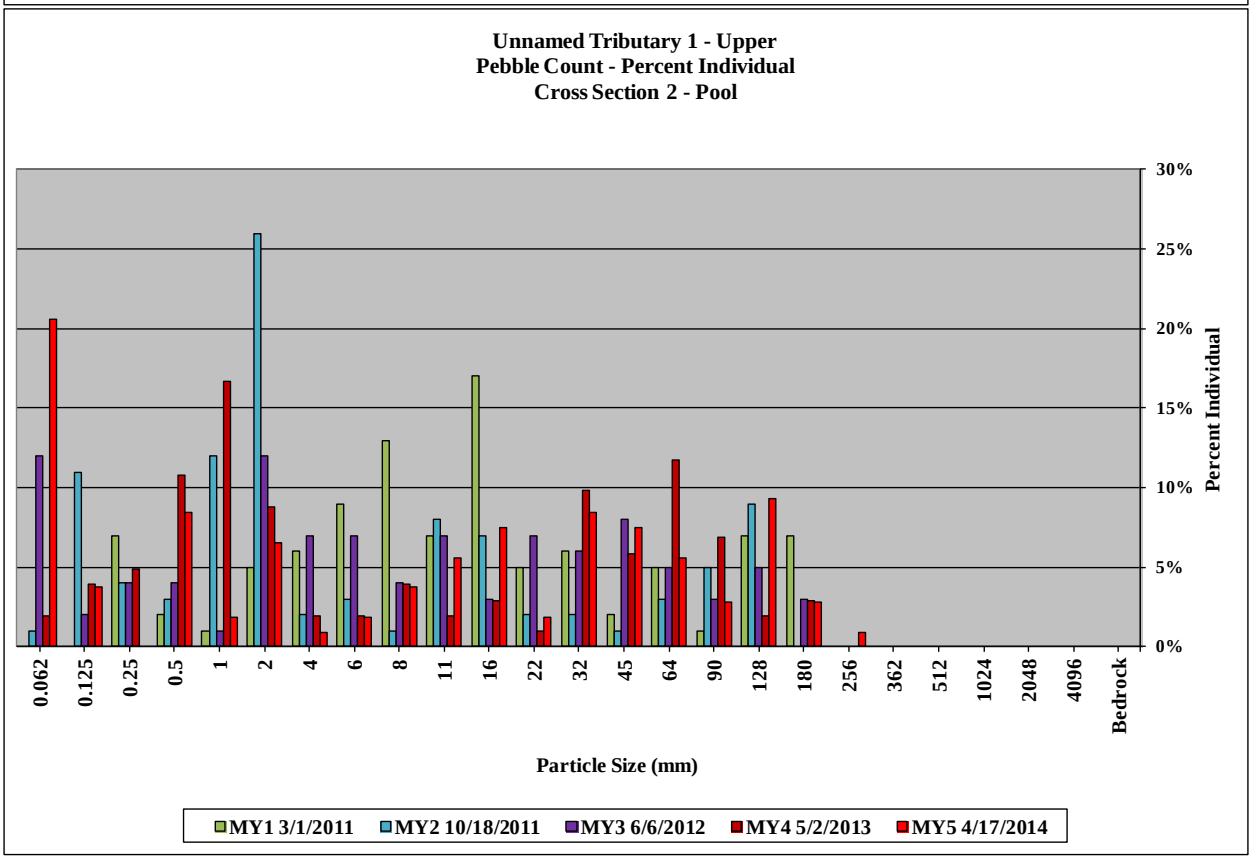

Unnamed Tributary 1 - Upper
Pebble Count - Percent Cumulative
Cross Section 1 - Riffle
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Cumulative Percent Finer Than
0.062
0.125
0.25
0.5
1
2
4
6
8
11
16
22
32
45
64
90
128
180
256
362
512
1024
2048
4096
Bedrock
Particle Size (mm)
MY1 3/1/2011
MY2 10/18/2011
MY3 6/6/2012
MY4 5/2/2013
MY5 4/17/2014


Unnamed Tributary 1 - Upper
Pebble Count - Percent Individual
Cross Section 1 - Riffle
30%
25%
20%
15%
10%
5%
0%
Percent Individual
0.062
0.125
0.25
0.5
1
2
4
6
8
11
16
22
32
45
64
90
128
180
256
362
512
1024
2048
4096
Bedrock
Particle Size (mm)
MY1 3/1/2011
MY2 10/18/2011
MY3 6/6/2012
MY4 5/2/2013
MY5 4/17/2014

UT Crab Creek Stream & Wetland / Project No. 857 UT1 - Upper - Cross-Section 2 - Pool Pebble Count Summary					
			Monitoring Year 5		
Description	**Material**	**Size (mm)**	**Total #**	**Item %**	**Cum %**
Silt/Clay	silt/clay	0.062	22	21%	21%
Sand	very fine sand	0.125	4	4%	24%
	fine sand	0.25	0	0%	24%
	medium sand	0.50	9	8%	33%
	coarse sand	1.00	2	2%	35%
	very coarse sand	2.00	7	7%	41%
Gravel	very fine gravel	4.0	1	1%	42%
	fine gravel	5.7	2	2%	44%
	fine gravel	8.0	4	4%	48%
	medium gravel	11.3	6	6%	53%
	medium gravel	16.0	8	7%	61%
	coarse gravel	22.3	2	2%	63%
	coarse gravel	32	9	8%	71%
	very coarse gravel	45	8	7%	79%
	very coarse gravel	64	6	6%	84%
Cobble	small cobble	90	3	3%	87%
	medium cobble	128	10	9%	96%
	large cobble	180	3	3%	99%
	very large cobble	256	1	1%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
	very large boulder	4096	0	0%	100%
Bedrock	bedrock	>4096	0	0%	100%
TOTALS			107	100%	100%

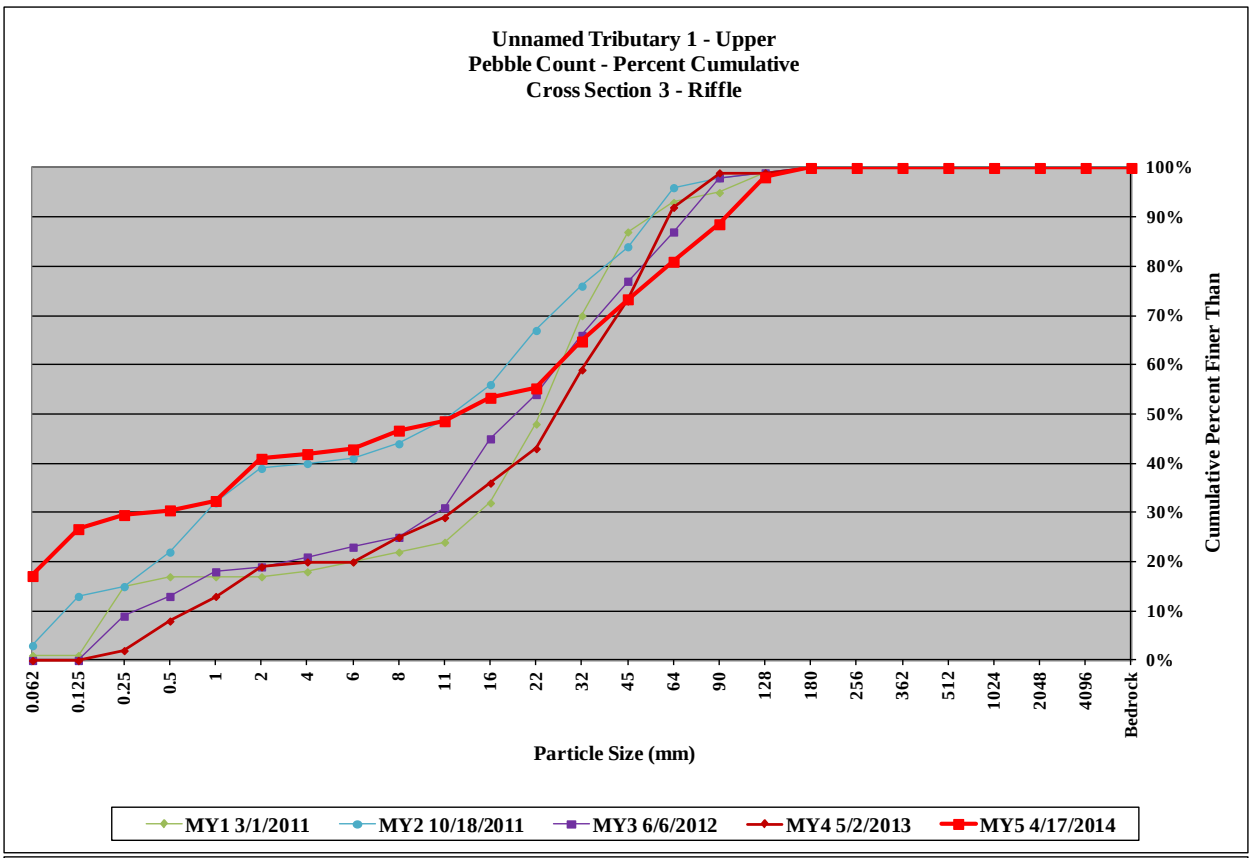
Summary Data	
D50	9.1
D84	64
D95	120

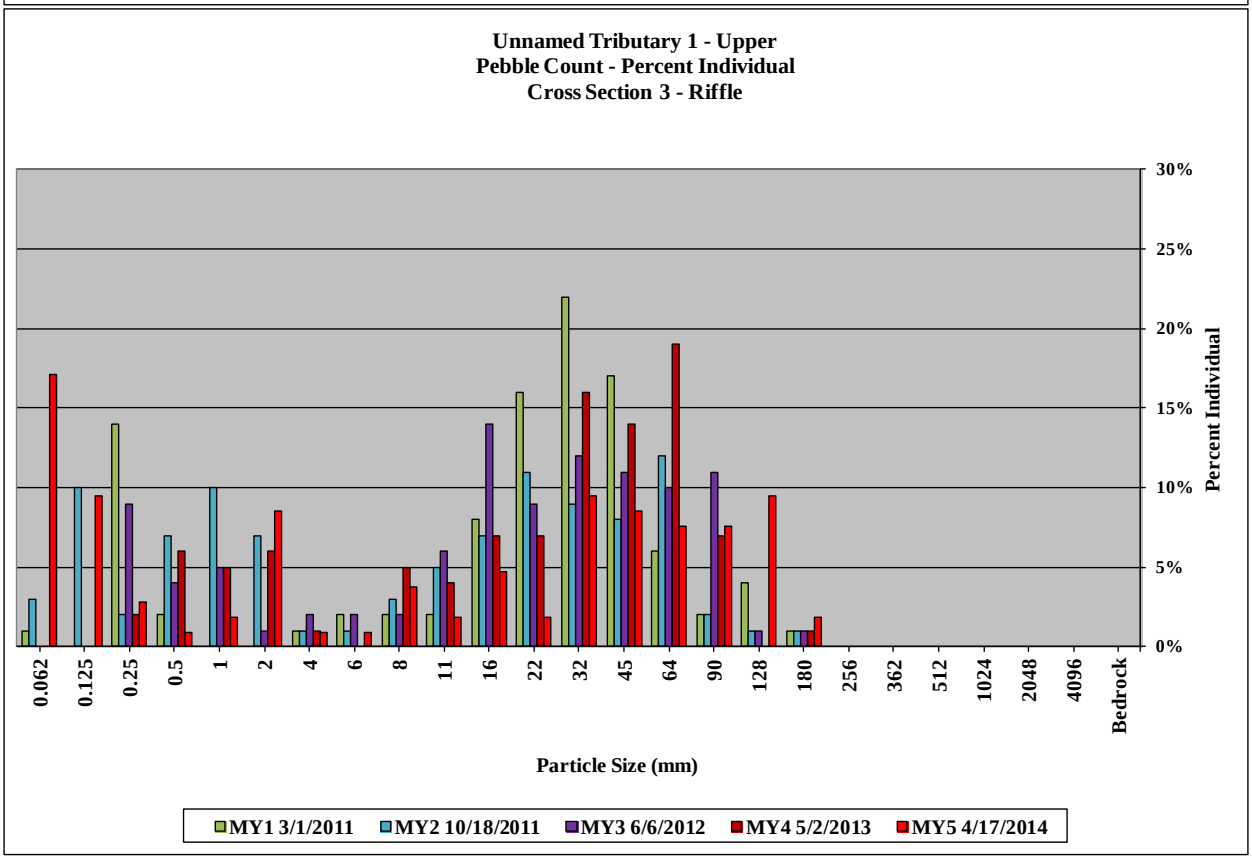

Unnamed Tributary 1 - Upper
Pebble Count - Percent Cumulative
Cross Section 2 - Pool
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Cumulative Percent Finer Than
0.062
0.125
0.25
0.5
1
2
4
6
8
11
16
22
32
45
64
90
128
180
256
362
512
1024
2048
4096
Bedrock
Particle Size (mm)
MY1 3/1/2011
MY2 10/18/2011
MY3 6/6/2012
MY4 5/2/2013
MY5 4/17/2014


Unnamed Tributary 1 - Upper
Pebble Count - Percent Individual
Cross Section 2 - Pool
30%
25%
20%
15%
10%
5%
0%
Percent Individual
0.062
0.125
0.25
0.5
1
2
4
6
8
11
16
22
32
45
64
90
128
180
256
362
512
1024
2048
4096
Bedrock
Particle Size (mm)
MY1 3/1/2011
MY2 10/18/2011
MY3 6/6/2012
MY4 5/2/2013
MY5 4/17/2014

UT Crab Creek Stream & Wetland / Project No. 857 UT1 - Upper - Cross-Section 3 - Riffle Pebble Count Summary					
			Monitoring Year 5		
Description	**Material**	**Size (mm)**	**Total #**	**Item %**	**Cum %**
Silt/Clay	silt/clay	0.062	18	17%	17%
Sand	very fine sand	0.125	10	10%	27%
	fine sand	0.25	3	3%	30%
	medium sand	0.50	1	1%	30%
	coarse sand	1.00	2	2%	32%
	very coarse sand	2.00	9	9%	41%
Gravel	very fine gravel	4.0	1	1%	42%
	fine gravel	5.7	1	1%	43%
	fine gravel	8.0	4	4%	47%
	medium gravel	11.3	2	2%	49%
	medium gravel	16.0	5	5%	53%
	coarse gravel	22.3	2	2%	55%
	coarse gravel	32	10	10%	65%
	very coarse gravel	45	9	9%	73%
	very coarse gravel	64	8	8%	81%
Cobble	small cobble	90	8	8%	89%
	medium cobble	128	10	10%	98%
	large cobble	180	2	2%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
	very large boulder	4096	0	0%	100%
Bedrock	bedrock	>4096	0	0%	100%
TOTALS			105	100%	100%

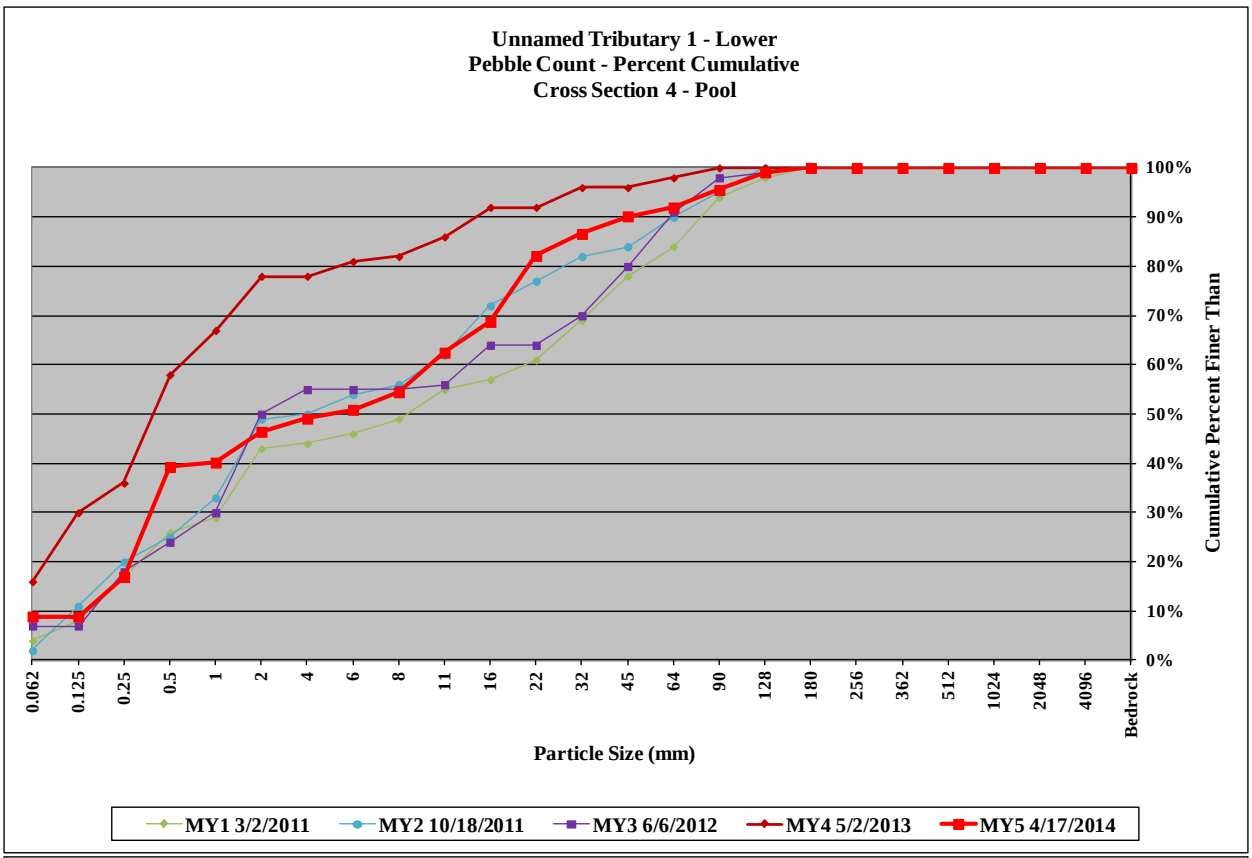
Summary Data	
D50	12
D84	73
D95	110

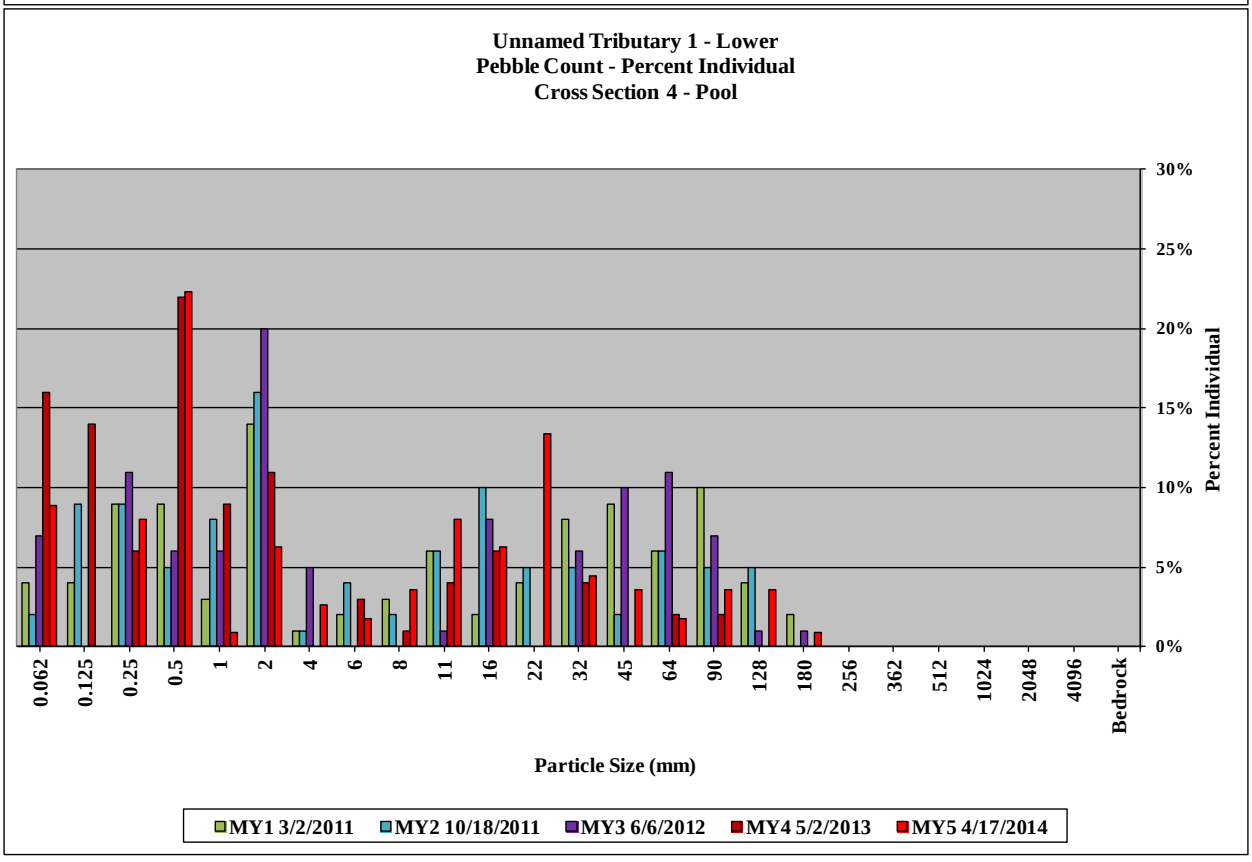

Unnamed Tributary 1 - Upper
Pebble Count - Percent Cumulative
Cross Section 3 - Riffle
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Cumulative Percent Finer Than
0.062
0.125
0.25
0.5
1
2
4
6
8
11
16
22
32
45
64
90
128
180
256
362
512
1024
2048
4096
Bedrock
Particle Size (mm)
MY1 3/1/2011
MY2 10/18/2011
MY3 6/6/2012
MY4 5/2/2013
MY5 4/17/2014


Unnamed Tributary 1 - Upper
Pebble Count - Percent Individual
Cross Section 3 - Riffle
30%
25%
20%
15%
10%
5%
0%
Percent Individual
0.062
0.125
0.25
0.5
1
2
4
6
8
11
16
22
32
45
64
90
128
180
256
362
512
1024
2048
4096
Bedrock
Particle Size (mm)
MY1 3/1/2011
MY2 10/18/2011
MY3 6/6/2012
MY4 5/2/2013
MY5 4/17/2014

UT Crab Creek Stream & Wetland / Project No. 857 UT1 - Lower - Cross-Section 4 - Pool Pebble Count Summary					
			Monitoring Year 5		
Description	**Material**	**Size (mm)**	**Total #**	**Item %**	**Cum %**
Silt/Clay	silt/clay	0.062	10	9%	9%
Sand	very fine sand	0.125	0	0%	9%
	fine sand	0.25	9	8%	17%
	medium sand	0.50	25	22%	39%
	coarse sand	1.00	1	1%	40%
	very coarse sand	2.00	7	6%	46%
Gravel	very fine gravel	4.0	3	3%	49%
	fine gravel	5.7	2	2%	51%
	fine gravel	8.0	4	4%	54%
	medium gravel	11.3	9	8%	63%
	medium gravel	16.0	7	6%	69%
	coarse gravel	22.3	15	13%	82%
	coarse gravel	32	5	4%	87%
	very coarse gravel	45	4	4%	90%
	very coarse gravel	64	2	2%	92%
Cobble	small cobble	90	4	4%	96%
	medium cobble	128	4	4%	99%
	large cobble	180	1	1%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
	very large boulder	4096	0	0%	100%
Bedrock	bedrock	>4096	0	0%	100%
TOTALS			112	100%	100%

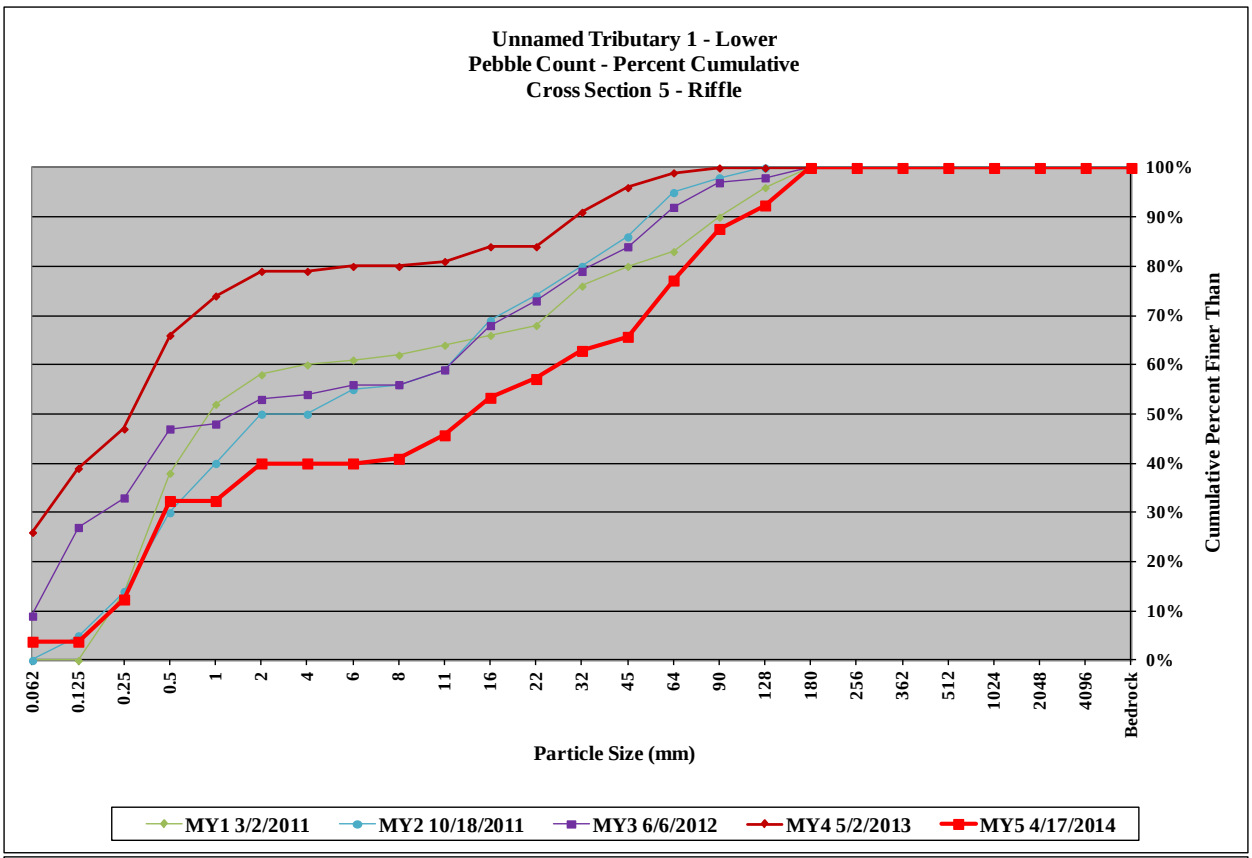
Summary Data	
D50	4.9
D84	26
D95	86

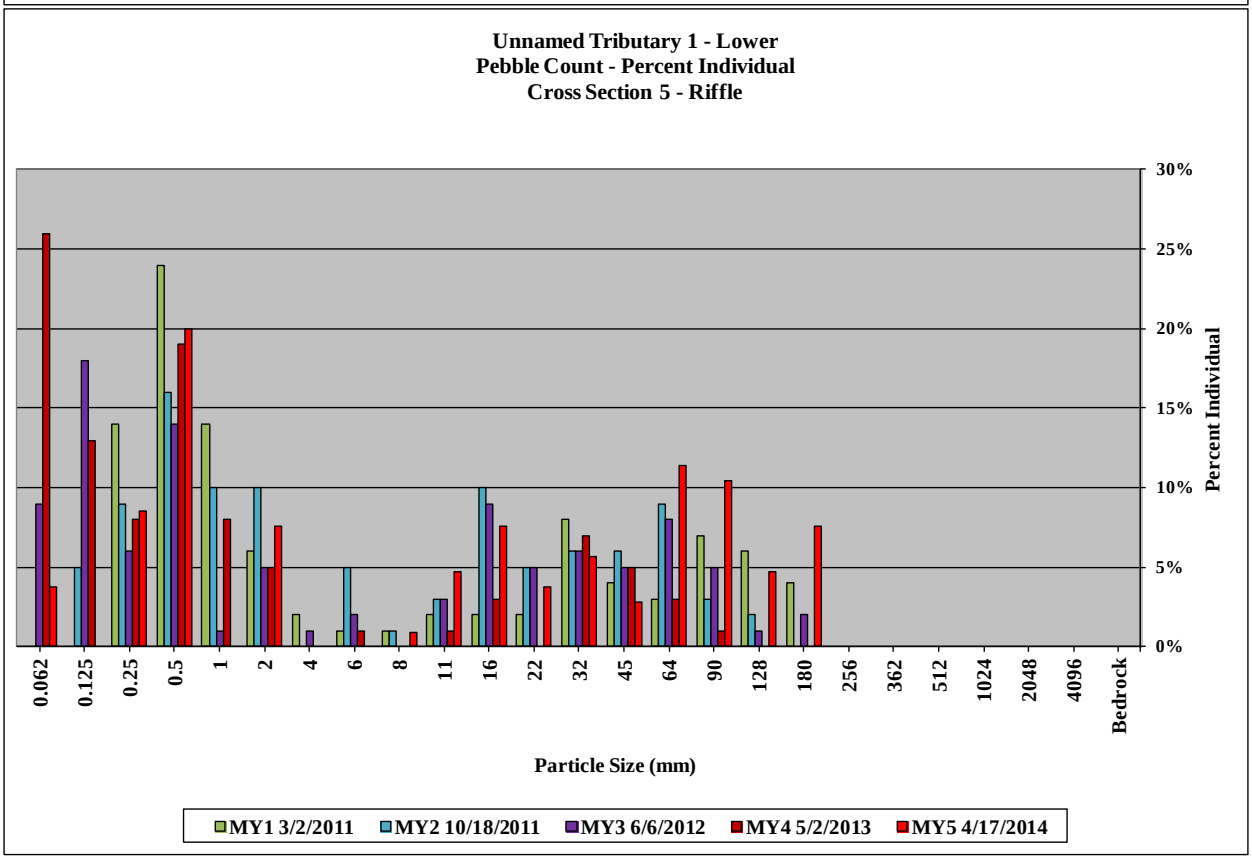

Unnamed Tributary 1 - Lower
Pebble Count - Percent Cumulative
Cross Section 4 - Pool
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Cumulative Percent Finer Than
0.062
0.125
0.25
0.5
1
2
4
6
8
11
16
22
32
45
64
90
128
180
256
362
512
1024
2048
4096
Bedrock
Particle Size (mm)
MY1 3/2/2011
MY2 10/18/2011
MY3 6/6/2012
MY4 5/2/2013
MY5 4/17/2014


Unnamed Tributary 1 - Lower
Pebble Count - Percent Individual
Cross Section 4 - Pool
30%
25%
20%
15%
10%
5%
0%
Percent Individual
0.062
0.125
0.25
0.5
1
2
4
6
8
11
16
22
32
45
64
90
128
180
256
362
512
1024
2048
4096
Bedrock
Particle Size (mm)
MY1 3/2/2011
MY2 10/18/2011
MY3 6/6/2012
MY4 5/2/2013
MY5 4/17/2014

UT Crab Creek Stream & Wetland / Project No. 857 UT1 - Lower - Cross-Section 5 - Riffle Pebble Count Summary					
			Monitoring Year 5		
Description	**Material**	**Size (mm)**	**Total #**	**Item %**	**Cum %**
Silt/Clay	silt/clay	0.062	4	4%	4%
Sand	very fine sand	0.125	0	0%	4%
	fine sand	0.25	9	9%	12%
	medium sand	0.50	21	20%	32%
	coarse sand	1.00	0	0%	32%
	very coarse sand	2.00	8	8%	40%
Gravel	very fine gravel	4.0	0	0%	40%
	fine gravel	5.7	0	0%	40%
	fine gravel	8.0	1	1%	41%
	medium gravel	11.3	5	5%	46%
	medium gravel	16.0	8	8%	53%
	coarse gravel	22.3	4	4%	57%
	coarse gravel	32	6	6%	63%
	very coarse gravel	45	3	3%	66%
	very coarse gravel	64	12	11%	77%
Cobble	small cobble	90	11	10%	88%
	medium cobble	128	5	5%	92%
	large cobble	180	8	8%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
	very large boulder	4096	0	0%	100%
Bedrock	bedrock	>4096	0	0%	100%
TOTALS			105	105%	100%

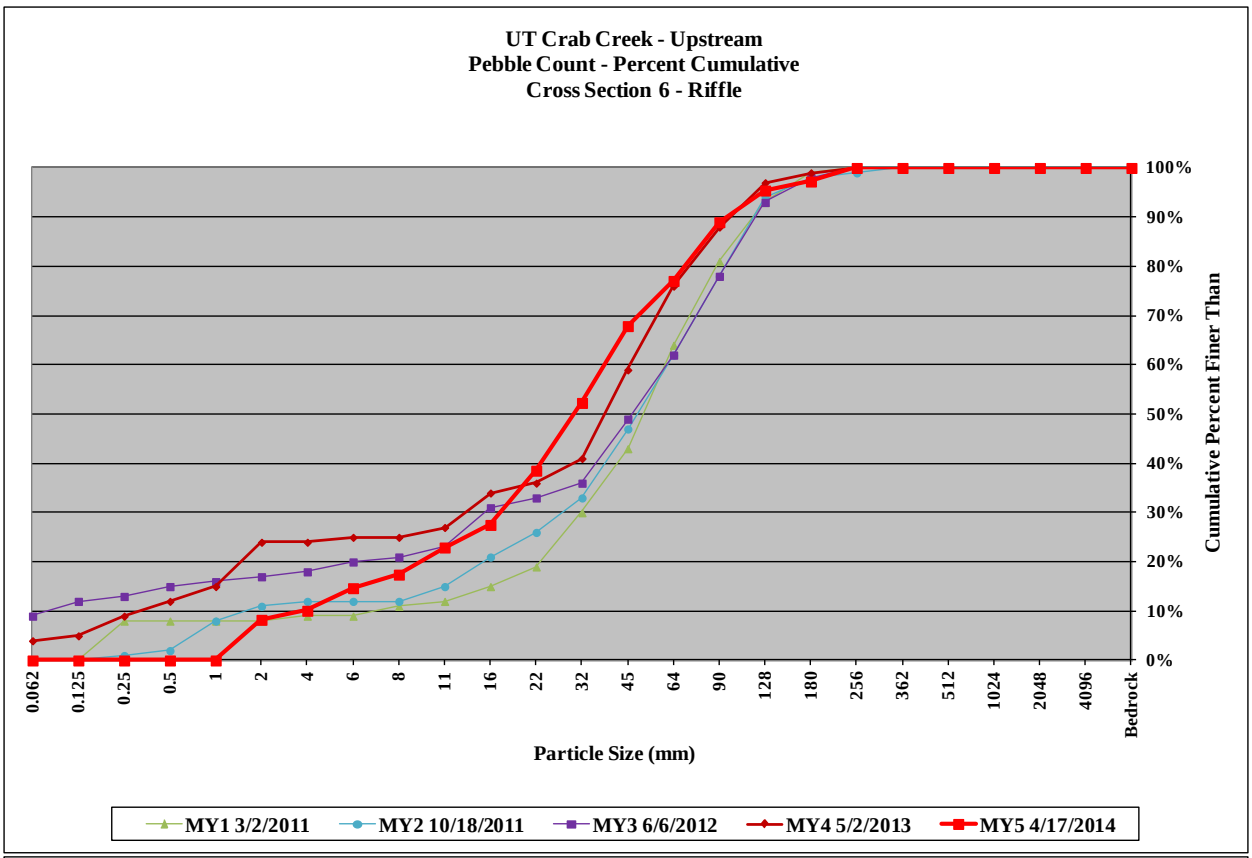
Summary Data	
D50	14
D84	80
D95	140

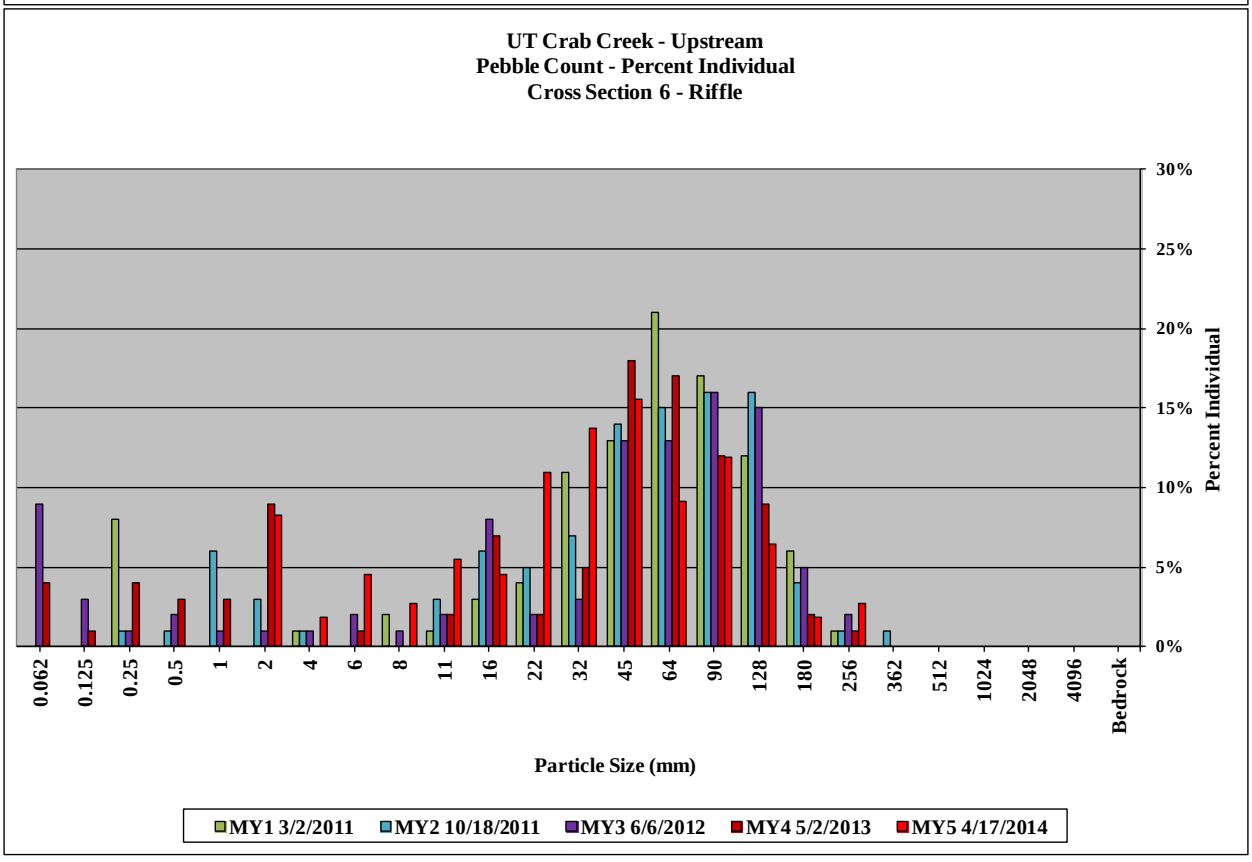

Unnamed Tributary 1 - Lower
Pebble Count - Percent Cumulative
Cross Section 5 - Riffle
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Cumulative Percent Finer Than
0.062
0.125
0.25
0.5
1
2
4
6
8
11
16
22
32
45
64
90
128
180
256
362
512
1024
2048
4096
Bedrock
Particle Size (mm)
MY1 3/2/2011
MY2 10/18/2011
MY3 6/6/2012
MY4 5/2/2013
MY5 4/17/2014


Unnamed Tributary 1 - Lower
Pebble Count - Percent Individual
Cross Section 5 - Riffle
30%
25%
20%
15%
10%
5%
0%
Percent Individual
0.062
0.125
0.25
0.5
1
2
4
6
8
11
16
22
32
45
64
90
128
180
256
362
512
1024
2048
4096
Bedrock
Particle Size (mm)
MY1 3/2/2011
MY2 10/18/2011
MY3 6/6/2012
MY4 5/2/2013
MY5 4/17/2014

UT Crab Creek Stream & Wetland / Project No. 857 UTCC - Upstream - Cross-Section 6 - Riffle Pebble Count Summary					
			Monitoring Year 5		
Description	**Material**	**Size (mm)**	**Total #**	**Item %**	**Cum %**
Silt/Clay	silt/clay	0.062	0	0%	0%
Sand	very fine sand	0.125	0	0%	0%
	fine sand	0.25	0	0%	0%
	medium sand	0.50	0	0%	0%
	coarse sand	1.00	0	0%	0%
	very coarse sand	2.00	9	8%	8%
Gravel	very fine gravel	4.0	2	2%	10%
	fine gravel	5.7	5	5%	15%
	fine gravel	8.0	3	3%	17%
	medium gravel	11.3	6	6%	23%
	medium gravel	16.0	5	5%	28%
	coarse gravel	22.3	12	11%	39%
	coarse gravel	32	15	14%	52%
	very coarse gravel	45	17	16%	68%
	very coarse gravel	64	10	9%	77%
Cobble	small cobble	90	13	12%	89%
	medium cobble	128	7	6%	95%
	large cobble	180	2	2%	97%
	very large cobble	256	3	3%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
	very large boulder	4096	0	0%	100%
Bedrock	bedrock	>4096	0	0%	100%
TOTALS			109	100%	100%

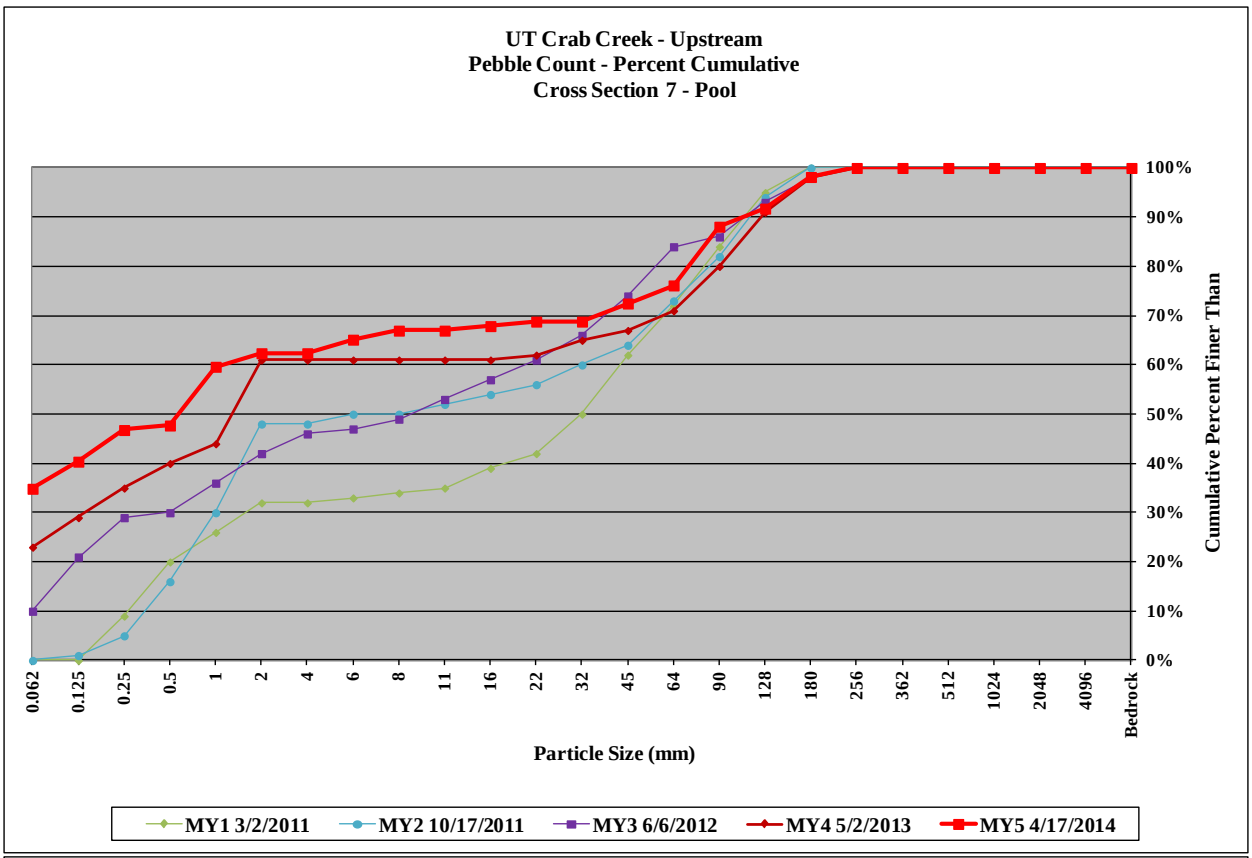
Summary Data	
D50	30
D84	78
D95	130

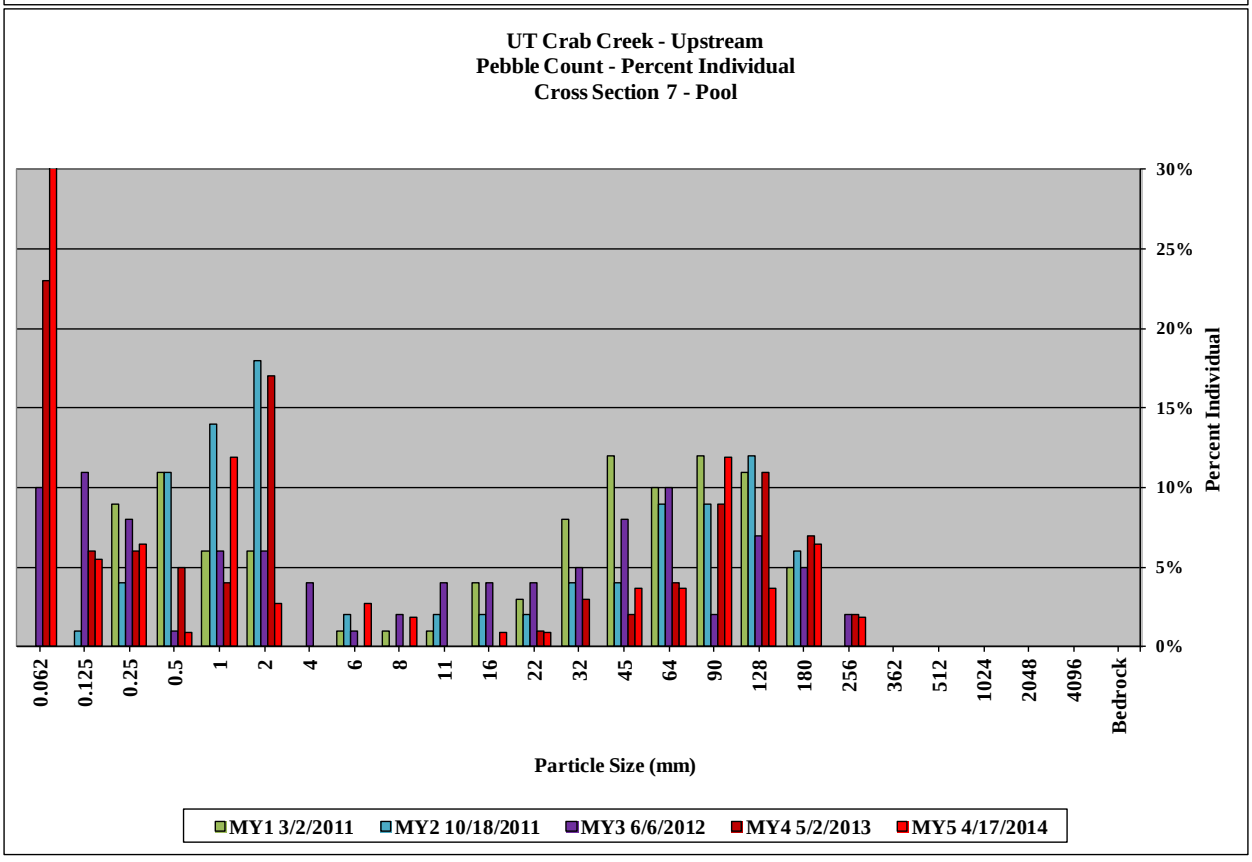

UT Crab Creek - Upstream
Pebble Count - Percent Cumulative
Cross Section 6 - Riffle
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Cumulative Percent Finer Than
0.062
0.125
0.25
0.5
1
2
4
6
8
11
16
22
32
45
64
90
128
180
256
362
512
1024
2048
4096
Bedrock
Particle Size (mm)
MY1 3/2/2011
MY2 10/18/2011
MY3 6/6/2012
MY4 5/2/2013
MY5 4/17/2014


UT Crab Creek - Upstream
Pebble Count - Percent Individual
Cross Section 6 - Riffle
30%
25%
20%
15%
10%
5%
0%
Percent Individual
0.062
0.125
0.25
0.5
1
2
4
6
8
11
16
22
32
45
64
90
128
180
256
362
512
1024
2048
4096
Bedrock
Particle Size (mm)
MY1 3/2/2011
MY2 10/18/2011
MY3 6/6/2012
MY4 5/2/2013
MY5 4/17/2014

UT Crab Creek Stream & Wetland / Project No. 857 UTCC - Upstream - Cross-Section 7 - Pool Pebble Count Summary					
			Monitoring Year 5		
Description	**Material**	**Size (mm)**	**Total #**	**Item %**	**Cum %**
Silt/Clay	silt/clay	0.062	38	35%	35%
Sand	very fine sand	0.125	6	6%	40%
	fine sand	0.25	7	6%	47%
	medium sand	0.50	1	1%	48%
	coarse sand	1.00	13	12%	60%
	very coarse sand	2.00	3	3%	62%
Gravel	very fine gravel	4.0	0	0%	62%
	fine gravel	5.7	3	3%	65%
	fine gravel	8.0	2	2%	67%
	medium gravel	11.3	0	0%	67%
	medium gravel	16.0	1	1%	68%
	coarse gravel	22.3	1	1%	69%
	coarse gravel	32	0	0%	69%
	very coarse gravel	45	4	4%	72%
	very coarse gravel	64	4	4%	76%
Cobble	small cobble	90	13	12%	88%
	medium cobble	128	4	4%	92%
	large cobble	180	7	6%	98%
	very large cobble	256	2	2%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
	very large boulder	4096	0	0%	100%
Bedrock	bedrock	>4096	0	0%	100%
TOTALS			109	100%	100%

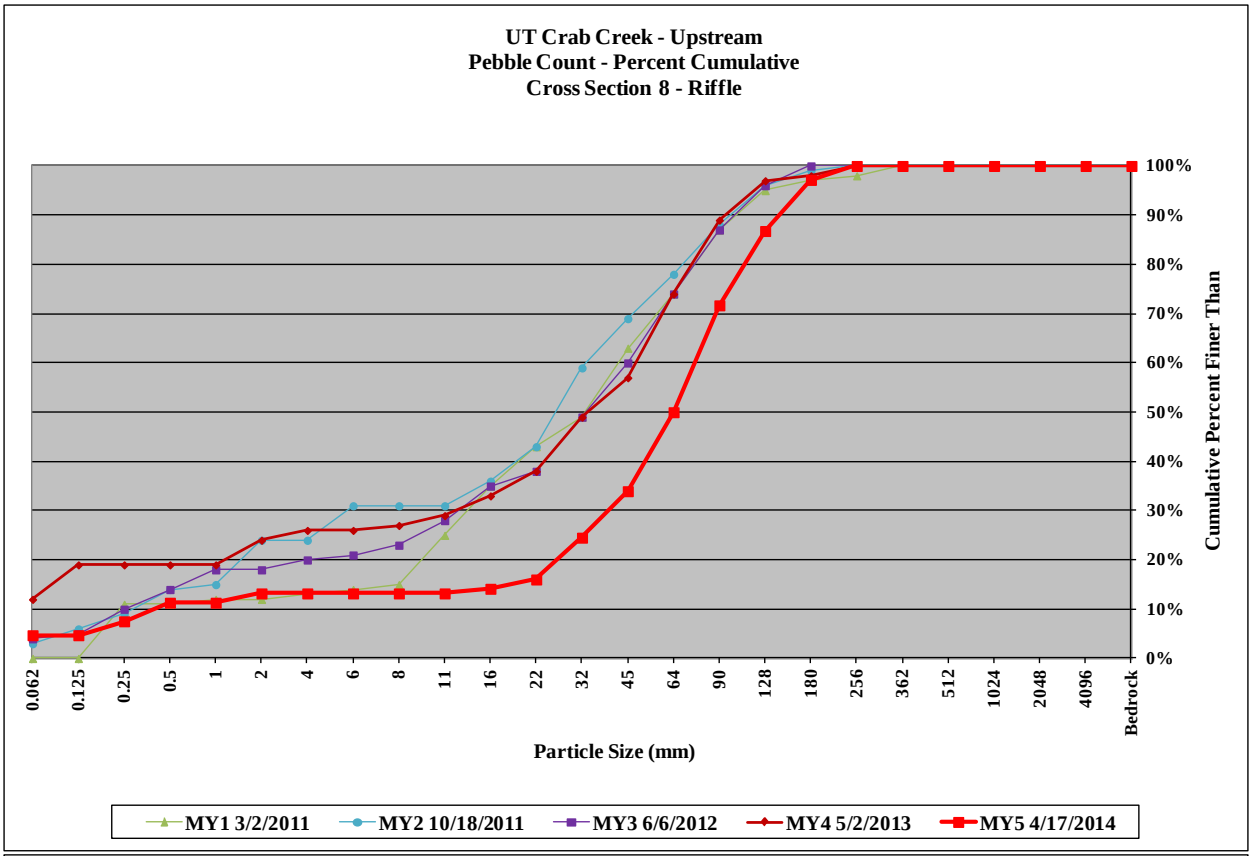
Summary Data	
D50	0.062
D84	80
D95	150

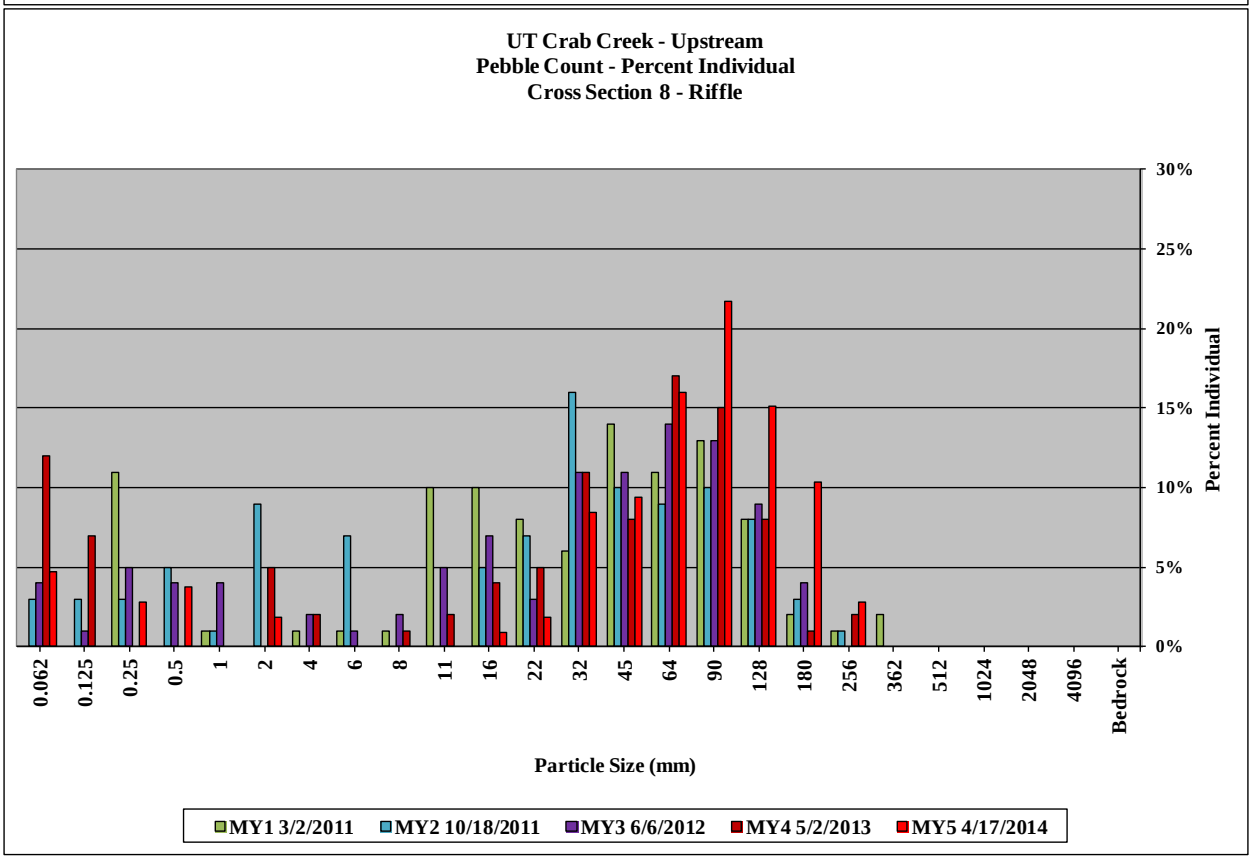

UT Crab Creek - Upstream
Pebble Count - Percent Cumulative
Cross Section 7 - Pool
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Cumulative Percent Finer Than
0.062
0.125
0.25
0.5
1
2
4
6
8
11
16
22
32
45
64
90
128
180
256
362
512
1024
2048
4096
Bedrock
Particle Size (mm)
MY1 3/2/2011
MY2 10/17/2011
MY3 6/6/2012
MY4 5/2/2013
MY5 4/17/2014


UT Crab Creek - Upstream
Pebble Count - Percent Individual
Cross Section 7 - Pool
30%
25%
20%
15%
10%
5%
0%
Percent Individual
0.062
0.125
0.25
0.5
1
2
4
6
8
11
16
22
32
45
64
90
128
180
256
362
512
1024
2048
4096
Bedrock
Particle Size (mm)
MY1 3/2/2011
MY2 10/18/2011
MY3 6/6/2012
MY4 5/2/2013
MY5 4/17/2014

UT Crab Creek Stream & Wetland / Project No. 857 UTCC - Upstream - Cross-Section 8 - Riffle Pebble Count Summary					
			Monitoring Year 5		
Description	**Material**	**Size (mm)**	**Total #**	**Item %**	**Cum %**
Silt/Clay	silt/clay	0.062	5	5%	5%
Sand	very fine sand	0.125	0	0%	5%
	fine sand	0.25	3	3%	8%
	medium sand	0.50	4	4%	11%
	coarse sand	1.00	0	0%	11%
	very coarse sand	2.00	2	2%	13%
Gravel	very fine gravel	4.0	0	0%	13%
	fine gravel	5.7	0	0%	13%
	fine gravel	8.0	0	0%	13%
	medium gravel	11.3	0	0%	13%
	medium gravel	16.0	1	1%	14%
	coarse gravel	22.3	2	2%	16%
	coarse gravel	32	9	8%	25%
	very coarse gravel	45	10	9%	34%
	very coarse gravel	64	17	16%	50%
Cobble	small cobble	90	23	22%	72%
	medium cobble	128	16	15%	87%
	large cobble	180	11	10%	97%
	very large cobble	256	3	3%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
	very large boulder	4096	0	0%	100%
Bedrock	bedrock	>4096	0	0%	100%
TOTALS			106	100%	100%

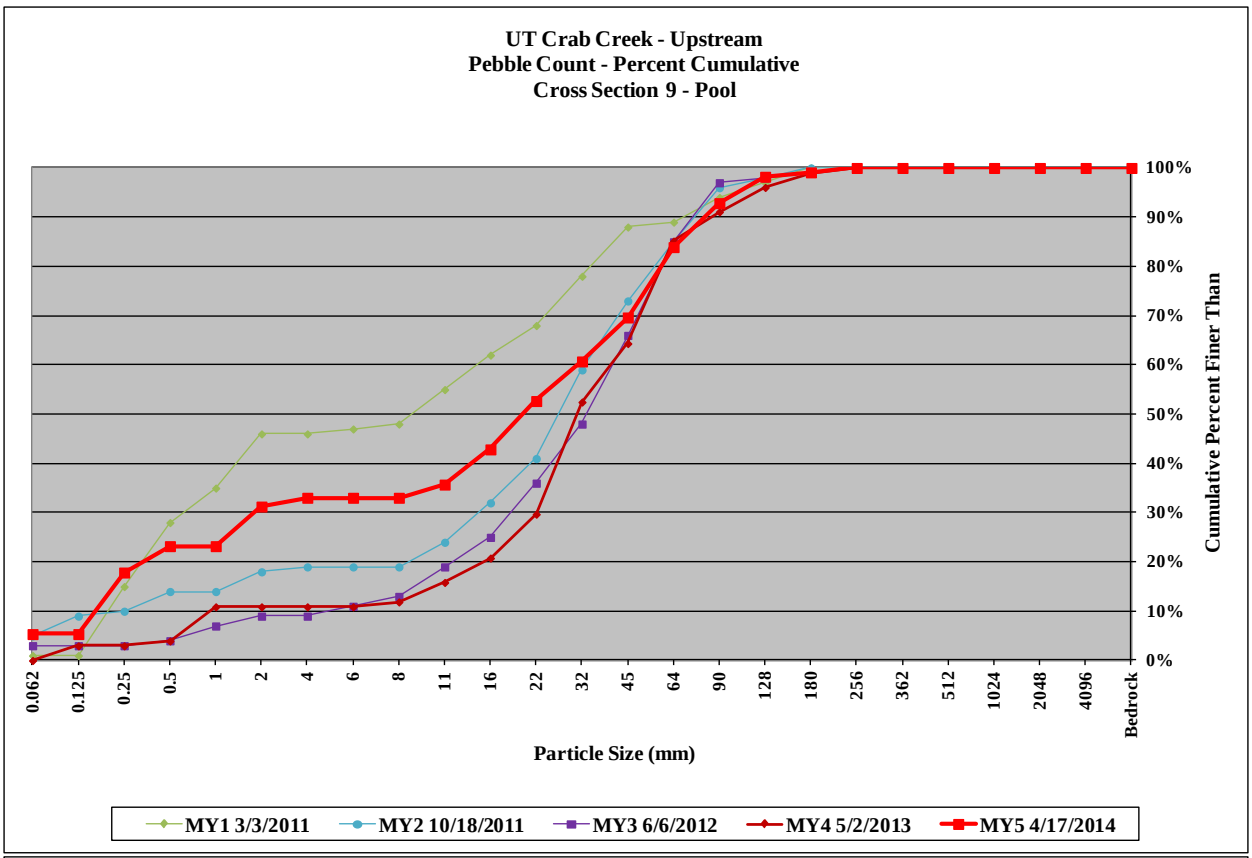
Summary Data	
D50	64
D84	120
D95	170

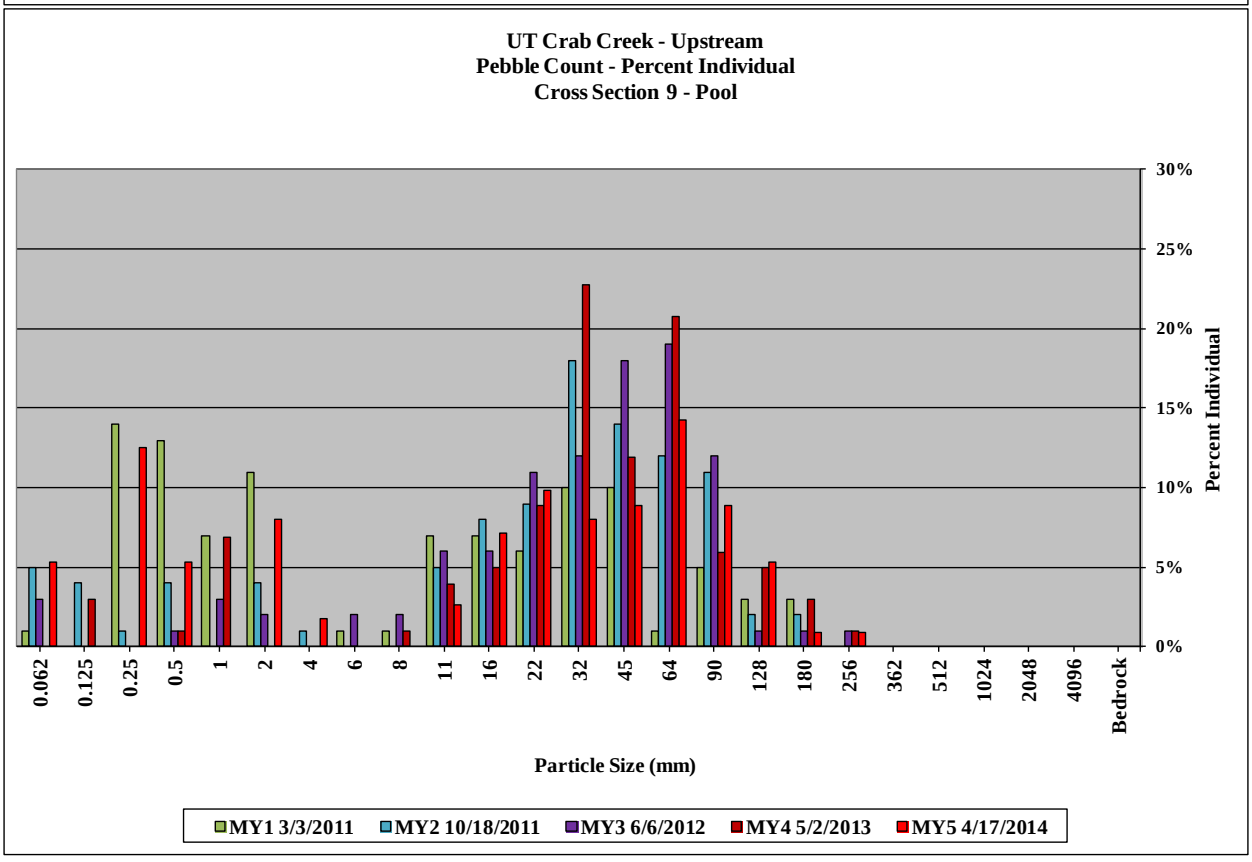

UT Crab Creek - Upstream
Pebble Count - Percent Cumulative
Cross Section 8 - Riffle
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Cumulative Percent Finer Than
0.062
0.125
0.25
0.5
1
2
4
6
8
11
16
22
32
45
64
90
128
180
256
362
512
1024
2048
4096
Bedrock
Particle Size (mm)
MY1 3/2/2011
MY2 10/18/2011
MY3 6/6/2012
MY4 5/2/2013
MY5 4/17/2014


UT Crab Creek - Upstream
Pebble Count - Percent Individual
Cross Section 8 - Riffle
30%
25%
20%
15%
10%
5%
0%
Percent Individual
0.062
0.125
0.25
0.5
1
2
4
6
8
11
16
22
32
45
64
90
128
180
256
362
512
1024
2048
4096
Bedrock
Particle Size (mm)
MY1 3/2/2011
MY2 10/18/2011
MY3 6/6/2012
MY4 5/2/2013
MY5 4/17/2014

UT Crab Creek Stream & Wetland / Project No. 857 UTCC - Upstream - Cross-Section 9 - Pool Pebble Count Summary					
			Monitoring Year 5		
Description	**Material**	**Size (mm)**	**Total #**	**Item %**	**Cum %**
Silt/Clay	silt/clay	0.062	6	5%	5%
Sand	very fine sand	0.125	0	0%	5%
	fine sand	0.25	14	13%	18%
	medium sand	0.50	6	5%	23%
	coarse sand	1.00	0	0%	23%
	very coarse sand	2.00	9	8%	31%
Gravel	very fine gravel	4.0	2	2%	33%
	fine gravel	5.7	0	0%	33%
	fine gravel	8.0	0	0%	33%
	medium gravel	11.3	3	3%	36%
	medium gravel	16.0	8	7%	43%
	coarse gravel	22.3	11	10%	53%
	coarse gravel	32	9	8%	61%
	very coarse gravel	45	10	9%	70%
	very coarse gravel	64	16	14%	84%
Cobble	small cobble	90	10	9%	93%
	medium cobble	128	6	5%	98%
	large cobble	180	1	1%	99%
	very large cobble	256	1	1%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
	very large boulder	4096	0	0%	100%
Bedrock	bedrock	>4096	0	0%	100%
TOTALS			112	100%	100%

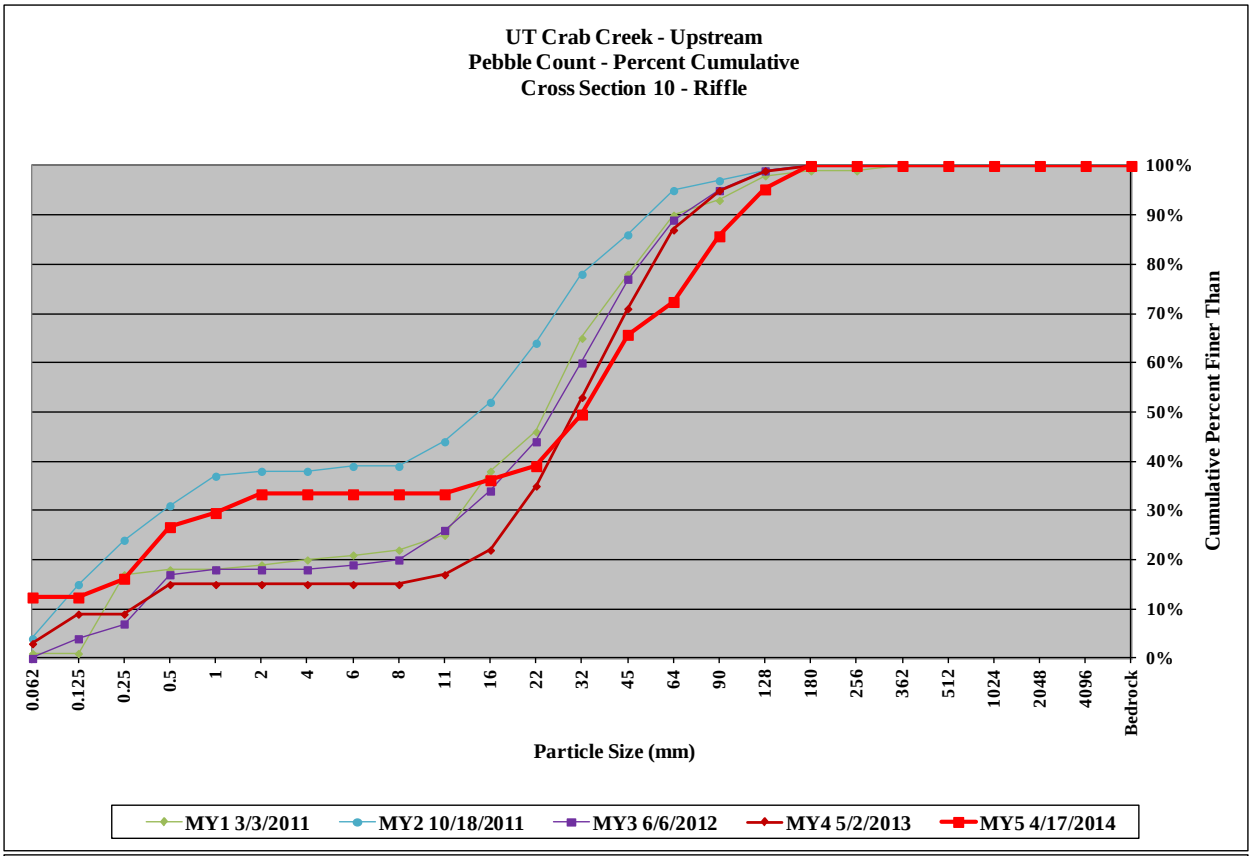
Summary Data	
D50	20
D84	64
D95	100


UT Crab Creek - Upstream
Pebble Count - Percent Cumulative
Cross Section 9 - Pool
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Cumulative Percent Finer Than
0.062
0.125
0.25
0.5
1
2
4
6
8
11
16
22
32
45
64
90
128
180
256
362
512
1024
2048
4096
Bedrock
Particle Size (mm)
MY1 3/3/2011
MY2 10/18/2011
MY3 6/6/2012
MY4 5/2/2013
MY5 4/17/2014


UT Crab Creek - Upstream
Pebble Count - Percent Individual
Cross Section 9 - Pool
30%
25%
20%
15%
10%
5%
0%
Percent Individual
0.062
0.125
0.25
0.5
1
2
4
6
8
11
16
22
32
45
64
90
128
180
256
362
512
1024
2048
4096
Bedrock
Particle Size (mm)
MY1 3/3/2011
MY2 10/18/2011
MY3 6/6/2012
MY4 5/2/2013
MY5 4/17/2014

UT Crab Creek Stream & Wetland / Project No. 857 UTCC - Upstream - Cross-Section 10 - Riffle Pebble Count Summary					
			Monitoring Year 5		
Description	**Material**	**Size (mm)**	**Total #**	**Item %**	**Cum %**
Silt/Clay	silt/clay	0.062	13	12%	12%
Sand	very fine sand	0.125	0	0%	12%
	fine sand	0.25	4	4%	16%
	medium sand	0.50	11	10%	27%
	coarse sand	1.00	3	3%	30%
	very coarse sand	2.00	4	4%	33%
Gravel	very fine gravel	4.0	0	0%	33%
	fine gravel	5.7	0	0%	33%
	fine gravel	8.0	0	0%	33%
	medium gravel	11.3	0	0%	33%
	medium gravel	16.0	3	3%	36%
	coarse gravel	22.3	3	3%	39%
	coarse gravel	32	11	10%	50%
	very coarse gravel	45	17	16%	66%
	very coarse gravel	64	7	7%	72%
Cobble	small cobble	90	14	13%	86%
	medium cobble	128	10	10%	95%
	large cobble	180	5	5%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
	very large boulder	4096	0	0%	100%
Bedrock	bedrock	>4096	0	0%	100%
TOTALS			105	100%	100%

Summary Data	
D50	32
D84	86
D95	130


UT Crab Creek - Upstream
Pebble Count - Percent Cumulative
Cross Section 10 - Riffle
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Cumulative Percent Finer Than
0.062
0.125
0.25
0.5
1
2
4
6
8
11
16
22
32
45
64
90
128
180
256
362
512
1024
2048
4096
Bedrock
Particle Size (mm)
MY1 3/3/2011
MY2 10/18/2011
MY3 6/6/2012
MY4 5/2/2013
MY5 4/17/2014

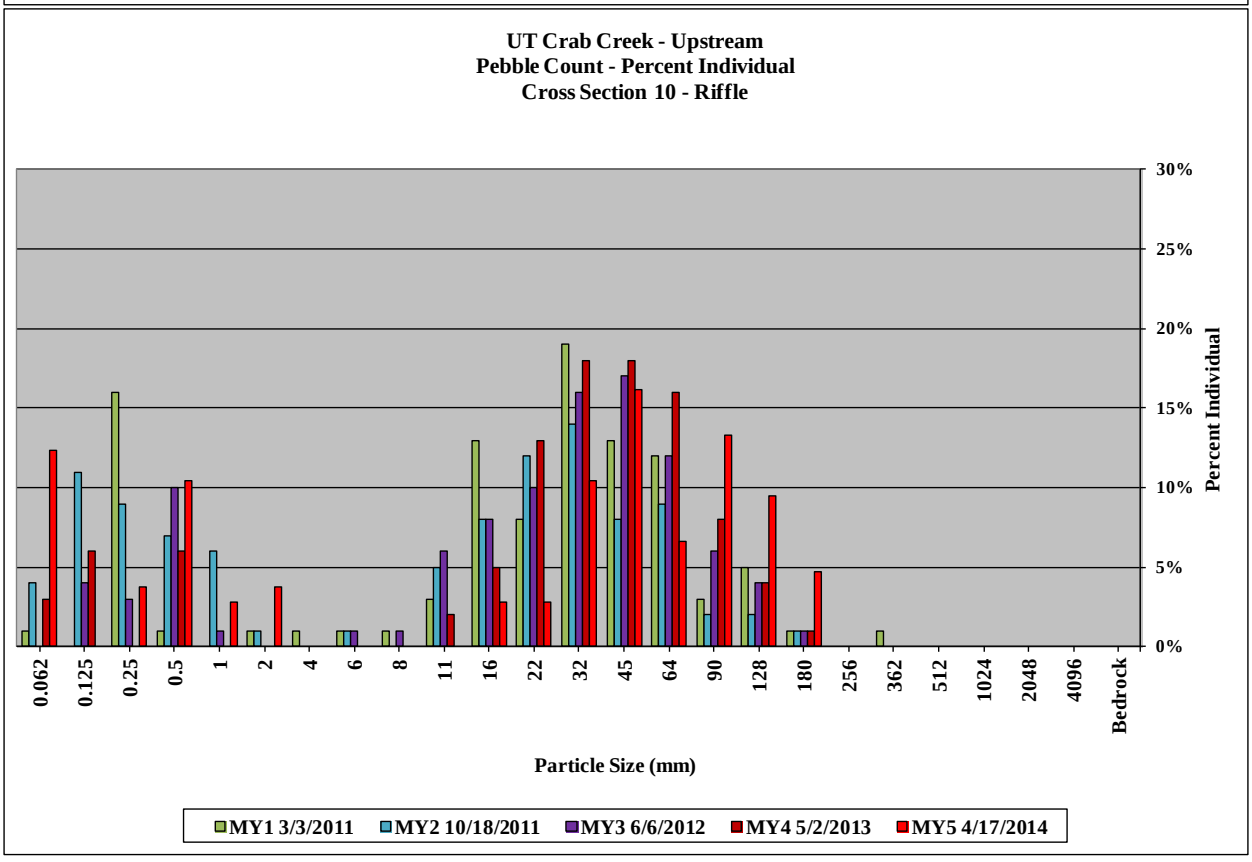

UT Crab Creek - Upstream
Pebble Count - Percent Individual
Cross Section 10 - Riffle
30%
25%
20%
15%
10%
5%
0%
Percent Individual
0.062
0.125
0.25
0.5
1
2
4
6
8
11
16
22
32
45
64
90
128
180
256
362
512
1024
2048
4096
Bedrock
Particle Size (mm)
MY1 3/3/2011
MY2 10/18/2011
MY3 6/6/2012
MY4 5/2/2013
MY5 4/17/2014

Table 10a. Baseline Stream Data Summary
UT Crab Creek Stream & Wetland / Project No. 857 - UT1 - Upper (500 feet)

Parameter	Regional Curve			Pre-Existing Condition						Reference Reach Data						Design*			Monitoring Baseline					
Dimension & Substrate - Riffle	**LL**	**UL**	**Eq.**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**
Bankfull Width (ft)	-	-	-	9.9	13.5	13.6	15.8	2.51	5	N/A	N/A	N/A	N/A	N/A	N/A	-	13.1	-	14.8	15.3	15.3	15.7	N/A	2
Floodprone Width (ft)				18.2	N/A	N/A	>55	N/A	5	N/A	N/A	N/A	N/A	N/A	N/A	22	-	33	>100	>100	>100	>100	N/A	2
Bankfull Mean Depth (ft)	-	-	-	0.90	1.20	1.20	1.50	0.23	5	N/A	N/A	N/A	N/A	N/A	N/A	-	1.10	-	1.30	1.50	1.50	1.60	N/A	2
Bankfull Max Depth (ft)				1.20	1.80	1.80	2.40	0.51	5	N/A	N/A	N/A	N/A	N/A	N/A	-	2.00	-	2.40	2.50	2.50	2.50	N/A	2
Bankfull Cross Sectional Area (ft^2)	14.0			14.1	15.1	15.0	15.9	0.72	5	N/A	N/A	N/A	N/A	N/A	N/A	-	14.8	-	20.3	22.2	22.2	24.0	N/A	2
Width/Depth Ratio				6.5	12.2	11.7	16.7	4.12	5	N/A	N/A	N/A	N/A	N/A	N/A	-	12.0	-	9.2	10.7	10.7	12.2	N/A	2
Entrenchment Ratio				1.2	3.4	3.3	>5.6	1.56	5	N/A	N/A	N/A	N/A	N/A	N/A	-	1.7	-	>6.4	>6.6	>6.6	>6.7	N/A	2
Bank Height Ratio				1.0	1.6	1.7	2.4	0.54	5	N/A	N/A	N/A	N/A	N/A	N/A	-	1.0	-	1.0	1.1	1.1	1.1	N/A	2
Profile																								
Riffle Length (ft)				-	-	-	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A	-	-	-	5.8	28.7	22.6	68.2	23.42	7
Riffle Slope (ft/ft)				0.023	-	-	0.057	-	-	0.014	-	-	0.03	-	-	0.014	-	0.03	0.014	0.023	0.022	0.033	0.007	7
Pool Length (ft)				7.0	-	-	13.0	-	-	14	-	-	47	-	-	14.0	-	47.0	3.5	8.6	8.1	19.8	4.44	13
Pool Max Depth (ft)				1.9	2.1	2.1	2.2	0.13	5	N/A	N/A	N/A	N/A	N/A	N/A	-	1.0	-	3.2	3.2	3.2	3.2	N/A	1
Pool Spacing (ft)				60.0	-	-	65.0	-	-	54	-	-	126	-	-	54.0	-	126.0	6.8	38.9	34.0	113.1	30.33	12
Pattern																								
Channel Belt Width (ft)				21.0	-	-	58.0	-	-	32	-	-	58	-	-	32.0	-	58.0	26.8	37.4	40.1	44.4	7.06	6
Radius of Curvature (ft)				11.0	-	-	37.0	-	-	20	-	-	37	-	-	20.0	-	37.0	28.7	34.7	32.4	51.3	8.35	6
Rc: Bankfull Width (ft/ft)				0.7	-	-	3.7	-	-	N/A	N/A	N/A	N/A	N/A	N/A	1.5	-	2.8	1.9	2.3	2.1	3.3	N/A	N/A
Meander Wavelength (ft)				90.0	-	-	191.0	-	-	90.0	-	-	191.0	-	-	90.0	-	191.0	117.9	135.5	130.7	162.6	20.10	4
Meander Width Ratio				1.3	-	-	5.8	-	-	N/A	N/A	N/A	N/A	N/A	N/A	2.4	-	4.4	2.6	2.6	2.6	2.7	N/A	2
Transport Parameters																								
Reach Shear Stress (Competency) lb/ft^2				-						N/A						-			2.08					
Max Part Size (mm) Mobilized at Bankfull				-						N/A						-			262					
Stream Power (Transport Capacity) W/m^2				-						N/A						-								
Additional Reach Parameters																								
Rosgen Classification				G4/C4						N/A						B4c/C4			Cb					
Bankfull Velocity (fps)	-			3.9 - 4.7						N/A						4.5								
Bankfull Discharge (cfs)	62			59 - 71						N/A						66								
Valley Length (ft)				-						N/A						-								
Channel Thalweg Length (ft)				1,730						N/A						1,621			500					
Sinuosity				1.19						N/A						1.14			1.14					
Water Surface Slope (ft/ft)				0.0210						N/A						0.0210			0.0238					
Bankfull Slope (ft/ft)				-						N/A						-			0.0251					
Bankfull Floodplain Area (acres)				-						N/A						-								
% of Reach with Eroding Banks				-						-														
Channel Stability or Habitat Metric				-						N/A														
Biological or Other				-						N/A														

- Information unavailable.
N/A - Item does not apply.
* The design cross-section criteria were developed using an analytical design approach. Pattern and profile data derived from stable enhancement reaches from the existing UT1 data.
Non-Applicable.

Table 10a. Baseline Stream Data Summary
UT Crab Creek Stream & Wetland / Project No. 857 - UT1 - Lower (397 feet)

Parameter	Regional Curve			Pre-Existing Condition						Reference Reach Data						Design*			Monitoring Baseline					
Dimension & Substrate - Riffle	**LL**	**UL**	**Eq.**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**
Bankfull Width (ft)	-	-	-	9.9	13.5	13.6	15.8	2.51	5	N/A	N/A	N/A	N/A	N/A	N/A	-	13.1	-	11.5	11.5	11.5	11.5	N/A	1
Floodprone Width (ft)				18.2	N/A	N/A	>55	N/A	5	N/A	N/A	N/A	N/A	N/A	N/A	22.0	-	33.0	>100	>100	>100	>100	N/A	1
Bankfull Mean Depth (ft)	-	-	-	0.90	1.20	1.20	1.50	0.23	5	N/A	N/A	N/A	N/A	N/A	N/A	-	1.1	-	1.50	1.50	1.50	1.50	N/A	1
Bankfull Max Depth (ft)				1.20	1.80	1.80	2.40	0.51	5	N/A	N/A	N/A	N/A	N/A	N/A	-	2.0	-	2.50	2.50	2.50	2.50	N/A	1
Bankfull Cross Sectional Area (ft^2)	14.0			14.1	15.1	15.0	15.9	0.72	5	N/A	N/A	N/A	N/A	N/A	N/A	-	14.8	-	17.6	17.6	17.6	17.6	N/A	1
Width/Depth Ratio				6.5	12.2	11.7	16.7	4.12	5	N/A	N/A	N/A	N/A	N/A	N/A	-	12.0	-	7.5	7.5	7.5	7.5	N/A	1
Entrenchment Ratio				1.2	3.4	3.3	>5.6	1.56	5	N/A	N/A	N/A	N/A	N/A	N/A	-	1.7	-	>8.7	>8.7	>8.7	>8.7	N/A	1
Bank Height Ratio				1.0	1.6	1.7	2.4	0.54	5	N/A	N/A	N/A	N/A	N/A	N/A	-	1.0	-	1.0	1.0	1.0	1.0	N/A	1
Profile																								
Riffle Length (ft)				-	-	-	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A	-	-	-	21.0	37.6	40.2	52.6	15.19	5
Riffle Slope (ft/ft)				0.023	-	-	0.057	-	-	0.014	-	-	0.030	-	-	0.014	-	0.030	0.020	0.026	0.027	0.033	0.005	5
Pool Length (ft)				7.0	-	-	13.0	-	-	14.0	-	-	47.0	-	-	14.0	-	47.0	11.8	17.4	17.4	27.1	6.24	5
Pool Max Depth (ft)				1.9	2.1	2.1	2.2	0.13	5	N/A	N/A	N/A	N/A	N/A	N/A	-	1.0	-	2.6	2.6	2.6	2.6	N/A	1
Pool Spacing (ft)				60.0	-	-	65.0	-	-	54.0	-	-	126.0	-	-	54.0	-	126.0	45.0	71.3	73.4	93.6	21.55	4
Pattern																								
Channel Belt Width (ft)				21.0	-	-	58.0	-	-	32	-	-	58	-	-	32.0	-	58.0	57.2	62.9	64.2	66.2	3.9	4
Radius of Curvature (ft)				11.0	-	-	37.0	-	-	20	-	-	37	-	-	20.0	-	37.0	31.2	36.6	37.8	39.7	3.8	4
Rc: Bankfull Width (ft/ft)				0.7	-	-	3.7	-	-	N/A	N/A	N/A	N/A	N/A	N/A	1.5	-	2.8	2.71	3.18	3.28	3.45	N/A	N/A
Meander Wavelength (ft)				90.0	-	-	191.0	-	-	90.0	-	-	191.0	-	-	90.0	-	191.0	142.0	196.0	202.0	244.0	N/A	3
Meander Width Ratio				1.3	-	-	5.8	-	-	N/A	N/A	N/A	N/A	N/A	N/A	2.4	-	4.4	5.58	5.58	5.58	5.58	N/A	1
Transport Parameters																								
Reach Shear Stress (Competency) lb/ft^2				-						N/A						-			1.36					
Max Part Size (mm) Mobilized at Bankfull				-						N/A						-			191					
Stream Power (Transport Capacity) W/m^2				-						N/A						-								
Additional Reach Parameters																								
Rosgen Classification				G4/C4						N/A						B4c/C4			C					
Bankfull Velocity (fps)	-			3.9 - 4.7						N/A						4.5								
Bankfull Discharge (cfs)	62			59 - 71						N/A						66								
Valley Length (ft)				-						N/A						-								
Channel Thalweg Length (ft)				1,730						N/A						1,621			397					
Sinuosity				1.19						N/A						1.14			1.15					
Water Surface Slope (ft/ft)				0.0210						N/A						0.0210			0.0156					
Bankfull Slope (ft/ft)				-						N/A						-			0.0174					
Bankfull Floodplain Area (acres)				-						N/A						-								
% of Reach with Eroding Banks				-						-														
Channel Stability or Habitat Metric				-						N/A														
Biological or Other				-						N/A														

- Information unavailable.
N/A - Item does not apply.
* The design cross-section criteria were developed using an analytical design approach. Pattern and profile data derived from stable enhancement reaches from the existing UT1 data.
Non-Applicable.

Table 10a. Baseline Stream Data Summary
UT Crab Creek Stream & Wetland / Project No. 857 - UTCC-US (2,455 feet)

Parameter	Regional Curve			Pre-Existing Condition						Reference Reach Data						Design			Monitoring Baseline					
Dimension & Substrate - Riffle	**LL**	**UL**	**Eq.**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**
Bankfull Width (ft)	-	-	-	17.6	20.4	19.8	24.5	2.91	4	59.7	62.3	62.3	64.9	N/A	2	-	24.0	-	25.0	26.7	26.5	28.7	N/A	3
Floodprone Width (ft)				65	-	-	>80	-	4	200	248	248	296	N/A	2	-	54.0	-	>200	>200	>200	>200	N/A	3
Bankfull Mean Depth (ft)	-	-	-	1.40	1.65	1.70	1.80	0.17	4	3.30	3.35	3.35	3.40	N/A	2	-	1.4	-	1.40	1.53	1.50	1.70	N/A	3
Bankfull Max Depth (ft)				2.40	2.78	2.75	3.20	0.33	4	5.00	5.40	5.40	5.80	N/A	2	-	2.3	-	2.40	2.50	2.50	2.60	N/A	3
Bankfull Cross Sectional Area (ft^2)	39.0			30.8	33.1	33.7	34.2	1.57	4	198.0	208.0	208.0	218.0	N/A	2	-	34.2	-	37.0	40.5	42.1	42.4	N/A	3
Width/Depth Ratio				10.0	12.7	11.5	17.9	3.52	4	18.1	18.6	-	19.1	-	-	-	17.1	-	14.7	17.7	19.0	19.5	N/A	3
Entrenchment Ratio				3.1	-	-	>4.1	-	4	3.1	4.0	-	5.0	-	-	-	2.3	-	>7.0	>7.5	>7.5	>8.0	N/A	3
Bank Height Ratio				1.0	1.1	1.0	1.2	0.10	4	1.0	1.0	1.0	1.0	N/A	-	-	1.0	-	1.0	1.0	1.0	1.1	N/A	3
Profile																								
Riffle Length (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14.9	60.5	64.9	100.0	22.55	19
Riffle Slope (ft/ft)				0.020	-	-	0.042	-	-	0.015	0.029	0.027	0.048	0.012	5	0.014	-	0.045	0.006	0.013	0.012	0.021	0.005	19
Pool Length (ft)				29.0	-	-	53.0	-	-	-	-	-	-	-	-	21.0	-	105.0	10.4	41.1	39.0	79.2	21.76	19
Pool Max Depth (ft)				3.0	3.1	3.1	3.3	NA	3	-	-	-	-	-	-	-	1.9	-	2.7	2.9	2.9	3.0	N/A	2
Pool Spacing (ft)				-	95.0	-	-	-	-	116.0	190.0	161.0	188.0	93.70	4	45.0	-	136.0	51.7	130.7	113.2	241.7	52.31	18
Pattern																								
Channel Belt Width (ft)				13.0	-	-	43.0	-	-	-	500	-	-	N/A	1	75.0	-	211.0	54.7	101.7	102.5	132.8	23.59	15
Radius of Curvature (ft)				0.0*	-	-	51*	-	-	-	55.1	-	-	N/A	1	43.0	-	128.0	37.5	51.1	42.5	146.7	26.21	16
Rc: Bankfull Width (ft/ft)				0.0*	-	-	2.9*	-	-	0.88	0.88	0.88	0.88	-	-	1.7	-	5.1	1.5	1.9	1.6	5.1	N/A	N/A
Meander Wavelength (ft)				*	-	-	*	-	-	51.3	159.0	61.6	540.0	213.0	5	20.0	-	228.0	204.4	238.7	234.4	314.2	32.62	15
Meander Width Ratio				0.5	-	-	2.4	-	-	8.0	8.0	8.0	8.0	N/A	-	3.0	-	8.4	3.6	3.9	3.9	4.1	N/A	3
Transport Parameters																								
Reach Shear Stress (Competency) lb/ft^2				0.89						-						0.73			0.71					
Max Part Size (mm) Mobilized at Bankfull				130						-						125			118					
Stream Power (Transport Capacity) W/m^2				-						-						-								
Additional Reach Parameters																								
Rosgen Classification				C4						C3						C4			C					
Bankfull Velocity (fps)	-			3.3 - 3.8						-						3.3								
Bankfull Discharge (cfs)	197			111 - 130						-						117								
Valley Length (ft)				-						-						-								
Channel Thalweg Length (ft)				2,086						1,034						2,405			2,455					
Sinuosity				1.04						1.20						1.20			1.21					
Water Surface Slope (Channel) (ft/ft)				0.0090						0.0088						0.0080			0.0080					
Bankfull Slope (ft/ft)				-						-						-			0.0083					
Bankfull Floodplain Area (acres)				-						-						-								
% of Reach with Eroding Banks				-						-														
Channel Stability or Habitat Metric				-						-														
Channel Stability or Habitat Metric				-						-														
Biological or Other				-						-														

- Information unavailable.
N/A - Item does not apply.
*Existing stream has been channelized and does not have a natural meander pattern with distinct pool and riffle features.
Non-Applicable.

Table 10b. Baseline Stream Data Summary
(Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)
UT to Crab Creek Stream & Wetland / Project No. 857 - UT1-Upper (500 feet)

Parameter	Pre-Existing Condition							Reference Reach Data							Design							Monitoring Baseline						
Ri% / Ru% / P% / G% / S%	-	-	-	-	-			N/A	N/A	N/A	N/A	N/A			-	-	-	-	-	-	-	42	8	24	22	4		
SC% / Sa% / G% / C% / B% / Be%	<1*	10*	59*	28*	3*	0*		N/A	N/A	N/A	N/A	N/A	N/A															
d16 / D35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)	7.2*	22.2*	40.0*	103.0*	197.0*	-	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A														
Entrenchment Class <1.5 / 1.5 - 1.99 / 2 - 4.9 / 5.0 - 9.9 / >10	-	-	-	-	-			-	-	-	-	-																
Incision Class <1.2 / 1.2 - 1.49 / 1.5 - 1.99 / >2.0	-	-	-	-				-	-	-	-																	

- Information unavailable.
N/A - Item does not apply.
* Numbers reported are the mean percentages from the riffle surface pebble counts.
Non-Applicable.

Table 10b. Baseline Stream Data Summary
(Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)
UT to Crab Creek Stream & Wetland / Project No. 857 - UT1-Lower (397 feet)

Parameter	Pre-Existing Condition							Reference Reach Data							Design							Monitoring Baseline						
Ri% / Ru% / P% / G% / S%	-	-	-	-	-			N/A	N/A	N/A	N/A	N/A			-	-	-	-	-	-	-	48	5	22	25	1		
SC% / Sa% / G% / C% / B% / Be%	<1*	10*	59*	28*	3*	0*		N/A	N/A	N/A	N/A	N/A	N/A															
d16 / D35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)	7.2*	22.2*	40.0*	103.0*	197.0*	-	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A														
Entrenchment Class <1.5 / 1.5 - 1.99 / 2 - 4.9 / 5.0 - 9.9 / >10	-	-	-	-	-			-	-	-	-	-																
Incision Class <1.2 / 1.2 - 1.49 / 1.5 - 1.99 / >2.0	-	-	-	-				-	-	-	-																	

- Information unavailable.
N/A - Item does not apply.
* Numbers reported are the mean percentages from the riffle surface pebble counts.
Non-Applicable.

Table 10b. Baseline Stream Data Summary
(Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)
UT to Crab Creek Stream & Wetland / Project No. 857 - UTCC-US (2,455 feet)

Parameter	Pre-Existing Condition							Reference Reach Data							Design							Monitoring Baseline						
Ri% / Ru% / P% / G% / S%	-	-	-	-	-			-	-	-	-	-			-	-	-	-	-	-	-	47	9	32	12	0		
SC% / Sa% / G% / C% / B% / Be%	0*	1*	62*	36*	<1*	0*		0	18	5	48	18	11															
d16 / D35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)	11*	23*	44*	104*	150*	-	-	1.4	-	144	512	-	-	-														
Entrenchment Class <1.5 / 1.5 - 1.99 / 2 - 4.9 / 5.0 - 9.9 / >10	-	-	-	-	-			-	-	-	-	-																
Incision Class <1.2 / 1.2 - 1.49 / 1.5 - 1.99 / >2.0	-	-	-	-				-	-	-	-																	

- Information unavailable.
* Numbers reported are the mean percentages from the riffle surface pebble counts.
Non-Applicable.

Table 11a. Monitoring Data - Dimensional Morphology Summary
UT Crab Creek Stream & Wetland / Project No. 857 - UT1 - Upper (500 Feet)
(Dimensional Parameters - Cross-Sections)
UT Crab Stream & Wetland / Project No. 857 - UT1-Upper (500 feet)

	Cross-Section 1 Riffle						Cross-Section 2 Pool						Cross-Section 3 Riffle					
Dimension	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
Record Elevation (datum) Used	2,605	2,605	2,605	2,605	2,605	2,605	2,603	2,603	2,603	2,603	2,603	2,603	2,598	2,598	2,598	2,598	2,598	2,598
Bankfull Width (ft)	15.7	15.9	15.3	16.0	17.3	18.4	18.4	18.0	17.6	18.0	17.9	17.9	14.8	14.7	14.9	15.0	15.0	15.3
Floodprone Width (ft)	>100	>100	>100	>100	>100	>100	>100	>100	>100	>100	>100	>100	>100	>100	>100	>100	>100	>100
Bankfull Mean Depth (ft)	1.3	1.2	1.3	1.2	1.2	1.1	1.9	1.9	1.8	1.8	1.7671	1.7	1.6	1.6	1.6	1.6	1.618	1.6
Bankfull Max Depth (ft)	2.4	2.4	2.5	2.4	2.5	2.4	3.2	3.2	3.3	3.1	3.0831	2.9	2.5	2.5	2.6	2.6	2.698	2.8
Bankfull Cross Sectional Area (ft^2)	20.3	18.5	19.3	19.5	20.0	20.1	34.3	33.4	32.2	32.4	31.651	29.8	24.0	23.8	23.8	24.4	24.25	23.9
Bankfull Width/Depth Ratio	12.2	13.8	12.1	13.1	14.9	16.9	9.9	9.7	9.6	10.0	10.136	10.8	9.2	9.1	9.4	9.2	9.262	9.8
Bankfull Entrenchment Ratio	>6.4	>6.3	>6.5	>6.3	>5.8	>5.4	>5.4	>5.5	>5.7	>5.5	>5.6	>5.6	>6.7	>6.8	>6.7	>6.7	>6.7	>6.5
Bankfull Bank Height Ratio	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.0649	1.1	1.1	1.1	1.1	1.1	1.096	1.1
Cross Sectional Area between End Pins (ft^2)	20.3	19.0	19.4	19.6	20.0	20.1	34.3	33.6	32.2	32.4	32	29.8	24.3	24.1	24.2	24.6	24	23.9
d50 (mm)	N/A	17	4.6	6.6	19	8.8	N/A	11	1.7	6.4	4.9	9.1	N/A	23	12	19	26	12

N/A - Item does not apply.

Table 11a. Monitoring Data - Dimensional Morphology Summary
(Dimensional Parameters - Cross-Sections)
UT Crab Creek Stream & Wetland / Project No. 857 - UT1-Lower (397 feet)

	Cross-Section 4 Pool						Cross-Section 5 Riffle					
Dimension	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
Record Elevation (datum) Used	2,571	2,571	2,571	2,571	2,571	2,571	2,571	2,571	2,571	2,571	2,571	2,571
Bankfull Width (ft)	16.7	14.3	14.7	14.7	14.4	14.2	11.5	12.2	12.3	11.8	11.7	12.3
Floodprone Width (ft)	>100	>100	>100	>100	>100	>100	>100	>100	>100	>100	>100	>100
Bankfull Mean Depth (ft)	1.1	1.3	1.1	1.1	1.2	1.1	1.5	1.4	1.4	1.4	1.42	1.3
Bankfull Max Depth (ft)	2.6	2.5	2.4	2.5	2.5	2.5	2.5	2.6	2.6	2.5	2.72	2.6
Bankfull Cross Sectional Area (ft^2)	18.8	18.0	16.7	16.7	17.3	15.4	17.6	17.5	17.3	16.8	16.5	15.8
Bankfull Width/Depth Ratio	14.8	11.4	12.9	13.0	12.0	13.2	7.5	8.5	8.8	8.3	8.25	9.5
Bankfull Entrenchment Ratio	>6.0	>7.0	>6.8	>6.8	>6.9	>7.0	>8.7	>8.2	>8.1	>8.5	>8.6	>8.1
Bankfull Bank Height Ratio	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.02	1.0
Cross Sectional Area between End Pins (ft^2)	18.9	18.0	16.7	16.7	17.3	15.4	21.1	21.5	21.6	21.1	16.5	15.8
d50 (mm)	N/A	8.4	4	2	0.4	4.9	N/A	0.91	2	1.3	0.06	14

N/A - Item does not apply.

Table 11a. Monitoring Data - Dimensional Moprhology Summary
(Dimensional Parameters - Cross-Sections)
UT Crab Creek Stream & Wetland / Project No. 857 - UTCC-US (2,455 feet)

	Cross-Section 6 Riffle						Cross-Section 7 Pool						Cross-Section 8 Riffle						Cross-Section 9 Pool						Cross-Section 10 Riffle					
Dimension	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
Record Elevation (datum) Used	2,571	2,571	2,571	2,571	2,571	2,571	2,571	2,571	2,571	2,571	2,571	2,571	2,566	2,566	2,566	2,566	2,566	2,566	2,554	2,554	2,554	2,554	2,554	2,554	2,554	2,554	2,554	2,554	2,554	2,544
Bankfull Width (ft)	25.0	24.7	27.2	25.1	24.3	23.7	27.7	27.8	27.8	27.6	27.4	27.6	28.7	27.9	28.0	27.9	27.5	27.7	23.5	23.8	23.0	23.1	23.7	22.9	26.5	27.2	26.4	27.8	27.3	26.4
Floodprone Width (ft)	>200	>200	>200	>200	>200	>200	>200	>200	>200	>200	>200	>200	>200	>200	>200	>200	>200	>200	>200	>200	>200	>200	>200	>200	>200	>200	>200	>200	>200	>200
Bankfull Mean Depth (ft)	1.7	1.7	1.5	1.6	1.6	1.6	1.7	1.7	1.6	1.6	1.5	1.4	1.5	1.4	1.4	1.3	1.3	1.2	1.7	1.7	1.6	1.6	1.5	1.4	1.4	1.4	1.4	1.3	1.38	1.4
Bankfull Max Depth (ft)	2.6	2.5	2.5	2.6	2.6	2.5	3.0	3.4	3.4	3.5	3.46	3.2	2.5	2.4	2.5	2.4	2.43	2.5	2.7	2.9	2.7	2.8	2.75	2.7	2.4	2.4	2.5	2.6	2.56	2.6
Bankfull Cross Sectional Area (ft^2)	42.4	41.9	41.3	41.0	40.0	37.6	47.3	47.1	45.1	43.9	40.9	38.1	42.1	39.5	38.4	37.6	35.9	34.5	40.7	40.9	36.1	36.8	35.6	32.2	37.0	37.2	35.9	37.5	37.5	36.6
Bankfull Width/Depth Ratio	14.7	14.6	17.9	15.3	14.8	14.9	16.3	16.4	17.1	17.4	18.3	20.0	19.5	19.7	20.4	20.7	21.1	22.3	13.5	13.9	14.6	14.5	15.8	16.3	19.0	19.9	19.4	20.6	19.8	19.1
Bankfull Entrenchment Ratio	>8.0	>8.1	>7.4	>8.0	>8.2	>8.4	>7.2	>7.2	>7.2	>7.2	>7.3	>7.2	>7.0	>7.2	>7.1	>7.2	>7.3	>7.2	>8.5	>8.4	>8.7	>8.7	>8.4	>8.7	>7.5	>7.3	>7.6	>7.2	>7.3	>7.6
Bankfull Bank Height Ratio	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.05	1.1	1.0	1.0	1.0	1.0	1.04	1.0	1.0	1.0	1.0	1.0	1.04	1.0
Cross Sectional Area between End Pins (ft^2)	42.4	41.9	41.3	41.0	40.0	37.6	47.3	47.3	45.1	43.9	40.9	38.1	43.2	40.1	38.5	37.6	35.9	34.5	41.5	41.2	36.1	36.8	35.6	32.2	38.6	39.9	37.1	39.7	37.5	36.6
d50 (mm)	N/A	51	48	46	38	30	N/A	32	6	8.7	1.3	0.06	N/A	33	26	33	33	64	N/A	8.8	27	33	31	20	NA	24	15	25	30	32

N/A - Item does not apply.

Table 11b. Monitoring Data - Stream Reach Data Summary
UT Crab Creek Stream & Wetland / Project No. 857 - UT1-Upper (503 feet)

Parameter	Baseline						MY - 1						MY - 2						MY - 3						MY - 4						MY - 5					
Dimension & Substrate - Riffle	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**
Bankfull Width (ft)	14.8	15.3	15.3	15.7	N/A	2	14.7	15.3	15.3	15.9	N/A	2	14.9	15.1	15.1	15.3	N/A	2	15.0	15.5	15.5	16.0	N/A	2	15.0	16.2	16.2	17.3	N/A	2	15.30	16.85	16.85	18.40	N/A	2
Floodprone Width (ft)	>100	>100	>100	>100	N/A	2	>100	>100	>100	>100	N/A	2	>100	>100	>100	>100	N/A	2	>100	>100	>100	>100	N/A	2	>100	>100	>100	>100	N/A	2	>100	>100	>100	>100	N/A	2
Bankfull Mean Depth (ft)	1.3	1.5	1.5	1.6	N/A	2	1.2	1.4	1.4	1.6	N/A	2	1.3	1.5	1.5	1.6	N/A	2	1.2	1.4	1.4	1.6	N/A	2	1.2	1.4	1.4	1.6	N/A	2	1.10	1.35	1.35	1.60	N/A	2
Bankfull Max Depth (ft)	2.4	2.5	2.5	2.5	N/A	2	2.4	2.5	2.5	2.5	N/A	2	2.5	2.6	2.6	2.6	N/A	2	2.4	2.5	2.5	2.6	N/A	2	2.5	2.6	2.6	2.7	N/A	2	2.40	2.60	2.60	2.80	N/A	2
Bankfull Cross-Sectional Area (ft^2)	20.3	22.2	22.2	24.0	N/A	2	18.5	21.2	21.2	23.8	N/A	2	19.3	21.6	21.6	23.8	N/A	2	19.5	22.0	22.0	24.4	N/A	2	20.0	22.1	22.1	24.2	N/A	2	20.10	22.00	22.00	23.90	N/A	2
Width/Depth Ratio	9.2	10.7	10.7	12.2	N/A	2	9.1	11.4	11.4	13.8	N/A	2	9.4	10.8	10.8	12.1	N/A	2	9.2	11.2	11.2	13.1	N/A	2	9.3	12.1	12.1	14.9	N/A	2	9.80	13.35	13.35	16.90	N/A	2
Entrenchment Ratio	>6.4	>6.6	>6.6	>6.7	N/A	2	>6.3	>6.5	>6.5	>6.8	N/A	2	>6.5	>6.6	>6.6	>6.7	N/A	2	>6.3	>6.5	>6.5	>6.7	N/A	2	>5.8	>6.25	>6.25	>6.7	N/A	2	>5.4	>5.95	>5.95	>6.5	N/A	2
Bank Height Ratio	1.0	1.1	1.1	1.1	N/A	2	1.0	1.1	1.1	1.1	N/A	2	1.1	1.1	1.1	1.1	N/A	2	1.1	1.1	1.1	1.1	N/A	2	1.1	1.1	1.1	1.1	N/A	2	1.1	1.1	1.1	1.1	N/A	2
Profile																																				
Riffle Length (ft)	5.8	28.7	22.6	68.2	23.4	7	11.7	37.5	35.0	76.0	24.3	6	11.1	36.8	33.0	80.7	26.1	6	15.1	38.2	34.2	79.3	24.4	6	30.3	49.1	48.1	79.1	18.0	6	33.34	49.03	47.59	69.68	13.49	6
Riffle Slope (ft/ft)	0.0143	0.0233	0.0220	0.0333	0.0065	7	0.0136	0.0193	0.0192	0.0273	0.0052	6	0.0160	0.0257	0.0209	0.0432	0.0110	6	0.0152	0.0219	0.0196	0.0365	0.0077	6	0.0180	0.0218	0.0196	0.0319	0.0054	6	0.0129	0.0212	0.0195	0.0378	0.0088	6
Pool Length (ft)	3.5	8.6	8.1	19.8	4.4	13	4.3	9.1	8.7	15.6	3.2	12	6.6	10.0	9.5	15.8	2.7	12	6.4	10.2	9.7	14.5	2.2	11	5.7	9.8	10.5	14.0	2.7	10	6.06	10.11	9.95	16.58	3.38	10
Pool Max Depth (ft)	3.2	3.2	3.2	3.2	N/A	1	3.2	3.2	3.2	3.2	N/A	1	2.9	3.2	3.1	3.9	0.3	11	2.5	2.9	2.9	3.8	0.4	10	2.0	2.3	2.2	3.1	0.4	8	1.2	1.4	1.4	1.9	0.2	8
Pool Spacing (ft)	6.8	38.9	34.0	113.1	30.3	12	10.3	41.7	38.5	109.1	28.1	11	8.6	42.2	37.4	109.0	29.4	11	9.2	47.2	47.6	106.8	30.1	10	9.2	45.4	43.0	110.3	31.4	10	6.6	46.0	45.0	108.5	30.2	10
Pattern																																				
Channel Belt Width (ft)	26.8	37.4	40.1	44.4	7.06	6																														
Radius of Curvature (ft)	28.7	34.7	32.4	51.3	8.35	6																														
Rc: Bankfull Width (ft/ft)	1.9	2.3	2.1	3.3	N/A	N/A																														
Meander Wavelength (ft)	117.9	135.5	130.7	162.6	20.10	4																														
Meander Width Ratio	2.6	2.6	2.6	2.7	N/A	2																														
Additional Reach Parameters																																				
Rosgen Classification	Cb						C4b						C5b						C4b						C4b						C4b					
Channel Thalweg Length (ft)	500						511						503						506						507						511					
Sinuosity (ft)	1.14						1.17						1.15						1.16						1.16						1.17					
Water Surface Slope (Channel) (ft/ft)	0.0238						0.0228						0.0240						0.0233						0.0238						0.0238					
Bankfull Slope (ft/ft)	0.0251						0.0229						0.0240						0.0226						0.0242						0.0229					
Ri% / Ru% / P% / G% / S%	42	8	24	22	4		45%	10%	22%	19%	5%		45%	11%	25%	15%	4%		48%	13%	23%	11%	5%		61%	9%	21%	5%	4%		61%	6%	21%	8%	5%	
SC% / SA% / G% / C% / B% / Be%*							<1%	20%	71%	9%	0%	0%	2%	46%	44%	8%	0%	0%	4%	29%	57%	10%	0%	0%	2%	31%	57%	10%	0%	0%	15%	27%	42%	16%	0%	0%
d16 / d35 / d50 / d84 / d95 (mm)																																				
% of Reach with Eroding Banks	0%						1%						1%						1%						2%						2%					
Channel Stability or Habitat Metric	N/A						N/A						N/A						N/A						N/A						N/A					
Biological or Other	N/A						N/A						N/A						N/A						N/A						N/A					

N/A - Information does not apply.
Ri = Riffle / Ru = Run / P = Pool / G = Glide / S = Step
SC = Silt-Clay / SA = Sand / G = Gravel / C = Cobble / B = Boulder / Be = Bedrock
*Percentages based on riffle and pool pebble counts.

Table 11b. Monitoring Data - Stream Reach Data Summary
UT Crab Creek Stream & Wetland / Project No. 857 - UT1-Lower (396 feet)

Parameter	Baseline						MY - 1						MY - 2						MY - 3						MY - 4						MY - 5					
Dimension & Substrate - Riffle	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**
Bankfull Width (ft)	11.5	11.5	11.5	11.5	N/A	1	12.2	12.2	12.2	12.2	N/A	1	12.3	12.3	12.3	12.3	N/A	1	11.8	11.8	11.8	11.8	N/A	1	11.7	11.7	11.7	11.7	N/A	1	12.3	12.3	12.3	12.3	N/A	1
Floodprone Width (ft)	>100	>100	>100	>100	N/A	1	>100	>100	>100	>100	N/A	1	>100	>100	>100	>100	N/A	1	>100	>100	>100	>100	N/A	1	>100	>100	>100	>100	N/A	1	>100	>100	>100	>100	N/A	1
Bankfull Mean Depth (ft)	1.5	1.5	1.5	1.5	N/A	1	1.4	1.4	1.4	1.4	N/A	1	1.4	1.4	1.4	1.4	N/A	1	1.4	1.4	1.4	1.4	N/A	1	1.4	1.4	1.4	1.4	N/A	1	1.3	1.3	1.3	1.3	N/A	1
Bankfull Max Depth (ft)	2.5	2.5	2.5	2.5	N/A	1	2.6	2.6	2.6	2.6	N/A	1	2.6	2.6	2.6	2.6	N/A	1	2.5	2.5	2.5	2.5	N/A	1	2.7	2.7	2.7	2.7	N/A	1	2.6	2.6	2.6	2.6	N/A	1
Bankfull Cross-Sectional Area (ft^2)	17.6	17.6	17.6	17.6	N/A	1	17.5	17.5	17.5	17.5	N/A	1	17.3	17.3	17.3	17.3	N/A	1	16.8	16.8	16.8	16.8	N/A	1	16.5	16.5	16.5	16.5	N/A	1	15.8	15.8	15.8	15.8	N/A	1
Width/Depth Ratio	7.5	7.5	7.5	7.5	N/A	1	8.5	8.5	8.5	8.5	N/A	1	8.8	8.8	8.8	8.8	N/A	1	8.3	8.3	8.3	8.3	N/A	1	8.3	8.3	8.3	8.3	N/A	1	9.5	9.5	9.5	9.5	N/A	1
Entrenchment Ratio	>8.7	>8.7	>8.7	>8.7	N/A	1	>8.2	>8.2	>8.2	>8.2	N/A	1	>8.1	>8.1	>8.1	>8.1	N/A	1	>8.5	>8.5	>8.5	>8.5	N/A	1	>8.6	>8.6	>8.6	>8.6	N/A	1	>8.1	>8.1	>8.1	>8.1	N/A	1
Bank Height Ratio	1.0	1.0	1.0	1.0	N/A	1	1.0	1.0	1.0	1.0	N/A	1	1.0	1.0	1.0	1.0	N/A	1	1.0	1.0	1.0	1.0	N/A	1	1.0	1.0	1.0	1.0	N/A	1	1.0	1.0	1.0	1.0	N/A	1
Profile																																				
Riffle Length (ft)	21.0	37.6	40.2	52.6	15.2	5	25.2	39.1	32.0	55.5	14.4	5	27.9	38.2	29.3	54.3	13.5	5	22.7	38.0	36.9	50.8	12.6	5	13.5	34.3	33.2	57.2	19.3	4	11.2	35.2	37.7	54.2	21.9	4
Riffle Slope (ft/ft)	0.0199	0.0257	0.0266	0.0334	0.0054	5	0.0015	0.0196	0.0239	0.0288	0.0108	5	0.0022	0.0198	0.0178	0.0398	0.0137	5	0.0026	0.0149	0.0139	0.0254	0.0084	5	0.0166	0.0270	0.0206	0.0503	0.0157	4	0.0162	0.0242	0.0208	0.0391	0.0105	4
Pool Length (ft)	11.8	17.4	17.4	27.1	6.2	5	8.4	14.3	16.3	18.8	4.6	5	5.6	14.4	16.3	18.3	5.1	5	4.9	19.8	16.3	41.4	13.4	5	10.7	21.1	11.7	46.6	15.6	6	11.37	22.70	12.94	52.42	17.22	6
Pool Max Depth (ft)	2.6	2.6	2.6	2.6	N/A	1	2.5	2.5	2.5	2.5	N/A	1	2.3	3.1	3.2	3.6	0.5	5	2.3	3.0	3.2	3.4	0.4	5	2.6	3.1	3.0	3.5	0.3	6	2.3	3.0	2.9	3.5	0.5	6
Pool Spacing (ft)	45.0	71.3	73.4	93.6	21.6	4	45.5	68.9	68.3	95.5	21.7	4	51.0	69.4	62.9	100.8	22.8	4	52.3	71.6	64.8	104.5	24.9	4	45.3	70.5	73.3	106.0	24.7	5	41.2	71.6	71.8	106.3	23.7	5
Pattern																																				
Channel Belt Width (ft)	57.2	62.9	64.2	66.2	3.9	4																														
Radius of Curvature (ft)	31.2	36.6	37.8	39.7	3.8	4																														
Rc: Bankfull Width (ft/ft)	2.7	3.2	3.3	3.5	N/A	N/A																														
Meander Wavelength (ft)	142.0	196.0	202.0	244.0	N/A	3																														
Meander Width Ratio	5.58	5.58	5.58	5.58	N/A	1																														
Additional Reach Parameters																																				
Rosgen Classification	C						C5b						C5b						C5b						C5b						C5b					
Channel Thalweg Length (ft)	397						400						396						398						399						398					
Sinuosity (ft)	1.15						1.16						1.15						1.15						1.16						1.17					
Water Surface Slope (Channel) (ft/ft)	0.0156						0.0156						0.0154						0.0167						0.0166						0.0177					
Bankfull Slope (ft/ft)	0.0174						0.0172						0.0175						0.0175						0.0177						0.0184					
Ri% / Ru% / P% / G% / S%	48	5	22	25	1		50%	6%	18%	26%	0%		53%	8%	20%	19%	0%		50%	10%	26%	12%	1%		35%	17%	33%	15%	0%		36%	16%	35%	12%	0%	
SC% / SA% / G% / C% / B% / Be%*							2%	48%	33%	17%	0%	0%	1%	48%	43%	8%	0%	0%	8%	44%	40%	9%	0%	0%	15%	51%	30%	5%	0%	0%	7%	37%	41%	15%	0%	0%
d16 / d35 / d50 / d84 / d95 (mm)																																				
% of Reach with Eroding Banks	0%						0%						0%						0%						2%						4%					
Channel Stability or Habitat Metric	N/A						N/A						N/A						N/A						N/A						N/A					
Biological or Other	N/A						N/A						N/A						N/A						N/A						N/A					

N/A - Information does not apply.
Ri = Riffle / Ru = Run / P = Pool / G = Glide / S = Step
SC = Silt-Clay / SA = Sand / G = Gravel / C = Cobble / B = Boulder / Be = Bedrock
*Percentages based on riffle and pool pebble counts.

Table 11b. Monitoring Data - Stream Reach Data Summary
UT Crab Creek Stream & Wetland / Project No. 857 - UTCC-US (2,465 feet)

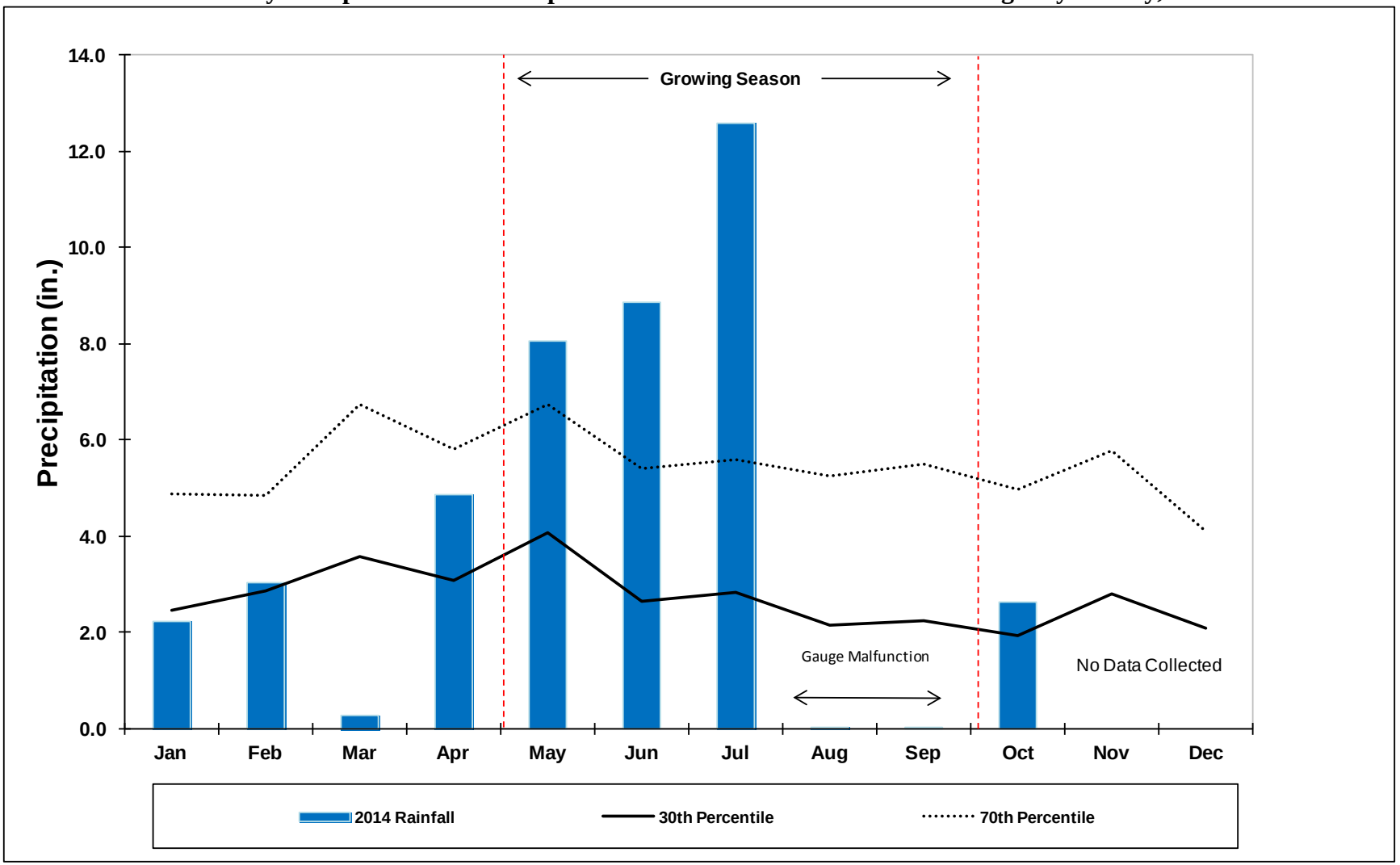
Parameter	Baseline						MY - 1						MY - 2						MY - 3						MY - 4						MY - 5					
Dimension & Substrate - Riffle	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**
Bankfull Width (ft)	25.0	26.7	26.5	28.7	N/A	3	24.7	26.6	27.2	27.9	N/A	3	26.4	27.2	27.2	28.0	N/A	3	25.1	26.9	27.8	27.9	N/A	3	24.3	26.4	27.3	27.5	N/A	3	23.7	25.9	26.4	27.7	N/A	3
Floodprone Width (ft)	>200	>200	>200	>200	N/A	3	>200	>200	>200	>200	N/A	3	>200	>200	>200	>200	N/A	3	>200	>200	>200	>200	N/A	3	>200	>200	>200	>200	N/A	3	>200	>200	>200	>200	N/A	3
Bankfull Mean Depth (ft)	1.4	1.5	1.5	1.7	N/A	3	1.4	1.5	1.4	1.7	N/A	3	1.4	1.4	1.4	1.5	N/A	3	1.3	1.4	1.3	1.6	N/A	3	1.3	1.4	1.4	1.6	N/A	3	1.2	1.4	1.4	1.6	N/A	3
Bankfull Max Depth (ft)	2.4	2.5	2.5	2.6	N/A	3	2.4	2.4	2.4	2.5	N/A	3	2.5	2.5	2.5	2.5	N/A	3	2.4	2.5	2.6	2.6	N/A	3	2.4	2.5	2.6	2.6	N/A	3	2.5	2.5	2.5	2.6	N/A	3
Bankfull Cross-Sectional Area (ft^2)	37.0	40.5	42.1	42.4	N/A	3	37.2	39.5	39.5	41.9	N/A	3	35.9	38.5	38.4	41.3	N/A	3	37.5	38.7	37.6	41.0	N/A	3	35.9	37.8	37.5	40.0	N/A	3	34.5	36.2	36.6	37.6	N/A	3
Width/Depth Ratio	14.7	17.7	19.0	19.5	N/A	3	14.6	18.1	19.7	19.9	N/A	3	17.9	19.2	19.4	20.4	N/A	3	15.3	18.9	20.6	20.7	N/A	3	14.8	18.6	19.8	21.1	N/A	3	14.9	18.8	19.1	22.3	N/A	3
Entrenchment Ratio	>7.0	>7.5	>7.5	>8.0	N/A	3	>7.2	>7.5	>7.3	>8.1	N/A	3	>7.1	>7.4	>7.4	>7.6	N/A	3	>7.2	>7.5	>7.2	>8.0	N/A	3	>7.3	>7.6	>7.3	>8.2	N/A	3	>7.2	>7.7	>7.6	>8.4	N/A	3
Bank Height Ratio	1.0	1.0	1.0	1.1	N/A	3	1.0	1.0	1.0	1.1	N/A	3	1.0	1.1	1.1	1.1	N/A	3	1.0	1.1	1.1	1.1	N/A	3	1.0	1.1	1.1	1.1	N/A	3	1.0	1.1	1.1	1.1	N/A	3
Profile																																				
Riffle Length (ft)	14.9	60.5	64.9	100.0	22.6	19	14.4	61.4	59.1	169.0	32.9	18	11.4	56.8	51.3	214.2	46.5	17	11.9	56.2	57.3	214.0	46.3	17	16.9	66.7	61.3	243.9	52.8	16	18.5	65.6	59.4	231.1	50.5	16
Riffle Slope (ft/ft)	0.0058	0.0131	0.0119	0.0214	0.0048	19	0.0046	0.0127	0.0123	0.0180	0.0043	18	0.0050	0.0148	0.0132	0.0360	0.0081	17	0.0049	0.0133	0.0129	0.0227	0.0055	17	0.0051	0.0132	0.0126	0.0197	0.0047	16	0.0050	0.0142	0.0156	0.0220	0.0051	16
Pool Length (ft)	10.7	46.0	52.7	103.5	24.7	19	11.0	42.6	40.7	87.7	21.1	19	18.7	43.0	44.9	83.7	16.3	19	18.6	40.4	44.4	59.9	13.0	19	18.5	39.4	37.3	59.3	12.5	18	22.1	39.9	39.0	63.6	12.1	18
Pool Max Depth (ft)	2.7	2.9	2.9	3.0	N/A	2	2.9	3.2	3.2	3.4	0.4	2	2.2	3.9	4.0	4.9	0.8	18	1.8	3.6	3.7	4.6	0.7	19	1.5	3.3	3.4	4.1	0.7	17	2.2	3.7	3.8	4.5	0.6	17
Pool Spacing (ft)	51.7	130.7	113.2	241.7	52.3	18	57.3	130.9	124.1	244.4	53.4	18	49.9	128.9	132.5	301.0	63.2	18	55.4	129.3	126.4	295.6	61.5	18	47.2	136.9	134.7	296.5	69.7	17	42.3	136.9	134.5	294.7	66.4	17
Pattern																																				
Channel Belt Width (ft)	54.7	101.7	102.5	132.8	23.6	15																														
Radius of Curvature (ft)	37.5	51.1	42.5	146.7	26.2	16																														
Rc: Bankfull Width (ft/ft)	1.5	1.9	1.6	5.1	N/A	N/A																														
Meander Wavelength (ft)	204.4	238.7	234.4	314.2	32.6	15																														
Meander Width Ratio	3.6	3.9	3.9	4.1	N/A	3																														
Additional Reach Parameters																																				
Rosgen Classification	C						C4						C4						C4						C4						C4					
Channel Thalweg Length (ft)	2,455						2,465						2,465						2,475						2,469						2,469					
Sinuosity (ft)	1.21						1.22						1.22						1.22						1.22						1.22					
Water Surface Slope (Channel) (ft/ft)	0.0080						0.0081						0.0081						0.0078						0.0078						0.0089					
Bankfull Slope (ft/ft)	0.0083						0.0083						0.0082						0.0079						0.0084						0.009					
Ri% / Ru% / P% / G% / S%	47%	9%	32%	12%	0%		45%	8%	33%	14%	0%		40%	9%	34%	17%	0%		40%	8%	32%	19%	1%		45%	10%	30%	14%	0%		44%	11%	30%	14%	1%	
SC% / SA% / G% / C% / B% / Be%*							<1%	23%	54%	22%	<1%	0%	2%	26%	51%	21%	0%	0%	5%	16%	58%	21%	0%	0%	7%	17%	55%	21%	0%	0%	12%	18%	42%	28%	0%	0%
d16 / d35 / d50 / d84 / d95 (mm)																																				
% of Reach with Eroding Banks	0%						1%						1%						1%						2%						2%					
Channel Stability or Habitat Metric	N/A						N/A						N/A						N/A						N/A						N/A					
Biological or Other	N/A						N/A						N/A						N/A						N/A						N/A					

N/A - Information does not apply.
Ri = Riffle / Ru = Run / P = Pool / G = Glide / S = Step
SC = Silt-Clay / SA = Sand / G = Gravel / C = Cobble / B = Boulder / Be = Bedrock
*Percentages based on riffle and pool pebble counts.

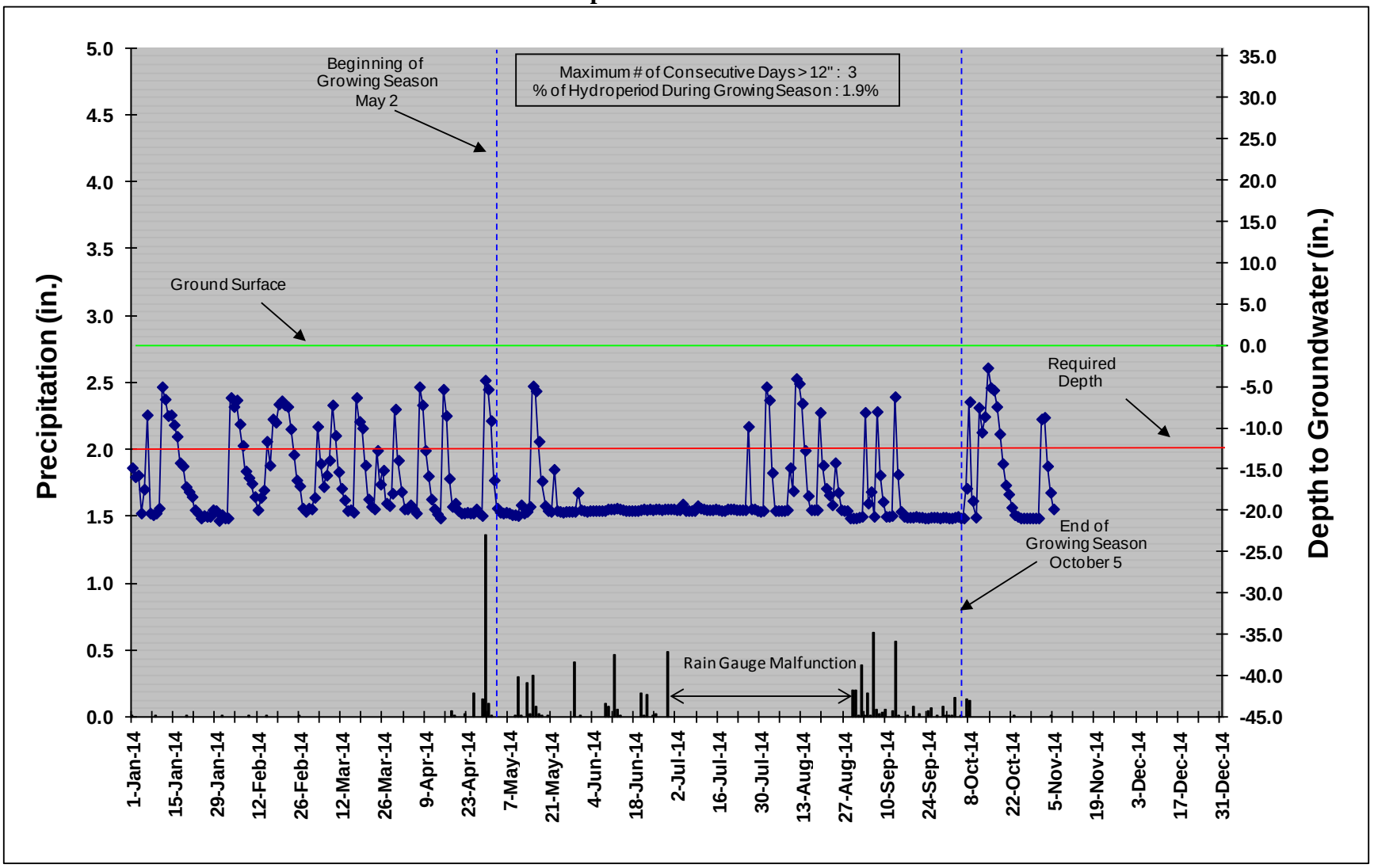
Appendix E
Hydrologic Data

Table 12. Verification of Bankfull Events UT Crab Creek Stream & Wetland / Project No. 857			
Date of Data Collection	**Date of Occurrence**	**Method**	**Photo # (if available)**
4/2010	4/2010	Wrack lines	
2/2/2011	12/2/2010	Crest gauge & wrack lines	
4/10/2013	2/26/2013	Crest gauge & wrack lines	
10/30/2013	Unknown	Wrack lines	
11/5/2014	Unknown	Wrack lines	

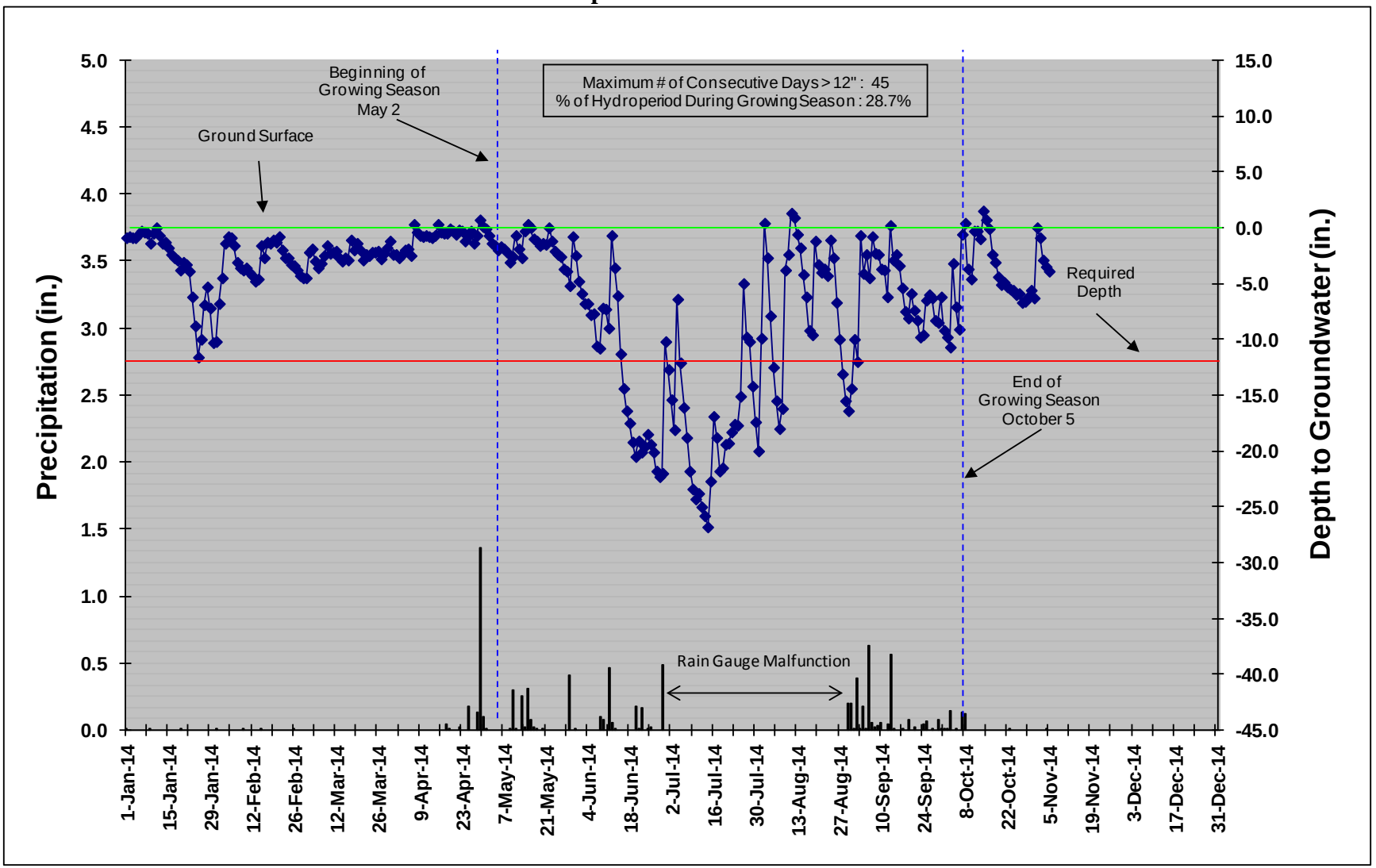
Monthly Precipitation Data Compared to 30th and 70th Percentiles for Alleghany County, NC



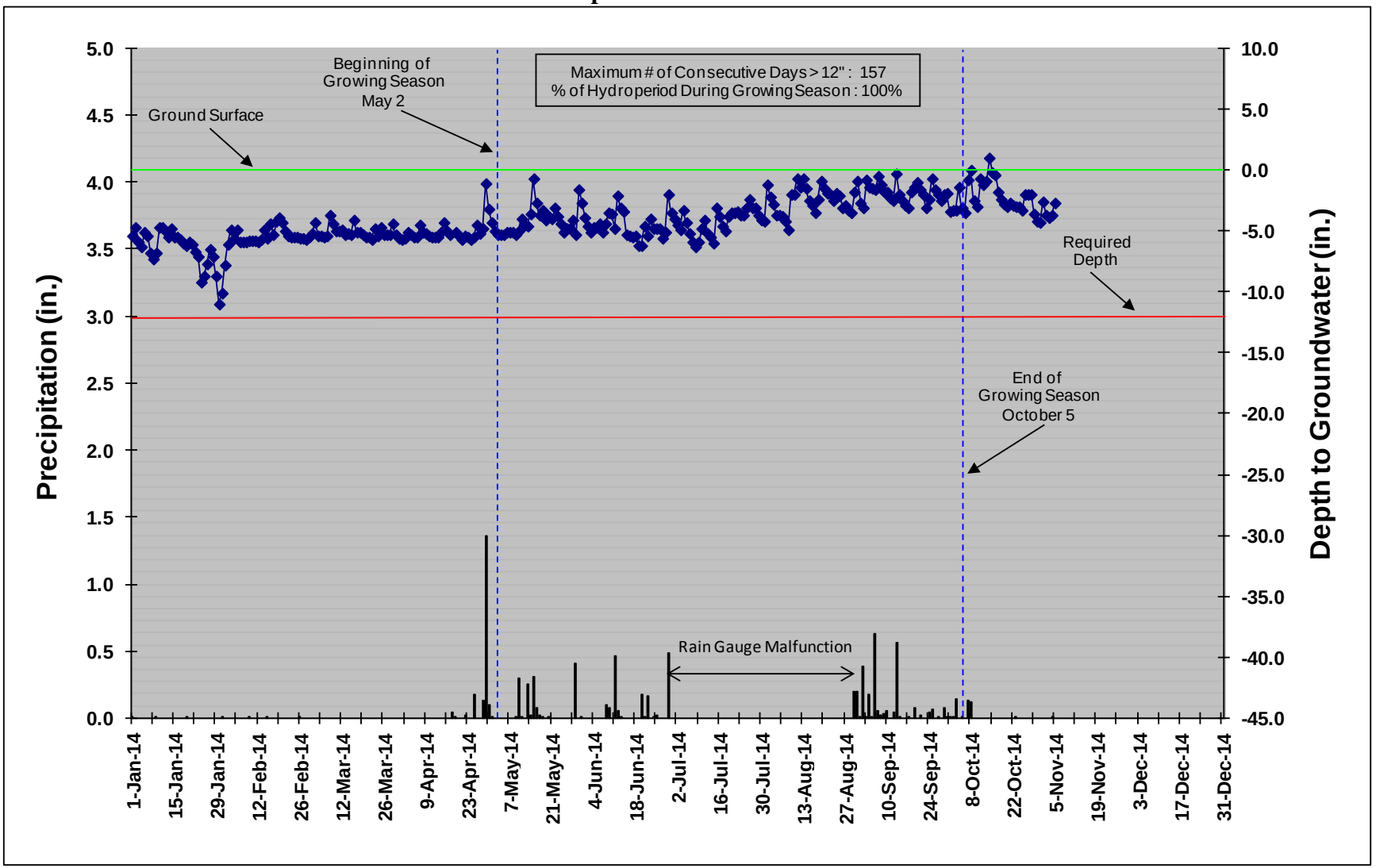
UTC-1 Precipitation and Water Level Plot



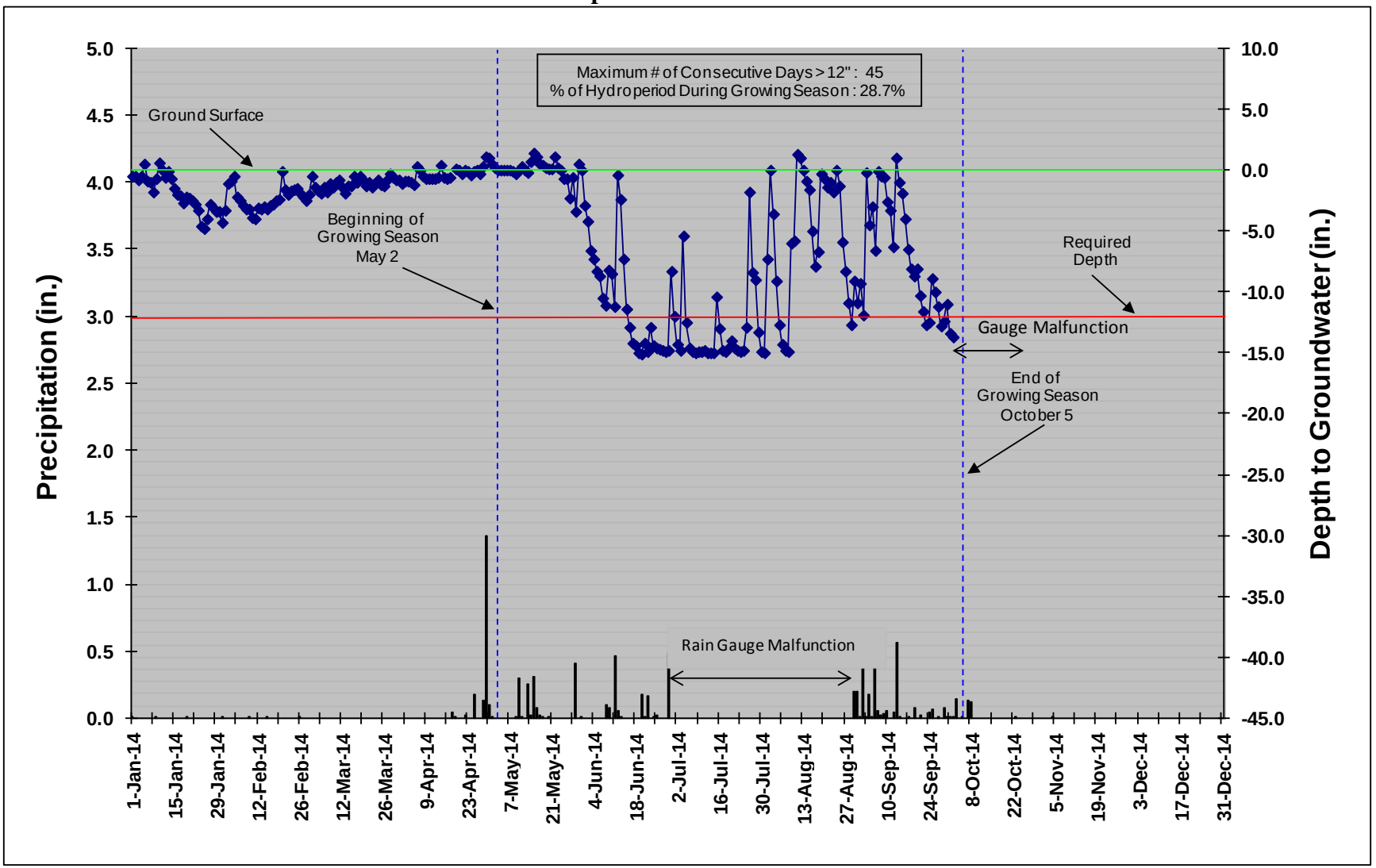
UTC-2 Precipitation and Water Level Plot



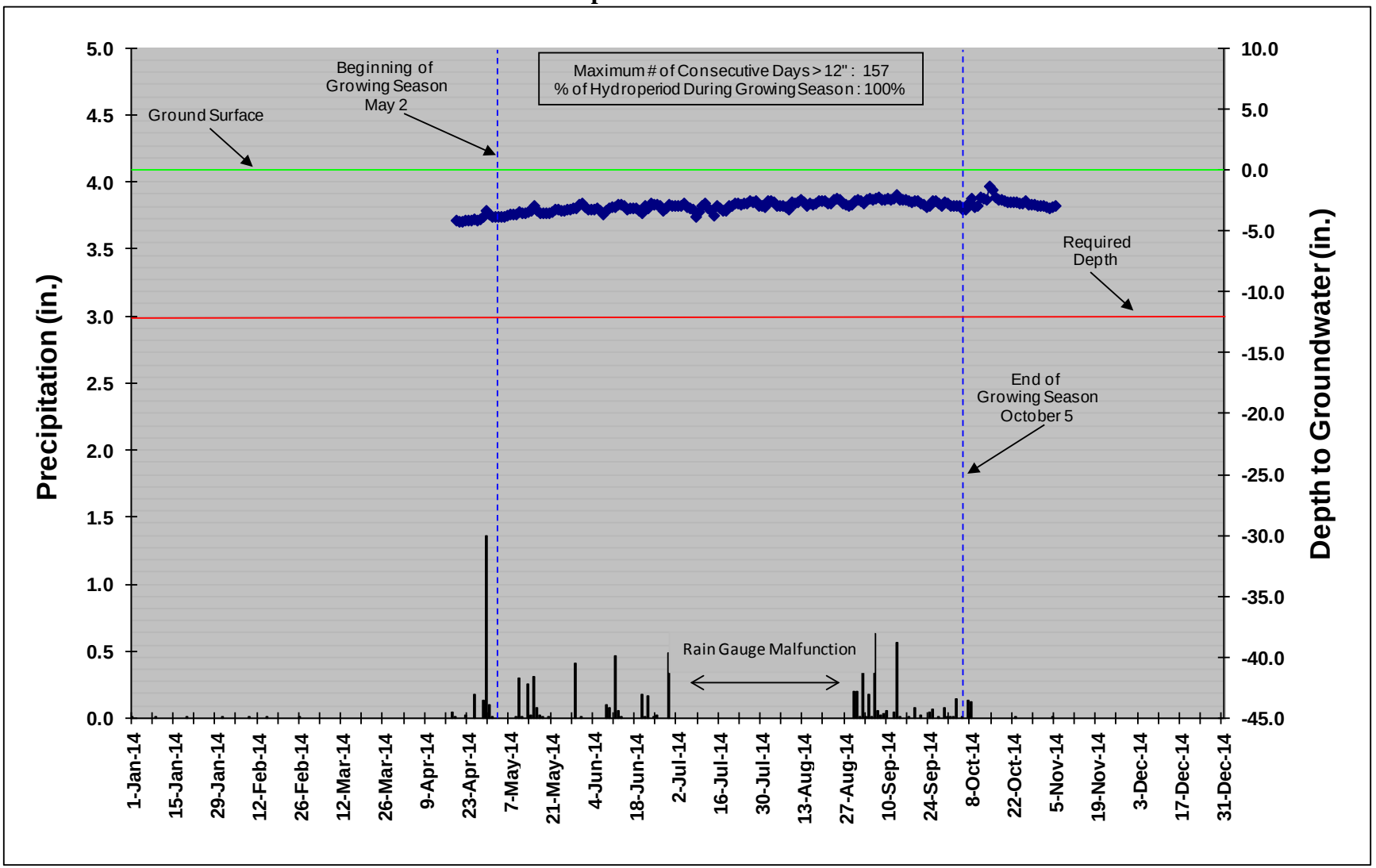
UTC-3 Precipitation and Water Level Plot



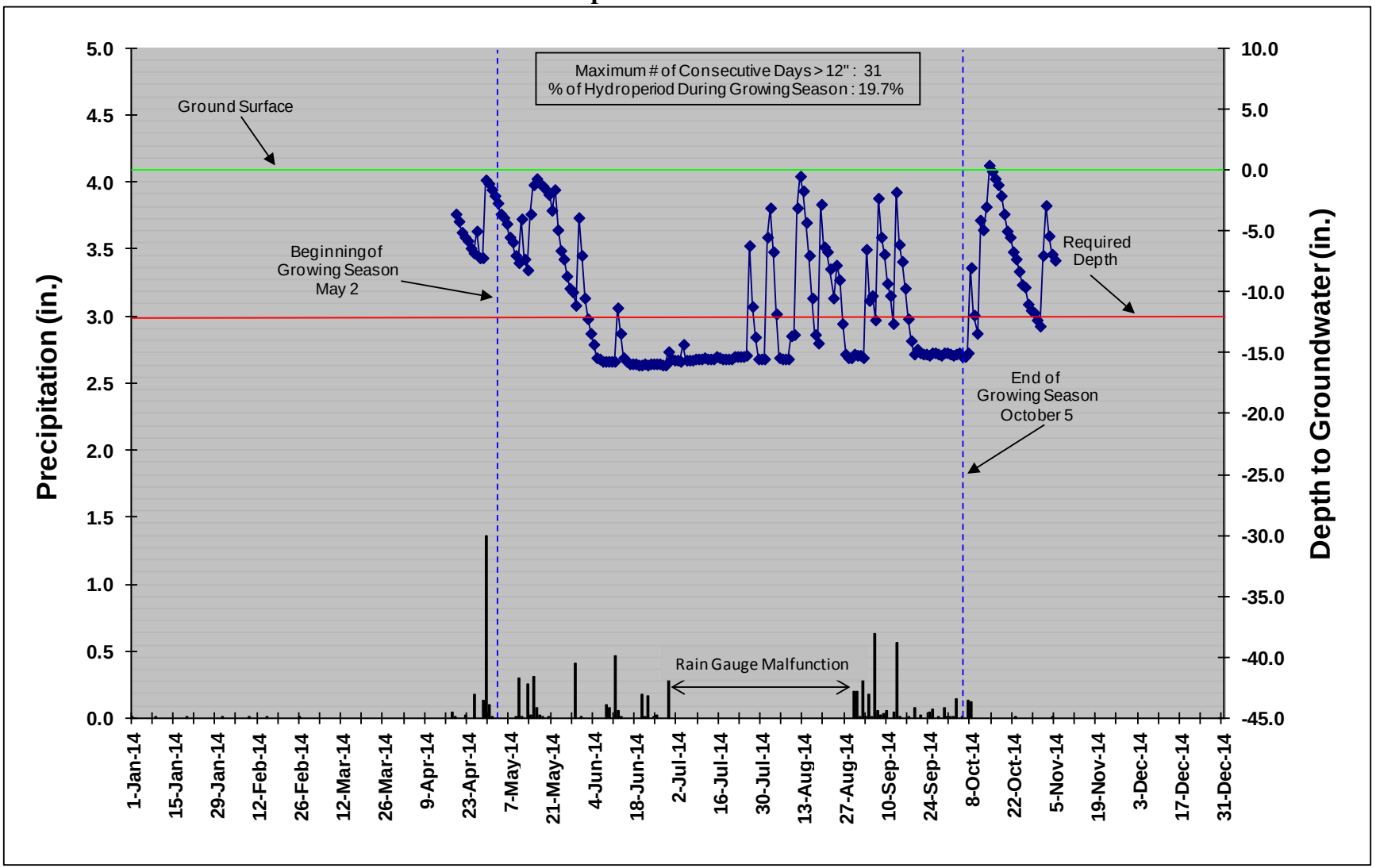
UTC-4 Precipitation and Water Level Plot



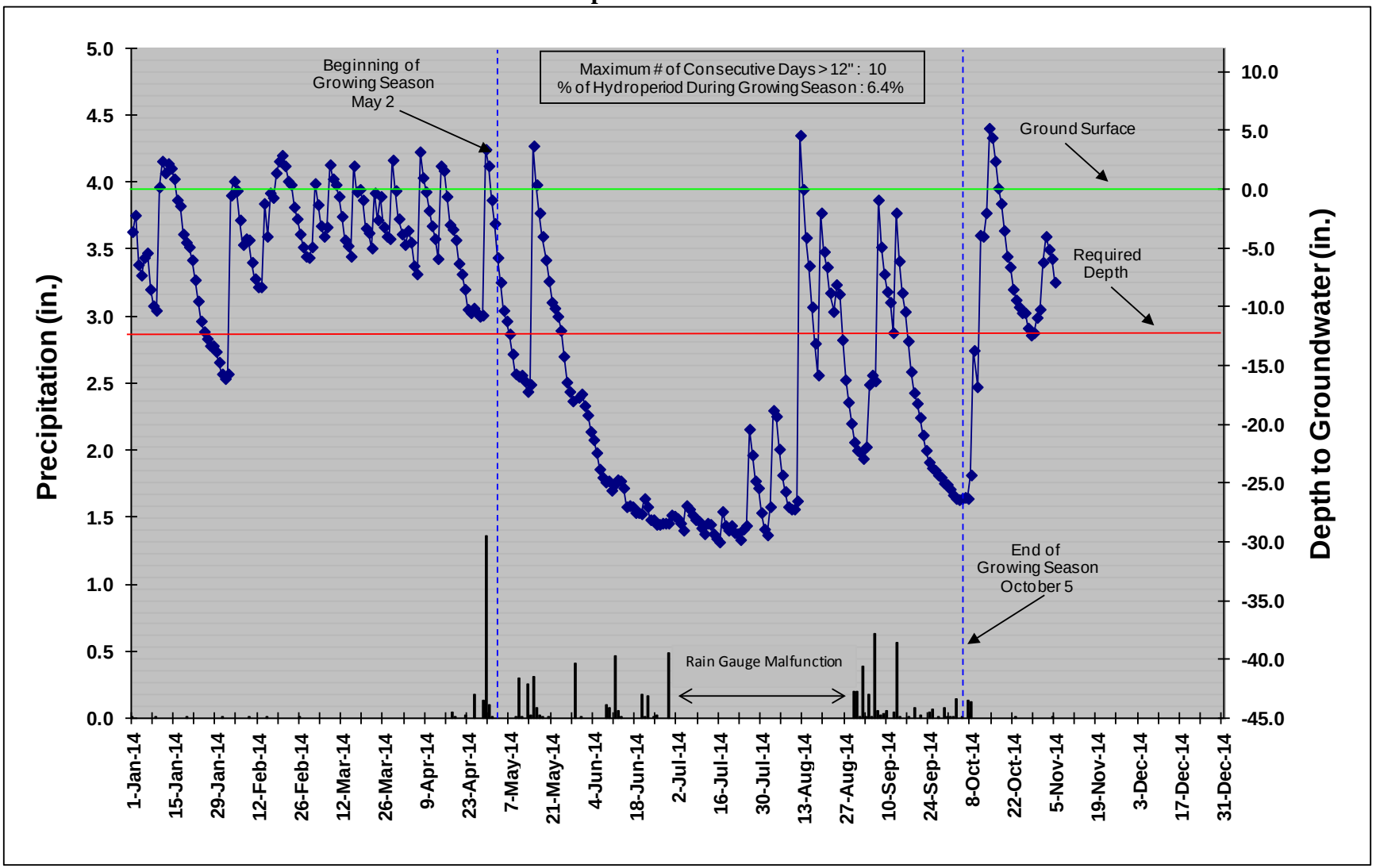
UTC-5 Precipitation and Water Level Plot



UTC-6 Precipitation and Water Level Plot



UTC-7 Precipitation and Water Level Plot



UTC-8 Precipitation and Water Level Plot

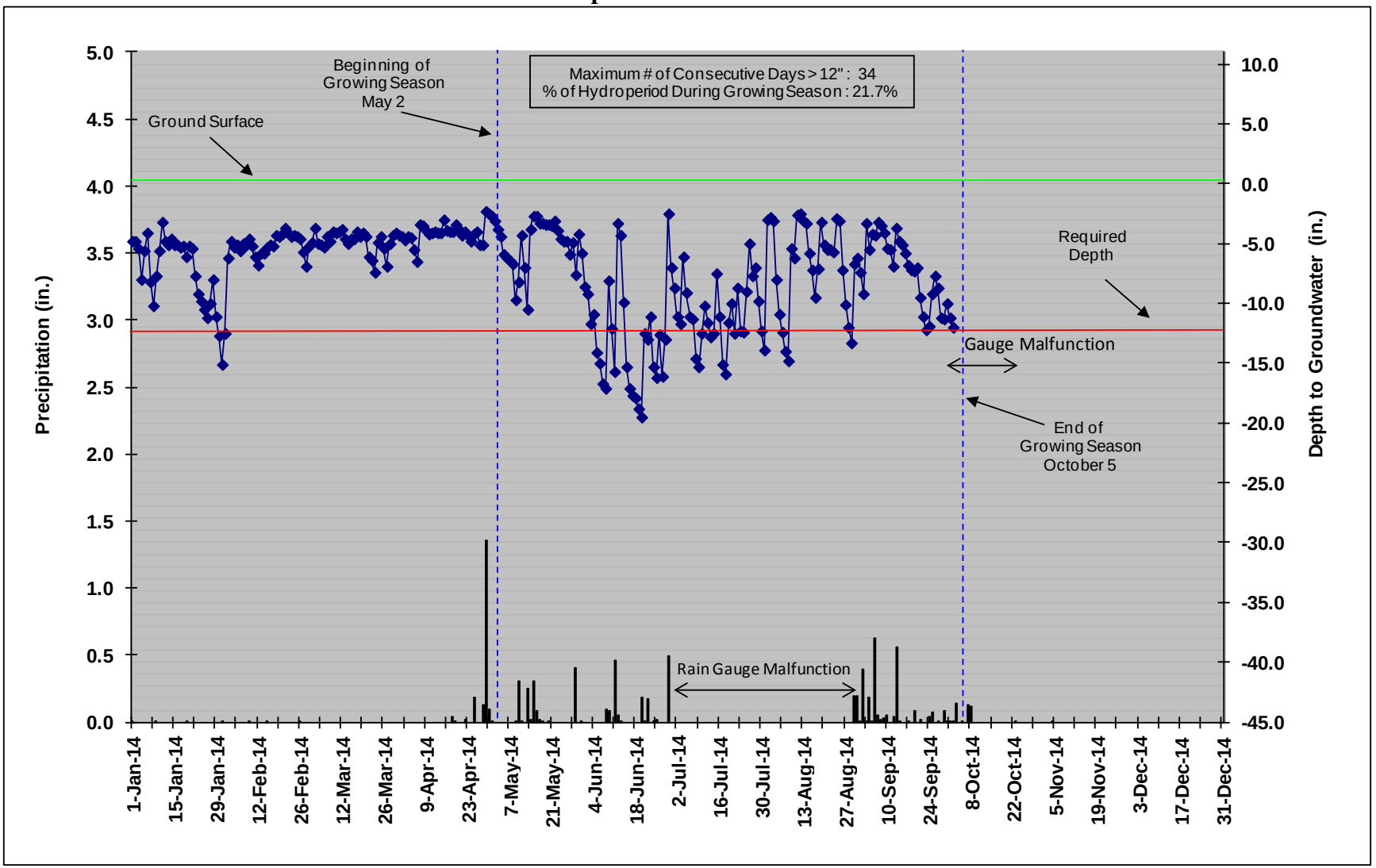


Table 13. Wetland Gauge Attainment Data Summary of Groundwater Gauge Results UT Crab Creek Stream & Wetland / Project No. 857					
Gauge ID	**Success Criteria Achieved/Max Consecutive Days During Growing Season (Percentage)**				
	Year 1 (2010)	**Year 2 (2011)**	**Year 3 (2012)**	**Year 4 (2013)**	**Year 5 (2014)**
UTC-1	No/6 3.8 Percent	No/6 3.8 Percent	No/4 2.5 Percent	Yes/9 5.7 Percent	No/3 1.9 Percent
UTC-2	Yes/70 44.6 Percent	Yes/30 19.1 Percent	Yes/39 24.8 Percent	Yes/148 94.3 Percent	Yes/45 28.7 Percent
UTC-3	Yes/35 22.3 Percent	Yes/33 21.0 Percent	Yes/143 91.1 Percent	Yes/74 47.1 Percent	Yes/157 100.0 Percent
UTC-4	Yes/52 33.1 Percent	Yes/61 38.9 Percent	Yes/55 35.0 Percent	Yes/157 100.0 Percent	Yes/45 28.7 Percent
UTC-5	Yes/157 100.0 Percent	Yes/155 98.7 Percent	Yes/157 100.0 Percent	Yes/157 100.0 Percent	Yes/157 100.0 Percent
UTC-6	Yes/22 14.0 Percent	Yes/38 24.2 Percent	Yes/45 28.7 Percent	Yes/132 84.1 Percent	Yes/31 19.7 Percent
UTC-7	Yes/15 9.6 Percent	Yes/8 5.1 Percent	No/6 3.8 Percent	Yes/68 43.3 Percent	Yes/10 6.4 Percent
UTC-8	Yes/37 23.6 Percent	Yes/58 36.9 Percent	Yes/48 30.6 Percent	Yes/45 28.7 Percent	Yes/ 34 21.7 Percent

Growing season = 157 days